The Republic of Botswana
Ministry of State President
Department of Broadcasting Services

THE PROJECT
FOR
IMPLEMENTATION OF THE DIGITAL MIGRATION PROJECT
IN
REPUBLIC OF BOTSWANA
PROJECT COMPLETION REPORT
(Separate Volume)

AUGUST 2016

MINISTRY OF STATE PRESIDENT
DEPARTMENT OF BROADCASTING SERVICES
AND
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
YACHIYO ENGINEERING CO., LTD.

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Separate Volume -1

HD program production manual

HD Program Production Manual

May, 2016

Department of Broadcasting Services
Ministry of State President

PREAMBLE

This production manual is created for Botswana Television (BTV) by the Implementation of the Digital Migration Project commenced in August 2014. The project is supported by Japan International Cooperation Agency (JICA). The main objective of the production manual are to demonstrate the step by step instruction to produce HD programs to the new staff, , as well as to improve knowledge, skills, and techniques of the program production of the experienced staff. Utilization of the manual would help producers to properly plan and execute their production.

Botswana Television (BTV) is transforming into digital and is expected to increase the number of the programs. Therefore, this manual is targeted to all news, production, and technical staff of BTV, to support to create different kinds of programs with different contents and angles.

The content is basically divided into the following parts:

1. Basic Production Process for Television Programs
2. Pre-production (Preparation before filming)
3. Production (Shooting)
4. Post-production (Editing and completing the program)
5. Evaluation of the programs
6. Annex (Blank form and format)

May, 2016

Created by DiMT (Digital Migration for Television)
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ABBREVIATIONS

BS	Bust Shot
BTV	Botswana Television
CU	Close Up Shot
ECU	Extreme Close Up Shot
ELS	Extreme Long Shot
HD	High Definition
JICA	Japan International Cooperation Agency
KS	Knee Shot
LBS	Loose Bust Shot
LS	Long Shot
MS	Medium Shot (Waist Shot)
SD	Standard Definition
TBS	Tight Bust Shot
WG	Working Group

CHAPTER 1

PRODUCTION PROCESS OF HD TELEVISION PROGRAMS

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PRODUCTION PROCESS OF HD TELEVISION PROGRAMS

1.1 Program Production Process

BTV has been producing a good number of live programs such as daily news, Botswana Premier League football games, and various other events throughout the countries including programs using the BTV studios, such as talk shows. Most of the programs are live or recorded in the studio or on location and there are hardly any programs which are originally planned and edited. (See the Table 1-1) Therefore, the level of the techniques and skills of the staff is relatively high. However, the techniques and skills of staff do not reach the enough level to create originally-proposed and planned programs. This manual focuses on procedure of basic program production to produce edited original programs, considering HD (high definition) format. However, the shooting techniques in HD format will be useful for camera works for live broadcast and studio programs, and editing techniques can be applied to switching the cameras.

The table 1-1 indicates the numbers and types of the programs BTV produces each year. Depending on the year and circumstances, the programs would be added or canceled, therefore, the numbers are approximate.

Table 1-1: Programs BTV Produces Each Year

TYPES OF PROGRAM	NUMBERS OF PROGRAMS / YEAR
Live News in Setswana	365
Live News in English	365
Live broadcast of the events (Independence day, President Day, etc.)	20
Live sports games coverage	60 ~ 65
Educational talk show (live or recorded)	56
Music show	104
Religious programs (Gospel music, Church services, etc.)	208
Talk show	104
Current affairs (Studio)	52

Source: BTV

The process of all production of the programs can be divided into 3 stages: pre-production, production and post-production. The figure 1-1 shows basic production procedure.

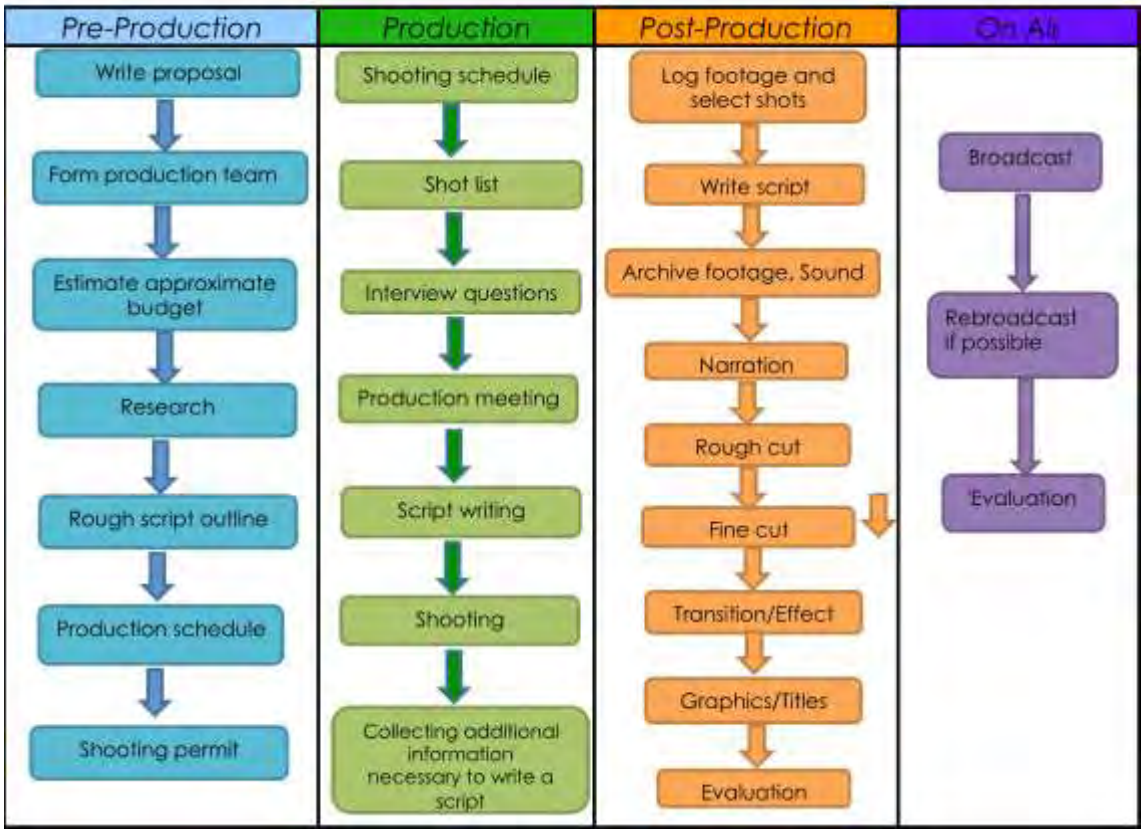


Figure 1-1: Program Production Process

1.2 PRODUCTION CREW

Production crews vary in size depending on the magnitude of the production. For example, live broadcast of a football game requires large crew, as compared to a news crew that could limit to only a journalist and a cameraman. The table 1-2 below indicates basic production crew for small-scale original programs.

Table 1-2: Basic Production Crew

Roll	Description
Producer	Responsible for all the staff involved in the production and coordinates technical and nontechnical issues. In small-scale production, the producer maybe director and/or writer at the same time.
Director	In charge of actual production from pre-production to completion of the programs. In small-scale production director may be producer and/or writer at the same time.
Writer	In a small-scale production producer and/or director is writer.
Videographer	Operates cameras and shoot.
Audio technician	In charge of all the audio operations. Sometimes assist videographer in recording sounds or interview on location.
Editor	Operates post-production editing system. Often producer and/or director makes rough cut before fine cut.
Graphic designer	Creates computer graphics, program titles, charts, graphs, etc.

1.3 STAGE 1: PRE-PRODUCTION

Pre-production is basically the preparation and organization of the whole production process before the actual shooting. The process starts with having a concept, setting the objectives, and writing a proposal. Once the proposal is approved, necessary information for the program content must be researched and collected. Based on the result of the research, shooting locations, interviewees, and obtaining filming permissions, etc. are selected. Rough script outline, questions for the interview, and filming schedule must be prepared before going to locations. It is also recommended to have meetings with all the production crew, including journalists, producers, directors, and technical crew to share the information and filming plan.

Pre-Production crew: *Producer and/or director*

1.4 STAGE 2: PRODUCTION

The pre-production, shooting at the locations or in the studios will be done according to the plan, however, if any additional subjects might be interesting for the program are found on locations, the plan can be modified. Interviews also can be flexible, depending on the interviewees and their answers. Additional information must also be collected.

It is important for all the staff to communicate, share information, and work together during the shoot.

Production crew: *Producer and/or director*
Writer
Videographer
Audio technician

1.5 STAGE 3: POST-PRODUCTION

After completing the shoot and before editing, the script must be rewritten. It can be revised during and after the picture is edited. Producer, director, or reporter, must share the information and the script with their editor, explain the purpose of the program, and edit the program together by exchanging opinions and impression. Narration can be recorded before or after the editing the pictures, depending on the program or theme and/ or the style of the editing.

Depending on the program, use of archive footage or photographs, depending on the program, can be effective and can makes the story more interesting to the viewers. In addition, music or sound effects can be used to enrich the message of the theme.

Post-Production crew:	*Producer and/or director*
	Editor
	Graphic designer

It is recommended to preview the news or the programs with other colleagues before broadcasting program to confirm the quality and information.

CHAPTER 2

PRE-PRODUCTION

CHAPTER 2:PRE-PRODUCTION

2.1 PROPOSING A STORY IDEA/DEVELOPING A STORY IDEA

A story idea can be developed from an interesting story you heard from someone, articles or incidents from a book or a newspaper, or just anything you think might be suitable for a program.

It is important to consider the following guidelines in the table 2-1when developing the idea:

Table 2-1: Points To Consider

Item	Points To Consider
PROGRAM TITLE	The title should be interesting and draw the attention of the audience.
OBJECTIVES	• What is the message you would like to address to the audience through the program? • Is the program educational, entertaining, or informational?
TARGET AUDIENCE	• Is the program for children, teenagers, adults, elderly people, or general? • Also it is necessary to consider the interests of the audience. Example: travel, music, food, animal, drama, international issues, history, etc.
PROGRAM FORMAT	• Is it a single program or a series? • How long is the program? • If it will be a series, how many programs will a series comprise of and how long will the series continue?
PRODUCTION METHOD	• Live or recorded? • Single or multiple cameras?
TENTATIVE BUDGET	Is the production cost of the program reasonable and realistic?

Once the idea is developed and you have a rough concept, the program proposal sheet can be useful to clarify your ideas. After filling up the proposal sheet, submit it to get approval from the production of the program. Since the program genre of the programs varies depending on the intention of the producer, it is necessary to be noted in the proposal, as well as the objective of the program. Including the tentative broadcast date is a necessary item in order to determine whether the program proposed is appropriate or not. Further, in order to determine whether the proposed program production is realistic or not, program length, content, shooting locations and the production period must be noted.
(Reference: Example 2-1 Program Proposal Sheet)

1. Name of the program
2. Producers and other crew members
3. Category
4. Duration
5. Broadcasting date(s)
6. Objectives
7. Content
8. Shooting Locations
9. Remarks
10. Production period
11. Budget

Several check points must be considered when you develop your idea and write a proposal.

1. Is the theme interesting and easy to understand to the audience?
2. Is the content appropriate to broadcast?
3. Are the information and the content valid and based on the truth?
4. Is the program a copy or very similar to the already-existed program?
5. Does the program contain propaganda or advertisement for particular organizations or person?
6. Is the program timely?
7. Is the content visually interesting?

8. Does the program need to clear copy or property right?
9. Is production realistic?
10. Is the program live, recorded in the studio or shot on location and edited?

EXAMPLE 2-1: Program Proposal Sheet

BTV Program Proposal Sheet
EXAMPLE

Date: September 2015

Name of Program: Nature and People in Botswana		**Production Team**	
		Producers	Kefilwe Mokgaotsane Gail Mohanang Gaamangwe Mathame
Category	Edutainment A series of 5-minutes episodes		
		Cameraman	Ontlametse Gaothuse
Duration	Each episode: 5 minutes		

Broadcasting Date:	**Re-broadcasting Date:**	**Re-broadcasting Date:**
Starts from mid October, 2015		

[Objectives of the Program]

- To introduce and educate the society about the current issues related to the forest and the activities and projects by Forestry and Range Resources (DFRR)
- To address the importance of how government of Botswana is dealing with related issues

[Contents]

- Wild fire management
- Sand dune stabilization and installation
- Alien invasive species management – ie: Prosopis
- Land reclamation / Soil conservation projects / Deforestation
- Community based Natural resources management projects
- Backyard nursery tree seedling farmers
- Poverty eradication project

[Locations]

- Kasane (Wild fire management project)
- Tsabong, Struizendm, Bokspits (Prosopis management project)
- Khawa (Sand dune project)
- Maun (Natural resources management projects)
- Lerala, Lecheng (Cosmetic products out of Morula fruits project)
- Shorobe (Basketry from Mokolwane trees project)
- Mosu Serowe
- Mokungwane (Poverty eradication project)

[Note or Remarks]

- 5-minutes episodes can be re-broadcasted many times as "fillers" between the longer programs.
- More audiences are able to watch the programs and will be educated and informed.
- This series can be continued with different subjects

Production Period: Jun e, 2015 ~	Beginning Date: March, 2015	Completion Date:	Estimate Budget:

2.2 BUDGET

Calculating the rough budget at the beginning of the production is very important for completing the program. The categories could include the followings:

- Transportation
- Staff / crew
- Talent / actors
- Script
- Equipment (if any rental)
- Post-production
- Props
- Permit
- Food
- Lodging
- Supplies

The following example 2-2: budget sheet is one type one of the examples. Depending on production, some of the items might not be necessary and/or BTV does not require certain items. Previous funding means if you have any budget remains from the previous production. Considering budget you need in each stages of production. For example, do you have to hire a scriptwriter or can the producer write the script during the pre-production stage? For production, if the shooting locations are out of Gaborone, budget for traveling and accommodation must be secured. Going through the items and requesting sufficient budget will be a key to the successful production.

EXAMPLE 2-2: Budget Sheet

TV PRODUCTION BUDGET SUMMARY SHEET		
Name of Program		
Number of Episodes & Duration		
Previous Funding		
Development	BWP	
Production	BWP	
TV DEVELOPMENT / SCRIPT		
Concept & Rights	BWP	
Research	BWP	
Story / Script / Writers Fees	BWP	
Other (Specify)	BWP	
Development Subtotal		***BWP***
TV PRODUCTION		
Producer Fees	BWP	
Director Fees	BWP	
Actors / Talents	BWP	
Production Staff & Crew	BWP	
Studio / Locations	BWP	
Rental Equipment	BWP	
Make-up / Wardrobe / Art Department	BWP	
Travel / Accommodations / Living	BWP	
Other (specify)	BWP	
Production Subtotal		***BWP***
TV POST PRODUCTION		
Music & Copyright	BWP	
Archive Footage & Copyright	BWP	
Stock	BWP	
Picture post-production	BWP	
Audio post-production	BWP	
Titles / Graphics	BWP	
Post-production labor	BWP	
Other (specify)	BWP	
Post-Production Subtotal		***BWP***
TV MARKETING & ADMINISTRATION		
Marketing / Delivery	BWP	
Administration / Overheads	BWP	
Legal	BWP	
Insurance	BWP	
Finance	BWP	
Other (specify)	BWP	
TV Marketing & Administration Subtotal		***BWP***
ANY OTHER		
	BWP	
	BWP	
Any Other		***BWP***

TOTAL TELEVISION PRODUCTION BUDGET	***BWP***
Total cost per episode	***BWP***

2.3 RESEARCH

It is important to conduct research for the preparation of some programs, for example, documentaries, news, interviews, and period dramas in order to collect necessary information and also to confirm accuracy of content is accurate. Research would help in selecting facts about the subjects that will make the program effective. The most important point during the research is to obtain information from different sources. Information must be verified and confirmed to be the truth, therefore the information from only one source or the source itself might not be reliable. Broadcasting wrong information must be avoided. For example, if you find an interesting article on the newspaper, you can visit or contact the person who has written the article and confirm the content. Also if it is about a person or an organization, you can also contact the person or the organization to verify the information in the article is accurate or correct. There are several ways to research.

- Articles of the newspaper
- Books and references
- Internet
- Interview
- Location visits

2.4 SCRIPTWRITING

Scriptwriting is involved in all the three stages of the production. It starts with an idea or concept, then develops to a story which can be modified, added, and re-written during and after the shooting, as well as during the editing stage. The script helps the producers or directors to clarify ideas, develop the program that communicates with the audience, and coordinate with the production team.

Sometimes some crews on location, for example a news crew or certain types of production crews, shoot spontaneously without a script outline.

SCRIPTWRITING BASICS

There is no rules how to write a script, however, in order to write a good script that is easy to understand for the audience and clear message to be delivered, the following basics will help and guide the writer. The table 2-2 indicates some of the basics of the scriptwriting.

Table 2-2: Scriptwriting Basics

	Items	Points to Consider
1	**Simple Script Outline**	Before writing the main script, it is helpful to write a simple outline by covering important points to be included in the script.
2	**Visualization**	• Visualize the program when you write any comments, narration or content. Sometimes not the words, but the pictures can deliver necessary information or impress the audience. • Avoid long "talking-heads" which can be very boring. • Include any important visuals in the script.
3	**Information**	• Avoid overloading information in any section or the whole program. Giving too much information can confuse the audience. • Keep the information simple. • Use of the graphs, charts, and diagrams may make the information easier to understand.
4	**Flow of Ideas**	• Comments/narrations should match the pictures. Different information on the screen and comments can cause confusion. • Avoid cutting between different subjects and stick with one topic at a time. • Transitions from one sequence or section to the next must be done smoothly without jumping suddenly.
5	**Pacing**	• Pacing should be varied throughout the program in order to make the program interesting. • Avoid a very fast pace when the program is delivering information or facts. Slow pacing can be boring, however, sometimes soothing and restful. Use the pacing cleverly and effectively. • Unless the audience record the program or have interactive mechanism, they are not able to rewind and watch the program again or later. Remember not to lose the interest of the audience.

6	**Writing Style**	• Consider the targeted audience and choose appropriate writing style. For example, use simple and easy language for the children's programs. • Never use vulgar languages. • Be careful and pay respect to all ethnic backgrounds, culture, and life-style.

2.5 STORY STRUCTURE and SCRIPT OUTLINE

The pattern of the script varies and there is not only one way to develop the story, however, most of the typical story of any kind have the basic and classic pattern that is divided into four parts as shown in the table 2-3:

Table 2-3: Four Parts of Story Structure

Parts of the story	Description
Introduction	What is the story about?
Development	More details of the content and keeping the story alive
Turn (Climax)	What is the most important point of the content and message you want to deliver to the audience?
Conclusion **(Ending or Resolution)**	Closing the story

The script outline can be created based on the story structure. Example 2-3 is one of the script outlines created by a BTV producer before writing the actual script, during the Working Group production of Digital Migration for Television Project. The story was about a wild fire drilling in Kasane that is a part of the wildfire management projects organized by Department of Forestry and Range Resources. Producing this type of the originally edited program is quite rare at BTV and this was the first time the producer has used the outline before writing a script. Based on the outline, the producer has written a script after shooting has done and footage has been reviewed.

EXAMPLE 2-3: SCRIPT OUTLINE

SCRIPT OUTLINE: EXAMPLE

NAME OF THE PROGRAM	**Edutainment 5 minutes Program Series**
CONTENT	**VELD FIRE DRILLING IN KASANE: June, 2015**

	CONTENT
INTRODUCTION **What is the story about?**	- Introduction of the fire drilling project - Introduction of the location - Kasane
DEVELOPMENT (BUILD UP) **More details of the content and bring the story alive.**	Very short interview of a DFRR or a fire fighter of Kasane Fire Station: Why the fire drilling in Kasane is necessary - How the training is conducted by the experts from Australia - Preparation of the drilling
TURN (CLIMAX) **What is the most important point of the content and message you want to deliver to the audience?**	The most important message: There are a lot of efforts by many fire fighters and organizations to protect the lives of people - Fire fighters in Kasane extinguishing fire - Experts from Australia teaching the trainees - Interview of an Australian expert - Reaction of a fire fighter about the training
CONCLUSION (ENDING) **Closing the story**	Wrap up the story - Interview of a DFRR: The trainings have been executed not only in Kasane, but other areas around the country - Battle and mission against the wild fire in Botswana continue…

A good drama operates on numbers of conscious and unconscious levels, all of which must be made explicit by the writer. The writer must select the following four basics to form the structure of the story.

- Theme What is the story about
  Is it a love story, an adventure, a tragedy, or life of a family?
- Plot How does the story move forward and develop

How does it start, develop, and end?

- Characters — How do all the characters react to each other? What are the relationships between characters?
  Who is the main character(s) and how they react to each other?
- Environment — Where does the action take place?
  Is it in the big city, rural areas, or abroad?

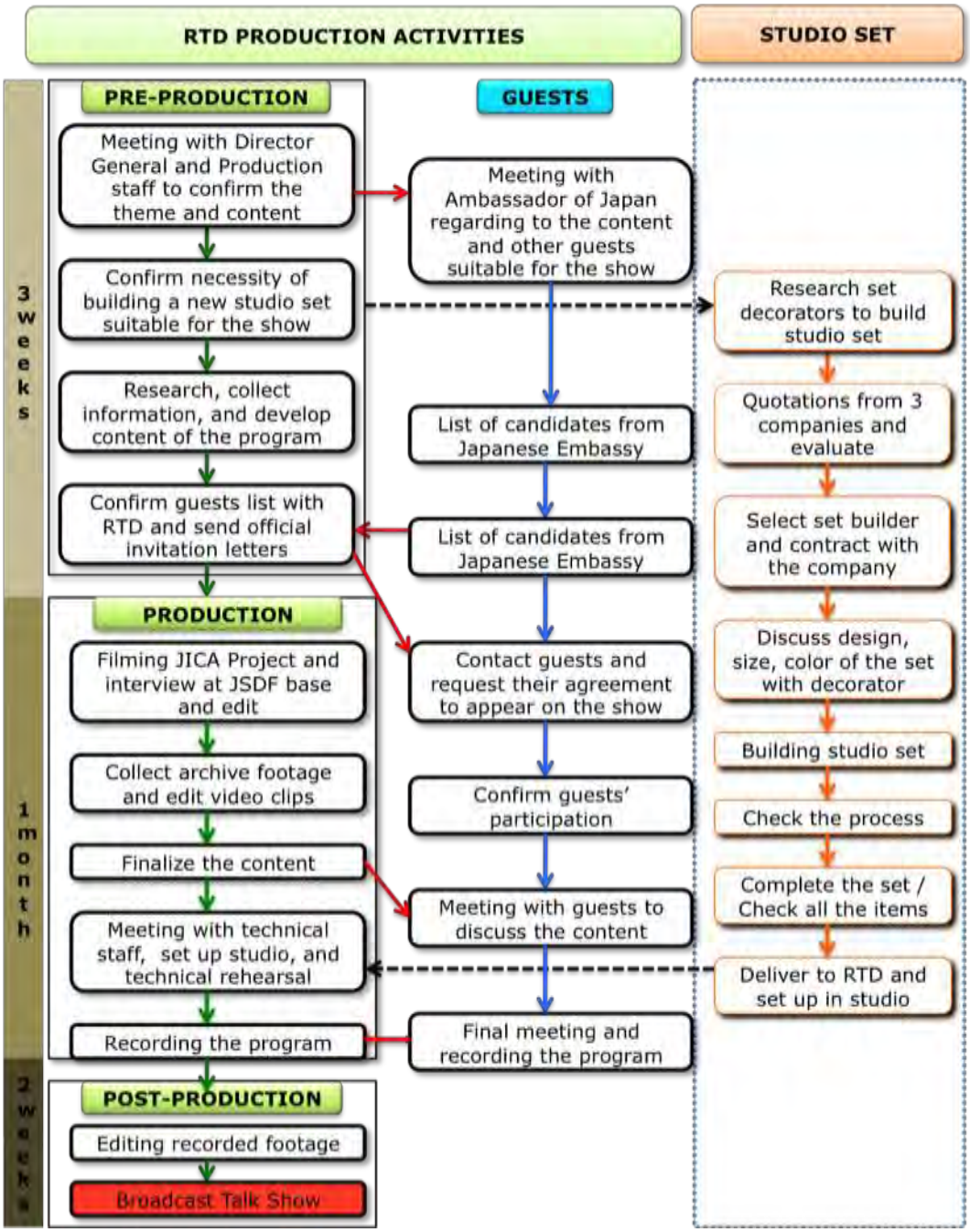
2.6 PRODUCTION SCHEDULE

The production schedule should clarify the responsibility and a timeline to all the crew involved in the production. It must include three stages of the production with enough and realistic time frame to meet the deadline.

Example 2-4: Production Schedule for Talk Show with Guests indicates the flow of the production started in middle of October and all the activities have taken until the actual recording date of the show in early December. The left column shows the production activities of the staff of the TV station. Middle column shows how the staff contacted the guests, obtained the permissions and invited them to the show. The right column shows the studio set TV station ordered to the outside professional builder. Each activity in three columns simultaneously happened.

The best way to schedule production is to plan backward from the tentative date of broadcast and to list up all the necessary items must be taken care of. Sharing with all the relevant staff and who will take care what must be decided by when.

EXAMPLE 2-4: Production Schedule for Talk Show with Guests



2.7 PRE-PRODUCTION FLOW: STEP BY STEP

Pre-production process does not have a definite rule, therefore, it can be decided according to the type of the program, scale of production, crew size, etc. The figure 2-1 indicates one of the basic pre-production flows. For example, once the theme and basic concept has been developed, research can be done before selecting production team.

Steps	Production Process	Reference
Step 1	PROPOSAL Hold brain-storm meetings with your colleagues or by yourself; develop a concept or an idea, select theme and topics, and write a proposal.	Blank proposal sheet in Annex
↓		
Step 2	CREW/PRODUCTION TEAM/ Select crew and form a production team.	Production crew list
↓		
Step 3	BUDGET Calculate rough budget	Example of budget sheet
↓		
Step 4	RESEARCH Once the proposal is approved, research and collect necessary information.	- Newspaper articles - Books/References - Internet - Interview -Going to the location directly
↓		
Step 5	SCRIPTING Based on the information gathered, write an outline of the script.	- Introduction - Development - Turn/Climax - Conclusion/Ending
↓		

Step 6	PRODUCTION SCHEDULE Decide the date of filming and make a schedule and share with your production team.	Example
	↓	
Step 7	PERMIT If necessary, request permission to shoot.	- Official letter - E-mails - Telephone call - In person

Figure 2-1: Flow of Basic Pre-Production

CHAPTER 3

PRODUCTION

CHAPTER 3: PRODUCTION

3.1 SHOOTING SCHEDULE

Before starting shooting, it is recommended to make your shooting schedule and share it with your crew, preferably not on the day of the shoot, but prior to the shooting day/days. It will allow everyone to understand not only the time schedule, but also the purpose of the program and shoot. Based on the shooting schedule, a production meeting can be held. The followings are some of the important points must be discussed at the meeting:

1. Expected date of broadcast
2. Crew members and their responsibility/task
3. Date and time of shooting
4. Locations and addresses
5. Contact person and his/her contact information
6. Shooting objects

Once the shooting dates, locations, and subjects are decided, it is highly recommended to make a shooting schedule and share with production team.
It clarifies who is the crew, shooting is for which program, what is the object and subjects to shoot, locations, contact persons, and timeframe, Example 3-1: Shooting Schedule indicates one day shooting for the first episode of special news feature.

EXAMPLE 3-1: Shooting Schedule

BTV SHOOTING SCHEDULE (Example)

NAME OF THE PROGRAM	BTV Goes Digital: Digital Migration: Part 1
DATE of BROADCAST	1st week of April
PRODUCERS	Gail Kgomotso
REPORTER	
CAMERAMAN	Ontlametse Goaothuse

DATE of SHOOTING	13 March, 2015 (Friday)
OBJECT	Demonstration of Set Top Box by Data Broadcasting + PR Working Group Audience Survey by Programming WG

LOCATION	Airport Junction Mall
CONTACT/COORDINATOR	Oreneile Matsetse – JICA Administration/Publicity Officer Office: 365 3219 Mobile: 73 620 616

TIME	SCHEDULE	✓
11:00	Preparation @ BTV – Load equipment	
11:30	Crew call / Leave from Media Complex – Exact location?	
	(Gail, Ontlametse, Chiaki, Katsuya)	
12:00	Arrive @ Airport Junction Mall	
	Start shooting as soon as ready	
	Demonstration of Set Top Box by Data Broadcasting WG for Public Relations WG	
	• Demonstration	
	- Setting up the booth and equipment (W, M, CU of hands, faces, etc., various shots)	
	- Demonstration by PR WG (W, M, CU, P, various shots)	
	- Public watching demonstration and asking some questions (Various shots from different angles)	
	- Interaction between WG and public (Various shots)	
	• Interviews	

	- BTV Data Broadcasting WG staff (HS) - Public (HS) **Audience Survey** • Survey by Programming WG - Setting up (?) (W, M, CU of hands, faces, etc., various shots) - Taking surveys by Programming WG (W, M, CU, various shots) - Public taking surveys (Various shots from different angles) - Interaction between WG and public (Various shots) • Interviews - BTV PR WG staff (HS) - Public (HS) **B-Rolls** • Exterior of the Airport Junction - W or P of the mall - CU of the name of the mall, if any • Airport Junction – Various shots of shops, people, etc. Wrap up and leave Back to Media Complex	
15:00 or (as soon as shooting is completed)		

3.2 INTERVIEW

Except unplanned or street interviews, it is highly recommended to prepare the questions prior to the shooting and send them to the interviewees. Knowing the questions ahead of the time, the interviewees are able to prepare answers and you are able to receive clearer, more accurate, and better answers. The interview situation might not be as you expect, since most of the interviewees are not professional talkers, accepted interviews out of courtesy, could be nervous, or are not be able to take a long time, therefore, you must be prepared to deal with any situation, in order to obtain the interview and information that you plan. The following example 3-2 indicates some tips to conduct successful interview.

EXAMPLE 3-2: Tips for Interviews

TIPS FOR CONDUCTING INTERVIEWS

		TIPS
1	**REQUEST INTERVIEWS**	1. Contact interviewees through one of the mediums: a) Telephone b) Letter c) E-mail d) In person Choose the medium which you think is most appropriate and best. 2. If you do not hear from the person for 2-3 days, do not wait longer rather follow up. 3. Remind interviewees and confirm date and time of the interview 1-2 days before the interview.
2	**QUESTIONS**	1. Provide questions to interviewees before the interview, except in cases of street or unexpected interviews. 2. Questions should be short and clear. 3. Confirm that interviewees understand the content of the questions in order to obtain clear answers.
3	**LINE OF SIGHT/VISION**	1. Look at your interviewees and show you are interested. Do not look at your notes all the time. 2. Ask your interviewees to look at you and talk.
4	**TIME MANAGEMENT**	1. Be on time, but do not go too early. The interviewees might not be ready. 2. Set up as quick as possible. If you have time, check the location of the interview beforehand and decide where you will conduct your interview. 3. Minimize the duration of the interview, unless interviewees are willing to talk or the content of interview is very interesting and worth to continue.
5	**LANGUAGE and HOW TO**	1. Use polite/appropriate languages to everyone. Never use vulgar language or words that might hurt interviewees. 2. Do not use complicated language. Use simple words

	CONDUCT INTERVIEWS **HOW TO CONDUCT INTERVIEWS**	and phrases that are easy to understand and clear confusions. 3. If the interviewees look nervous, start your interview with casual talk. 4. When interviewees are talking do not interrupt or stop them until they finish, unless it is very long or the answers are going to the wrong direction. 5. If you do not get the answers in the right direction, or the answers are not clear, phrase the questions using different words. 6. Respect interviewees, even when they are not polite. Remember you requested for the interview. 7. Even though interviewees accepted to be interviewed, always take permission for their interviews to be broadcasted. 8. Obtain all the information you think you need from the interview. (on and off camera) 9. Information can be used in the narration.
6	**SHOOTING**	1. Choose the most interesting or effective background and position to set up the camera. 2. Do not forget to shoot insert cuts and B-rolls.
7	**BEFORE BROADCAST**	1. If information is not enough or not clear to complete your story or program, contact interviewees to confirm. 2. Inform the interviewees the date of broadcast.

3.3 ASPECT RATIO

Basically digital television system has 2 different formats: SD (Standard Definition) TV and HD (High Definition) TV. The difference between two formats is the aspect ratio: the width-to-height proportion of the screen is shown in the figure 3-1 and 3-2.

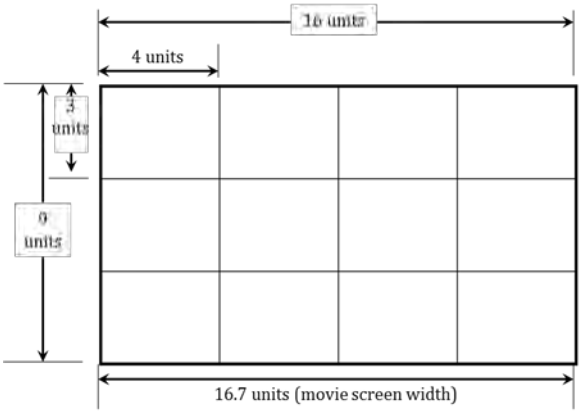


Figure 3-1: 16 x 9 ASPECT RATIO

The aspect ratio of HDTV is 16 units wide by 9 units high. This ratio is similar to the movie screen.

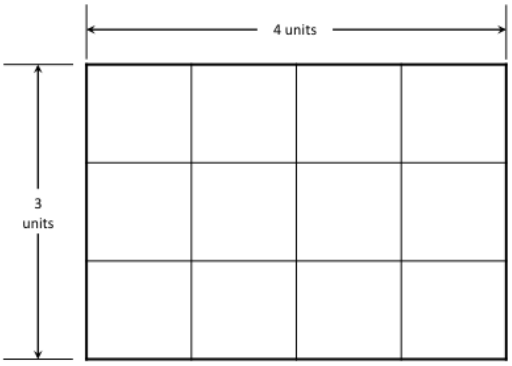


Figure 3-2: 4 x 3 ASPECT RATIO

The traditional aspect ratio of the television screen is 4 units wide by 3 units high.

Since the aspect ratio of HDTV is quite different from the standard 4 x 3 format, different technical skills and consideration are required. The same size as of HDTV might not be suitable for a particular shot for SD or does not fulfill the purpose of the shot. Therefore, the cameramen should consider and adjust the composition, framing, positioning the subjects, left and right space when shooting with the HDTV 16 x 9

format. Since there is more space horizontally, it is able to include more background images on the screen. This space can be use effectively. For example during the interview in SDTV, usually the main subject in the frame will be the interviewee and it is not possible to show the background activity. On the other hand, in HDTV, the composition including the background activity is possible. It is possible to show two subjects at the same time and the image can be sufficient to describe the situation without explaining on the voice over or the graphics.

3.4 VISUAL

(1) TYPES OF THE SHOTS

Selecting the shot is the first step for the cameraman. Each type of shot has its own advantages and disadvantages, therefore it must be decided depending on the content and the purpose of the shot (how will it be used in editing?). For example, the following questions can be considered in order to select the size of the shot and camera movement that will represent the purpose of the shot .:

1. To describe the location or situation?
2. To allow the audience to see emotions or the details?
3. To establish the mood or the scene?
4. To dramatize the event?
5. To show the relative positions or sizes of the subjects?

(2) SIZE OF THE SHOTS

The table 3-1 indicates typical types of the shots:

Table 3-1: Typical Types of Shots

Type of Shot	Description and Characteristic	Example Shot
Extreme Close Up Shot (ECU)	ECU can be used to show the extreme details to the audience, clarifies a situation or adds drama to the situations, such as showing the emotion of a person.	
Close Up Shot (CU)	CU is a very powerful shot and draws the attention of the audience. It can be used to reveal or point out information that might otherwise be overlooked, or only discerned with difficulty. It is also effective when you intend to show the emotion or have impact upon the audience.	
Tight Bust Shot (TBS)	Tighter shot above the bust can be used for interviews when you intend to emphasize emotions and expression of a subject. In HDTV this type of the shot is more effective.	
Bust Shot (BS)	Shot above the shot is used most commonly for interviews.	

Loose Bust Shot (LBS)	Looser BS can be used for interviews in which more gestures of a person can be shown.	
Medium Shot (MS) / Waist Shot	MS is also called waist shot. It can be used when you intend to show the gestures of a person, since you are close enough to a person to see his/her expressions and emotions, but far enough away to understand some of the context.	
Knee Shot (KS)	KS is a shot above the knee and can be used	
Long Shot (LS) /Full Shot	The LS is called full shot or establishing shot. It is able to establish the situation or show the location. It can be used to show a full figure (from a head to feet) of a person in order to give a whole image of the person.	
Extreme Long Shot (ELS)	It is also called establishing shot. The ELS can be used to cover a very widespread location or an action, however, it might give detached feelings to the audience.	

(3) OTHER COMMON SHOTS

Two-shot

When two persons are in the frame it is called two-shot.

Three-shot

When three persons are in the frame it is called three-shot.

Over-the-shoulder-shot

Over-the-shoulder-shot is usually two-shot, used for interviews or conversations. It is shot over one person's shoulder, so that mostly the face of this person is not shown and other person can be recognized.

For HD, the tight or loose bust shot could be very effective instead of the regular bust shot. TBS can be used to show more emotion or expressions and LBS can be used to show more gestures of a person, since the screen is wider. It allows to give more impact than the screen of SDTV. Knee shot must be carefully shot, since there are more spaces on each side.

(4) MOVEMENT and ANGLE

The table 3-2 indicates typical types of the camera movement and angle.

Table 3-2: Camera Movement

Movement	Description
Zoom In and Out (ZI / ZO)	Zoom lens is equipped on most TV cameras and it can adjust the focal length within its range without interrupting the shot. ZI or ZO can be used to show from the full image to the details or vise versa in one shot. It can be used to attract more interest of the audience to the subject and creates emotions within a shot.
Pan Tilt Up (TP) Tilt Down (TD)	Pan is a shot turning the camera horizontally from left to right (pan right) or from right to left (pan left). Pan can be used when you intend to cover a wider range of the scene that cannot be covered in one still shot, such as a landscape. TP and TD are the movement of the camera from down to up (TU) or from up to down (TD). This vertical movement can be used to show a tall building from the top to the bottom or vise versa.
Dolly Shot	There are various types of the dollies that can be used depending on what kind of movement is aimed. Usually the whole camera is mounted on the dolly and moves towards or away from the subject. In studio the tripod with wheels can be used for the dolly movement.
Shot Using the Jib Arm	Jim arm is a crane like device to all different types of movement including swinging 360 degrees, dolly, truck, lower or higher the camera.
Low Angle (LA) High Angle (HA)	The camera is positioned in the lower level and shoots the subject looking up (LA) or above the subject and shoots the subject looking down (HA). For example, LA can be used to show a full shot of a tall tree that regular eye-level shot cannot cover. HA includes aerial shot from an airplane or a helicopter to show the wide area.

Zoom shot is the only camera movement done by not moving the camera, but using the lens. The following rules apply when zooming in:

- Zooming in does not mean to zoom toward the center of the frame.
- At any point during movement of zooming in or out, the shot must be established.

The figure 3-3 indicates the framing for zooming in and out described the above.

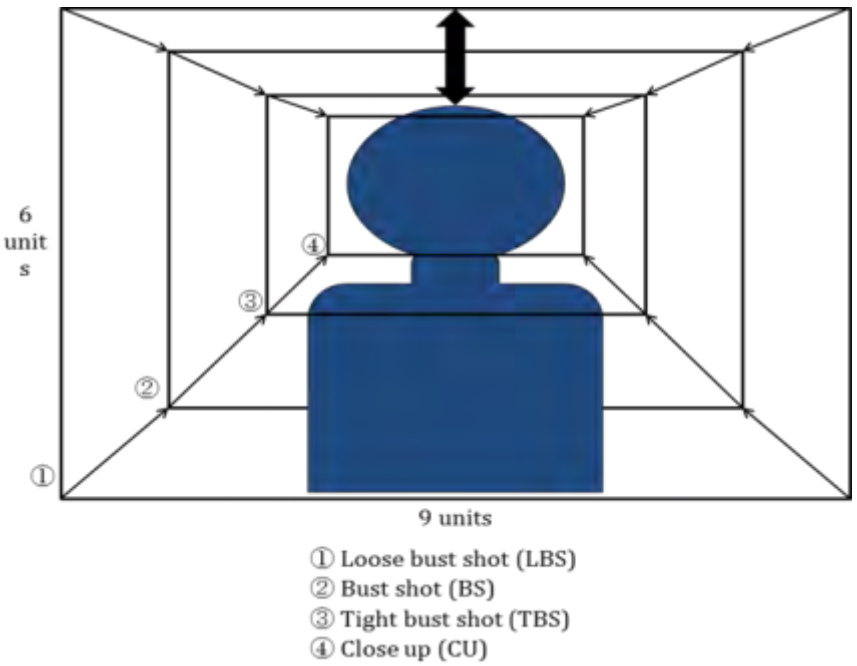


Figure 3-3: Framing for Zooming In/Out

(5) COMPOSITION AND FRAMING

A) COMPOSITION

There are no specific rules for the composition. They are the indicators of how the audience react or respond to the image they see on the screen. It is important to consider the intention of the shot and balance of the composition. For example, what do you want your audience to see or pay attention to? Composition also allows the audience to either receive a strong impact or to become bored vise versa. For example, if you intend to show a person in front of the house, you must compose the person as a main subject in the frame. If you compose a long/full shot of the house, attention of the audience do not go to the person, but the image of the house.

B) FRAMING

Framing is selecting what is to be included within the picture and how they are to be placed in the frame. The followings following points must be considered when decisions of the framing are made:

- Intention of the shot: Do you intent to show the details or emotion by using CU? Or do you intent to show describe the scene by using LS?
- Headroom – the amount of the space above the head of a person: Since the edges of the TV frame seem to attract the attention of the audience, it is recommended to leave some space above people's head. However, leaving too much headroom gives uncomfortable feeling, therefore, it is necessary to find a headroom comfortable to the audience.
- The size of the person or the object within the frame: The size of the subjects relates to the purpose or intention of the shot. For example, if you intent to show how a person look like, ELS is not suitable, since the person is too far and the audience is not able to recognize the look.
- The position of the person or the object within the frame: If a main subject is positioned too close to the edges of the frame or a part is cut off, the audience feels uncomfortable. It is necessary to find the balance within the frame and also consider what is the purpose of the shot.
- Distance and relationships of the subjects: If you intend to show two people talking, the distance between them must be closer, unless their positions are far

(one person is across the street and one on the other side and a long distance represent certain meaning).

(6) BALANCE OF FRAMING

Balance of the composition and framing is able to create impact, dynamic atmosphere or tension, and various effects to the shot. Balancing in a image is effected by the size of a subject within the frame, its tone, and its position. Unbalanced picture gives uncomfortable feeling to the audience, unless that is the purpose of the shot.

- The subject does not always have to be centered, sometimes centering the subject can be a boring shot. This allows the audience to see not only the subject, but also the surrounding that gives more information,
- If you choose to position the subject on one side of the frame, you need to place something on the other side to counterbalance and create a symmetrical balance. If you have a person on the right side of the frame and nothing is located in the frame, it is totally unbalanced. Something counterbalance can be a building, a tree, a garden, or a group of people far away.
- Tone, color, and brightness influence the balance and visual weight – for example, cooler colors look lighter than warmer colors and the light-toned subjects look larger than the dark-toned subjects

In order to change the balance:

- Adjust lighting: Usually eyes of the audience are drawn to the brightest place in the frame, therefore, you can balance by darkness and brightness.
- Change the position of the camera or move the subjects: If the distance between two people talking is too long that causes unbalance and awkward feeling, the camera can be moved to shorten the distance or two people can move closer.
- Adjust the size of the shot by zooming in or out: ZI or ZO is able to change the balance of the subjects within the frame.
- Change the height of the camera or angle: Same effect can be expected such as change the position of the camera or move the subjects.

(7) SHOT LIST

Preparing the shot list before the actual shoot is highly recommended. It can be prepared by the producer, the cameraman, or brainstormed and discussed during the production meeting. This will not only help to ensure that the important shots are included, but also to plan the editing process. Example 3-3 is a shot list prepared for a shoot of the first news feature produced during the activity of Implementation of Digital Migration Project. Subjects and shots are planned before the actual shoot, however, they were modified on site according the situation.

EXAMPLE 3-3: Shot List – News Feature

BTV SCENE/SHOT LIST OF PROGRAM PRODUCTION (Example)

NAME OF THE PROGRAM	BTV Goes Digital: Digital Migration: Part 1
DATE OF BROADCAST	1st week of April
PRODUCERS	Kefilwe Mokgaotsane, Gail Kgomotso, Gaamangwe Mathame
REPORTER	
CAMERAMAN	Ontlametse Goaothuse

SHOT TERMS:	ELS	Extreme long shot	LS	Long shot
	KS	Knee shot	MS	Medium (knee) shot
	LBS	Loose bust shot	BS	Bust shot
	TBS	Tight bust shot	CU	Close Up shot
	ECU	Extreme close up		
	LA	Low Angle	HA	High Angle
	P	Pan → or ←		
	TU	Tilt Up ↑	TD	Tilt down ↓
	Dolly		ZI/SO	Zoom in and out

DATE	LOCATION	SHOT	✓
13 March 2015 (Friday) 12:00~	Airport Junction Event 12:00 – 17:00	**Demonstration of Set Top Box** • Demonstration by PR WG - Setting up the booth and equipment (LS, M, CU of hands, faces, etc., various shots) - Demonstration by Data Broadcasting WG (ELS, P, various shots) - Public watching demonstration (Various shots from different angles) - Interaction between WG and public (Various shots) • Interviews - BTV Data Broadcasting WG staff (HS) - Public (HS) **Audience Survey** • Survey by Programming WG - Setting up (W, M, CU of hands, faces, etc., various shots) - Taking surveys by Programming WG (W, M, CU, various shots) - Public taking surveys (Various shots) - Interaction between WG and public (Various shots from different angles) • Interviews - BTV PR WG staff (HS) - Public (HS) **B-Roll** • Exterior of the Airport Junction - W or P of the mall - CU of the name of the mall, if any • Shops, customers, @ Airport Junction – Various shots	

(8) LIGHTING

The cameras need certain amount of light to produce a shot with a good tonal range. Lighting is not only to make the subjects or locations visible, but also to adds artistic influence, set the mood and atmosphere, enhance the setting or location, or create some effects to the scene. Lighting can be used also on location when the natural or existing light is not enough, too bright, too contrasting, or not suitable for the purpose of the shot. Basically there are two types of lightning shown in the table 3-3.

Table 3-3: Basic Types of Light

Type of Light	Description
Spotlights	A spotlight is a directional or hard illumination that produces sharp shadows. The sun is also a spotlight.
Floodlight	Floodlight or soft light is scattered and diffused illumination and does not create sharp shadows. If the diffusion material is placed in front of it, the spotlight can be used as a diffused light.

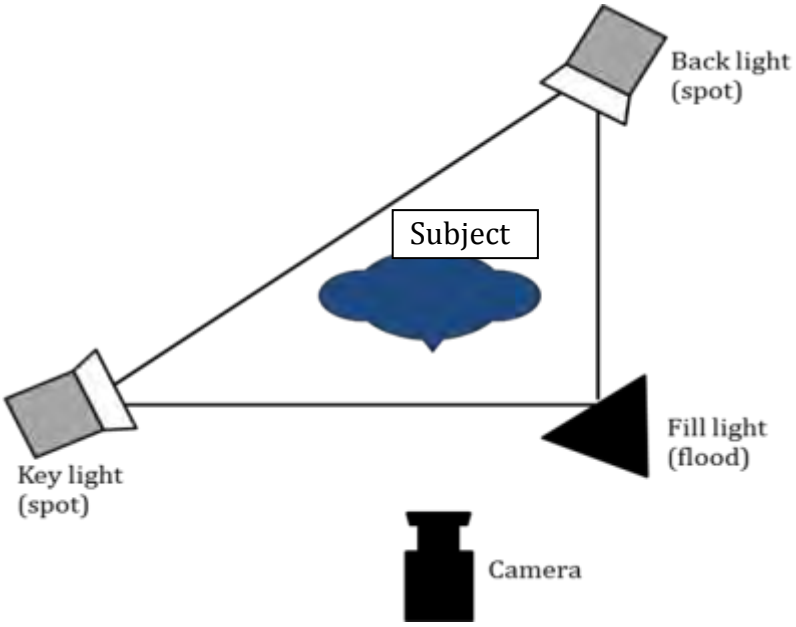
A) BASIC LIGHTING (Three-Point Lighting)

Three-point lighting is the most basic lighting method to light a person or an object with three lights; the key light (main light), the fill light, and the backlight. The table 3-4 explains about three lights.

Table 3-4: Function of Three Lights

Type of Light	Description
Key Light	The main light, usually a spotlight, aims to reveal the shape of the subject from one side of the camera and usually slightly from the above.
Fill Light	The fill light is usually placed in the opposite side of the camera from the key light to reduce a strong shadow created by the key light.
Backlight (Hair light)	The backlight is placed behind and slightly above from the subject to separate the subject and the background.

EXAMPLE 3-4: Three-point Lighting

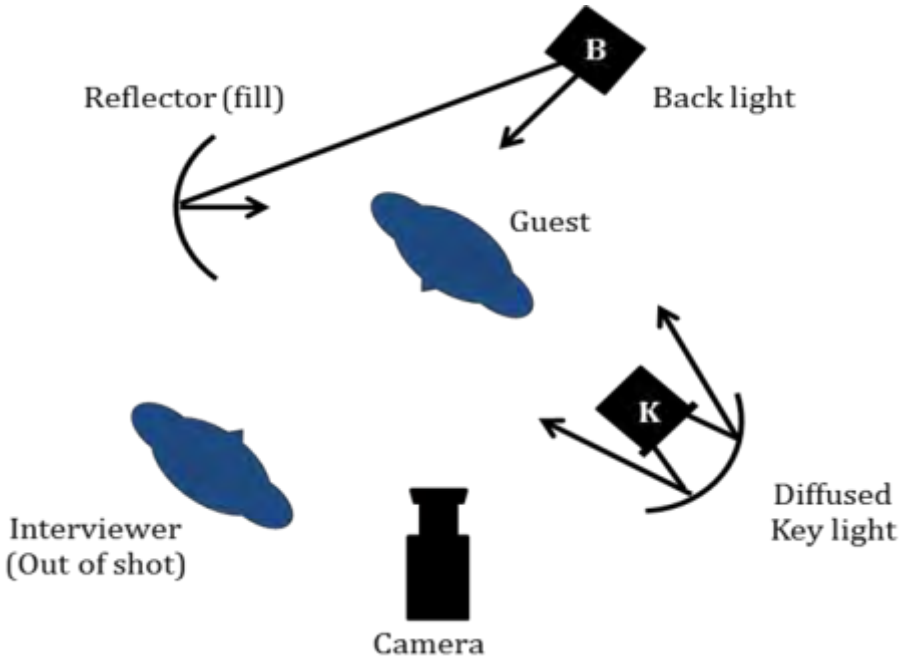


Back light is also called hair light.

B) LIGHTING FOR INTERVIEWS

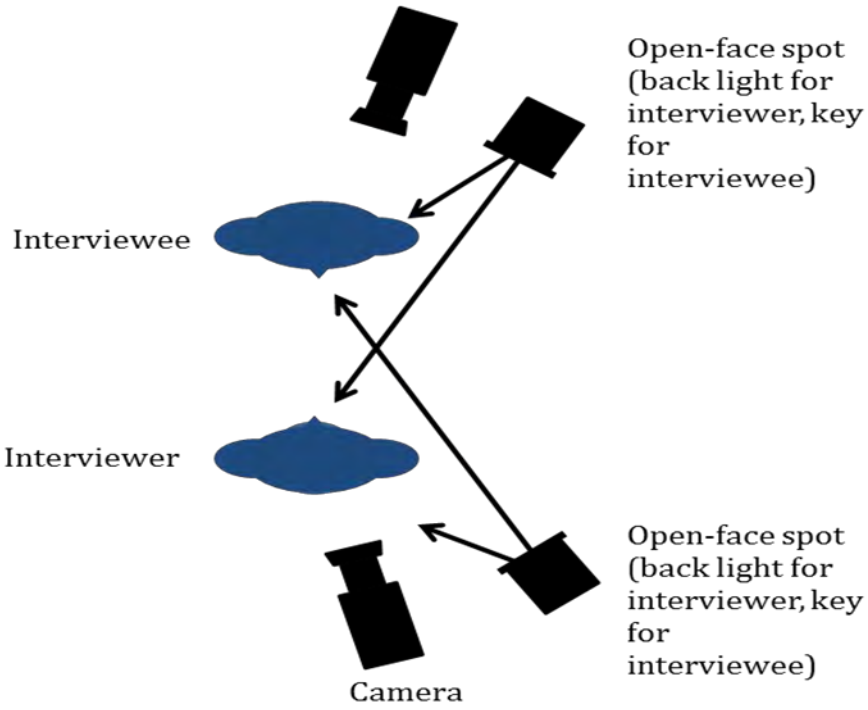
Lighting for an interview can be managed with two lights as shown in the examples 3-5 and 3-6. In example 3-5 the diffused key light is an open-faced spot with a scrim, a tent, or an umbrella. The back light is a spread or focused open-face spot. If fill light is necessary, it can be created with a reflector. Note that the interviewee is looking at the interviewer who is sitting or standing next to the camera, out of the shot.

EXAMPLE 3-5: Triangle Lighting for Interviews



EXAMPLE 3-6: Cross-Keying Lighting for Interviews

When both interviewer and interviewee will be shot with two cameras, two lights still can manage to give enough light. It means one light works as both the key light and the back light. The spill of the key lights works as the backlight at the same time. Two open-face sports with tents, scrims, or umbrella reflectors can be placed, so that they shine over the shoulder of the participants sitting or standing opposite each other. In this cross-keying, the two lights serve as multifunction key and back lights.



C) DIFFERENT LIGHTING TECHNIQUES

The key light does not have to be placed in front of the subjects. Depending on the situation, time of the day, or artistic purpose, it can be set in a different angle.

For example, if you are shooting around the sunset, key light from the front is too strong and does not match the surrounding, so it should be placed in the direction of the sun and intensity and color of the light must be carefully set.

D) REFLECTORS

Reflectors can be used in numbers of situations with different techniques. The followings are some of the examples of how the reflectors can be used are as follows:

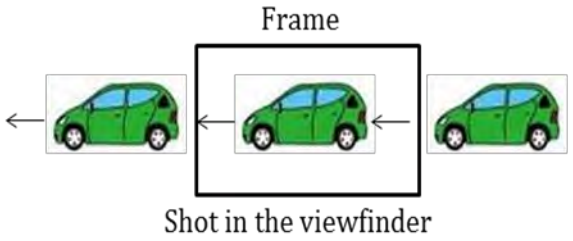
1) The key light is the sunlight and the reflector is the fill light.
2) A reflector provides additional light to the subject or the scene.
3) Depending on the situation, the silver or white reflectors can be selected to increase the amount of light.
4) Placing the reflector close to or away from the subjects can increase or decrease the amount of light.
5) Angles of the reflector give different effects.

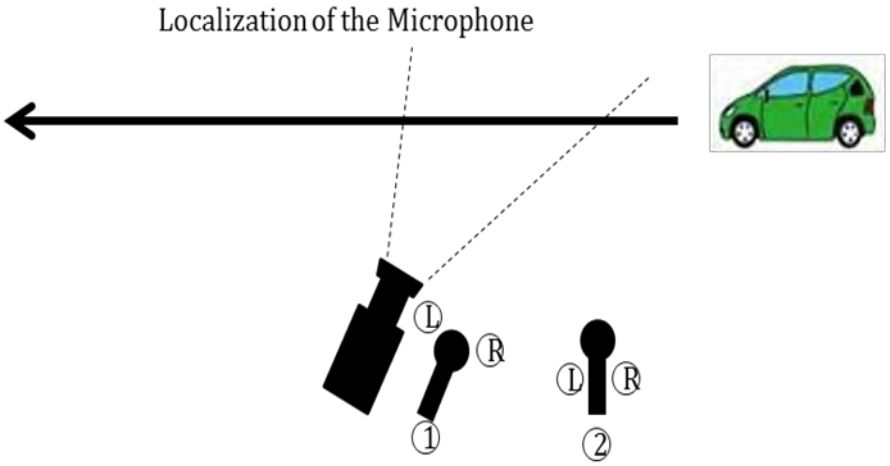
3.5 AUDIO RECORDING FOR HDTV (Stereo)

Audio in the HD production is stereo sound that creates an illusional space and dimension like watching a movie, especially on the large screen. It also allows the audience to locate where the sound is coming from, therefore, considering how to record the sound must be required, depending on the scene, the shot, or situation, especially location of the microphone. The audience who has a TV monitor without stereo speakers is not able to benefit from the stereo sound effect.

For example, when shooting the moving object horizontally from left to right or right to left such as a vehicle, the position of the microphone and how to point the microphone toward the moving object can be critical to record the sound. If you place the microphone near the camera, you can record the sound coming toward you and going away, however, the stereo effect will not be obvious. The microphone must be placed where the stereo sound can be recorded with maximum effect. The figure below shows this example.

EXAMPLE 3-7: Recording Stereo Sound of the Moving Object





3.6 PRODUCTION FLOW EXAMPLE: STEP BY STEP

Production process does not have a definite rule, therefore, it can be decided according to the type of the program, scale of production, crew size, etc. The figure 3-4 indicates one of the basic production flows. For example, production meeting can be held not only once, but numbers of times according the necessity, before and after preparing a shooting schedule or a shot list.

Step 1	SHOOTING SCHEDULE Prepare a shooting schedule.	Example
↓		
Step 2	SHOT LIST Make a shot and location list.	Example
↓		
Step 3	INTERVIEW QUESTIONS Prepare questions for interviews. It is recommended to send the questions to interviewees beforehand, for them to prepare their answers and clarify the purpose of the interviews.	Tips
↓		
Step 4	PRODUCTION MEETING Hold a production meeting with your whole shooting crew; share all the necessary information, and brain-storm the ideas about how the shooting should be done.	- Script - Shooting schedule - Shot list
↓		
Step 5	SCRIPT Revise the script, if necessary.	
↓		
Step 6	SHOOTING Shooting on locations or in the studio.	Shot list

↓

Step 7	INFORMATION In case of the location shooting, collect additional information, if necessary.	

Figure 3-4: Flow of Basic Production

CHAPTER 4

POST-PRODUCTION

CHAPTER 4: POST-PRODUCTION

4.1 PRE-EDITING

Before starting the actual editing with your editor, pre-edit preparation must be done. Preparation includes reviewing all the footage and sources, logging the shots, thinking about how the scenes will be constructed, revising your script, selecting some shot - if not all, reserving the editing facility and the editor, and reviewing the original schedule to meet the deadline.

A) LOGGING FOOTAGE

Logging the recorded materials saves time. The editor will be able to locate the shots easily when editing. Also you can select the shots you would like to use, note the bad shots, and make remarks. The most common log sheet are mentioned below: so that the editor who usually does not accompany the shooting is able to locate the footage easily and quickly.

- Title of the program
- Date shot
- Location
- Cameraman shot the footage
- Scene
- Description
- Time code of IN and OUT
- Remarks or notes

Annex: Sample of a log sheet

B) REVISING THE SCRIPT

After logging the footage, considering what kind of shots and scenes you have, the script must be reviewed and if necessary, it can be modified, rewritten, or added. You can also revise the script as you edit.

4.2 BASIC EDITING DECISIONS

During the editing process, it is necessary to take several decisions in order to construct the story and make the editing process smoothly. Some of the points to consider are as follows:

1. How does the opening sequence start and how does the program end?
2. Which shots do you want to use? Is the shot you chose suitable for the sequence or the scene? How long is the duration of the shot?
3. How will each shot transit (cut, dissolve, wipe, fade, etc.) to the next shot or sequence and how fast will be the transition?
4. Is the continuity between the shots good?
5. Do you want to show the entire action or interrupt?
6. Is audio natural or is it recorded sound?
7. Any music or additional sounds?
8. Any graphics?
9. Any special effects?
10. Is narration necessary?

EXAMPLE 4-1: Extreme Changes in Distance

Extreme Long Shot (ELS)

Close Up (CU)

4.3 EDITING TECHNIQUES

Editing techniques are created out of experience. If the editing is done well, the audience do not notice the errors. The most common editing techniques in order not to make the juxtaposed pictures confused to the audience and to make the flow of the story smooth.

- Cutting between two shots of the same size (for example, long shot to long shot) is called a JUMP CUT and must be avoided.
- Cutting between static shots and moving images (tilting, zooming in and out, panning, etc.) should be avoided, unless there is a specific purpose.
- Cutting between shots of extremely different sizes of the same subject (for example, from long shot to extreme close up) makes the audience dizzy.
- Cutting of shots that make the subject jump from one side of the frame to the other side must be avoided.
- If two or more subjects are moving in the same direction, they must move in the same direction across the screen.
- If the continuity of the action will be broken, the cut-away shot must be inserted.
- Transition from one shot to the next should be smooth.

4.4 TRANSITIONS

Juxtaposing shots is done with the transitions that play a significant role in the audience's understanding of what is going on in a scene. The table 4-1 indicates typical types of transitions.

Table 4-1: Typical Types of Transitions

Types of Transitions	Description
Cut	The most common, and general-purpose of transition. It is an instantaneous switch from one shot to another and can be used to instantly associate two situations or when you intend to give more impact to the audience by the sudden change of the shot.
Dissolve	An effect produced by fading out one shot while fading in another. A quick dissolve can be used to imply that the action in the two scenes is happening at the same time. A slow dissolve can be used to suggest the passing of time or changing the location.
Fade	A gradual change (dissolve) between black and a shot or an image. Fade in is from black to an image and fade out is from an image to black. Fade in and out are mostly used to open up the story, changing the scene, and ending of the program.
Wipe	A novel transition of one image wiping onto another, covering the original image with the new images. There are many different geometric forms with a variety of applications. It can be used to provide a change of time, change of location, or sometimes just for decorative transitions.

4.5 CONTINUITY

Continuity in editing is extremely important. If continuity of the action, screen positions, and the story is broken, the audience will get confused and the story will not be delivered.

- The shots must be juxtaposed in order of the action taken.
- Avoid editing between shots of extreme changes in distance, in this way the audience is able to recognize a subject from one shot to the next shot.
- Continuity of the sound must be considered. Editing dialogue or commentary requires an extra care to keep the rhythm of the speech. Sudden change in sound can be destructive. If the whole song is not going to be used, the music should fade in or fade out.
- Screen positions of the subjects must be considered carefully. If, for example, the reporter interviewing someone in over-the-shoulder two-shot is on the left side and the interviewee is on the right side, two of them must remain in their relative screen positions and not switch places in the reverse-angle shot. (See the example 4-2)

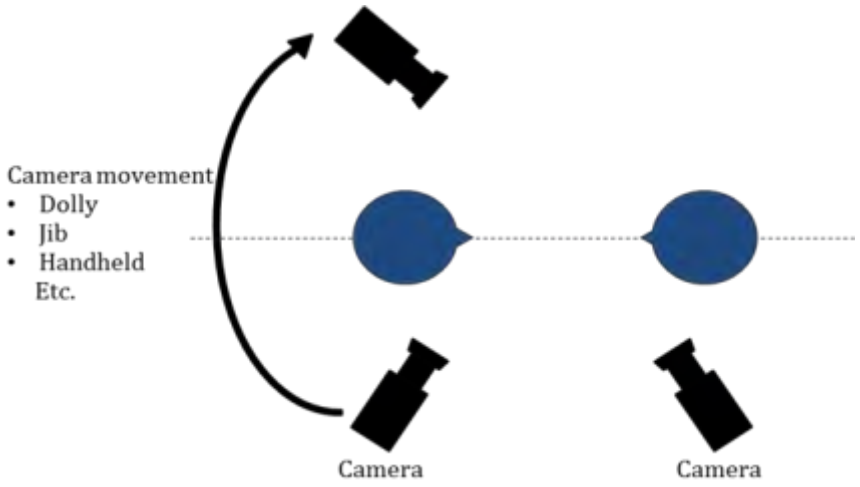
EXAMPLE 4-2: Maintaining Screen Positions in Reverse-Angle

VECTOR LINE (180 Degree Rule)

As shown in the example 4-2, maintaining the screen positions is important. In order to not confuse the audience, keeping the subjects in their expected screen locations in reverse-angle shot is the vector line. The vector line is the line of conversation and action and an extension of converging index vectors of a motion vector in the direction of object travel.

The example 4-3 shows how to cross the vector line and shoot from the opposite side. The moving shot with hand-held, a dolly, a jib, etc. shows the audience the camera has moved, therefore, the audience is able to recognize the change in positions of the subjects in the screen.

EXAMPLE 4-3: Vector Line



4.6 ETHICS

Except for drama or fiction, the most important principle is to present the actual event or situation and not to distort the truth when the program presents non-fictional events. For example, if you add a shot of a full house from the other event to the musical concert where there are not many people, you are changing the actual event and it is an unethical act. Also staging or making the events more than the actual events will give a wrong impression to the audience and must be avoided. You should be responsible to deliver the right information and fact to the audience as a professional, therefore, extra caution is required in juxtapose shots, using the effects, and other editing techniques.

4.7 POST-PRODUCTION FLOW (EXAMPLE): STEP BY STEP

Post-production process does not have a definite rule, therefore, it can be decided according to the type of the program, scale of production, crew size, etc. The figure 4-1 indicates one of the basic post-production flows. For example, narration can be prepared after pictures have edited.,

Step 1	LOG Review the recorded footage and log the shots and scenes. Mark the shots possibly to be used.	Blank log sheet in Annex
↓		
Step 2	SCRIPT Re-write your script and check if the story flows, contains enough information, and interests the audience.	
↓		
Step 3	ARCHIVE FOOTAGE Consider if the archive footage is necessary. If so, find or locate the footage.	
↓		
Step 4	SOUND Ensure music or other recorded sound are effective and will be used.	
↓		
Step 5	NARRATION If narration will be used in the program, it can be recorded before editing the picture or after completing the editing of picture.	
↓		
Step 6	ROUGH CUT	- Editing Technique - Continuity
↓		

Step 7	FINE CUT - Trimming - Sound editing, etc.	
↓		
Step 8	TRANSITION/EFFECTS	
↓		
Step 9	GRAPHICS/TITLES Insert the program title, subtitles, graphics, and necessary information. (Names, locations, translation, etc.)	
↓		
Step 10	EVALUATION (Pre-broadcasting) Check the completed program Preview the program with other colleagues and obtain their opinions. Re-edit the program, if necessary to improve the content.	
↓		
Step 12	BROADCAST the program	
↓		
Step 13	EVALUATION (Post-broadcasting) After the broadcast, view the program with other colleagues and make evaluation in order to improve the news programs in the future.	

Figure 4-1: Flow of Basic Post-Production

CHAPTER 5

EVALUATION OF THE PROGRAMS

CHAPTER 5:
EVALUATION OF THE PROGRAMS

5.1 PRE-BROADCASTING

If the production schedule allows, it is recommended to review the completed program with other colleagues at BTV who have not been involved in the production. It allows to get the third opinion and suggestion to improve the program as well as to confirm if the program makes sense, and is suitable to the audience; especially to ensure the intended news, and the message is delivered through the program. Technical aspect (quality of the picture, sound balance, etc.) must be examined.

The basic of the news is that the content must be objective, fair, accurate and impartial, information and message provided must be clear to all the audience, and the all the facts must be collected and confirmed from multiple sources. The following example 5-1 indicates the important check-points of news programs.

EXAMPLE 5-1: Check List of BTV News Content

CHECK LIST OF BTV NEWS CONTENT

Title or Topic of the News	
Name of Producer/Reporter A Person in Charge	
Expected Broadcast Date	
Duration	

No	Check-Point	✓	Remarks
1	Are the elements of **5WH+1H** (Who / What / Where / When / Why + How) clearly described? If No, which one is missing?		
2	Is the addressed **The Message or Information** of the news addressing is **clear**?		
3	Is the news **objective**?		
4	Are the information in the news collected from **multiple sources**? If yes, how many sources are used?		

5	Are the **sources appropriately used**?		
6	Is there a **climax** in the news? If so, is it effective?		
7	Is the news written in **appropriate format**?		
8	Is the **language proper** for all the audience? Is it easily **understandable**?		
9	What do you think about **the use of words**? Is there any words that create **double meaning** or that can make any one **feel humiliated or offended**? If yes, then please list them out for the future reference.		
10	Is the content **fair, accurate and impartial**?		

5.2 POST-BROADCASTING

In order to improve the quality of the programs produced by BTV in the future, it is recommended to hold an in-house screening, evaluation, and discussion for any news, documentary, live, and other programs after broadcast.

Participants of the evaluation can be invited from different departments (news, production, technique, and administration) and all the levels, including the production team who produced program, experienced senior staff, and new staff.

After screening, participants exchange their opinions, impressions, suggestions, and different point of view freely. Evaluation is not criticism, but to encourage all the staff at BTV to produce better programs, they should be allowed to expressing his/her own idea without hesitation.

Production team produced program share his/her own experience and perspectives towards the produced program. Senior staff is able to add his/her experience gained during their career and encourage staff for future production.

There is numbers of ways to evaluate the program. The following example 5-2 indicates some points that can be considered to improve the future production of the programs. Not only the quality and the content of the program from the point of view of the audience, but also reviewing the process of production from pre-production to post-production, the situation of equipment, and future plan must be discussed according to the standard of BTV. Therefore, the participants should be mixed of staff involved with production and also staff not participated in production.

EXAMPLE 5-2: Points of the Evaluation

Points	What to consider
OVERALL QUALITY	• *Was it a good program?* • *Was the length of the program too short or long?*
PRODUCTION	• *Positive/good experience to share* • *Points to improve for the future*
BUDGET	• *Was the budget appropriate for the production scale?* • *Was the budget properly used?*
MESSAGE IN THE PROGRAM	• *Was the message clearly delivered?* • *Was the message strong enough to impress the audience?*
TECHNICAL ISSUES	• *Any technical difficulties? (Equipment, Studio, etc.)* • *Any suggestions for the future production*
EDITING	• *Was it effective and impressive?* • *Any points to remark or improve?*
FEEDBACK FROM AUDIENCE	• *Did any audience contact and express their impression or opinion?* • *What to consider from the opinion of the audience?*
FUTURE PLAN	• *Can this program be a series?* • *Can any follow up program can be produced?*

ANNEX

Annex 1

BTV Program Proposal Sheet

Date:

Name of Program:		**Production Team**	
		Producer	
Category			
		Cameraman	
Duration			

Broadcasting Date:	**Re-broadcasting Date:**	**Re-broadcasting Date:**

[Objectives of the Program]

[Contents]

[Locations]

[Note or Remarks]

Production Period:	Beginning Date:	Completion Date:	Estimate Budget:

Annex 2

SCRIPTING: BTV

NAME OF THE PROGRAM	
CONTENT	

	CONTENT
INTRODUCTION **What is the story about?**	
DEVELOPMENT (BUILD UP) **More details of the content and bring the story alive.**	
TURN (CLIMAX) **What is the most important point of the content and message you want to deliver to the audience?**	
CONCLUSION (ENDING) **Closing the story**	

Annex 3

BTV SHOOTING SCHEDULE

NAME OF THE PROGRAM	
DATE of BROADCAST	
PRODUCERS	
REPORTER	
CAMERAMAN	

DATE of SHOOTING	
OBJECT	

LOCATION	
CONTACT/COORDINATOR	

TIME	SCHEDULE	✓

Annex 4

BTV SCENE/SHOT LIST OF PROGRAM PRODUCTION

NAME OF THE PROGRAM	
DATE OF BROADCAST	
PRODUCERS	
REPORTER	
CAMERAMAN	

SHOT TERMS:

ELS	Extreme long shot	LS	Long shot
KS	Knee shot	MS	Medium (knee) shot
LBS	Loose bust shot	BS	Bust shot
TBS	Tight bust shot	CU	Close Up shot
ECU	Extreme close up		
LA	Low Angle	HA	High Angle
P	Pan → or ←		
TU	Tilt Up ↑	TD	Tilt down ↓
Dolly		ZI/SO	Zoom in and out

DATE	LOCATION	SHOT	✓

Annex 5

LOG SHEET

Title	
Date Shot	
Location	
Shot by	

PAGE #_____

Scene	Description	In (Time Code)	Out (Time Code)	Notes or Remarks

REFERENCE

REFERENCE

Title	Author	Published by
Television Production 16th Edition	Jim Owens Asbury University	Focal Press
Television Production Handbook 10th Edition	Herbert Zettl San Francisco State University	Wadsworth Cengage Learning
Television Production Practical Manual	Yoshitaka Yoshino	Toka Shobo
Television Production Technique	NHK	Kenrokukan Shuppan

In memory of the WG member and BTV engineer, Ernest Bushy Segokotlo

Supported by Japan International Cooperation Agency (JICA)
Project for Implantation of the Digital Migration Project (DiMT)

Separate Volume -2
Data broadcasting training manual

Training Materials

for

Data Broadcasting Program Production

May, 2016

Department of Broadcasting Services

Ministry of State President

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Introduction

The transformation of terrestrial broadcasting from analog to digital transmission continues to move forward. At the moment, there are mainly three international standards for digital terrestrial broadcasting, including ISDB-T, DVB-T and ATSC. DVB-T is mainly used in Europe, whereas ATSC is used in North America.

Japan has developed ISDB-T (Integrated Services Digital Broadcasting) that is considered more radio-disturbance/interference resistant than the other two standards. ISDB-T is now employed in 13 countries worldwide, including Japan, Brazil, Peru, Argentina, Chili, Venezuela, Ecuador, Costa Rica, Paraguay, Philippines, Bolivia, Uruguay, and Maldives, and Botswana joined by finding advantages over other standards.

Started in December 2000, ISDB-T broadcasting in Japan already has a history of more than 10 years. Data broadcasting services, which is explained in “Data broadcasting structure” (Section 1.2), is one of the main topics of this document as well as a key feature of digital broadcasting. The services, which were first introduced in BS digital broadcasting, have also been provided in terrestrial digital broadcasting since December 2003, adding extra value to the digital broadcasting industry.

Based on these facts, Botswana television regards Data broadcasting as one of the pillars of digital broadcasting and started the service with assistance from JICA technical cooperation project. This document is prepared by the members of the working group to provide information on data broadcasting as a feature of digital broadcasting. The focus will be on the structure of terrestrial digital broadcasting and data broadcasting content creation technologies.

May, 2016

Printed in Gaborone, Botswana

Created by DiMT Project (Digital Migration for Television)

Chapter 1 Basic information on Data Broadcasting

1.1 Features of terrestrial digital media broadcasting by ISDB-T

ISDB-T consists of 13 different segments. However, its most significant feature allows transmission parameters, such as modulation methods of carrier waves, to be set for each segment. With this standard, the maximum combination number of modulation methods is three (three layers).
ISDB-T allocates a combined bandwidth from all 13 segments (approx. 5.75MHz) to a single channel. Among the 13 segments, 12 segments are used to provide services to fixed receivers with a 64QAM (64 Quadrature Amplitude Modulation: by using the phase and amplitude each by eight, they assign a value to a combination of methods to send and receive data of 6 bits value at a time), and the other segment provides one-segment services for mobile devices using QPSK modulation (Quadrature Phase Shift Keying: one of the modulation schemes that convert an analog signal to digital value. A kind of phase shift keying modulation scheme to represent the information in a combination of out-of-phase multiple waves).

ISDB-T uses a multiplex method called OFDM (Orthogonal Frequency Division Multiplex) that splits information and sends it by modulating transmissions with various orthogonal subcarriers.

OFDM, although transmitted in parallel on the frequency axis data signal, is converted into a narrow band at low speed in high-speed data signal FDM (Frequency Division Multiplexing). Further use of the orthogonality in OFDM allows the overlap on the frequency axis. The overlapping can be arranged closely to each other without interference. However, some overlap multiple carriers to achieve the efficient use of broadband transmission of a narrow frequency range. As a result, efficiency of frequency use is increased.

Unlike BS broadcasting, terrestrial broadcasting is susceptible to multi-path (delay-wave) interference caused by reflections from buildings. Multi-path interference is similar to the “ghost interference” of the analog era. With the ability to recover signals without degrading them, OFDM is highly resistant to multi-path interference. SFN (Single Frequency Network) is applied in adjoining areas as it can treat non-primary wavelengths as multi-paths, and can retransmit data on a single wavelength. As a result, the effective use of wavelengths is achieved.

ISDB-T was officially chosen as the transmission standard of Brazil in June 22, 2006, which was its first time to be employed outside Japan. It was highly regarded for its capacity to split bandwidth in order to allocate a segment exclusively for terrestrial digital broadcasting to mobile devices also for having a wider transmission band than North America’s ATSC.

The main features of digital terrestrial broadcasting using ISDB-T include:
1. High resolution and high quality
2. Multi-channels (multi-broadcasting)
3. Data broadcasting
4. EPG (Electric Program Guide)
5. Mobile broadcasting using the same output equipment
6. EWS (Emergency Warning System)

This document focuses on no. 3 (data broadcasting) from the list above.

1.2 Data broadcasting services

Services of data broadcasting can be roughly divided into two categories. One is services that offer viewers with useful information that is not related to TV programs (independent data broadcasting), and the other is services that provide information related to TV programs (relational data broadcasting). The specific examples are as follows:

- Independent data broadcasting (Not related to TV Programs)

Data broadcasting today offers "portal" services that provide various types of information independent of television programs. The typical examples include:

- News (global news and local news)
- Weather report (national weather, local weather, weather by hour, rainfall, precipitation percentages, etc.)
- Warnings/advisories (Heavy rain warning/Flood warning etc.)
- Typhoon information
- Earthquake/Tsunami information
- Sports news
- Traffic report
- TV program information
- Advertisements/banners etc.

Figure 1 shows the common appearance of a portal screen.

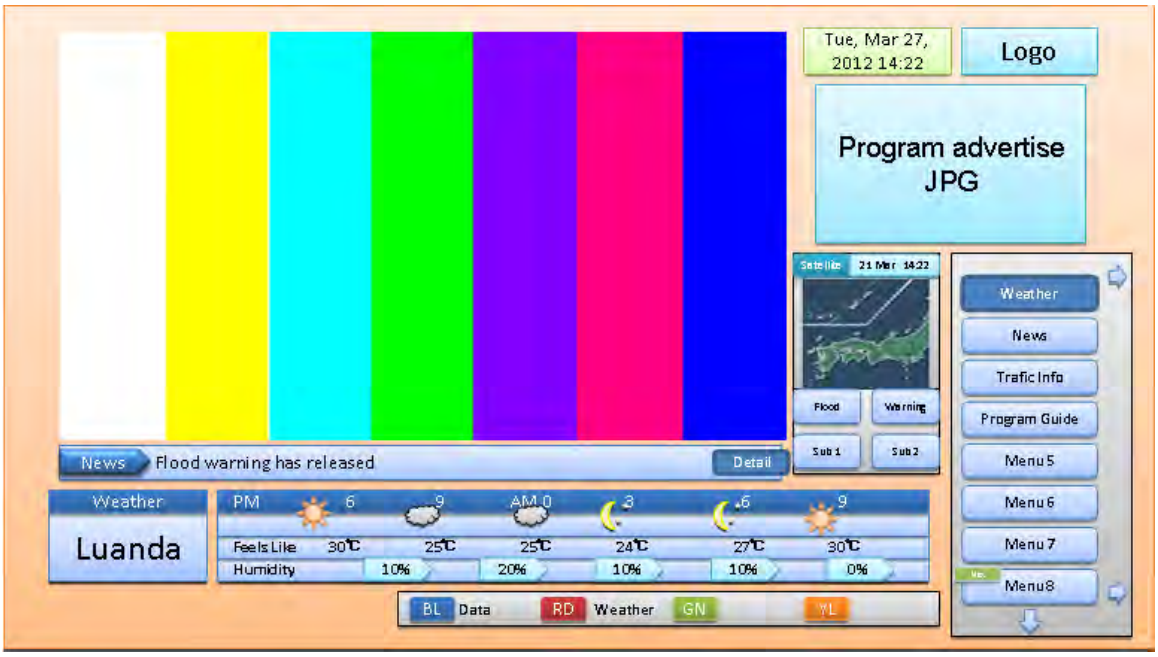


Figure 1 Portal screen -Top screen

As Figure 1 exhibits, data broadcasting screens are displayed around the main TV program screen to provide various types of useful information. The top screen of a portal typically contains weather information and TV program banners. Users can access other contents by pressing buttons on the right side of the screen using a remote controller.

For example, when “Weather” button is pressed, the display changes to as shown in the picture below.

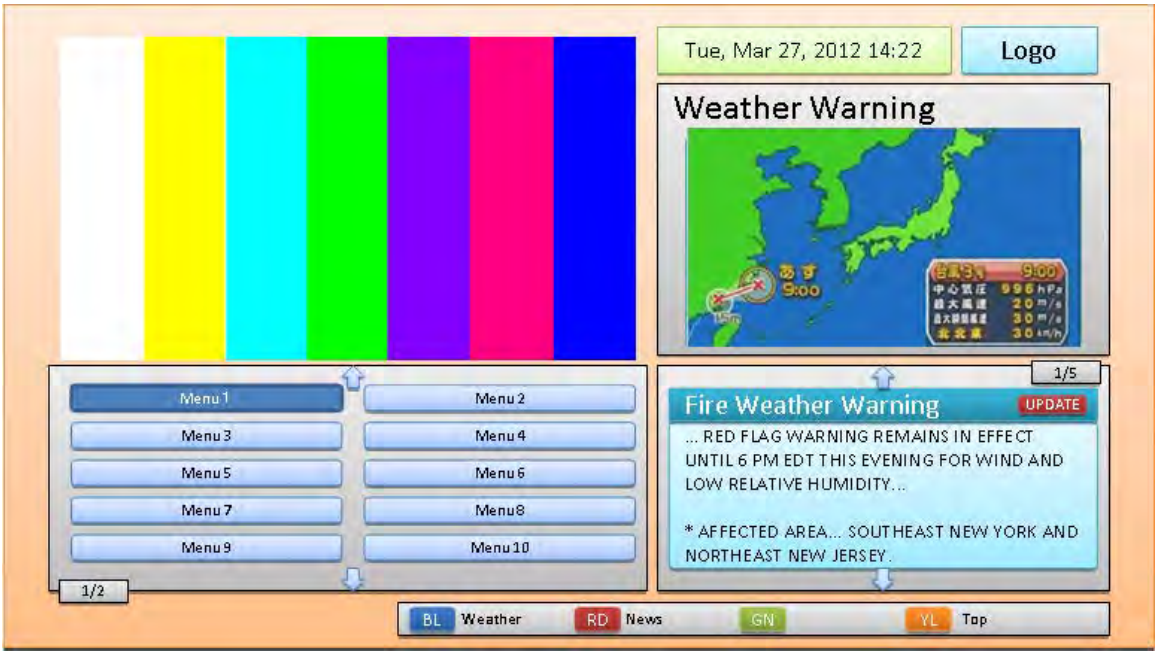


Figure 2 Portal screen -Weather report

Screen displays a specific page with each button pressed.

✓ Relational data broadcasting

Data broadcasting also offers services that are synchronized with TV programs, notably sports programs, variety shows, dramas, and anime programs.

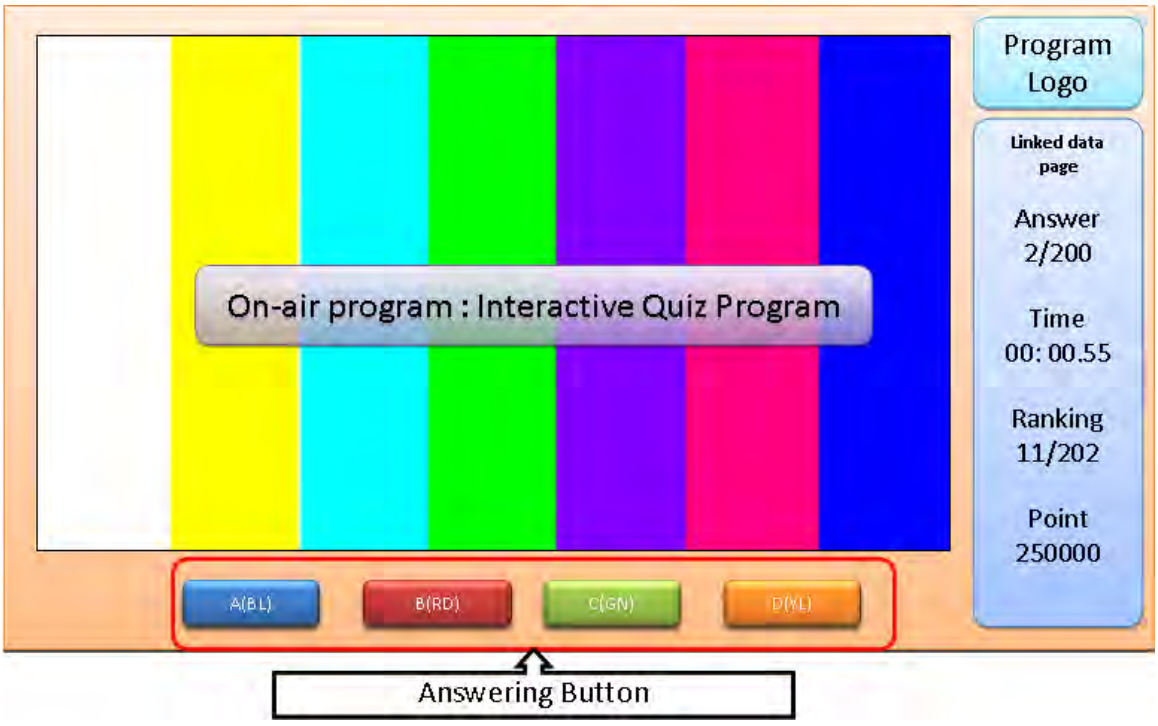


Figure 3 Sample image from a variety show

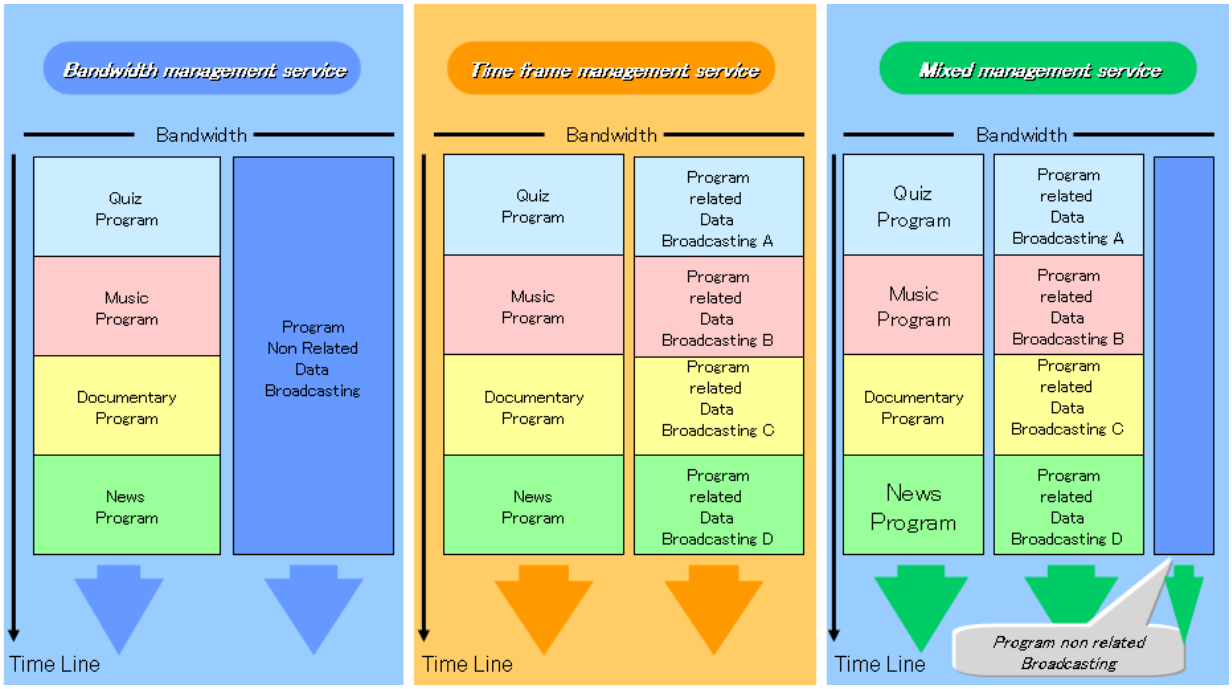
The image above shows a service example of a quiz show. Viewers can participate in the show just as the panelists and, if their TVs can access the Internet, they can even send their answers to the program and see their rankings among all participants.

Figure 4 Sample image from a TV drama

This screen, which was used for a TV drama, allows users to view the synopses of episodes that they have missed as well as the character diagram. The services are also available on anime programs.

Now, you may wonder if users can access independent data broadcasting while watching a TV program that comes with relational data services.

Independent data stream uses part of the bandwidth, while relational data is a component of a TV program. Hence, bandwidths are normally controlled to include both of them for offer combined services.



Type A Type B Type C

Figure 5 Bandwidth management of each service

Type A: Data broadcasting with audio and visual streams with no regard to TV programming.

Type B: Data broadcasting with audio and video streams that synchronizes with TV programming.

Type C: Data broadcasting that synchronizes with TV programming, also allows portal broadcast to use part of the bandwidth.

Chapter 2 Data broadcasting structure

2.1 Overview

This chapter explains the structure of data broadcasting.

Data broadcasting is scripted with BML (Broadcast Markup Language), which was developed for the purpose of broadcasting multimedia information, including audio and video contents as well as text and still images. The information is then encoded into MPEG 2TS before output.
BML will be explained in detail in Chapter 3.

Data is sent out using a method called “carousel” and then retrieved by digital TVs embedded with a BML browser as needed to be displayed on a TV screen.
The chart below illustrates the process of the carousel method.

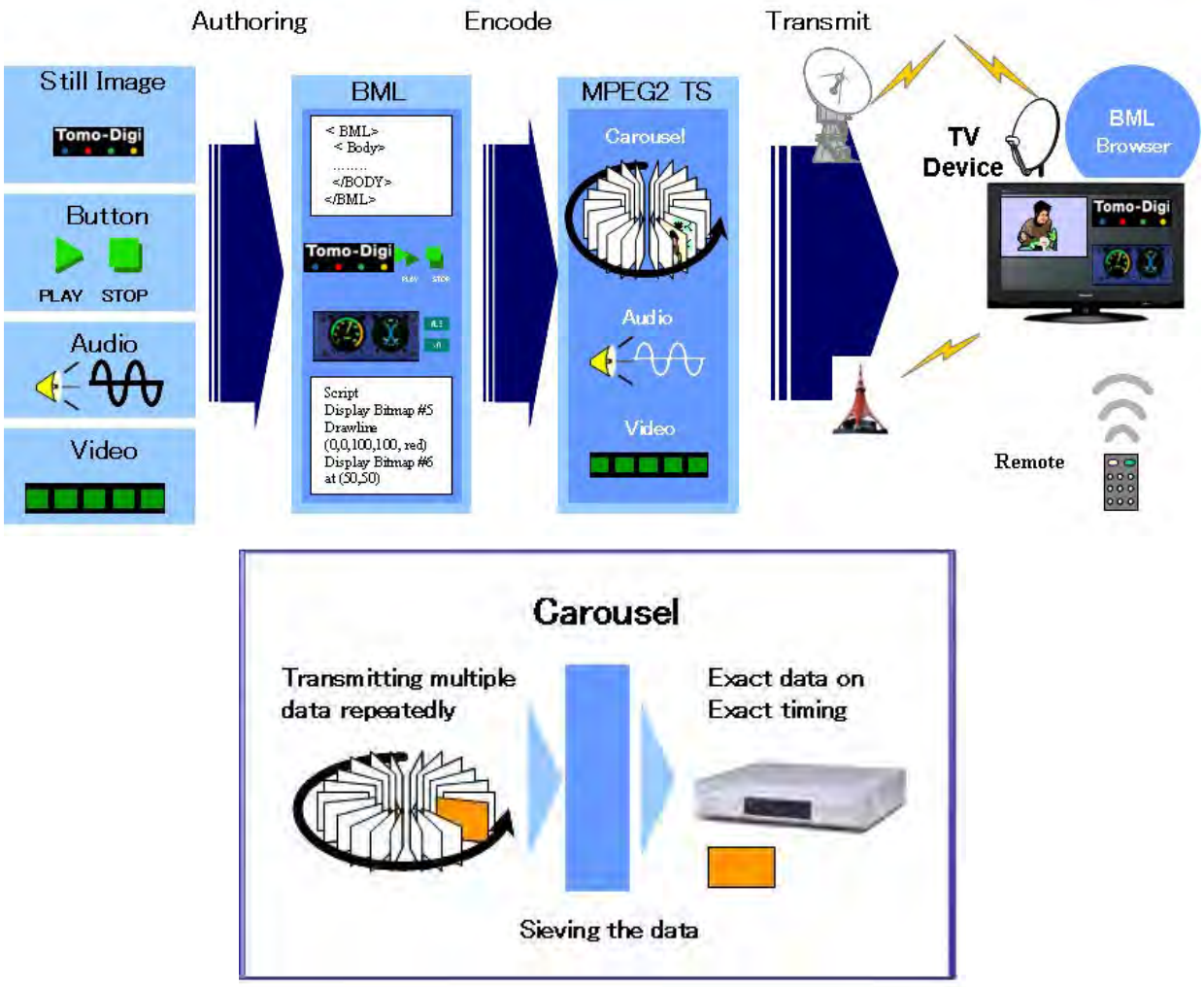


Figure 6 Data Broadcasting Structure

The description of each device will be explained in detail in Chapter 7.

2.2 TS, ES and the carousel method

Some of the key words will be explained in this chapter as in the Figure 6.

■TS (Transport Stream):
TS is a transport stream format specified in an MPEG standard (ISO/IEC 13818-1). It is composed of a packet transport of 188Byte known as TS packet. TS packet is composed of data packet header and payload for the purpose of carrying.
Transport stream has been designed in consideration of the applicability of the integrity and error correction with the transmission network.

■ES (Elementary Stream):
ES stands for Elementary Stream which corresponds to encoded video, audio, and independent data in PES packets. A single ES is transmitted by the PES packet that has the same stream ID.

■Data carousel method:
Data carousel is a method developed for sending and/or receiving data in various types of data broadcasting. In this method, attached data rotates just as a carousel and is constantly sent out so that receivers can retrieve desired data from streams at any time, regardless of hour.

The multi-part modules will be mentioned first and then how to write the file path of the file will be discussed.
Content of data broadcast is composed of multiple resources, which are managed by chunks called multiple resources, and this one module.

A technique called multi-part has been adopted to organize a plurality of resource files. File management of the resource data in the pieces of data can be modularized as a multiple resource data. In this way, the management of transmission frequency on a per-module basis is possible.

This is a multi-part of the module.

■Writing a file path to a specific file from BML
・Multi-part module method
“/ES ID number (hex)/module number(hex)/file name”
・Module direct mapping method
“/ES ID number (hex)/module number(hex)”
The chart below shows the process that TS goes through when first received by a TV to being displayed on the TV screen.

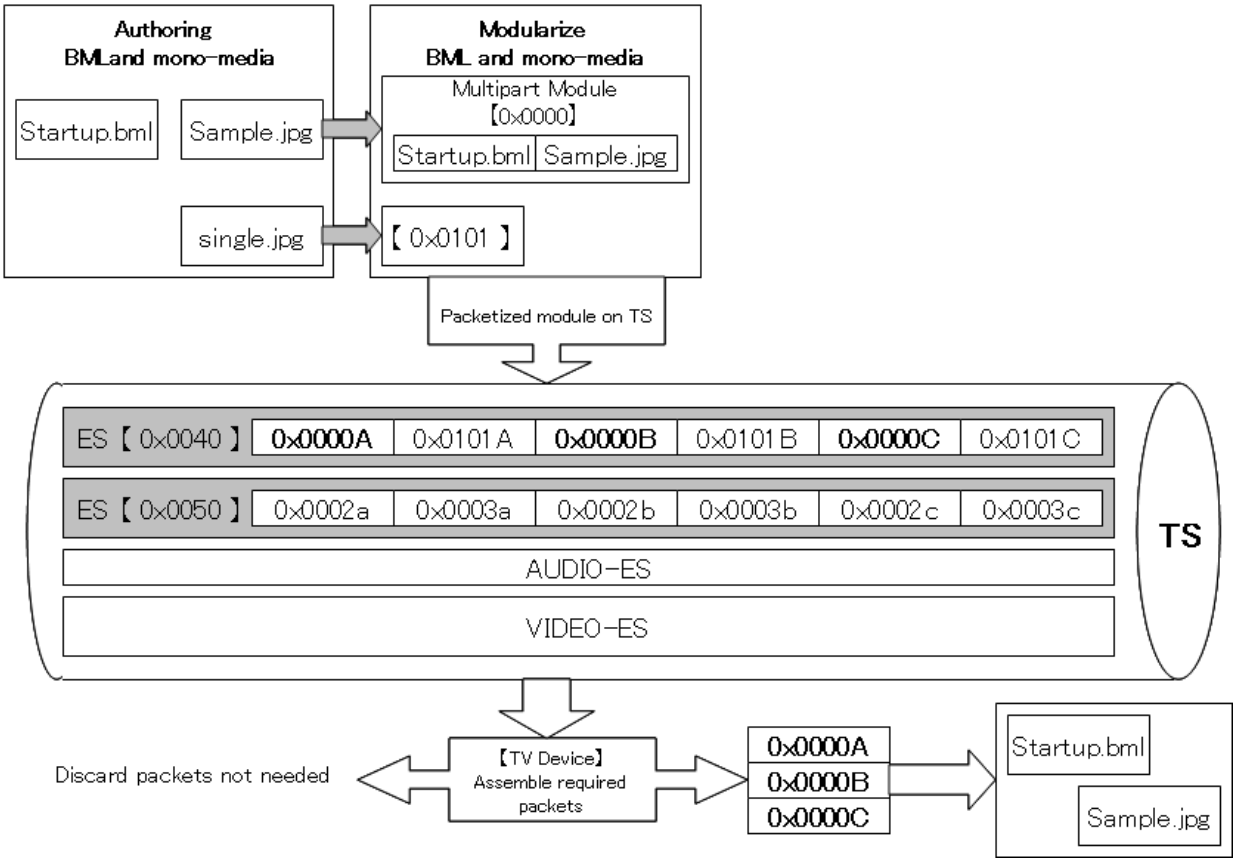


Figure 7 TS process

2.2.1 Exercise

Delivery efficiency shows a significant difference when files of the same size are sent by broadcasting and online.

Q1) Review the advantages and disadvantages of each delivery method.

Q2) Draw a diagram of the connections between TS, ES, carousel, module and resources.

2.3 Concept of timeline

Understanding of timing control will be crucial from here on, and, in this document, it will be explained as a concept of timeline.

■Module update

In data broadcasting, where mono-media is constantly modularized and sent out, module update is conducted at certain timings during TV broadcast as a method to replace specific modules and provide updated contents.

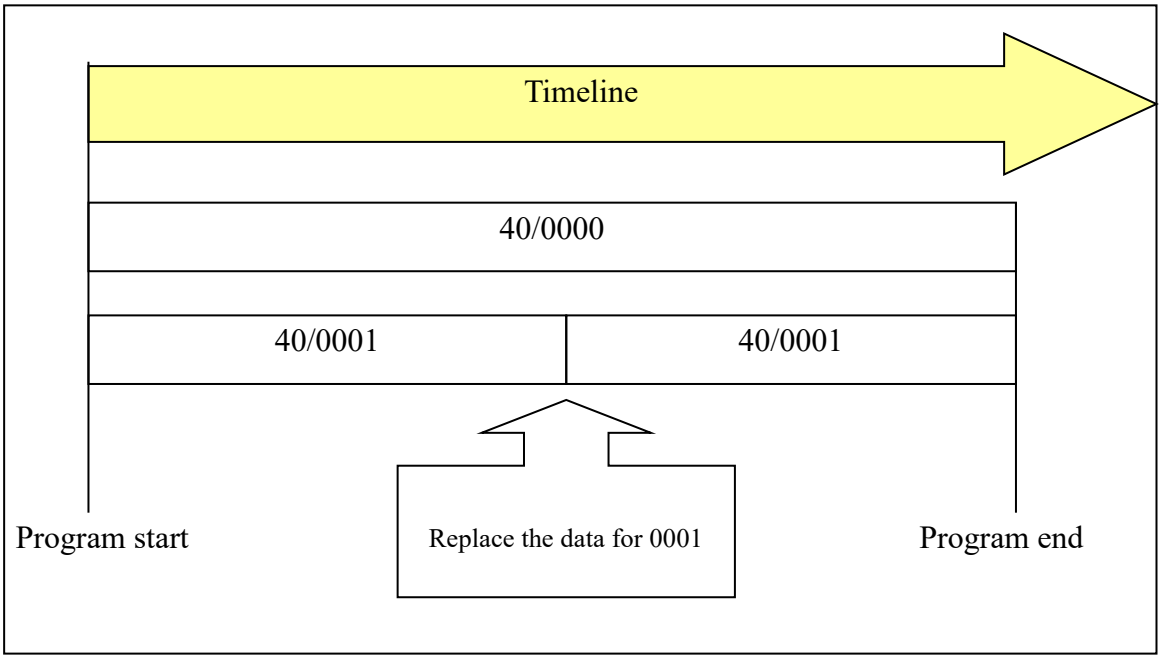


Figure 8 The concept of time axis

■Event messages

Equipment in broadcast stations can send 244 byte short electric messages (event messages) in addition to other control information and contents. Event messages enable the control of contents on receivers.

As event messages can reach receivers faster than module update (as explained in the next page), they are used for contents that are synchronized with videos.

1. Timing of sending event messages can be controlled.
   - **Issuing time-specific event messages**
     A method to send a message at specific timing

   - **Issuing take-style event messages (dependent on TV station equipment)**
     A method to send a message at an optional timing during TV broadcast,
     i.e. Displaying questions on a live quiz show in synchronization with the program flow.

2. Triggering of received event messages can be timed on the receiver's side
   - **Instant triggering**
     Receiving device conducts a specific operation as soon as an event message is received.

   - **Triggering with the NPT Method (Dependent on TV station equipment)**
     After an electric message containing specified triggering time information is sent and received along with a message, the receiving device monitors NPT and triggers the event message at a specific timing. This method can only be used when the station equipment is set to deliver NPT messages.

2.3.1 Exercise

Q1 Which method do you think is more appropriate for a live sports program – "Take" style event message method or specified time event message method?

Q2 Which method do you think is better for creating the below two contents –
A. module update or B. event messages – and why?

Content 1: News article with a photo

Content 2: Earthquake early warning

2.4 Screen sizes for data broadcasting (resolution)

■Resolutions for data broadcasting
For HD data broadcasting (16:9)

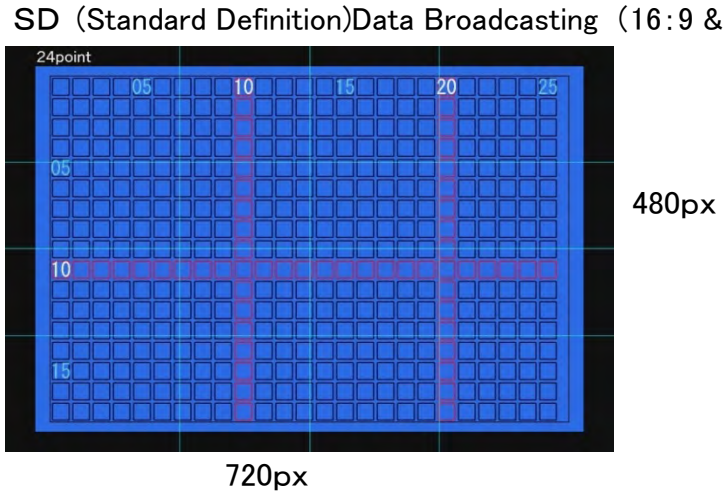


Figure 9 Definitions

Resolution is set at 960x540 (16:9) for HD data broadcasting, while it is 720x480 for SD data broadcasting.

SD data appears horizontally stretched (approx. 853 x 480) on a 16:9 display and narrowed (approx. 640 x 480) on a 4:3 one.

■The size of the video screen should be viewable on data broadcasting.
Data broadcasting on 960x540 (16:9) format

Table 1 Definitions

Video Format	Graphic text Plane										
1920x1080/16v9 1440x1080/16v9	960x540 (8/8)	-	840x472 (7/8)	720x405 (6/8)	600x337 (5/8)	480x270 (4/8)	-	360x202 (3/8)	240x135 (2/8)	-	-
720x480/16v9	-	853x480	840x472	720x405	600x337	480x270	426x240	360x202	240x135	213x120	106x60
720x480/4v3	-	640x480	630x472	540x405	450x337	360x270	320x240	270x202	180x135	160x120	80x60

- When SD 4:3 format is displayed on a screen set at 16:9, side panels are inserted on the receiver's side to maintain the aspect ratio of the video file.
- When SD 16:9 format is displayed on a screen set at 4:3, letter boxes are inserted on the receiver's side to maintain the original aspect ratio of the video file.

Table 2 Data broadcasting on 720x380 (16:9) format

Video Format	Graphic Text Plane						
1920x1080/16v9 1440x1080/16v9	–	–	–	–	–	–	–
720x480/16v9	720x480	630x420	540x360	450x300	360x240	270x180	180x120
720x480/4v3	–	–	–	–	–	–	–

Table 3 Data broadcasting on 720x480 (4:3) format

Video Format	Graphic Text Plane						
1920x1080/16v9 1440x1080/16v9	–	–	–	–	–	–	–
720x480/16v9	–	–	–	–	–	–	–
720x480/4v3	720x480	630x420	540x360	450x300	360x240	270x180	180x120

2.5 Mono-media

In this chapter, information will be provided on mono-media materials that can be used in data broadcasting. Its types and the ways to create them will also be explained.

■Still image materials

・PNG: A picture file that uses 256 colors. It is similar to GIF format that is commonly used in the Internet.

・CLUT: A palette file with 256 colors, with which users can use one common color palette; not for each image file, but for each screen.

・JPEG: A full-color picture file and a subset of the commonly used JPEG format.

■Animation material

・MNG: It is a similar format with web-based GIF animation format. It consists of a series of PNG files.

■Fonts

・The four fonts mentioned below are embedded in receivers with four color scales (background color, font and two additional color scales).

・Round gothic style Size: 16, 20, 24, 30, 36 pixels

・Bold round gothic style Size: 30 pixels

・Kaku gothic style Size: 20, 24 pixels

2.5.1 Usages of JPEG/PNG/MNG and precautions

In the previous chapter, the basic information on mono-media will be provided. Consequently, this chapter explains about their usages and precautions.

JPEG

Usage : For photographs and company logos that require full-color display

Precautions : When the resolution is HD size (960x540), the material needs to be double the width and height of the size as specified in a BML script.

PNG

Usage : Unlike JPEG or main video contents, PNG images can be transparent (256 levels).

Precautions : PNG files do not contain palette information. Each BML file has a palette (CLUT file), and PNG files only contain index values for the palette information.

CLUT

Usage : CLUT specifies all colors used for graphic/font plans, including PNG images, embedded fonts, backgrounds and drawings. It provides a palette of 256 color levels (0-255) each for RGBα.

Precautions : As 0 - 16 are fixed colors, only No. 17-223 – a total of 207 colors – are freely adjustable.
Even though No.0 (0, 0, 0, 255) and No.8 (0, 0, 0, 0) look alike; No.0 is designated as “black” whereas No.8 is used for transparent images, such as transparent GIFs.

MNG

Usage : MNG is animation format that consists of a series of PNGs.
Although the same effect (as MNG) can be achieved by switching PNG images using scripts, the switching speed may become unreliable then because the drawing functions of receivers tend to vary.

Directions for use : Horizontal pixel resolution ‘x’, vertical pixel resolution ‘x’, bit depth ‘x’, the number of PNGs has to be kept under 512KB.
Ten frames per second can be played with MNG at the fastest, with 100 milliseconds basis and 64 cuts maximum.

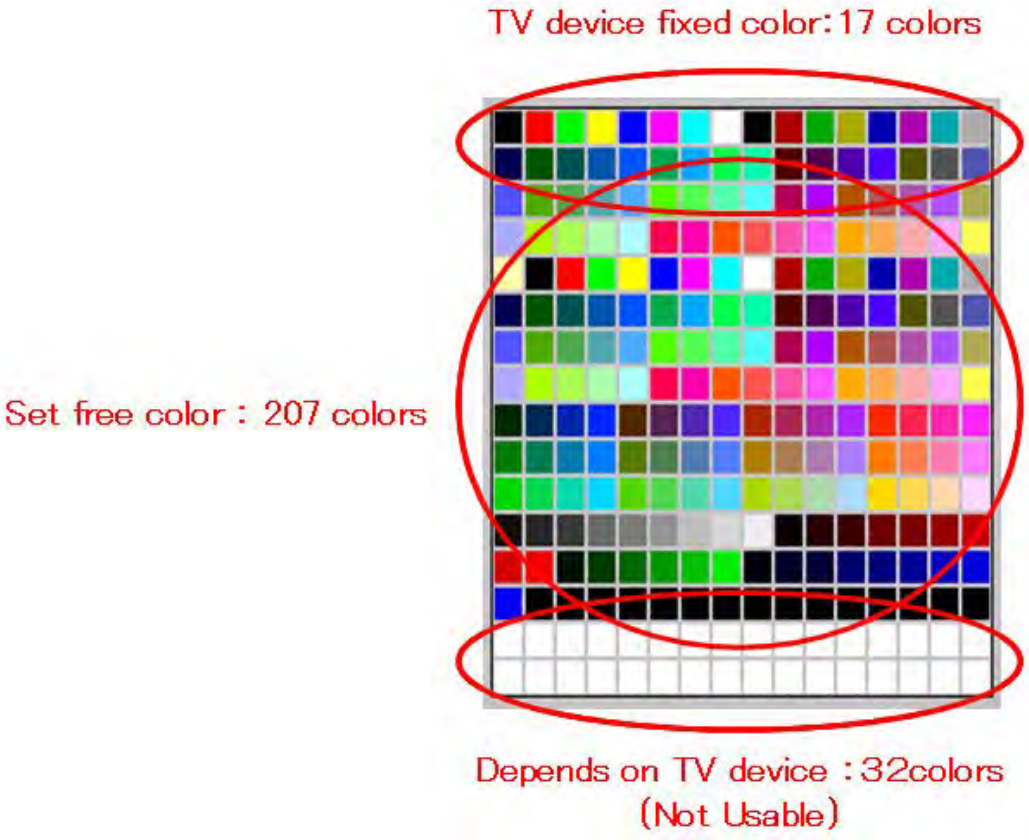


Figure 10 Available Colors

■Audio elements

☐AIFF: Encoded version of AIFF-C (only uncompressed elements used)
Maximum file size is 96 KB, 12 kHz 16 bit (maximum of about 4 seconds).
AIFF files can be played along with main audio, AAC files and audio signals of a receiving device.

☐AAC: Audio element encoded in the same way as main audio.
Maximum file size is 512 KB, 45 kHz, 32 kHz, 16 bit.
Play time is inversely proportional to bit rates (sound quality).

☐Audio signals: 14 types of sounds embedded in receivers can be played only by ECMA scripting.
0-4: Warnings chime
5-12: Decision sound, focus transition sound
13: Error sound that comes with invalid inputs and input errors

■Others

☐Binary table: Text information, numbers and zip codes that are binarized and saved as a file. Files can be read by BML using ECMA script so that users can search data on them.

Important Reminders:

Reminders for creating data

Formats of the image elements above are strictly regulated by the ARIB standard. Although files of the same formats can be created on common graphics software, such as Photoshop, they may contain invalid data for broadcasting. Therefore, ARIB-standardized tools, such as SceneCreatorDD, are recommended for creating files.

Reminders for displaying image elements

PNG/JPEG/MNG images cannot be enlarged or shrunk on a display.

Reminders for layering elements

In the field of data broadcasting, there are concepts called “plane” and “layer”, and layering of JPEG, main videos, PNG, MNG and text is specified between each format.
(Note: This is regarding concepts in content creation, not file structures on hardware.)

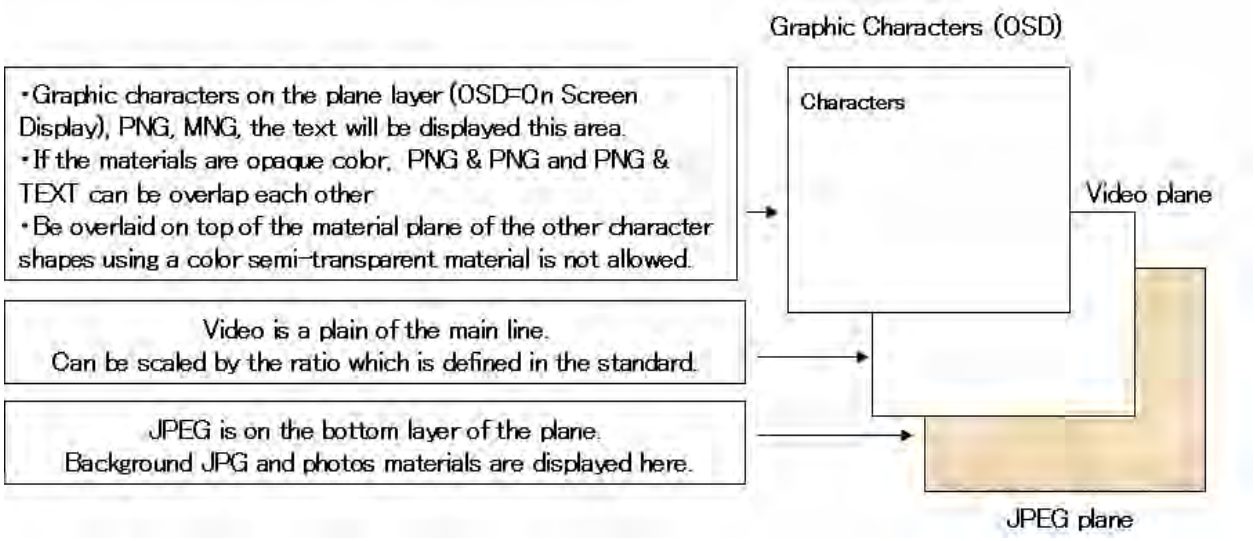


Figure 11 Method of Layering Elements

2.5.2 Exercise

Q1 One of the difficulties of data broadcasting is that it has trouble using audio elements other than audio signals. What do you think is the reason?

Q2 It is also difficult to add new color elements on a screen after contents are created. What do you think is the reason?

Chapter 3 Data Broadcasting programming language and software

3.1 Overview of BML (Broadcast Markup Language)

- BML is based on XHTML
  - What is XHTML?
    - The format was re-defined by XML, and HTML was defined using SGML.
    - Because it is XML-based and follows strict grammar ⇒ interpretation process is simple
    - Functionally equivalent to HTML 4.0.

- BML uses ECMAScript as its description language.
  - ECMAScript is a script language standardized by Ecma International, a standards organization for information and communication systems.

(http://www.ecma-international.org/publications/standards/Ecma-262.htm)

- In order to collectively specify the position of each object, CSS (Cascading Style Sheet) is used.

- Functionality expansion required for broadcasting:
  - Audio/Video control
  - Operation control using remote controller
  - TV program synchronization
  - Automatic update of information display
  - Interactive communication control

- Only a subset of features specified by the industry is actually embedded.

3.2 BML coding

Operational standards for terrestrial digital broadcasting are based on ARIB TR-B14.

BML version

major version=3, minor version=0

BML3.0

DTD declarations

```
<?xml version="1.0" encoding="EUC-JP"?>
<!DOCTYPE bml PUBLIC "+//ARIB STD-B24:1999//DTD BML Document//JA"
"http://www.arib.or.jp/B24/DTD/bml_1_1.dtd">
<?bml bml-version="3.0"?>
```

External reference for CSS and script

<link rel="stylesheet" type="text/css" charset="EUC-JP" href="bml.css">

<script type="text/X-arib-ecmascript; charset="euc-jp"" src="pdnlib.es">

■Comparison with HTML (usable HTML tags)

There are only a limited number of usable elements (tags) on digital broadcasting. A part of them is as follows:

** :** Mainly used to define a section for layout

<object>: Used for reference to a main video and for the layout of image data, including JPEG and PNG files.

<p>: Used to position text

<input>: Used to specify an input field where the user can enter data

a. Unusable tags

<IMG>: <object> tag is used for embedding image files.

<TABLE>: Tables are defined by combining <p> and with frames.

b. Special tags (* mainly tags expanded for broadcasting)

<bevent>: Parent element of <beitem>

<beitem>: Used to retrieve various events, such as event messages and module update status monitoring

c. Restrictions for document structure

Operational guidelines include restrictions for document structure, such as “the child element of body elements must be either ‘div’ or ‘p’ element (ARIB-B24 ver.2 Appendix 2 - 4.8.1. Positioning and restrictions)”, which must be recognized and respected.

■Comparison with HTML (Usable tags 2）

Restriction on elements in head element

The sequence and use of tags in head element is specified as below:

<head>

<title /> (once)

<meta /> (0 to once)
<style /> (0 to once)
<link /> (0 to once)
<script /> (0 to once / 0 to twice for a tag with src attribute)
<bevent /> (0 to once)
</head>

■Layout method (CSS)

Style including coordinate, color and font, is designated to place each tag in a specific position.
As for coordinate, top-left is always “x=0, y=0”, and each position is calculated using the base point.
You can also specify a relative coordinate by nesting a tag.
In object-layering (z-index), objects are presented based on the order of tags. In other words, the elements that appeared first in a BML script are the ones presented at the inner part.
Operational guidelines include restrictions on layering, which must be recognized and respected.

Example of defining P element

```
#texts{
   Left                    : 191px;
   Top                     : 145px;
   Width                   : 240px;
   Height                  : 24px;
   Visibility              : visible;
   font-family             : "round gothic";
   font-size               : 24px;
   text-align              : left;
   color-index             : 0;
   background-color-index  : 8;
   grayscale-color-index   : 131 206;
}
```

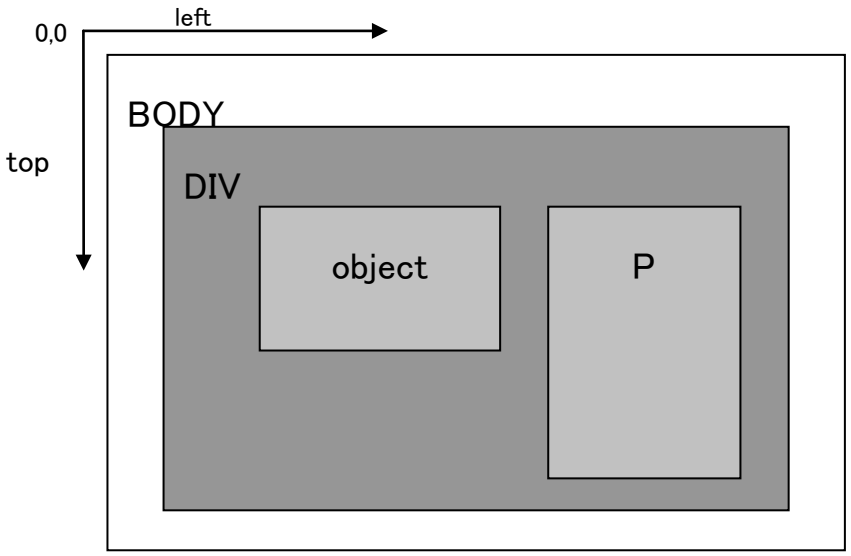


Figure 12 Example of defining P element

■Layout method (BML)

Script example for a layout of PNG, JPEG and main video files

PNG

```
<object id="PNG" type="image/X-ARIB-png" data="sample.png "
        style="width:640px; height:480px; left:30px; top:40px;"/>
```

JPEG

```
<object id="JPEG" type="image/jpeg" data="sample.jpg "
        style="width:640px; height:480px; left:30px; top:40px;"/>
```

Main video/audio

```
<object id="Vstream" type="video/X-arib-mpeg2" data="/-1 "
        style="width:960px; height:540px; left:0px; top:0px;"/>
<object id="Astream" type="audio/X-arib-mpeg2-aac"
        data="/-1" streamstatus="play"/>
```

Script example for playing AAC/AIFF files

AAC

```
<object id="AAC" type="audio/X-arib-mpeg2-aac"
        data="sample.aac" streamstatus="play"/>
```

AIFF

```
<object id="AIFF" type="audio/X-arib-aiff"
        data="sample1.aif" streamstatus="play"/>
```

Attributes	
Id	Object ID (identifier)
Type	Media-type
Data	Name of an AAC fiile
Stream status	Use “play” and “stop”. Initial entry should be “stop” (“stop” means “mute”, not “abort”)

3.2.1 Exercise

Q1 Create a reference content of a full-screen main video.

Q2 Transform an image material to a BML content referring to a designer’s layout specifications.

Chapter 4 Overview of ECMA (expansion function for broadcasting, etc.)

■Overview

For digital broadcasting, a control function specialized for broadcasting is used in addition to regular DOM operation.

4.1 Basic information

1) Concept of DOM on basic BML

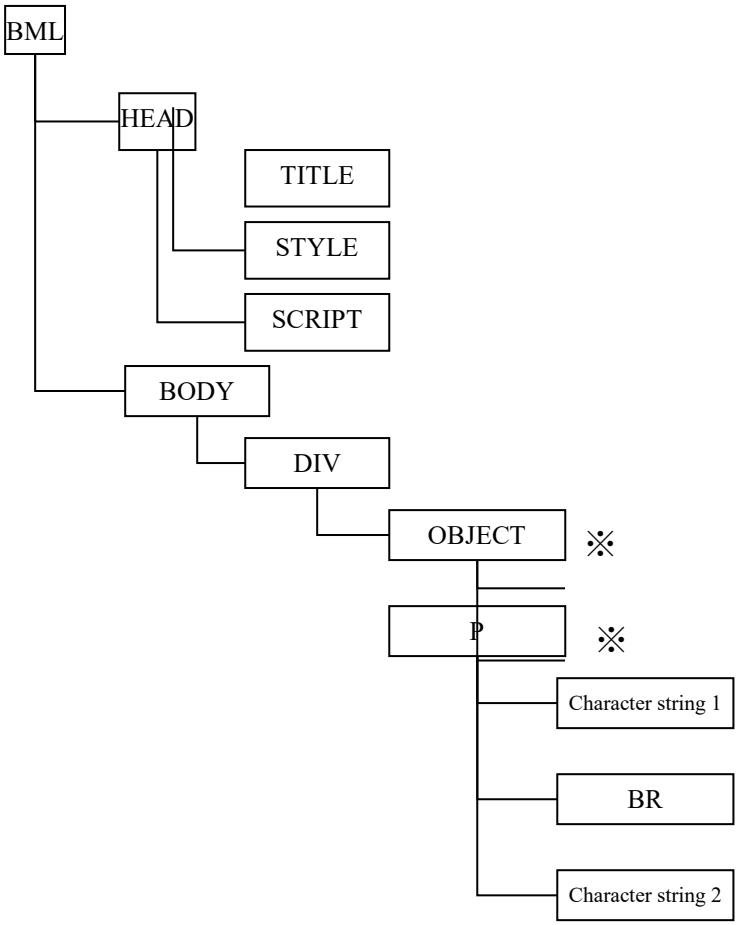


Figure 13 Concept of DOM on basic BML

```
<?xml version="1.0" encoding="EUC-JP"?>
<!DOCTYPE bml PUBLIC "+//ARIB  STD-B24:1999//DTD
 BML Document//JA" "http://www.arib.or.jp/B24/DTD/bml_1_1.dtd">
<?bml bml-version="3.0"?> <bml>
    <head>
        <title>basic BML </title>
        <style> …abbr.… </style>
        <script> …abbr.… </script>
    </head>
    <body>
        <div>
            <object id=“photo1” type=“image/jpeg” data=“photo1.jpg” />     ※1
            <p id=“text”> character string 1 <br /> character string 2 </p>   ※2
        </div>
    </body>
</bml>
```

As you can see in the above tree chart, all elements such as DIV and P, have parent-child relationships.

This concept is called DOM (Document Object Model), where a component of a XML document is called “node”. There are several types of nodes.

Some types of node can include a node within itself, which is called “child node”. XML documents are a type of node themselves.

For setting a dynamic expression with ECMA script, you can specify a target node and change the attribute.

2) Basic ECMA scripts for DOM operation

■Hiding the”photo1” file

document.getElementById(“photo1”).normalStyle.visibility = “hidden”;

■Replacing “photo1” file with “photo2.jpg” file

document.getElementById(“photo1”).data = “photo2.jpg";

■Changing the character string in “p” test

document.getElementById(“text”).firstChild.data = “a new character string“;

Formatting an ECMA script

Insert periods (.) between orders and objects.

The above example of changing the character string of <p> means “getElementByld() with the id “text” in the document and input a new character string in the data field of firstChild node”.

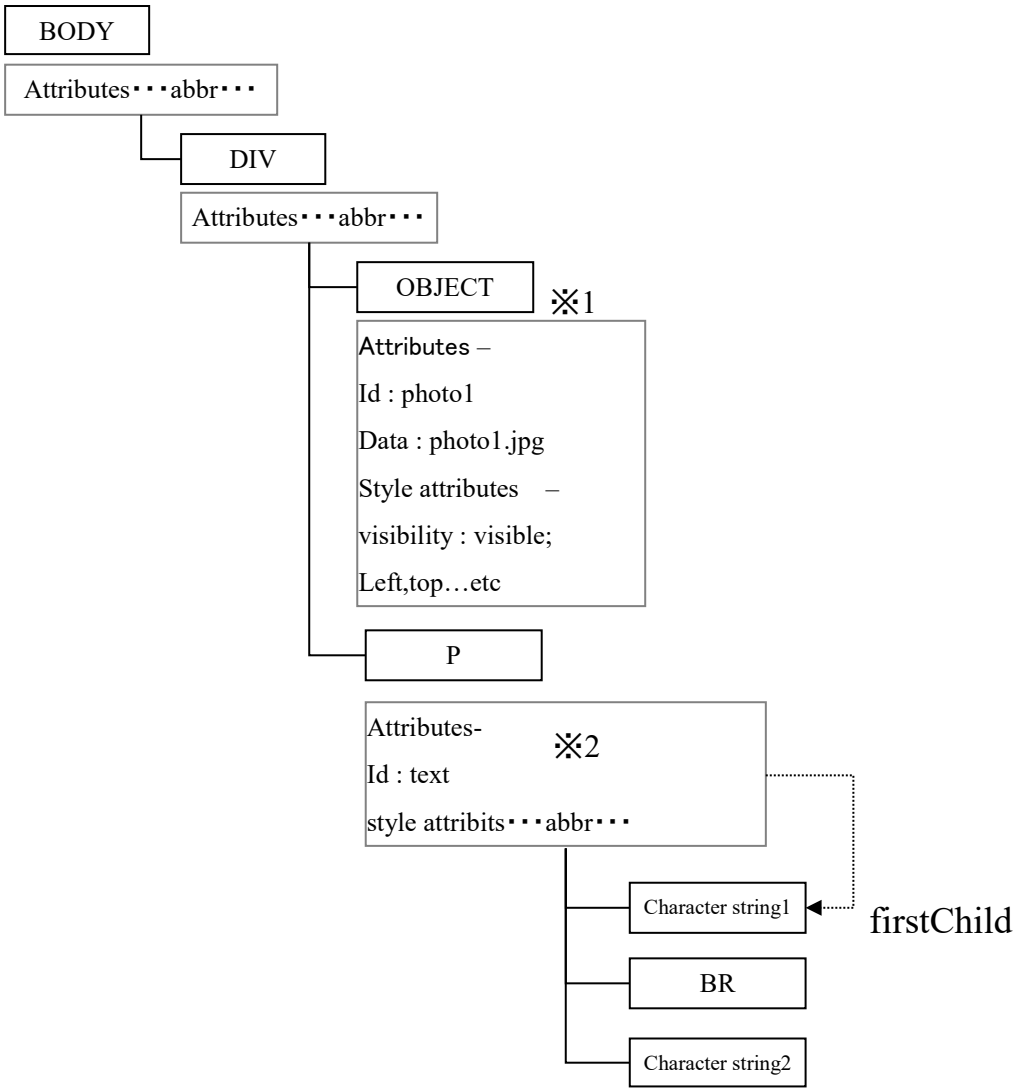


Figure 14 Changing the character string in “p” test

3) Global script and onLoad script

```
<script>
<![CDATA[
        browser.launchDocument("/40/0000/menu.bml","cut");
]]>
</script>
```

```
<script>
<![CDATA[
        function gonext(){
                browser.launchDocument("/40/0000/menu.bml","cut");
        }
]]>
</script>
</head>
<body onload="gonext();">
```

*Operational differences

Global: Global script is processed after data is read by a BML browser and before graphics are loaded.

onLoad: onLoad script is displayed when a BML browser finishes loading graphics.

Note: Timings may slightly vary depending on the receiver. Therefore, scripts should be tested on each receiver before use.

4) Script example for playing audio signals

Sounds embedded in a receiving device

browser.playRomSound(*soundID*);

Parameter: soundID

Index numbers of audio signals in a receiver, which range from 0 to 13.

*(example: "romsound://5")

*Sound tones are standardized for all receivers.

Also, ID no. 0 to 4 are designated as warning chimes, 5 to 12 are operational sounds, and 13 is an alarm.

4.2 Expansion for broadcasting

1. Interference by SetInterval and controlling MNG

Layout of a MNG file

<object id="MNG" type="image/X-arib-mng"
data="sample.mng" streamstatus="play“
style="*left:50px;top:50px;width:100px;height:100px;*"/>

Attributes	
Id	Object ID (identifier)
Type	Media type
Data	Name of a MNG file
Streamstatus	Use “play” and “stop”. Initial entry should be “stop“
Style	Specify the position and color

Streamstatus values and screen status

Play : File is displayed and played
Pause : Pausing on a screen; restarts when the status is changed to “play”.
Stop : Disappearance from a screen; replays from the beginning when the status is changed to “play”.

*When the visibility is changed to “hidden” with the stream status “play”, the display is turned off, while the file is still playing.

Controlling a MNG file by modifying Streamstatus

document.getElementById(*objectid*).streamStatus = status

Objectid : Use ObjectID (identifier) of a MNG file.
Status : Use the status（"play", "pause", "stop"） for playing a MNG file.

Interference by setInterval

With setInterval, a specific behavior can be invoked after a certain amount of time or every time. setInterval is also known as “timer function”.

browser.setInterval(***"func();"*** **,** ***msec*** **,** ***iteration*** **);**

Parameters

func()	:	The name of an order executed with timer interference or a function
Msec	:	Time length of interference pattern
Iteration	:	Recurrence rate

Return value

Positive value	:	Registered timer ID
NaN	:	Failure

2. Referring to a binary table

Reading a binary table

var ***MyBtb*** **= new BinaryTable(** ***table_ref*** **,** ***structure*** **);**

Parameters

table_ref [String] The name of a binary file (specifying a table file)

structure [String] The format of the binary file（Example："2,S:2V,S:2V,S:2V"）

Return value

Success [String] Created binary table object

Failure null

【Retrieving one field as a character string】

MyBtb.toString(***row*** **,** ***column*** **);**

Parameter

row [Number] The row number of the field to retrieve

Column [Number] The column number of the field to retrieve

Return values

Success [String] Content of the target field

Failure null

【Retrieving a field as a value】

MyBtb.toNumber(***row*** **,** ***column*** **);**

Parameter

row [Number] The row number of the field to retrieve

Column [Number] The column number of the field to retrieve

Return values

Success [String] Content of the target field

Failure null

【Retrieving a field as a record array】

MyBtb.toArray(*startrow* , *numrow*);

Parameters

startrow [Number] Starting position of the record to retrieve

numrow [Number] The number of records to retrieve

Return values

Success [Array] Array that contains a consecutive series of records

Failure null

3. Control by interference (event)

Script example: case of an event message

```
<bevent>
<beitem id="bei_evtmssg" type="EventMessageFired"
                es_ref="/40"
                        onoccur="evt_evtmssg();“
                        subscribe="subscribe"/>
</bevent>
```

Attributes of Beitem

Type	:	Input “EventMessageFired” for receiving an event message. Other options include “ModuleUpdated“, ”DataButtonPressed”, ”MediaStopped”, etc.
Es_ref	:	Input the ES of the target event message. Automatically set to the same ES as that of BML when no specific value is set.
Onoccur	:	Parameters executed at an event occurrence
Subscribe	:	Set valid/invalid.
message_id	:	Event message ID. Set to 255 to receive all messages when no specific value is set.

4. Reading from and writing on NVRAM

Variables in scripts are erased when they are transited to another BML. Although, within the same program, they can be exchanged between BMLs using Ureg fields, NVRAM (non-volatile RAM) becomes convenient when channel needs to be changed or variables will be carried over to next week’s broadcast.

NVRAMs provide common area to input specific types of information, such as a name, and areas that service providers can optimize for their use.

Writing on NVRAM
browser.writePersistentArray(*filename, structure , array , period*);

Reading from NVRAM
browser.readPersistentArray(*filename , structure*);

Parameters

filename	Name of a file in NVRAM (e.g.: "nvram://~/0")
structure	Structure to be used for each element (i.e.: "S:1V,S:1V")
array	Array to be stored
period	Period of use (not required)

Return value
Number of bytes written: success
NaN: Failure

Operation of NVRAM

・Common area
nvram://tr_common/<block no.>

・Service provider affiliation area
nvram://<affiliation_id>;group/<block no.>

・Service provider local area
nvram://local/<block no.>

・Service provider local web area
nvram://local_web/<block no.>

・Receiver's residence information
nvram://receiverinfo/prefecture (prefecture code)

5. Operation of temporary storage

・Greg[ ]: Can be accessed by all contents. Data is retained until the power is turned off. However, some receivers do not perceive disconnection and only switch to standby – data is retained until they run out of power supply.

・Ureg[ ]: Can be accessed only by displayed contents. Data is erased when channel is changed.

6. Communication function via networks of receivers for terrestrial digital broadcasting

Ideally, receivers should be equipped with an Ethernet terminal or a modem, and it is stated in TR-B14 that a modem of 28.8kbps is preferred. However, in reality, Internet communication is rarely done on BS/CS/terrestrial digital broadcasting receivers. TR-B14 also suggests that HTTP1.1 should be supported by a receiver, while mentioning the use of HTTP1.1 in digital broadcasting.

Operation of namespace

From broadcasting to communication http://-, https://-
From communication to broadcasting arib://～、arib-dc://～

Functions related to digital communication

getBrowserSupport()	: Makes an inquiry as to whether a specific function is installed
setISPParams()	: Configures a receiver with provider information
getISPParams()	: Retrieves provider information from a receiver
connectPPP()	: Connects a receiver with the Internet providing specific connection information
connectPPPWithISPParams()	: Connects a receiver with the Internet using already set provider information
disconnectPPP()	: Terminates Internet connection
getConnectionType()	: Retrieves information on circuit class
isIPConnected()	: Checks IP connection
launchDocumentRestricted()	: Used in a transition from broadcasting to communication
launchExApp()	: Launches an external application
transmitTextDataOverIP()	: Sends and receives a text mail using TCP/IP

“Link state” and “non-link state” of contents transmitted via networks

Link state: Domain contents directly transferred from broadcasting.
If the link state is active, you can access broadcast video, audio and other resources - under almost the same conditions with BML on carousel.

Non-link state: Contents of other domains transferred from link-state contents.
When the link state is inactive, you cannot access broadcast video, audio and other resources.
Also, only a limited number of functions can be used.

Character entry function

Using the character entry function, you can input hiragana and katakana. Commercial kana-kanji convertors are still being planned.

Attributes newly added to input element
・inputmode attribute (for disabling onkeyup setting) : Attribute for controlling character entry function

direct : Character entry function becomes activated as focus is set.
indirect : Character entry function becomes activated when focus is on and a select button is pressed
none : No launching of entry application（In compliance with the “input element” of B-24）

・charactertype attributes
Attribute to control character
Valid only when “direct” or “indirect” is specified in inputmode attribute.

all : No limit
number : Half-width digits only
alphabet : Half-width（English alphabets + symbols）
hankaku : Half-width（English alphabets, numbers, symbols）
zenkaku : Full-width（hiragana, katakana, alphanumerics, numbers, symbols）
katakana : Full-width（katakana ＋ symbols）
hiragana : Full-width（hiragana ＋ symbols）

So far, the structure of data broadcasting and production technologies have been explained.

4.2.1 Exercise

○Preparing for exercises

・installation of the development tools for data broadcast

○Create contents of the following basic functions:

・minimum function

・a full screen video

・Transit to another screen using the “d” button

○Create contents of the following functions:

・Hide data broadcasting using the “d” button

・Move the focus using nav-index

・Action for when the “Select” button is pressed

・Action for when the “Color” button is pressed

・Add sound to the focus

・Receive and display the event message

○Create contents of the following additional functions:

・Add AIFF sound file

・interruption-handling of the timer

・Read and display the Binary Table file

・interruption-handling of the “module updated”

・interruption-handling of the “Data Event Changed”

・Read and write the NVRAM (Non Volatile RAM)

Chapter 5 Basic knowledge required for data broadcasting content production /editing

While the previous chapter explained the basic technologies of data broadcasting, this chapter will give step by step description of how contents are made.

Here, the process of the production of relative data broadcasting will be explained.

5.1 Basic process flow of data broadcasting production

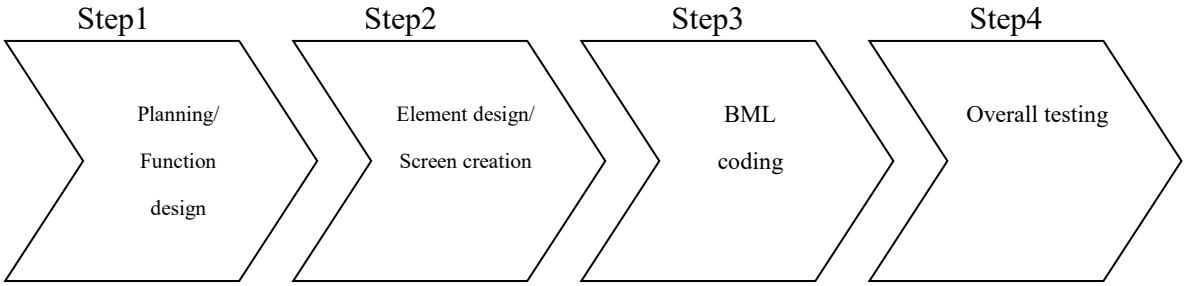


Figure 15 Production flow

1. It goes without saying, production of a content starts with planning. After the ideas for a data broadcast content are discussed and planned, the functional structure of the content is designed based on the plan.
2. Once required functions are identified, a screen with media elements that meet the functional needs is designed. After screen designing, mono-media elements are created referring to the design.
3. Once the functions and screen design are specified, coding is designed carefully to realize all the specified functions. Then, actual BML coding starts. At the coding stage, each function is examined on a BML browser.
4. The only remaining task after BML coding is overall testing. The finished content is tested in the development environment first and later in a testing environment at a station.

5.2 Actual production of relative data broadcasting

In this section, a production process that was actually conducted based on the flow chart will be described as shown in Figure 15.

1. Planning/function designing

   TV programs have sponsors. Upon hearing the producer’s ideas, production members transform their ideas into plans. Once planning is complete, they start making a flow chart of screen transition and identify required functions for function designing.

Drawing a flow chart similar to Figure 16 is highly recommended for function designing.

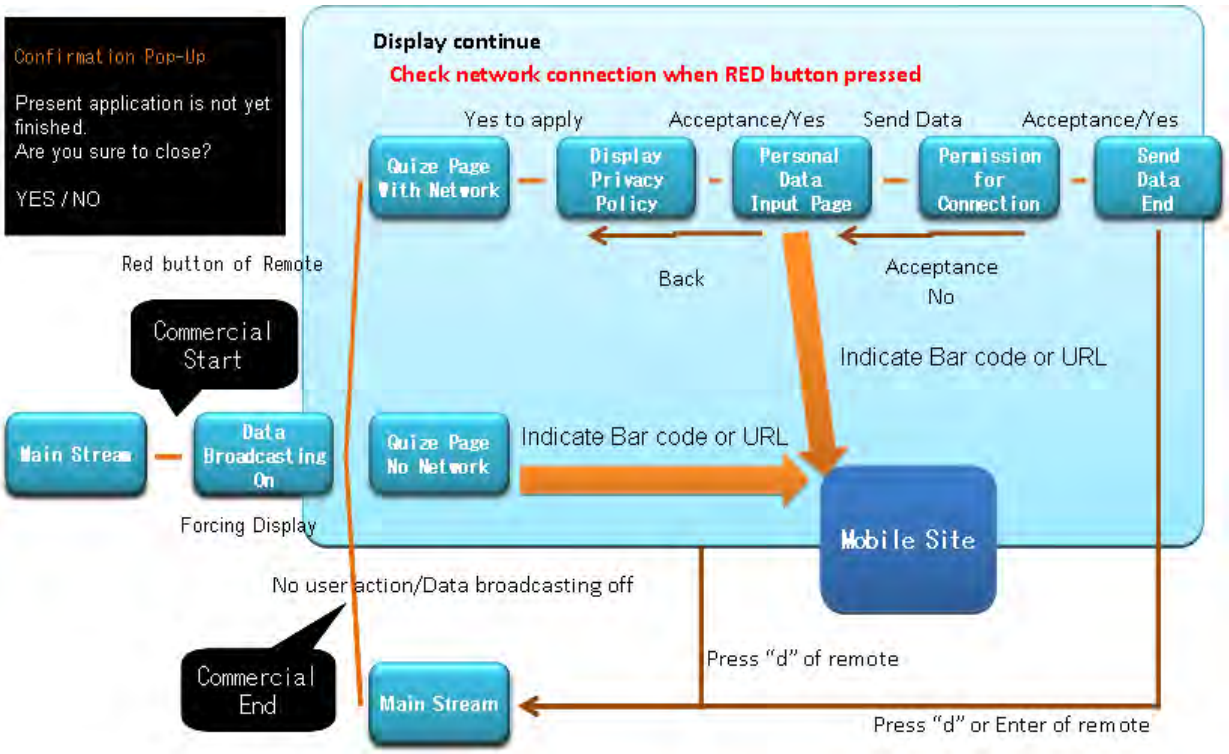


Figure 16 Flow Chart of Contents

Once function designing is complete, evaluation method is developed and documented. The document is then handed over to programmers as an evaluation policy.

2. Element design/screen creation

The completed design is then transformed into screens. Design direction is specified and gradually finalized. Based on the direction, function buttons are carefully positioned – note that the buttons will be pressed with a remote controller. The positioning requires careful planning to increase users' accessibility.

Once the designing stage is complete, media elements (mono-media) are ready to be created.

Each screen is designed based on a flow chart. The images below are design examples.

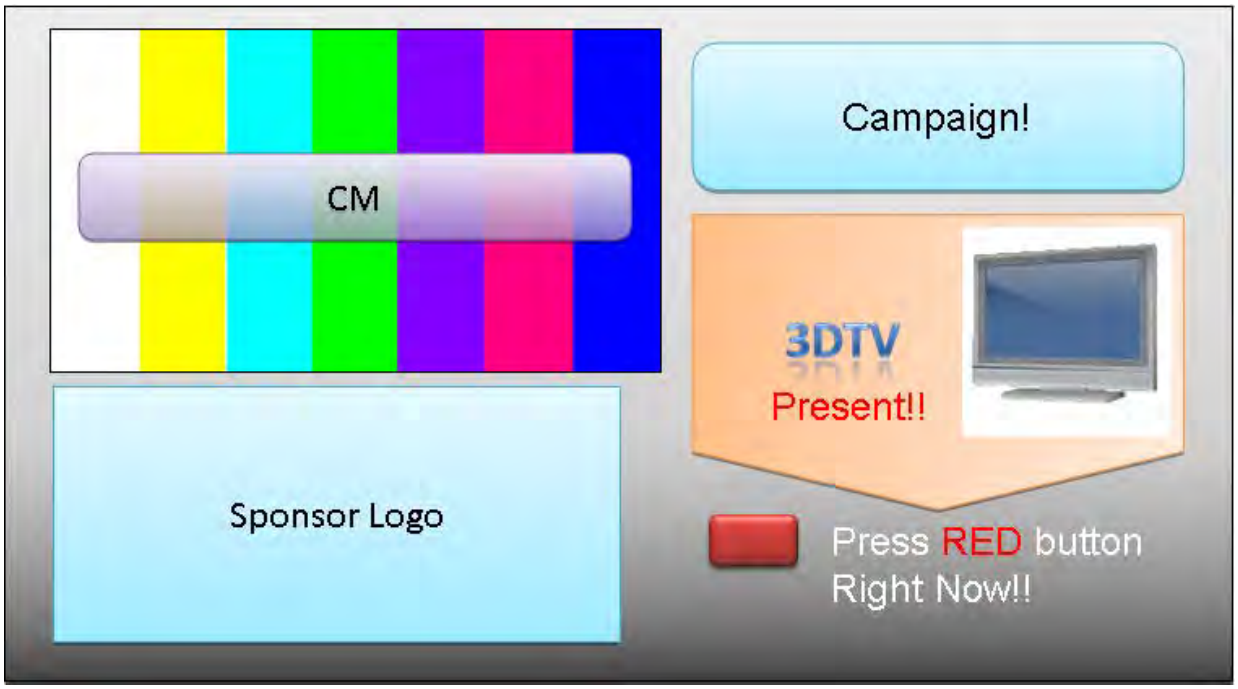


Figure 17 Top Screen

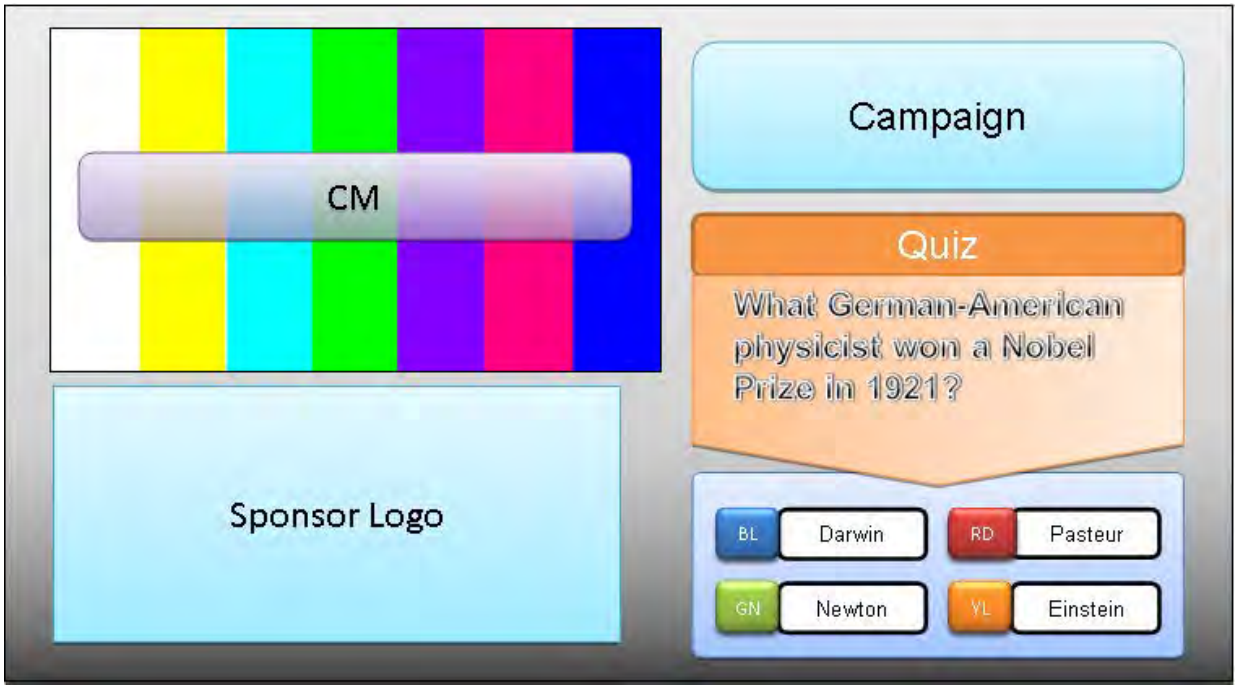


Figure 18 Quiz and prize entry screen

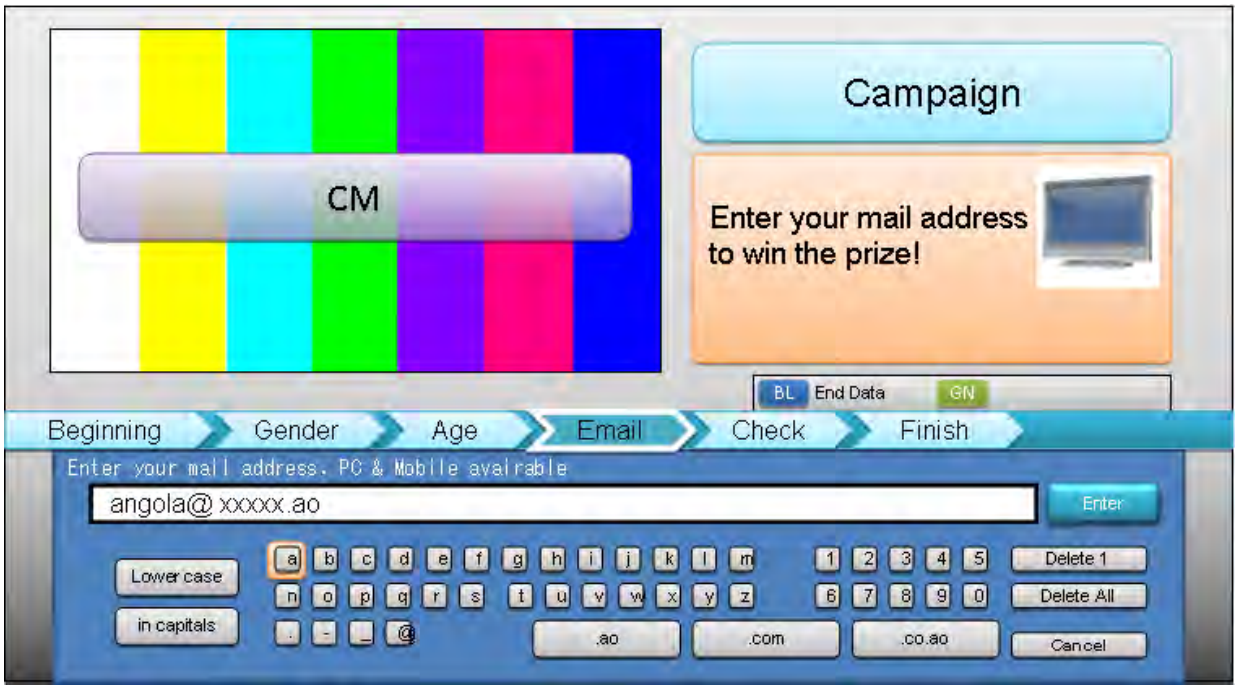


Figure 19 Prize entry screen/application form

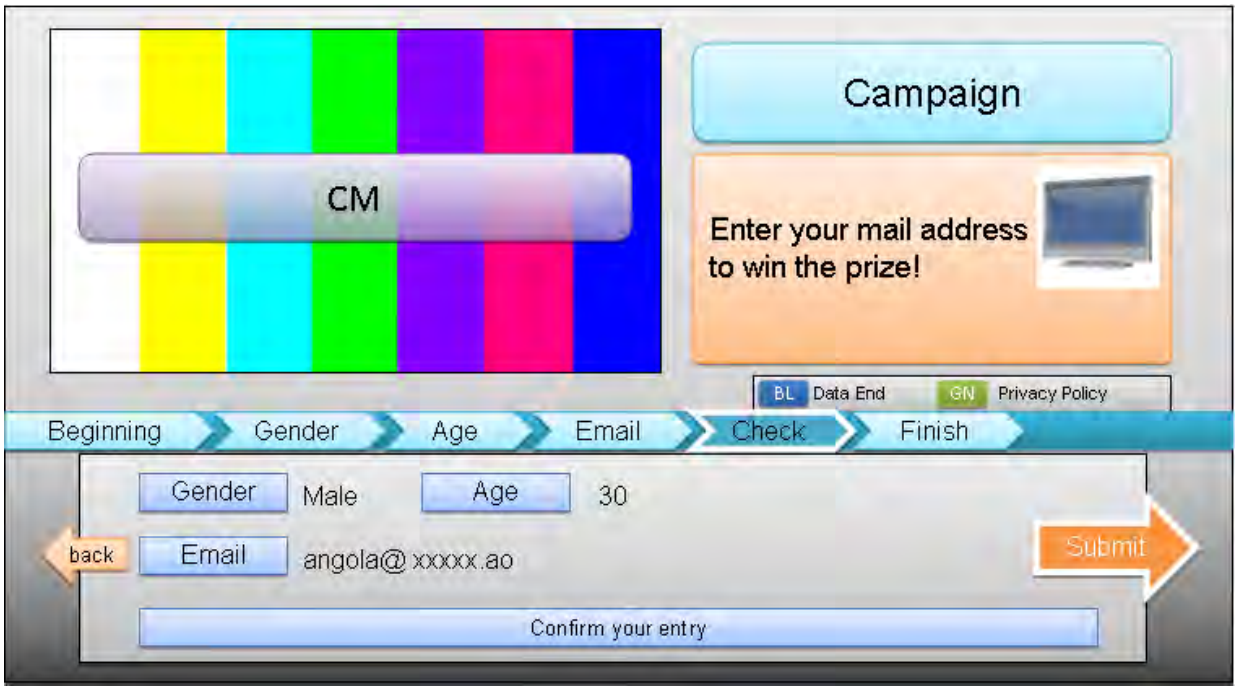


Figure 20 Confirmation screen/interaction communication screen

3. BML coding

Upon completion of designing, BML coding of the content can be started. During this stage, all the functions required for each screen are actualized through detail design.
To complete the detail design process, the completion of an evaluation sheet is necessary, which is filled out based on the evaluation policy document from the upper process. Once the detail design is complete, programmers can finally start the actual coding process. While coding, programmers evaluate each function to be implemented on a BML browser, along with updating the evaluation sheet.
Meanwhile, designers provide programmer with mono-media files that they created prior to coding.
Once mono-media is incorporated, the coding process is complete.

4. Overall testing

Once the processes of BML coding and mono-media incorporation are complete, overall testing is started. First testing is to confirm the validity of each function in a developing environment.
After the initial testing, final testing is conducted at a broadcast station. Data production can be complete only when all the required functions for the content are rated as satisfactory in the testing.
As it is the case for the function evaluation during this process, testing tends to be nothing more than a mere process when everything is normal; however, it is important that irregular situations are always expected and handled properly so that risks can be minimized.
In the production of contents, remaining risks (if there is any) are expected to be detected at the final testing stage. Also, it is recommended to make a list of possible measures for the risks.

5. Flow of broadcasting

The flow of relative data broadcasting is as follows:

1. At the beginning of a TV program that comes with data, prepared data is delivered.
2. It is indicated in the main stream that data broadcasting is available for viewers.
3. Viewers display data using a remote controller.
   Corresponding to the flow of the TV program, questions are displayed in event messages. Answers are also delivered along with questions.
4. As a response to viewers' actions, BML judges if their answers are right or wrong.
5. Quiz participants are led to a prize entry screen.

6. Participants input personal information in a form and send the data. Here, the flow is divided into two directions.
   - When a TV is connected to the Internet, viewers send the data only.
   - When a TV is not connected to the Internet, they can send the data using QR code from a mobile device.
7. When the data is sent, TV displays “Thanks” screen.
8. At the end of the program, data broadcasting screen shows a full screen version of the main stream.

You can see screen examples in the image below.

Figure 21 Flow Chart of Contents functionality

Chapter 6 Coding/decoding technologies used in data broadcasting

In this chapter, the coding/decoding technologies for data broadcasting will be discussed.

Main resource files used in data broadcasting are as follows:

■Resource examples

BML file : BML tag, script, style sheet
PNG file : PNG image file
JPEG file : JPEG image file
CLT file : Color palette file
CSS file : Style sheet
script file : External script file
drcs file : External character file
BTB file : Binary table file

These resources are multipart (modularized) and are integrated into a single file.
* Multipart is a method to store different types of elements for data broadcasting.
These module files are stored as DII/DDB files using the section format of DSM-CC (ISO13818-6) before delivered as TS packets.

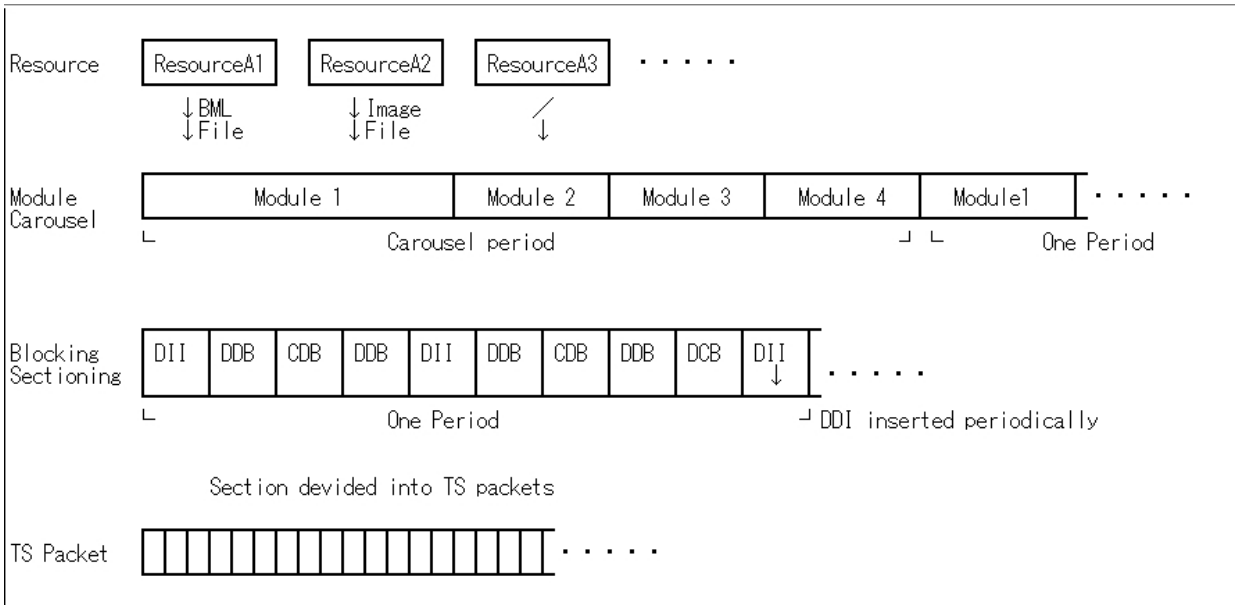


Figure 22 Packetizing procedure of data broadcasting

Digital TV device demodulates the radio wave that was received as a broadcast wave. It further generates TS file, ES file from MPEG2-TS packet, and builds a module / resources within the ES required to display the BML content.

Even in the same data broadcasting, the resource has been placed on the WEB server communication, as well as the normal WEB content in order to get the data in units of resource files from the WEB server and to build a BML content.

6.1 Exercise

When the audience selects a channel, the amount of time required for displaying data broadcasting on a screen is influenced by the size of each module and the bandwidth for ES.

Q1 When multiple ESs (40, 50) are used, how should these be delivered?
A Template of data broadcasting (100KB)
B Data for update A (200KB)
C Data for update B (10KB)
D Design a module structure

Q2 Insufficient bandwidth for data broadcasting may cause update delays on the receiver's side, unless update intervals of modules are properly controlled.
Explain the reason from the perspectives of update frequency of resource files and carousel cycle.

Chapter 7 Delivery of content for data broadcasting and connection to a transmitter

7.1 Basic equipment required for data broadcasting

The equipment required for data broadcasting are as follows:

1. Creation of data carousel
   Role: Unlike the Internet where data is delivered only once, data broadcasting is required to constantly deliver the same data so that viewers can access news report or weather report at their convenience. Carousel is a device to deliver data on a regular basis (commonly referred to as a “transmitter”). The literal meaning of carousel is “merry-go-round”; and the device name stems from the fact that a carousel rotates in a circle just as a merry-go-round to constantly send the same information to receivers.

2. MPEG2-video (for videos) and MPEG2 aac encoder (for audio)
   Role: The sizes of video signals become significantly larger when a video file is digitized. Thus, MPEG2 encoder was developed to transform digitized video signals into MPEG2 data using the MPEG2 compression technique. The compression process roughly consists of two stages, including “space compression” and “time compression”. Image data, as a series of still images, are space-compressed first and then time-compressed based on the timeline.

3. MPEG2-TS multiplexer (MUX)
   Role: Multiplexer is a mechanism that outputs several input signals as one signal. In digital signal processing, a multiplexer (MUX) is used as a device that combines several digital data streams into one data stream of a higher data transmission rate. The device enables to transmit multiple data streams into a single link from one place to another.

4. Modulator (ISDB-T, ODFM modulator)
   Role: OFDM stands for Orthogonal Frequency Division Multiplexing. It is essentially a variation of FDM scheme; however, there is a conceptual difference between FDM and OFDM in wavelength multiplexing. A modulator is used to modulate the ODFM scheme that is based on ISDB-T standard.

Also, equipment of an actual broadcast station includes:

・CMS (Content Management System) for registering/managing data broadcast contents

Role: It is a device that registers data broadcast contents and external media elements (mono-media) as well as provides a specific time slot to registered data. Categories of TV programs vary from drama series to across-the-board programs and to re-runs. Besides, CMS is employed to modify data contents to fit them to TV programs.

・Cooperation with affiliate systems for data broadcasting

Role: Most Japanese terrestrial broadcast stations rely on an affiliate system, where TV programs are delivered from the key station in Tokyo/Osaka/Nagoya to local affiliate stations. Data contents that accompany TV programs are also delivered to affiliate stations all across Japan through a fiber optic/satellite circuit.

*These pictures (Photo 1 and 2) are that of the delivery/evaluation environment at a data broadcast content production company. In addition to the equipment above (1-4), commercial television sets by various manufacturers are used for operation verification – this helps them to detect problems and operation differences before a content is broadcasted.

Photo 1 Example of data broadcasting transmitting system

Photo 2 Example of receiver test and monitoring equipment

Although broadcast stations use a wider variety of equipment for unit duplexing and viewing other channels, the principles remain the same.

7.2 Content registration on a transmission equipment

Data broadcast contents are registered by module as mentioned earlier in this document.

A module contains multiple resource files, and a BML file that specifies module configurations recorded by equipment at TV stations.

●BCML sample file

```
<?xml version="1.0" encoding="Shift_JIS"?> <!DOCTYPE bcml PUBLIC "-//ARIB//DTD
BCML 1.0//JA" "http://www.arib.or.jp/B35/DTD/bcml_1_0.dtd">
<bcml version="1.0">
  <data_es component_tag="40" document_resolution="960x540_16v9"
    duration="00:10:00" entry_point_flag="FALSE"
    file_storable_flag="FALSE" format_type="BML" format_version="3.0"
    max_carousel_period="00:10:00" name="es60"
    ondemand_retrieval_flag="TRUE">
    <carousel name="60" start_time="00:00:00">
      <!—start up document -->
```

```
        <module compress="FORCE"
compression_type="ZLIB" module_id="0000" name="0000" original_size="51820"
priority="6" version_up_flag="FALSE">
        <resource name="startup.bml"
type="text/X-arib-bml;charset=&amp;quot;euc-jp&amp;quot;"/>
        </module>
```

A BCML file specifies the program component and the program time when the content is used as well as a resource file group in the content.

Chapter 8 User Experience and User Interface

8.1 Fundamentals

Being familiar with the technologies and techniques for data broadcasting is not enough to create better, useful contents.
It is necessary to know about the characteristics of devices, how to use them, and who uses them.

1. TV
   Display to show video and other contents. Basically has 16:9 aspect ratio and variety of sizes but almost all of them have same pixel resolution, 1920 x 1080.
2. Remote Controller
   Device to control TV. Many buttons exist and sometimes a function of a button may change depending on contents.
3. Users
   People who watch contents on TV. This means everyone who can watch TV is included.

8.2 Designing Contents

To design better contents, carefully consider the points listed below.

1. Amount of Information
2. User interface
3. User experience
4. Universal design
5. Color universal design

1. Amount of information
   Because of the characteristics of TV, screens filled with letters are stressful for users. TVs are for watching videos, not reading text.

Figure 23 Example of text base information on web

2. User interface

It is necessary to control TV and data broadcasting contents with remote controls consisting of many buttons. Since most of users cannot memorize the position of all buttons and functions, it is necessary to look at the remote to find the right button for our purpose.

Figure 24 Example of data broadcasting supported remote

3. User experiences

Nice graphics and appropriate amount of information is not enough to make content look good. If users feel difficulty using your content, they won't use or watch your

content ever again.

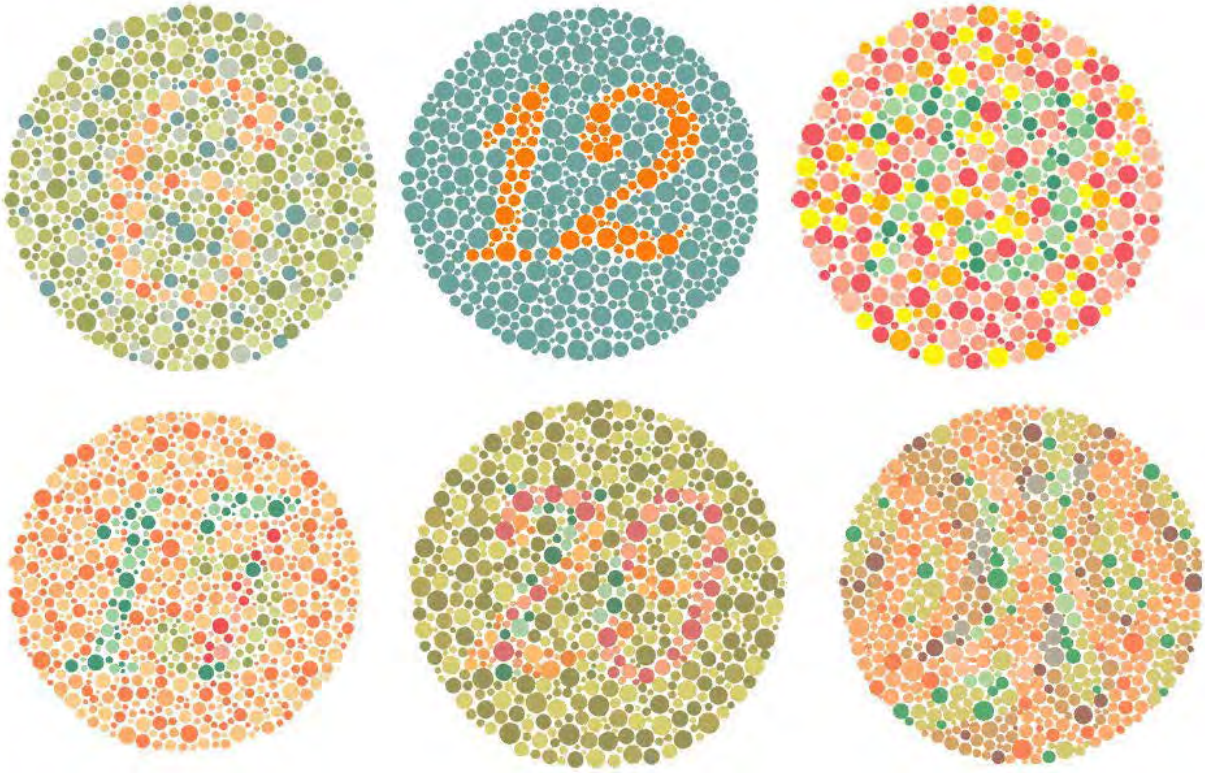
Broadcasters should be aware of creating contents that the users can refer to without any stress or uneasiness.

4. Universal design

   Anyone can be a user of your contents. Basically, broadcasters should think about graphics and user interfaces accessible to everyone.

5. Color universal design

   Not all people see a red button as same color. There are a lot of people who recognize “red” as different color than others. And there are some people having difficulties distinguishing particular colors.



Going through these elements can help in creating better and useful contents for users.

Figure 25 Example of Color blindness test

Chapter 9 For BTV, On-Job-Training for Datacasting service-in process

9.1 Overview of Data broadcasting service-in process

For data broadcasting service-in, certain procedures are needed service by service, program by program, event by event. Figure 26 is the common procedure of Datacasting service-in.

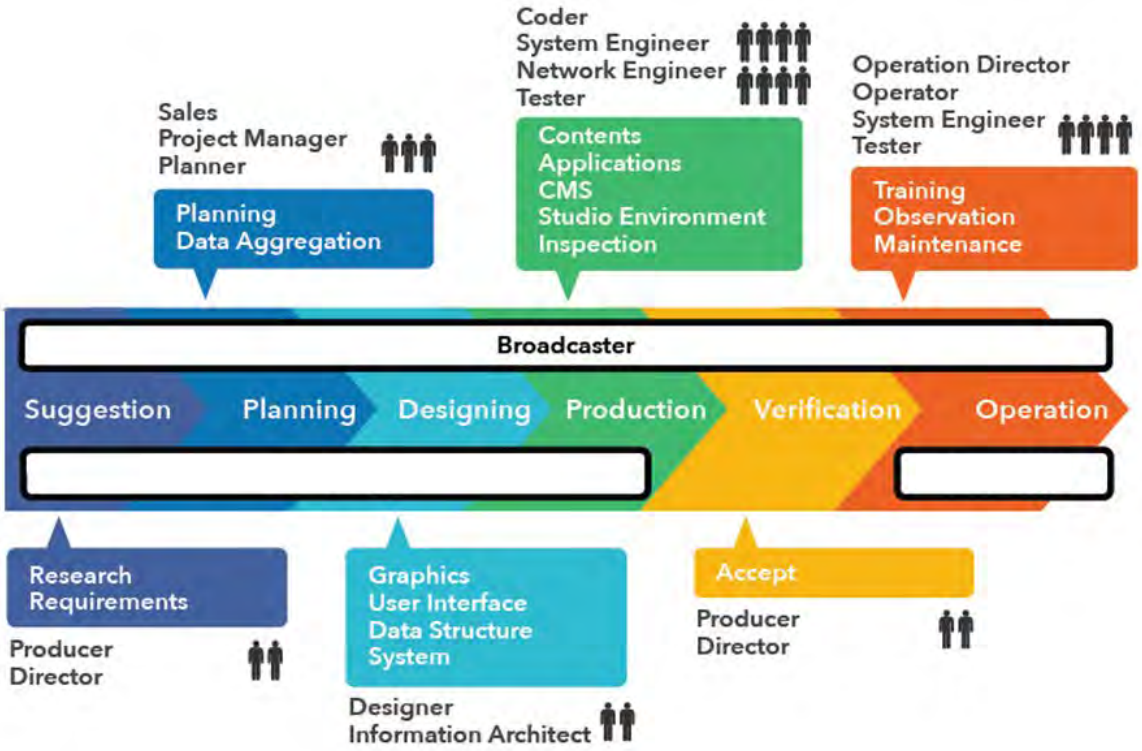


Figure 26 Common procedure of Datacasting service-in

There are step by step procedure of Suggestion, Planning, Designing, Production, Verification, and Operation. BTV can choose the level of work allocation for each procedure like, either doing all work by BTV only and placing all order to the outsourcing company or working together. The outsourcing company can also provide training for each procedure as well.

According to BTV's section structure, it is necessary to optimize people to be in charge of each procedure. Figure 27 is BTV's Data broadcasting service-in procedure mentioning the necessary involvement of specific BTV Data broadcasting unit and related sections in each step.

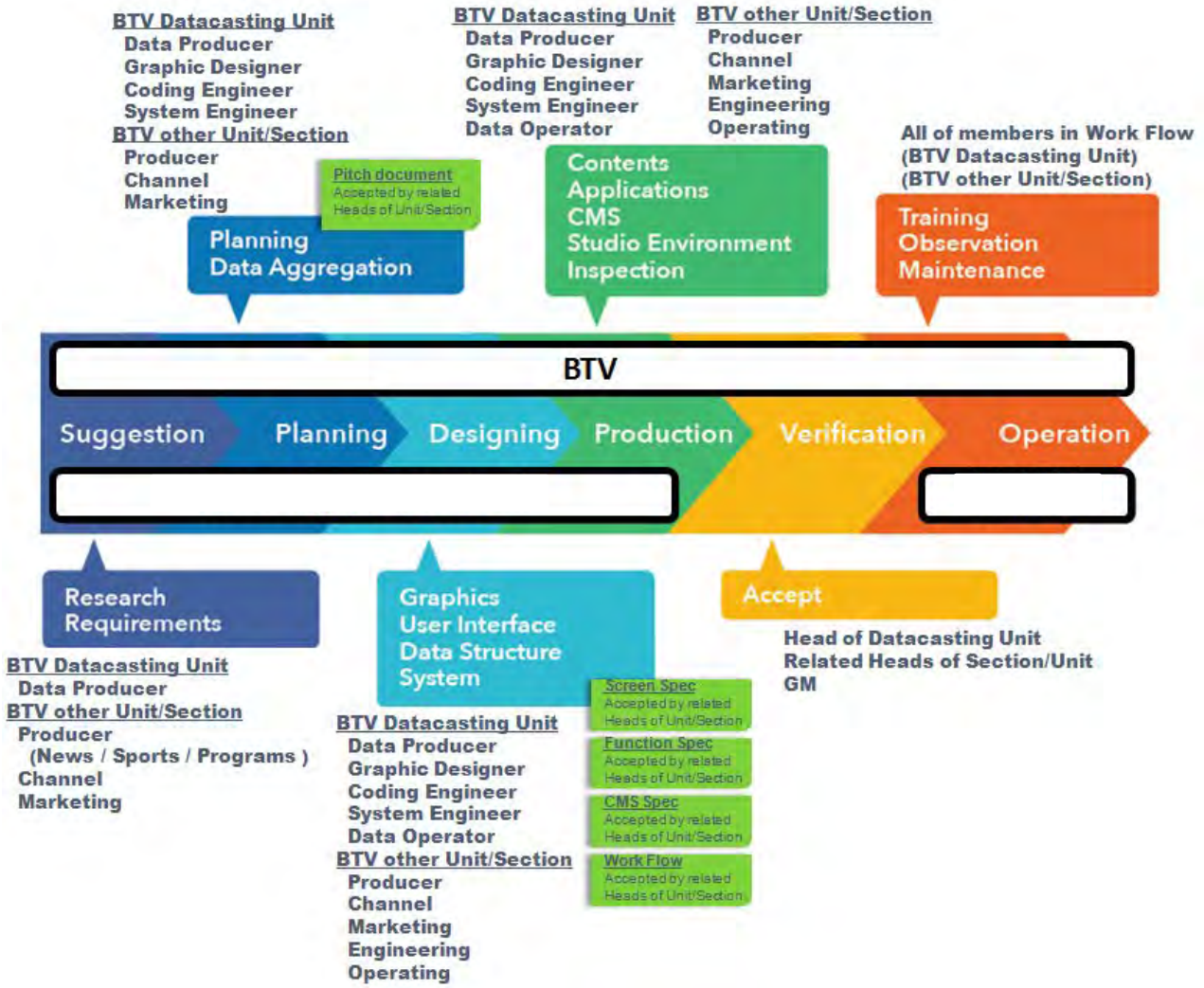


Figure 27 BTV's Data broadcasting service-in procedure

✓ Each procedure need to work in cooperation with multiple sections as mentioned below. **Suggestion**

This progress considers new or upgraded service comprising of:

- Research: Viewer feedback, Advertiser feedback
- Requirements: Ministries' requirement

This progress needs the co-operation of,

BTV Data broadcasting Unit

- Data producer: Managing Datacasting service policy

BTV other Unit/Section

- Video program producer: Considering about program related service
- Channel: Considering program time table
- Marketing: Considering Ad policy for this new or upgraded service

✓ **Planning**

After suggestion, some good items will appear, then detail service planning will require,

- Planning: Detail service planning
- Data aggregation: Planning about information delivered from outside

This progress needs cooperation of following units:

BTV Data broadcasting Unit

- Data producer: Managing Data broadcasting service overall
  Creating "Pitch document" together with Video program producer
- Graphic designer: Managing Data broadcasting design
- Coding engineer: Managing Data broadcasting functions
- System engineer: Managing Data broadcasting operation system

BTV other Unit/Section

- Video program producer: Considering about program related service
  Creating "Pitch document" together with Data producer
- Channel: Considering program time table
- Marketing: Considering Ad policy for this service

✓ **Designing (This covers graphical as well as all technical designing)**

After planning, this detail technical designing will need,

- Graphic: Graphic elements structure designing
- User Interface: User navigation, page structure designing
- Data Structure: Contents delivery data structure designing
- System: Datacasting transmitting and operation system designing

This progress needs cooperation of,

BTV Data broadcasting Unit

- Data producer: Managing Data broadcasting service overall
  Managing "Work Flow" with others
- Graphic designer: Creating "Screen Spec"
- Coding engineer: Creating "Function Spec"
- System engineer: Creating "CMS Spec"
- Data operator: Managing "Work Flow" with others

BTV other Unit/Section

- Video program producer: Managing program related data operation
  Managing "Work Flow" with others
- Channel: Managing program time table, and channel structure
- Marketing: Managing Ad policy, and Ad data operation
- Engineering: Managing Datacasting transmitting with system engineer
- Operating: Managing program related data operation cooperation

✓ **Production**

After technical designing, the technical production needs,

- Contents: BML contents coding according to "Screen spec" and "Function spec"
- Applications: Operation tools development according to "CMS spec"
- CMS: Contents Management System (CMS) development according to "CMS spec"
- Studio Environment: Needed studio environments like studio/OB video sharing, Quantel, ENPS, Omnibus, and Broadcast master, especially for live program synchronized Datacasting services, according to "Work Flow"
- Inspection: Needed tests of all above developed elements together, using Simulator and reference STB

This progress needs cooperation of following units,

BTV Data broadcasting Unit

- Data producer: Managing Data broadcasting service overall at testing
- Graphic designer: Developing graphic elements
- Coding engineer: Developing BML code
- System engineer: Managing CMS developed by at testing
- Data operator: Managing Operation tools developed by at testing

BTV other Unit/Section

- Video program producer: Managing program related data operation at testing
- Channel: Managing program time table, and channel structure at testing
- Marketing: Managing Ad policy, and Ad data operation at testing
- Engineering: Managing Data broadcasting transmitting with system engineer at testing
- Operating: Managing program related data operation cooperation at testing

✓ **Verification**

After production including tests, the Verification requires:

- Acceptance: Acceptance of final simulation test by head members

This progress needs cooperation of:

- Head of Data broadcasting Unit: Data broadcasting service & operation acceptance
- Related heads of Section/Unit: Program related service & operation acceptance
- GM: Final On-air acceptance

✓ **Operation**

After verification, this operation needs:

- Training: Daily or Eventually operation training

And continuous BTV internal training for new members.

- Observation: Monitoring Data broadcasting services and observation for watching service problems. And also gathering feedback from viewers.
- Maintenance: System maintenance, and updating system bugs

This progress needs cooperation of:

- All of the members in Work Flow: BTV Data broadcasting Unit & BTV other Unit/Section

There are 5 important spec documentations in above procedures which are schematically presented in Figure 28 (documentation procedure).
The details of each document will be provided from section 9.2 to 9.6.

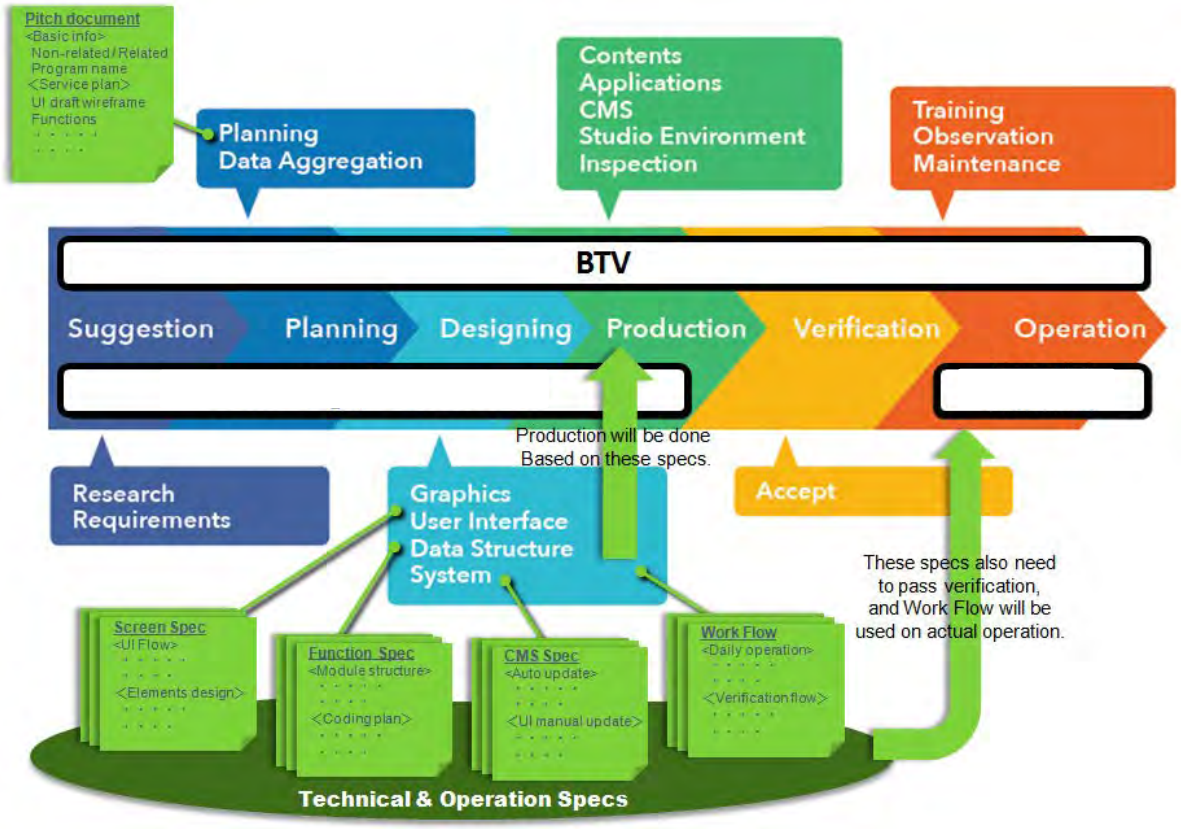


Figure 28 Documentation Procedure

- ✓ Ground service planning : Pitch document → 9.2
- ✓ User Interface (UI) designing : Screen spec → 9.3
- ✓ BML coding : Function spec → 9.4
- ✓ CMS & Operation tools : CMS spec → 9.5
- ✓ Operational Work Flow : Work Flow → 9.6

This is the 1st launch of BTV's Data broadcasting services, so we needed to create package of services that brings viewers with sophisticated and consistency information services.

BTV pick up following 9 services for 1st launch Data broadcasting.

- ✓ Channel (Program info, weather, market)
- ✓ News & Current Affairs
- ✓ Sports
- ✓ Special Events
- ✓ Marketing (Advertisement)
- ✓ Flava Dome (Music show)
- ✓ Silent Shout (Talk show)
- ✓ Talk Back (Talk show)
- ✓ Molemo Wa Kgang (Talk show)

9.2 Ground service planning: Pitch document

This Ground service planning sheet requires the cooperation of Data producers and related video program producers. Figure 29 is sample of the Pitch document for the 1st launch of BTV Portal page.

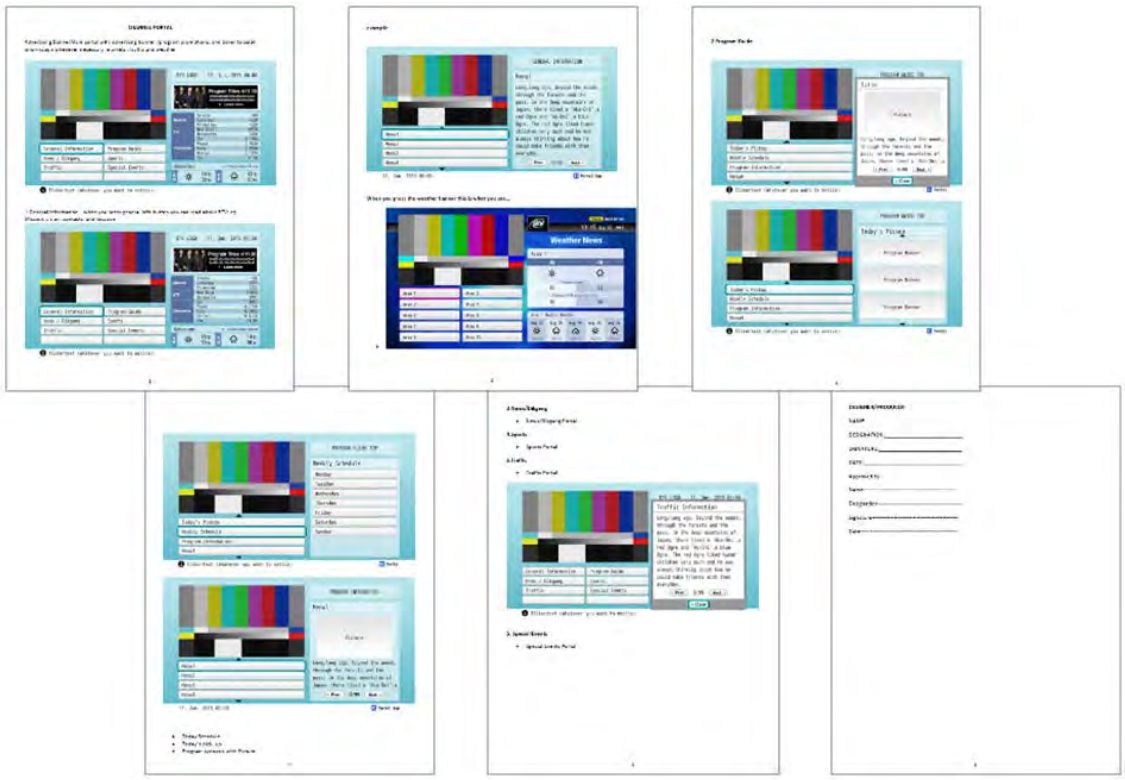


Figure 29 Sample of Pitch document (Portal page)

Before this documentation, rough service image was discussed at the "Suggestion" stage. In this stage, detail definitions of services are needed. In case of program related service, details of video program are also needed like, on-air time, production time (Live or Pre-production), etc.

Data graphic designer helps producers to create screen image on this document. Data coding engineer helps producers to understand available functions on BML spec. Data system engineer helps producers to understand system capacity, and if additional system is needed for this new service. Further, Data system engineer needs to consider system upgrade as well.

In addition, this Pitch document needs to be accepted by Head of Data broadcasting unit. In case of program related service, it also needs to be accepted by Head of Video program section/unit. Moreover, the document needs to be accepted by Head of Channel in order to use new channel structure. For Data broadcasting advertisement, it needs to be accepted by Head of Marketing.

9.3 User Interface (UI) designing: Screen spec

According to accepted Pitch document, Data graphic designer creates the technical designing spec for User interface. Figure 30 is sample of 1st launch of BTV whole UI flow chart.

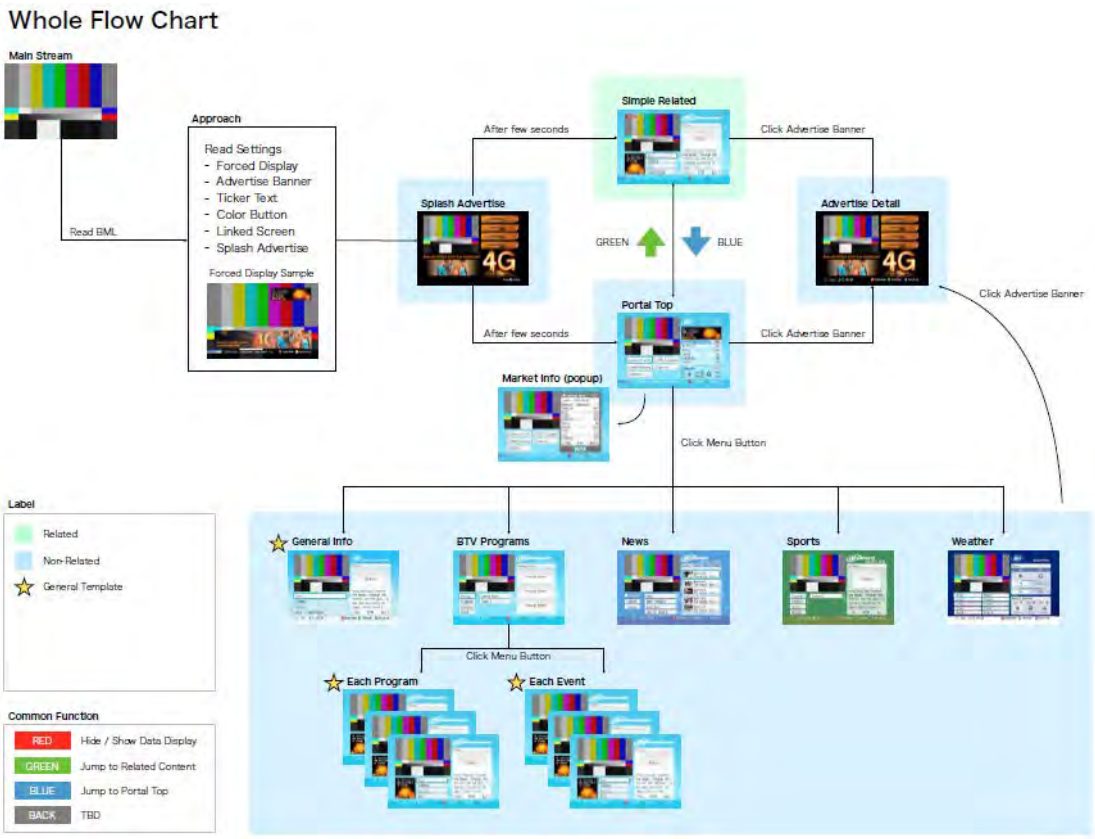


Figure 30 Sample of UI Flow Chart

Figure 31 is sample of UI detail for each page which are about BTV news articles. BTV has News section which provides all image and article text data. BTV news broadcast morning, noon, and evening program, and provide latest data to Data broadcasting unit once every day.

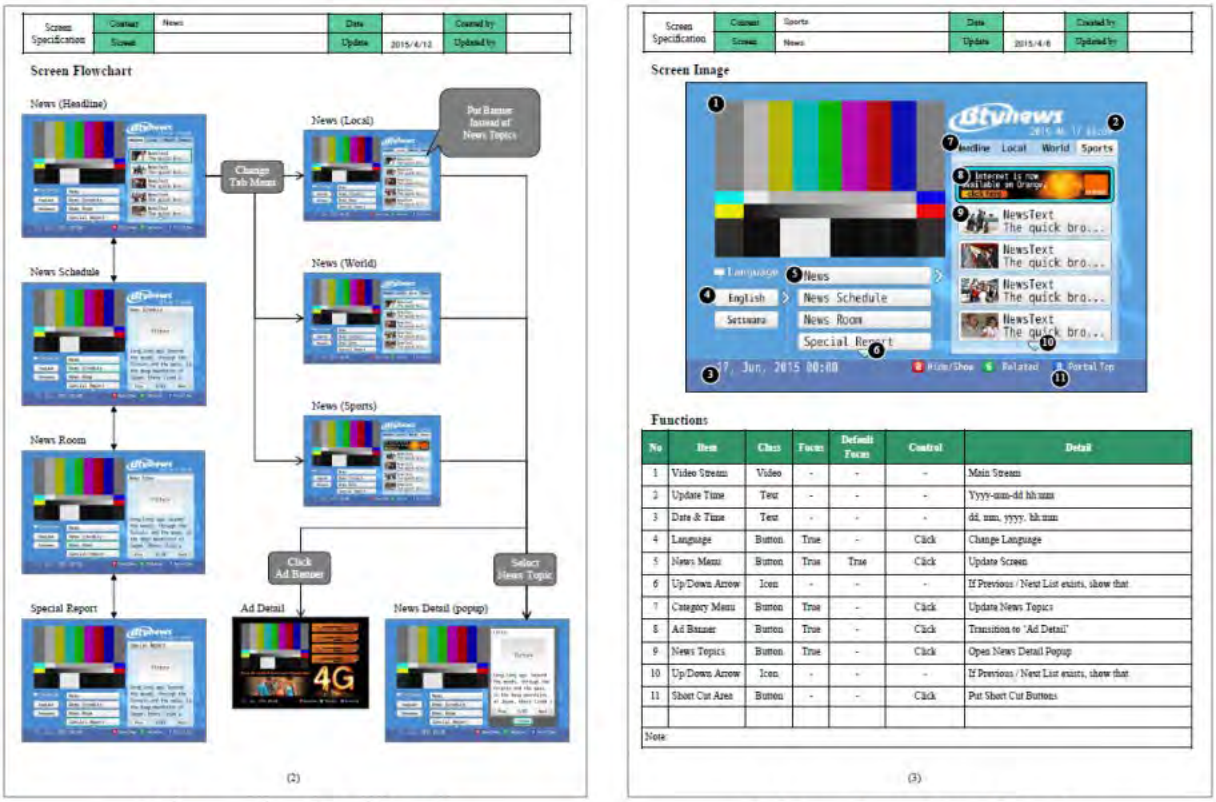


Figure 31 Sample of UI detail for each pages

In creation of this Screen spec, view point of "easy to use" is very important. Data broadcasting is new media for viewers, and exploring information service on TV is also new experience for viewers. There is no other way to give how-to-use instructions, so each screen should be easy to understand, and needs to show the ways to reach information that viewers require. The training about such User interface designing is provided during the training and this Screen spec was created through the training.

And this Screen spec needs to be accepted by Head of Data broadcasting unit. In case of BTV news pages, it also needs to be accepted by Head of News section. Channel structure is same as normal broadcasting, so no acceptance is needed from Channel section. However, Data broadcasting advertisement is inserted with news articles, so it needs to be accepted by Head of Marketing.

9.4 BML coding: Function spec

According to accepted Pitch document, Data coding engineer creates this technical designing spec for Data broadcasting functions. Figure 32 is sample of function spec for 1st BTV launch program related template.

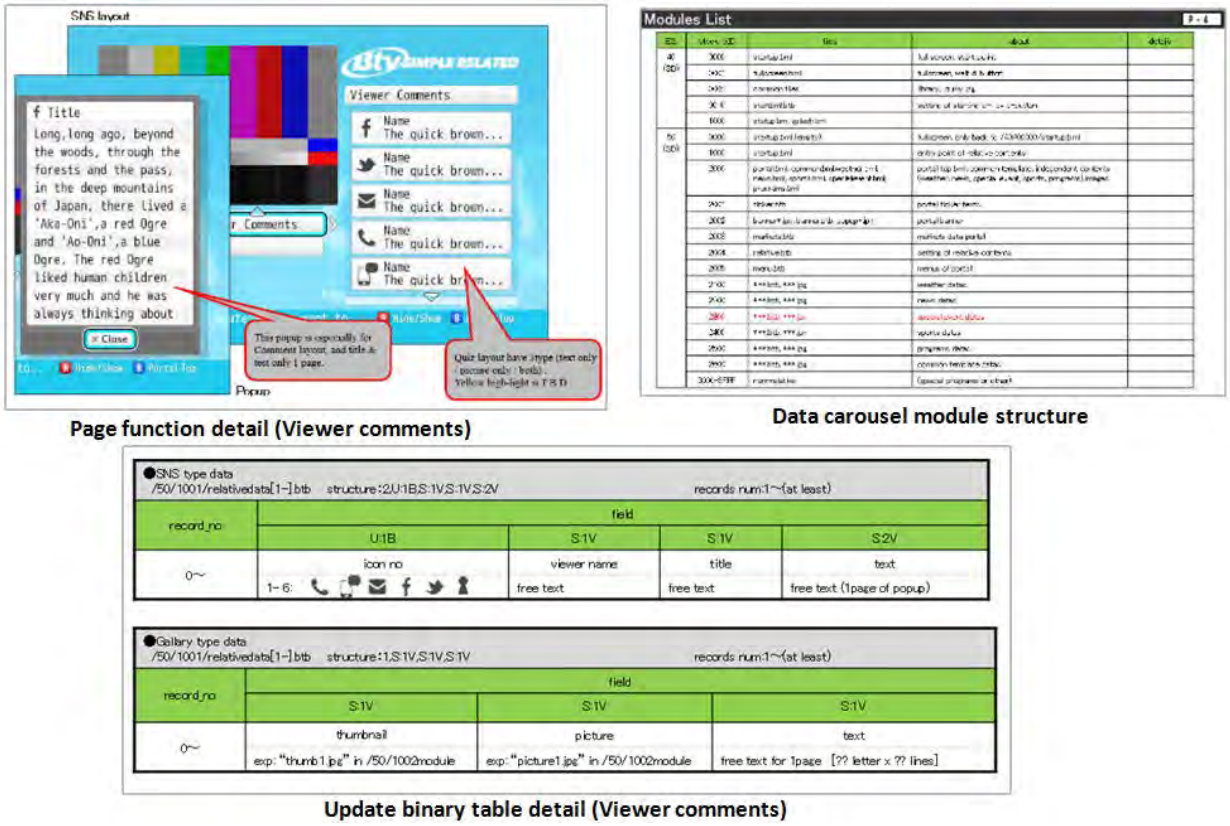


Figure 32 Sample of BML cording Function spec

This program related template is used for multiple programs: Special events, Flava Dome (Music show), Silent Shout (Talk show), Talk Back (Talk show), and Molemo Wa Kgang (Talk show). This template includes a lot of function to cover all requirements from the programs like, image + text base information fields, picture gallery sub menu, and viewer comments sub menu. Each program can use different graphical design and page structure.

"Page function detail" in Figure 32 is about function for each field. In the case of viewer comments, BTV can insert various comments from call-in phone, Twitter, Facebook, and Email.

"Data carousel module structure" in Figure 32 is about data transmitting structure for program related template. Its static structure is for all allocated programs.

"Update binary table detail" in Figure 32 indicates data source exchanging format. In the case of viewer comments, data format covers various data source from call-in phone, Twitter,

Facebook, and Email.

And this Function spec needs to be accepted by Head of Data broadcasting unit. In case of program related template, it also needs to be accepted by each Head of Program unit. The channel structure is same as normal broadcasting, so no acceptance is needed from Channel section. However, Data broadcasting advertisement is inserted, so it needs to be accepted by Head of Marketing.

9.5 CMS & Operation tools: CMS spec

According to accepted Pitch document, A CMS spec is created before developing CMS & Operation tools. Data system engineer & Data operator need to manage the technical designing spec for Datacasting system & operation. Figure 33 is sample of CMS spec for 1st launch of BTV.

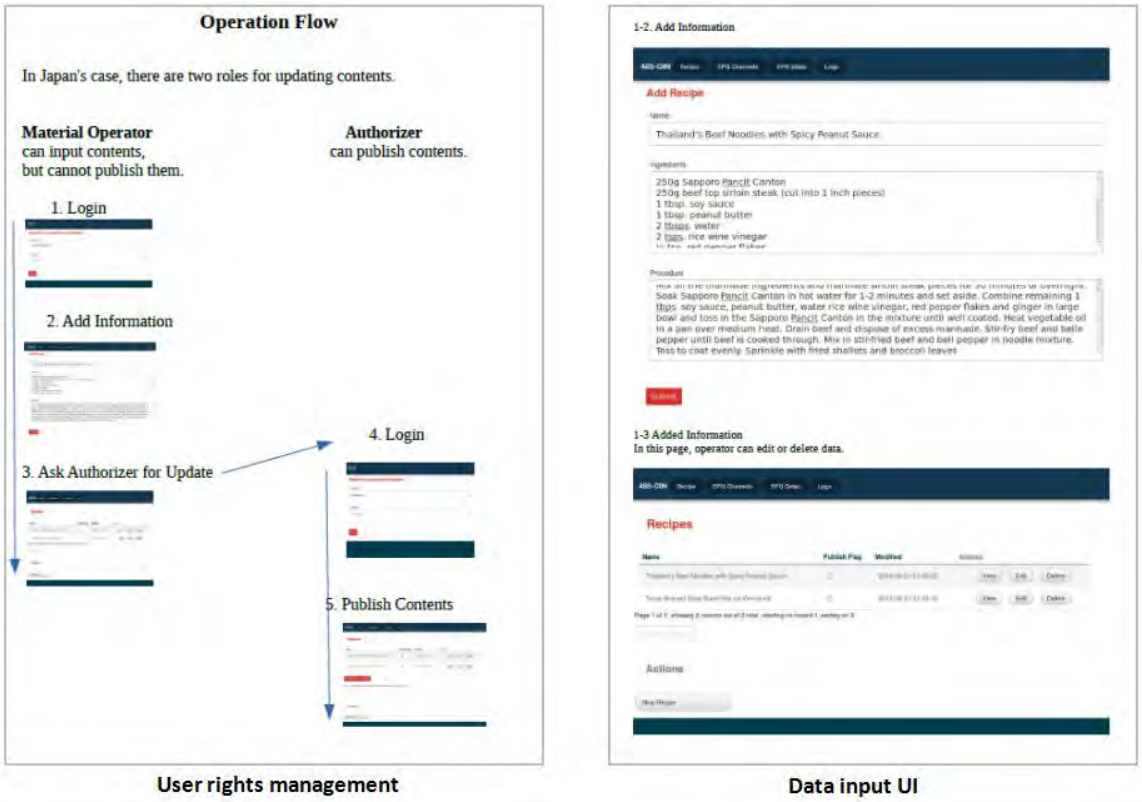


Figure 33 Sample of CMS & Operation tool spec

"User right management" in Figure 33 is about system security of login management. There are mainly 2 layers of system user, one is Operator and the other is Authorizer. Operator can input contents data with this system, but cannot publish them On-air. Authorizer checks the contents data which operator inserts, then publishes contents On-air.

"Data input UI" in Figure 33 is about operation web screen designing. In case of news article,

operator can input title, article body text, and images from this screen.

Actual CMS & Operation tools are developed according to BTV's requirements. This CMS spec is used for the confirmation of CMS & Operation tools spec. Data system engineer and Data operator need to manage this spec to cover all requirements from related section/units.

And this CMS spec needs to be accepted by Head of Datacasting unit.

9.6 Operational work flow: Work Flow

According to accepted Pitch documents, Work Flow is needed to clarify each related member's daily and eventual works. Figure 34 is sample of Work Flow for BTV news Datacasting.

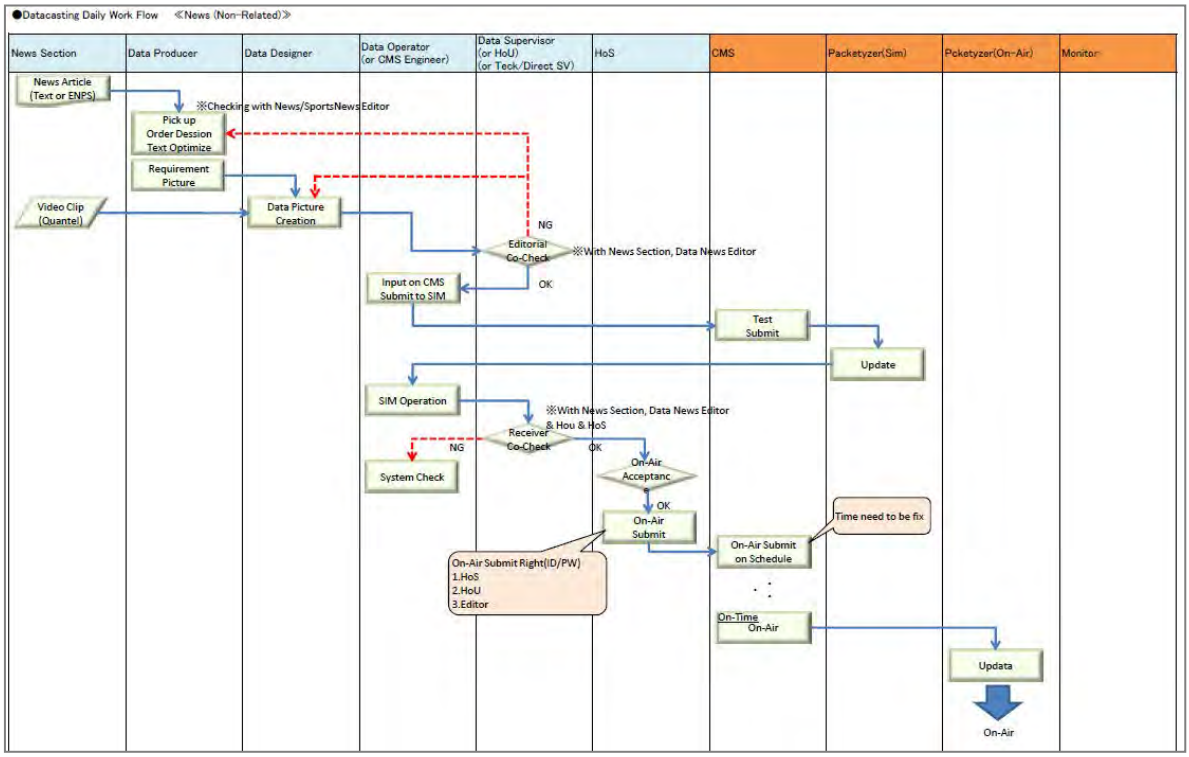


Figure 34 Sample of Work Flow

In case of BTV news pages, all information comes from News section. There are 2 kinds of data source, one is text base news article that is managed in system of ENPS, and the other is video clip that is managed in system of Quantel. Text base news articles are picked up by Data producer together with News section editors. There is limitation for number of articles in Datacasting as Data producer picks up certain number of articles every day. Data producer orders Data designer to create pictures for picked up articles which is made using screenshot using Quantel system. After editorial co-check by Data supervisor with News section supervisor, Data operator inputs the articles on CMS, and inserts all contents on Simulator. Simulator can show actual moving Data broadcasting with new articles on reference STB, which is followed

by receiver co-check conducted by Data supervisor with News section supervisor. After confirming On-air acceptance, Head of Data broadcasting unit or Data supervisor submit articles to broadcast On-air.

This kind of work flow discussion is needed for each page and service.

And this Work Flow need to be accepted by Head of Data broadcasting unit. In case of BTV news pages, it also needs to be accepted by Head of News section. As channel structure is same as normal broadcasting, no acceptance is needed from Channel section. However, Data broadcasting advertisement is inserted with news articles, so it needs to be accepted by Head of Marketing.

9.7 BTV Service-in result

After completing all the procedures, BTV started 1st launch Data broadcasting service at June 2015. Figure 35 indicates the 1st launch of BTV operation system.

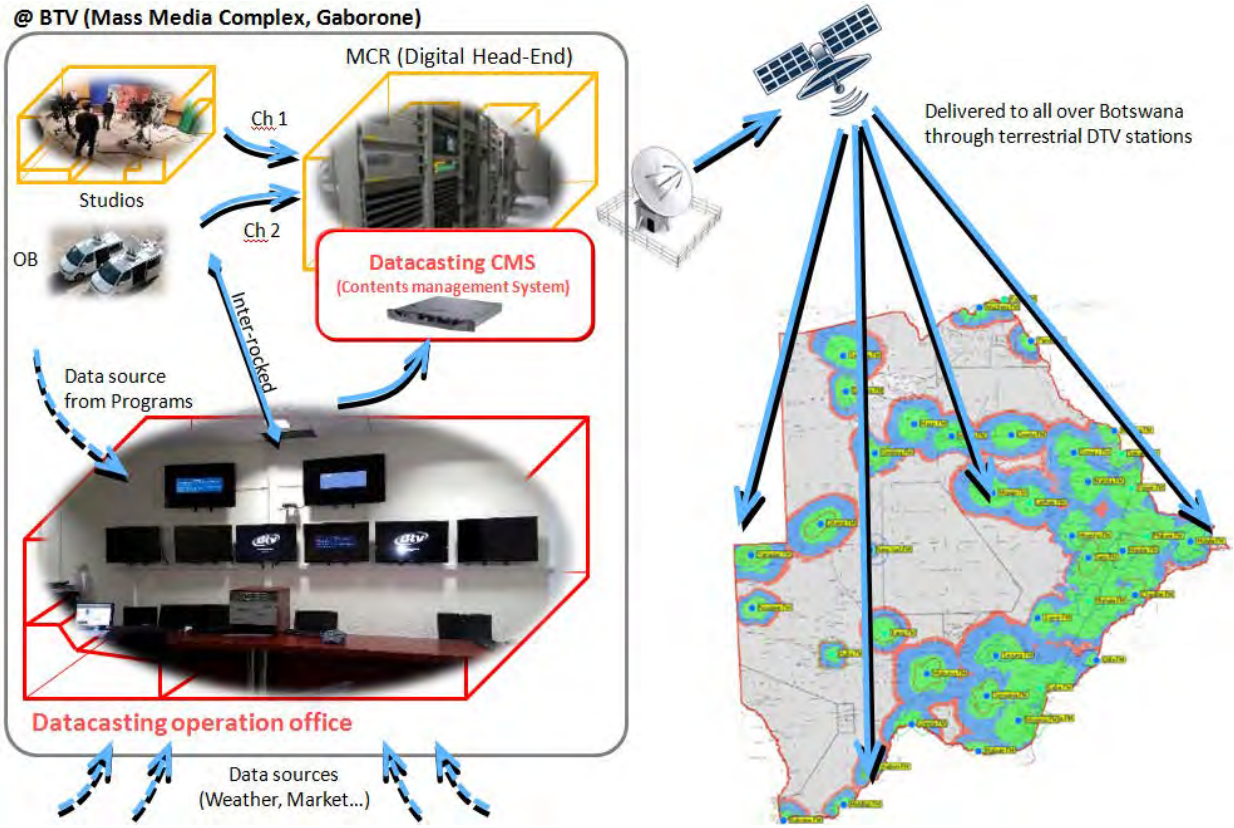


Figure 35 BTV 1st launch operation system

BTV is now broadcasting 2 channels, BTV1 and BTV2. All TV programs are managed at Gaborone and distributed all over Botswana through satellite. Datacasting is also managed at Gaborone and same Data is delivered to all. But by benefit of Datacasting technology,

Datacasting can carry local detail information together like weather; as a result viewer can access suitable local information anytime. Auto profiling display control is also available in Datacasting technology, but the automated control is not done at 1st launch, it will be in future upgrade only.

Figure 36 denotes 1st launch of BTV Datacasting services (1).

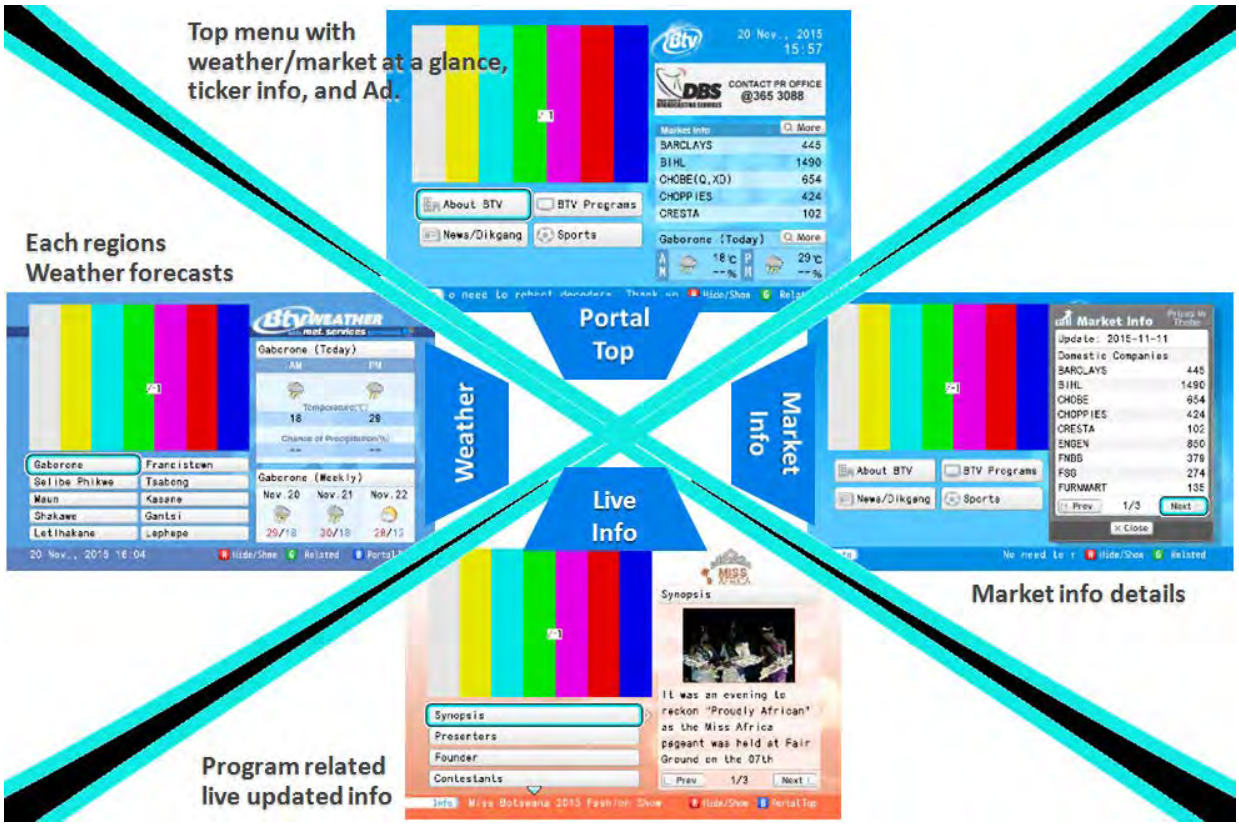


Figure 36 BTV 1st launch services (1)

Portal top is the first screen displayed, when viewer presses "Data" button on remote controller. On top page, Gaborone weather, market, ticker info, and advertisement rate are displayed at a glance. Weather forecast detail page provides each region's weather forecast information. Market info detail is also available when "More" button is pressed. By pressing "Green" button, program related information page displays. This program related page is provided for Special events: Flava Dome (Music show), Silent Shout (Talk show), Talk Back (Talk show), and Molemo Wa Kgang (Talk show).

Figure 37 indicates BTV 1st launch Datacasting services (2).

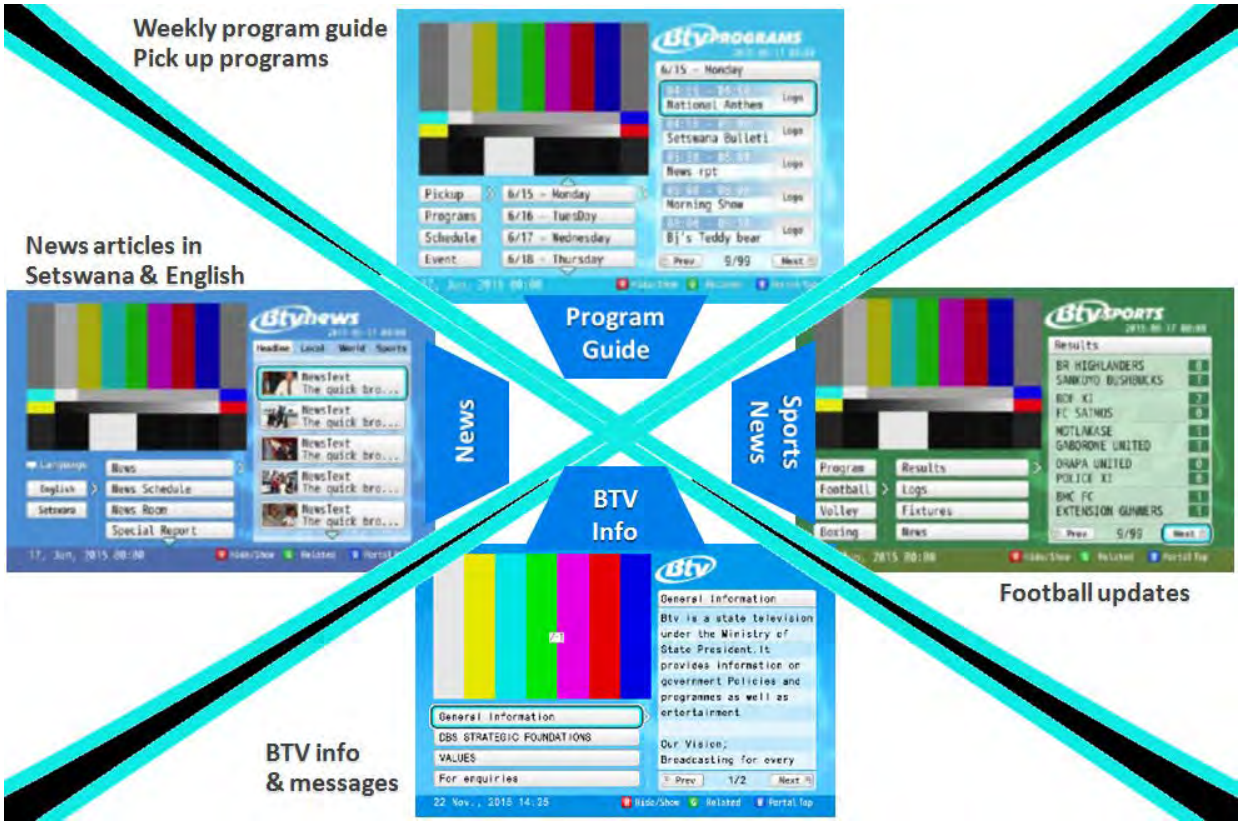


Figure 37 BTV 1st launch services (2)

Program guide page provides weekly program time table, and some pick up program information. News page provides latest news articles in both Setswana & English languages. Sports news page provide football game results, logs, fixtures, and sports news articles. BTV info page provides message from BTV.

These pages are daily or eventually updated by BTV themselves. This Data broadcasting service is carried out with strong cooperation between related BTV sections and units. This is the stable operated service which BTV started as one of the biggest benefit of TV Digital Migration.

References

For information on standards for digital broadcasting, BML and ECMA

●Standards issued by Association of Radio Industries and Business (ARIB)

ARIB STD-B21 Receiver for Digital Broadcasting (Desirable Specifications)
http://www.arib.or.jp/english/html/overview/doc/6-STD-B21v4_6-E1.pdf

ARIB STD-B23 Application Execution Engine Platform for Digital Broadcasting
http://www.arib.or.jp/english/html/overview/doc/6-STD-B23v1_1-E1.pdf

ARIB STD-B24 Data Coding and Transmission Specification for Digital Broadcasting (Fascicle 1)
http://www.arib.or.jp/english/html/overview/doc/6-STD-B24v5_2-1p3-E1.pdf

Data Coding and Transmission Specification for Digital Broadcasting (Fascicle 2-(1/2))
http://www.arib.or.jp/english/html/overview/doc/6-STD-B24v5_2-2p3-1-E1.pdf

Data Coding and Transmission Specification for Digital Broadcasting (Fascicle 2-(2/2))
http://www.arib.or.jp/english/html/overview/doc/6-STD-B24v5_2-2p3-2-E1.pdf

Data Coding and Transmission Specification for Digital Broadcasting (Fascicle 3)
http://www.arib.or.jp/english/html/overview/doc/6-STD-B24v5_2-3p3-E1.pdf

ARIB STD-B25 Conditional Access System Specifications for Digital Broadcasting
http://www.arib.or.jp/english/html/overview/doc/6-STD-B25v5_0-E1.pdf

ARIB STD-B31 Transmission System for Digital Terrestrial Television Broadcasting
http://www.arib.or.jp/english/html/overview/doc/6-STD-B31v1_6-E2.pdf

ARIB STD-B32 Video Coding, Audio Coding and Multiplexing Specifications for Digital Broadcasting
http://www.arib.or.jp/english/html/overview/doc/6-STD-B32v2_1-E1.pdf

ARIB TR-B14 Operational Guidelines for Digital Terrestrial Television Broadcasting (Fascicle 1-(1/2))
http://www.arib.or.jp/english/html/overview/doc/8-TR-B14v3_8-1p3-1-E1.pdf

Operational Guidelines for Digital Terrestrial Television Broadcasting (Fascicle 1-(2/2))

http://www.arib.or.jp/english/html/overview/doc/8-TR-B14v3_8-1p3-2-E1.pdf
Operational Guidelines for Digital Terrestrial Television Broadcasting (Fascicle 2)
http://www.arib.or.jp/english/html/overview/doc/8-TR-B14v3_8-2p3-E1.pdf

Operational Guidelines for Digital Terrestrial Television Broadcasting (Fascicle 3)
http://www.arib.or.jp/english/html/overview/doc/8-TR-B14v3_8-3p3-E1.pdf

ARIB TR-B15 Operational Guidelines for Digital Satellite Broadcasting (Fascicle 1)
http://www.arib.or.jp/english/html/overview/doc/8-TR-B15v4_6-1p4-E1.pdf

Operational Guidelines for Digital Satellite Broadcasting (Fascicle 2)
http://www.arib.or.jp/english/html/overview/doc/8-TR-B15v4_6-2p4-E1.pdf

Operational Guidelines for Digital Satellite Broadcasting (Fascicle 3)
http://www.arib.or.jp/english/html/overview/doc/8-TR-B15v4_6-3p4-E1.pdf

Operational Guidelines for Digital Satellite Broadcasting (Fascicle 4)
http://www.arib.or.jp/english/html/overview/doc/8-TR-B15v4_6-4p4-E1.pdf

● The word ”digital broadcasting” is used for standards for satellite/digital satellite/terrestrial broadcasting.

- For information on satellite/digital satellite broadcasting, refer to both TR-B15 and STD-B24.
- For information on terrestrial digital broadcasting, refer to both TR-B14 and STD-B24.

Supported by Japan International Cooperation Agency (JICA)

Project for Implantation of the Digital Migration Project (DiMT)

Separate Volume -3
Market survey report for digital migration

Market Survey Report
for
Digital Migration

September 2015

Department of Broadcasting Services

Ministry of State President

Table of Contents

LIST OF FIGURES & TABLES

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ABBREVIATIONS

ASO – Analogue Switch Off
BOCRA – Botswana Communications Regulatory Authority
BOPA – Botswana Press Agency
BTV – Botswana Television
DBS – Department of Broadcasting Services
DiMT – Digital Migration in Television
DIS – Department of Information Services
DSTV – Digital Satellite Broadcasting Television
DTT – Digital Terrestrial Television
DTTB – Digital Terrestrial Television Broadcasting
DVB-T2 – Digital Video Broadcasting - Terrestrial 2
ENPS – Electronic News Production System
EWBS – Emergency Warning Broadcasting System
GBC TV – Gaborone Broadcasting Corporation Television
HDTV – High Definition Television
ISDB-T – Integrated Service Digital Broadcasting-Terrestrial
ITU – International Telecommunication Union
MPEG-2 – Motion Picture Experts Group 2
NGOs – Non-Governmental Organisations
OFDM – Orthogonal Frequency Division Multiplexing
PR – Public Relations
SADC – Southern African Development Community
SDTV – Standard Definition Television
SMS – Short Message Service
SNS – Social Networking Service
WG – Working Group
WTISD – World Telecommunication and Information Society Day

Chapter 1 Introduction

1.1 Background

Digital Migration Standard

The government of Botswana launched the Digital Migration Task Force on 28 April 2009 in Gaborone. The Digital Migration Task Force has the mandate to chart the process of DiMT and advise the Minister on standards and other issues that need attention during the digital terrestrial television migration from analogue to digital transmission.

Digital broadcasting makes more efficient use of the radio frequency spectrum than does analogue broadcasting. It will also allow broadcasters to offer television with better picture and sound quality, and with interactive capabilities.
The International Telecommunication Union (ITU) has set the year 2015 as the deadline for the whole world to have migrated their terrestrial television broadcast signal from analogue to digital.

In 2010 the Southern African Development Community (SADC) started discussions on digital terrestrial broadcasting standards. During the planning of the GE 06 a digital video broadcasting terrestrial standard was adopted by SADC. However, subsequent to this other digital broadcasting standards, such as Integrated Service Digital Broadcasting-Terrestrial (ISDB-T) and Digital Video Broadcasting - Terrestrial 2 (DVB-T2), became available and hence there was a move to consider these standards. SADC ICT Ministers established an Ad Hoc Committee, a team comprising representatives from the SADC secretariat and nine SADC Member States, to investigate the issue of digital television standards.

Botswana Adopted ISDB-T

Government has decided to adopt ISDB-T as its Digital Terrestrial Television (DTT) standard, as part of the digital migration process. The adoption of the ISDB-T standard was the result of a thorough process of research and evaluation of the available options. This was done in order to determine the most appropriate DTT standard for the country so as to meet the country's switchover target of the 17th of June 2015.

The ISDB-T standard was evaluated favourably in the context of its adaptability as a platform for socio-economic development, as well as for entertainment. In this respect, it is anticipated that DTT will become an additional driver in Botswana's efforts to transform the country into an e-Society

The government of Botswana was of the view that the expansion of television services through digital migration would inevitably open up new and exciting economic opportunities for Batswana.

Digital Migration in Television (DiMT) Project

After the government of Botswana made the decision to adopt the ISDB-T standard as the broadcasting technology with which to deliver digital terrestrial television services and set the target for digital migration in accordance with GE06, Botswana established a Project Management Office, which is addressing digital migration with the support by the Ministry of Internal Affairs and Communications of Japan. Botswana also plans to procure studio equipment and transmitters and is preparing the relevant laws and regulations.

However, Botswana did not have the knowledge, technology or equipment that is needed to undertake the full-scale introduction of a digital broadcasting service, and requested the implementation of a technical cooperation project by the government of Japan. Subsequently, the record of discussions (R/D) was signed in May 2014 and the Digital Migration in Television (DiMT) Project was begun. The objectives of the project are shown below.

Table 1.1: Objectives of the Project

Overall Goal	Terrestrial digital broadcasting that takes advantage of the features of Integrated Services Digital Broadcasting –Terrestrial (ISDB-T) is effectively available.
Project Purpose	Environment for terrestrial digital broadcasting that takes advantage of the features of ISDB-T is ready.
Output 1	Various plans and systems necessary for migration to digital broadcasting are developed.
Output 2	DBS's capacity of producing programmes including High Definition (HD) and Data Broadcasting is improved.

Several working groups (WG) including the Programming WG were established in the DiMT project to achieve the objectives. The members of the WG include not only Japanese experts but also related organizations such as Ministries, the Botswana Communications Regulatory Authority (BOCRA), DBS and BTV. The objectives and scope of responsibility of each WG are shown in Table 1-2.

The purpose of the Programming WG is to develop a programing plan for digital television broadcasting. In order to achieve this purpose, several market surveys were conducted from March to May 2015 to gain an understanding of the preferences and needs of the viewers through demonstrations of One-seg and data broadcasting and the advantages of ISDB-T functions. The results of the market surveys were analysed and used to draw up the new programming plan for digital broadcasting.

Table 1.2: Objectives and Scope of Responsibility of WGs

WG	Objective	Scope of Responsibility
Technology and Licencing	Prepare ISDB-T technical standards appropriate to Botswana and promote the smooth digital migration from the technical point of view.	• Technical standards and licencing criteria for digital broadcasting • Provision of advice and exchange of ideas on other activities
Public Relation	Expedite the smooth digital migration and promote digital broadcasting	• Roadmap to ASO and Public Information Plan
Programme Production	Improve capacity to produce programmes and develop human resources for the digital migration	• Development of HD programme production capacity • Provision of advice and exchange of ideas on other activities
Programing	Understand the demand for television programmes that make use of the advantages of ISDB-T, and examine broadcasting business strategy	• Digital broadcasting Programming plan. • Provision of advice and exchange of ideas on other activities • Quality control
Data Broadcasting	Learn operation technology for stable data broadcasting and the ability to produce advanced data broadcasting programmes	• Matters relating to the establishment of the Data Broadcasting Section, the data broadcasting programme production training system, and the planning and production of data broadcasting programmes

1.2 Overview of Television in Botswana

Batswana have enjoyed mainly radio broadcasting since independence in 1966, and local television is fairly new in the country. There are many reasons why the government of Botswana did not introduce television much earlier despite the acknowledgement that broadcasting was inadequate. The main reason is that the national development policy focused on those projects which would benefit the greater number of people. Electrification was still the major national challenge until the 1990s, and was likely to constrain the use of television sets; it was clear that television would be enjoyed only by the few affluent members of communities who had access to TV, receivers and electricity.

Botswana's first national television service, Botswana Television (BTV), started broadcasting in 2000 following a 1997 government decision to embark on a Television Project. Before Botswana set up its own national television station, Botswana was limited to viewing channels mainly from South African state-owned free-to-air television services. In addition to BTV, there is a private commercial free-to-air terrestrial television station called eBotswana. eBotswana, which used to be known as Gaborone Broadcasting Corporation TV, began as a local Gaborone station in the late 1980s and later included South African television broadcasts in its programming. While eBotswana has a licence to operate nationally, eBotswana is currently available only in Gaborone and surrounding areas.

Satellite television services are also available in Botswana. DSTV, which is operated by Multichoice and provides subscribers with digital satellite television services in Africa, is the most popular satellite television station in Botswana. DSTV offers many foreign programmes including movies, sports, news, documentaries, children's programmes, entertainment, etc.

Although DSTV is subscription television, free-to-air decoders are widely used throughout Botswana. People used to be able to view popular channels such as SABC 1, 2, and 3. According to the "Audience Survey for the Broadcasting Sector in Botswana", which was conducted by Probe Market Intelligence and published by BOCRA in 2013, BTV was the most popular station in 2013, followed by SABC1.

1.3 Overview of BTV

Botswana Television (BTV) was established in July 2000 as a publicly-funded national television service for the people of Botswana, under the then Department of Information and Broadcasting. The Department of Information and Broadcasting was split into two separate departments in 2003, namely Information Services (DIS) and Broadcasting Services (DBS).

BTV is a national broadcasting service. It is required to provide a wide-ranging service comprising information and entertainment, which offers something of value to everyone in Botswana. Audiences must be able to trust what BTV tells them about events and issues in Botswana and around the world. Its news and factual programming must be truthful, timely, fair and honest. The Government of Botswana expects BTV's programme makers to decide the nature, content and scheduling of all programmes, free from outside interference and from undue pressure by other government departments or by politicians.

The Department is determined to set the highest standards in public service broadcasting, providing the people of Botswana with authoritative and accurate news, current affairs and information on government programmes, a wide range of programmes celebrating and reflecting the cultures of Botswana, and a popular entertainment service.

The Government of Botswana is a signatory to the African Charter of Fundamental Freedoms, which guarantees freedom of the media. Botswana strongly believes in democratic values, including freedom of expression and freedom of information. Mindful of accepted international standards ensuring freedom of speech (including the United Nations Universal Declaration of Human Rights) the Government of Botswana has decided that, in the public interest, BTV shall have editorial independence in the selection of its programme material, within an agreed framework of editorial standards.

BTV has editorial standards that aim to address the fundamental issues of editorial freedom and social responsibility faced by public broadcasters throughout the world. BTV staff and contributors are mostly inexperienced at running a major broadcasting organisation, and it will be important for them to review and revise their approach to programming in the light of experience and taking audience reaction into account.

As BTV matures into an established broadcasting system, its guidelines will be reviewed from time to time in the light of experience, and any changes to the guidelines will be subject to a period of public consultation in which the people of Botswana will be invited to give their views on the standards which they expect their national television service to uphold.

1.4 Features of Terrestrial Digital Broadcasting by ISDB-T

ISDB-T is the most advanced international standard for Digital Terrestrial Television Broadcasting (DTTB), originally developed in Japan. ISDB-T was introduced in Japan in December 2003, and the number of countries who adopt ISDB-T is gradually increasing with the recognition of its technological advantages. The main features of digital terrestrial broadcasting using ISDB-T include:

1. High Resolution and High Quality
   ISDB-T offers a high resolution and high quality picture through the adoption of MPEG-4 video coding technology, which supports many kinds of video quality and format for both HDTV and SDTV.

2. Multi-channels (Multi-broadcasting)
   ISDB-T uses flexible multiplex technology and a flexible and highly efficient video and audio coding system. As a result, many types of broadcasting service, such as HDTV, HDTV+SDTV and Multi-channel SDTV are supported by ISDB-T.

3. Robustness / Reception Flexibility
   ISDB-T uses the “Time Interleave” technology for its transmission system. This technology enables robustness against multi-path, urban noise, fading and other types of interference.

4. Data Broadcasting
   ISDB-T provides data broadcasting which offers many kinds of information such as news, weather, market information and education which may relate to the programmes broadcast. Viewers can access news and other information anytime they wish.

5. One-seg Service
   ISDB-T uses a new transmission technology, named the "Segmented OFDM transmission system". This technology enables One-seg service by using 1 segment in the bandwidth. A One-seg receiver is easily mounted into mobile devices including mobile phones and makes possible an "any time, any place" broadcast service.

6. Emergency Warning Broadcasting System (EWBS)
   ISDB-T has the function known as EWBS for disaster prevention. This function enables receivers to turn on automatically through the transmission of an emergency signal inserted into the broadcast signal.

1.5 Data Broadcasting Services

Data broadcasting is one of the main features of the ISDB-T system described above. Data broadcasting services can be roughly divided into two categories. One is services that offer viewers useful information not related to a television programme (Non-linked data broadcasting), and the other is services that provide information that is related to a television programme (linked data broadcasting). Specific examples are as follows:

Non-linked Data Broadcasting (Non-Programme Related)

Data broadcasting today offers “portal” services that provide various types of information independent of television programmes. Typical examples include:

- News (local news and international news)
- Weather (national weather, local weather, weather by the hour, rainfall, precipitation probability percentages, etc.)
- Warnings/advisories (Heavy rain warning/Flood warning, etc.)
- Sports news
- Traffic reports
- Television programme information
- Advertisements, banners etc.

Figure 1.1 shows an image of a portal screen.

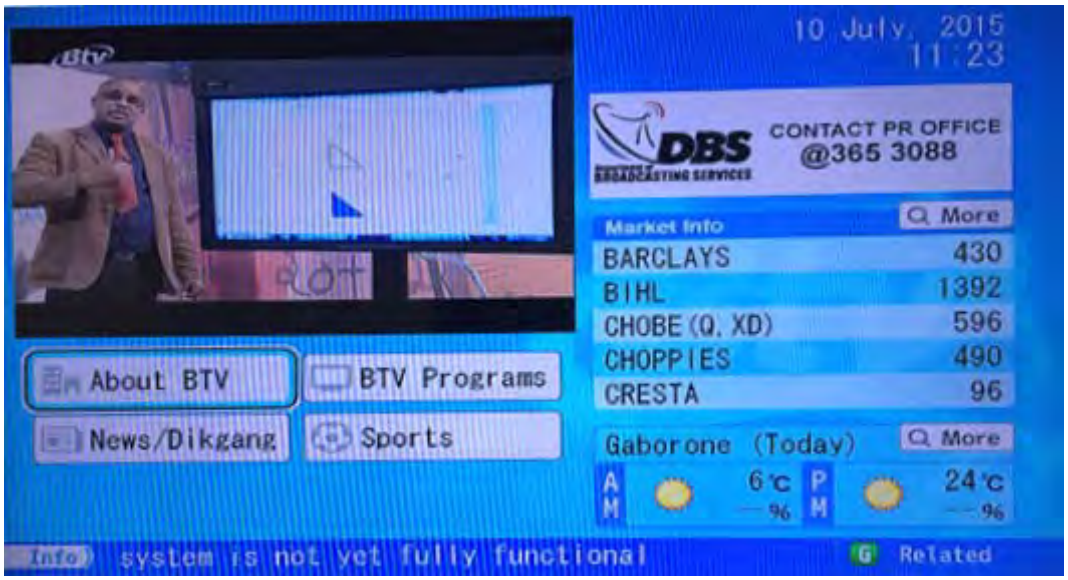


Figure 1.1: Sample Image of BTV Portal

As Figure 1 shows, the data broadcasting screen is displayed around the main television programme screen to provide various types of useful information. The right-hand side of a portal typically contains weather and market information and the television programme banner. Users can access other content by pressing buttons on the left side of the screen using a remote controller.

Linked Data Broadcasting (Programme Related)

Data broadcasting also offers services that are synchronized with television programmes, notably sports programmes, variety shows, dramas and anime programmes. For example, in a sports programme, it is possible to check the progress of the game and to see information about the athletes or players.

Figure 1.2: Sample Image of Linked Data Broadcasting

Figure 1.2 shows an example of a special programme for President's Day. Viewers can check many kinds of information related to the programme.

1.6 Objective of the Survey

The objective of this survey is to come up with a programming plan for digital television that includes programme-linked and non-linked data broadcasting content through the consideration of the information gathered and analysed in the survey. In order to develop a programming plan which adequately reflects viewers' opinions, the survey should investigate such topics as popular genres and programmes, viewer satisfaction, viewing habits and the need for new content.

Interaction with the public was necessary in order to establish their needs and preferences with regard to television as well as to educate them concerning digital broadcasting and how it will affect television programming. A comparison with previous audience surveys is also important in examining the results of the survey.

The market survey is a task undertaken by the Programming WG whose mission is to develop a programming plan for digital broadcasting, including data broadcasting, based on the needs indicated by the market survey. The Public Relations (PR) WG also participated in the survey in order to educate people through demonstrations of the actual datacasting system.

To achieve the objective, first of all a market survey was conducted to educate the viewers on what digital broadcasting is and how it can be used to improve the current television

programming schedule. The first survey involved demonstrations of the actual datacasting system for the viewers to see for themselves the benefits of digital broadcasting as well as to have the chance to use the system as participants.

The demonstrations were tailored in such a way that afterwards the viewers were given the chance to fill out questionnaires in which they gave their opinions on the new system they had just experienced as well as on the current programming schedule. The content of the questionnaire is shown in Appendices 1 to 3. The questionnaires were used to gather information on the current programming schedule, so that when digital broadcasting is implemented the opinions and preferences of the viewers can be taken into consideration.

Chapter 2 Methodology

2.1 Introduction

With the nationwide changeover from analogue to digital broadcasting, research is necessary into how the migration will affect the television industry, as well as into what it will mean to television viewers.

Data broadcasting is one of the core elements of digital broadcasting using the ISDB-T standard. Therefore the introduction of this service to the public via market research was a chance both to give the public more information and to gather their opinions on the coming changes.

Data broadcasting involves transmitting information over a wide area using radio waves; it also involves providing the viewers with supplementary information sent out by the television station along with the digital television signal. A market survey was carried out with the purpose of educating viewers as to what data broadcasting is and how it will affect television. This is because the current television programming schedule has to be linked to data broadcasting, so that viewers need to understand what it is and to be able to give their opinions on it. This chapter describes the market survey and how it was carried out.

2.2 Research Methods and Design

The market survey was designed not only to obtain the opinions of viewers regarding the programming schedule, but also to educate them and demonstrate what data broadcasting and digital migration are.

While viewers have been aware of the implementation of digital migration, this survey was also an attempt to teach citizens more about how this transition will affect television and what it will mean to them as television viewers.

All the benefits of data broadcasting were explained and demonstrated, including how it would work on their television sets and what they would need to be able to enjoy all the benefits of data broadcasting. The Emergency Warning Broadcasting System (EWBS) was also part of the demonstration, so that viewers had the opportunity to witness the full extent of what data broadcasting can do for them. Participation in the demonstrations provided viewers with the opportunity to use the system for themselves and really get to experience it.

The method chosen for the survey was a questionnaire, as responses were expected from large numbers of people. A questionnaire was considered the most effective way of collecting information from people in a short space of time. The use of a questionnaire

would give viewers the chance to express their opinions fully and describe any improvements they would like to see with regard to their television watching habits and the current programming schedule. Therefore a questionnaire was designed that was tailored to obtain feedback from viewers regarding the current programming and their experience of data broadcasting.

The survey was carried out as follows;

1. Development of a questionnaire to discover the needs of the viewers.

The focus was on the advantages and benefits of ISDB-T functions such as One-seg (mobile application) and data broadcasting, to discover the needs relating to these new services. The questionnaire was also designed to determine the opinions of the viewers with regard to the current programming schedule, and also to obtain their opinions on changes they would like to see in the digital programming schedule.

The questionnaire was tailor-made to appeal to the different types of people expected to attend the demonstrations, and to serve the needs of all. To further cater for the needs of the people and make the survey more user-friendly, the questionnaire was created in the native language, Setswana, as well as in English. This was to ensure that everybody understood, as participants were able to choose their preferred language.

2. Staging of events where the questionnaires could be collected and digital terrestrial broadcasting demonstrated to the public.

Events were staged in shopping malls where the test signal could be received. In demographic terms, two locations were chosen. The aim of the events was to educate the public about ISDB-T functions (data broadcasting and One-seg) and also to obtain their views on the system. The public was also given the chance to interact with the system and experience it first-hand.

Authorisation was obtained from the management of the shopping malls hosting these demonstrations. The Programming and PR WGs obtained permission to bring and set up our equipment in the malls for the demonstrations.

3. Implementation of a market survey to understand the needs of the viewers.

In addition to the questionnaire, demonstration equipment and booths were prepared to attract the attention of the public. The system was explained and demonstrated to the public interactively, and the questionnaire was also distributed. Members of the public were given the chance to interact directly with the system, after which they were allowed to give their opinions on it by answering the questionnaire. This included feedback on the current programming schedule as well as the improvements and/or the preferences the viewers

would like to see.

4. Analysis of the results of the market survey

After the questionnaires were collected in they were analysed and discussed by the programming WG team members to study the feedback and to determine whether the goal of the survey had been met, after which the results were tabulated. These results will help create a new programming plan for the broadcasters which will be linked to data broadcasting. This programming plan will be developed with the feedback given by the public taken into consideration, though this is not to imply that everything will satisfy the wishes of all. The opinions received will help the broadcasters determine to what capacity the needs and preferences of the public can be met, or what can be changed in order to do so.

5. Reflection of the results of the market survey in the new programming plan.

The programming plan for digital broadcasting will be created based on the results of the market survey.

2.3 Target Area

This survey was targeted at all participants, the aim of the survey being to obtain feedback in a number of locations from both males and females, of all ages and occupations, and with differing interests. The survey was planned to avoid obtaining only one type of feedback and hence receiving redundant information. The important thing was that the surveys should be held in different places at different times. Shopping malls are considered best suited for the effective collection of information using such a survey.

In order to collect data from not only cities such as Gaborone but also from rural areas so as to understand the general trend of TV-watching habits in Botswana, the target areas were decided on in collaboration with the Public Relations (PR) WG Team. The capital city Gaborone and second largest city Francistown were selected as representative urban target areas. Gantsi in Ghanzi district was selected as a representative rural target area because a big event celebrating World Telecommunication and Information Society Day (WTISD) was planned there, making it easier to collect data from a large number of people.

Table 2.1 shows the details of the seminars and demonstrations staged for the survey.

Table 2.1: Place and Date of Seminar/Demonstration

No	Date	Place Name	Name of Town	Type*	Remarks
1	13.03.2015 14.03.2015	Airport Junction Mall	Gaborone	D	
2	20.03.2015 21.03.2015	Main Mall	Gaborone	D	
3	16.04.2015	Gaborone International Conference Centre in the Grand Palm Hotel	Gaborone	S,D	Digital Migration Seminar
4	07.05.2015	Conference Hall in Cresta Marang Gardens	Francistown	S,D	Digital Migration Seminar
5	16.05.2015	Show Ground	Ghanzi	D	World Telecommunication and Information Society Day (WTISD) commemoration

** S: Seminar, D: Demonstration*

After the questionnaires had been collected, an assessment was carried out. Even though the survey did not cover very many areas, questionnaires were collected from a wide range of people, i.e. children, students, government employees, private company employees, business owners, Gaborone residents, people living outside the city etc. While the samples are not plentiful, they are enough to obtain a rough idea of trends in Botswana.

2.4 Sampling Strategy

The sampling strategy was planned taking statistics into consideration. The ideal strategy is one in which different people from a variety of different backgrounds are represented, and this needs to be kept in mind when carrying out the questionnaires to avoid obtaining the same kind of information and ending up with no useful data.

The ideal sampling strategy would cover urban areas as well as rural areas; the technologically able as well as those not so technologically able; the young and the old; working and non-working, etc. This strategy will be helpful in obtaining a wide range of feedback, because not all viewers have the same television experiences or preferences, and this strategy allows their different needs to be catered for. Understanding television watching habits will help us determine how the system can be better adapted to suit its viewers.

Random sampling was used for the survey and questionnaire because a lot of people were attending the demonstrations; the environment was not controlled, as the demonstrations

were being staged in shopping malls where sampling could not be done in a systematic manner; random sampling was easy to administrate. The use of random sampling also ensures that feedback is not biased towards any particular group of people; it is highly representative of everyone at the demonstration because everyone has the chance to fill out the questionnaire.

In this case the survey was able to reach students and the working class, both the young and the old. This was helpful because it included children, the young and adults. These three different age groups have different television watching habits and preferences, and it was helpful to obtain the views of each group because they watch different shows at different times.

The locations covered in this survey were useful because even though they do not represent the entire population, they reflect the average views of all those targeted by this survey. It was possible to interact with employed people, unemployed people, young people, adults, technologically able people and business owners in different fields.

This survey was a chance to learn about current opinions on the current programming schedule, preferred content and preferred times for watching programmes, as well as the manner in which people watch television. With regard to digital migration and data broadcasting, this survey gave people the opportunity to learn more about the system, learning about its benefits and how it works. This was important because it was an opportunity for us to see their reactions to the system as they learnt about it and as they were given the chance to use it and experience it for themselves. Viewer reactions are an important part of the survey because they are the foundation on which conclusions on the expected feedback are based. This also provided the chance to see how the system itself can be improved to better suit viewers' needs.

2.5 Limitations of the Survey

In this first Market Survey Report, all data collected during the survey were used for analysis. This is because there was not enough time or resources to carry out a survey based on the sampling strategy described in chapter 2.3. Though data was gathered only in three places, Gaborone, Francistown and Ghanzi, with a total of 534 questionnaires, and may not represent the true voice of Botswana, it is enough to get a rough idea of Botswana's television watching habits and needs.

Of course, an additional survey is already planned to collect more data from all parts of Botswana, in accordance with the sampling strategy. The newly-collected data should be added to the existing data and analysed, after which this report will be updated.

This report is just the first step towards understanding viewer needs in Botswana, and will be updated periodically to reflect the people's voices as more market surveys are carried out.

One of the limitations to reaching a wider target market was that the work of this survey was the responsibility of the Programming WG, which on its own did not have any events/demonstrations lined up. Therefore it had to depend on the PR WG to hold such events so that the market survey could be carried out. Without the PR WG and the Data Broadcasting WG, this market survey would not have been possible. It was a joint venture between the three WG's, so that delay by one group affected the other groups. The PR group was there to organise the mall events and advertising to the public to encourage attendance. The Data Broadcasting group was responsible for the actual demonstration of the datacasting system and its benefits. Finally, the Programming WG was responsible for carrying out the market survey and obtaining feedback from the public about what they had learned.

There were many delays in preparing for the market survey, including the acquisition of authorisation to release the advertisements, authorisation of the logo to be used for the survey, etc. These delays meant that there was very little time to prepare for the survey so that a lot was not possible, such as covering more areas than those that were covered. Obtaining the proper equipment for the project (shelters, advertising material such as banners, etc.) was also an issue, as was just working out the logistics of how to carry out the survey. This contributed to major delays in carrying out the survey and failure to obtain the optimum results originally expected.

However in the little time available, in order to get as much feedback as possible, in Gaborone three areas were covered, namely Airport Junction, Main Mall and Gaborone International Convention Centre. In these areas 410 questionnaires were collected. Outside Gaborone seminars in Francistown and in Ghanzi were covered and a total of 124 questionnaires were collected.

The greatest challenge in covering so few locations is that although the results received are supposed to reflect accurate statistics of viewers across the entire country, not covering a greater part of the country may not reflect the country at large, and therefore the information obtained may not be truly representative of the majority. This means the results obtained from the questionnaires represent only these locations, not the entire country.

Chapter 3 Profile of Respondents

3.1 Age and Gender Profile

AGE

As mentioned in the chapter describing methodology, respondents were divided into five age groups, i.e. “under 16”,“18-29”, “30-39”, “40-49”, “50-59” and “over 60”. Figure 3.1 shows the percentage of the respondents in each of the five categories. Figure 3.2 shows a detailed breakdown of where respondents were interviewed.

The largest age group in the survey is “26-40”, followed by “17-25” and “40-60”. The respondents in the “26-40” and “40-60” age groups ranged across all seminars and demonstration events. Of the total 534 respondents, about half were interviewed at the Airport Junction mall. Almost all of the respondents in the “17-25” age group were surveyed in the mall events, because most participants at the seminars in Francistown and Gaborone were government officers.

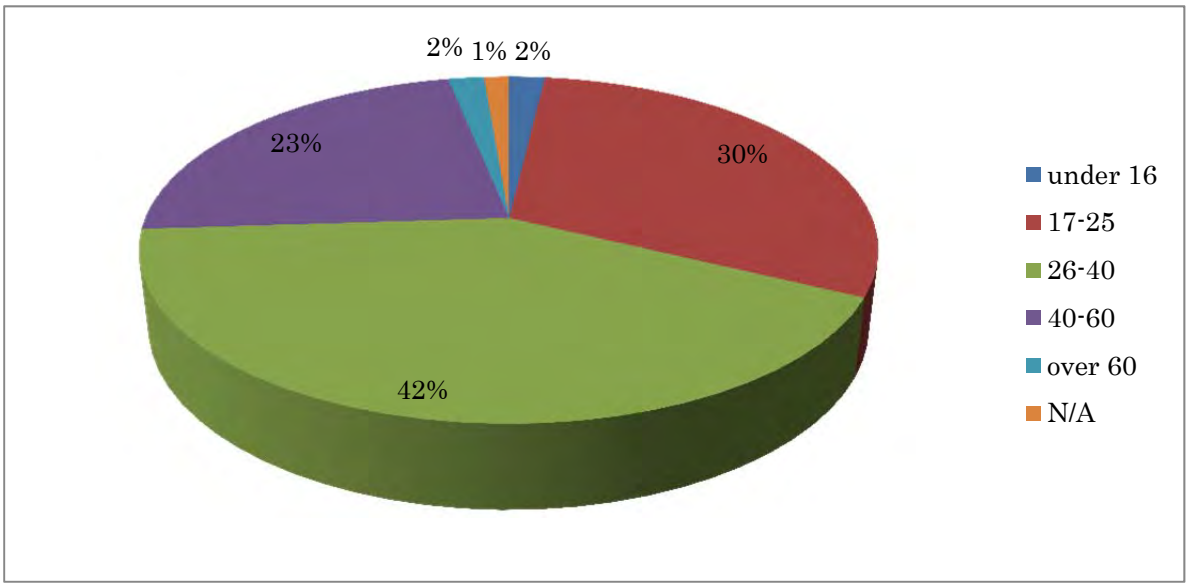
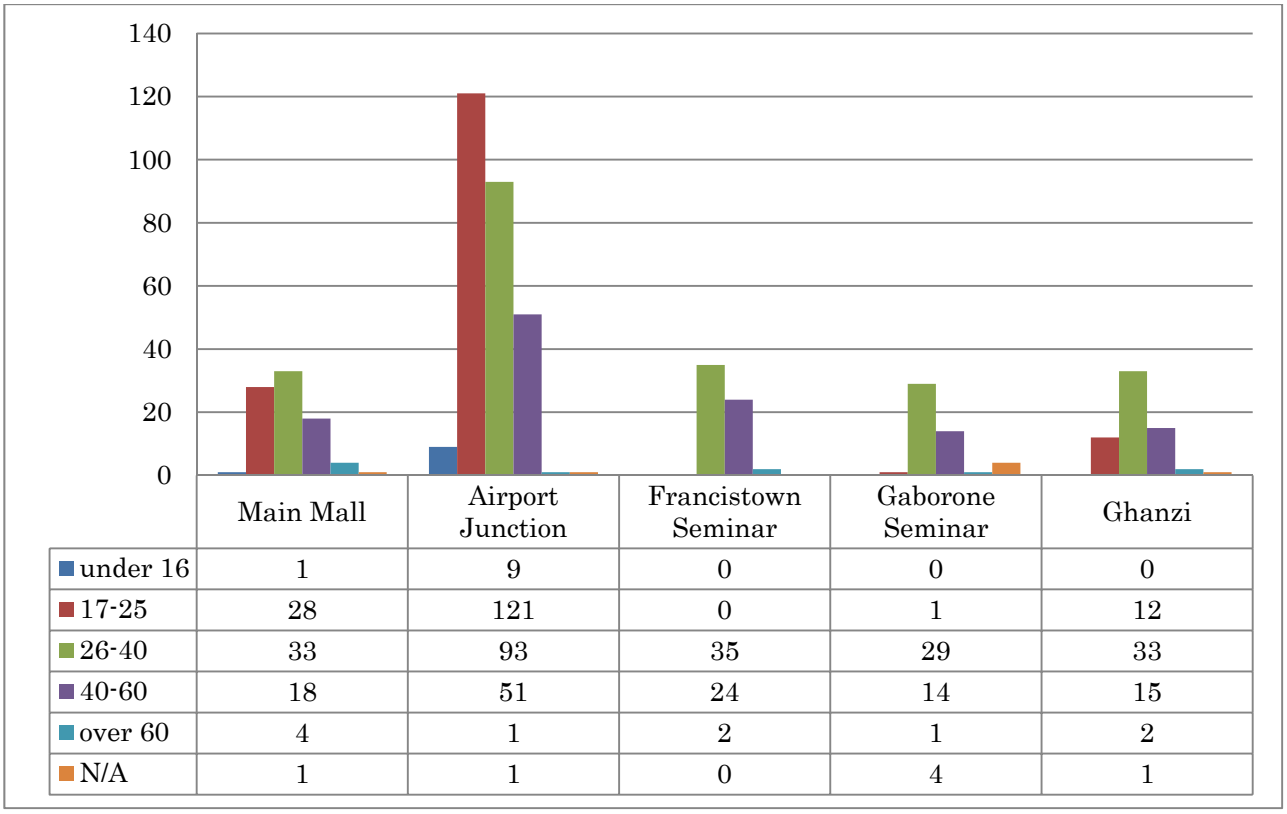


Figure 3.1: Breakdown of Respondents by Age Group



	Main Mall	Airport Junction	Francistown Seminar	Gaborone Seminar	Ghanzi
under 16	1	9	0	0	0
17-25	28	121	0	1	12
26-40	33	93	35	29	33
40-60	18	51	24	14	15
over 60	4	1	2	1	2
N/A	1	1	0	4	1

Figure 3.2: Breakdown of Attendance at Seminars/Demonstrations by Age Group

GENDER

335 of respondents that participated in the survey were males (63.6%) while 192 (36.4%) were females. Figure 3.3 shows the breakdown of the respondents by gender.

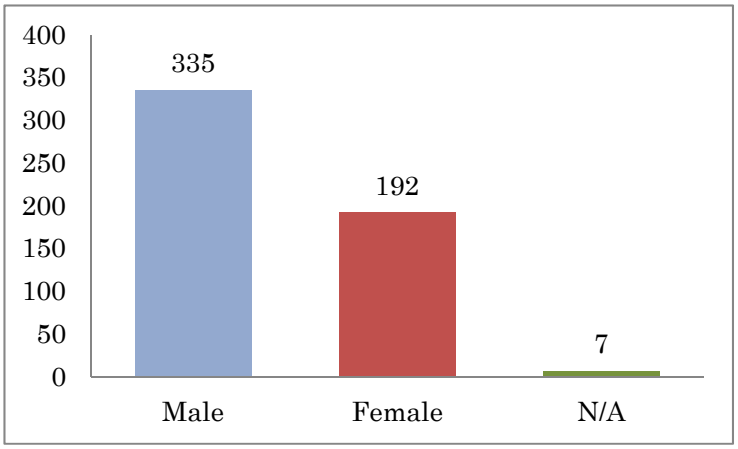


Figure 3.3: Breakdown of Respondents by Gender

3.2 Occupation of Respondents

Figure 3.4 shows the occupations of respondents. About two thirds of the respondents in the survey were government workers. This number is reasonable, because according to the Central Statistics Office more than 47% of people in Botswana are employed by central/local government, and the seminars were held mainly for governmental officials.

The occupations of other respondents differed and varied from person to person, and included not only private company workers but also workers at NGOs or students.

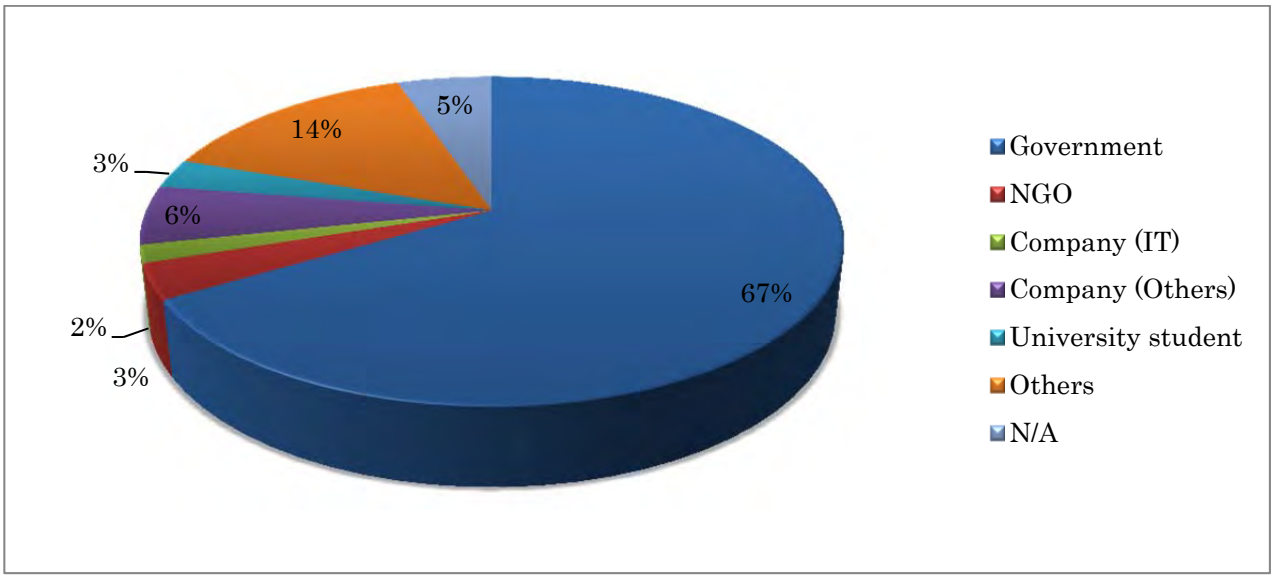


Figure 3.4: Occupation of Respondents

Chapter 4 TV Watching Habits and Preferences

4.1 Frequency with which People Watch BTV

According to this survey, 67% of people in Botswana watch BTV very often. The survey showed that 30% of the people watch BTV sometimes. Only 2% of the people indicated that they never watch BTV. This indicates that BTV is watched frequently and favoured by most people in Botswana. The frequency with which people watch BTV is shown in Figure 4.1.

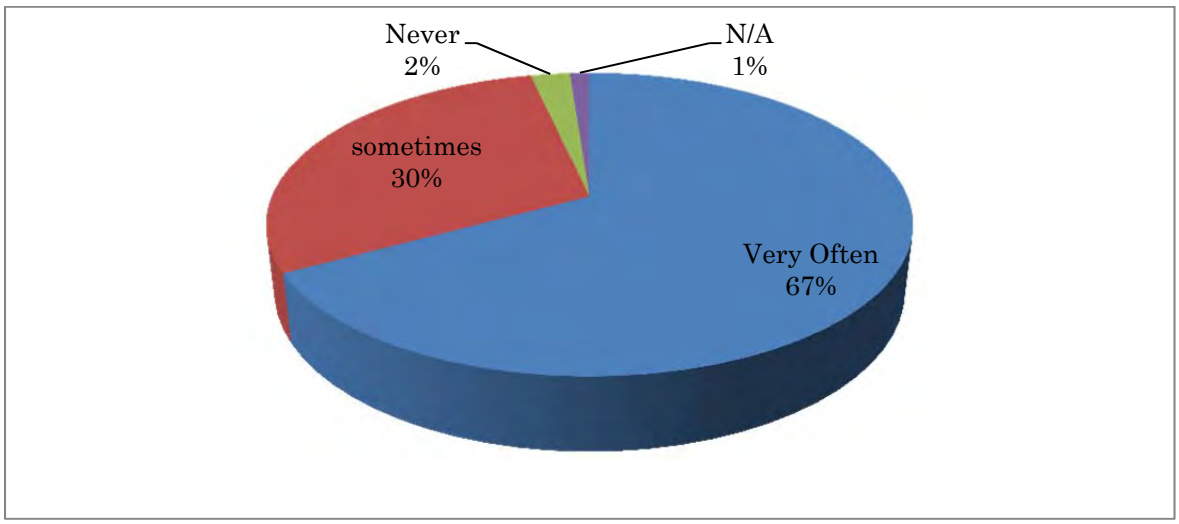


Figure 4.1: Frequency with which People Watch BTV

Figure 4.2 shows a breakdown by age group of the frequency with which people watch BTV. The graph indicates that people watch more frequently as they grow older. Less than 40% young people aged between 16 and 25 answered that they watched BTV very often. However for the 26-39 age group the percentage was in excess of 50%, and over 80% for those aged 40-60. The sample data for the under-16s and over-60s are omitted because the number of respondents was too small for a comparison with other groups.

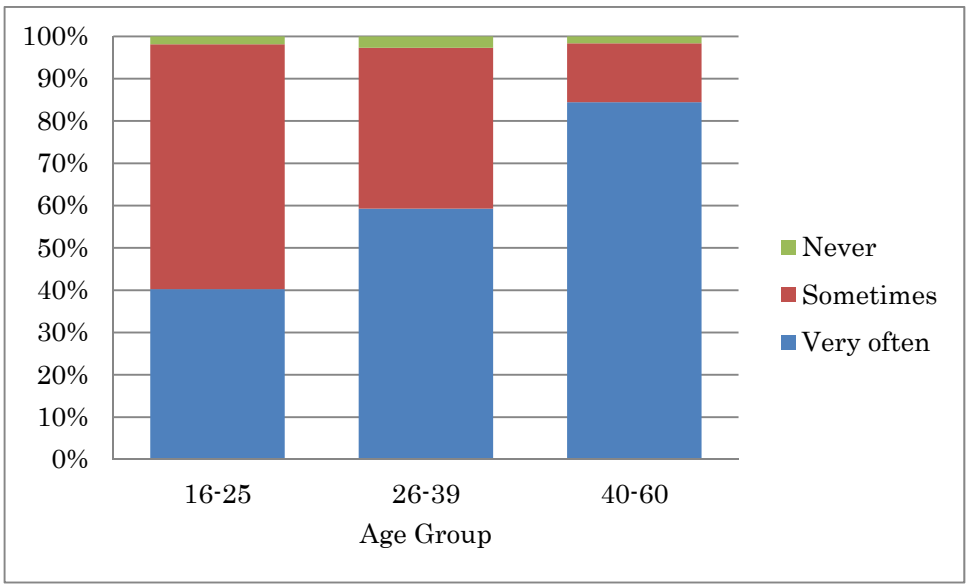


Figure 4.2: Breakdown by Age Group of Frequency with which People Watch BTV

4.2 Time Preference

Figure 4.2 shows when respondents watch television. According to the survey 58% of people watch television in the evening, 25% of people watch television during the day time, 9% of people watch BTV at night, and only 5% of people watch BTV in the morning.

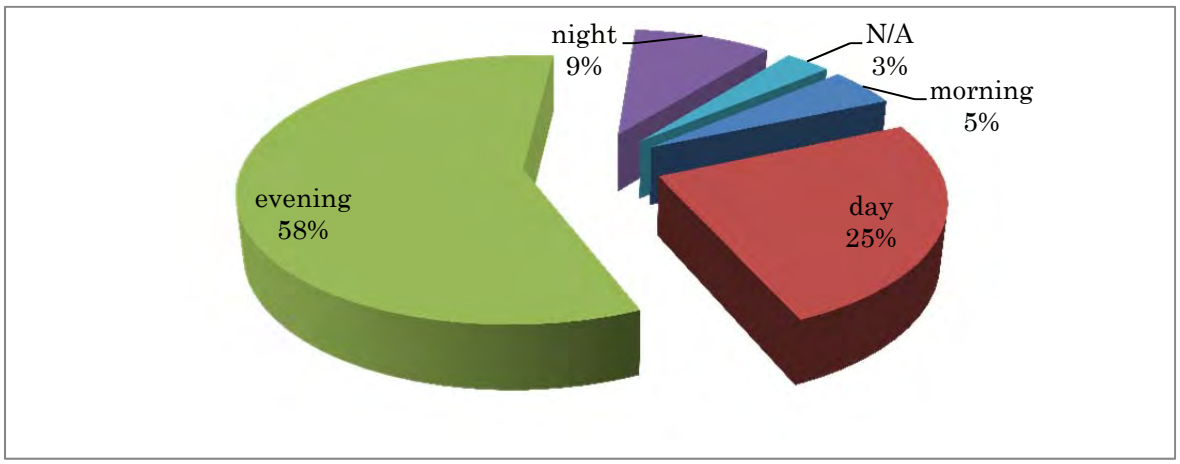


Figure 4.3: When People Watch Television

4.3 Watching Environment

Figure 4.3 shows the environment in which respondents watch TV. According to the survey nearly three quarters of respondents watch television in the company of family members, while 13% of people watch alone. This suggests that people in Botswana often enjoy television as a family in the evening, taking into consideration the results showing when people watch television.

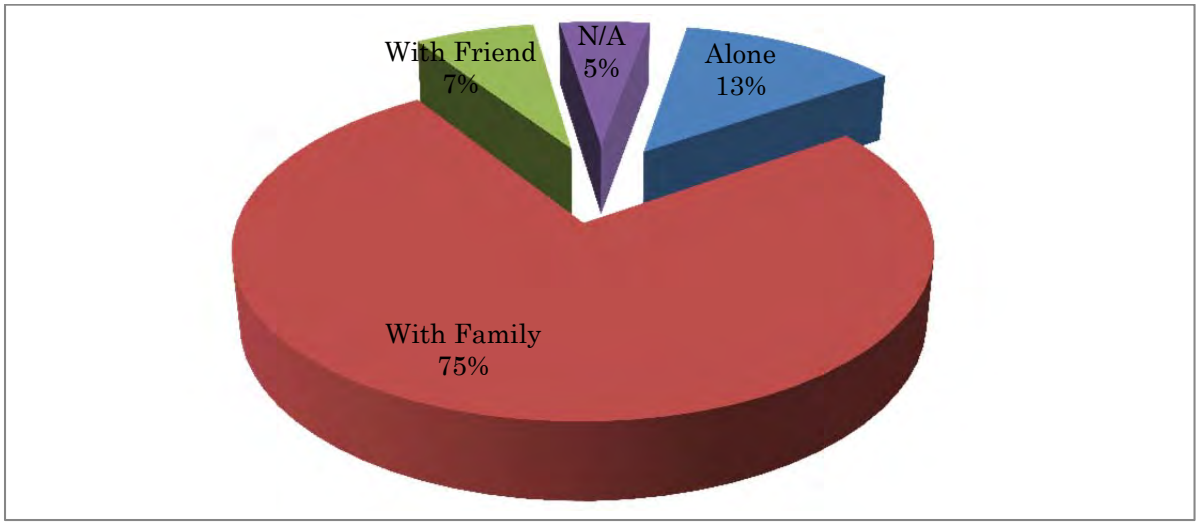


Figure 4.4: Watching Environment

4.4 Popular Genres/Language

The popularity of different programme genres is shown in Figure 4.5 below. The most popular genre according to the research is News, at more than 65%. The second most popular genre is Sports at 33%. Sports is followed by Drama, Weather, Music, Movie and Others, in that order.

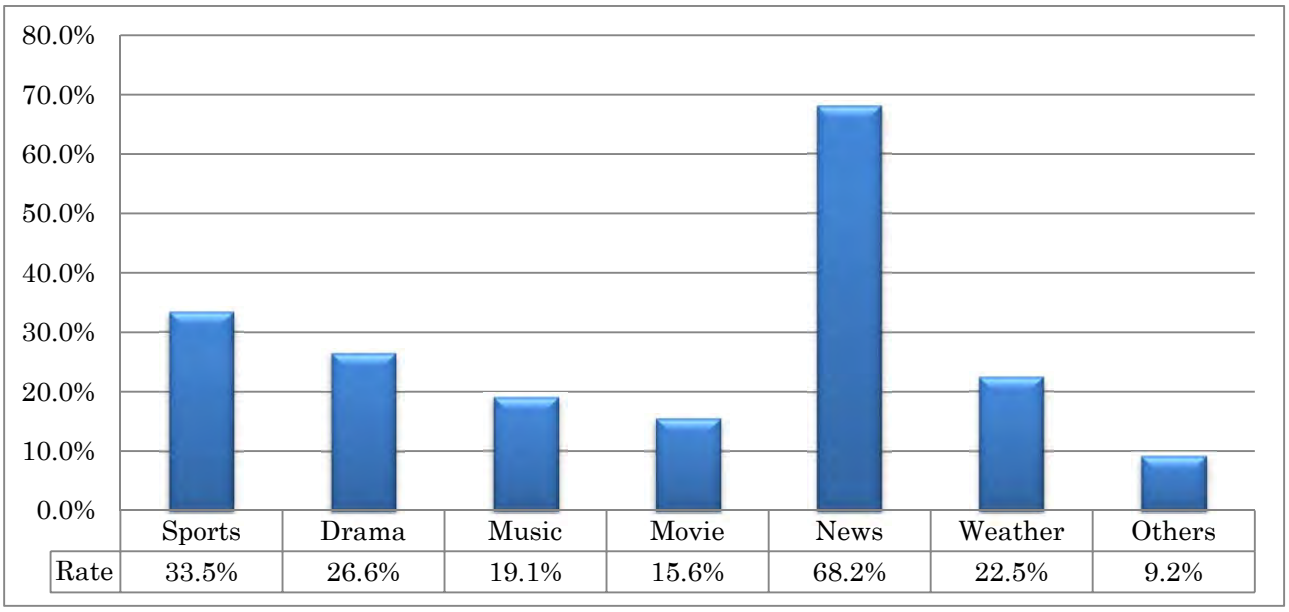


Figure 4.5: Popular Genres

Figure 4.6 shows preferences in television programme content. This survey shows that 40 percent of people prefer local content, compared to 44% who prefer international content. 9 percent of the people indicated that they like both local and international content.

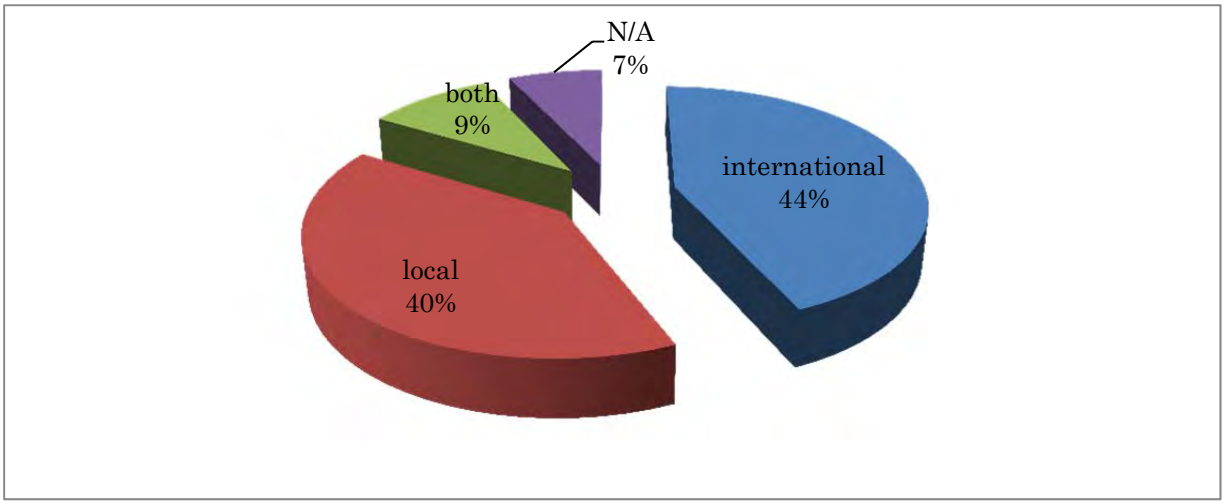


Figure 4.6: Preference for International or Local Content

The popularity of international and local content in each age group was investigated. The results are shown in Figure 4.7. More than 50% of the 16-25 age group answered that they preferred international content to local, while the result was the opposite for the 26-39 and 40-60 age groups. The sample data for the under-16s and over-60s are omitted because the number of people who answered was too small for a comparison with other age groups.

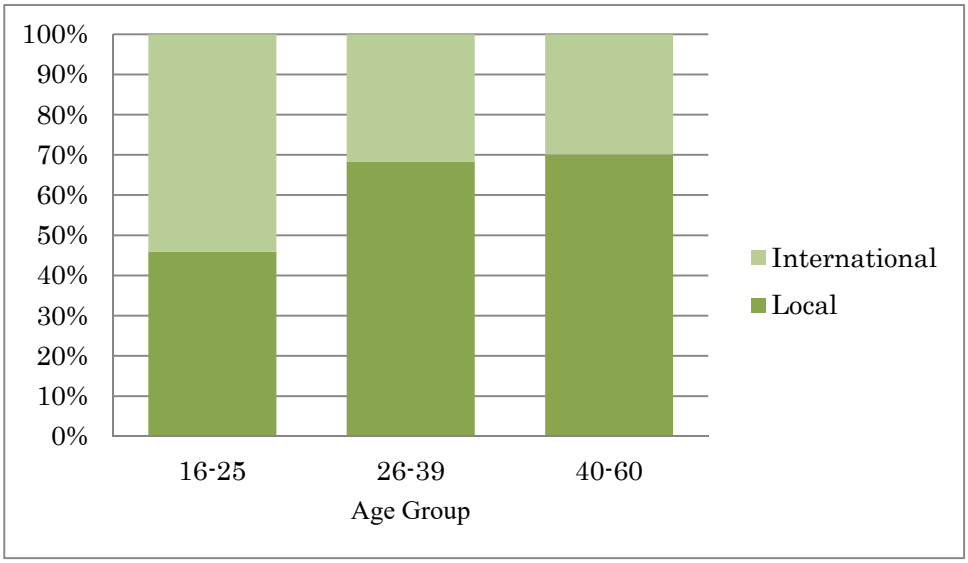


Figure 4.7: Breakdown by Age Group of Preference for International and Local Content

4.5 Most Popular Television Programmes on BTV

The top 10 popular television programmes were identified on the basis of the research. Table 4.1 shows the top 10 popular television programmes on BTV. The News is the most popular programme, followed by Itshireletse. Flava Dome, The Eye, Mokaragana, Matlho a Phage, Molemo wa Kgang, Pula Power, Tshamekang and Tsa Temo Thuo, in that order.

Table 4.1: Top 10 Popular Television Programmes on BTV

BTV Programme	Frequency (2015)	Ranking		
		2015	2013*	2009*
News	151	1	2	2
Itshireletse	88	2	1	6
Flava Dome	45	3	4	3
The Eye	36	4	9	4
Mokaragana	26	5	3	1
Matho a Phage	21	6	5	11
Molemo wa Kgang	21	6	6	6
Pula Power	17	8	-	-
Tshamekang	12	9	11	8
Tsa temo thuo	11	10	10	9

* The ranking of each programme in 2009 and 2013 is given in the Report "Audience Survey for the Broadcasting Sector in Botswana", April 2013

The News was found to be most popular programme, that is, the most watched, in 2015; it was the second most popular in 2013 and 2009. This shows that most people prefer to be always up to date with regard to what's going on in the country and world-wide. The second most popular BTV programme is Itshireletse. This programme is a police drama which is both educational and entertaining. It is suitable for viewing by all ages. Flava Dome is an entertainment programme which is mostly enjoyed by young people. As Table 4-2 shows, Flava Dome is watched mostly by the 17-2 age group.
Flava Dome is then followed by The Eye, which a current affairs programme which is viewed more by people in the 26-40 and 41-60 age groups than by the other age groups.

Table 4.2 shows the top 5 popular television programmes for each age group. The News is the most popular programme for all age groups except the under-16s. This is because people of all ages from the 17-25 age group to the over-60s are interested in being up to date with the everyday news for Botswana and also other countries.

Table 4.2: Top 5 Popular Television Programmes for Each Age Group

Position	Under 16	17-25	26-40	41-60	Over 60
1	Itshireletse	News	News	News	News
2	News	Flava Dome	Itshireletse	Itshireletse	Itshireletse
3	Mokaragana	Itshireletse	The Eye	The Eye	Mokaragana
4	-	The Eye	Matho a Phage	Mokaragana	-
5	-	Pula Power	Molemo wa Kgang	Molemo wa Kgang	-

4.6 Requests for New BTV Programmes

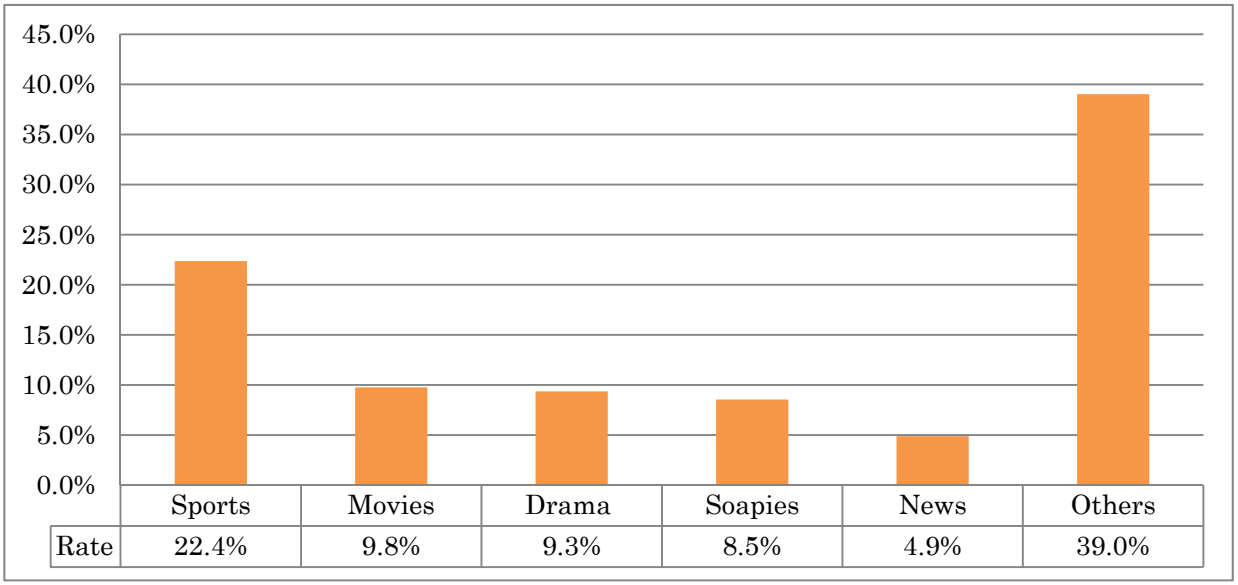


Figure 4.8: Request for New BTV Content

In the questionnaire, people were asked what kind of new programme they would like to see on BTV. Figure 4.8 shows the results. Sport is the type of content that most people want to see more of on BTV; this shows that most people want more new sports programmes on BTV. 22.0% of respondents requested Sports. Movies are the second most requested content, followed by drama, soaps and News. The "Others" section in Figure 4.8 includes "Educational Programmes", "Music", "Local Programmes", "Christian Channel", "Culture", "Documentaries", "Foreign Programme", "Entertainment", "Animals", "Parliamentary Discussion", "Comedy" etc. These are grouped together because the percentage for each was very low.

4.7 Demand for Data Broadcasting/Mobile Television

The demand for data broadcasting was investigated and correspondents were also asked what kind of information they would like to see in data broadcasting. According to the findings shown in Figure 4.9, most correspondents would like to view information related to the following genres, in order of preference; News, Movie, Sports, Music, Drama, Weather, Programme Schedule.

News is the most important feature in Batswana lives; Figure 4.9 indicates that 45.9% of respondents would like to see news information in data broadcasting. News is followed by Movies, at 43.9%. This is because many people would like to see information on a movie in data broadcasting, e.g. cast information or profiles, before watching the movie. 43.2% of

respondents would to see sporting information in data broadcasting. Many people who love sports would like to be always up-to-date on what's going in the sports world. Fixtures, results etc., are very important to sports fans.

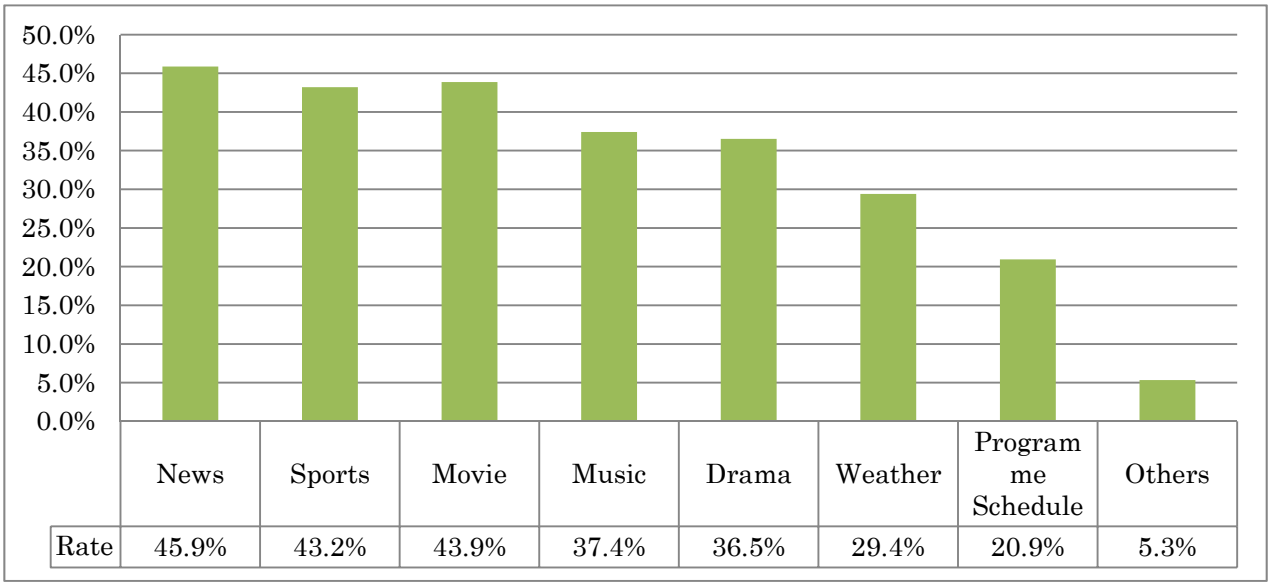


Figure 4.9: Requested Content for Data Broadcasting

Figure 4.10 shows respondents' requests for which television programmes they would like to see with linked-data broadcasting. 47.0% of respondents indicated that they want the News to be linked-data broadcasting. 44.0% of respondents would like sports programmes to be linked to data broadcasting. Many people would like to enjoy the experience of watching their favourite sports together with data broadcasting. Other requests were Movies 36.0%, Itshireletse 35.8%, The Eye 29.0%, Silent Shout 12.7 and others, in that order.

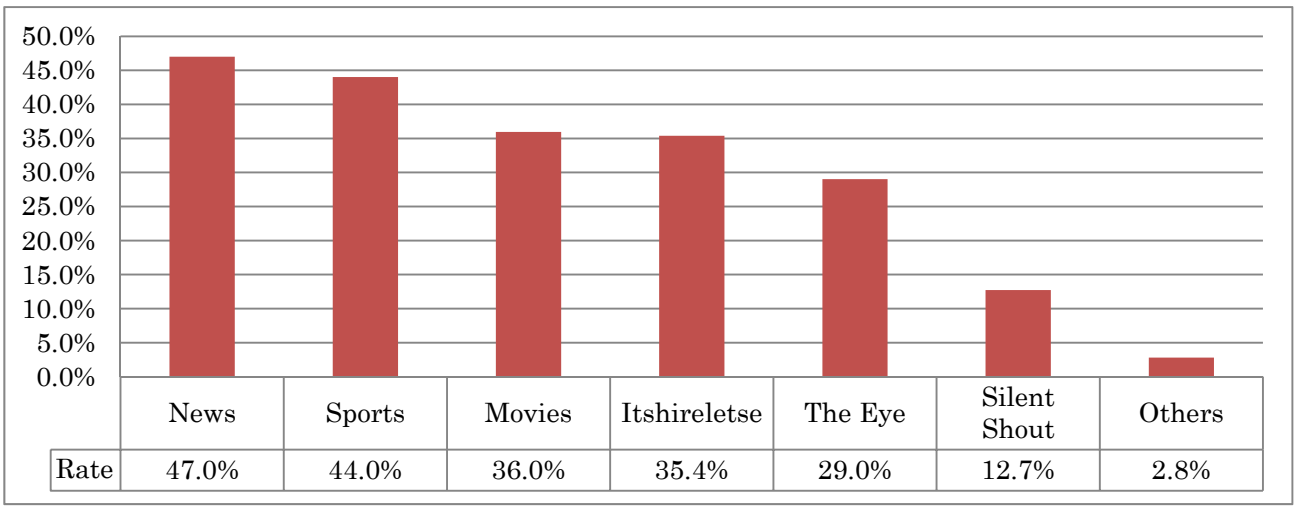


Figure 4.10: Content Requested for Linked Data Broadcasting

Figure 4.11 shows the content that respondents would like to see on mobile television. News (41.9%) is the most requested content, as expected, followed by Sports (39.1%) and Music (35.2%).

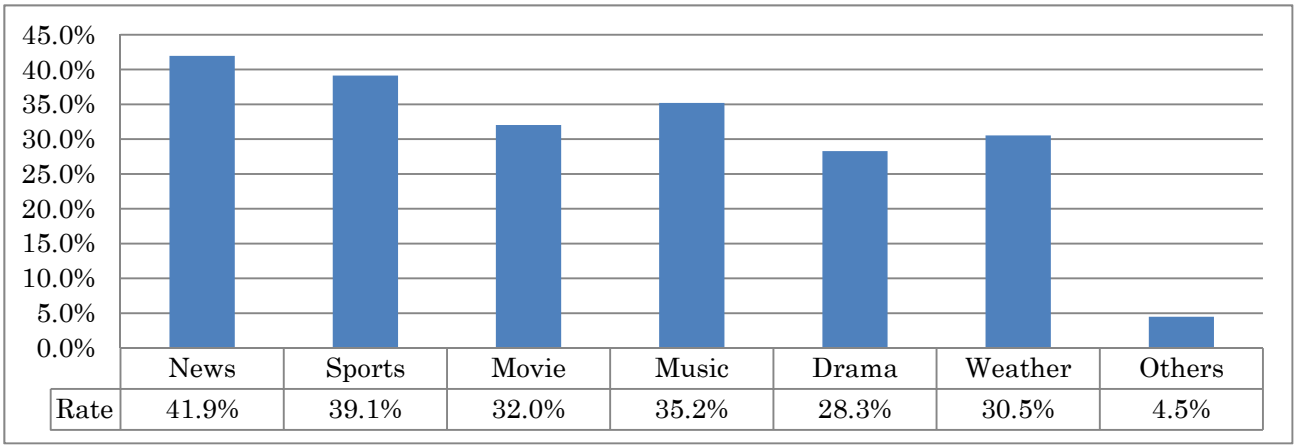


Figure 4.11: Content Requested for Mobile Television

4.8 Overall Analysis

Popularity of BTV

BTV is a popular television station in Botswana and 67% of the respondents answered that they watch BTV programmes very often. According to the previous survey (Audience Survey for the Broadcasting Sector in Botswana, April 2013), in 2013 the most popular television station was BTV followed by SABC 1 (see Table 4-3: Popular TV stations in 2013). However an investigation of favourite television stations was not included in this survey; considering that the SABC channels are no longer available in Botswana, BTV is still expected to the most popular television station and obviously expected to play a crucial role in the development of the television industry in Botswana. DSTV is considered to be gaining more popularity in place of SABC because it offers a variety of channels, including those SABC used to offer.

Table 4.3: Popular Television Stations in 2013

	Top of Mind	Spontaneous	Have Watched	Favourite	Most Often Watched
BTV	**653**	246	921	328	332
eBotswana	10	315	378	17	17
SABC1	217	637	824	426	438
SABC2	6	830	791	31	27
SABC3	2	822	781	19	23
DSTV Channels	32	213	225	78	62
Philibao Channels	6	232	216	20	21

Source: Audience Survey for the Broadcasting Sector in Botswana, April 2013

People are able to watch BTV programmes by many means; by receiving the terrestrial signal transmitted by the BTV directory, through DSTV, or using free-to-air decoders. This means more people have a chance to watch BTV, and this contributes to the popularity of BTV. Furthermore, the popularity of the station also can be explained by the citizens' faith in the government. The economic and democratic success of the country so far has led them to trust BTV, which as the national broadcaster plays a crucial role in disseminating information about government policies and local news. This preference for the national broadcaster could be explained by the prevalence of South Africa-based television channels in Botswana before the country had its own national television. Thus, now that BTV has been launched as the national television of Botswana, the citizens feel that they have a channel of their own to watch. It can further be argued that citizens view the media as a means of asserting Botswana's national sovereignty. Furthermore, one of the objectives of national development in Botswana is self-reliance. Ultimately, having a national television reduces Botswana's dependence on South African television services, thus ensuring greater self-reliance.

Comparison of the Preferences of Younger and Older Viewers

Although BTV enjoys significant popularity as a whole, the station is more popular with the older rather than younger generations. According to Figure 4.2, the percentage of people who watch BTV 'very often' increases with age, with a corresponding drop in the percentage who watch 'sometimes'. There is also a difference in the preference for local and international content. Older viewers prefer local to international content, while on the other hand, younger viewers prefer international content. This tendency can be applied to younger viewers though not enough samples from younger viewers were collected in this survey.

This tendency does not lead immediately to the unpopularity of BTV among younger viewers; even though the percentage is relatively low compared to older viewers, more than 40% of respondents aged between 16 and 25 watch BTV 'very often'. However as the nation has developed and people can easily get more information than before, it is possible that younger viewers will be attracted by other channels and may even lose their appetite for BTV programmes.

One good measure to keep younger viewers' attention on BTV is to devote more time to genres that are popular with the young. Another reasonable method is to focus on programmes that can be enjoyed with family members. Fortunately people in Botswana watch TV with family quite often, as this survey shows. Furthermore since BTV is highly popular among older generations who watch very often, it is appropriate to provide programmes that can be enjoyed by both young and old.

In the survey in Gaborone, some younger viewers stated in the questionnaire that BTV was really boring or that they never watch it. Apparently the needs of city youth are different from those of older viewers. BTV needs to make good use of limited resources to provide programming that can appeal to various audiences.

Television Viewing Habits

58% of respondents said that they often watch television in the evening, and 25% said they watched during the day. These percentages reflect the lifestyle in Botswana. However, modernisation of the economy is changing the lifestyle in Botswana; the ordinary people wake up early in the morning and work until around 4:30PM, then spend time with their family. Evening is the most popular time of all to watch TV with family, as Table 4-3 shows.

Table 4.4: Television Watching Environment

	Evening	Day	Morning	Night
Family	**80.2%**	**62.5%**	**75.0%**	100.0%
Alone	11.2%	25.0%	25.0%	0.0%
Friend	8.6%	12.5%	0.0%	0.0%

The trend in popular genres has not changed since the previous surveys, which were conducted in 2009 and 2013. News is the most popular genre among BTV programmes, and other genres have lower popularity according to this survey. However, according to the previous survey which investigated respondents' television preferences (not limited to BTV programmes), entertainment/movies, music and sports were also popular genres, as well as news. It is not likely that a time lapse of two years would influence people's preferences very much. The results show that viewers have different expectations of BTV and other broadcasters including DSTV and eBotswana; viewers mainly seek news from BTV, and not so much the other genres mentioned above.

Table 4.5: Comparison of Popular Television Genres

	This Survey	Previous Surveys	
	2015 (only for BTV)	2013*	2009*
News	**68.2%**	39.6%	83.9%
Entertainment/Movies	**42.2%**	76.4%	77.6%
Music	**19.1%**	54.2%	63.4%
Sports	**33.5%**	66.2%	51.4%

* The data for 2009 and 2013 are from the Report "Audience Survey for the Broadcasting Sector in Botswana", April 2013

The reason why BTV news is popular and frequently watched is that people really want to know what is happening in their surroundings. Of course there are several local news sources available in their daily life, such as newspapers, radio and other television channels; but people prefer to watch BTV because it can be accessed throughout the country for free and is very informative compared to the other sources.

Needs for New Technology

ISDB-T has many features, as described in Chapter 1. Data broadcasting and mobile television are two of the new functions.

Viewers can get the news and information on the weather, traffic stock market, etc., via data broadcasting. The information may be offered without any relation to the programme. It may also be interactive, as in gaming, shopping, or education. A programme guide is also available.

Mobile television is another new technology which enables people to watch television anytime and anywhere they want, on a small handheld or mobile device via a terrestrial television station.

As shown in Figures 4.6, 4.7 and 4.8, viewers want varied content including news, sports, movies, music etc.. This shows the expectation that the new technologies can provide more information. Considering the fact that all over the country mobiles are more plentiful than TV sets and that other fee-charging information sources are limited in Botswana, it is natural that the desire for these technologies should be high.

BTV needs to meet the people's expectations for the technology by choosing adequate programmes. Data broadcasting content is suggested in Chapter 5.

The Way Forward for BTV

Considering all the circumstances mentioned above, there is no doubt that so far there is little change in television viewing habits in Botswana, and that expectations for the new technologies are high. BTV is moving in the right direction and does not need to make drastic changes to their programmes. To keep BTV as the most popular and trusted television station in Botswana, it is worthwhile to gather information from viewers regularly and to take their opinions into account not only in programme production but with respect to all activity in BTV.

Chapter 5 Digital Programming Plan

5.1 Current Situation regarding Programming in BTV

Before the consideration of a digital programming plan, interviews were held with staff members involved in programming to clarify the present situation with regard to programming. The findings from the interviews are shown below.

1. There are 3 kinds of programme; programmes produced by BTV, programmes produced by other Ministries, and programmes that are purchased externally.
2. The number of programmes made by BTV is low compared to the other programmes.
3. Programmes aired between 8:00-18:00 are mainly repeats.
4. The most popular programmes are broadcast from 18:00-19:00 and 20:00-21:00
5. Educational programmes for students are aired on weekdays from 11:00-13:00
6. The addition of a new educational channel is now under discussion within BTV.
7. There is no department or section for programming in BTV.
8. A programming schedule for the key station only is required; there is no need to consider local station programming.
9. Advertisement scheduling is controlled by the Channel Control Division.
10. There are no guidelines so far for special programmes or data broadcasting.
11. There is a programming scheduling system exclusive to news programmes called the Electronic News Production System (ENPS). BTV News items are stored in the ENPS and broadcast.

5.2 Policies for the Digital Programming Plan

Policies for development of the digital programming plan are proposed taking into account the results of the market survey and the current situation regarding BTV programming. The policies were prepared through careful discussions with members of the Data Broadcasting WG. The policies are described below.

1. BTV will offer at most 3 different programmes with linked data broadcasting at the initial stage of data broadcasting, taking into consideration the capacity of the staff to implement data broadcasting.
2. At least one programme for linked data broadcasting will be selected from the top 3 most popular programmes identified by the market survey.
3. At least one programme which is popular with young viewers will have linked data broadcasting.
4. The most important programme, the News, should be provided always in both English and Setswana.
5. The content of non-linked data broadcasting will be selected on the basis of the feasibility study (see Chapter 5.3).

6. The BTV Portal should be designed for ease of operation. It is recommended that the portal be structured to have no more than five layers.
7. Linked and non-linked data broadcasting can be broadcast at the same time.
8. Advertisements will be included in data broadcasting by the Marketing Department.
9. Special programmes will be prepared for important days such as President's Day and Independence Day.
10. Non-linked data broadcasting will be aired 24 hours a day so that viewers can check information anytime.

5.3 Feasibility Study of Data Broadcasting Content

The feasibility of data broadcasting for linked and non-linked programmes was evaluated. Table 5.1 shows the results of the evaluation.

Table 5.1: Feasibility of Data Broadcasting Programming

	Genre	Feasibility	Reason
Portal Programme non-linked	News	Feasible	Information is available from BTV, BOPA (The Botswana Press Agency)
	Weather	Feasible	Information is available from BTV
	Programme Schedule	Feasible	Information is available from BTV
	Market	Feasible	Information is available from BTV, although it is not possible to obtain real-time market information
	Education	Difficult	Content should be prepared in collaboration with the Ministry of Education
	Traffic Information	Difficult	There are no information sources available
	Advertisement	Feasible	Easy to operate
Programme linked	Talk show	Feasible	Easy to operate if the scenario is predetermined
	Music	Feasible	Easy to operate if the performers are predetermined
	Special event	Feasible	Depends on human resources and skill levels
	Drama	Difficult	Handling rights issues
	Movie	Difficult	Handling rights issues
	Documentary	Difficult	Handling rights issues

Programme Non-Linked

News is feasible as a non-linked data programme. BTV News Section manages all news sources used for BTV news aired in the morning, noon and evening. All information is stored in the ENPS. In the initial stages of data broadcasting, information for data broadcasting will be input manually, though operation will be less labour-intensive once

the connection between the data broadcasting system and ENPS has been established. Daily News, which is managed by BOPA, is also available as a news source for data broadcasting.

Weather and market information is rather more difficult, less feasible, for data broadcasting than News. This is because the ENPS system in the BTV News Section contains little information. Weather information includes only high and low temperatures for each area. Market information is provided once a day. BTV needs to secure more information resources and to update the information frequently.

Non-linked data programming of the Programme Schedule is feasible. Of course BTV has its own programme schedule and it does not change very often. Once the current Programme Schedule for data broadcasting is prepared, the only task is to update the data according to the schedule.

Education is not feasible for the initial stages of data broadcasting. The content for data broadcasting, including target ages and subjects, should be planned in collaboration with the Ministry of Education. Talks between the Ministry and BTV have not started yet.

Traffic Information is also not feasible. It is difficult not only in terms of operation but also in terms of information sources. Traffic information is currently broadcast on the Breakfast Show in the form of an interview with a police officer. This kind of information needs to be updated constantly, otherwise it is meaningless; and there are no other sources available at the moment.

Programme linked

Linked data broadcasting is feasible for talk shows. Usually the theme for the next show has been already decided. A summary of previous content or discussions and the next theme can easily be prepared for linked-data broadcasting. In addition to providing information about the talk show, real-time interaction with viewers through SMS or even SNS such as Facebook and Twitter is suggested as a means of attracting viewers.

Linked data broadcasting is also feasible for music programmes. A few brief details about musicians performing on the programme would be the most possible content for linked data broadcasting. Collaboration with popularity contests and the provision of real-time information or results is also promising.

The feasibility of linked data broadcasting for special events is low, though not impossible. The main reason is the lack of a skilled workforce. In the initial stages of data broadcasting it will be rather difficult to prepare the content for programmes dealing with special events

such as Independence Day, elections, sports programmes etc., at the same time as carrying out ordinary daily tasks. Linked data broadcasting for special events should not start until such time as the technicians become more skilful or can spare months for preparation.

Linked data broadcasting for dramas, documentaries and movies is not feasible because of problems regarding rights. The use of a picture of a cast member for a film, for example, is not allowed without the permission of the film maker or the individual in question. While the rights issue is difficult to overcome in the case of purchased programmes, in the case of programmes produced by BTV itself, it is possible to use information for linked data broadcasting.

Unfortunately, the police drama Itshireletse, which is a BTV programme that is popular with both young and adult viewers, is not produced by BTV. Itshireletse is produced by the Botswana Police Service. Furthermore, this programme does not have any continuity between stories and is not suitable for linked data broadcasting. Other dramas are also not produced by BTV. BTV needs to build the capacity to produce dramas with linked data broadcasting.

5.4 Digital Programming Plan

Proposed Data Broadcasting Programmes

The data broadcasting programmes for BTV are proposed taking the policies and the feasibility study into consideration. The proposed programmes are shown in Table 5.1.

Table 5.2: Proposed Data Broadcasting Programmes

	Genre	Programme
Non-Linked Data Broadcasting	-	News, Weather, Market info, Programme Guide, Sports, BTV info, Advertisement
Linked Data Broadcasting (Programme produced by BTV)	Talk Show	Molemo wa Kgang, Talk Back, Silent Shout
	Music	Flava Dome
	Special Event	President's Day etc.
Linked Data Broadcasting (Purchased programmes and programmes provided by other Ministries)	Documentary/Movie/ Drama	-

A total of seven kinds of information - News, weather, market information, programme guide, sports, BTV information and advertisement - are selected for non-linked data

broadcasting.

Three Talk Show programmes are proposed for linked data broadcasting, namely, Molemo wa Kgang, Talk Back and Silent Shout. This is because the data source for the shows is in-house, meaning they are made by BTV, therefore it would be easier to acquire the information needed for data broadcasting.

In the Music genre, Flava Dome is selected for linked data broadcasting. As described in Chapter 4, BTV needs to focus on the younger generation. This programme is ranked the second favourite BTV programme in the 17-25 age group. This selection aims to promote BTV to the younger generation.

There are no linked data broadcasting programmes in the Documentary, Movie, and Drama genres. As noted in the feasibility study above, linked data broadcasting for these programmes is difficult because the programmes are not produced by BTV.

As a general rule data broadcasting for special events is not recommended in the initial stages. However, data broadcasting could be feasible in the case of important national holidays such as President's Day or Independence Day because the dates are fixed and there would be enough time to prepare the content.

Proposed Basic Structure of Non-Linked Data broadcasting

A basic structure for the proposed non-linked data broadcasting is shown in Figure 5-1 below. It is planned so as to be simple and easy for anyone to find information. There are only five layers.

All data broadcasting information can be accessed from the initial screen, called "BTV portal". BTV portal acts as the entrance to non-linked data broadcasting. Viewers first enter the portal and then go to the information they want using a remote control. The initial screen of the Portal offers 7 kinds of information: "BTV Programmes", "News/Dikgang", "Sports", "Weather", "About BTV", "Market", and "Advertisement".

"BTV Programmes" consists of three parts: "Pickup", "Schedule" and "Event". "Pickup" includes recommended programmes on BTV. Viewers can check the weekly schedule from "Schedule". If there is an event related to a programme, viewers can access the information from "Event".

News is provided in both Setswana and English from "News/Dikgang". Viewers can check not only news headlines, local and international news but also sports news or even special reports, in both languages, whenever they want. The information of BTV newsroom and

the time schedule for BTV News are also available at any time.

“Sports” mainly provides information about football. People can check results, logs, fixtures, and related news. Other sports information such as boxing or volleyball can also be seen from this menu.

A variety of information can be provided via BTV Portal; the most important thing is the maintenance of a full range of information. BTV must provide an adequate and manageable amount of information, taking into consideration the number of staff members and their skill levels.

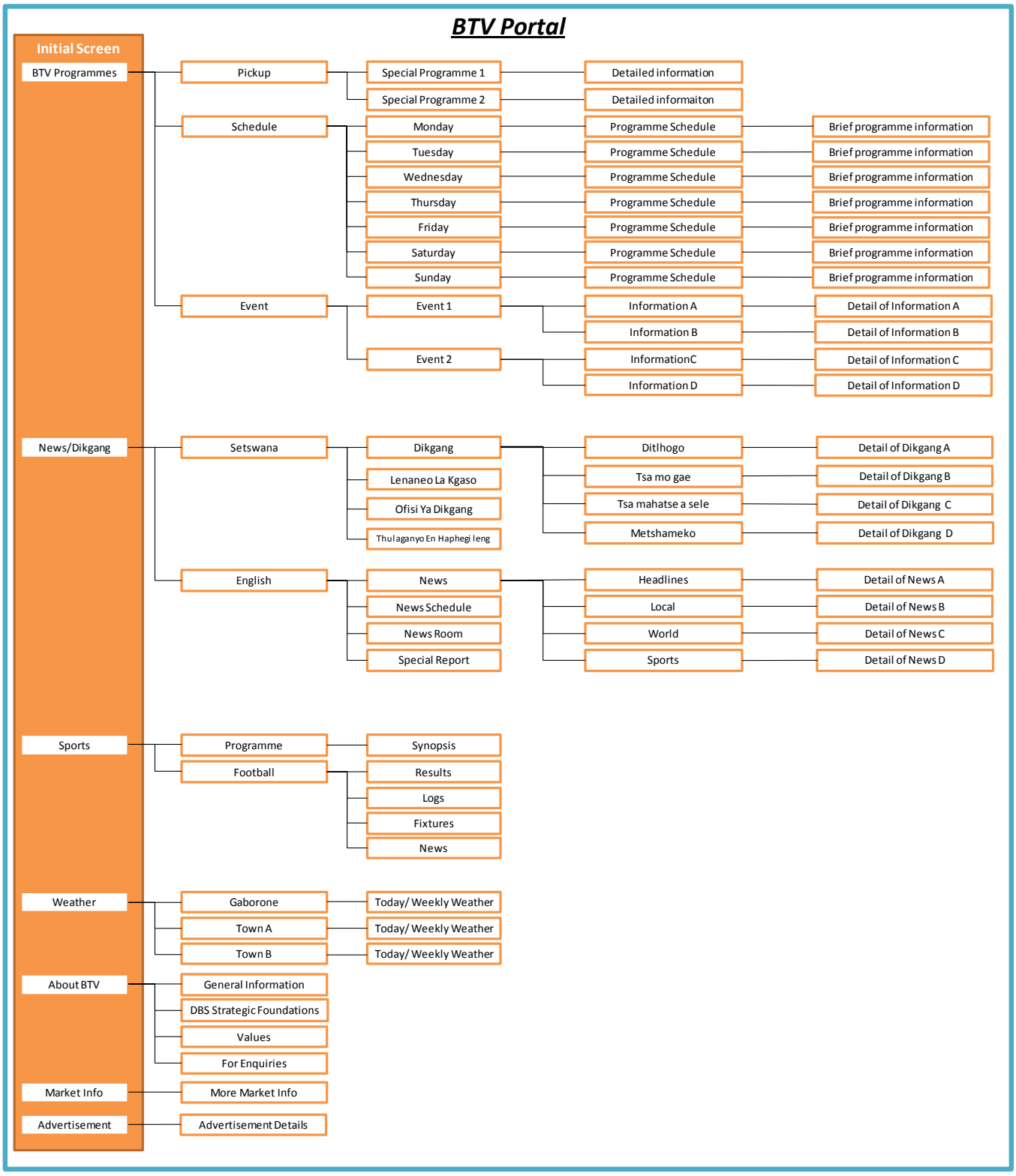


Figure 5.1: Structure of Non-linked Data Broadcasting

Sample of Digital Programming Schedule

The weekly digital programming schedule is proposed based on the current programming schedule. Figure 5.2 shows a sample digital schedule which includes special programmes for President's Day. Programmes with linked data broadcasting are coloured in blue. The special programmes with linked data broadcasting are coloured in yellow. The non-linked data broadcasting is aired 24 hours a day. Viewers can switch to non-linked data broadcasting even if they are watching a linked data broadcasting programme.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
4:55	National Anthem	National Anthem	National Anthem	National Anthem	National Anthem		
4:56	Phatsima	Phatsima	Phatsima	Phatsima	Phatsima		
05:00 06:00	Setswana Bulletin rpt	Setswana Bulletin rpt	Setswana Bulletin rpt	Setswana Bulletin rpt	Setswana Bulletin rpt		
06:00 07:30	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast		
07:30 08:00							National Anthem Phatsima
08:00 08:30	Worship rpt	700 Club	Best Dance Sports	Tla Patlelong rpt	Lobebe rpt		President's Day Traditional song and dance
08:30 09:00		Maxed out rpt		Tla patlelong rpt			
09:00 09:30	Road to Rio rpt	World Equestrian rpt	Weirdest restaurant rpt	How to be Indie rpt	Tsa Botsogo rpt	Anthem	
						Phatsima	
09:30 10:00	Police rpt	Prime Time rpt	First Issues	TsaTemo Thuo rpt	Ditlhabololo rpt	Letlhabile rpt	
10:00 11:00	Molemo wa kgang rpt	Flava Dome rpt	Matlho a phage	The Eye rpt	Mokaragana rpt	Comedy and Drama	
11:00 11:15	EBD	Biology rpt	Biology	Biology	Biology		
11:15 11:30		Maths (Form 1) rpt	Maths (Form 2)	Maths (Form 2)	Maths (Form 3)		
11:30 11:45		Chemistry rpt	Chemistry	Chemistry	Chemistry		
11:45 12:00		Design and technology rpt	Commerce	Commerce	Commerce		
12:00 12:15		Talk Back rpt	Maths Bgcse	Maths Bgcse	Maths Bgcse	EBD Rpt	
12:15 12:30			Physics	Physics	Physics		
12:30 12:45			IT	IT	IT		
12:45 13:00			Beyond school	Beyond school	Beyond school		
13:00 13:30	Dikgang	Dikgang	Dikgang	Dikgang	Dikgang		
13:30 14:00	Public Service day Poetry rpt	Property for you rpt	Pelokgale rpt	Melodi ya kgalaletso rpt	Sam Soon rpt	Enole	
14:00 14:30		My Star rpt	Batho Pele rpt				
14:30 15:00			Life with Derek Rpt	Only One Earth rpt	Tla Patlelong	Road to Rio	
15:00 15:30		Tla Patlelong	Tla Patlelong	Tla Patlelong			
15:30 16:00	Maxed out	Weird Resturants	Only one Earth	Face of the Earth	Planet 3 rpt	Choral Music and Poetry	
16:00 16:30	Life with Derek	Movie rpt	Beijin Love story rpt	From The Ground	From The Ground rpt		
16:30 17:00	How to be Indie sr						
17:00 17:30	Best Dance Sports		Melodi ya Dinno rpt	Sedibeng rpt	Motor Speedway		
17:30 18:00				Top 20 shoot-out rpt			
18:00 18:05	Ghana vs congo	News Headlines	News Headlines	News Headlines	News Headlines	Building tomorrow (SADC) Documentaries	
18:05 18:30	Itshireletse	Silent Shout	Talk Back	Molemo wa kgang	Dikopane		
18:30 19:00	Property For you	Sedibeng			World Equestrian		
19:00 20:00	Dikgang	Dikgang	Dikgang	Dikgang	Dikgang	Dikgang	Dikgang
20:00 20:30	Temo thuo	First Issues	The Eye	Ditlhabololo	Flava Dome	Mokaragana	President's Day Traditional song and dance
20:30 21:00	Pelokgale	Letlhabile		Batho pele			
21:00 22:00	News	News	News	News	News	News	News
22:00 23:00	Lobebe	Beijing Love Story	Pula Power rpt	France 24 rpt	President's Day Fashion Show	Pula Power	President's Day Traditional song and dance
23:00 23:30		France 24					
23:30 04:55							

: Linked Data Broadcasting Programme

: Special Programme

Figure 5.2: Sample of Digital Programming Schedule

Appendix A

Questionnaire for Seminar

1. ***Gender***

   Male ☐ Female ☐

2. ***Age group***

   Under 25 ☐ 26 – 40 ☐ 41 – 60 ☐ Above 60 ☐

3. ***Organization***

   Government NGO Company (IT) Company (Others)

   Professor ☐ University student ☐ Others_____

[Seminar]

4. ***How was the seminar schedule?***

   Too long ☐ Just OK ☐ Too short ☐

5. ***How were the contents of the seminar (Presentations)?***

   Easy to understand ☐ Not really ☐ Difficult ☐

6. ***Was the Information of digital migration enough?***

   Yes ☐ No ☐

7. ***What extra information would you like to be included?***

   _____

8. ***What is the most important message form the seminar?***

   Back ground ☐ Responsibility to spread information about digital Migration ☐

   Benefits ☐ Standards ☐ Others _____

[BTV Program]

9. ***How often do you watch BTV?***

Very Often ☐ Sometimes ☐ Never ☐

10. What time do you usually watch BTV?

Morning ☐ Day ☐ Evening ☐ Night ☐

11. With who do you usually watch BTV?

Alone ☐ Family ☐ Friend ☐ Others _____

12. What kind of program do you like watching?

Sports ☐ Drama ☐ Music ☐ Movie ☐ News ☐ Weather ☐

Other: _____

13. What is your favorite show on BTV?

_____

14. What kind of <u>NEW program</u> would you like to watch?

Sports ☐ Drama ☐ Music ☐ Movie ☐ News ☐ Others _____

15. ***Which contents do you prefer?***

Local Content ☐ Internationally Popular Content ☐

[Data Broadcasting]

16. Was it easy to understand what data broadcasting is?

Yes ☐ Not really ☐ No ☐

17. How was the layout & design of data broadcasting?

Good ☐ Just OK ☐ Bad ☐

18. ***Was it easy to use the remote-control for the Data Broadcasting? (if you had a chance)***

Yes ☐ Not really ☐ No ☐

19. Will you use the Data Broadcasting service once it has started?

Yes ☐ No ☐ Reasons : _____

20. What information would you like to see on data broadcasting?

Sports ☐ Drama ☐ Music ☐ Movie ☐ News ☐ Weather ☐

Program Schedule ☐ Other:_____

21. Which shows would you like to have linked to data broadcasting?

News ☐ Sports ☐ Itshireletse ☐ Silent Shout ☐

The Eye ☐ Movies ☐ *Other:*_____

22. What genre of television programs would you like to see on mobile television?

Sports ☐ Drama ☐ Music ☐ Movie ☐

News ☐ Weather ☐ Other:_____

23. Any other comment

Appendix B

Questionnaire for Demonstration (English Version)

1. ***Gender***

   Male ☐ Female ☐

2. ***Age group***

   Under 25 ☐ 26 – 40 ☐ 41 – 60 ☐ Above 60 ☐

3. ***Organization***

   Government ☐ NGO ☐ Company (IT) ☐ Company (Others) ☐

   Professor ☐ University student ☐ Others_____

[BTV Program]

4. ***How often do you watch BTV?***

   Very Often ☐ Sometimes ☐ Never ☐

5. ***What time do you usually watch BTV?***

   Morning ☐ Day ☐ Evening ☐ Night ☐

6. ***With who do you usually watch BTV?***

   Alone ☐ Family ☐ Friend ☐ Others _____

7. ***What kind of program do you like watching?***

   Sports ☐ Drama ☐ Music ☐ Movie ☐ News ☐ Weather ☐

   Other: _____

8. ***What is your favorite show on BTV?***

   _____

9. ***What kind of NEW program would you like to watch?***

   Sports ☐ Drama ☐ Music ☐ Movie ☐ News ☐ Others _____

10. ***Which contents do you prefer?***

Local Content ☐ Internationally Popular Content ☐

[Data Broadcasting]

11. Was it easy to understand what data broadcasting is?

Yes ☐ Not really ☐ No ☐

12. How was the layout & design of data broadcasting?

Good ☐ Just OK ☐ Bad ☐

13. ***Was it easy to use the remote-control for the Data Broadcasting? (if you had a chance)***

Yes ☐ Not really ☐ No ☐

14. Will you use the Data Broadcasting service once it has started?

Yes ☐ No ☐ Reasons : _____

15. What information would you like to see on data broadcasting?

Sports ☐ Drama ☐ Music ☐ Movie ☐ News ☐ Weather ☐

Program Schedule ☐ Other: _____

16. Which shows would you like to have linked to data broadcasting?

News ☐ Sports ☐ Itshireletse ☐ Silent Shout ☐

The Eye ☐ Movies ☐ *Other:* _____

17. What genre of television programs would you like to see on mobile television?

Sports ☐ Drama ☐ Music ☐ Movie ☐

News ☐ Weather ☐ Other: _____

18. Any other comment

Appendix C

Questionnaire for Demonstration (Setswana Version)

1. ***Bong***

   Rre ☐ Mme ☐

2. ***Dingwaga tsa gago***

   Kwa tlase ga 25 ☐ 26 – 40 ☐ 41 – 60 ☐ Kwa godimo ga 60 ☐

3. ***O direla kae/Lephata***

   Mmereki wa Puso ☐ NGO ☐ Khamphani (IT) ☐ Khamphani (tse dingwe) ☐
   Moithuti ☐
   Tse Dingwe _____

[Dithulaganyo BTV]

4. ***O lebelela BTV go le kafe?***

   Thata ☐ Nako tse dingwe ☐ Ga ke e lebe ☐

5. ***Ga ntsi o lebelela BTV ka nako efe?***

   Maphakela ☐ Motshegare ☐ Maitseboa ☐ Bosigo ☐

6. ***Ga ntsi o lebelela BTV le bo mang?***

   O le nosi ☐ Ba lelwapa ☐ Ditsala ☐
   Ba bangwe _____

7. ***O rata mohuta wa thulaganyo efe?***

   Metshameko ☐ Bodiragatsi ☐ Mmino ☐ Difilimi ☐ Dikgang ☐
   Tsa tepo loapi ☐
   Tse dingwe: _____

8. ***Ke efe thulaganyo ya BTV e o e ratang go fetisa?***

   _____

9. ***O ikgethela dithulaganyo dife?***

   Tsa mo gae ☐ Tsa mafatshe a sele ☐

[Data Broadcasting]

10. A go ne go le motlhofo go tlhaloganya maranyane a data broadcasting?

Ee ☐ Eseng thata ☐ Nnyaa ☐

11. O bone ditebego tsa data broadcasting di ntse jang?

Di dintle ☐ Di siame ☐ Di maswe ☐

12. ***A go ne go le motlhofo go dirisa Data Broadcasting? (fa o nnile le sebaka)***

Ee ☐ Eseng thata ☐ Nnyaa ☐

13. A o tlaa dirisa maranyane a data broadcasting fa a sena go simolola?

Ee ☐ Nnyaa ☐

Mabaka: _____

14. O ka eletsa go bona dikitsiso dife mo data broadcasting?

Metshameko ☐ Bodiragatsi ☐ Mmino ☐ Difilimi ☐ Dikgang ☐

Tepo loapi ☐ Lenaneo la dithulaganyo ☐

Tse dingwe**:**_____

15. O ka rata go bona dithulaganyo dife mo data broadcasting?

Dikgang ☐ Metshameko ☐ Itshireletse ☐ Silent Shout ☐

The Eye ☐ Movies ☐

Tse dingwe*:*_____

16. O ka rata go bona mofuta ofe wa dithulaganyo mo?

Metshame ☐ Bodiragatsi ☐ Mmino ☐ Difilimi ☐

Dikgang ☐ Tsa Tepo Loapi ☐

Tse dingwe**:** _____

17. Re fe maikutlo a gago

_____

Supported by Japan International Cooperation Agency (JICA)
Project for Implantation of the Digital Migration Project (DiMT)

Separate Volume -4
ISDB-T Standards of Botswana and Technical Specification for digital receivers

ISDB-T STANDARDS OF BOTSWANA

ISSUED BY

BOTSWANA COMMUNICATIONS REGULATORY AUTHORITY

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Contents

Issued by:

Botswana Communications Regulatory Authority
Plot 5067 Independence Avenue
Private Bag 00495
Gaborone
Botswana

Telephone: +267 395 7755
Fax: +267 395 7976
E-mail:
Website: http://www.bocra.org.bw/

Scope

This document serves to provide technical specifications of equipment and products, and to establish secure the interconnectivity/interoperability by defining ISDB-T Standards of Botswana. The document is compiled for Botswana by extracting and modifying essential parts from ARIB Standards completed in Japan and the Standards of ABNT (Associação Brasileira de Normas Técnicas) as described in Recommendation ITU-R BT.1306.

Botswana Communications Regulatory Authority shall type-approve all ISDB-T equipment based on the standards defined in this document.

The Annex, which is the integral part of the standards, covers the details of Botswana Standards as modified from the existing standards;

Reference Documents to the Standards

1. ***T***he Appendix ***1***, ***Titled*** **"Operational Guidelines for Operating ISDB-T Broadcasting"** is not the integral part of ***the standards but gives*** supplementary ***information*** to the standards, ***and*** covers the operational guidelines for the general operations at broadcasting stations for digital terrestrial television broadcasting and functional specifications for digital terrestrial television equipment***.***
2. The Appendix 2, "Titled **"Botswana ISDB-T Standards Development Process"** gives full details of how the Botswana ISDB-T standards were developed. The document gives specific details (section and Items) and the rationale of modifications done on the existing ISDB-T standards to derive Botswana ISDB-T standard.

Entry into force

This specification shall enter into force on DD/MM/YY.

Document History

Description	**Status**	**Date**
Edition 1	Draft	10/03/15

ISDB-T Standards

1. Transmission

Parameters are given in Table 1c) of ITU-R BT.1306. For details, ABNT NBR 15601 shall be referred as listed in Appendix 3 to Annex 1 of ITU-R BT.1306. Because ABNT NBR 15601 is the standards for 6MHz/ch transmission bandwidth, the transmission parameters have been modified for 8MHz/ch transmission bandwidth as shown here-below. The following transmission parameters would apply;

- Symbol duration : 6/8 shorter than 6MHz/ch
- Bandwidth : 8/6 wider than 6MHz/ch
- IFFT sample clock : 8/6 faster than 6MHz/ch
- transmission bitrate : 8/6 faster than 6MHz/ch
- Guard interval length : 6/8 shorter than 6MHz/ch
- channels : set by every 8MHz
- 13 segments in 8MHz

See Annex 1 for details.

2. Video Coding

All the technical parameters related to video coding shall be in accordance with ABNT NBR 15602-1. However the frame rate of 25 Hz and 50 Hz, and the video format of 576i and 576p shall be supported and video coding parameters for full-seg services are applied to any layers except for the partial reception layer. See Annex 2 for details.

3. Audio Coding

All the technical parameters related to audio coding shall be in accordance with ABNT NBR 15602-2. However audio coding parameters for full-seg services are applied to any layers except for the partial reception layer.

4. Multiplexing

All the technical parameters related to multiplex shall be in accordance with ABNT NBR 15602-3.

5. Service information

The technical parameters related to service information shall be in accordance with ABNT NBR15603 with the following modifications;

- Network ID, Service ID, and Affiliation ID shall be allocated to be respectively unique within Botswana, and Remote Control Key ID shall be allocated to be unique within each of the broadcast service areas.

See Annex 4 for the details.

6. Receiver

The technical parameters related to receivers shall be in accordance with ABNT NBR15604. The operational specifications defined in document DTT001 shall apply.

7. Security issues

All the technical parameters related to security issues shall be in accordance with ABNT NBR 15605-1.

8. Data broadcasting

ISDB-T Standards covers multiple Data broadcasting standards such as BML, Ginga and HTML5.

All the technical methods and parameters for BML data broadcasting, subtitle and superimposed characters coding shall be in accordance with ARIB STD-B24.

The character set and character coding shall be as per Annex 6. Annex 6 gives Data broadcasting standard with respect to remote control requirements.

9. Interactive channel

All the technical parameters related to interactive channel shall be in accordance with ABNT NBR 15607-1.

10. Emergency Warning Broadcast System (EWBS)

All the technical methods and parameters shall be in accordance with ISDB-T Harmonization Document PART 3: Emergency Warning Broadcast System (EWBS).

Annex

The annex details Botswana Standards as modified from the existing standards

Annex 1 Transmission

Table A1-1 Transmission Parameters

Item		Botswana ISDB-T Standards
6.1 Table 1 — Parameters of the transmission system	2. Segment width	8000/14 = 571.43 kHz
	3. Used bandwidth	7.433MHz(mode1) 7.431MHz(mode2) 7.429(mode3)
	6. Active symbol duration	189μs (mode 1) 378 μs (mode 2) 756 μs (mode 3)
	7. Carrier spacing	Bws/108 = 5.291… kHz Bws/216 = 2.645… kHz Bws/432 = 1.322… kHz
	8. Guard interval duration	47.25, 23.625, 11.8125, 5.90625 μs (mode1) 94.5, 47.25, 23.625, 11.8125 μs (mode2) 189, 94.5, 47.25, 23.625 μs (mode3)
	9. Overall symbol duration	236.25, 212.625, 200.8125, 194.90625 μs (mode1) 472.5, 425.25, 401.625, 389.8125 μs (mode2) 945, 850.5, 803.25, 779.625 μs(mode3)
6.1 Principal parameters		Further, pilot signal shall be added to data segment in the OFDM framing section to form an OFDM segment (with a bandwidth of 8/14 MHz).
		Up to three hierarchical layers may be transmitted in an 8 MHz channel.
OFDM segment parameters		ARIB STD-B31 Version 2.2-E1 Table A-5: ODFM Segment Parameters (8MHz Bandwidth System)

Item	Botswana ISDB-T Standards
Transmission signal parameters	ARIB STD-B31 Version2.2-E1 Table A- 6: Transmission Signal Parameters (8MHz Bandwidth System)
Data rate of a single segment	ARIB STD-B31 Version2.2-E1 Table A- 7: Data Rate per a Single Segment (8MHz Bandwidth System)
Total data rate	ARIB STD-B31 Version2.2-E1 Table A- 8: Total Data Rate*1 (8MHz Bandwidth System)
6.15.1 Position of the segments within the 6 MHz spectrum	6.15.1 Position of the segments within the 8 MHz spectrum
7.1 Frequency bandwidth	A frequency bandwidth of 7.6 MHz shall be used for digital terrestrial television broadcasting.
	The frequency bandwidth shall be 7.6 MHz when the OFDM carrier bandwidth is 7. 433 MHz with 5.291 kHz spacing between carrier frequencies in Mode 1. This bandwidth shall apply regardless of which mode is chosen, and has been selected to ensure that the bandwidth of 7. 480 MHz has some margin to determine that each carrier of the uppermost and lowermost in the 7.433..MHz bandwidth includes 99 % of energy.
7.3 Frequency offset of the OFDM carriers	Offset not be used.
	High VHF channels not be used.
	See table A1-3 for 8MHz/ch UHF channels

Item	Botswana ISDB-T Standards
7.4 IFFT sampling frequency and permissible deviation	The IFFT sampling frequency for use with OFDM for digital terrestrial television broadcasting shall be as follows: Fs = 2048/189 MHz = 10 835 978 Hz
	The permissible deviation is ± 0.2 Hz/MHz.
	An IFFT sampling frequency of 2048/189 MHz, a theoretical sample frequency, may be used if the permissible deviation requirement is met.
7.5.1 Characteristics of the transmission spectrum mask	7.5.1 Characteristics of the spectrum limit mask The out-of-band spectrum level allocated for broadcasting the television signal shall be reduced applying a proper filtering. Figure A1-1 and Table A1-4 indicate the spectrum limit mask for sensitive and non-critical mask, where the relative power level is defined in a reference bandwidth of 4kHz with the 0dB reference level corresponding to the mean output power measured in the channel bandwidth as described in ITU-R Recommendation BT.1206-1.
	See Figure A1-1 for 8MHz/ch Spectrum limit masks
	See Table A1-4 for 8MHz/ch break points

Item	Botswana ISDB-T Standards
7.5.2 Criteria for applying masks	Two spectrum masks are specified in Fig. A1-1 and the associated Table A1-4. The upper curve defines the spectrum mask for the non-critical cases and the lower curve defines the spectrum mask for the sensitive cases as described in ITU-R Recommendation BT.1206-1.
7.6 Table 45 — Allowable spurious emission power	See Table A1-5 for Allowable spurious emission power as described in RR Appendix 3 or ITU-R SM.329.

Table A1-2 Examples of transmission capacities for AC carriers
(mode 1, guard interval of 1/8) (See Table A1-1 Column 6.14.4 Table 25)

	Synchronous modulation's segment		Differential modulation's segment	
	1	13	1	13
AC1	9,4 kbps	121,7 kbps	9,4 kbps	121,7 kbps
AC2	-	-	18,7 kbps	243,4 kbps

Table A1-3 8MHz/ch UHF channels
(See Table A1-1 Column 7.3 Frequency offset of the OFDM carriers)

Channel	Start Frequency (MHz)	End Frequency (MHz)	Center Frequency (MHz)
21	470	478	474
22	478	486	482
23	486	494	490
24	494	502	498
25	502	510	506
26	510	518	514
27	518	526	522
28	526	534	530
29	534	542	538
30	542	550	546
31	550	558	554
32	558	566	562
33	566	574	570
34	574	582	578

Channel	Start Frequency (MHz)	End Frequency (MHz)	Center Frequency (MHz)
35	582	590	586
36	590	598	594
37	598	606	602
38	606	614	610
39	614	622	618
40	622	630	626
41	630	638	634
42	638	646	642
43	646	654	650
44	654	662	658
45	662	670	666
46	670	678	674
47	678	686	682
48	686	694	690

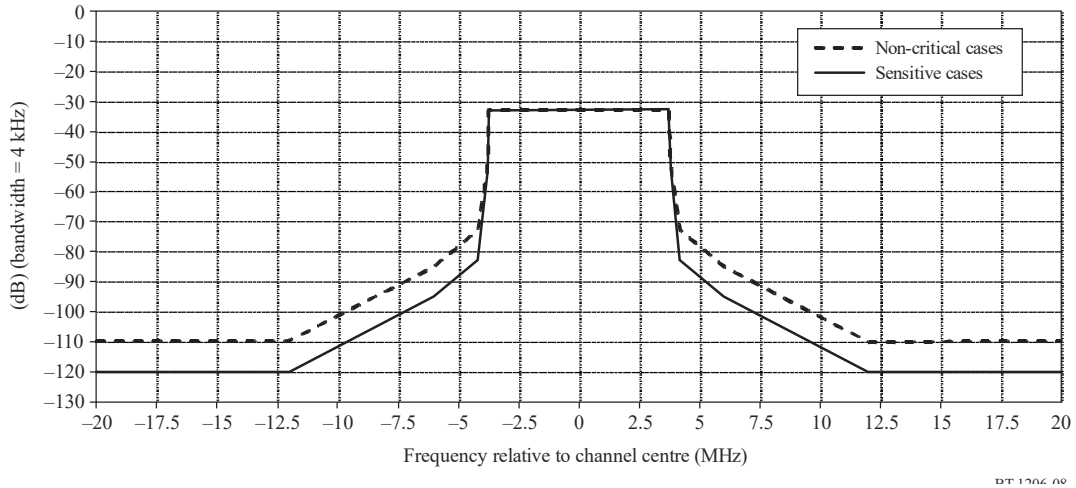

Figure A1-1 Transmission spectrum limit masks for 8 MHz
(See Table A1-1 Column 7.5 Transmission spectrum mask)

Table A1-4 Break points corresponding to Figure A1-1
(See Table A1-1 Column 7.5 Specification of the transmission spectrum mask)

Frequency relative to the center of the 8 MHz channel (MHz)	Relative level in a 4 kHz measurement bandwidth (dB)	
	Non-critical emission mask	Sensitive cases
–20	–110	–120
–12	–110	–120
–6	–85	–95
–4.2	–73	–83
–3.81	–52.7	–52.7

Frequency relative to the center of the 8 MHz channel (MHz)	Relative level in a 4 kHz measurement bandwidth (dB)	
	Non-critical emission mask	Sensitive cases
–3.72	–32.7	–32.7
+3.72	–32.7	–32.7
+3.81	–52.7	–52.7
+4.2	–73	–83
+6	–85	–95
+12	–110	–120
+20	–110	–120

Table A1-5 Allowable spurious emission power

(See Table A1-1 Column 7.6 Table 45 — Allowable spurious emission power)

Separation in relation to the digital signal central carrier	Attenuation (dB) below the power supplied to the antenna transmission line
> 20 MHz	46+10log(P),or 60dBc, whichever is less stringent, without exceeding the absolute mean power level of 12mW for UHF stations.
< - 20 MHz	

Annex 2 Video coding

Video coding parameters for full-seg services shown in Table A2-2 are applied to any layers except for the partial reception layer.

Table A2-1 Video Coding

Item	Botswana ISDB-T Standards
5.4 Parameters for video signals	ITU Recommendation BT.709-5 and ITU Recommendation BT.601-5.for 50Hz field frequency. Video coding parameters for Full-Seg services should meet the parameters indicated in Table A2-2.
8.3.1 General specifications	5 Hz, 10 Hz, 12 Hz, 15 Hz, 24 Hz, 25 Hz, 30 Hz

Table A2-2 Video coding parameters for Full-Seg services

Number of horizontal pixels	Number of vertical pixels	Frame rate [Hz]	Scanning system	Aspect ratio	Profile and level
720	576	25	Interlaced	4:3 16:9	H.264|MPEG-4 AVC HP@L3
720	576	50	Progressive	16:9	H.264|MPEG-4 AVC HP@L3.1
1280	720	50	Progressive	16:9	H.264|MPEG-4 AVC HP@L4
1920	1080	25	Interlaced	16:9	H.264|MPEG-4 AVC HP@L4
1920	1080	25	Progressive	16:9	H.264|MPEG-4 AVC HP@L4

Annex 3 Audio coding

Audio coding parameters for full-seg services are applied to any layers except for the partial reception layer.

Annex 4 Service information

Table A4-1 Service Information

Item	Botswana ISDB-T Standards
6.1 PID used for tables transmission	specified by signal of broadcasters.

TableA4.2 Service Information

Item	Botswana ISDB-T Standards
8.3.4 Component descriptor	Add video formats described in table A5-4 to Table 28.
8.3.30 Video decode control descriptor	Add video encoding format as described in Table A5-5.
8.3.31 Terrestrial delivery system descriptor	(474 + 8 x (X – 21)) x 7 = (xxx)d
Area_code specification	Assignment of area_code is in compliance with Appendix 1 (reference document)
Specification for tuning physical and logical channel	- 8MHz
Original_network_id	Refer to Annex A4-1 in this document about the structure of original_network_id.

Table A4-3 Modifications from ABNT NBR 15603-3

Item	Botswana ISDB-T Standards
8.2.5 Short node information descriptor	EXAMPLE English has 3-character code "eng", which is coded as: “0110 0101 0110 1110 0110 0111”, and Setswana has 3-character code “tsn”, which is coded as: “0111 0100 0111 0011 0110 1110”
B.1.4.3 B.2.7	- Botswana

Table A4-4 Stream_content and component_type (additional items)
(See Table A4-2 Column 8.3.4 Component descriptor)

Stream_content	Component_type	Description
0x05	0x05	H264/AVC video 625i(576i), 4:3 aspect ratio
0x05	0x06	H264/AVC video 625i(576i), 16:9 aspect ratio with pan vectors
0x05	0x07	H264/AVC video 625i(576i), 16:9 aspect ratio without pan vectors
0x05	0x08	H264/AVC video 625i(576i), > 16:9 aspect ratio
0x05	0xA5	H264/AVC video 625p(576p), 4:3 aspect ratio
0x05	0xA6	H264/AVC video 625p(576p), 16:9 aspect ratio with pan vectors
0x05	0xA7	H264/AVC video 625p(576p), 16:9 aspect ratio without pan vectors
0x05	0xA8	H264/AVC video 625p(576p), > 16:9 aspect ratio

Table A5-5 Video encoding format
(See Table A4-2 Column 8.3.30 Video decode control descriptor)

Video encoding format	Description
0000	1080p
0001	1080i
0010	720p
0011	480p or 576p
0100	480i or 576i
0101	240p
0110	120p
0111	Reserved
1000	180p
1001-1011	Reserved
1100-1111	For video encoding format extension

A4-1 Original_network_id
(See Table A5-2 Column Annex H.2: Original_network_id)

Refer to Figure A5-1 about the structure of original_network_id.

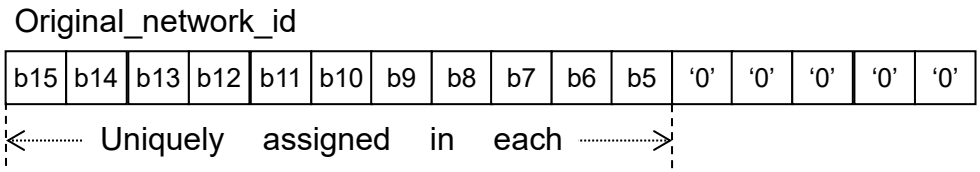

Figure A5-1 Structure of original_network_id

Annex 5 Receiver

Table A5-1 Receiver

Section No. and item	Botswana ISDB-T Standards
Video Output	- PAL-I - Standard: I
6: Environment and safety conditions	Relevant Botswana Standards
7.1: Reception antenna	a) the antenna shall allow the reception of digital terrestrial television signals that are comprehended between the UHF channels from 21 to 48;
Connector	type IEC 61169-2
7.2.2.1: Fixed or mobile (full-seg) reception devices	The receiver unit shall be able to tuning the television channels limited by the UHF band, comprehended between the channels 21 to 48.
7.2.2.2: Portable devices for partial reception (one-seg)	The partial reception unit shall be able to tuning, at least, the television channels limited by the UHF band, comprehended between the channels 21 to 48.
	Deleted
7.2.3 Channel bandwidth	a) fixed or mobile (full-seg) reception devices: 7.6 MHz; b) portable (one-seg) devices: 0.58 MHz.
7.2.4: Table 3 – Frequencies of channels of UHF band	See Table A1-3 for 8MHz/ch UHF channels

Section No. and item	Botswana ISDB-T Standards
7.2.5: Sensitivity	a) minimum antenna signal input level: - 78,4 dBm or lower; b) maximum antenna signal input level: equal or higher than 0 dBm;
7.2.6: Selectivity – Protection ratio	Deleted
7.2.7: First intermediate frequency (IF)	The central frequency of the IF shall be of 36 MHz, and optionally direct conversion in base band. Low-IF under 10MHz is also acceptable such as for Silicon-Tuner use. As for frequency conversion, either upper or lower heterodyne conversion is acceptable as long as there is no side-effect.
7.2.21: Primary data decoder	All the technical methods and parameters for BML data broadcasting shall be in accordance with ARIB STD-B24.
7.2.27.7: RF Output	according to Clause 8, Table 10.
7.2.28: Remote control	See Table A6-2 for remote control keys used for data broadcasting; and Fig A6-1 for examples of remote controllers.
8.1.4.2: Full-seg receiver	The full-seg receivers shall support at least the video decoding in the 576i, 576p, 720p, 1080i and 1080p format~~s~~.
8.1.4.4: Full-seg receiver with support to the one-seg exhibition	See Table A6-3 for resolutions which shall be supported.
8.1.5.1 Full-seg receivers	The full-seg receivers shall at least support the frames rate of 25 Hz and 50 Hz.
8.1.5.2 One-seg receiver	The one-seg receivers shall at least support the frames rate 5fps, 10fps, 12fps, 15fps, 24fps, 25fps and 30fps

Section No. and item	Botswana ISDB-T Standards
8.1.6.1: Full-seg receivers type digital converter	8.1.6.1 Full-seg receivers type digital converter The digital converter receiver (set-top box) shall have an RCA connector, 75 Ω, for composite video 625i output encoded in PAL-I. The video signal with the specified configuration shall always be present independently of the encoder parameters of a video pertaining to the stream received for decoding. This requirement is optional for integrated receivers with display, fixed or portable.
9: Primary data decoding	About Data broadcasting, all the technical methods and parameters for BML shall be in accordance with ARIB STD-B24. See attached document.
11.3 Semantics for parental rating descriptor	EXAMPLE Botswana country has 3 character code " BWA", which is coded as: “0100 0010 0101 0111 0100 0001”
11.4 Cases in which the receiver shall not block the event	BWA”=0x425741
14.1.2: Full-seg receiver	It is optional for the full-seg receiver manufacturers to provide the USB port.
Annex A: Priority parameters of the receiver unit	In “ISDB-T HARMONIZATION DOCUMENT PART 1: HARDWARE” (NOTE)

Table A5-2 Remote control keys used for data broadcasting
(See Table A5-1 Column 7.2.28: Remote control)

Key type	Guidelines
↑、↓、←、→ (up, down, left, right keys)	To move up, down, left, right.
0 - 9 (number keys)	To input numbers
Confirm	Separator of operation (enter)
Back	Cancel operation
	Back space of user input character (or bulk erase)

	Disconnection of a call to a communication server (*)During connection, receiver units will take the instruction; after connection, instruction is carried out in the contents. (A display to the effect that the connection will be terminated is desirable when the back key is pressed.)
	(*)It is okay to use BML documents for the purpose of going back. However, whether or not there is something after returning should be considered.
Data	Switches display/non-display of multi-media data broadcasting. (*)Separated “Data” button is recommended.
Red, green, yellow, and blue (color keys)	Selection of operation (execution) (*)Location of buttons on the remote control should be in order of red, green, yellow, blue from the left.
Bookmark (Optional)	Recording of bookmark.

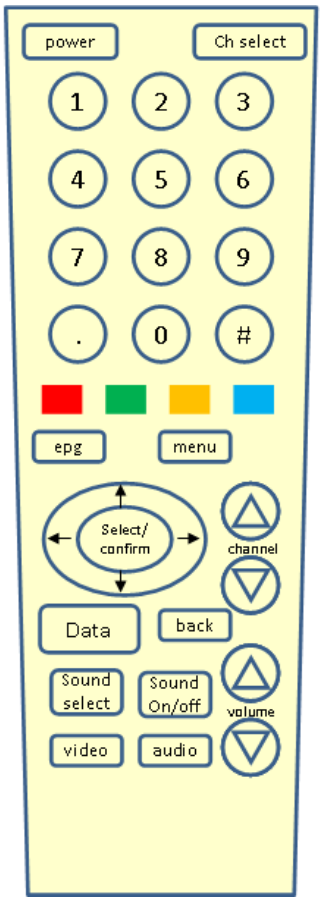

Fig A5-1 Example of Remote Controller
(See Table A5-1 Column 7.2.28: Remote control)

Table A5-3 Resolutions which shall be supported

Output video format	Aspect ratio	Number of lines to be decoded	Aspect ratio info	Output video format	Aspect ratio	Number of lines to be decoded	Aspect ratio idc
SQVGA	4:3	160 x 120	1	576i	4:3	720 x 576	2

SQVGA	16:9	160 x 90	1	576i	16:9	720 x 576	4
QVGA	4:3	320 x 240	1	576p	16:9	720 x 576	4
QVGA	16:9	320 x 180	1	720p	16:9	1280 x 720	1
CIF	4:3	352 x 288	2	1080i	16:9	1920 x 1080	1
				1080p	16:9	1920 x 1080	1

Annex 6 Data broadcasting

All the technical methods and parameters for BML data broadcasting, subtitle and superimposed characters coding shall be in accordance with ARIB STD-B24.
ARIB STD-B24 includes the usage of UCS (Universal multi-octet coded character set) and UTF-8 (UCS Transformation Format—8-bit) in it, yet it is intended for the usage in Japan only. Therefore for the usage in Botswana, some modifications are needed.

A6-1 Modifications for BML data broadcasting

The details of the modifications from ARIB STD-B24 necessary for BML data broadcasting in Botswana are shown in Table A6-1-1.

Table A6-1-1 BML data broadcasting

Item	Botswana ISDB-T Standards
7.2 Universal multi-octet coded Character Set (UCS)	For Botswana localized character set. See Table A6-1-2.
	See “7.1.2 Coding of control function” and Tables 7-14, 7-15, 7-16, and 7-17.
	Adding descriptions about UTF-8. - No use “Byte Order Mark”. - C0 control codes (0x00 – 0x1F) are 0x0000 – 0x001F in UTF-8. - C1 control codes (0x80 – 0x9F) are 0xC280 – 0xC29F in UTF-8.

Table A6-1-2 Character set for Botswana (See Table A6-1-1 Column 7.2 Universal multi-octet coded Character Set (UCS))

U+0021	U+002D	U+0039	U+0045	U+0051	U+005D	U+0069	U+0075	U+00A4	U+00BC	U+201D	U+20A7	U+20B3
!	–	9	E	Q	]	i	u	¤	¼	”	₧	₳
U+0022	U+002E	U+003A	U+0046	U+0052	U+005E	U+006A	U+0076	U+00A5	U+00BD	U+203C	U+20A8	U+20B4
″	.	:	F	R	^	j	v	¥	½	‼	₨	₴
U+0023	U+002F	U+003B	U+0047	U+0053	U+005F	U+006B	U+0077	U+00A7	U+00BE	U+2047	U+20A9	U+20B5
#	/	;	G	S	_	k	w	§	¾	⁇	₩	₵
U+0024	U+0030	U+003C	U+0048	U+0054	U+0060	U+006C	U+0078	U+00A9	U+00D7	U+2048	U+20AA	U+20B6
$	0	<	H	T	`	l	x	©	×	⁇	₪	₶
U+0025	U+0031	U+003D	U+0049	U+0055	U+0061	U+006D	U+0079	U+00AB	U+00F7	U+2049	U+20AB	U+20B7
%	1	=	I	U	a	m	y	«	÷	⁉	₫	₷
U+0026	U+0032	U+003E	U+004A	U+0056	U+0062	U+006E	U+007A	U+00AE	U+00CA	U+20A0	U+20AC	U+20B8
&	2	>	J	V	b	n	z	®	Ê	₠	€	₸
U+0027	U+0033	U+003F	U+004B	U+0057	U+0063	U+006F	U+007B	U+00B0	U+00D4	U+20A1	U+20AD	U+20B9
’	3	?	K	W	c	o	{	°	Ô	₡	₭	₹
U+0028	U+0034	U+0040	U+004C	U+0058	U+0064	U+0070	U+007C	U+00B1	U+00EA	U+20A2	U+20AE	U+20BA
(	4	@	L	X	d	p	|	±	ê	₢	₮	₺
U+0029	U+0035	U+0041	U+004D	U+0059	U+0065	U+0071	U+007D	U+00B5	U+00F4	U+20A3	U+20AF	U+2103
)	5	A	M	Y	e	q	}	µ	ô	₣	₯	℃
U+002A	U+0036	U+0042	U+004E	U+005A	U+0066	U+0072	U+007E	U+00B6	U+2018	U+20A4	U+20B0	U+2109
*	6	B	N	Z	f	r	~	¶	‘	£	₰	℉
U+002B	U+0037	U+0043	U+004F	U+005B	U+0067	U+0073	U+00A2	U+00B7	U+2019	U+20A5	U+20B1	U+2116
+	7	C	O	[	g	s	¢	·	’	₥	₱	№
U+002C	U+0038	U+0044	U+0050	U+005C	U+0068	U+0074	U+00A3	U+00BB	U+201C	U+20A6	U+20B2	U+2121
,	8	D	P	¥	h	t	£	»	“	₦	₲	℡

Table A6-1-2 Character set for Botswana (Cont.)

U+2122	U+215B	U+2168	U+2178	U+2198	U+25B2	U+260F	U+263B	U+266C
™	⅛	Ⅸ	ⅸ	↘	▲	☏	☻	♬
U+2150	U+215C	U+2169	U+2179	U+2199	U+25B3	U+2610	U+2660	U+266D
☐	⅜	Ⅹ	ⅹ	↙	△	☐	♠	♭
U+2151	U+215D	U+216A	U+217A	U+21D0	U+25BC	U+2611	U+2661	U+266E
☐	⅝	Ⅺ	ⅺ	⇐	▼	☑	♡	♮
U+2152	U+215E	U+216B	U+217B	U+21D1	U+25BD	U+2612	U+2662	U+266F
☐	⅞	Ⅻ	ⅻ	⇑	▽	☒	♢	♯
U+2153	U+2160	U+2170	U+2190	U+21D2	U+2600	U+2613	U+2663	U+26C4
⅓	Ⅰ	ⅰ	←	⇒	☀	X	♣	☃
U+2154	U+2161	U+2171	U+2191	U+21D3	U+2601	U+2614	U+2664	U+26C5
⅔	Ⅱ	ⅱ	↑	⇓	☁	☔	♤	⛅
U+2155	U+2162	U+2172	U+2192	U+21D4	U+2602	U+261C	U+2665	U+26C6
⅕	Ⅲ	ⅲ	→	⇔	☂	☜	♥	□
U+2156	U+2163	U+2173	U+2193	U+21D5	U+2603	U+261D	U+2666	U+26C7
⅖	Ⅳ	ⅳ	↓	⇕	☃	☝	♦	□
U+2157	U+2164	U+2174	U+2194	U+21D6	U+2604	U+261E	U+2667	U+26C8
⅗	Ⅴ	ⅴ	↔	⇖	☄	☞	♧	□
U+2158	U+2165	U+2175	U+2195	U+21D7	U+2605	U+261F	U+2669	
⅘	Ⅵ	ⅵ	↕	⇗	★	☟	♩	
U+2159	U+2166	U+2176	U+2196	U+21D8	U+2606	U+2639	U+266A	
⅙	Ⅶ	ⅶ	↖	⇘	☆	☹	♪	
U+215A	U+2167	U+2177	U+2197	U+21D9	U+260E	U+263A	U+266B	
⅚	Ⅷ	ⅷ	↗	⇙	☎	☺	♫	

A6-2 Modifications for subtitle and superimposed characters

Table A2-2 Modifications for Subtitle and superimposed characters

Section No. and item	Botswana ISDB-T Standards
4 Presentation function of caption and superimpose Presentation function of caption	Characters defined in UTF-8 character code
5.2 Character set	Character set defined in UCS should be used.
5.5 Character coding	For character coding, UTF-8 character code shall be used.
5.6 Control code	Control code used for caption is in compliance with Annex A8-1 in this document.

Appendix Operational Guideline

1. Transmission

Operational guideline of transmission should be referred to ABNT NBR 15608-1 with the modifications as follows.

- Delete or ignore all the descriptions of VHF
- Replace DQPSK with QPSK

For more detail, please refer to the table AP1-1.

Concerning the channel planning described in the above document, coverage parameters can be defined by Botswana based on other materials: The recommendation ITU-R BT.1368 is one of the useful materials for the planning criteria. The recommendation ITU-R BT.2036 is also useful for a reference receiving system. Available parameters according to hierarchical transmission mode should be referred to the table AP1-2.

Table AP1-1 Modifications from ABNT NBR 15608-1

Section No. and item	page	Original ISDB-T Standards	Botswana ISDB-T Standards
5.2 Frequency assignment	4	tables 2, 3, 4, 5 and 6	Table A1-3 8MHz/ch UHF channels
		table2 -VHF Channels	N/A
		table4-High VHF channels	N/A
	5	table 5 14ch-69ch	21-48ch
6.1 Outline	7	6.1 Outline DQPSK or 16QAM is employed	QPSK or 16QAM is employed
6.2.1 Multiplexing …	7	6.2.1, DQPSK is preferable …	Deleted
	8	table8	Ignore DQ and DQPSK
6.3 channel-coding…	12	DQPSK	QPSK
	16	Figure7, 8, 9 and 10 DQPSK	QPSK
8.3.1 Broadcasting…	19	0.3ppm	0.2ppm
9.4.3 Data arrangement…	38	d) EXEMPLO DQPSK	QPSK
10 Transmission…	42	Table 30 Delay time	Delay time values are to be replaced to the ones multiplied by 6/8
11.5 Example of link budget	57	Table42 DQPSK 1/2: 6.2 2/3: 7.7 3/4: 8.7 5/6: 9.6 7/8: 10.4	QPSK 1/2: 4.9 2/3: 6.6 3/4: 7.5 5/6: 8.5 7/8: 9.1
	58	Table43 DQPSK Data rate	QPSK All data rate are to be replaced to the one multiplied by 8/6

Table AP1-2 Available Parameters According to Hierarchical Transmission Mode

Patterns	Layer	Layer Name	Number of segments	Transmission (See Table AP1-3)
(1)	A	Low Protection Layer	13	a
(2)	A	Low Protection Layer	13	b
(3)	A	High Protection Layer	1 (Partial reception)	c
	B	Low Protection Layer	12	a
(4)	A	High Protection Layer	8 to 2	b
	B	Low Protection Layer	5 to 11	a
(5)	A	High Protection Layer	1 (Partial reception)	c
	B	Low Protection Layer	12	b
(6)	A	High Protection Layer	1 (Partial reception)	c
	B	Middle Protection Layer	7 to 1	b
	C	Low Protection Layer	5 to 11	a

(Note) With regard to combinations of transmission parameters, Type c of transmission mode shall take transmission parameters with an equal or lower CN ratio than Type b of transmission mode and Type b of transmission mode shall take transmission parameters with a lower CN ratio than Type a of transmission mode. The required CN ratios are shown in Table 42 of ABNT NBR 15608-1 modified according to the table AP1-1. For example, if layer A in (5) uses 16QAM and 1/2, layer B may use only 16QAM and 1/2, or 16QAM and 2/3 as shown in Type b in Table AP1-3 as modulation and error correction parameters.

Layers: A, B and C represent layers described in the TMCC signal.

Layer name: The name of the layer used in Hierarchical transmission described in ABNT NBR 15608-3.

The services provided by the layers to which transmission mode (Type a), transmission mode (Type b) and transmission mode (Type c) shown in Table AP1-2 are respectively applied may be called the “fixed service”, “mobile service” and “portable service”, respectively.

No digital audio service will be provided.

Table AP1-3 Transmission Parameters

Type	Mode(Note 1)			Guard Ratio(Note 1)				Time Interleave(Note 2)				Modulation and Error Correction														
												64QAM					16QAM					QPSK				
	1	2	3	1/4	1/8	1/16	1/32	I=0	I=1	I=2	I=4	7/8	5/6	3/4	2/3	1/2	7/8	5/6	3/4	2/3	1/2	7/8	5/6	3/4	2/3	1/2
a	X	X	O	O	O	O	X	X	O	O	O	O	O	O	O	O	X	X	X	O	O	X	X	X	X	X
b	X	X	O	O	O	O	X	X	O	O	O	X	X	X	X	X	X	X	X	O	O	X	X	X	O	O
c	X	X	O	O	O	O	X	X	O	O	O	X	X	X	X	X	X	X	X	X	O	X	X	X	O	O

O: Transmission parameters that can be used

X: Transmission parameters that cannot be used

Note 1: The mode and guard ratio are specified and applied to all layers and they cannot be individually specified for each layer.

Note 2: The use of “no time interleaving (I=0)” shall be restricted even in fixed reception, considering the tolerance to pulse noise.

A-3

2. Video Coding

The operational guideline of video coding should be referred to ABNT NBR 15608-2. However video coding parameters for full-seg services are applied to any layers except for the partial reception layer.

3. Audio Coding

The operational guideline of audio coding should be referred to ABNT NBR 15608-2. However audio coding parameters for full-seg services are applied to any layers except for the partial reception layer.

4. Multiplexing

The operational guideline of multiplexing should be referred to ABNT NBR 15608-3.

5. Service Information

Operational guideline of service information should be referred to ABNT NBR 15608-3 with the modifications as shown in Table AP5-1.

AP5-1 Modifications from ABNT NBR 15608-3

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
2 Normative references	1	ABNT NBR 15606-2, Digital terrestrial television	Deleted
5.1 Coding table	3	The PSI/SI table coding, including tis descriptors adheres to ISO/IEC 8859-15, as shown in Table 1.	The PSI/SI table coding, including tis descriptors adheres to UTF-8, as shown in Appendix 8. Table1, 2 and 3 should be ignored.
	4	For caption strings and data packages coding, the coding table and the control characters shown in Table 2 should be used.	For caption strings and data packages coding, the coding table and the control characters shown in Appendix 8 should be used.
	4	Furthermore, in caption string coding, it is recommended that the special G3 characters shown on Table 3 be used as specified in ABNT NBR 15606-1. Since the G3 special characters are attributed hexadecimals values coincident with the character map defined by ISO/IEC 8859-15, for correct decoding, it is recommended that each G3 special characters value be preceded by the control code <SG3> (0x1D).	Deleted
Table 28 — Attribution of	22	- 0x40 to 0x6F : Mono media and	- 0x40 to 0x7F : Mono media

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
component_tag values		objects carousel - 0x70 to 0x7F : Events messages and data carousel (DII and DDB)	 - 0x40 to 0x7F : Events messages and data carousel (DII and DDB)
Table 30 — ES for transmission in different layers from that intended for partial reception	25	- MPEG-4 AAC Audio (48kHZ) - Mono-media Component tag value : 0x40 to 0x6F - Objects carousel - Event messages and data carousel (DII and DDB) Component tag value : 0x70 to 0x7F	- MPEG-4 AAC Audio - Mono-media Component tag value : 0x40 to 0x7F - Deleted - Event messages and data carousel (DII and DDB) Component tag value : 0x40 to 0x7F
19.2 Local_offset_time_ descriptor configuration	31-32	-BRA -0x425241 -UTC-3 -Brazilian	-BWA -0x425741 -UTC+2 - Botswana
Table 35 — Details of TOT sections	32	- UTC-3 - official Brazilian time - =”BRA”=0x425241 - See Table 36	- UTC+2 - official Botswana time - =” BWA”=0x425741 - =0
Table 36 – Sections of the local_offset_ Time_descriptor	33	Table 36	Deleted
21.2 Additional specification concerning data components Table 39	37	- data_component_id 0x0007 Ginga_XML base multimedia coding - data_component_id 0x00A4 Ginga - Application executing engine - data_component_id 0x00A3 Ginga – Application - data_component_id 0x00A0 Ginga - Application executing engine information table	・data_component_id 0x000C A profile BML (for Home TV) ・data_component_id 0x000D C profile BML (for One-seg)
Table 44 - Data structure of the data content descriptor	41	“por”=0x706F72 (defines the language used in “text char”)	“eng”=0x656E67 or “tsn”=0x74736E can be used
23.5 Operating rules for transmission Table 49	46	- 0011: 480p - 0100: 480i - 0111: 288p - 1001 up to 1111: video_encode_format (extended)	- 0011: 480p or 576p - 0100: 480i or 576i - 0111: Reserved - 1001 up to 1011: Reserved - 1100 up to 1111: video_encode_format (extended)
29.5.1 SDTT Data structure	60	The identification should be made using the prefixes defined by ANATEL.	Deleted

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
29.9.1.6 Band width	71	-0.25/0.38 quantity -0,25 used segment -10x1024x1024x8/(351.07x1000)=238,94 s -The bandwidth of the network of 1 segment is 1 404,29 Kbit/s -1404,29x0,25=351,07 [Kbits/s] -86400/238,94/2=180,8 times	-0.18/0.28 quantity -0.18 used segment -10x1024x1024x8/(337.03x1000)=248.90 s - The bandwidth of the network of 1 segment is 1 872.39 Kbit/s -1872.39x0.18=337.03 [Kbits/s]. Note that the bandwidth limitation is 0.35207 Mbit/s as described above in order to keep consistency with 6 MHz countries about the bandwidth limitation. -86400/248.9/2=173.5 times
29.9.5 Daylight saving time operations (SDTT method)	78	Brazilian time (UTC-3)	Botswana time (UTC+2)
31.2 Affiliation_id	83	The affiliation_id field allows identifying which network (Globo, SBT, Record, Band, RedeTV, etc.) a broadcaster belongs.	The affiliation_id field allows identifying which network a broadcaster belongs.
31.2 Affiliation_id	83	For standardization of affiliation_id value, the characters codes shown in Table 76 should be used in order to generate the affiliation_id value for each network. The mains TV networks and your affiliation_id are shown in Tabl·e 80.	Deleted
31.2 Affiliation_id	83	Table 80	Deleted
31.2 Affiliation_id	83	The networks that are not listed in Table 80 should request the affiliation_id value to the SBTVO Forum.	Deleted

6. Receiver

The operational guideline on receiver should be based on “ISDB-T HARMONIZATION DOCUMENT PART 1: HARDWARE” (at least mandatory and recommended items) (Note). Guard interval mask characteristics should be referred to the recommendation ITU-R BT.2036. Any other items should be in accordance with the Chapter 6 of the main body.

(Note) The “ISDB-T HARMONIZATION DOCUMENT PART 1: HARDWARE” doesn’t correspond to 8MHz system. Japan is ready to propose the modifications to include 8MHz system for the next ISDB-T International Forum..

7. Security Issues

The operational guideline on Security Issues should be in accordance with the Chapter 7 of the main body.

8. Data broadcasting

Operational guideline of BML data broadcasting, subtitle and superimposed characters coding should be in accordance with ARIB TR-B14 Vol.3 “DIGITAL TERRESTRIAL TELEVISION BROADCASTING Specifications for Data Broadcasting Operations”.

There are some modifications for the Botswana guideline as shown in the Table AP8-1. Data broadcasting guideline is referred also in Service Information guideline in point of data_component_descriptor. See Appendix 5 for the details.

Table AP8-1 Modifications from ARIB TR-B14

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
3 Definitions	3-2 3-3	- 8-bit character encoding - DRCS - EUC-JP - Kana-Kanji conversion	Deleted Deleted UTF-8 Deleted
1.2.1 Table 1-2 Presentation restrictions on the screen plane	3-16	- MPEG-2 - MPEG-1 - 8-bit character codes including (*)EUC-JP - 8-bit character codes	H.264 Deleted UTF-8 UTF-8.
1.2.3 Table 1-4 Overview of restriction conditions for mono-media encoding presented in each screen plane	3-21	- MPEG-2 - Stream format identification = 0x02 - MPEG-1 - 8-bit character codes(*) Including EUC-JP	- H.264|MPEG-4 AVC - Stream format identification = 0x1B - Deleted - UTF-8
1.2.4 Table 1-5 Audio playing function	3-25	- AAC-LC - Audio PES; Stream format identification = 0x0F - 48kHz,32kHz	- MPEG4-AAC standard - Audio PES; Stream format identification = 0x11 - 48kHz,44.1kHz
1.2.5 Table 1-6 Fonts	3-25	Character type	See Annex8 Table A8-1-2 for Character set for Botswana
1.4.2 Table 1-9 Type and capacity of BproNV	3-27	Whole of Table	The number of affiliations has been fixed as 24.
1.6 Character entry function	3-28	Functions not defined in this document such as the kana kanji conversion function are implementation dependent.	Deleted
1.6.1 Table 1-12 “charactertype” attribute	3-30	- hankaku - zenkaku - katakana - hiragana	- Deleted - Deleted - Deleted - Deleted

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
1.6.1 Function specifications	3-30	EUC-JP encoding	UTF-8 encoding
1.6.2 Table 1-14 character type	3-32	- 2 byte characters	- Deleted
1.6.3 Kana Kanji conversion function	3-32	Whole of section	Deleted
3.1.1 MPEG-1 Video	3-80	Whole of section	Deleted
3.1.2 MPEG-2 Video	3-80	Whole of section	Deleted
3.1.3 MPEG-4 Visual	3-85	Encoding methods using MPEG-4 Visual are not operated.	Adding H.264|MPEG-4 AVC operation. Details in ABNT NBR 15608-2.
3.3.1 MPEG-2 AAC	3-88	Whole of section	Deleted
3.3.2 AIFF-C	3-89	Whole of section	Deleted
3.3.3 MPEG-4 Audio	3-89	Audio encoding method using MPEG-4 is not operated.	Adding MPEG4-AAC operation. Details in ABNT NBR 15608-2.
3.3.6.2 Simultaneous playable encoding method	3-90	- AAC-LC	- MPEG-4 AAC
3.4 Character encoding	3-91	Whole of section	No use in Botswana
Volume 3 Section 2 4.2.8.7 Data Contents Descriptor Table 4-10 Setup parameters of the Data Content Descriptor for caption	3-107	Fixed to jpn(Japanese).	“eng”=0x656E67 or “tsn”=0x74736E can be used
Volume 3 Section 2 4.4.1 Character codes	3-109	The character encoding method used for caption/superimpose is 8-bit character codes.	The character encoding method used for caption/superimpose is UTF-8 character code.
Volume 3 Section 2 4.4.3 Character size control	3-109	Restrictions related to character display are stipulated in Table 4-14	Deleted
Volume 3 Section 2 4.4.3 Character size control Table 4-14 Area of coding group that can be used for specification of display format and specification of character size controls	3-110	Whole table	Deleted
Volume 3 Section 2 4.4.3 Character size control	3-111	Whole of paragraph (1)	

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
Volume 3 Section 2 4.4.3 Character size control	3-111	(2)	Deleted
Volume 3 Section 2 4.5.1 Control codes	3-123	Control codes used in caption are in compliance with ARIB STD-B24 Vol. 1 Part 2, 7.1.2.	Control codes used in caption are in compliance with Annex A8-1 in this document
Volume 3 Section 2 4.5.2 Operation of flashing	3-132	Flashing of the 8-bit character codes character string does the character flashing	Flashing string (“FLC”) of the UTF-8 enables the character flashing
Volume 3 Section 2 4.6 Operation of the DRCS	3-135 3-136	Whole section	Deleted
5.2 Operation of NVRAM	3-142	able 5-1 NVRAM used in Digital Terrestrial Television Broadcasting	The maximum number of Affiliations and Networks in one broadcasting area should be set as 24. See Table AP8-2 as the exact list of NVRAM when using the number of 24.
5.5 Operation of character codes	3-159	Refer to ARIB STD-B24 Vol. 2 Appendix 2 ”4.1. Character codes”.	UTF-8
5.5.1 Transmission of DRCS pattern data	3-159	Whole of section	Deleted
5.6 Operation area of media type and mono-media	3-160	charset='euc-jp'	charset='UTF-8'
5.7.3 Table 5-9 Operational guidelines relating to the attributes of elements	3-164	- Fixed to "ja" - Fixed to "EUC-JP" - ･･･and type attribute is either "audio/X-arib-aiff" or "audio/X-arib-mpeg2-aac".	- Fixed to " tn" - Fixed to "UTF-8" - ・・・ and type attribute is “audio/X-arib-mpeg4-aac”.
5.11 Presentation control of BML document	3-175	- "video/X-arib-mpeg1" or "video/X-arib-mpeg2" - "audio/X-arib-mpeg2-aac"	- “video/X-arib-H264-high” - “audio/X-arib-mpeg4-aac”
5.14.6.6 Interaction channel function-TCP/IP	3-201 3-202	EUC-JP	UTF-8
5.14.6.12 External character function	3-209	Whole of section	Deleted
5.14.8 Operation guideline for transmission of communication contents	3-215 ~3-220	- ja - audio/X-arib-mpeg2-aac - audio/X-arib-aiff - application/X-arib-drcs - EUC-JP	- tn - audio/X-arib-mpeg4-aac - Deleted - Deleted - UTF-8
Appendix 5-1 DTD	3-280	EUC-JP	UTF-8
1 Introduction	3-301	MPEG-2 AAC	MPEG-4 AAC

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
3.2.4 Table 3-6 Desired audio mono-media to be presented	3-310	- MPEG-2 AAC - stream format identifier = 0x0F - Sampling frequency 24kHz, 48kHz	- MPEG-4 AAC - stream format identifier = 0x11 - Sampling frequency 32kHz, 44.1kHz, 48kHz
3.2.5 Table 3-7 Fonts	3-310	- Kanji (level 1, 2) - Hirakana - Katakana	- Deleted - Deleted - Deleted
3.4.2 Table 3-10 Type and capacity of BproNV	3-313	- 288KB(12 affiliations x 24KB)	The number of affiliations has been fixed as 24.
3.6.3 Character types	3-314	- refer to ARIB STD-B24, Vol. 1, Part 2, 7.3 - Kanji	- refer to ARIB STD-B24, Vol. 1, Part 2, 7.2 (Refer Annex8 A8-1) - Deleted
3.6.4 Kana Kanji conversion function	3-314	Whole of section	Deleted
4.1.2.4 Configuration of the ES transmitted by 1 service	3-330	MPEG-2 AAC	MPEG-4 AAC
4.1.5.1 Receiver operation at the beginning of data broadcasting	3-333	Moreover, Playback is executed as an audio stream of MPEG-2 AAC (sampling frequency = 24KHz) if the component of the component_tag=0x83 or 0x84 is included. Similarly, Playback is executed out as an audio stream of MPEG-2 AAC (sampling frequency = 48KHz) if the component of the component_tag=0x85 or 0x86 is included.	Moreover, Playback is executed as an audio stream of MPEG-4 AAC (sampling frequency = 48KHz) if the component of the component_tag=0x83 or 0x84 is included. Similarly, Playback is executed out as an audio stream of MPEG-4 AAC (sampling frequency = 44.1KHz) if the component of the component_tag=0x85 or 0x86 is included. Similarly, Playback is executed out as an audio stream of MPEG-4 AAC (sampling frequency = 32KHz) if the component of the component_tag=0x90 or 0x91 is included.
5.1.1 H.264|MPEG-4 AVC	3-355	Whole of section	Details in ABNT NBR 15608-2.
5.3.1 MPEG-2 AAC	3-369	Whole of section	MPEG-4 AAC Follows ABNT NBR 15608-2
5.3.5 Audiosynthesis of receiver units	3-371	MPEG-2 AAC	-MPEG-4 AAC
5.4 Character codes	3-372	- 5.4.1 8-bit character codes for C-profile - 5.4.2 Shift JIS	- Deleted - 5.4.1 UTF-8
Volume 3 Section 4 6.2.4 Operation of closed caption management data Table 6-3: Closed caption management data parameters	3-376	Used language code (“jpn” fixed)	Used language code (“eng”=0x656E67 or “tsn”=0x74736E can be used)

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
Volume 3 Section 4 6.4.1 Character entity	3-379	Whole sentences and Table 6-2	Deleted
Volume 3 Section 4 6.4.1 Character entity	3-379		The character encoding method used for closed caption is UTF-8 character code. Control code range is from 0x0000 to 0x001F (inclusive) and from 0xC280 to 0xC29F (inclusive).
Volume 3 Section 4 6.5 Control code used in closed caption	3-381	The control code used in the closed caption is compliant with ARIB STD-B24, Vol. 1, Part 2, 7.1.2.	The control code used in the closed caption is compliant with Annex A8-1 in this document.
7.2 Operation of NVRAM in Digital Terrestrial Television C-profile broadcasting	3-388	Table 7-1 NVRAM used by Digital Terrestrial Television C-profile broadcasting	The maximum number of Affiliations and Networks in one broadcasting area should be set as 24. See Table AP8-3 as the exact list of NVRAM when using the number of 24.
7.5 Operation of character coding schemes	3-393	See ARIB STD-B24, Vol. 2, Appendix 4, “4.1. Character Coding Schemes”.	Using UTF-8
7.7.1 Declaration of XML and DOCTYPE	3-393	Shift_JIS	UTF-8
7.73 Table 7-5 Operations for attributes of elements	3-397	- Shift_JIS - audio/X-arib-mpeg2-aac	- UTF-8 - audio/X-arib-mpeg4-aac
7.9 extended property specification	3-414	- Refer to the ARIB STD-B24, Vol. 1, Part 2, Chapter 7, 7.3 "Shift-JIS character codes” - Kanji set	- Refer to ARIB STD-B24, Vol. 1, Part 2, 7.2 (Refer Annex8 A8-1) - Deleted
7.10.7 Extended function provided by digital terrestrial broadcasting (2)	3-447	- tokyo_dgree - tokyo_dms	- Deleted - Deleted
7.12.6.1 Table 7-27 Attribute operation related to stream presentation	3-465	audio/X-arib-mpeg2-aac	audio/X-arib-mpeg4-aac

Table AP8-2 NVRAM usage for Botswana A-profile Data broadcasting
(See Table AP8-1 Column 5.2 Operation of NVRAM)

Type	Meaning	NVRAM amount
A-profile memory area for all the broadcasters	Common area available for use by all terrestrial digital broadcasters.	2KB (Fixed length block of 64bytes * 32)
A-profile memory area for the affiliation	Common area available for use by broadcasters that belong to the same system.	･4KB for one Affiliation (Fixed length block of 64bytes * 64) ･Number of systems: more than 24

Type	Meaning	NVRAM amount
A-profile memory area for the specified broadcaster	Area occupied by each broadcaster	･4KB for one broadcaster (Fixed length block of 64bytes * 64) ･Number of broadcasters that should be secured by receiver units simultaneously: more than 24
A-profile memory area of communication purpose for the specified broadcaster	Area to share information with broadcasting contents and communication contents	･2KB for 1 broadcaster. (Fixed length block of 64bytes *32) ･Number of broadcasters that should be secured by receiver simultaneously: more than 24
Memory area for bookmark service	Area available to use for the bookmark service	･Total of more than 50 blocks of variable length block with maximum of 320 bytes.
Memory area for root CA certificates	Area to store root CA certificate of general purpose transmitted by carousels in memory.	･3KB for one certificate ･Quantity : 8
Memory area for registration transmission	Area to store messages that carry out registration transmission	･More than 3 blocks of variable length block with maximum of 1.5 KB.

Table AP8-3 NVRAM usage for Botswana C-profile Data broadcasting
(See Table AP8-1 Column 7.2 Operation of NVRAM in Digital Terrestrial Television C-profile broadcasting)

Class	Purpose	Capacity of NVRAM
Digital Terrestrial Television C-profile area for the affiliation	Area used commonly by operators belonging to the same affiliation area	• 24KB per affiliation (64 byte fixed block * 384) • 8KB out of 24KB is for inner affiliation common area, and the remaining 16KB is divided by 8 and used as the individual operator area. • Affiliation number: 24 affiliations
TVlink area	Area used for TVlink service	• Maximum of 256 bytes variable block • Writable block number: 50 or more

9. Interactive channel

The operational guideline on the Interactive channel should be in accordance with the Chapter 9 of the main body.

10. EWBS

The operational guideline on EWBS should be in accordance with the Chapter 10 of the main body.

If there is a TV broadcaster not operating the EWBS, the TV receivers tuned to that channel cannot receive the EWBS signal. Therefore it is required that all broadcasters should operate the EWBS.

Area codes in Botswana are as follows.

AP10-1 Area code

For the EWBS application purpose, receivers should pre-store the area code allocation table. In accordance with ABNT15603, area code uses a 12-bit string, with the left bit first, as shown in Figure AP10-1

b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

Figure AP10-1 12-bit string for area code

AP10-2 Actual allocation table

The actual allocation table of area code in Botswana is shown in Table AP10-1.

Table AP10-1 Area code allocation Table

Common	District	Sub-District / Area	Area Code (Binary)	Area Code (Decimal)
National			000001100100	100
	Central District		000011001000	200
		Francistown	000011001001	201
		Serowe/Palapye	000011001010	202
		Tutume	000011001011	203
		Bobonong	000011001100	204
		Letlhakane	000011001101	205
		Mahalapye	000011001110	206
		Selebi-Phikwe	000011001111	207
		Sowa Town	000011010000	208
		Tonota	000011010001	209
	Ghanzi District		000100101100	300
		Charleshill	000100101101	301
		Ghanzi	000100101110	302
	Kgalagadi District		000110010000	400
		Hukuntsi	000110010001	401
		Tsabong	000110010010	402
		Kang	000110010011	403
		Bokspits	000110010100	404
	Kgatleng District		000111110100	500
		Mochudi	000111110101	501

Table AP10-1 Area code allocation Table (Cont.)

Common	District	Sub-District / Area	Area Code (Binary)	Area Code (Decimal)
	Kweneng District		001001011000	600
		Letlhakeng	001001011001	601
		Mogoditshane	001001011010	602
		Molepolole/ Lentsweletau	001001011011	603
		Thamaga	001001011100	604
	North-East District		001010111100	700
		Masunga	001010111101	701
	Chobe		001100100000	800
		Kasane	001100100001	801
		Pandamatenga	001100100010	802
	North-West District		001110000100	900
		Gumare	001110000101	901
		Maun	001110000110	902
		Shakawe	001110000111	903
	South-East District		001111101000	1000
		Gaborone	001111101001	1001
		Ramotswa	001111101010	1002
	Southern District		010001001100	1100
		Goodhope	010001001101	1101
		Jwaneng	010001001110	1102
		Kanye	010001001111	1103
		Mabutsane	010001010000	1104
		Lobatse	010001010001	1105
		Moshopa	010001010010	1106

11. Outline of operational parameters

Some operation parameters for Botswana digital terrestrial television broadcasting are shown in Table AP11-1

Table AP11-1

Item		Contents
DTTB system		ISDB-T system
Operating channel		470–694MHz (channels 21 to 48)
Channel bandwidth	Full-seg	7.6 MHz
	One-seg	0.58 MHz
Central carrier frequency		474 –690
Transmission mode		Mode 3
Guard Interval ratio		1/4, 1/8, 1/16
Carrier Modulation	Full-seg	QPSK, 16QAM, 64QAM
	One-seg	QPSK, 16QAM
Error Correction (Inner Code)		Convolutional Code (Coding Rate: 1/2, 2/3, 3/4, 5/6 or 7/8)
Error Correction (Outer Code)		(204,188) Reed-Solomon Code
Interleave	Full-seg	Frequency and Time Interleave
	One-seg	Time interleaving length: I=1,2 or 4
Video Coding		H.264|MPEG-4 AVC (ISO/IEC 14496-10)
Video profile	Full-seg	Up to HP @ L4.0
	One-seg	Up to BP @ L1.3
Video format	Full-seg	576i, 576p, 720p, 1080i, 1080p
	One-seg	SQVGA, QVGA, CIF
Video frame rate	Full-seg	25, 50fps
	One-seg	5, 10, 12, 15, 24, 25, 30fps
Audio Coding		MPEG-4 AAC (ISO/IEC 14496-3)
Audio Profile	Full-seg	LC AAC @L2, L4 HE-AAC+SBR v.1 @ L2, L4
	One-seg	HE-AAC+SBR+PS v.2 @ L2
Audio sampling frequency	Full-seg	48kHz, 44.1kHz
	One-seg	48kHz, 44.1kHz, 32kHz (AAC sampling frequency: 24kHz, 22.05kHz, 16kHz)
Multiplexing		MPEG-2 Systems (ISO/IEC 13818-1)
Data Broadcasting		BML
EWBS		ISDB-T Harmonization Document PART 3

12. ARIB Standards

ARIB Standards

http://www.arib.or.jp/english/html/overview/sb_ej.html

The versions of ARIB Standards refered in the Botswana ISDB-T Standards are as follows.

Standrd		Version
Number	Title	
ARIB STD-B24	Data Coding and Transmission Specification for Digital Broadcasting	5.2
ARIB STD-B31	Transmission system for digital terrestrial television broadcasting	2.2
ARIB TR-B14	Operational guidlines for digital terrestrial television broadcasting	3.8

Bibliograpy

(ITU Recommendation)
http://www.itu.int/en/publications/Pages/default.aspx

(ISO/IEC standards)
http://www.iso.org/iso/home/store/catalogue_tc/catalogue_tc_browse.htm?commid=45316

(ABNT Standards)
http://forumsbtvd.org.br/acervo-online/normas-brasileiras-de-tv-digital/
The versions of ABNT Standards refered in the Botswana ISDB-T Standards are as follows.

Standrd		Version
Number	Title	
ABNT NBR 15601	Digital terrestrial television – Transmission system	2007
ABNT NBR 15602-1	Digital terrestrial television – Video coding, audio coding and multiplexing Part 1: Video coding	2007
ABNT NBR 15602-2	Digital terrestrial television – Video coding, audio coding and multiplexing Part 2: Audio coding	2007
ABNT NBR 15602-3	Digital terrestrial television – Video coding, audio coding and multiplexing Part 3: Signal multiplexing systems	2007
ABNT NBR 15603-1	Digital terrestrial television – Multiplexing and service information (SI) Part 1: SI for digital broadcasting systems	2008
ABNT NBR 15603-2	Digital terrestrial television – Multiplexing and service information (SI) Part 2: Data structure and definitions of basic information of SI Descriptors:	2009
ABNT NBR 15603-3	Digital terrestrial television – Multiplexing and service information (SI) Part 3: Syntaxes and definitions of extension information of SI Descriptors:	2009
ABNT NBR 15604	Digital terrestrial television – Receivers	2007
ABNT NBR 15605-1	Digital terrestrial television — Security issues Part 1: Copy control	2009
ABNT NBR 15607-1	Digital terrestrial television — Interactive channel Part 1: Protocols, physical interfaces and software interfaces	2011
ABNT NBR 15608-1	Digital terrestrial television – Operational guideline Part 1: Transmission system – Guide for implementation of ABNT NBR 15601:2007	2008
ABNT NBR 15608-2	Digital terrestrial television – Operational guideline Part 2: Video coding, audio coding and multiplexing – Guideline for implementation of ABNT NBR 15602:2007	2010
ABNT NBR 15608-3	Digital terrestrial television — Operational guideline Part 3: Multiplexing and service information (SI) − Guideline for implementation of ABNT NBR 15603:2007	2012

(ISDB-T Harmonization Document)
http://www.dibeg.org/techp/aribstd/harmonization.html

ISDB-T Standards of Botswana

Preface

Around the world, countries are converting their analogue terrestrial television platforms to digital technology. Immense benefits can be achieved through digital migration. These benefits include the increase in efficiency in the use of spectrum, a good quality of sound and pictures, and launch of new services for viewers creating opportunities for the convergence with other ICT services and securing the future of the terrestrial television as a viable platform for an advanced information society.

In 2006 Regional Radio Communication Conference (RRC-06), resolved that the transition from analogue to digital broadcasting services should be effected by June 2015 in the African & European Region.

The government of Botswana has made a decision to adopt the Integrated Services Digital Broadcasting - Terrestrial (ISDB-T) Standard as its Digital Terrestrial Television standard after the comparative testing between the two leading international standards, namely Digital Video Broadcasting-Television second generation (DVB-T2) and ISDB-T.

The test revealed that the ISDB-T standard has significant advantages. Of particular note is the ISDB-T system's hierarchical mode of operation, which allows for the simultaneous transmission to fixed, mobile and portable receivers from a single transmitter. In addition, ISDB-T has advantageous functions to provide value added services such as Data broadcasting and Emergency Warning Broadcast System (EWBS).

This document serves to provide technical specifications to manufacture equipment and products, secure the interconnectivity/interoperability by establishing ISDB-T Standards of Botswana. The document is compiled for Botswana by extracting and modifying essential parts from ARIB Standards completed in Japan and the Standards of ABNT (Associação Brasileira de Normas Técnicas) as described in Recommendation ITU-R BT.1306.

A special thanks must be given to Digital Broadcasting Experts Group (DiBEG) under Association of Radio Industries and Businesses (ARIB), who drafts this document with the intention to contribute to the establishment of ISDB-T Standards of Botswana, and

JICA who provides a significant support on this document as one of their Project activities in Botswana.

Contents

ISDB-T Standards

1. General

Currently there are two standard specifications of the ISDB-T System; one is the ARIB Standards, and the other is the Standards of ABNT (Associação Brasileira de Normas Técnicas) as described in Recommendation ITU-R BT.1306, in its Appendix 3 to Annex 1, Bibliography of System C Standard. At first, the ARIB Standards have been completed in Japan where the ISDB-T was originally developed. And then, the ABNT Standards have been completed in Brazil, based on the ARIB Standards yet incorporating the latest technologies which became available at that time. Furthermore, there came out the Harmonization Documents by the ISDB-T International Forum, intending to establish a commonality among the ISDB-T adopting countries on the operation of the EWBS (Emergency Warning Broadcast System) and the specifications of the ISDB-T

receiver products.

With the above history as its background, Botswana ISDB-T standards is basically compiled based on the ABNT standards yet also incorporating the specifications of the ARIB standards as well as the Harmonization Documents.

Furthermore, while the existing ABNT standards specify the transmission parameters for the 6MHz/ch bandwidth, the parameters for the 8MHz/ch bandwidth are not specified. Therefore the transmission parameters and any other related items shall be adjusted for 8MHz/ch bandwidth from the ABNT standards based on Recommendation ITU-R BT.1306.

In the light of the situation above, this technical documentation presents the ISDB-T standards of Botswana;

The Annex, which is the integral part of the standards, covers the details of modifications made to the existing standards; and the Appendix 1 **"Operational Guidelines for ISDB-T in Standards in Botswana"** (separate document), which is not the integral part of but supplementary to the standards, covers the operational guidelines for the general operations at broadcasting stations for digital terrestrial television broadcasting and functional specifications for digital terrestrial television equipment.

2. Transmission

Parameters are given in Table 1c) of ITU-R BT.1306. For details, ABNT NBR 15601 shall be referred as listed in Appendix 3 to Annex 1 of ITU-R BT.1306. Because ABNT NBR 15601 is the standards for 6MHz/ch transmission bandwidth, the transmission parameters have been modified for 8MHz/ch transmission bandwidth as shown here-below. See Annex 1 for details.

- Symbol duration be 6/8 shorter than 6MHz/ch
- Bandwidth be 8/6 wider than 6MHz/ch
- IFFT sample clock be 8/6 faster than 6MHz/ch
- transmission bitrate be 8/6 faster than 6MHz/ch
- Guard interval length be 6/8 shorter than 6MHz/ch
- channels be set by every 8MHz and not be used 1/7MHz frequency shift
- 13 segments in 8MHz

3. Video Coding

All the technical parameters related to video coding shall be in accordance with ABNT NBR 15602-1. However the frame rate of 25 Hz and 50 Hz, and the video

format of 576i and 576p shall be supported and video coding parameters for full-seg services are applied to any layers except for the partial reception layer. See Annex 2 for details.

4. Audio Coding

All the technical parameters related to audio coding shall be in accordance with ABNT NBR 15602-2. However audio coding parameters for full-seg services are applied to any layers except for the partial reception layer.

5. Multiplexing

All the technical parameters related to multiplex shall be in accordance with ABNT NBR 15602-3.

6. Service information

Most of all the technical parameters related to service information shall be in accordance with ABNT NBR15603, however there are some modifications. The main points to be modified are shown here-below. See Annex 5 for the details.

- Network ID, Service ID, and Affiliation ID shall be allocated to be respectively unique within Botswana, and Remote Control Key ID shall be allocated to be unique within each of the broadcast service areas.

7. Receiver

While most of all the technical parameters related to receivers shall be in accordance with ABNT NBR15604, there are some modifications required. With respect to the receiver, the technical specification issued by BOCRA shall be referred. The main points to be modified are shown here-below. See Annex 6 for the details.

- In order to adopt BML for data broadcasting, some items that are based on Ginga such as the remote control key and the demodulator for data broadcasting shall be modified.
- As the analog video format of Botswana is of PAL-I, those items of PAL-M format shall be replaced to PAL-I.
- The frame rate of 25 Hz and 50 Hz, and the video format of 576i and 576p shall be supported.
- As for the RF INPUT-TERMINAL of the receivers for Botswana, IEC 61169-2 -type terminal (Belling-Lee) should be recommended.
- The priority parameters of the receiver unit of Annex A are described as the operational guidelines, thus it should be subject to ISDB-T Harmonization Document PART 1: Hardware.
- Since there is no detailed specification of "Accessibility resources (Audio

locution)" in ABNT, it is preferable to remove it.

- Since “Accessibility resources (LIBRAS window)” is a specification unique only to Brazil, it is desirable to remove it.
- Silicon-Tuner is mostly adopted in the recent TV-Front-End products, making outputs of Low-IF below 10MHz. Thus Low-IF below 10MHz shall also be acceptable. Accordingly, with respect to the frequency conversion, either upper or lower heterodyne conversion shall be acceptable as long as there is no side-effect.
- As for safety standards, it shall be in reference to actual standards in Botswana.

8. Security issues

All the technical parameters related to security issues shall be in accordance with ABNT NBR 15605-1.

9. Data broadcasting

ISDB-T Standards covers multiple Data broadcasting standards such as BML, Ginga and HTML5.

For the first stage of TV Digitalization, BML, which is proved to work and operationalized, is the most effective standard in terms of providing its service and cost effective receivers for the households..

For the next stage after ASO, HTML5, which is based on two way network standard, can be adopted subject to the development of its service availability. In this document, the specs to localize BML standard for Botswana is described as focusing in the first stage.

All the technical methods and parameters for BML data broadcasting, subtitle and superimposed characters coding shall be in accordance with ARIB STD-B24.

About the localization for Botswana, the main points to be modified are character set and character coding. See Annex 8 for the details.

Data broadcasting standard is referred also in the receiver standard with respect to remote control requirements. See Annex 6 for the details.

10. Interactive channel

All the technical parameters related to interactive channel shall be in accordance with ABNT NBR 15607-1.

11. EWBS

All the technical methods and parameters shall be in accordance with ISDB-T Harmonization Document PART 3: Emergency Warning Broadcast System (EWBS).

Annex Details of modifications made to the existing standards

Annex 1 Transmission

The details of the modifications from ABNT NBR 15601 are shown in Table A1-1.

Table A1-1 Modifications from ABNT NBR 15601

Section, (Table) No. and item		Page	Original ISDB-T Standards	Botswana ISDB-T Standards
6.1 Table 1 — Parameters of the transmission system	2. Segment width	6	6000/14 = 428,57 kHz	8000/14 = 571.43 kHz
	3. Used bandwidth		5,575 MHz (mode 1) 5,573 MHz (mode 2) 5,572 MHz (mode 3)	7.433MHz(mode1) 7.431MHz(mode2) 7.429(mode3)
	6. Active symbol duration		252μs (mode 1) 504 μs (mode 2) 1 008 μs (mode 3)	189μs (mode 1) 378 μs (mode 2) 756 μs (mode 3)
	7. Carrier spacing		Bws/108 = 3,968 kHz (mode 1) Bws/216 = 1,984 kHz (mode 2) Bws/432 = 0,992 kHz (mode 3)	Bws/108 = 5.291… kHz Bws/216 = 2.645… kHz Bws/432 = 1.322… kHz
	8. Guard interval duration		63; 31,5; 15,75; 7,875 μs (mode 1) 126; 63; 31,5; 15,75 μs (mode 2) 252; 126; 63; 31,5 μs (mode 3)	47.25, 23.625, 11.8125, 5.90625 μs (mode1) 94.5, 47.25, 23.625, 11.8125 μs (mode2) 189, 94.5, 47.25, 23.625 μs (mode3)
	9. Overall symbol duration		315; 283,5; 267,75; 259,875 μs (mode 1) 628; 565; 533,5; 517,75 μs (mode 2) 1.260; 1 134; 1 071; 1.039,5 μs (mode 3)	236.25, 212.625, 200.8125, 194.90625 μs (mode1) 472.5, 425.25, 401.625, 389.8125 μs (mode2) 945, 850.5, 803.25, 779.625 μs(mode3)
6.1 Principal parameters		6	Further, pilot signal shall added to data segment in the OFDM framing section to form an OFDM segment (with a bandwidth of 6/14 MHz).	Further, pilot signal shall be added to data segment in the OFDM framing section to form an OFDM segment (with a bandwidth of 8/14 MHz).
		7	Up to three hierarchical layers may be transmitted in a 6 MHz channel.	Up to three hierarchical layers may be transmitted in an 8 MHz channel.
6.1 Table 2 — OFDM segment parameters		8	Table 2 — OFDM-segment parameters	ARIB STD-B31 Version2.2-E1 Page84 Table A-5: ODFM Segment Parameters (8MHz Bandwidth System)
6.1 Table 3 — Transmission signal parameters		9	Table 3 — Transmission signal parameters	ARIB STD-B31 Version2.2-E1 Page85 Table A- 6: Transmission Signal Parameters (8MHz Bandwidth System)

Section, (Table) No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
6.1 Table 4 — Data rate of a single segment	10	Table 4 — Data rate of a single segment	ARIB STD-B31 Version2.2-E1 Page86 Table A- 7: Data Rate per a Single Segment (8MHz Bandwidth System)
6.1 Table 5 — Total data rate	11	Table 5 — Total data rate	ARIB STD-B31 Version2.2-E1 Page87 Table A- 8: Total Data Rate*1 (8MHz Bandwidth System)
6.14.4 Table 25 — Examples of transmission capacities for AC carriers (mode1, guard interval of 1/8)	43	Table 25 — Examples of transmission capacities for AC carriers (mode1, guard interval of 1/8)	See Table A1-2 for Examples of transmission capacities for AC carriers (mode1, guard interval of 1/8)
6.15.1 Position of the segments within the 6 MHz spectrum	43	6.15.1 Position of the segments within the 6 MHz spectrum	6.15.1 Position of the segments within the 8 MHz spectrum
7.1 Frequency bandwidth	51	A frequency bandwidth of 5.7 MHz shall be used for digital terrestrial television broadcasting.	A frequency bandwidth of 7.6 MHz shall be used for digital terrestrial television broadcasting.
		The frequency bandwidth shall be 5.7 MHz when the OFDM carrier bandwidth is 5.572 MHz with 4 kHz spacing between carrier frequencies in Mode 1. This bandwidth shall apply regardless of which mode is chosen, and has been selected to ensure that the bandwidth of 5.610 MHz has some margin to determine that each carrier of the uppermost and lowermost in the 5.572..MHz bandwidth includes 99 % of energy.	The frequency bandwidth shall be 7.6 MHz when the OFDM carrier bandwidth is 7. 433 MHz with 5.291 kHz spacing between carrier frequencies in Mode 1. This bandwidth shall apply regardless of which mode is chosen, and has been selected to ensure that the bandwidth of 7. 480 MHz has some margin to determine that each carrier of the uppermost and lowermost in the 7.433..MHz bandwidth includes 99 % of energy.
7.3 Frequency offset of the OFDM carriers	52	The frequency of the terrestrial transmission signal shall have a positive offset of 1/7 MHz (142.857 kHz) in relation to the channel central carrier to be used in the current channel allotment plan (see Figure 37).	Offset not be used.
		Table 39 — High VHF channels	High VHF channels not be used.
	53	Table 40 — UHF channels	See table A1-3 for 8MHz/ch UHF channels

Section, (Table) No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
7.4 IFFT sampling frequency and permissible deviation	54	The IFFT sampling frequency for use with OFDM for digital terrestrial television broadcasting shall be as follows: Fs = 512/63 MHz = 8 126 984 Hz	The IFFT sampling frequency for use with OFDM for digital terrestrial television broadcasting shall be as follows: Fs = 2048/189 MHz = 10 835 978 Hz
		The permissible deviation is ± 0.3 Hz/MHz.	The permissible deviation is ± 0.2 Hz/MHz.
		An IFFT sampling frequency of 512/63 MHz, a theoretical sample frequency, may be used if the permissible deviation requirement is met.	An IFFT sampling frequency of 2048/189 MHz, a theoretical sample frequency, may be used if the permissible deviation requirement is met.
7.5.1 Characteristics of the transmission spectrum mask	54	7.5.1 Characteristics of the transmission spectrum mask The out-of-band spectrum level allocated for broadcasting the television signal shall be reduced applying a proper filtering. Figure 38 and Table 41 indicate the minimum attenuation and the out-of-band emission in relation to the transmitter average power, specified in relation to the spacing of the signal central carrier, for critical, sub-critical and non-critical mask.	7.5.1 Characteristics of the spectrum limit mask The out-of-band spectrum level allocated for broadcasting the television signal shall be reduced applying a proper filtering. Figure A1-1 and Table A1-4 indicate the spectrum limit mask for sensitive and non-critical mask, where the relative power level is defined in a reference bandwidth of 4kHz with the 0dB reference level corresponding to the mean output power measured in the channel bandwidth as described in ITU-R Recommendation BT.1206-1.
	54	Figure 38 — Transmission-spectrum limit masks for digital terrestrial television broadcasting	See Figure A1-1 for 8MHz/ch Spectrum limit masks
	55	Table 41 — Specification of the transmission spectrum mask	See Table A1-4 for 8MHz/ch break points
		The values of Table 41 shall be measured with a spectrum analyzer configured according to Table 42. Table 42 Spectrum settings for mask measurement The cut point shall be measured using a spectrum analyzer adjusted for a 20 MHz span frequency or lower and a 10 kHz bandwidth resolution (RBW).	Deleted. It is enough to specify the spectrum mask and spurious according to the relevant RR regulations and ITU-R Recommendation, not necessary to specify the method to measure them.

Section, (Table) No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
7.5.2 Criteria for applying masks	55	Application of masks shall take in account the class of the stations and substations. Digital stations are classified in …	Two spectrum masks are specified in Fig. A1-1 and the associated Table A1-4. The upper curve defines the spectrum mask for the non-critical cases and the lower curve defines the spectrum mask for the sensitive cases as described in ITU-R Recommendation BT.1206-1.
7.6 Table 45 — Allowable spurious emission power	5556	Table 45 — Allowable spurious emission power	See Table A1-5 for Allowable spurious emission power as described in RR Appendix 3 or ITU-R SM.329.

Table A1-2 Examples of transmission capacities for AC carriers
(mode 1, guard interval of 1/8) (See Table A1-1 Column 6.14.4 Table 25)

	Synchronous modulation's segment		Differential modulation's segment	
	1	13	1	13
AC1	9,4 kbps	121,7 kbps	9,4 kbps	121,7 kbps
AC2	-	-	18,7 kbps	243,4 kbps

Table A1-3 8MHz/ch UHF channels
(See Table A1-1 Column 7.3 Frequency offset of the OFDM carriers)

Channel	Start Frequency (MHz)	End Frequency (MHz)	Center Frequency (MHz)
21	470	478	474
22	478	486	482
23	486	494	490
24	494	502	498
25	502	510	506
26	510	518	514
27	518	526	522
28	526	534	530
29	534	542	538
30	542	550	546
31	550	558	554
32	558	566	562
33	566	574	570
34	574	582	578

Channel	Start Frequency (MHz)	End Frequency (MHz)	Center Frequency (MHz)
35	582	590	586
36	590	598	594
37	598	606	602
38	606	614	610
39	614	622	618
40	622	630	626
41	630	638	634
42	638	646	642
43	646	654	650
44	654	662	658
45	662	670	666
46	670	678	674
47	678	686	682
48	686	694	690

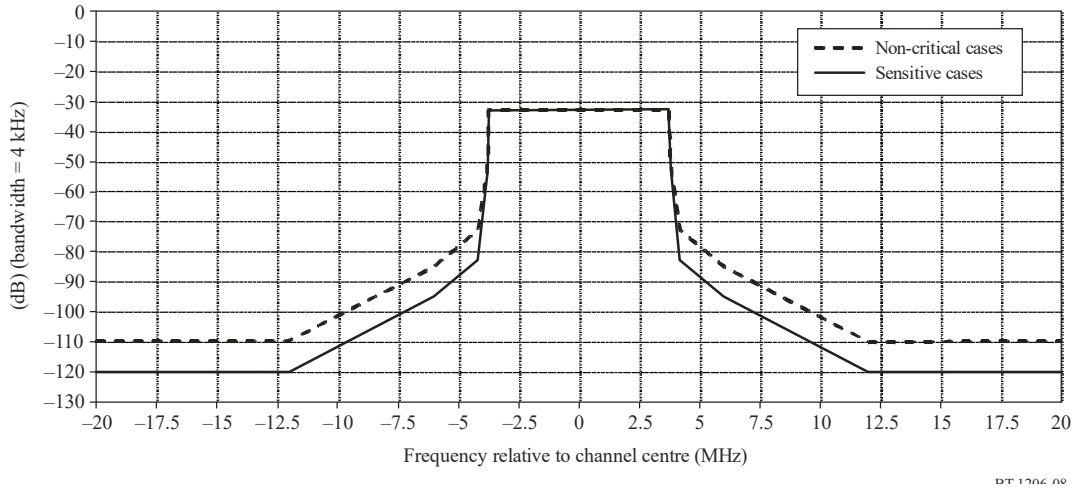

Figure A1-1 Transmission spectrum limit masks for 8 MHz
(See Table A1-1 Column 7.5 Transmission spectrum mask)

Table A1-4 Break points corresponding to Figure A1-1
(See Table A1-1 Column 7.5 Specification of the transmission spectrum mask)

Frequency relative to the center of the 8 MHz channel (MHz)	Relative level in a 4 kHz measurement bandwidth (dB)	
	Non-critical emission mask	Sensitive cases
–20	–110	–120
–12	–110	–120
–6	–85	–95
–4.2	–73	–83
–3.81	–52.7	–52.7

Frequency relative to the center of the 8 MHz channel (MHz)	Relative level in a 4 kHz measurement bandwidth (dB)	
	Non-critical emission mask	Sensitive cases
–3.72	–32.7	–32.7
+3.72	–32.7	–32.7
+3.81	–52.7	–52.7
+4.2	–73	–83
+6	–85	–95
+12	–110	–120
+20	–110	–120

Table A1-5 Allowable spurious emission power

(See Table A1-1 Column 7.6 Table 45 — Allowable spurious emission power)

Separation in relation to the digital signal central carrier	Attenuation (dB) below the power supplied to the antenna transmission line
> 20 MHz	46+10log(P),or 60dBc, whichever is less stringent, without exceeding the absolute mean power level of 12mW for UHF stations.
< - 20 MHz	

Annex 2 Video coding

The details of the modifications from ABNT NBR 15602-1 are shown in Table A2-1. Video coding parameters for full-seg services shown in Table A2-2 are applied to any layers except for the partial reception layer.

Table A2-1 Modifications from ABNT NBR 15602-1

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
5.4 Parameters for video signals	4	NOTE See ITU Recommendation BT.709-5 and ITU Recommendation BT.601-5.for additional information.	NOTE Table 5 to 14 and Figures 1 to 13 are for 60Hz field frequency. See ITU Recommendation BT.709-5 and ITU Recommendation BT.601-5.for 50Hz field frequency. Video coding parameters for Full-Seg services should meet the parameters indicated in Table A2-2.
8.3.1 General specifications	25	5 Hz, 10 Hz, 12Hz, 15 Hz, 24 Hz, 30Hz	5 Hz, 10 Hz, 12 Hz, 15 Hz, 24 Hz, 25 Hz, 30 Hz

Table A2-2 Video coding parameters for Full-Seg services

Number of horizontal pixels	Number of vertical pixels	Frame rate [Hz]	Scanning system	Aspect ratio	Profile and level
720	576	25	Interlaced	4:3 16:9	H.264|MPEG-4 AVC HP@L3
720	576	50	Progressive	16:9	H.264|MPEG-4 AVC HP@L3.1
1280	720	50	Progressive	16:9	H.264|MPEG-4 AVC HP@L4
1920	1080	25	Interlaced	16:9	H.264|MPEG-4 AVC HP@L4
1920	1080	25	Progressive	16:9	H.264|MPEG-4 AVC HP@L4

Annex 3 Audio coding

There is no amendment to ABNT 15602-2. However audio coding parameters for full-seg services are applied to any layers except for the partial reception layer.

Annex 4 Multiplexing

There is no amendment to ABNT 15602-3

Annex 5 Service information

The details of the modifications from ABNT NBR 15603-1, 15603-2 and 15603-3 are shown in Table A5-1, A5-2 and A5-3, respectively.

Table A5-1 Modification from ABNT NBR 15603-1

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
6.1 PID used for tables transmission	8	・・・ specified by the Brazilian Ministry of Communications or signal of broadcasters.	・・・ specified by signal of broadcasters.

TableA5-2 Modifications from ABNT NBR 15603-2

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
8.1 Table 26: Location and requirements of SI descriptors	45	- Carousel ID descriptor - Association tag descriptor - Deferred association tag descriptor	Deleted Deleted Deleted
8.3.4 Component descriptor	49	Table 28	Add video formats described in table A5-4 to Table 28.
8.3.30 Video decode control descriptor	80	Table 66 — Video encoding format	Add video encoding format as described in Table A5-5.

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
8.3.31 Terrestrial delivery system descriptor	80	(473 + 6 x (X - 14) + 1/7) x 7 = (xxx)d	(474 + 8 x (X – 21)) x 7 = (xxx)d
Annex E: Area_code specification	116 117	(Whole of Annex E)	Assignment of area_code is in compliance with Appendix 10 in this document
Annex G Specification for tuning physical and logical channel	120	- 6MHz	- 8MHz
Annex H.2: Original_network_id	122	(Whole of Annex H.2)	Refer to Annex A5-1 in this document about the structure of original_network_id.
3.2 8.3.21 Annex A Annex I.1: Annex I.6	3 61 103 124 126	- Brazilian - Brazil	- Botswana - Botswana
7.2.7.1 7.2.8 7.2.9.1 7.2.12 8.3.25 Annex A	28 29 30 35 67 103	- Brazil (UTC-3) - UTC-3	- Botswana (UTC+2) - UTC+2
8.3.4 8.3.7 8.3.15	48 52 59	EXAMPLE Portuguese, Brazilian official language, has 3 coded characters ‘’por’’, which is coded as: ’’0111 0000 0110 1111 0111 0010”.	EXAMPLE English has 3-character code "eng", which is coded as: “0110 0101 0110 1110 0110 0111”, and Setswana has 3-character code “tsn”, which is coded as: “0111 0100 0111 0011 0110 1110”
8.3.6 8.3.11 8.3.25 8.3.26	52 55 67 69	EXAMPLE Brazilian country has 3 character code "BRA", which is coded as: “0100 0010 0101 0010 0100 0001”	EXAMPLE Botswana country has 3 character code " BWA", which is coded as: “0100 0010 0101 0111 0100 0001”

Table A5-3 Modifications from ABNT NBR 15603-3

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
8.2.2 8.2.6 8.2.6 Table 13 B.1.4.3 B.5	15 19 19 30 50	- UTC-3	- UTC+2
8.2.5 Short node information descriptor	17	EXAMPLE Portuguese, Brazilian official language, has 3 coded characters ‘’por’’, which is coded as: ’’0111 0000 0110 1111 0111 0010”.	EXAMPLE English has 3-character code "eng", which is coded as: “0110 0101 0110 1110 0110 0111”, and Setswana has 3-character code “tsn”, which is coded as: “0111 0100 0111 0011 0110 1110”
B.1.4.3 B.2.7	30 42	- Brazilian	- Botswana

Table A5-4 Stream_content and component_type (additional items)
(See Table A5-2 Column 8.3.4 Component descriptor)

Stream_content	Component_type	Description
0x05	0x05	H264/AVC video 625i(576i), 4:3 aspect ratio
0x05	0x06	H264/AVC video 625i(576i), 16:9 aspect ratio with pan vectors
0x05	0x07	H264/AVC video 625i(576i), 16:9 aspect ratio without pan vectors
0x05	0x08	H264/AVC video 625i(576i), > 16:9 aspect ratio
0x05	0xA5	H264/AVC video 625p(576p), 4:3 aspect ratio
0x05	0xA6	H264/AVC video 625p(576p), 16:9 aspect ratio with pan vectors
0x05	0xA7	H264/AVC video 625p(576p), 16:9 aspect ratio without pan vectors
0x05	0xA8	H264/AVC video 625p(576p), > 16:9 aspect ratio

Table A5-5 Video encoding format
(See Table A5-2 Column 8.3.30 Video decode control descriptor)

Video encoding format	Description
0000	1080p
0001	1080i
0010	720p
0011	480p or 576p
0100	480i or 576i
0101	240p
0110	120p
0111	Reserved
1000	180p
1001-1011	Reserved
1100-1111	For video encoding format extension

A5-1 Original_network_id

(See Table A5-2 Column Annex H.2: Original_network_id)

Refer to Figure A5-1 about the structure of original_network_id.

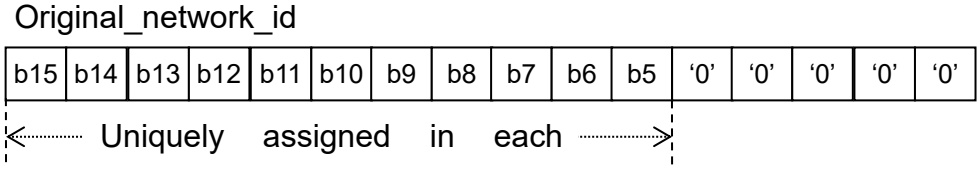

Figure A5-1 Structure of original_network_id

Annex 6 Receiver

The details of the modifications from ABNT NBR 15604 are shown in Table A6-1.

Table A6-1 Modifications from ABNT NBR 15604

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
Contents	v, vi	Annex B (normative) Priority parameters of middleware Ginga Annex C (normative) Measurement method C.1 Sensitivity C.2 Selectivity (protection ratio)	Deleted
4 5.2 Figure 2: 7.2.27.7	6 8 22	- PAL-M - Standard: M	- PAL-I - Standard: I
6: Environment and safety conditions	10	Environment and safety conditions	About safety regulations, it shall be in reference to actual standards in Botswana.
7.1: Reception antenna	12	a) the antenna shall allow the reception of digital terrestrial television signals that are comprehended between VHF channels from 07 to 13 and the UHF channels from 14 to 69, for the fixed and mobile (full-seg) receivers and at least the channels comprehended in the UHF band between the channels 14 to 69 for the portable (one-seg) receivers;	a) the antenna shall allow the reception of digital terrestrial television signals that are comprehended between the UHF channels from 21 to 48;
		b) optionally, the antenna may yet allow the reception of analog terrestrial television signals that are comprehended between the VHF channels from 02 to 13 and UHF from 14 to 62;	Deleted
7.2.1.1 7.2.1.2	12	type F	type IEC 61169-2
7.2.2.1: Fixed or mobile (full-seg) reception devices	13	The receiver unit shall be able to tuning television channels limited by the VHF high band, comprehended between the channels 07 to 13 and the receiver unit shall be able to tuning the television channels limited by the UHF band, comprehended between the channels 14 to 69.	The receiver unit shall be able to tuning the television channels limited by the UHF band, comprehended between the channels 21 to 48.
7.2.2.2: Portable devices for partial reception (one-seg)	13	The partial reception unit shall be able to tuning, at least, the television channels limited by the UHF band, comprehended between the channels 14 to 69.	The partial reception unit shall be able to tuning, at least, the television channels limited by the UHF band, comprehended between the channels 21 to 48.

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
		The VHF high band channels reception is optional in the portable receivers (one-seg).	Deleted
7.2.3 Channel bandwidth	13	a) fixed or mobile (full-seg) reception devices: 5.7 MHz; b) portable (one-seg) devices: 0.43 MHz.	a) fixed or mobile (full-seg) reception devices: 7.6 MHz; b) portable (one-seg) devices: 0.58 MHz.
7.2.4: Table 3 – Frequencies of channels of UHF band	13	Table 3 – Frequencies of channels of UHF band	See Table A1-3 for 8MHz/ch UHF channels
7.2.5: Sensitivity	16	a) minimum antenna signal input level: - 77 dBm or lower, as shown in Annex C, subclause C.1. b) maximum antenna signal input level: equal or higher than – 20 dBm;	a) minimum antenna signal input level: - 78,4 dBm or lower; b) maximum antenna signal input level: equal or higher than 0 dBm;
7.2.6: Selectivity – Protection ratio	16	The measurement method is demonstrated in Annex C.	Deleted
7.2.7: First intermediate frequency (IF)	16	The central frequency of the IF shall be of 44 MHz, and optionally direct conversion in base band. The local oscillator frequency shall be located at the upper side of the received frequency.	The central frequency of the IF shall be of 36 MHz, and optionally direct conversion in base band. Low-IF under 10MHz is also acceptable such as for Silicon-Tuner use. As for frequency conversion, either upper or lower heterodyne conversion is acceptable as long as there is no side-effect.
7.2.10.1 Figure 5 7.2.10.2 Figure 6	17 18	44MHz or base band	36MHz or base band
7.2.21: Primary data decoder	20	The porting of middleware Ginga is optional; however when it is embedded in the receiver, the minimum requirements defined in Table B.1 shall necessarily to be implemented (see Clause 9).	All the technical methods and parameters for BML data broadcasting shall be in accordance with ARIB STD-B24.
7.2.24: Accessibility	21	c) locution;	"Locution" specification is not necessary since there is no detail in ABNT.
	21	e) LIBRAS window.	"LIBRAS window" is a unique item to Brazilian standard. So it is not necessary.
7.2.27.1 7.2.27.1	21 21	“F” type	“IEC 61169-2” type
7.2.27.7: RF Output	22	according to Clause 8, Table 9.	according to Clause 8, Table 10.
7.2.28: Remote control	22	7.2.28 Remote control	See Table A6-2 for remote control keys used for data broadcasting; and Fig A6-1 for examples of remote controllers.

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
8.1.4.2: Full-seg receiver	26	The full-seg receivers shall support at least the video decoding in the 525i, 525p, 750p and 1125i formats, according to the specified in the ABNT NBR 15602-1.	The full-seg receivers shall support at least the video decoding in the 576i, 576p, 720p, 1080i and 1080p formats.
8.1.4.4: Full-seg receiver with support to the one-seg exhibition	26	Table 8 – Resolutions which shall be supported	See Table A6-3 for resolutions which shall be supported.
8.1.5.1 Full-seg receivers	26	The full-seg receivers shall at least support the frames rate of 30/1.001 Hz and 60/1.001 Hz.	The full-seg receivers shall at least support the frames rate of 25 Hz and 50 Hz.
8.1.5.2 One-seg receiver	26	The one-seg receivers shall at least support the frames rate 5fps, 10fps, 12fps, 15fps, 24fps and 30fps	The one-seg receivers shall at least support the frames rate 5fps, 10fps, 12fps, 15fps, 24fps, 25fps and 30fps
8.1.6.1: Full-seg receivers type digital converter	27	8.1.6.1 Full-seg receivers type digital converter The digital converter receiver (set-top box) shall have a RCA connector, 75 Ω, for composite video 525i output encoded in PAL-M. The video signal with the specified configuration shall be always present independently of the encoder parameters of a video pertaining to a stream received for decoding. This requirement is optional for integrated receivers with display, fixed or portable.	8.1.6.1 Full-seg receivers type digital converter The digital converter receiver (set-top box) shall have an RCA connector, 75 Ω, for composite video 625i output encoded in PAL-I. The video signal with the specified configuration shall always be present independently of the encoder parameters of a video pertaining to the stream received for decoding. This requirement is optional for integrated receivers with display, fixed or portable.
8.1.7 Analog video output	27-29	8.1.7 Analog video output	Deleted
9: Primary data decoding	34	9 Primary data decoding	About Data broadcasting, all the technical methods and parameters for BML shall be in accordance with ARIB STD-B24. See attached document.
11.3 Semantics for parental rating descriptor	35	EXAMPLE Brazilian country has 3 character code "BRA", which is coded as: “0100 0010 0101 0010 0100 0001”	EXAMPLE Botswana country has 3 character code " BWA", which is coded as: “0100 0010 0101 0111 0100 0001”
11.4 Cases in which the receiver shall not block the event	36	“BRA” (0x425241)	BWA”=0x425741
12: Accessibility resources	39	Portuguese	English and Setswana
	39	c) Audio locution	"Locution" specification is not necessary since there is no detail in ABNT.

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
	39	e) LIBRAS window	"LIBRAS window" is an item unique to Brazilian standard. So it is not necessary.
14.1.2: Full-seg receiver	42	It is optional for the full-seg receivers manufacturers the implementation of the USB port, since such equipment do not have interactivity channel, even if the middleware Ginga is embedded on them.	It is optional for the full-seg receiver manufacturers to provide the USB port.
Annex A: Priority parameters of the receiver unit	47	In Table A.1	In “ISDB-T HARMONIZATION DOCUMENT PART 1: HARDWARE” (NOTE)
	48 -57	Table A.1	Deleted
Annex B: Priority parameters of middleware Ginga	58-62	Annex B Priority parameters of middleware Ginga	Deleted
Annex C(normative) Measurement method	63-64	Annex C(normative) Measurement method	Deleted

(NOTE) The “ISDB-T HARMONIZATION DOCUMENT PART 1: HARDWARE” doesn’t correspond to 8MHz system. Japan is ready to propose the modifications to include 8MHz system for the next ISDB-T International Forum..

Table A6-2 Remote control keys used for data broadcasting
(See Table A6-1 Column 7.2.28: Remote control)

Key type	Guidelines
↑、↓、←、→ (up, down, left, right keys)	To move up, down, left, right.
0 - 9 (number keys)	To input numbers
Confirm	Separator of operation (enter)
Back	Cancel operation
	Back space of user input character (or bulk erase)
	Disconnection of a call to a communication server (*)During connection, receiver units will take the instruction; after connection, instruction is carried out in the contents. (A display to the effect that the connection will be terminated is desirable when the back key is pressed.)
	(*)It is okay to use BML documents for the purpose of going back. However, whether or not there is something after returning should be considered.
Data	Switches display/non-display of multi-media data broadcasting. (*)Separated “Data” button is recommended.

Red, green, yellow, and blue (color keys)	Selection of operation (execution) (*)Location of buttons on the remote control should be in order of red, green, yellow, blue from the left.
Bookmark (Optional)	Recording of bookmark.

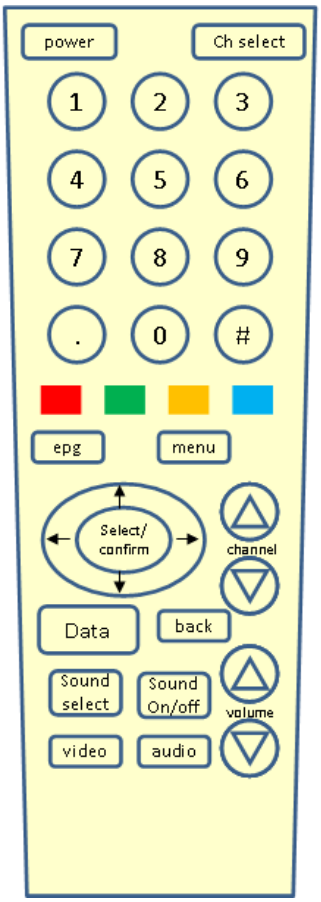

Fig A6-1 Example of Remote Controller
(See Table A6-1 Column 7.2.28: Remote control)

Table A6-3 Resolutions which shall be supported

Output video format	Aspect ratio	Number of lines to be decoded	Aspect ratio info	Output video format	Aspect ratio	Number of lines to be decoded	Aspect ratio idc
SQVGA	4:3	160 x 120	1	576i	4:3	720 x 576	2
SQVGA	16:9	160 x 90	1	576i	16:9	720 x 576	4
QVGA	4:3	320 x 240	1	576p	16:9	720 x 576	4
QVGA	16:9	320 x 180	1	720p	16:9	1280 x 720	1
CIF	4:3	352 x 288	2	1080i	16:9	1920 x 1080	1
				1080p	16:9	1920 x 1080	1

Annex 7 Security issue

There is no amendment to ABNT NBR 15605-1.

Annex 8 Data broadcasting

All the technical methods and parameters for BML data broadcasting, subtitle and superimposed characters coding shall be in accordance with ARIB STD-B24.
ARIB STD-B24 includes the usage of UCS (Universal multi-octet coded character set) and UTF-8 (UCS Transformation Format—8-bit) in it, yet it is intended for the usage in Japan only. Therefore for the usage in Botswana, some modifications are needed.

A8-1 Modifications for BML data broadcasting

The details of the modifications from ARIB STD-B24 necessary for BML data broadcasting in Botswana are shown in Table A8-1-1.

Table A8-1-1 Modifications from ARIB STD-B24 (BML data broadcasting)

Section No. and item		Page	Original ISDB-T Standards	Botswana ISDB-T Standards
Volume 1 Chapter 7	7.1 JIS 8bit character code	34	Whole of section	No use in Botswana.
	7.2 Universal multi-octet coded Character Set (UCS)	102	- Table 7-19 Code Values for Added Symbols Set - Table 7-20 Revision to Table 7-19: Modification of code values of Additional Symbols Set to comply with JIS X0213:2004 - 7.2.1.2 Supplemental characters (Gaiji)	No use in Botswana. For Botswana localized character set. See Table A8-1-2.
		105	7.2.2 Coding of control code The control codes available to this standard are limited to 0x007F (DEL); 0x000D and 0x000A (CR/LF); and 0x0009 (TAB).	See “7.1.2 Coding of control function” and Tables 7-14, 7-15, 7-16, and 7-17.

Section No. and item		Page	Original ISDB-T Standards	Botswana ISDB-T Standards
		105	7.2.3 Character encoding scheme	Adding descriptions about UTF-8. - No use “Byte Order Mark”. - C0 control codes (0x00 – 0x1F) are 0x0000 – 0x001F in UTF-8. - C1 control codes (0x80 – 0x9F) are 0xC280 – 0xC29F in UTF-8.
	7.3 Shift-JIS Character Codes	105	Whole of section	No use in Botswana.

Table A8-1-2 Character set for Botswana (See Table A8-1-1 Column 7.2 Universal multi-octet coded Character Set (UCS))

U+0021	U+002D	U+0039	U+0045	U+0051	U+005D	U+0069	U+0075	U+00A4	U+00BC	U+201D	U+20A7	U+20B3
!	–	9	E	Q	]	i	u	¤	¼	”	₧	₳
U+0022	U+002E	U+003A	U+0046	U+0052	U+005E	U+006A	U+0076	U+00A5	U+00BD	U+203C	U+20A8	U+20B4
″	.	:	F	R	^	j	v	¥	½	‼	₨	₴
U+0023	U+002F	U+003B	U+0047	U+0053	U+005F	U+006B	U+0077	U+00A7	U+00BE	U+2047	U+20A9	U+20B5
#	/	;	G	S	_	k	w	§	¾	⁇	₩	₵
U+0024	U+0030	U+003C	U+0048	U+0054	U+0060	U+006C	U+0078	U+00A9	U+00D7	U+2048	U+20AA	U+20B6
$	0	<	H	T	`	l	x	©	×	⁇	₪	₶
U+0025	U+0031	U+003D	U+0049	U+0055	U+0061	U+006D	U+0079	U+00AB	U+00F7	U+2049	U+20AB	U+20B7
%	1	=	I	U	a	m	y	«	÷	⁉	₫	₷
U+0026	U+0032	U+003E	U+004A	U+0056	U+0062	U+006E	U+007A	U+00AE	U+00CA	U+20A0	U+20AC	U+20B8
&	2	>	J	V	b	n	z	®	Ê	₠	€	₸
U+0027	U+0033	U+003F	U+004B	U+0057	U+0063	U+006F	U+007B	U+00B0	U+00D4	U+20A1	U+20AD	U+20B9
’	3	?	K	W	c	o	{	°	Ô	₡	₭	₹
U+0028	U+0034	U+0040	U+004C	U+0058	U+0064	U+0070	U+007C	U+00B1	U+00EA	U+20A2	U+20AE	U+20BA
(	4	@	L	X	d	p	|	±	ê	₢	₮	₺
U+0029	U+0035	U+0041	U+004D	U+0059	U+0065	U+0071	U+007D	U+00B5	U+00F4	U+20A3	U+20AF	U+2103
)	5	A	M	Y	e	q	}	µ	ô	₣	₯	℃
U+002A	U+0036	U+0042	U+004E	U+005A	U+0066	U+0072	U+007E	U+00B6	U+2018	U+20A4	U+20B0	U+2109
*	6	B	N	Z	f	r	~	¶	‘	£	₰	℉
U+002B	U+0037	U+0043	U+004F	U+005B	U+0067	U+0073	U+00A2	U+00B7	U+2019	U+20A5	U+20B1	U+2116
+	7	C	O	[	g	s	¢	·	’	₥	₱	№
U+002C	U+0038	U+0044	U+0050	U+005C	U+0068	U+0074	U+00A3	U+00BB	U+201C	U+20A6	U+20B2	U+2121
,	8	D	P	¥	h	t	£	»	“	₦	₲	℡

Table A8-1-2 Character set for Botswana (Cont.)

U+2122	U+215B	U+2168	U+2178	U+2198	U+25B2	U+260F	U+263B	U+266C
™	⅛	Ⅸ	ⅸ	↘	▲	☏	☻	♬
U+2150	U+215C	U+2169	U+2179	U+2199	U+25B3	U+2610	U+2660	U+266D
☐	⅜	Ⅹ	ⅹ	↙	△	☐	♠	♭
U+2151	U+215D	U+216A	U+217A	U+21D0	U+25BC	U+2611	U+2661	U+266E
☐	⅝	Ⅺ	ⅺ	⇐	▼	☑	♡	♮
U+2152	U+215E	U+216B	U+217B	U+21D1	U+25BD	U+2612	U+2662	U+266F
☐	⅞	Ⅻ	ⅻ	⇑	▽	☒	♢	♯
U+2153	U+2160	U+2170	U+2190	U+21D2	U+2600	U+2613	U+2663	U+26C4
⅓	Ⅰ	ⅰ	←	⇒	☀	X	♣	☃
U+2154	U+2161	U+2171	U+2191	U+21D3	U+2601	U+2614	U+2664	U+26C5
⅔	Ⅱ	ⅱ	↑	⇓	☁	☔	♤	⛅
U+2155	U+2162	U+2172	U+2192	U+21D4	U+2602	U+261C	U+2665	U+26C6
⅕	Ⅲ	ⅲ	→	⇔	☂	☜	♥	□
U+2156	U+2163	U+2173	U+2193	U+21D5	U+2603	U+261D	U+2666	U+26C7
⅖	Ⅳ	ⅳ	↓	⇕	☃	☝	♦	□
U+2157	U+2164	U+2174	U+2194	U+21D6	U+2604	U+261E	U+2667	U+26C8
⅗	Ⅴ	ⅴ	↔	↖	☄	☞	♧	□
U+2158	U+2165	U+2175	U+2195	U+21D7	U+2605	U+261F	U+2669	
⅘	Ⅵ	ⅵ	↕	↗	★	☟	♩	
U+2159	U+2166	U+2176	U+2196	U+21D8	U+2606	U+2639	U+266A	
⅙	Ⅶ	ⅶ	↖	↘	☆	☹	♪	
U+215A	U+2167	U+2177	U+2197	U+21D9	U+260E	U+263A	U+266B	
⅚	Ⅷ	ⅷ	↗	↙	☎	☺	♫	

A8-2 Modifications for subtitle and superimposed characters

The details of the modifications from ARIB STD-B24 necessary for subtitle and superimposed characters are shown in Table A8-2.

Table A8-2 Modifications from ARIB STD-B24
(Subtitle and superimposed characters)

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
Volume 1 Part 3 4 Presentation function of caption and superimpose Table 4-1: Presentation function of caption	142	Kanji, hiragana, katakana, symbol, alphanumerical, Greece characters, Russian characters, ruled line, DRCS	Characters defined in UTF-8 character code
Volume 1 Part 3 5.2 Character set	144	Standard character set should be kanji, hiragana, katakana, symbol, alphanumeric, Greece characters, Russian characters, box drawing, and DRCS.	Character set defined in UCS should be used.
Volume 1 Part 3 5.5 Character coding	144	For character coding, 8bitcode shall be used.	For character coding, UTF-8 character code shall be used.
Volume 1 Part 3 5.6 Control code	144	Control code used for caption is in compliance with Volume 1, Part 2 of this standard.	Control code used for caption is in compliance with Annex A8-1 in this document.
Volume 1 Part 3 9.3.1 Table 9-8: Character coding	155	Reserved for UCS	UCS

Annex 9 Interactive channel

There is no amendment to ABNT NBR 15607-1.

Annex 10 EWBS

There is no amendment to ISDB-T Harmonization Document PART 3: Emergency Warning Broadcast System (EWBS).

Supported by Japan International Cooperation Agency (JICA)
Project for Implantation of the Digital Migration Project (DiMT)

TECHNICAL SPECIFICATION

FOR

DIGITAL TERRESTRIAL SET TOP BOX

ISSUED BY

BOTSWANA COMMUNICATIONS REGULATORY AUTHORITY

Document Number: DTT001
Revision: 2
Date: DD/MM/2015

Technical Specification
for
Digital Terrestrial Set Top Box

Contents

Issued by:

Botswana Communications Regulatory Authority
Plot 5067 Independence Avenue
Private Bag 00495
Gaborone
Botswana

Telephone: +267 395 7755
+267 368 5500
Fax: +267 395 7976
E-mail: info@bocra.org.bw
Website: http://www.bocra.org.bw/

Scope

This specification shall apply to all the Digital Terrestrial Television broadcast Set Top Boxes that shall be manufactured, imported or used in Botswana for the purpose of receiving the DTT broadcast programmes by the viewers/consumers or any other purpose that shall be deemed to access the DTT Network. It will not apply to integrated digital Television set, portable and mobile receivers.

The specification gives the minimum requirements in which the STBs shall comply. The other value added features, including, but not limited to High Definition TV decoding, Satellite decoding, Conditional Access, Return Path would be dictated by the market.

Botswana Communications Regulatory Authority shall type-approve all set top boxes based on the minimum specifications as outlined in this document.

Annexure 1 gives the details of each feature specified under the Operational and Technical Specifications.

Entry into force

This specification shall enter into force on XXXXX.

Document History

Description	Status	Date
Edition 1	Approved	November 2014

Operational Specifications Summary

	Feature	Description/functionality
1	On/Off button	Switches the STB power on or off
2	On Screen Display	Presents the channel programme Number or Programme guide on the screen
3	Electronic Programme Guide (EPG)	Lists the schedules, displays them on screen once operated
4	Auto Search	The unit will perform an automatic search for channels. (Manual search optional)
5	Signal Quality level indicator	Indicates signal strength and quality level (reception)
6	Video Output	PAL I is the video signal for Botswana and most analogue TV sets have PAL I inputs
7	Languages	STB Operational Manual should be in English. Setswana is optional
8	Remote Control Unit	Commands and execute the full STB functions. Small in size and using AA or AAA batteries.
9	Channels	The STB software must up to 100 programmes selectable at random as per user's requirement
10	Warranty	The STB shall carry a minimum of 1 year (12 months) warranty
11	Operations Manual	Clear and easy to understand with basic trouble shooting and pictorial illustrations.
12	Conditional Access (optional)	Optional and shall not prohibit viewers on free-to -air DTT channels
13	Connectors	Rear Panel or front side

Technical Specifications Summary

	Feature	Specification
1	RF Input Impedance	75Ω
2	AC Mains Power supply	220V ±20V 50Hz ±2Hz
3	DC power supply	Optional 12V
4	Power plugs	BS 1363, 4573, 546-3pin
5	Network functionality	MFN and SFN
6	Connectors	RCA 3 connectors (2 audio and 1 video)
7	Modulation	Comply with Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877
8	FEC on OFDM	Comply with Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877
9	Input signal	0 dBm to -78.4 dBm or -35 dBm to -85 dBm
10	Frequency	UHF (470-694 MHz), and VHF (174-230 MHz) Optional
11	Signal Bandwidth	8 MHz Channelization Plan of GE06
12	Frequency off-set	125 kHz
13	Guard intervals	Comply with Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877
14	Channel/Noise Ratio	Comply with Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877
15	Interleaving	Comply with Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877
16	Video decoding	MPEG-4 (H.264)
17	PAL I	625 Lines, 50 Hz, Video bandwidth: 5 MHz
18	Aspect Ratio	4:3 and 16:9
19	Frame frequency	25 Hz
20	Conditional Access	Smart card / software applicable (optional)
21	RAM	128 Mbytes (DDRAM) 8 Mbytes Flash
22	Processor	≥300 MHz
23	Bit stream conversion	MPEG-2 ISO/IEC 13818
24	Audio decoding	MPEG-4 AAC

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8MHz Bandwidth

		Sampling rate: 32 kHz, 44.1 kHz and 48 kHz (Dolby and other related approved audio decoding optional)
25	Serial Interface	RS 232 or USB
26	Audio mode	Single track/dual track/stereo
27	GE06 channelization Plan	Compliant
28	STB electronic Components	Comply with Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877
29	Intrinsic immunity	EN 55020 or CISPR 20
30	Intrinsic radiation	EN 55013 or CISPR13
31	Voltage Fluctuations	EN 61000-3-3/IEC 61000-3-3

Additional Notes

BOCRA recognises equivalent standards from other standardisation bodies and countries in ITU Region 1.

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8MHz Bandwidth

Annexure

I. Manual

The Operation's Manual for the STB shall be written in the English language and easy to read, understand and follow. It shall have the basic installation guide. Setswana will be an optional extra. Use of graphic/drawing for illustation is encouraged.

II. Decoding and Outputs

The Set Top Box shall be a decoder which should be able to decode the DTT signal and has an analogue output of PAL I. The other outputs such as HDMI and USB or RS232 shall be deemed optional. In the event these are included, the type approval for them shall follow the same criteria. A RS232 or USB port shall be provided where a device can be connected for upgrades.

It shall be able to search channels automatically (manual shall be optional). Most of the TV sets have the AV inputs using RCA connectors. This allows simpler input with colour coded cable leads for the viewers. There shall be stereo (left and right) outputs for audio using RCA connectors (females) and the video output shall be an RCA connector (female) as well. The acceptance test for electronic components shall be in accordance with approved processes and acceptable to the ITU.

III. Remote Control Unit

It shall have the remote control unit which is easier to operate or use. The remote control unit shall be powered by either 1 (one) AA battery or 2 (two) AAA batteries. It shall have the capability to switch on/off the STB, change, scan, program/edit/re-arrange channels as well as reduce or increase the volume. The remote control unit shall be able to access the root and sub-roots menu of the STB. The remote control unit shall be in the category of low power emitting devices.

IV. Display of Programme number

The receiver shall display the programme number in a convenient way and selectable manually or through the remote control unit. It shall display the programme Number on the front panel either selected manually or through the IR Remote Control. The Channel number is essential for the storage and selection of channels. The

viewer will then know according to the numbers which channels are where once the STB has been programmed accordingly.

V. Front Panel Menu Buttons & LEDs

There shall be standard LEDs to indicate good or bad signals. These shall be clearly illustrated in the manual. There shall be all the necessary buttons for manual operation on the front panel. These include but not limited to the following: the Menu button, the power “on/off”, the channel selection “up/down”and volume control. The STB should glow red on power LED when “ON” and black when it is “OFF”.

VI. On Screen Display (OSD)

It is mandatory that the STB has capability for ‘On Screen Display’. The OSD will enable the viewer to view any information that she/he wishes to bring forward for reading

VII. Electronic Programme Guide (EPG)

EPG shall be displayed by the use of the remote control unit or by manual operation through the menu button on the front panel of the STB. This shall be an exclusive button on the remote control unit. The remote control unit shall enable the viewer to input the programme number with much ease for choice of Programme.

Any data casting such as news online, notices etc. that will be available in the transmission shall be displayed as and when needed by the viewer. The STB shall be able to clearly display any transmitted information intended for the viewer.

VIII. Warranty

It shall carry a minimum of 1 (one) year warranty.

IX. Packaging (include batteries)

The Set top Box shall be packed in a sealed box. In the event the seal is broken the purchaser shall have the right to refuse the item. In addition, the packaging shall contain in it the remote control unit with sealed batteries, the AV Cable, the Operations Manual and the power cable.

X. Connectors

The AV connections together with Power supply connector, the USB port and the HDMI shall be at the rear of the STB. It shall also have RF in and RF out connectors. Should the STB have external power input other than the mains supply, it shall also be on the rear panel of the STB.

XI. Navigator (USER INTERFACE)

The STB shall have a navigator menu, activated by remote control unit and shall be in English, Setswana is an option.

XII. Power Supply

The AC supply in Botswana is 240V at 50Hz. The STB shall operate from an AC supply of 220V ±20V at 50Hz ±2Hz. Mains supply in Botswana is as stated above and it is mandatory as this will not change in the near future. Mains connection shall conform to any of the specifications for the power outlets listed in this document.

There are commonly used power plugs and outlets in Botswana. The power plugs and sockets shall be any of the following standards;

BS 1363 

BS 4573 

BS 546 – 3pin 

All STB power supplies must be fused. In the even the manufactured chooses the BS4573 or BS 546 -3pin, there shall be a 13 Amp fuse installed before the circuitory of the STB.

XIII. DC power supply (optional)

The STBs may have an additional DC power socket for 12V power supply. The socket shall be mounted on the back panel insulated with centre pin at 2.1mm diameter and the plug with the centre hole being positive (+) and the outer part being negative (-). It shall not exceed the 5A rating. Where this is available, the connector cable to battery shall be supplied with colour coded leads (red for positive and black for negative.

XIV. Electromagnetic Compatibility (EMC)

The EMC standards aim to minimise electromagnetic interference from electrical and electronic devices to others and immunity to the interference. Some of the existing standards that are already in

use shall form part of the compliance of the STBs. The following standards or equivalent shall apply;

EN 55020 or CISPR 20
Sound and television broadcast receivers and associated equipment-Immunity characteristics-Limits and methods measurements.

EN 55013 or CISPR 13
Sound and television broadcast receivers and associated equipment-Radio disturbance characteristics-Limits and methods measurements.

EN 61000-3-3 IEC 61000-3-3
Part 3-3: Limits — Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current 16A per phase and not subject to conditional connection

XV. Conditional Access (CA)

The STB may provide for Conditional Access (CA). This is to enable the future expansion of broadcasting where Pay TV may be introduced. The facility for conditional access shall be in the STBs that will be used for that purpose only. It will not affect the basic STBs for normal access. The CA shall be optional and the CA shall be approved by the Authority where it has been included. The necessary documentation of the CA shall be provided for reference in the application for approval. STB with Conditional Access shall still carry Free to Air channels and shall not at any given time be affected by the non-payment of subscription of pay per view service providers. All STBs shall be able to carry free to air DTT services.

XVI. Upgrade

Software upgrades are important to allow service to provide bug fixes and quality improvements to their products. The STB shall have the ability to perform any software upgrade that might be available through a USB or any other available interface. This shall in no way compromise the operation of the STB and the service provider shall take full responsibility for the upgrade and the effects to consumer devices.

XVII. Tuning/Scanning procedures

The receiver shall, in case of same Transport stream ID and Service ID on two or more different frequencies save all frequencies, or select the frequency with better signal. The receiver shall be able to receive and react on tuning parameters in PSI/SI tables. In addition to the automatic search, the receiver shall allow a manual search where Channel ID (or frequency) is entered by the end user. The receiver shall tune to this channel, search all available transmission modes, add new services and replace existing services in the service list (without considering any quality criteria).

XVIII. RF Input impedance

The RF (Radio Frequency) impedance shall be 75Ω for use with standard outdoor or indoor aerial via a coax cable. This is the nominal impedance that is used across almost all broadcast or receiver equipment of radio frequency signals. The source impedance and for maximum power transfer the RF input impedance shall match that of the unit. In general, the antennae are based on the 75Ω specification.

XIX. Bypass Input

The decoder/receiver shall enable the RF to pass through to the set regardless of the mode of operation. i.e. whether on ‘standby’ mode or ‘off where external input is required by the viewer, the STB should be able to provide for the desired input to be viewed without having to switch on the decoder or the STB. It shall maintain an RF input to RF output.

XX. Modulation

The modulation in the DTT has to have a high level of resilience in co-channel narrowband interference hence it is implemented in digital terrestrial TV broadcast.

There has to be a number of parameters that safeguard the tranmission signals against interference and also gives rise to minimum set of values that protects the customer in order for them to enjoy reception. The ITU has come up with specific recoomendations to guide broadcasters, equipment suppliers and other manufacturers to adhere to these standards.

Any STB which is to be imported, sold, distributed and operated/used in Botswana shall be able to decode digital terrestrial television broadcast which complies with the requirements of Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877.

XXI. Forward Error Correction (FEC)

The FEC figures are standard in decoders and these are meant to safeguard inter carrier frequency interference. FEC consistently corrects any errors using the Reed Solomon sequence and Convolution Code (RS+CC) [1].
Optional: the Bose-Chaudhuri-Hocquengham and Low-density parity-chek (BCH+LDPC).
The STB shall have an error free recovery mode and the response time in the variation of shall be not more than one (1) second.
FEC coding shall be the nominal sequence of the OFDM. The STB shall conform to the Recommendation ITU-R BT1306 System C[1] or ITU-R BT.1877.

XXII. Input signal

The sensitivity of the receive side of the STB is here specified. This is to enable bare minimum for the STB to be able to handle the minimum required signal in order to provide reproduction of the signal. In the event the signal is lost, the no signal shall be displayed on the screen. This will assist the viewer to be able to see that the TV set is not the one that is off but transmission has been lost.

The input signal level shall be

: a maximum of 0 dBm which shall be the maximum allowed level. The maximum level is specified in order that the demodulator will be protected. The input level is set at -78.4dBm[1]

or: a maximum of -35dBm which shall be the maximum allowed level. The maximum level is specified in order that the demodulator will be protected. The input level is set at -85dBm

which shall constitute the minimum input level to able to be detected and demodulated by the RF input unit. The minimum signal is set in order for the STB to be able demodulate because most of the terrestrial signals are at very low levels.

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8MHz Bandwidth

XXIII. Subtitles

The STB shall be able to display Subtitling in reference to ARIB STD-B24[1] or ETSI300 743) .

XXIV.C/N

In any signal propagation, there is bound to be noise in the signal. In broadcasting environment there is need for a significant ratio between the carrier signal and the inherent noise. The bigger the ratio the better the quality of the RF signal in the case of television broadcast. The conformance shall be within Recommendation ITU-R BT. 1306 System C[1] or ITU-R BT.1877.

XXV. Guard Intervals

The standard guard intervals allow separation of signals and it is desirable that a clear separation is recommended so that there is conformance in terms of the originating transmissions. It is however desirable those shorter guard intervals are used. This will increase the channel efficiency. The required guard intervals are as Recommendation ITU-R BT.1306 or System C[1] or ITU-R BT.1877.

XXVI.Operational Frequency

The unit shall operate within the band of frequencies as agreed by the ITU for Region 1 which is 470 MHz to 694 MHz (UHF).

The above mandatory 470 MHz to 694 MHz is the specified digital terrestrial Television broadcast which the STB must receive.

XXVII. Signal Bandwidth

Botswana is signatory to the ITU's Region 1 GE06 and the frequency planning that has been agreed and planned for is a bandwidth of 8MHz. It is therefore mandatory that the STB shall decode channels in accordance with the GE06 Channelization plan.

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8MHz Bandwidth

XXVIII. Frequency off set

An off-set frequency of 125 kHz from the nominal centre frequency is specified and the STB should be able to still decode the signal.

XXIX. Memory and processor

The RAM requirement is to be able to store the configurations for the STB and as well as any other information, the viewer does not have to store everything from the beginning when power is lost. The higher the RAM and the processor speed the better. The basic processor shall give the minimum required here and that it does not take much time to process the input commands. The unit shall consist of the following minimum specifications: 128Mbytes for DDRAM SDRAM, 8Mbytes for Flash Memory and 300MHz processor.

XXX. Aspect Ratio

A number of conventional TV sets are still in the 4:3 aspect ratio and mandatory is that the STB shall be able to provide for this format. This will enable the viewers to still enjoy the full screen viewing in the old TV sets. In the same token other productions are still done in the same format (4:3). For those that have wide screen ready TV sets, it is an advantage where a wide screen viewing is available for them to utilize it particularly in sport. The STB shall be able to produce 4:3 picture viewing with blank side shaded to black on a 16:9 format and also produce 16:9 viewing without leaving uncovered areas on the screen or oversizing the picture.

XXXI. Resolution

The resolutions tally well with aspect ratios. The STB shall be able to display 4:3 signal to 16:9 and the reverse shall also take place. The required video quality shall be 720x576 for the SD aspect ratio and 1920 x1080 for HD aspect ratio.

XXXII. Frame Rate

The standard format for Botswana is PAL I. The 16:9 and 4:3 formats conform to PAL I which a number of TV sets in Botswana have as the basic format. The frequency frame shall be 25Hz for PAL.

XXXIII. Audio Decoding

The audio shall be able to decode MPEG-4 AAC and sample at 32kHz, 44.1kHz and 48kHz whereas any other sampling such as 96kHz will not be a mandatory requirement. An internationally approved formats such Dolby etc. can be used and documentation shall be provided for type-approval by the Authority. This will allow high quality audio presented in mono, dual or stereo signal to be received.

XXXIV. Interface

The serial interface is the connection normally using the RS 232 or USB to communicate with other devices. In other operational requirements, the RS 232 or USB connector could also be an interface for the PC/Laptop to project data for a programme source. The requirement is generally for interoperability with other equipment for similar operations. The interface for RF video input shall be in accordance with the IEC 61169-2 female input on 75Ω impedance and, shall also conform to IEC 61169-2 male for RF bypass loop. The bundled item of conversion adaptor is also acceptable. The HDMI shall be optional.

XXXV. Software applications

These STB specifications allow for creativity and innovation in developing software application for datacasting.

XXXVI. Additional Hardware

Personal Video Recoder (optional)

TECHNICAL SPECIFICATION

FOR

INTEGRATED DIGITAL TELEVISION (IDTV) SET

ISSUED BY

BOTSWANA COMMUNICATIONS REGULATORY AUTHORITY

Document Number: **DTT002**
Revision: **1**
Date: ***YYYY***

Technical Specification
for
Integrated Digital Television Set

Contents

Issued by:

Botswana Communications Regulatory Authority
Plot 5067 Independence Avenue
Private Bag 00495
Gaborone
Botswana

Telephone: +267 395 7755
Telephone +267 368 5500
Fax: +267 395 7976
E-mail: info@bocra.org.bw
Website: http://www.bocra.org.bw/

Scope

This specification shall apply to all the Digital Terrestrial Television broadcast Integrated Digital Television Set (hereinafter “IDTV") that shall be manufactured, imported or used in Botswana for the purpose of receiving the DTT broadcast services by the viewers/consumers or any other purpose that shall be deemed to access the DTT Network. It will not apply to Set Top Boxes, Portable and Mobile Receivers.

The specification gives the minimum requirements in which the IDTVs shall comply. The other value added features, including, but not limited to Conditional Access, Return Path will be guided by the market.

Botswana Communications Regulatory Authority (hereinafter “BOCRA”) shall type-approve all IDTVs based on the minimum specifications as outlined in this document.

Annexure gives the details of each feature specified under the Operational and Technical Specifications.

Entry into force

This specification shall enter into force on DD/MM/YY.

Table 1: Document History

Description	Status	Date
Edition 1	Approved	XXXX

Table 2: Operational Specifications Summary

	Feature	Description/functionality
1	On/Off button	Switches the IDTV power on or off.
2	On Screen Display	Presents the channel programme Number or Programme guide on the screen.
3	Electronic Programme Guide (EPG)	Lists the schedules, displays them on screen once operated.
4	Auto Search	The unit will perform an automatic search for channels. (Manual search optional)
5	Signal strength and Quality level	Indicates signal strength and quality level (reception).
6	Languages	English is the official language, IDTV Operational Manual should be in English. Setswana is optional.
7	Remote Control Unit	Commands and execute the full IDTV functions. Small in size and using AA or AAA batteries.
8	Channels	The IDTV software must store up to 100 programmes selectable at random per user's requirements.
9	Warranty	The IDTV shall carry a minimum of 12 months (1 Year) warranty
10	Operations Manual	Clear and easy to understand with basic trouble shooting and pictorial illustrations.
11	Conditional Access (optional)	Optional and shall not prohibit viewers on free-to -air DTT channels

Table 3: Technical Specifications Summary

	Feature	Specification
1	Input Impedance	75 Ω
2	AC Mains Power supply	220 V ±20 V 50 Hz (±2 Hz)
3	Power plugs	BS 1363, 4573, 546 - 3pin
5	Modulation	In compliance with the GE06 Channelling Plan of Recommedation ITU-R BT.1306 System C[1] or ITU-R BT.1877
6	FEC on OFDM	Comply with Recommedation ITU-R BT.1306 System C[1] or ITU-R BT.1877
7	Input signal	0 dBm to -78.4 dBm Or -35 dBm to -85 dBm
8	Frequency	UHF (470 - 694 MHz), and VHF (174 - 230 MHz) Optional

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8MHz Bandwidth

9	Signal Bandwidth	8 MHz Channelization Plan of GE06
10	Guard intervals	Comply with Recommedation ITU-R BT.1306 System C[1] or ITU-R BT.1877
11	Channel/Noise Ratio	Recommedation ITU-R BT.1306 System C[1] or ITU-R BT.1877
12	Interleaving	Comply with Recommedation ITU-R BT.1306 System C[1] or ITU-R BT.1877
13	Video decoding	MPEG-4 (H.264)
14	Aspect Ratio	4:3 and 16:9
15	Frame frequency	25 Hz
16	Conditional Access	Smart card /software applicable (Optional)
17	RAM	128 Mbytes (DDRAM) 8 Mbytes (Flash
18	Processor	≥300 MHz
19	Bit stream conversion	MPEG-2 ISO/IEC 13818
20	Audio decoding	MPEG-4 AAC are required. Sampling rate: 32 kHz, 44.1 kHz and 48 kHz (Dolby and other related approved audio decoding optional)
21	Serial Interface	RS 232 or USB
22	Audio mode	Single track/dual track/stereo
23	GE06 channelization Plan	Compliant
24	Intrinsic immunity	EN 55020 or CISPR 20
25	Intrinsic radiation	EN 55013 or CISPR 13
26	Voltage Fluctuations	EN 61000-3-3/IEC 61000-3-3

Additional Notes

BOCRA recognises equivalent standards from other standardisation bodies and countries in ITU Region 1.

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8MHz Bandwidth

Annexure

I. Manual

The Operation's Manual for the IDTV shall be written in the English language and easy to read, understand and follow. It shall have the basic installation guide. Setswana language will be optional. The use of graphic/drawings for illustation is encouraged.

II. Decoding and Outputs

The IDTVs outputs such as an analogue PAL ,HDMI and RS232 or USB shall be deemed optional. However, a RS232 or USB port shall be provided where a device can be connected for upgrades.

The IDTV should be able to search channels automatically.

III. Remote Control Unit

The IDTV shall have a remote control which is easier to operate or use. The remote control unit shall be powered by either 1 (one) AA battery or 2 (two) AAA batteries. It shall have the capability to switch on/off the IDTV, change, scan, program/edit/re-arrange channels as well as reduce or increase the volume. The remote control unit shall be able to access the root and sub-roots menu of the IDTV. The remote control unit shall be in the category of low power emitting devices.

IV. On Screen Display(OSD)

It is mandatory that the IDTV has capability for 'On Screen Display' (OSD). The OSD will enable the viewer to view any information that the viewer wishes to bring forward for reading.

V. Electronic Programme Guide (EPG)

Electronic Programme Guide (EPG) shall be displayed by the use of the remote control of the IDTV. This shall be an exclusive button on the remote control unit. The remote control shall enable the viewer to input the programme number with much ease for choice of Programme.

Any data casting such as news online, notices etc. that will be available in the transmission shall be displayed as and when prompted by the viewer. The IDTV shall be able to clearly display any transmitted information intended for the viewer.

VI. Warranty

It shall carry a minimum of one (1) year warranty.

VII. Packaging (include batteries)

The packaging shall contain in it the remote control unit with sealed batteries and the operations manual.

VIII. Navigator (USER INTERFACE)

The IDTV shall have a navigator menu, activated by remote control and shall be in English, Setswana is an option.

IX. Power Supply

The AC supply in Botswana is 240 V at 50 Hz. The IDTV shall operate from an AC supply of 220 V ±20 V at 50 Hz (±2 Hz). Mains supply in Botswana is as stated above and it is mandatory as this will not change in the near future. Mains connection shall conform to any of the specifications for the power outlets listed in this document.

There are commonly used power plugs and outlets in Botswana. The power plugs and sockets shall be any of the following standards;

BS 1363

BS 4573

BS 546 – 3pin

All IDTV power supplies must be fused. In the event the manufactured chooses the BS 4573 or BS 546 - 3pin, there shall be a 13 Amps fuse installed before the circuitry of the IDTV.

X. Electromagnetic Compatibility (EMC)

The EMC standards aims to minimise electromagnetic interference from electrical and electronic devices to others and immunity to the interference. Some of the existing standards that are already in use shall form part of the compliance of the IDTVs.

The following standards of equivalent shall apply;

EN 55020 or CISPR 20
Sound and television broadcast receivers and associated equipment-Immunity characteristics-LimIDTV and methods measurements.

EN 55013 or CISPR 13
Sound and television broadcast receivers and associated equipment-Radio disturbance characteristics-LimIDTV and methods measurements.

EN 61000-3-3 IEC 61000-3-3
Part 3-3: Limits — Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current 16A per phase and not subject to conditional connection

XI. Conditional Access (CA)

The IDTV may provide for Conditional Access (CA). This is to enable the future expansion of broadcasting where Pay TV may be introduced. The facility for conditional access shall be in the IDTVs that will be used for that purpose only. It will not affect the basic IDTVs for normal access. The CA shall be optional and the CA shall be approved by the Authority where it has been included. The necessary documentation of the CA shall be provided for reference in the application for approval. IDTV with Conditional Access shall still carry Free to Air channels and shall not at any given time be affected by the non-payment of subscription of pay per view service providers. All shall be able to carry free to air DTT services.

XII. Upgrade

Software upgrades are important to allow service to provide bug fixes and quality improvements to their products. The IDTV shall have the ability to perform any software upgrade that might be available through a USB or any other available interface. This shall in no way compromise the operation of the STB and the service provider shall take full responsibility for the upgrade and the effects to consumer devices.

XIII. Tuning/Scanning procedures

The receiver shall, in case of same Transport stream ID and Service ID on two or more different frequencies save all frequencies, or select the frequency with better signal. The receiver shall be able to receive and react on tuning parameters in PSI/SI tables. In addition to the automatic search, where Channel ID (or frequency) is entered by the end user. The receiver shall tune to this channel, search all available transmission modes, add new services and replace existing services in the service list (without considering any quality criteria).

XIV. Input impedance

The impedance shall be 75 Ω for use with standard outdoor or indoor aerial via a coax cable. This is the nominal impedance that is used across almost all broadcast or receiver equipment of radio frequency signals. The source impedance and the input impedance for maximum power transfer shall match that of the unit. In general, the antennae shall be based on the 75 Ω specification.

XV. Modulation

The modulation in the DTT has to have a high level of resilience in co-channel narrowband interference hence it is implemented in digital terrestrial TV broadcast.

There has to be a number of parameters that safeguard the transmission signals against interference and also give rise to minimum set of values that protect the customer in order for them to enjoy reception. The ITU has come up with specific recommendations to guide broadcasters, equipment suppliers and other manufacturers to adhere to these standards.

Any IDTV which is to be imported, sold, distributed and operated/used in Botswana shall be able to decode digital terrestrial television broadcast which complies with the requirements of Recommedation ITU-R BT.1306 System C[1] or ITU-R BT.1877

XVI. Forward Error Correction (FEC)

The FEC figures are standards in decoders and this are meant to safeguard inter carrier frequency interference. FEC consistently corrects any errors using the Reed Solomon sequence and Convolution Code (RS+CC).
Optional: the Bose-Chaudhuri-Hocquengham and Low-density parity-chek (BCH+LDPC).
The IDTV shall have an error free recovery mode and the response time in the variation shall be not more than one (1) second.
FEC coding shall be the nominal sequence of the OFDM. The IDTV shall conform to the Recommedation ITU-R BT.1306 System C[1] or ITU-R BT.1877.

XVII. Input signal

The sensitivity of the receive side of the IDTV should be specified. This is to enable bare minimum for the IDTV to be able to handle the minimum required signal in order to provide reproduction of the signal. In the event the signal is lost, the 'no signal' shall be displayed on the screen. This will assist the view to see that the TV set is not the one that is off but transmission has been lost.

The input signal level shall be;

a maximum of 0 dBm which shall be the maximum allowed level. The maximum level is specified in order that the demodulator will be protected. The input level is set at -78.4 dBm[1] or

a maximum of -35 dBm which shall be the maximum allowed level. The maximum level is specified in order that the demodulator will be protected. The input level is set at -85 dBm

which shall be the maximum allowed level. The 0 dBm is specified in order that the demodulator will be protected. The input level is set at -78.4 dBm which shall constitute the minimum input level to be detected and demodulated by the RF input unit. The minimum signal is set in order for the IDTV to demodulate because most of the terrestrial signals are at very low levels. In the same aspect, the maximum level of 0 dBm has to be specified in order to protect the IDTV internal demodulator.

XVIII. Subtitles

The IDTV shall be able to display Subtitling in ARIB STD-B24[1] or ETSI300 743 .

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8MHz Bandwidth

XIX. C/N

In any signal propagation, there is bound to be noise in the signal. In broadcasting environment there is a significant ratio between the carrier signal and the inherent noise. The bigger the ratio the better the quality of the video signal in the case of television broadcast.. The conformance shall be within Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877.

XX. Guard Intervals

The standard guard intervals allow separation of signals and it is desirable that a clear separation be recommended so that there is conformance in terms of the originating transmissions. It is however desirable that those shorter guard intervals are used. This will increase the channel efficiency. The required guard intervals are as Recommedation ITU-R BT.1306 System C[1] or ITU-R BT.1877.

XXI. Operational Frequency

The IDTV shall operate within the band of frequencies as agreed by the ITU for Region 1 which is 470 MHz to 694 MHz (UHF).

The above mandatory 470 MHz to 694 MHz is the specified digital terrestrial Television broadcast which the IDTV must receive.

XXII. Signal Bandwidth

Botswana is signatory to the ITU's Region 1 GE06 and the frequency planning that has been agreed and planned for a bandwidth of 8 MHz. It is therefore mandatory that the IDTV shall decode channels in accordance with the GE06 Channelization plan.

XXIII. Frequency off set

An off-set frequency of 125 kHz from the nominal centre frequency is specified and the IDTV should be able to still decode the signal.

XXIV. Memory and Processor

The RAM requirement is to be able to store the configurations for the IDTV and as well as any other information, the viewer does not have to store everything from the beginning when power is lost. The higher the RAM and the processor speed the better. The basic processor shall give the minimum required here that it does not take much time to process the input commands. The unit shall consist of the following minimum specifications: 128 Mbytes for DDRAM SDRAM, 8 Mbytes for Flash Memory and 300 MHz processor.

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8MHz Bandwidth

XXV. Resolution

The resolutions tally well with aspect ratios. The IDTV shall be able to display 4:3 signal to 16:9 . The required video quality shall be 720 x 576 for SD aspect ratio and 1920 x 1080 for 16:9 HD aspect ratio.

XXVI. Frame Rate

The frequency frame shall be 25 Hz.

XXVII. Audio Decoding

The IDTV shall be able to decode MPEG-4 AAC sampled at 32 kHz, 44.1 kHz and 48 kHz whereas any other sampling such as 96 kHz will not be a mandatory requirement. An internationally approved formats such as Dolby etc. can be used and documentation shall be provided for type-approval by the Authority. This will allow high quality audio presented in mono, dual or stereo signal to be received.

XXVIII. Interface

The serial interface is the connection using the USB or RS 232 to communicate with other devices. In other operational requirements, the USB or RS 232 connector could also be an interface for the PC/Laptop to project data for a programme source. (Optional)

The requirement is generally for interoperability with other equipment for similar operations. The interface for RF input shall be in accordance with the IEC 61169-2 female input on 75 Ω impedance. The bundled item of conversion adaptor is also acceptable. The HDMI shall be optional.

XXIX. Software applications

These IDTV specifications allow for creativity and innovation in developing software application for datacasting.

XXX. Additional Hardware

Personal Video Recoder (optional)

TECHNICAL SPECIFICATION

FOR

DIGITAL TERRESTRIAL TELEVISION BROADCAST PORTABLE AND MOBILE RECEIVERS (DPMR)

ISSUED BY

BOTSWANA COMMUNICATIONS REGULATORY AUTHORITY

Document Number: DTTXXX
Revision: 1
Date: *YYYY*

Technical Specification
for
Digital Terrestrial Television
Portable and Mobile Receivers

Contents

Issued by:

Botswana Communications Regulatory Authority
Plot 5067 Independence Avenue
Private Bag 00495
Gaborone
Botswana

Telephone: +267 395 7755
Fax: +267 395 7976
E-mail:
Website: http://www.bocra.org.bw/

Scope

This specification shall apply to all of the Digital Portable and Mobile Receivers (hereinafter “DPMR”), which will be accomodated into either a mobile or potable device, that shall be manufactured, imported or used in Botswana for the purpose of receiving the Digital Terrestrial Television (hereinafter “DTT”) broadcast programmes by the viewers/consumers or any other purpose that shall be deemed to access the DTT Network.

The specification gives the minimum requirements in which the Portable and Mobile receivers shall comply.

Botswana Communications Regulatory Authority shall type-approve all of Portable and Mobile Receivers based on the minimum specifications as outlined in this document.

Annexure 1 gives the details of each feature specified under the Operational and Technical Specifications.

Entry into force

This specification shall enter into force on DD/MM/YY.

Document History

Description	Status	Date
Edition 1	Approved	XXXX

Operational Specifications Summary

	Feature	Description/functionality
1	Auto Search Manual Search (optional)	The unit will perform an automatic search for channels or can be selected manually (optional)
2	Languages	DPMR Operational Manual should be in English. Setswana is optional.
3	Warranty	The DPMR should carry a minimum of 1 year (12 months) warranty
4	Operations Manual	Clear and easy to understand with basic trouble shooting and pictorial illustrations.

Technical Specifications Summary

	Feature	Specification
1	Modulation	Full seg: Comply with Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877 One seg: QPSK
2	FEC on OFDM	Comply with Recommendation ITU-R BT.1306 System C or ITU-R BT.1877
	Input signal	Full seg: 0 dBm to -78.4 dBm One seg: no specific requirement
3	Frequency	UHF (470-694 MHz), and VHF (174-230 MHz) optional
4	Guard intervals	Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877
5	Interleaving	Recommendation ITU-R BT.1306 System C[1] or ITU-R BT.1877
6	Video decoding	MPEG-4 (H.264)
7	Bit stream conversion	MPEG-2 ISO/IEC 13818
8	Audio mode	Single track/dual track/stereo
9	GE06 channelization Plan	Compliant

Additional Notes

BOCRA recognises equivalent standards from other standardisation bodies and countries in ITU Region 1.

Annexure

I. Manual

The Operation's Manual for the DPMR shall be written in the English language and easy to read, understand and follow. It shall have the basic installation guide. Setswana will be an optional extra. Use of graphic/drawing for illustation is encouraged.

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8 MHz Bandwidth

II. Warranty

It shall carry a minimum of 1 (one) year warranty.

III. Tuning/Scanning procedures

The receiver shall, in case of same Transport stream ID and Service ID on two or more different frequencies save all frequencies, or select the frequency with better signal. The receiver shall be able to receive and react on tuning parameters in PSI/SI tables. The DPMR shall be able to search channels automatically. In addition to the automatic search, the receiver shall allow a manual search where Channel ID (or frequency) is entered by the end user. The receiver shall tune to this channel, search all available transmission modes, add new services and replace existing services in the service list (without considering any quality criteria).

IV. Modulation

The modulation in the DTT has to have a high level of resilience in co-channel narrowband interference hence it is implemented in digital terrestrial TV broadcast.

There has to be a number of parameters that safeguard the transmission signals against interference and also gives rise to minimum set of values that protects the customer in order for them to enjoy reception. The ITU has come up with specific recommendations to guide broadcasters, equipment suppliers and other manufacturers to adhere to these standards.

Any DPMR which is to be imported, sold, distributed and operated/used in Botswana shall be able to decode digital terrestrial television broadcast which complies with the requirements of Recommendation_ITU-R BT.1306 System C[1] or ITU BT.1877.

V. Forward Error Correction (FEC)

The FEC figures are standard in decoders and this are meant to safeguard inter carrier frequency interference. FEC consistently corrects any errors using the Reed Solomon sequence and Convolution Code (RS+CC). The DPMR shall have an error free recovery mode and the response time in the variation of shall be not more than 1 (one) second.
FEC coding shall be the nominal sequence of the OFDM. The Portable and Mobile Receiver shall conform to the Recommendation ITU-R BT.1306 System C[1] or ITU BT.1877.

VI. Subtitles

The DPMR prefer to display Subtitling in reference to ARIB STD-B24[1].
(ETSI300 743 is optional.)

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8 MHz Bandwidth

VII. Guard Intervals

The standard guard intervals allow separation of signals and it is desirable that a clear separation is recommended so that there is conformance in terms of the originating transmissions. It is however desirable those shorter guard intervals are used. This will increase the channel efficiency. The required guard intervals are as Recommendation ITU-R BT.1306 System C[1] or ITU BT.1877.

VIII. Operational Frequency

The unit shall operate within the band of frequencies as agreed by the ITU for Region 1 which is 470 MHz to 694 MHz (UHF).

The above mandatory 470 MHz to 694 MHz is the specified digital terrestrial Television broadcast which the DPMR must receive.

[1] Botswana has chosen ISDB-T Standard for all the parameters using 8 MHz Bandwidth

Supported by Japan International Cooperation Agency (JICA)

Project for Implantation of the Digital Migration Project (DiMT)

Separate Volume -5
Public relations plan for digital migration

Public Relations Plan for the Digital Migration

in

the Republic of Botswana

March, 2016

Department of Broadcasting Services

Ministry of State President

Preface

In modern society many communication means are used, such as television, radio, mobile telephone, wireless, etc. Among these means, the radio waves used for communication and broadcasting are limited to certain frequencies, which already have a significant demand on these frequencies. By converting television broadcasting from analogue to digital, several programmes can be transmitted per channel. Additionally, single frequency network is available for development of TV network, so that the frequencies can be effectively utilised. Therefore, there is a trend towards digital migration worldwide.

The government of Botswana decided to migrate to Digital Terrestrial Television Broadcasting (DTTB) and adopt the Integrated Services Digital Broadcasting - Terrestrial (ISDB-T) as Japanese standard for DTTB in 2003. The government of Botswana plans to migrate from analogue to digital by June 2015, in accordance with the suggestion by International Telecommunication Union (ITU). The migration requires not only the replacement of the transmitting system, but also purchasing digital receiver as a preparation for the people who are going to watch the DTTB.

In order for DTTB to be transmitted and viewed, the broadcasting company must digitise the transmission system, and the broadcasting equipment must be suitable for high definition (HD). At the same time, it is necessary for the viewers to have a receiving system that can enable DTTB to be viewed. When these are accomplished, the viewers can view HD programmes. Moreover, DTTB will be the first communication system in Botswana; so it is also possible that it will not comply with the current systems and laws. Hence, in this case it will be needful to amend the systems and laws regarding broadcasting. Accordingly, various processes will be significant in order to progress digital migration as a national policy. In this way, the transition to DTTB will then be completed after completion of these issues and tasks.

The Public Relations Plan is a guide which encourages viewers to buy replacement receivers, provides basic knowledge regarding digital migration, and promotes understanding of digital migration. The objective of this guide is to impart proper knowledge regarding digital migration and have the necessary equipment installed so that programmes telecasted according to the new service of DTTB can be enjoyed without confusions.

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ABBREVIATIONS

ASO	Analogue Switch Off
BOCRA	Botswana Communications Regulatory Authority
BTCL	Botswana Telecommunication Corporation Limited
BTV	Botswana Television
DC	District Commissioner
DBS	Department of Broadcasting Services
DSO	Digital Switch Over
DSTV	Digital Satellite Broadcasting Television
DTTB	Digital Terrestrial Television Broadcasting
FTA	Free to Air
GBC	Gaborone Broadcasting Corporation
HD	High Definition video
ISDB-T	Integrated Service Digital Broadcasting-Terrestrial
ITU	International Telecommunication Union
JET	Japanese Expert Team
JICA	Japan International Cooperation Agency
STB	Set Top Box
WG	Working Group

Chapter 1. Background and current situation

Batswana has been enjoying Botswana Television (BTV) viewing since it went on air in 1999. It has been growing consistently over the years due to the introduction of more programmes and coverage of other areas in the country. Prior to that, the majority of the population used to view Gaborone Broadcasting Corporation (GBC) television and free-to-air (FTA) aerials/satellites television which made broadcasting of South African Channels possible. People in Botswana used Philibao, a FTA digital satellite receiver, which allows viewers to watch free channels on their television. It is a decoder made by China. It does not need subscription but offers many FTA channels from other countries. The percentage of the household's penetration is around 70% in the whole country, with at least 95% usage in urban areas. Additionally, a small population of the country, about 20% residing in the capital city and towns subscribes to the monthly Digital Satellite Television (DSTV) through multi choice. However, the rest of the country watches television through Philibao, which provides other African channels.

The Department of Broadcasting Service (DBS), the Government of Botswana has set the numerical target of Analogue Switch Off (ASO) for 90% of current analogue service coverage area and 60% of household of receiver penetration after commencement of DTTB. The adoption of the ISDB-T system has been reported in newspaper and other publications in Botswana. However, an explanation of "what is DTTB?", "when the migration starts?" and/or "how and what should we do to watch the DTTB?" have not been reported yet. Therefore, the viewers do not have enough information on DTTB currently.

In Botswana, the rate of watching foreign TV programmes is relatively high. However, many people watch BTV programmes to get information and watch news of their own country. Even though the migration starts, the viewers are unable to watch DTTB. To prevent the inability and ensure smooth migration, it is essential and urgent to provide sufficient information and promotion for the viewers prior to migration.

Chapter 2. Purpose of Public Relations Plan

Botswana has a vast land, yet people are sparse and scattered over the whole country. By contrast, information infrastructures are still under development. In order to deal with this issue, the involvement of stakeholders in each district is necessary which acts as a key factor to achieve public relations activities efficiently for the completion of digital migration in certain period. Various kinds of public relations activities are essential in different areas, which might help people obtain accurate and precise information.

Intentions of viewers are:

i. to comprehend digital migration in Botswana
ii. to learn the benefits from digitalization
iii. to know the time of digital switch over and analogue switch off
iv. to gain understanding of preparation for watching DTTB

With integrated activities, confusion caused by wrong information can be prevented, and viewers can get exact and precise information everywhere in right timing. Also, it is helpful for preventing gaps in the information that needs to be communicated; such as the status of digital migration, the necessary requirements for viewing DTTB, and the person to be contacted in case of problems.

Once the viewers are informed and have gained proper understanding, they will be able to enjoy viewing television programmes by the new service of DTTB without confusion.

Chapter 3. The Basic Concept of Public Relations Plan

As mentioned earlier, the smooth migration to DTTB is one of the most important challenges in Botswana. In ensuring numbers of national awareness activities about DTTB, migration should be conducted in such a way that the public can adopt and utilise it. Since the time for migration to DTTB is limited, it is necessary for Botswana to utilise the stakeholders including local public bodies, churches, teachers, leaders of communities who are influencers for each community. To that end, the contents of the public relations activities must be easily understood by the viewers, as the viewers might not have technical knowledge related to broadcast or "Digital Migration." This public relations plan has been prepared based on the concept that even the viewer, who is not an expert of technology, can carry out the strategies.

The key concept of the public relations plan is as mentioned below:

i. Multiple access: to provide opportunities in order to obtain information by different approaches
ii. Continuity: to ensure to provide information on a continual basis
iii. Familiarity: to provide real visible images of DTTB

3.1 Implementation Method

One of the important things for the public relations plan is to always catch up the depth of people's understanding of DTTB. It is possible that the effectiveness through the activities in the planning stage is different than in the implantation stage. Therefore, the plan is executed by PDCA (Plan-Do-Check-Action) cycle method as shown in Figure 3-1.

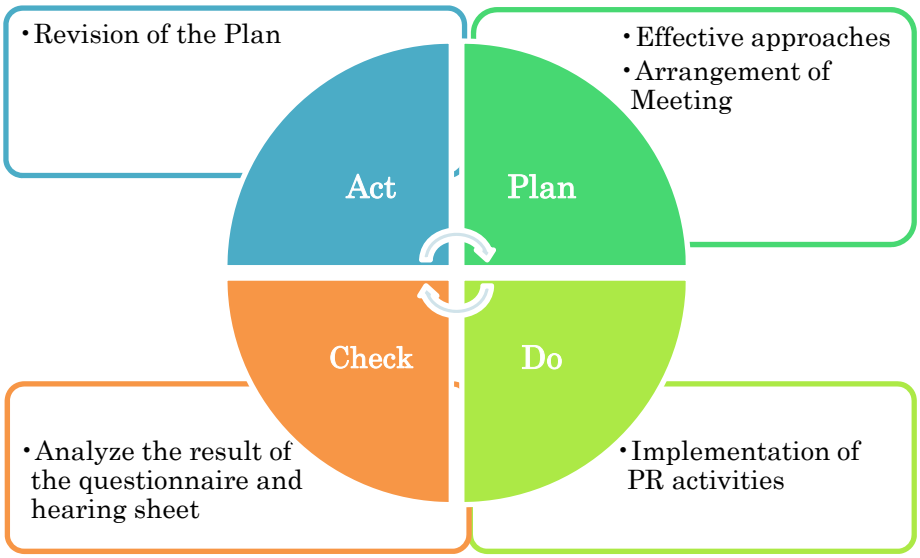

Figure 3-1 PDCA Cycle of Public Relations Plan

3.2 Main Organization in Charge

Public relations activities are planned by DBS for digital migration project. DBS has established a Working Group (WG) who are in charge of public relations activities. This WG implements public relations activities with the assistance of JICA and Japanese Expert Team (JET) dispatched by JICA. The JET advises the DBS using their experiences from Japan.

DBS hires consultancies and the consultancies carries out the activities according to the instructions provided by DBS. Further, DBS holds meetings regularly and confirms the progress of the public relations activities. Local consultancies should play active role and come up with ideas for the execution of the public relations activities.

As shown in Figure 3-2, this plan is prepared by DBS as an overall plan, and its implementation is carried out by local consultants.

Figure 3-2 below shows the framework of the public relations plan.

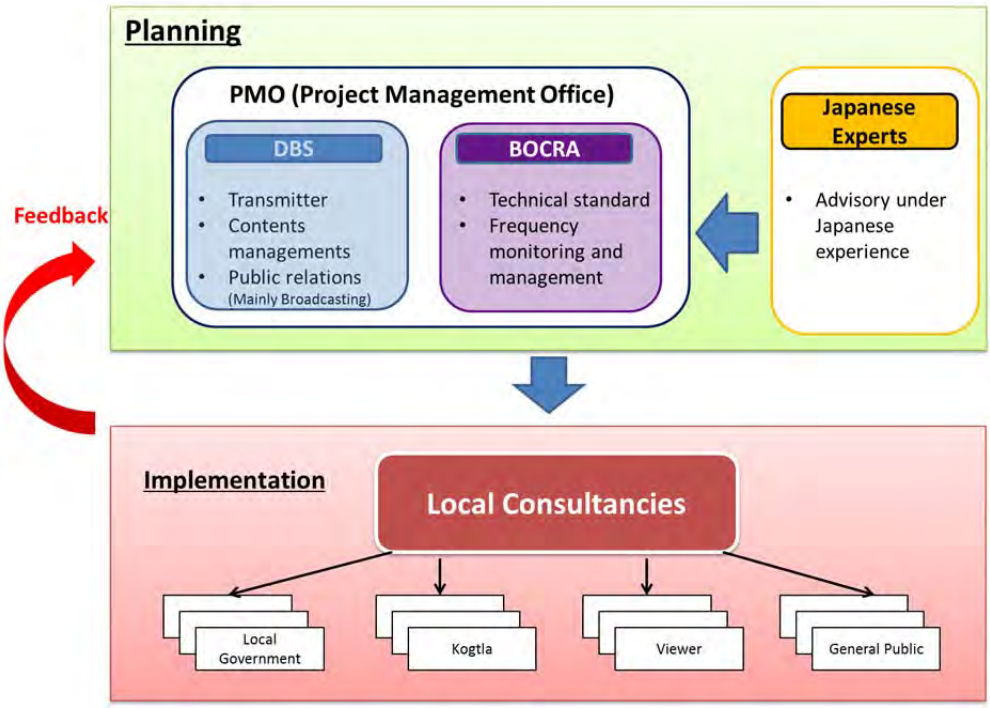

Figure 3-2 Framework of the Public Relations Plan

Chapter 4. Target of the Public Relations Plan

In order to reach mass target of the Public Relations Plan, the primary target group and the secondary target group are identified as shown in Figure 4-1. The digital migration is one of the national policies in Botswana and digital migration requires involving almost all nations which has TV sets.

The primary target group contains the central government ministries, District Commissioner (DC), Chiefs as well as media who are able to convey the information to the ordinary people. The DBS conducts the activities on the digital migration for the primary target group, as pilot activities, basically in the initial stage of the public relations. Meanwhile, the DBS hires three consultancies that implement the activities for the secondary target group in the whole country. The secondary target group consists of the ordinary viewers, consumer-electronics retailers, and general public and so on.

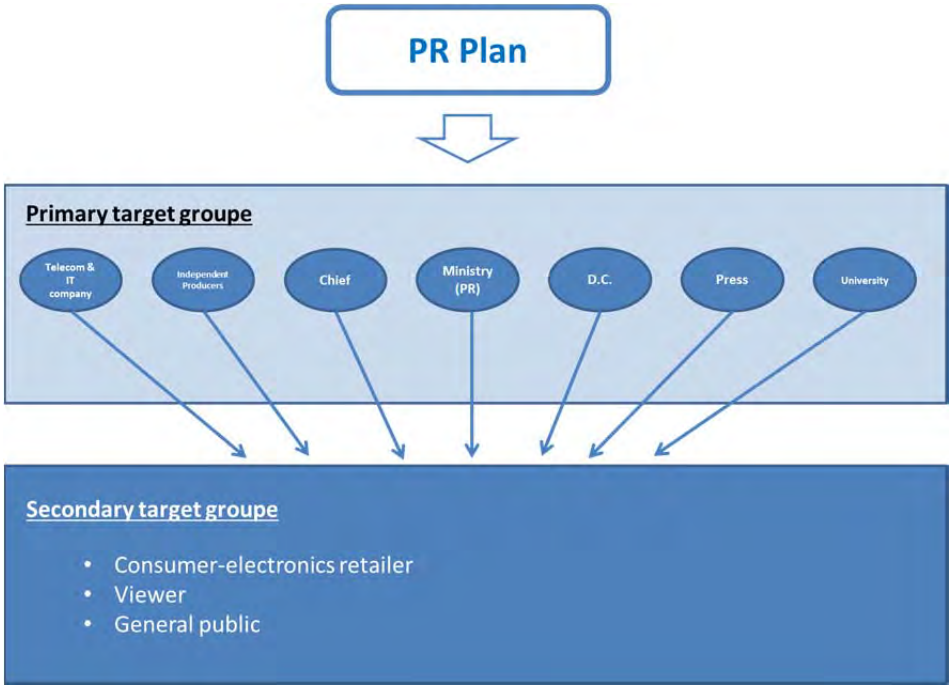

Figure 4-1 Target group for Public Relations Plan

Chapter 5. Public Relations Activities

The planned-public relations activities have been classified under 4 different categories according to the aims, which are mentioned as below:

i. Information Provision
ii. Public Relations Campaign
iii. Receiver Penetration
iv. Viewer Assistance Plan

Also, the purpose, exact target, methods and approaches, execution timing and estimated cost of all activities under these categories are mentioned in a project paper.

The activities are carried out by either DBS or local consultancies based on the target group. Further, DBS is supposed to conduct the activities as pilots in the initial stage under the support by JET. Those pilots are evaluated and the results of the evaluations are reviewed to revise the Public Relations Plan. Thus, the Public Relations Plan is utilised through those revisions and the activities are adjusted with such flexibility in order to meet the effects.

The framework of the public relations activities are indicated in Figure 5-1 as below.

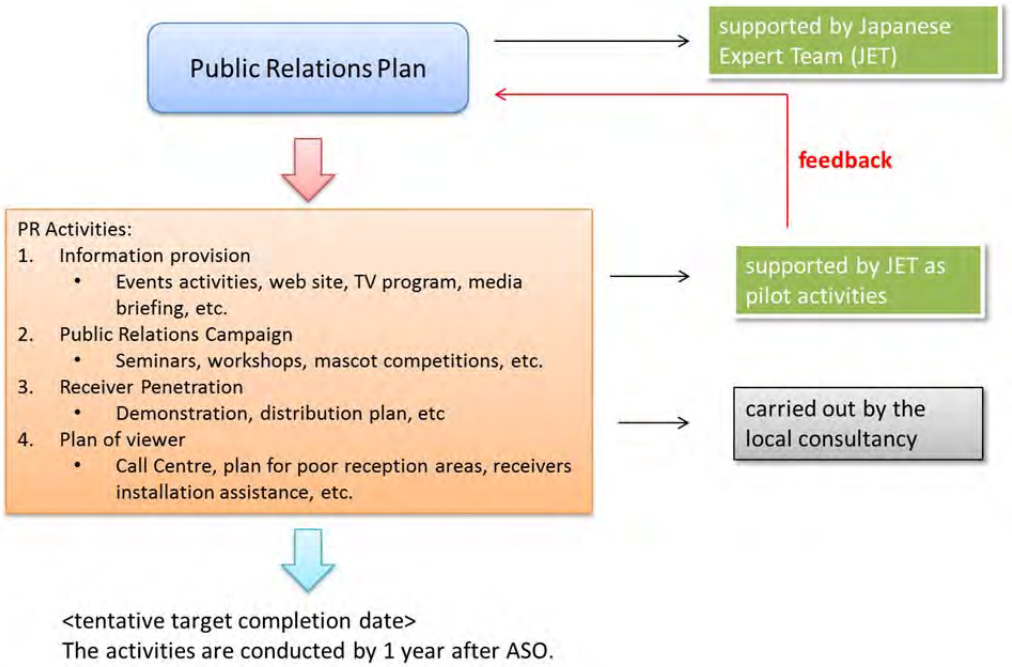

Figure 5-1 Framework of Public Relations Activities

Familiarization of DTTB is essential to raise awareness about digital migration. If the phrase “Digital Migration” gets popular, it will be easier to go to the next step like the prerequisites to manage the process of digital migration. The viewer takes necessary steps to adopt DTTB only when they are familiar with the words like “Digital Migration” and the changes that it will bring about. The public relations activities are devised and orchestrated in an orderly manner to allow for its effectiveness and efficiency.

5.1 Information Provision

Digital migration is one of the world’s challenges in terms of effective spectrums usage. It is necessary for viewers to understand why digital migration is needed and what should be done for the smooth ending of migration. Viewers should also know when, where and how the migration occurs. One of the advantages of digital migration is that the general public can receive more clear images and useful information. These advantages should be highlighted through public relations activities. Therefore, various public relations activities have to be performed to equip the viewer with all the information they need in order to migrate successfully.

Information Provision consists of 6 activities. The main target of Information Provision includes the people of the whole country. Therefore, many activities will provide information to many unspecified people using radio, television, and other media. In order to involve the media, the first task is to explain the details of digital migration to programme creators of television and radio, and also to newspaper and magazine journalists. If the people who write and publish the articles do not have accurate knowledge about digital migration, they will not be able to provide proper information to the people and might mislead them. By disseminating the basic knowledge of digital migration and of the new technology of digital broadcasting, they will be able to deliver correct information to the public. Also, it is necessary to ensure that these events do not limit to one round. This is because digital migration will be implemented on a timeline, so providing information only once will not communicate the progress and hence the timeline will be incomplete. By periodically supplying information to the media such as once every 3 months, the viewers will be able to learn about the current status of digital migration from the media. Therefore, the viewers can make planned progress on preparations for digital migration. As a result, the digital migration can be smoothly implemented.

The activities of Information Provision Category are listed below,

Table 5-1 Activities of Information Provision

Activities		**Target Audience**	**Timing**	**Target Place**
Information Provision	Events Notification	Viewer /General Public	ASO/DSO Information: Immediate notice once the date is decided Other Events: before 1 week each events	Whole Country
	Introduction of New Technologies	Viewer /General Public	From February, 2015 Information update every 2 months	Electric shop, Local Government, Kgotla
	Press briefing	Media Stakeholder	From 1st April, 2015 will be held occasionally with matters according to the situation	Gaborone

Activities		Target Audience	Timing	Target Place
	Web Page	General Public (web literate)	After consultancy is decided	Whole country
	TV Advert	Viewer	From February, 2015 Information update every 2 months	Whole country
	Radio Advert	Listener	From February, 2015 Information update every 2 months	Whole country

Refer to the Appendix 1. Project paper for details of each activity.

a). Purpose

Notify the progress of digital migration by providing information like a milestone or related information of when digital migration starts. It is essential to provide the necessary documents to promote the understanding of digital migration in Botswana.

b). Method and key feature

It utilises media such as the Broadcasting station, Radio station, print media, social media, mall demonstrations, and road shows, to offer the DTTB information to the unspecified number of people in different settings. Therefore, the use of the varied means of communications caters for a wider population through their different areas and set-up. Because the range of viewer spreads wide through all generations and depending upon the age group, different communication means are used. For example, it is possible to deliver information through internet to some people, but some might not have used computers at all. In that case, some other acquirable media can be used. The activities under information provision are designed in a way that all generations will get proper information at least through one or the other activity.

c). Detailed activities

The most important thing for information provision is to clarify “When,” “Where,” “Who,” “What,” “Why,” “How” of the information. To ensure the preciseness of the information, the aforementioned 5W1H should be included in the information. Sometimes a catchy slogan can be effective to penetrate the information of DTTB, though the uniformity of the “public relations activities” is essential. It is necessary to

thoroughly check the information which will be provided to the public to ensure clarity and preciseness.

- Events Notification

  Through the announcement of the various events scheduled to take place, it gives update of the progress on digital migration. The particularly important thing is ASO timing. It is necessary for the announcement of the ASO to cover a significant part of the population through all techniques immediately after the ASO schedule is fixed. The ASO notice shall continue the announcement until its completion.

  When the viewers obtain information regarding each type of event timely, they can make planned preparations necessary for receiving digital terrestrial broadcasts; so the digital migration can be implemented without confusion.

- Introduction of New Technologies

  Introduction of new technologies is very important as it provides people with the knowledge and necessary gadgets about DTTB. These new technologies make understanding of the migration process much smoother because of the demonstrations. For example, “what is data broadcasting?”, “What is possible with DTTB?” etc.

  If you are not a specialist, sometimes it is difficult to understand new technologies. However, digital migration is an event that affects the whole public, so the activities must be carried out so that it is easily possible for the people to understand.
  For example, in case when there is no technical expert to do demonstrations, self-help material such as pamphlets with clear instructions can also be created for extra knowledge. These can be distributed throughout the key areas where there is presence of mass population and even in electrical appliance shops.

  When the viewers understand the merits of the new technology of digital broadcasting, they will actively make the necessary preparations for receiving digital terrestrial broadcasts.

- Press Briefing

  The cooperation with press is necessary to disseminate enough information to the people. To cover precise information by newspapers or TV, a mutual understanding with the media is required. For this reason, some media briefings and tours for press to promote awareness of DTTB should be planned before providing information to the people. Similarly, progress updates should also be carried out after important milestones to promote the public participation and ownership of the migration.

  If journalists do not understand the necessity of digital migration, they cannot be expected to properly communicate the information. Also, it is necessary that information regarding the Digital Switch Over (DSO), Analogue Switch Off (ASO), and the progress status of digital migration be successively taken up by the news. Therefore, information must be periodically provided to journalists.

- DTTB Website

  Establishment of website for DTTB makes it easy for visitors to get information related to the DTTB migration any time by simply accessing the website. Through the website, question/answer and feedback portal can also be established to allow visitors to address some of their questions.

  The advantage of a website is that the information can be received at any time. However, the benefit is limited to those who are IT literate.

- TV/Radio Advert

  Broadcasting through TV and radio provides the progress of DTTB migration through CMs or news of some events. Once the date of ASO or DSO is near, the exact date will always be shown on TV and also be broadcasted on radio to allow vast number of people to access the message.

  Many television and radio programmes have a certain level of fixed viewers and listeners. By carrying out spot announcements at fixed times in addition to special announcement events at the irregular time periods, the term “digital migration”

will eventually become popular among the listeners and viewers. Establishing the word enables digital migration to feel familiar.

5.2 Public Relations Campaign

The campaign will focus on promoting more knowledge and understanding of DTTB among people. More clear images and useful information enables to create huge effect among viewers. The utilisation of promotional goods (not for sale) such as T-shirts printed with some awareness messages for example "Digital Terrestrial Television Broadcasting" can also be good advertisement for DTTB. The activities for Public Relations Campaign are below:

Table 5-2 Activities of Public Relation Campaign

Activities		**Target Audience**	**Timing**	**Target Place**
Public Relations Campaign	DTTB Migration Seminars	DTTB Stakeholders /Other concerned individual	Gaborone seminar (Kick off seminar) in April, 2015. After kick off seminar to spread across whole district by the end of 2016.	Capital of districts
	Visiting Workshop	Viewer /General Public	After following installation by districts	Capital of districts
	Competitions	General Public	Within 1 month after the 1st draft of public relations plan is prepared	Whole country

Refer to the Appendix 1. Project paper for details of each activity.

a). Purpose

Public relations campaign encourages the participants to create awareness about DTTB as well as create advertisements as public relation partners. These public relations partners may come up with fresh ideas. By incorporating the ideas into next plan, public relations campaign can be amended more effectively.

b). Method and key feature

Participants can feel close to DTTB migration through experience learning from public relations activities such as Workshops, DTTB migration seminar, a catchy slogan and mascot competition.

c). Detailed activities

Presentation of content by presenters from DBS is usually done to promote understanding of the migration process and the regulatory body's role in the process. This is usually followed by questions and answers to ensure people are satisfied with the information. People generally find it easier and faster to learn through visual stimulation, hence more demonstrations should be done to allow interaction and questions and answers.

- DTTB migration seminars

  "Why is digital migration necessary", "What is the procedure for migration to digital terrestrial broadcasting?" and "When is digital migration scheduled to be completed?" and other information that must be communicated is as described in Section 5.1 as activities of Information Provision. However, participatory information supply in contrast to one-way information supply communicates with living words, and has a higher effect. In addition, another merit of participatory type activities beyond information supply, is provision of experience; so the rate of retention of the content is higher. Also, information sharing rather than one way information supply enables those conducting the events to know the present problems of the participants and what they feel unsure about.

  The important things for carrying out a participatory activity are to clarify the activity's target group and time table. It is necessary to confirm that the places of the activities cover whole area of Botswana by dividing Botswana into regions. The contents of seminars should be adjusted to the target group. If a seminar includes some lectures, a preparation meeting is required with speakers to have some understanding of information to be disseminated to the people. The assessment of a seminar should be done by using a questionnaire which is distributed when people register the seminar. The questionnaire should be made and collected with a systematic method. To guarantee the return of the questionnaire, some efforts will be done like providing promotion goods in

exchange for the questionnaire. The result of the assessment from questionnaires is utilised to improve the quality of the next seminar.

An advance preparation is a key to the success of seminar. The size of the conference room and the accessibility should be examined carefully. A facilitator should be present at the seminar to control the time of presentations and Q&A session. Questionnaires posed by attendants should be documented for record keeping and also be used as an indicator for preparations of other seminars.

Note that the target audience for the DTTB Migration Seminars include those in government ministries and agencies that are influential and have a strong say in local affairs, DCs, Chiefs, etc. It is envisaged that they will have the responsibility of explaining digital migration to the second target group, so it is necessary that sound and correct information is provided.

- Visiting Workshops

Visiting workshops are majorly different than the DTTB Migration Seminars because its target audience are seniors. Usually it is difficult for them to understand new technologies and hence they tend to reject excessive use of technical terms. Bidirectional information exchange by the visiting workshops is an effective way for them to understand the new technologies. Further, the visiting workshops can provide adequate information for each individual or community.

In the DTTB Migration Seminars, it is envisaged that the participants will provide information on digital migration to the second target after attending the seminar. However, the second target group is the main audience for the Visiting Workshops. Hence, it is envisaged that it should be mainly experience based rather than explanation using difficult technical terms. (See Chapter 4)

- Competitions

A catchy slogan competitions or mascot competition are planned for public relations of DTTB. These competitions can make people spread the awareness and understanding of DTTB and advertise it more actively. A sufficient budget for manufacturing promotion goods of the contest winner and prose of the contest

should be secured. Easy to understand catch copy or an attractive mascot captures the feelings of the public, and can be easily created. Also, providing information at malls or on public transport means such as buses where there is a high concentration of customers will increase familiarisation. By adopting methods that can involve children, effective public relations for children can also be implemented.

5.3 Receiver Penetration

A particularly important factor in digital migration is the penetration of receivers. Therefore, opportunities will be provided to directly experience DTTB, a new technology, and thus promote understanding of equipment required for digital migration. When it is about promoting understanding of something, allowing people to experience it has a greater effect than simply providing information about it. Since receivers are new products based on a new technology, their market penetration will require certain time. Allowing the public to see and touch new equipment is expected to further enhance their interest in digital broadcasting and have an effect of promoting receiver penetration.

The activities for Receiver penetration are as listed below;

Table 5-3 Activities of Receiver Penetration

Activities		**Target Audience**	**Timing**	**Target Place**
Receiver Penetration	Demonstrations	General Public	1st: 13th to 14th March, 2015 (Airport Junction, Gaborone) 2nd: 20th to 21st March, 2015 (Main Mal, Gaborone) 3rd: 16th May, 2015 (Gantsi) 4th: 17th June, 2015 (Railway Park, Gaborone) These demonstrations will	Sub district level

			be carried out in all the districts by the end of 2016.	
	Pilot Project Appox. 10,000 revivers (STB and IDTV) provision	Public place, DBS officer	From June 2015	Public Place (Ministry, DC, Airport, Police, School, Bank, Communication private company)

Refer to the Appendix 1. Project paper for details of each activity.

a). Purpose

Introduction of receivers is essential for watching DTTB.

b). Method and key feature

Raise awareness for receivers by providing a chance to see and experience latest receivers through demonstration at the popular places of each town such as malls, schools, churches etc.

c). Detailed activities

- Demonstrations of Receivers

  People can watch beautiful and clear HD programmes through the latest receiver developed for Botswana by Japanese manufactures. Viewers can observe not only clear pictures but also experience how much information can be accommodated in 16:9 picture size. One of the main features of ISDB-T system is data broadcasting. Viewers can also experience this data broadcasting by using a remote control in the demonstration.

- Receivers distribution for pilot project

  Prior to free distribution to the general public, TVs and STBs owned by DBS will be distributed to the public facilities in Botswana. In the first stage, 100 sets will

be distributed to the public facilities in Gaborone. Since digital broadcasting has already started using test waves in Gaborone, it can be watched immediately after the free distribution of receivers. This measure is also useful in enhancing the recognition of digital broadcasting by citizens because it can be easily watched at the public facilities. Furthermore, integrated TVs (IDTV) offer viewing of digital broadcasting without installation of STBs. IDTVs owned by DBS will be distributed to the executives working at DBS partly as a test to check whether digital broadcasting can be watched. After distribution is completed in Gaborone, DBS will procure an additional 10,000 sets and distribute them to the public facilities nationwide.

The places distant from the transmitting station or where poor reception can be expected due to buildings, etc., outdoor antennas will be distributed in addition to receivers.

Possible distribution destinations in Gaborone under review are shown in the table below. These destinations have been chosen in consideration of their ability to attract customers and popularity of the place.

Table 5-4 Receivers Distribution (Gaborone Aria)

	Integrated TV	TV Monitor	STB	Antenna
Government	25	25	25	47
Senior Schools	0	10	10	10
Public Clinics/Hospitals	0	5	5	5
Private Clinics/Hospitals	0	2	2	2
News and Control Rooms	0	11	12	12
ICT Companies Parastatals	0	8	8	8
Private Broadcaster	0	4	4	4
Banks	0	12	12	12
Schools (Universities)	0	8	8	8

	Integrated TV	TV Monitor	STB	Antenna
Airport	1	0	0	1
Total	26	85	86	109

5.4 Viewer Assistance Plan

Even if the signal reception is poor, analogue broadcasting can be watched with deteriorated quality. However, digital broadcasting with signal lower than a certain level cannot be watched at all and the screen remains blank. If viewers experience problems due to migration from analogue to digital broadcasting, smooth digital migration is expected to be difficult. Therefore, viewer assistance plan is considered necessary for smooth digital migration.

Viewers encounter different problems depending on the situation. Each of them must be addressed appropriately in order to promote people's understanding of digital migration. A call centre is an effective means for dealing with such problems.

Provision of these supports with attention to details is a key to smooth digital migration.

The activities for Viewer Assistance Plan are below:

Table 5-5 Activity of Plan for viewers

Activities		**Target Audience**	**Timing**	**Target Place**
Viewer Assistance Plan	Call centre establishment and operation	Viewers/ General Public	As soon as the office is ready	Sub district level

Refer to the Appendix 1. Project paper for details.

a). Purpose

Provision of information directly and interactively

b). Method and key feature

Establishment of call centre. A call centre enables good customer care through interactive communication with callers. However, the establishment of a call centre requires an adequate human resources with proper knowledge of the subject.

c). Detailed activities

- Call centre

  Some issues which are not expected beforehand are likely to occur when DTTB migration proceeds. For example, an area which is expected to have good digital signal reception can receive only weak or no signal due to radio wave interference. Such issues vary from area to area and need to respond individually. A call centre is effective to deal with such issues because of the interactivity. As a result, issues related to DTTB migration can be known rapidly, which is extremely useful to utilise the revision of Public Relations Plan.

  The establishment of a call centre requires a securement of adequate human resources who can respond to many troubles. These staffs should also be capable enough to answer queries from viewers.
  Refer to the Chapter 7 for more information.

Chapter 6. Receivers Penetration

6.1 Necessity of Developing the Receiving Environment

In order to receive DTTB, in addition to the tasks of the broadcasters, the viewers must be provided the viewing environment for digital terrestrial broadcasts. It is likely necessary for the viewers to either install an STB and outdoor antenna for the television they currently own, or to buy a new IDTV that is capable of receiving the ISDB-T signal. In order to complete the migration to digital terrestrial broadcasting, it is necessary that the viewers understand how to provide the environment for receiving digital terrestrial broadcasts, and to provide the reception environment. Also with analogue broadcasting, even when the radio waves are poor, the images and the sound is considerably degraded; but it can be viewed. However, if the radio wave is poor in digital broadcasting, nothing is shown on the television; even listening and viewing is not possible. Therefore, in the case of environments that are distant from the transmission facilities or that has a building or the topography shielding the radio wave, it will be necessary to install an outdoor antenna. This information must be accurately conveyed.

6.2 Information Disclosure

As receivers become available, the most important thing is providing information to the viewers. The viewers must be accurately told when, where, and for how much STB and IDTV can be purchased. Also, the viewers cannot watch digital broadcasts if the receivers and the receiving sets are not properly installed. So, it is necessary to inform the people about the proper methods of installation. Therefore, before STBs and IDTVs become available on the market, it is necessary to organize study meetings on method of installation for consumer-electronics retailers.

The procedure of public relations for receivers is shown in Figure 6-1.

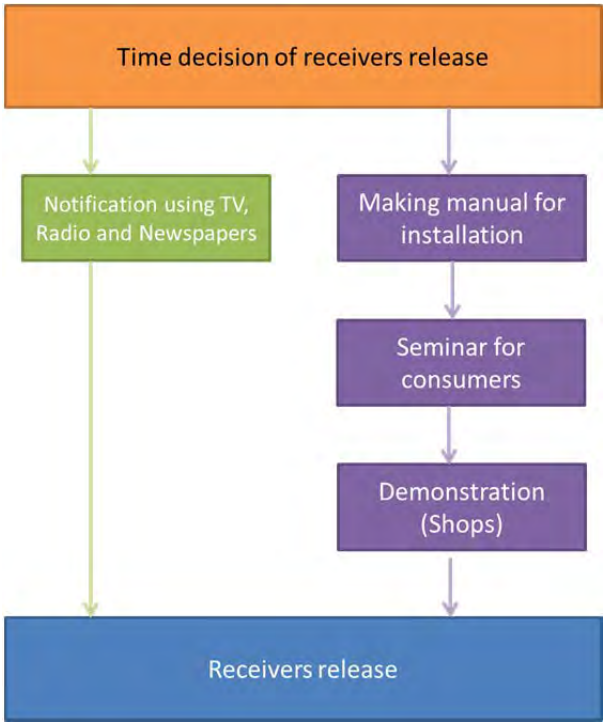

Figure 6-1 Procedure for Receivers Public Relations

Chapter 7. Call Centre Establishment and Operations

7.1 Background

Observing the experiences of digital migration in other countries such as Japan, assistance of viewers was a key point for the achievement of the completion of the migration in certain period as the plan. Even though the viewers are provided enough information, there might be many people who don't know how to set up the receiver either STB or IDTV with outdoor antenna. Also, a person with disability might not be able to install the receiver as well as outdoor antenna.

Since BTV has commenced digital broadcasting services and implementation of pilot public relations activities, DBS received many inquires through telephones. Also, retail shops, import agents in Botswana are not familiar enough with features of ISDB-T. Therefore, the establishment of a call centre is required for providing as much information as possible and also for avoiding confusion while people purchase the receiver. The call centre is expected to support viewers' digital migration accordingly.

7.2 Role and Responsibility

The roles and responsibilities of the call centre are as follows.

1. Telephone correspondence
2. Information provision
3. Installation support
    - Telephone consultation
    - Introduction of technician to install outdoor antennas and receivers

- Telephone correspondence

  General questions such as types of receivers, coverage of digital broadcasting and ASO timing, etc. are answered by telephone correspondence service.

- Information provision

  General information, FAQ, available receivers, common installation ways, etc. are described through the call centre website. Also pamphlets and brochure provide necessary information. Advertisement as a source of information provision is considered to be utilised as well.

- Installation support by telephone consultation

  A situation might arise when the viewer could not manage to install the receiver properly. In such cases, telephone consultation supports the viewer regarding how to connect cables between connectors and how to set up the receiver.

- Installation support -introduction of technician

  In case of viewer with disability, the call centre introduces a technician in that area, to install a receiver and outdoor antenna.

Also, not all viewers are capable of getting a technician with the specialist knowledge to carry out the installation. In many cases appropriate installation of outdoor antenna is difficult for individual households, such as there might be no one in some households, who can carry out heavy physical work. In such situations, the call centre provides information of technicians available in those areas.

7.3 In Collaboration with BTCL

The call centre is launched through collaboration with Botswana Telecommunication Corporation Limited (BTCL). BTCL has know-how on running a call centre for mobile services because it provides a 24-hour call centre service to their customers

such as operation of telephone correspondence system and handling the inquiries from customers.

Therefore, BTCL provides a telephone correspondence system and response manual to the customers. On the other hand, DBS manages office space, personnel acquisition and knowledge on DTTB. (Refer to Table 7-1). Collaboration with BTCL will help cost reduction especially for procurement of the telephone correspondence system.

Table 7-1 Division of Roles between DBS and BTCL for Call Centre Launch

DBS	BTCL
● Provision of office Preparation of a sufficient office space for Call Centre in DBS. At start up, there would be 6 operators and 1 engineer as manager on full-time basis. ● Provision of office supplies Provision of equipment and furniture necessary for carrying out the work such as photocopier, printer, desks and chairs, etc. ● Staffing <u>Manager</u> Assignment of a manager as the person responsible for the call centre. The manager shall be a call centre specialist. Also an engineer with 10 years or more experience is assigned. <u>Engineer</u> Assignment of 3 or more engineers from DBS capable for responding immediately to technical inquiries. The engineers might not be full time employee, but it is necessary to provide a hot line to enable them to respond	● Equipment Provision of telephone correspondence system and dedicated lines for responding to inquiries. The dedicated lines are provided between each DBS branch throughout the country and DBS headquarters so that engineers from each location can be contacted immediately. ● Know-How BTC provides a manual for the operators about ways of responding to customers, troubleshooting and other know-how based on their experience of operating call centres for customer support.

DBS	BTCL
immediately to inquiries. Operators Acquisition of 6 operators to receive telephone calls. It is envisaged that 2 operators are provided each from 3 consultant companies under the government contract with DBS for the public relations activities. These will be full time on a shift basis. ● Knowledge All staffs will share knowledge regarding digital migration.	

At the launching of call centre, two staff members are sent from each of the three local PR consultants procured by DBS. The call centre will open from 5:00 to 24:00 according to the BTV airtime and will be run by staff working in shifts. As a supervisor, DBS assigns an engineer so that appropriate advice can be given regarding technical questions from viewers.

The call centre is located in Gaborone that already has the necessary infrastructure for telephone correspondence system. However, quick handling to inquiries from all over the country is required.

The following figure shows an organization proposal.

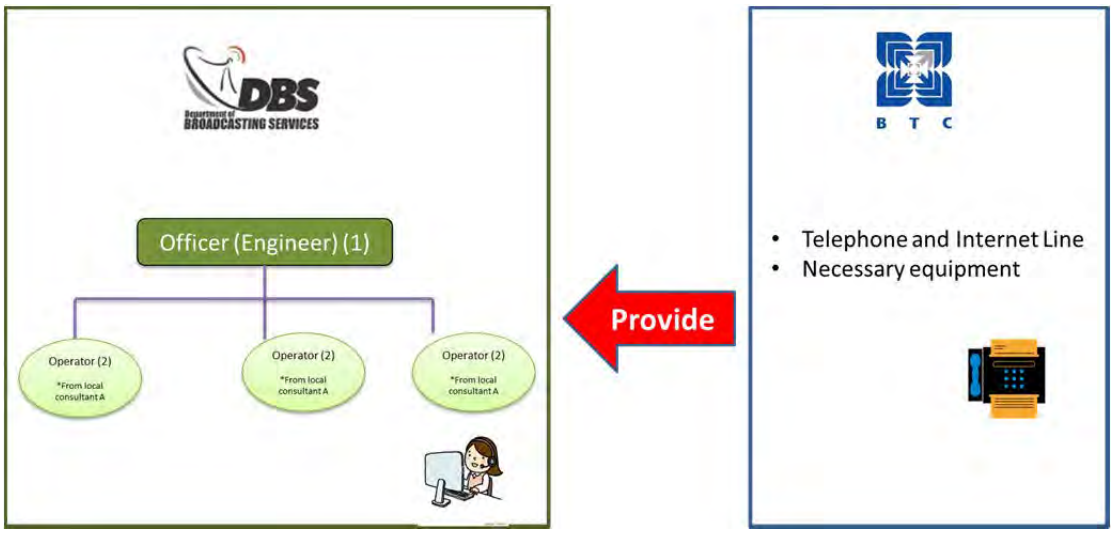

Figure 7-1 Organogram of Call Centre

7.4 Operation Manual

The important points in running the call centre are to correctly understand the question or problem of a viewer and to provide correct information. Providing different answers by different operators must be avoided under any circumstances. The call centre is operated according to an operation manual that is prepared before the establishment. The manual is prepared on the initiative of the supervisor and in collaboration with BTCL.

The following table shows the main items that are necessary.

Table 7-2 Manal Contents

Manual Contents	
General	・ Phrases used to answer calls ・ Items to be inquired and heard, etc. ・ Background to digital migration ・ Repeating and confirming a question being asked ・ Recording of a question being asked, etc.

Manual Contents	
	・ Where to purchase STBs, antennas, etc.
Technical	・ How to install STBs, antennas, etc. ・ Difference between analogue and digital TVs ・ How to check TV when it does not work ・ Installation guides
FAQs	・ FAQs obtained so far
Regional support contact list	・ List of technicians who have appropriate technical skills ・ List of contact addresses for support in each region

7.5 Staff Training Plan

Staff training is one of the most important things for the operation of the call centre. This is because the assigned or dispatched staffs neither will have enough knowledge of the digital migration, nor will they have experiences of working in a call center. Therefore, regular training is provided based on a manual that is prepared.

It is confirmed that a preparation period of one month is sufficient for a call centre office to start operation because BTC supplies equipment and has experience in establishing its own call centre. While preparation for the office is in progress, a draft call centre manual described in Chapter 7.4 is prepared. Staff training is provided according to the draft manual. The training regarding the operation start mainly consists of acquisition of reception manners, learning of basic technical terms, acquisition of basic knowledge on DTTB, and understanding of FAQs.

Short-period trainings are carried out intermittingly every month in order to revise the manual for incorporating the reflections from actual questions from viewers. Problems encountered during the actual operation of the call centre should be shared and examined to find solutions. Opinions raised in the training are reflected on the manual so that an up-to-date manual can be prepared and shared at all times.

The following time schedule is proposed as a draft-training schedule.

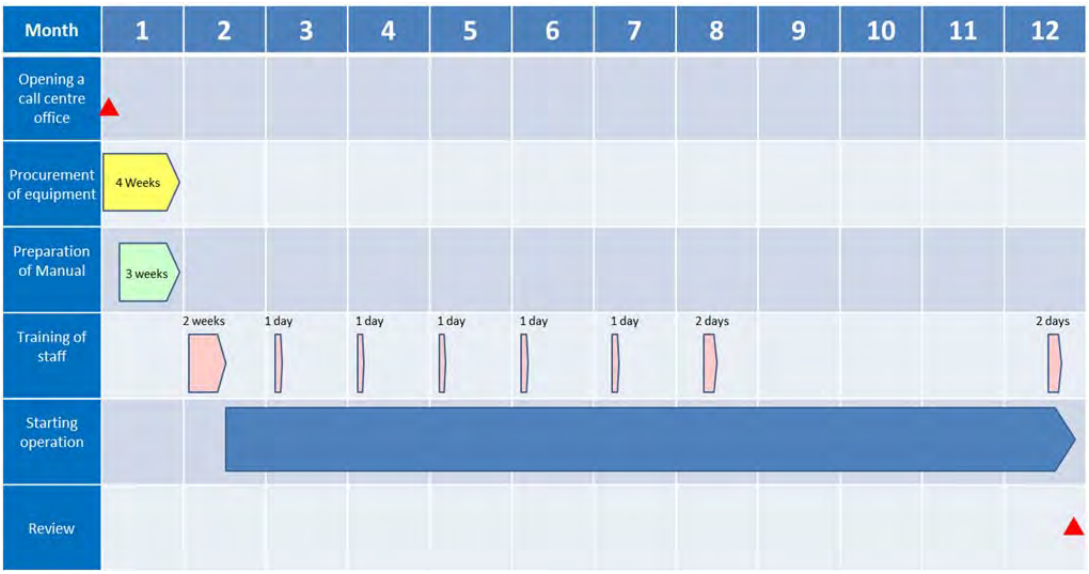

Figure 7-2 Call Centre Training Timeline

Chapter 8. Budget Estimation

Public Relation Activities are conducted multiple times for a year after ASO is developed as tentative plan. However, budget system of the government is operated every fiscal year. Therefore, preliminary budgets for each activity in this entire plan are calculated in accordance with the Project Papers in Appendix 1 and it makes smooth budget allocations. The staffs for the activities are DBS staffs and those from the consultants; for whom the contracts are already concluded. Hence, this primary budgets have not been included for staffs who already are determined. If additional external human resources are required, it is necessary to add the appropriate personnel budgets.

Determining the scale of the activities is important for calculating the preliminary budget. In particular, costs for conducting activities in the regions, the transport costs for moving the staff and the accommodation costs, etc., vary greatly. Therefore, activities can be carried out at low cost by methods such as strict selection of staffs in accordance with the scale of the activities. The Project Papers contain the necessary information for calculating the preliminary budgets, so the preliminary budgets can be calculated in accordance with the scale of the activities with reference to these papers.

Calculations of each activity are shown in Table 8-1 as references. In case of any changes in the input or preconditions, recalculation is required using this budget estimation sheet.

Table 8-1 Budget Estimation Sheet

Activities		Description	Unit price	Quantity	Total	Remarks
Information Provision	Events Notification (posters)	・ Poster design fee ・ Poster printing fee (A1) ・ Posted fee ・ Billboard fee ・ Transportation fee	P300 (once off) P10/Page P200 P20,000 TBD	1 11,000 11 20 TBD	P300 P110,000 P2,200 P400,000 TBD	**Billboard: Gaborone (7), Francistown (4), Other districts (each 1)**
	Introduction of New Technologies (fliers, newspapers)	・ Flier design fee ・ Flier printing ・ Advertisement fee ・ Transportation	P300 (once off) P15 P3,000/Full page TBD	2 5,000 45 TBD	P300 P75,000 P135,000 TBD	**Newspaper advertisement for 45 days (DSO 15 days, ASO 30 days)**
	Press briefing	・ Venue ・ PA system ・ Projector ・ MIC ・ Refreshments ・ Folders ・ Stationery (Pen) ・ Material handouts	- - - - P120 P20 P20 P15 (Both print)	- - - - 250 350 350 2,400	- - - - P30,000 P7,000 P7,000 P36,000	**Case of DBS meeting room (Venue) 50 guests Refreshments (tea and snacks) Handouts (8pages) 5 Times (Before DSO, DSO, Progress (2 Times), ASO)**
	Web Page	・ Design fee ・ Maintenance fee ・ Updating fee	P25,000 P2,500 P250/h	1 1 260	P25,000 P2,500 P65,000	**Maintenance for every month Updating for every week (5h/once) Per year**
	TV Advert	-	-	-	-	**In-house production**
	Radio Advert	-	-	-	-	**In-house production**

Activities		Description	Unit price	Quantity	Total	Remarks
Public Relations Campaign	DTTB Migration Seminars	・ Venue ・ Projector ・ MIC ・ PA system ・ Folders ・ Stationery (Pen) ・ Material handouts ・ Accommodation ・ Transportation	P27,500 P1,000 P300 P1,300 P20 P20 P15 (Both print) P1,500 TBD	11 11 22 11 1,100 1,100 22,000 330	P302,500 P11,000 P6,600 P14,300 P22,000 P22,000 P242,000 P495,000 TBD	**11 District** **Venue (1day, including lunch and tea break)** **80 Guests and 30 Staff** **Case of DBS meeting room** **Handouts (20 pages)** **Accommodation for staffs** **Transportation (Staff and equipment)**
	Visiting Workshop	・ Venue ・ Electric fee ・ MIC ・ PA system ・ Refreshments ・ Material handouts ・ Transportation	P1,500 P200 P300 (TBD) P1,500 (TBD) P10 P15 TBD	55 55 1 1 3,850 2,750	P82,500 P11,000 P300 (TBD) P1,500 (TBD) P38,500 P41,250 TBD	**5 towns for each district (55 towns)** **50 Participants** **Refreshments (Water)** **Handouts (Flier)** **Transportation (Staff and equipment)**
	Competitions	・ Venue (Awards) ・ Foods and refreshments ・ Advertised Commercial fee (Poster) ・ Advertised Commercial fee (Newspaper) ・ Commercialization (poster) ・ Commercialization (Goods) ・ MIC ・ PA system	P70,000 (TBD) P150 (TBD) P20/P P1,000/D (TBD) P10/page (TBD) P50 (TBD) P300 (TBD) P1,500 (TBD)	1 200 1,100 5 11,000 5,000 2 1	P70,000 (TBD) P30,000 (TBD) P22,000 P5,000 (TBD) P111,000 (TBD) P250,000 (TBD) P600 (TBD) P1,500 (TBD)	**200 (Guests and Staffs)** **Advertised commercial (Poster, Newspaper)** **Winning entry poster (1,000/District)** **Winning entry goods (5,000)**
Receiver Penetration	Demonstrations	・ Venue ・ Electric fee ・ MIC ・ PA system ・ Lunch ・ Refreshments ・ Fliers	P1,500 P200 P300 (TBD) P1,500 (TBD) P120 P10 P15	11 11 1 1 110 220 2,200	P16,500 P2,200 P300 (TBD) P1,500 (TBD) P13,200 P2,200 P33,000	**5 towns for each district (55 towns)** **Staff (10)** **Lunch for staffs** **Refreshments for staffs**

Activities		Description	Unit price	Quantity	Total	Remarks
Plan for viewers	Call centre	· Equipment · Manual fee · Operation cost	- P15 (Both print) TBD	- 500	- P7,500 TBD	**For equipment will be offering from BTC** **Manual (50 pages)** **Operation cost: Electric, Telephone, Internet and any other supplies expense)**

Chapter 9. Performance Target of Public Relations Plan

The aim of this public relations plan is to contribute conducting successful ASO within certain period. The target date of ASO has been set as December 2016 tentatively, however achievement of the ASO criteria must be required for switching off of the analogue broadcasting. The criteria are 65% of penetration rate of digital receivers and 90% coverage of current analogue service area. This Public Relations Plan aims to accelerate replacement of the receiver in households, which will affect penetration rate of the digital receivers. Therefore, continuous activities of the Public Relations are required and minimum performance target(s) of each activity is needed to define.

The following Table 9-1 shows each of the minimum performance targets, also the preliminary budget calculations are estimated based on this minimum performance targets. The timing of each activity is needed to consider, however events as mentioned below might have great opportunities. Thus, the beneficial activities must be carried out.

- Completion of development of digital TV network and its commencement of the service
- Publication of STB and IDTV specifications and launching them to the market
- Count down to the ASO date such as one year, 6 months, 3 months, 1 month prior to the date
- Announcement of an ASO experiment date and its implementation date
- Launch of Call Centres

Table 9-1 Minimum Performance Target for Each Activities

Activities		**Minimum Performance Target**	**Required Effect**
Information Provision	Events Notification	・ Notification of DSO time in every area ・ Notification of ASO	The people know the appropriate time for digital migration.
	Introduction of New Technologies	・ Notification of digital migration in the newspapers, etc. (Notification of DSO for more than	The people know about digital migration.

Activities		Minimum Performance Target	Required Effect
		15 days, Notification of ASO for more than 30 days)	
	Press briefing	・ Briefings held more than 3 times (Before DSO, DSO timing, ASO timing)	Those in mass communications have obtained accurate knowledge regarding digital terrestrial broadcasting.
	Web Page	・ Website opened	The people have obtained accurate knowledge regarding digital terrestrial broadcasting.
	TV Advert	・ News Spot (DSO timing, Every day till one month prior to ASO)	The viewers know about digital migration.
	Radio Advert	・ Radio Spot (DSO timing, Every day till one month prior to ASO)	The viewers know about digital migration.
Public Relations Campaign	DTTB Migration Seminars	・ A seminar is held at least once in 11 districts	Digital migration stakeholders have obtained accurate knowledge regarding digital terrestrial broadcasting.
	Visiting Workshop	・ A workshop is held at least 5 times in 11 districts	The people have obtained accurate knowledge regarding digital terrestrial broadcasting.
	Competitions	・ A competition is held at least once	The people know about digital migration.
Receiver Penetration	Demonstrations	・ A demonstration is held at least 5 times in 11 districts	The participants have obtained accurate knowledge regarding digital terrestrial broadcasting.
	Pilot Project	・ Distribution of receivers in the planned location	The people experience digital terrestrial broadcasts in the distribution location.
Plan for viewers	Call Centre	・ Commencement of Call Centre	Points of uncertainty regarding digital migration are resolved.

Botswana plans to conduct ASO in December 2016 as mentioned before. This public relations plan also describes a call centre as a measure to provide support to viewers. Additionally, the centre is supposed to assist the viewers until one year after ASO; even though all other activities are going to be completed by ASO. Therefore, this

public relations plan will be effective until one year after ASO. Also, the plan will be reviewed every 6 months after the release and will be revised as per the necessity within the validity period.

Appendices

Appendix1. Project Paper

Project Paper

Title of activity	Events notification
Outline of activity	[Objective] ➢ To initiate basic knowledge of digital migration in Botswana ➢ To inform about the importance of Digital Migration ➢ To notify the public about the progress on Digital Migration [Activities] ➢ Notification regarding event such as DSO, ASO, Demonstration, Seminar using poster, Press release and/or TV news. [Target Audience] ➢ All viewers ➢ General public [Timing] ➢ ASO / DSO information Immediate notice after the date is decided ➢ Other events 1 week prior to each events
Reason of its necessity	➢ The viewers need to know the date of digital migration ➢ The general public need to know the progress of digital migration
Total expected cost	➢ Design fee ➢ Printing fee (A1 Size)

Title of activity	Events notification
	➢ Advertisement fee ➢ Posting fee ➢ Billboard fee ➢ Transportation
Process of implementation	➢ To research the best effective place to put poster and/or billboard. ➢ To get accurate information of ASO.

Project Paper

Title of activity	Introduction of new technologies
Outline of activity	[Objective] ➢ To give basic knowledge of Digital Terrestrial Television Broadcasting (DTTB) including data broadcasting. [Activities] ➢ Introduce new technologies of DTTB using brochure, newspaper, poster, etc. ➢ Outsource prospective manufactures / dealers for set top boxes. [Target Audience] ➢ All viewers ➢ General public ➢ Manufactures [Timing] ➢ From February, 2015 until ASO Information update every 2 months
Reason of its necessity	➢ The viewers need to know about the new DTTB technologies. ➢ The general public need to know about the new equipment for watching DTTB.
Total expected cost	➢ Design fee ➢ Printing fee (A4 size)

Title of activity	Introduction of new technologies
	➢ Transportation fee (for providing)
Process of implementation	➢ Before printing, the information should be confirmed by DTTB expert. ➢ Data broadcasting information should be necessary.

Project Paper

Title of activity	Press Briefing
Outline of activity	[Objective] ➢ To introduce the new technology to the media ➢ To encourage media to publish regular progress report [Activities] ➢ Half day seminar for all media stakeholders not only in Botswana but also neighbouring countries. ・Explanation of Digital Terrestrial Television Broadcasting (DTTB). (Background, Economic effectiveness of DTTB, Milestone, Requirements, Basic knowledge) ➢ Periodical progress report ➢ Invitation for event's coverage [Target Audience] ➢ All media stakeholders ➢ Government public relations section [Timing] ➢ 1st session: 1st April, 2015 ➢ After the launch of transmitter installation, periodic progress report will be prepared every 3 months. * will be held occasionally with matters arising according to the situation.
Reason of its necessity	➢ Clear understanding of Digital Migration to distribute Digital Migration information to all citizens. ➢ Press members need to understand the new technology for

Title of activity	**Press Briefing**
	writing news. ➢ Press members need to be regularly updated of progress / stage for writing news.
Total expected cost	➢ Hand out material print fee ➢ Folder for all participants ➢ Pen for all participants ➢ Refreshment If it will be held outside of DBS, additional cost will be required for: ➢ Press briefing venue fee ➢ PA system and roving mic for question ➢ Projector ➢ Transportation (for staff and materials)
Process of implementation	➢ Clearly explain DTTB using easy words. ➢ Prepare hand out materials on seminar. ➢ Invite all stakeholders 10 days before seminar.

Project Paper

Title of activity	Independence Producer Meeting
Outline of activity	[Objective] ➢ To inform independence producers about strategy of BTV after digital migration. ➢ To prepare independence producers to prepare for the possibilities brought on by digital migration. [Activities] ➢ Half day seminar for independence producers in Botswana. ・Explanation of Digital Terrestrial Television Broadcasting (DTTB). (Background, Milestone, Basic knowledge) ・Contents of the BTV strategy. ・Data broadcasting. [Target Audience] ➢ Independence producers [Timing] ➢ It will be held as soon as BTV has decided on contents of the strategy.
Reason of its necessity	➢ After digital migration, it is possible that the programme of BTV increase shortly in future. ➢ Independence producers' clear understanding about BTV strategy to produce new contents for BTV. ➢ Independence producers need to understand the DTTB including data broadcasting.

Title of activity	**Independence Producer Meeting**
Total expected cost	➢ Hand out material print fee ➢ Folder for all participants ➢ Pen for all participants ➢ Refreshment If it will be held outside of DBS, the additional cost will be required for: ➢ Press briefing venue fee ➢ PA system and roving mic for question ➢ Projector ➢ Transportation (for staff and materials)
Process of implementation	➢ Clearly explain the contents of the BTV strategy. ➢ Prepare hand out material before seminar. ➢ Inform about seminar details through TV and radio information. ➢ The seminar will require pre-registration. (the numbers of participants should be known approximately)

Project Paper

Title of activity	Web Page
Outline of activity	[Objective] ➢ To provide latest information for viewers ➢ To provide feedback (create a link that allows e-mail inquiries) [Activities] ➢ Digital migration site creation ➢ Data collection for Digital Terrestrial Television Broadcasting (DTTB) ・ ASO, DSO, Progress report, Inquiry, etc. ➢ Develop understanding of requirements and set up ➢ Easy to explain about DTTB ➢ Inquiry support ➢ Regular updates ➢ FAQ ➢ Progress report [Target Audience] ➢ General public who are PC literate and who prefer websites [Timing] ➢ Webpage to be created as soon as possible after consultancy awards (web design). ➢ Information update twice per week. ➢ Information update as necessary.

Title of activity	Web Page
Reason of its necessity	➢ Viewers and general public need to be introduced to latest information regarding digital migration. ➢ Viewers and general public can get information easily if they have access to a PC. ➢ Effective information sharing.
Total expected cost	➢ Web design fee ➢ Web management fee ➢ Maintenance fee ➢ Equipment fee
Process of implementation	➢ Secure the expert resources ➢ Secure the management staff from DBS.

Project Paper

Title of activity	TV/Radio Advert
Outline of activity	[Objective] ➢ To entrench the basic knowledge of "Digital Migration" especially beneficiation, requirements, ASO date and contact. ➢ To provide fast notification reaching a lot of people country wide. [Activities] ➢ Spot news for Digital Migration. ➢ Jingle for Digital Terrestrial Television Broadcasting (DTTB). [Target Audience] ➢ Viewers ➢ Listeners ➢ General public [Timing] ➢ From February, 2015 ➢ Update every 2 months (earlier stage) ➢ Once the date of ASO is decided ➢ Update every week before 2 months of ASO ➢ Countdown before 10 days of ASO
Reason of its necessity	➢ Viewers (listeners) need to be informed of the "Benefit", "Requirements", "How to set up" and "Timing" of the digital migration.

Title of activity	TV/Radio Advert
Total expected cost	➢ Transportation for coverage crew
Process of implementation	➢ Explain basic knowledge of digital migration by use of simple words. ➢ Promote more accurate understanding of digital migration.

Project Paper

Title of activity	Digital Terrestrial Television Broadcasting (DTTB) migration seminars
Outline of activity	[Objective] ➢ To accelerate basic knowledge for the key persons who can assist in spreading digital migration information nationwide. [Activities] ➢ One day seminar for all districts. (11 districts) To inform about basic knowledge of digital migration such as schedule of DSO/ASO, critical requirements (Receivers, Antenna, and Set-top box), benefits and opportunities. ➢ Explain our progress ➢ Exhibitions of DTTB (demonstration of how the features of data broadcasting work) ➢ 70 invitees for Goborone and Francistown, 50 invitees for other places ➢ Questionnaire reviews [Target audience] ➢ DTTB Stake holders ・ Central Government (PR section) ・ Local Government (PR Section) ・ Kgotla ・ University ・ Heads of PR (Telecommunications) ➢ Other important stakeholders

Title of activity	**Digital Terrestrial Television Broadcasting (DTTB) migration seminars**
	[Timing] 1st: Middle of April (Gaborone) 2nd: Beginning of May (Francistown) 3rd: Beginning of September (Maun) 4th: End of October (Serowe) 5th: Middle of November (2 towns) 6th: End of January, 2016 (2 towns) 7th: End of February, 2016 (3 towns)
Reasons of its necessity	➢ Stakeholders will gain clear understanding of digital migration, they will distribute our message to the general public. ➢ Stakeholders can assist in spreading information of the new technology. ➢ Stakeholders need to be introduced to the new technology. ➢ Stakeholders need to be informed of progress and/or stages.
Total expected cost	[Shared information] ➢ Hand out material print fee ➢ Folder for all participants ➢ Pen for all participants ➢ T-shirts for staffs [Gaborone and Francistown] Full day conference package (for 130 participants including staffs): P43,000 (@P310) Data projector: P1,000

Title of activity	**Digital Terrestrial Television Broadcasting (DTTB) migration seminars**
	Roving microphone (2): P600 (`P300) PA system: P1,300 [Other Town] ➢ Full day conference package (for 100 participants including staffs): P25,000 (@P250) ➢ Data projector: P1,000 ➢ Roving microphone (2): P600 (@P300) ➢ PA system: P1,300 ➢ Accommodation: P1,300/night
Process of implementation	➢ Explain receivers' issues and specification issues which are still under consideration. ➢ Gain opinion from the participants.

Project Paper

Title of activity	Visiting workshop
Outline of activity	[Objective] ➢ To easily interpret the meaning of "Digital migration". ➢ To explain the requirements of digital terrestrial television broadcasting (DTTB). [Activities] ➢ Presentation on general information about digital migration. ➢ Explain about set up material ➢ Demonstration and practice to introduce DTTB and equipment such as IDTV, STB, Antenna etc.) ➢ Questions and Answers session ➢ Questionnaire [Target Audience] ➢ Viewers (especially elders) ➢ General public [Timing] ➢ After installation by district
Reason of its necessity	➢ Although new technologies are difficult for the seniors to understand, the face to face explanation through this workshop will make the understanding easier.
Total expected cost	➢ Workshop venue fee ➢ Transportation for equipment ➢ Hand out print fee

Title of activity	Visiting workshop
	➢ Refreshments
Process of implementation	➢ Select easy explanation process. ➢ Get opinion from the participants (using questionnaire).

Project Paper

Title of activity	Mall demonstration
Outline of activity	[Objective] ➢ To provide basic knowledge of digital migration in Botswana. ➢ To collect data about BTV programmes. [Activities] ➢ Information dissemination ➢ STB's remote control demonstration and experience ➢ Questionnaire review [Target Audience] ➢ All general public frequenting the mall (especially the householder who can manage the family budget) [Timing] ➢ Gaborone March-April 2015 ➢ Other town 2015-2016
Reason of its necessity	➢ Have an experience on new technology of DTTB. ➢ Clear understanding of digital migration by the public in order to welcome and transit to the new mode and acquire STB.
Total expected cost	➢ Demonstration venue fee ➢ Electric fee

Title of activity	Mall demonstration
	➢ Lunch and refreshment (for staffs) ➢ PA system ➢ Transportation for staffs and equipment
Process of implementation	➢ Explain receiver's issues such as why specification is still pending. ➢ Find out from the participants' opinion about collaboration prospects.

Title of activity	Call centre establishment and operations
Outline of activity	[Objective] ➢ To facilitate understanding of digital migration ➢ To provide suitable contact information according to each inquiry. ➢ To impart the general information of digital migration. ➢ To provide smooth adoption of digital migration through available assistance and/or information. [Activities] 1. Establish the call centre 2. Find a location for the call centre 3. Consider and secure budget 4. Consider and secure requirements 5. Secure supervisor resources 6. Manual preparation 7. Securing and training of proper persons 8. Receive a phone call requesting information 9. Inquiry data collection and analyse 10. Produce FAQ (Brochure) 11. Feedback FAQ (Distribute brochure, newspaper etc.) 12. Regular report [Target Audience] ➢ Viewers ➢ General public [Timing] ➢ As soon as possible

Title of activity	Call centre establishment and operations
Reason of its necessity	➢ General public need to know contacts for assistance that may arise during digital migration.
Total expected cost	➢ Equipment ➢ Employment cost ➢ Manual preparation fee ➢ Operation fee
Process of implementation	➢ Manual preparation ➢ Training ➢ Secure main resources (Engineer) ➢ Using existing know-how of mobile call centre ➢ Considering outsource

Appendix2. Example of Seminar Invitees (Gaborone)

Seminar Invitees in Gaborone seminar (Estimated numbers)

1) PR Heads from all Ministries ……(15)
2) Agencies ie: NACA, Disaster Management etc. (all under OP) (17)
3) JICA Botswana ……(3)
4) BOCRA ……(8)
5) Parliament ICT Committee ……(2)
6) Representative from Ntlo Ya Dikgosi ……(1)
7) National Strategy Office ……(1)
8) Botswana Innovation Hub ……(2)
9) BOCCIM ……(2)
10) Be Mobile Botswana …… (2)
11) Mascom Botswana ……(2)
12) Orange Botswana ……(2)
13) Multichoice Botswana ……(2)
14) Representative from the Film Industry ……(2)
15) Botswana Bureau of Standards ……(1)
16) Gaborone Technical College ……(1)
17) Limkokwing University ……(2)
18) University of Botswana (Media Studies) ……(2)
19) BIUST ……(1)
20) E- Botswana ……(2)
21) Botswana Society for the Deaf ……(2)
22) Horizon Ogilvy ……(2)
23) Hotwire PRC and Wired Y and R ……(2)
24) BGCIS ……(2)
25) Scripture Union Botswana ……(2)
26) 10 Managers from DBS Regional Offices ……(10)
27) DIT ……(2)
28) E-Government ……(2)

DBS STAFF ……**(30)**

Appendix3. Example of Seminar Programme (Gaborone)

Seminar (16th Thu, April, Gaborone, Grand Palm, Okavango room 1)
MC: Jericho Keletso

Time			Program	Presenter
9:00	-	9:30	Registration	
9:30	-	9:35	Prayer	Volunteer
9:35	-	9:40	Introduction of Guests	Director Broadcasting Services (Mr. Lesole Obonye)
9:40	-	10:00	Presentation Overview of Digital Migration	DPS BDCIS (Dr Jeff Ramsay)
10:00	-	10:20	Presentation Opportunities and Benefits of Digital Broadcasting	DBS (Mr. Calvin Goiletswe)
10:20	-	11:10	Tea Break	
11:10	-	11:30	Presentation Standards, Specifications and Coordination - Milestone of DSO and ASO - How can I watch the DTV? - Antenna, Receivers and Set Top Boxes	BOCRA (Mr Bathopi Luke)
11:30	-	11:35	Closing remarks	BOCRA Deputy Director Corporate Communications (Mr. Aron Nyelesi)
11:35	-	12:30	Exhibition (Digital TV and Receivers)	
12:30	-	13:30	Lunch	

Appendix4. Example of Seminar Questionnaire

Implementation of the Digital Migration Project
JICA Technical Cooperation Project
Mass Media Complex, Private Bag 0060, Gaborone

Questionnaire (DTTV Seminar in Maun 11/September/2015)

1. ***Gender***

   Male ☐ Female ☐

2. ***Age group***

   Under 25 ☐ 26 – 40 ☐ 40 – 60 ☐ Above 60 ☐

3. ***Organization***

   Government ☐ NGO ☐ Company (IT) ☐ Company (Others) ☐

   Professor ☐ University student ☐ Others _____

[Seminar]

4. ***How was the seminar schedule?***

   Too long ☐ Just OK ☐ Too short ☐

5. ***How were the contents of the seminar (Presentations)?***

   Easy to understand ☐ Not really ☐ Difficult ☐

6. ***Was the information of digital migration enough?***

7. ***Yes*** ☐ ***No*** ☐

8. ***What extra information would you like to be included?***

   _____

9. ***What is the most important message form the seminar?***

   Back ground ☐ Responsibility to spread information about digital Migration ☐

   Benefits ☐ Standards ☐ Others _____

[BTV Program]

10. ***How often do you watch BTV?***

    Very Often ☐ Sometimes ☐ Never ☐

11. ***What time do you usually watch BTV?***

    Morning ☐ Day ☐ Evening ☐ Night ☐

12. ***With who do you usually watch BTV?***

    Alone ☐ Family ☐ Friend ☐ Others _____

Back→

Office in Room 103, Department of Broadcasting Services, Mass Media Complex, Plot 37795 Wellie Seboni Road Telase 2,
Private Bag 0060, Gaborone, Botswana

13. *What kind of program do you like watching?*

Sports ☐ Drama ☐ Music ☐ Movie ☐ News ☐ Weather ☐

Other: _____

14. *What is your favorite show on BTV?*

_____

15. *What kind of NEW program would you like to watch?*

Sports ☐ Drama ☐ Music ☐ Movie ☐ News ☐ Others _____

16. *Which contents do you prefer?*

Local Content ☐ Internationally Popular Content ☐

[Data Broadcasting]

17. *Was it easy to understand what data broadcasting is?*

Yes ☐ Not really ☐ No ☐

18. *How was the layout & design of data broadcasting?*

Good ☐ Just OK ☐ Bad ☐

19. *Was it easy to use the remote-control for the Data Broadcasting? (If you had a chance)*

Yes ☐ Not really ☐ No ☐

20. *Will you use the Data Broadcasting service once it has started?*

Yes ☐ No ☐ Reasons : _____

21. *What information would you like to see on data broadcasting?*

Sports ☐ Drama ☐ Music ☐ Movie ☐ News ☐ Weather ☐

Program Schedule ☐ Other: _____

22. *What genre of television programs would you like to see on mobile television?*

Sports ☐ Drama ☐ Music ☐ Movie ☐

News ☐ Weather ☐ Other: _____

23. *Any other comment*

_____

Appendix5. Demonstration Equipment List

Demonstrations Requirement List

Equipment	Quantity	Remarks
Integrated Television Monitors	2	(Sharp)
Set – Top Boxes	3	
Television monitor	2	60 inch x 1, 32 inch x 2 Sharp
Cathode Ray Tube TV	1	Old television
Indoor Antenna	3	
Outdoor Antenna	1	
Extension Power Cable	2	10metres x 2
Pull up burners	3	Digital Migration information
Fliers	300	

Supported by Japan International Cooperation Agency (JICA)

Project for Implantation of the Digital Migration Project (DiMT)

Separate Volume -6
Test centre operation manual

Operation Manual
for
Test Centre

July 2016

Botswana Communication Regulatory Authority

Ver 1.0

Test Centre Operation Manual Ver.1.0

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Chapter 2

ABBREVIATIONS

16 QAM	16 Quadrature Amplitude Modulation
64 QAM	64 Quadrature Amplitude Modulation
ATSC	Advanced Television System Committee
BOCRA	Botswana Communications Regulatory Authority
DPMR	Digital Portable and Mobile Receiver
DTMB	Digital Terrestrial Multimedia Broadcast
DVB-T	Digital Video Broadcasting - Terrestrial
DVB-T2	Digital Video Broadcasting - Terrestrial 2
HD	High Definition
IDTV	Integrated Digital Television
ISDB-T	Integrated Service Digital Broadcasting-Terrestrial
MER	Modulation Error Rate
RCU	Remote Control Unit
SD	Standard Definition
STB	Set Top Box
QPSK	Quadrature Phase Shift Keying

Test Centre Operation Manual Ver.1.0

Chapter 1 Test Centre

1.1 The purpose of the Test Centre

① Test Centre is to verify the submitted sample devices, instruction manuals and other items (hereinafter the Sample) from the applicant when BOCRA makes the type approval of digital television broadcasting receivers, The type approval is carried out with reference to the specifications and standards that have been defined in the Technical Specifications to verify the compatibility.

② Test Centre is to create the technical assurance check manual.

③ Test Centre is to publish the technical assurance check results of the samples through BOCRA, to the general public and distributors of Botswana for reference in time of Sale, Purchase or just for viewing.

1.2 Organization of Test Centre in BOCRA

Organization of the Test Centre is as shown in Figure 1.2-1.

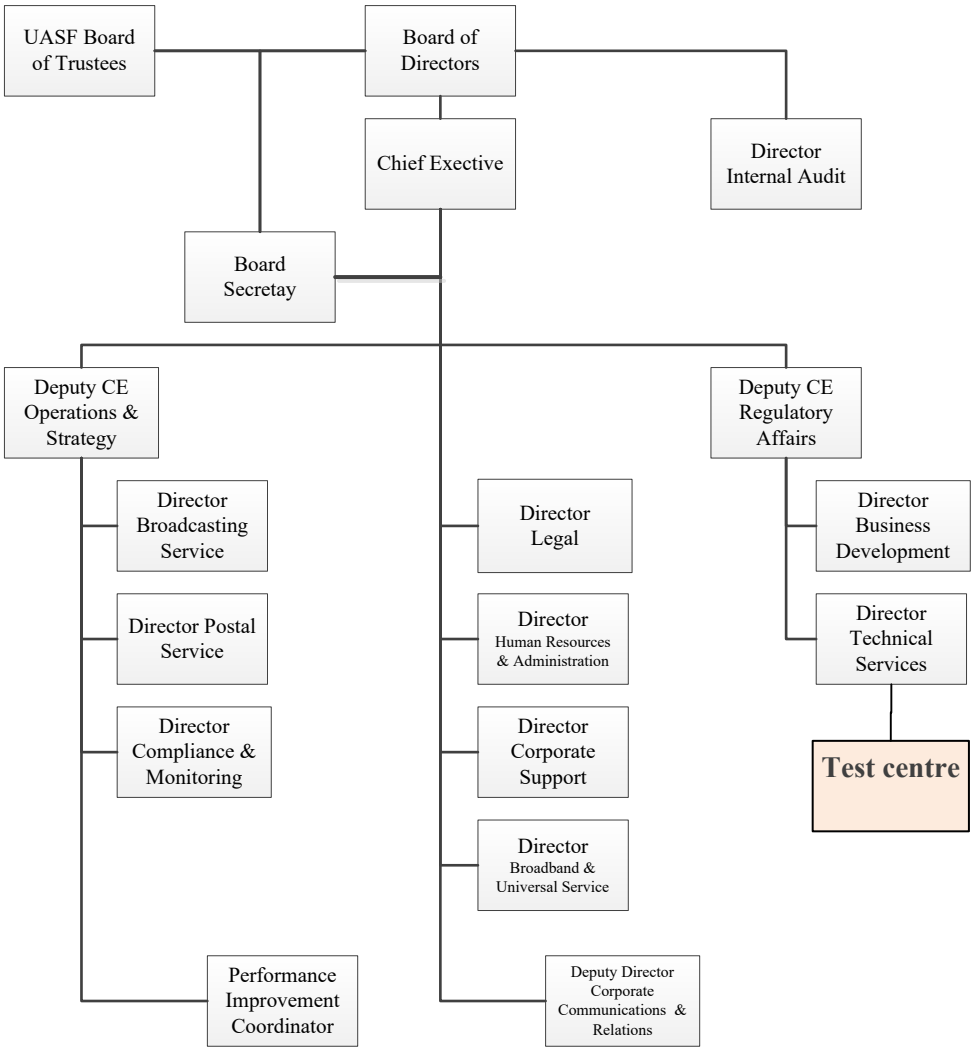


Figure 1.2-1: Test Centre Organization chart

1.3 Relationship Between BOCRA, Test Centre, Manufacture and Distributor.

Relationship is as shown in Figure 1.3-1.

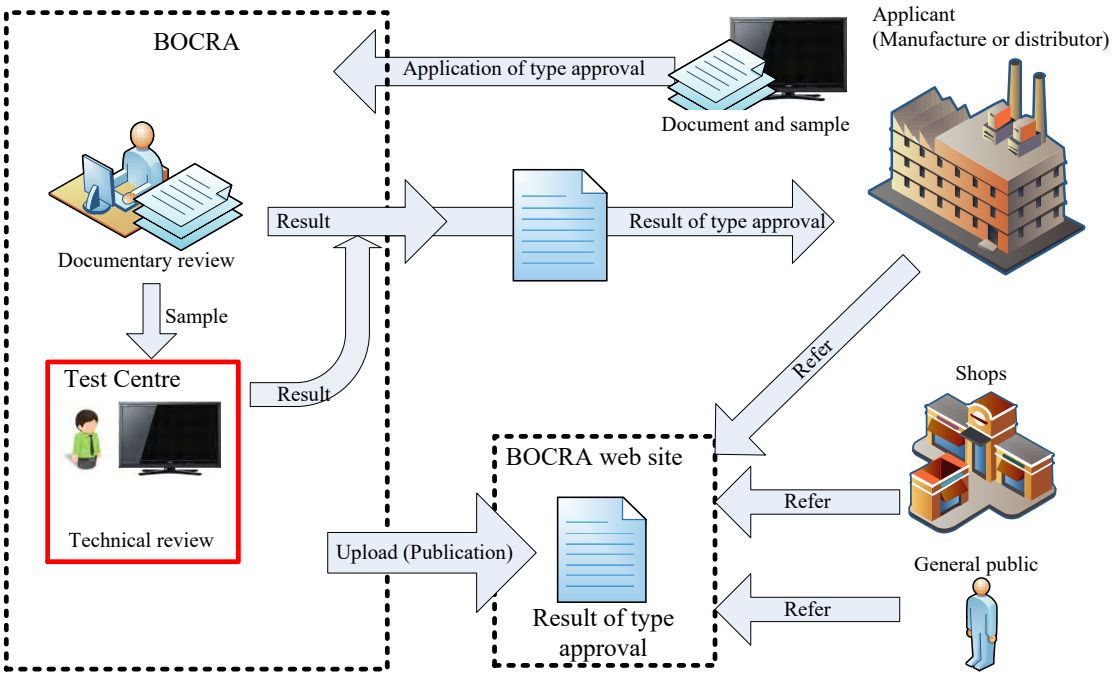


Figure 1.3-1: Relationship between BOCRA, Test Centre, Manufacture and distributor

1.4 Time table

Time table of the Test Centre operation is as shown in Figure 1.4-1

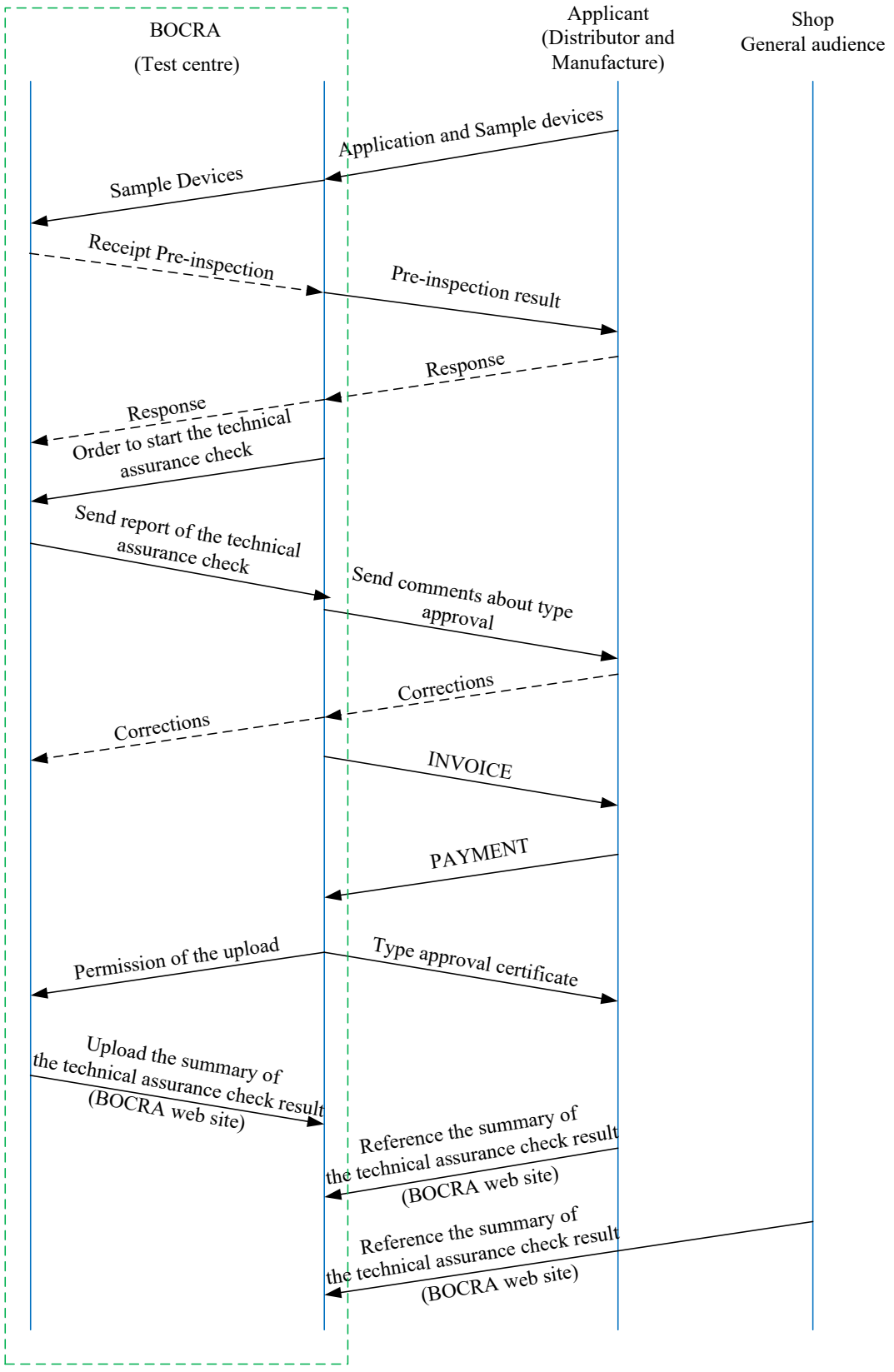


Figure 1.4-1: Time table of the test centre operation

Chapter 2 Technical assurance check

2.1 The Purpose of Technical Assurance Check

The purpose of technical assurance check is to check the basic functions and the electrical functions of the Sample. The technical assurance check is carried out with reference to the specifications and standards that have been defined in the ISDB-T STANDARDS OF BOTSWANA to verify the compatibility.

2.2 Target of Technical assurance

Test Centre will perform a Technical assurance check on the specified samples shown in Table 2.2-1.

Table 2.2-1: Sample List

No	Sample	Feature
1	IDTV	It receives ISDB-T digital terrestrial television broadcasting through an external antenna.
2	STB	It is external conversion device for receiving and viewing ISDB-T digital terrestrial television broadcasting for an analog television.
3	DPMR	It is a potable television. It receives ISDB-T digital terrestrial television broadcasting through an external or built-in antenna. Also mobile phone and smart phone that have a similar function are included. (Dongle is a type pf DPMR.) External equipment for receiving ISDB-T digital terrestrial television broadcasting on a mobile phone or smart phone etc.

The samples do not include equipment for receiving ATSC, DVB-T, DVB-T2 and DTMB.

2.3 Procedure of the technical assurance check

The basic procedure of the technical assurance check is as shown in Figure 2.3-1.

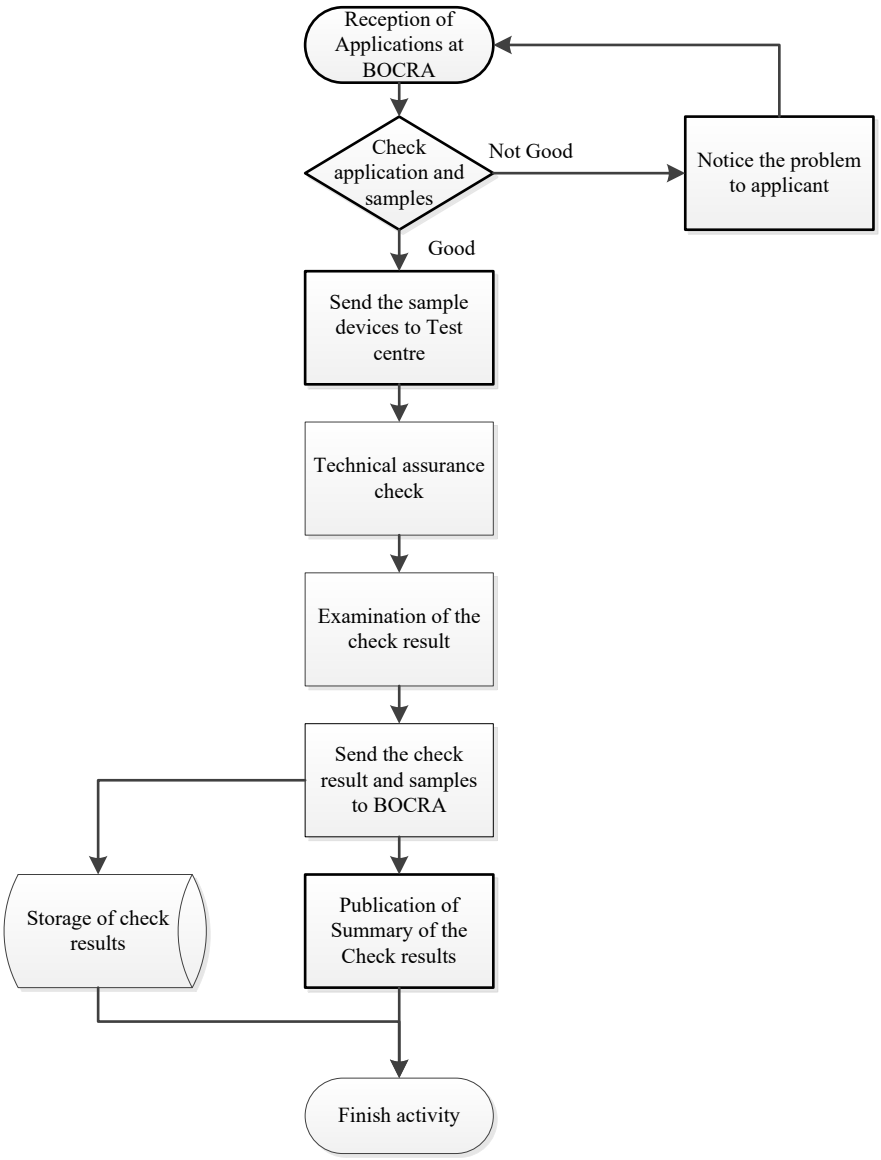


Figure 2.3-1: Basic Workflow of the technical assurance check.

2.4 Detail of the procedure

2.4-1 Reception and management of the sample

① Reception of the sample

When Test Centre receives the sample from BOCRA, Check the number of the samples and attached goods/items. Check the basic function of sample and the state of the attached goods (hereinafter: Pre-Inspection). If there is a problem with the sample (For Example, Sample does not turn on, Lack of attached goods/items, etc.), Test Centre must report it to BOCRA.

The Pre-Inspection work flow is as shown in Figure 2.4-1-1.

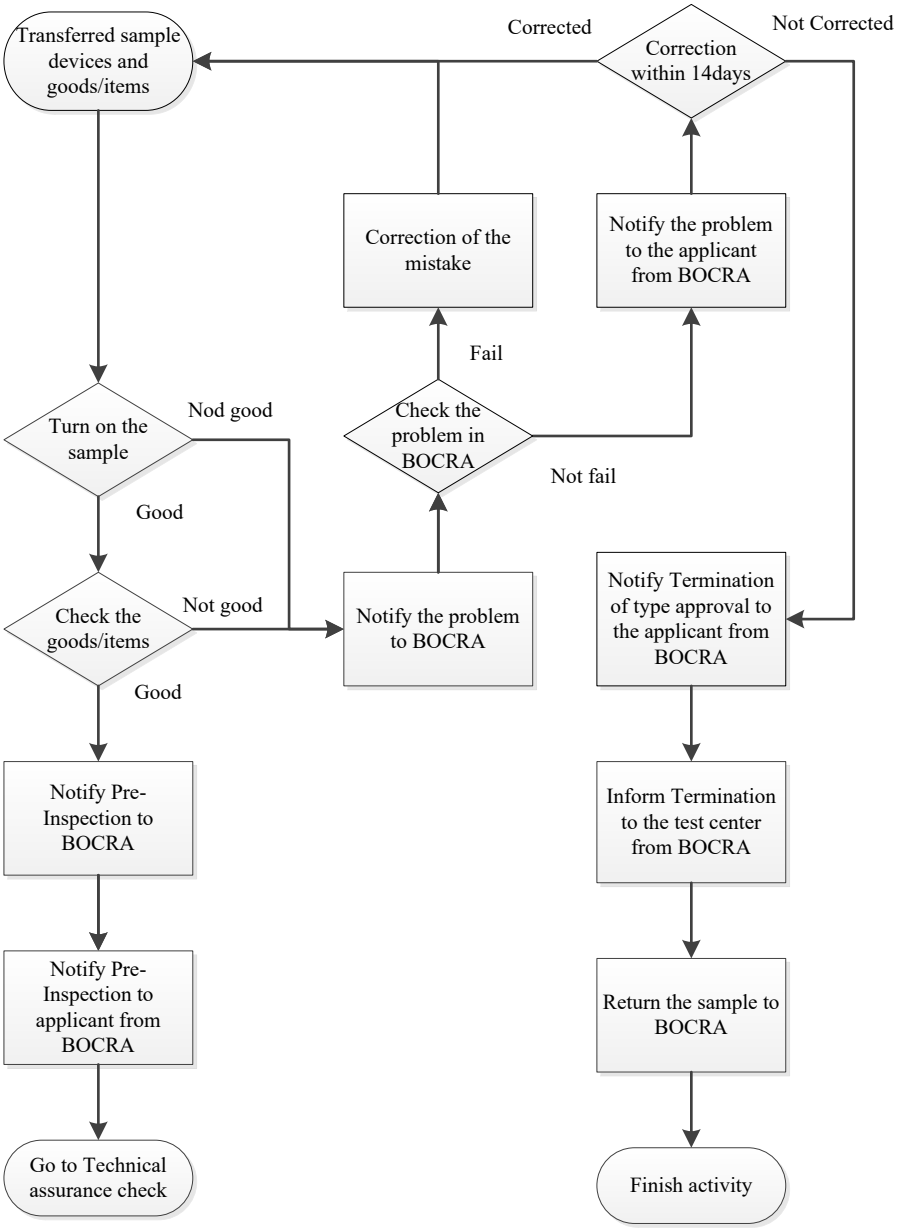


Figure 2.4-1-1: Pre-Inspection work flow

② Management of the sample

Test Centre must ensure that failure, damage, loss or theft (hereinafter: the incident) does not occur until sample is returned to BOCRA

If the incident occurs, Test Centre reports it to BOCRA without delay.

After the report, Test Centre inspects the incident and reports the inspection result to BOCRA.

BOCRA notices the inspection results to the applicant and requests for another sample. When BOCRA receives another sample, BOCRA sends it to test centre. Test centre start again the technical assurance check.

If the applicant does not send another sample to BOCRA, BOCRA aborts/terminate the type approval.

Work flow of the occurred incident is as shown in Figure 2.4-1-2.

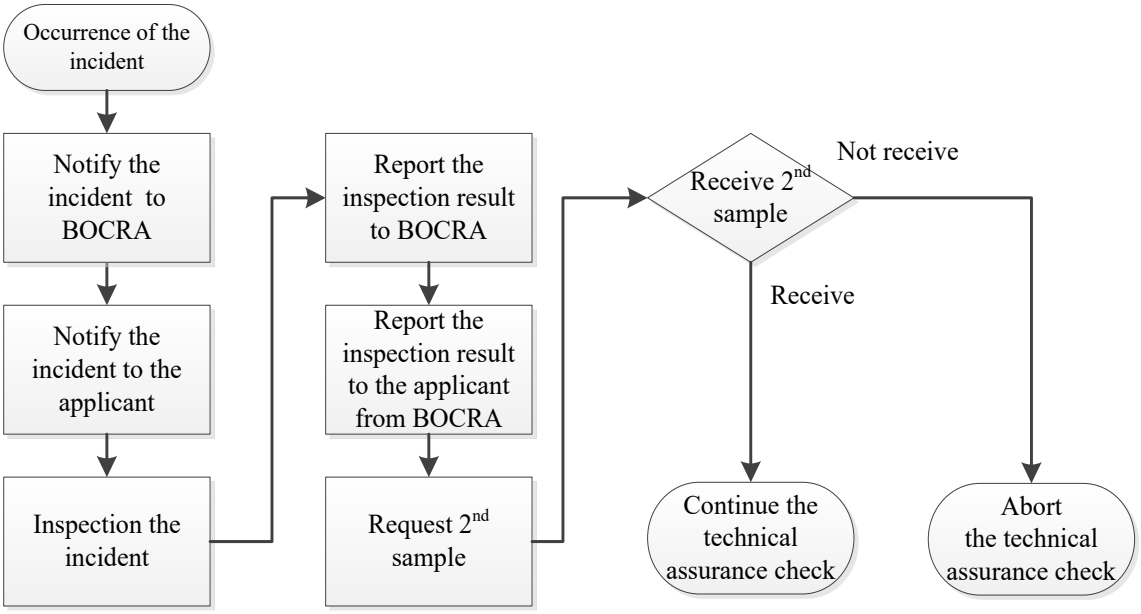


Figure 2.4-1-2: Work flow of the occurred incident

2.5 Measurement Equipment

2.5-1 Overview of the measurement equipment

The measurement equipment create ISDB-T radio wave signal for the technical assurance check.

Overview of the measurement equipment and sample are as shown in Figure 2.5-1-1.
Connection system diagram is as shown in Figure 2.5-1-2

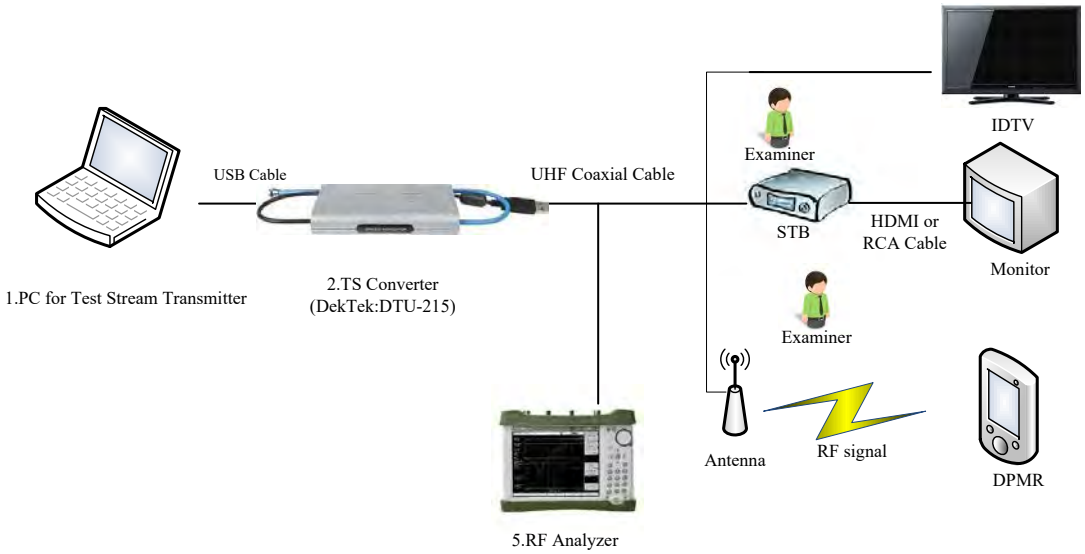


Figure 2.5-1-1: Overview of the technical assurance items.

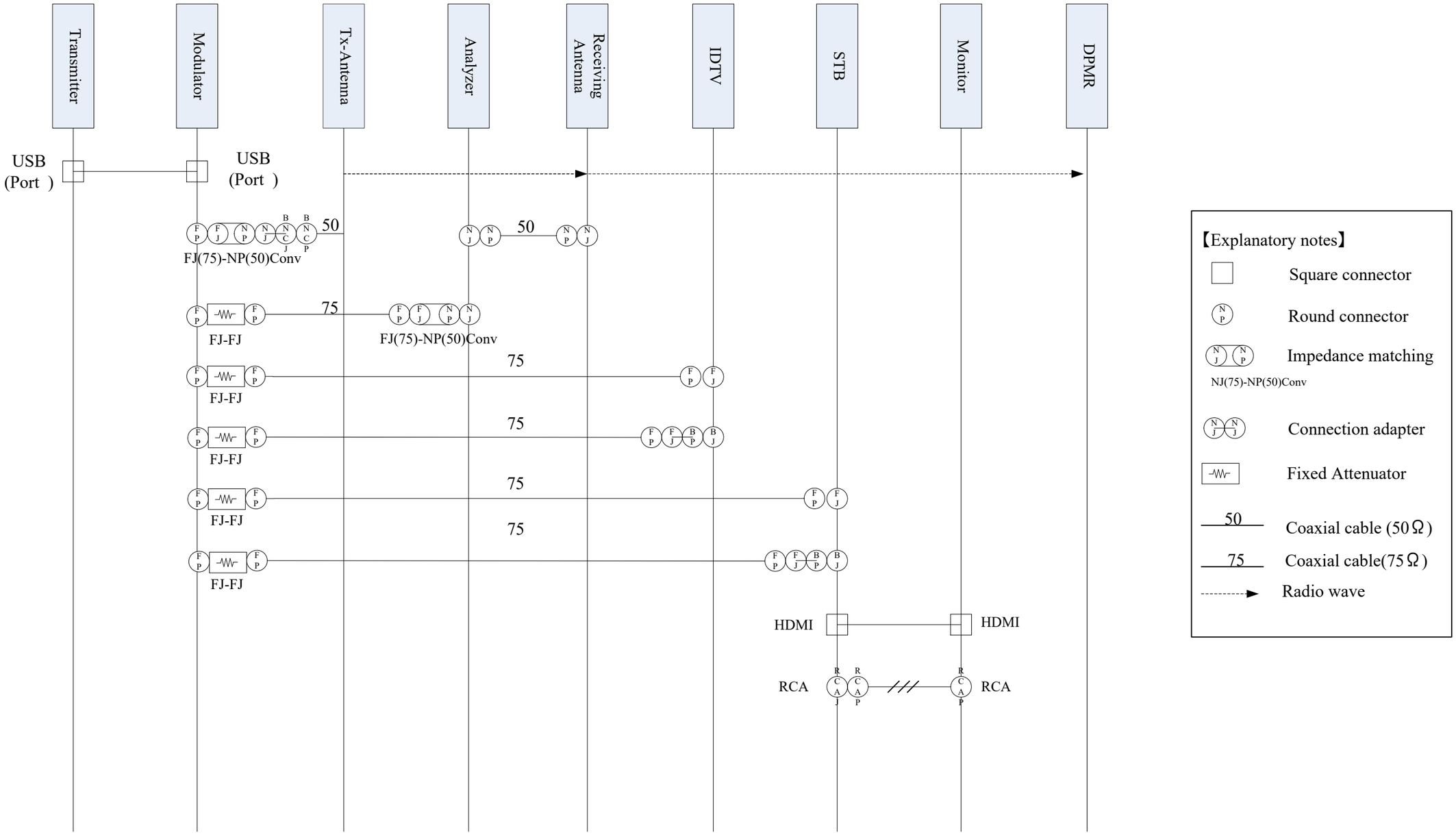


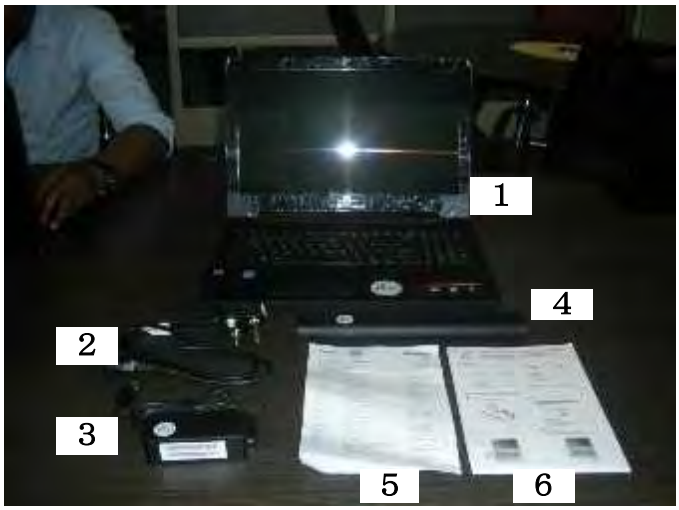
Figure 2.5-1-2: Connection system diagram

2.5-2 Components of the measurement equipment

① PC for test stream transmitter

Test stream transmitter (hereinafter: Transmitter) is an application software for creating a test data stream for testing an ISDB-T receiving device or refers to a computer that the application software is installed.

Components of Transmitter are as shown in Figure 2.5-2-1 and Table 2.5-2-1.



Components

1 Computer
2 Power cable
3 AC adapter
4 Battery
5 Repair contact list
6 Operation Manual

Figure 2.5-2-1: Components of Transmitter

Table 2.5-2-1: Components list of Transmitter

No	Item name	Product name or Standard	quant ity	Serial number	Remarks
1	Computer	Lenovo G80-50	1	PF09PQDD	Control Modulator
2	Power cable	-	1	-	
3	AC adapter	11S45N0289Z1ZS9 K54A0GE	1	11S36200602ZZ80054 A0GY	
4	Battery	L12L4A02	1	41NR19/66	
5	Repair contact list	148512414	1	-	
6	Operation Manual	-	1	-	

② ISDB-T Modulator

ISDB-T Modulator (hereinafter: Modulator) creates an RF signal from the Transmitter.

Components of Modulator are as shown in Figure 2.5-2-2 and Table 2.5-2-2.

Specifications of Modulator are as shown in Table 2.5-2-3.

1 Modulator
2 USB Memory
3 FJ-Belling Lee Convertor
4 BNCJ-FP Convertor
5 FJ-FJ Adaptor
6 Attenuator
7 Storage Box

Figure 2.5-2-2: Components of Modulator

Table 2.5-2-2: Components list of Modulator

No	Item name	Product name or Standard	quantity	Serial number	Remarks
1	Modulator	DTU-215	1	4215.004.317	Made by Dectek.co
2	USB memory	4GB-USB memory	1	-	Software and manuals are saved on this USB.
3	FJ-Belling Lee Convertor	FJ-Belling Lee	1	-	
4	BNCJ-FP Convertor	BNCJ-FP	1	-	
5	FJ-FJ Adaptor	FJ-FJ	1	—	
6	Attenuator		1	-	
7	Storage Box		1	—	Information of Modulator is described on the exterior of the storage box.

Table 2.5-2-3: Specifications of Modulator

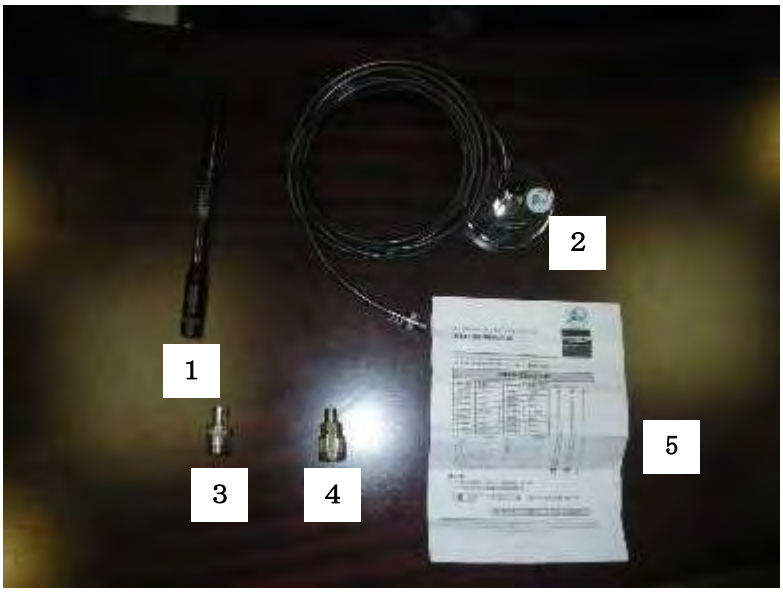
No	Specification	Information
1	Output channel	Among 21CH~48CH, any 1CH
2	Bandwidth	8MHz
3	Frequency range	470~690MH z （47~1000MHz）
4	QAM output level	-46 ~ -15 dBm
5	QPSK output level	-46 ~ -15 dBm
6	Output connector and Impedance	FP、75Ω
7	Input connector	USB2.0

③ RF antenna

RF antenna (hereinafter: Tx-Antenna) is connected to the RF output of the Modulator and emits an RF signal for technical assurance check for the DPMR.

Components of Tx-Antenna are as shown in Figure 2.5-2-3 and Table 2.5-2-4.

Specification of it is as shown in Table 2.5-2-5.



1 Antenna
2 Antenna fixture
3 BNCJ-NJ convertor
4 Impedance matching
5 Manual

Figure 2.5-2-3: Components of Tx-Antenna

Table 2.5-2-4: Components list of Tx-Antenna

No	Item	Product name or Standard	quantity	Serial number	Remarks
1	Antenna	RH795	1	-	
2	Antenna fixture	DP-MRX	1	-	Coaxial cable is integrated
3	Impedance matching	FJ(75)-NP(50)	1	-	
4	BNCJ-NJ convertor	BNCJ -NJ	1	-	

No	Item	Product name or Standard	quantity	Serial number	Remarks
5	Manual	-	1	-	

Table 2.5-2-5: Specification of Tx-Antenna

No	Specification	Information
1	Size	19.5～115 ㎝･
2	Frequency range	70～1000MHz
3	Gain	2.15dBi
4	Input connector	BNCP
5	Input impedance	50Ω

④ RF Analyzer

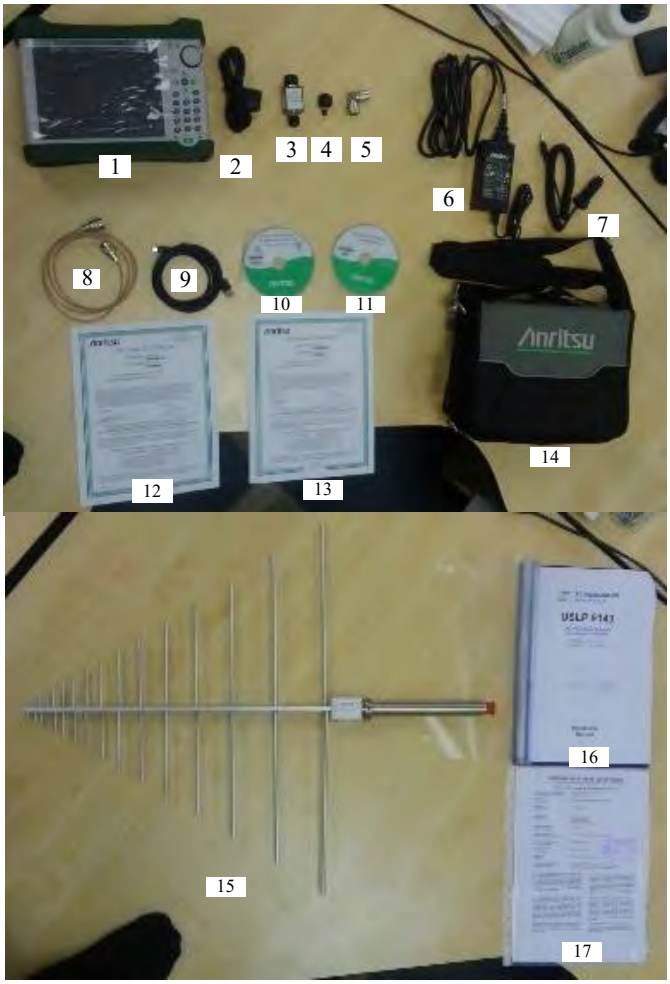
RF Analyzer (hereinafter: Analyzer) is connected to the RF output of the Modulator and check the RF signal for Technical assurance check.

In DPMR case, Connect the receiving antenna to the Analyzer after that, Check the RF signal that is emitted by the Tx-Antenna (connected at the output of the Modulator) for Technical assurance check.

By operating Analyzer correctly, it is possible to ensure the fairness of Technical assurance check.

Components of Analyzer are as shown in Figure 2.5-2-4 and Table 2.5-2-6.

The main items of specification of it are as shown in Table 2.5-2-7.



1. Spectrum Analyzer
2. GPS antenna
3. Matching pad
4. Adapter(NJ-SMAP)
5. Adapter(90DEG)
6. AC Adapter
7. DC Adapter (Cigarette spcket)
8. Coaxial cable
9. USB cable
10. Handheld Instruments Documentation
11. Anritsu Software Tool Box for Handheld RF Instruments
12. Certificate of Calibration MS2712E
13. Certificate of Calibration 12N50-75B
14. Carrying case
15. Log Periodic Antenna
16. Antenna manual
17. Antenna Calibration Certificate

Figure 2.5-2-4: Components of Analyzer

Table 2.5-2-6: Components list of Analyzer

No	Item	Product name or Standard	quantity	Serial number	Remarks
1	Spectrum Analyzer	MS2712E	1	1618048	Analyzer
2	20 MHz BW DEMOND	MS2712E-0009 Option 9	1	-	Installed in Analyzer
3	ISDB-T DIGITAL VIDEO MESUREMENTS	MS2712E Option 30	1	-	Installed in Analyzer
4	GPS receiver	MS2712E Option 31	1		Installed in Analyzer
5	GPS antenna	2000-1528-R	1	21950979	-
6	Matching pad	12N50-75B	1	1613007	75 ohm NJ to 50 ohm HJ

No	Item	Product name or Standard	quantity	Serial number	Remarks
7	Adapter(NJ-SMAP)	1091-27-R	1	-	NJ-SMAP 50ohm
8	Adapter(90DEG)	510-102-R	1	-	NJ-NJ 50ohm
9	AC Adapter	SA165E-12V	1	-	AC 100 ~ 240V to DC 12V
10	Power cable	806-141-R	1	-	Connect to car cigarette socket
11	Coaxial cable		1	-	NJ-NJ 50ohm
12	USB cable	3-2000-1498	1	-	USB(A)-USB(B)
13	Handheld Instruments Documentation	10920-00060	1	-	Analyzer manual
14	Anritsu Software Tool Box for Handheld RF Instruments	2300-577	1	-	Software Tool Box
15	Certificate of Calibration MS2712E	Calibration Certificate	1	1618048	Date of calibration April 26th ,2016
16	Certificate of Calibration 12N50-75B	Calibration Certificate	1	-	Date of calibration April 26th ,2016
17	Log Periodic Antenna	2000-1747-R	1	9143#566	Receiving antenna
18	Antenna manual	USLP 9143	1	-	Receiving antenna manual
19	Antenna Calibration Certificate	Calibration Certificate	1	-	Date of calibration March 30th ,2016
20	Carrying case	760-243-R	1	-	Accessories

Table 2.5-2-7: Specification of Analyzer

No	Specification item	Range/Specification
1	Measurements	Field Strength, Occupied Bandwidth, Channel power, ACPR (Adjacent Channel Power Ratio), AM/FM/SSB Demodulation, C/I(carrier-to-interference ratio), Emission mask, ISDB-T(Option 30)
2	Frequency Range	9kHz ~ 4GHz
3	RF out Damage level	23 dBm ±50 VDC
4	RF In Damage level	33 dBm peak
5	RF In connector	Type N, female, 50 ohm
6	GPS In connector	SMA, female
7	Battery	Type Li-Ion, Operation is 3.0 hours

No	Specification item	Range/Specification
8	Warranty	Standard three-year- warranty One-year warranty on battery

⑤ Set Top Box

Set top box (hereinafter: STB) is a signal converting apparatus for viewing digital terrestrial television broadcasting in analog television.

It is used in comparison with other STB's that will be submitted for the type approval.

Components of STB are as shown in Figure 2.5-2-5 and Table 2.5-2-8.

1. STB
2. Remote control unit
3. RGB cable
4. HDMI cable
5. Power Adaptor
6. Storage Box

Figure 2.5-2-5: Components of STB

Table 2.5-2-8: Components list of STB

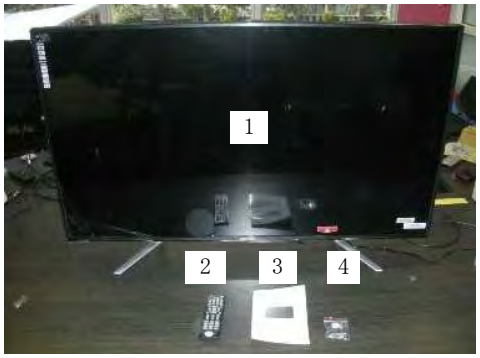
No	Item	Product name or Standard	Quantity	Serial number	Remarks
1	STB	EWD888	1	-	-
2	Remote control unit	-	1	-	-
3	RGB cable	RGB	1	-	Connection of a monitor
4	HDMI cable	HDMI	1	-	Connection of a monitor
5	Power Adaptor	-	1	-	
6	Storage Box	-	1	-	

⑥ Monitor

Monitor is used as a connection destination of STB that will be submitted for the type approval or for checking the measurement equipment.

When you do not use it, store in the storage box.

Components of Monitor are as shown in Figure 2.5-2-6 and Table 2.5-2-9.



Front view

Back view

Other components

Storage box

Component

1. Monitor
2. Remote control unit
3. Manual
4. Accessories (2 Fixing screws)
5. Storage box

Figure 2.5-2-6: Components of Monitor

Table 2.5-2-9: Components list of Monitor

No	Item	Product name or Standard	Quantity	Serial number	Remarks
1	Monitor	SLED-50FHD	1	SLED-50FHD350620151150	-
2	Remote control unit	-	1	-	-
3	Manual	-	1	-	-
4	Accessories	-	2	-	2 Fixing screws
5	Storage box	-	1	-	

⑦ Amplifier

Amplifier is used to amplify the Modulator output signal.

Components of Amplifier are as shown in Figure 2.5-2-7 and Table 2.5-2-10

1. Amplifier
2. Accessories
3. Storage box

Figure 2.5-2-7: Components of Amplifier

Table 2.5-2-10: Components list of Amplifier

No	Item	Product name or Standard	Quantity	Serial number	Remarks
1	Amplifier	ABSBP	1	-	-
2	Accessories	-	3	-	3 F type connector
3	Storage box	-	1	-	Information is wrote exterior of storage box.

⑧ Rack

Rack is used to store Measurement equipment

Components of Amplifier are as shown in Figure 2.5-2-8 and Table 2.5-2-11

Figure 2.5-2-8: Components list of Rack

Table 2.5-2-11: Components of Rack lists

No	Item	Product name or Standard	Quantity	Serial number	Remarks
1	RACK	VISION 3952228	1	-	-

2.5-3 Data Broadcasting Program

① Overview of Data Broadcasting Program

Data broadcasting program is prepared by the Ministry of internal Affairs and Communications of Japan for the test of ISDB-T digital terrestrial broadcasting receivers.

Transmitter and Modulator use the data to create RF signal for technical assurance check.

The Test stream data is as shown in Table 2.5-3-1.

Table 2.5-3-1: Data Broadcasting Programs.

No	Type of data	Purpose	Graphic sample
1	Full seg receiver test data	Check receiving function of IDTV and STB. And check Data Broadcasting receiving function.	
2	One seg receiver data	Check receiving function of DPMR. And check Data Broadcasting receiving function (optional).	

2.5-4 Maintenance of the measurement equipment

① Overview of maintenance

Measurement equipment must be made inspection based on the Table 2.5-4-1.

Table 2.5-4-1: Inspection of the period

No	Inspection name	Interval	Equipment of interest	Procedure	Remarks
1	Before technical assurance check.	Before technical assurance check.	Modulator Analyzer	Reference Chapter 2.6-1.	-
2	Periodic inspection	Every 3 months	Modulator Analyzer	Same as Before technical assurance check.	Periodic inspection is omitted if the Technical assurance check within 3 months was done.
3	Calibration	Per year	Analyzer	Manufacture inspection	Calibration

② Threshold value of Modulator output signal.

Quality of test signal can be determined by measuring the MER and output level.

Threshold values are as shown in Table 2.5-4-2.

Table 2.5-4-2: Test signal threshold value

No	Modulator output		Threshold value		
	Channel (Frequency)	Output level	MER (Total)	Output level	Frequency deviation
1	21CH (474MHz)	No signal or Unstable	No signal or Unstable	No signal or Unstable	No signal or Unstable
2	34CH (578MHz)				
3	48CH (690MHz)				

③ Reference Modulator output signal

As a reference value of the Modulator output signal that is the test result at the time of delivery are as shown the Table 2.5-4-3.

Configuration of the measurement is as shown Table 2.5-4-4.

Connecting the modulator and the Analyze is as shown Figure 2.5-4-1.

Table 2.5-4-3: Measurement result at the time of delivery inspection

No	Channel	Centre Frequency [MHz]	Modulator output [dBm]	Frequency deviation [Hz}	Output level [dBm]		MER [dB]		
					13seg	1seg	Total	Layer A (QPSK)	Layer B (16QAM)
1	21	474.000	-28	-271	-28	-38	38.2	40.4	37.3
2	22	482.000		-272	-27.9	-39	38.4	40.6	37.4
3	23	490.000		-271	-28.1	-40	38.2	40.5	37.3
4	24	498.000		-270	-28.3	-39.5	38.3	40.2	37.5
5	25	506.000		-270	-28.2	-39.2	38.4	40	37.6
6	26	514.000		-272	-28.2	-39.8	38.5	40.4	37.7
7	27	522.000		-272	-27.9	-39.5	38.6	40.4	37.7
8	28	530.000		-280	-27.9	-39.1	38.6	40.5	37.7
9	29	538.000		-271	-28.1	-39	38.6	40.2	37.8
10	30	546.000		-269	-28.2	-39.2	38.5	40	37.6
11	31	554.000		-270	-28.1	-39.8	38.5	40.2	37.6
12	32	562.000		-278	-28.1	-39.9	38.4	40.1	37.5
13	33	570.000		-271	-27.8	-39.2	38.5	40.3	37.7
14	34	578.000		-270	-28.2	-39.1	38.5	40	37.6
15	35	586.000		-271	-28	-39	38.4	39.9	37.5
16	36	594.000		-275	-28.1	-39.4	38.4	40.1	37.6
17	37	602.000		-272	-27.9	-39.3	38.5	40	37.6
18	38	610.000		-270	-27.9	-39	38.6	40.4	37.7
19	39	618.000		-269	-27.9	-39.3	38.6	40.1	37.8
20	40	626.000		-271	-27.8	-39.7	38.7	40.1	37.8
21	41	634.000		-270	-27.9	-39.2	39.9	42	39
22	42	642.000		-274	-27.9	-39	38.8	40.1	38
23	43	650.000		-273	-27.5	-38.9	38.9	40.1	38
24	44	658.000		-289	-27.2	-38.8	38.8	40.3	38
25	45	666.000		-291	-27.3	-39.2	38.7	40.1	37.9
26	46	674.000		-290	-27.5	-38.9	38.6	40	37.8
27	47	682.000		-289	-27.6	-38.7	38.7	40.1	37.9
28	48	690.000		-286	-27.2	-38.4	38.8	40.1	38

Table 2.5-4-4: Configuration at the time of delivery inspection

No	Item	Configuration	Remarks
1	Output level	-28dBm	Modulator output
2	Offset	1.9dB	Analyzer configuration
3	Measurement mode	Moving Average	Analyzer configuration
4	Average time	10	Analyzer configuration
5	Test data file name	Teststream_forOnesegDatacasting	

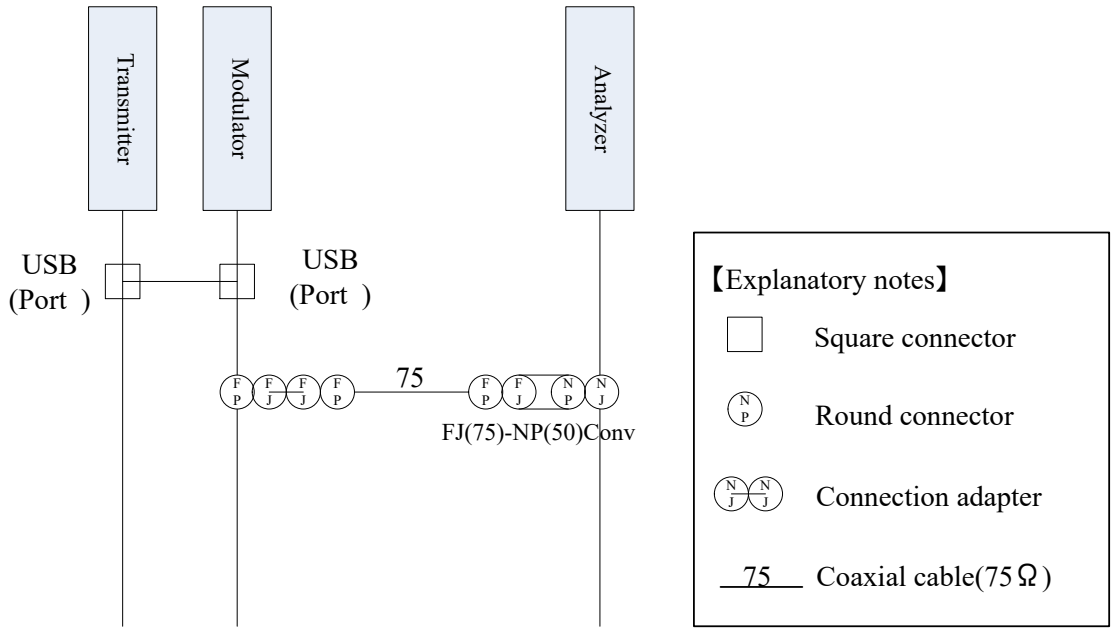


Figure 2.5-4-1: Connection diagram at the time of delivery inspection

④ Measurement Modulator

Procedure of Measurement the Modulator is referred chapter 2.6-1.

If the measurement result does not satisfy the threshold, check measurement equipment with reference to chapter 2.6-2.

2.6 Preparation for the measurement equipment

2.6-1 Preparation for the measurement of IDTV and STB

① Overview of the preparation

Overview of the preparation is as shown Figure 2.6-1-1.

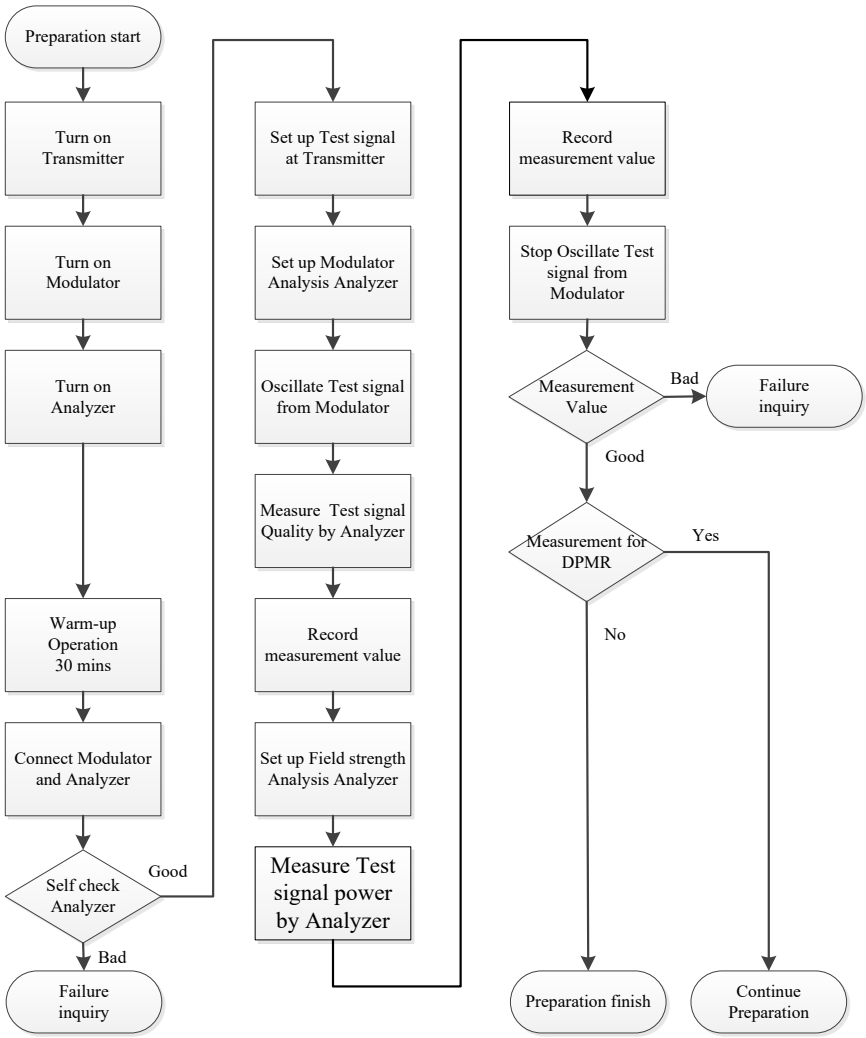


Figure 2.6-1-1: Preparation work flow (IDTV and STB)

② Preparation of Transmitter

Starting up the Transmitter is carried out in accordance to the procedure below and Figure 2.6-1-2.

1st. In login stage, Choose [BOCRA].
2nd. Enter the password.
3rd. Desktop will be displayed.

When it does not start, check it by referring to the Transmitter manual.

No	Procedure	No	Procedure
1st.	 LOGIN	2nd.	 PASSWORD
3rd.	 DESKTOP	.	

Figure 2.6-1-2: Starting up of the Transmitter

③ Starting up the Modulator

When Modulator and Transmitter have already been connected before the startup of the Transmitter, Modulator will automatically turn on.

When Modulator and Transmitter are not connected before the Startup of the Transmitter, The Modulator start up should be carried out in accordance to the procedure below and Figure 2.6-1-3.

1st. Connect the Modulator to Transmitter any USB port.

2nd. Check the Modulator lamp. When the lamp produces a blue light beam go to next. If it does not produce a blue light beam go back to ① and do again.

3rd. Push the「Stream Express」icon on Transmitter display (Desktop).

4th. After starting up the StremXpress, Check the upper-right corner of the window. When the item Adapter [MOD:(DTU-215)」is displayed starting up is successful. When startup is not successful, check it by referring to the Modulator manual.

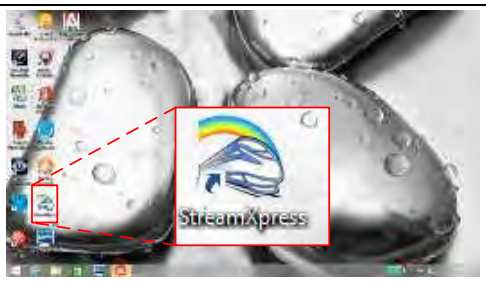
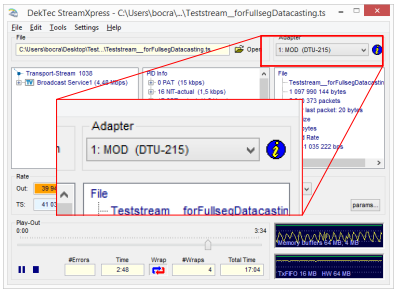
No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	

Figure 2.6-1-3: Starting up of the Modulator

④ Starting up the Analyzer

Starting the Analyzer is carried out in accordance to the procedure below and Figure 2.6-1-4.

1st. Push [Green button]

2nd. Check the power lamp and display.

When the lamp produces a light, it's now ON.

The Analyzer screen will then display the initial startup screen or the display screen of the previous work, Startup is successfully.

When it does not startup, check it by referring to the Analyzer manual.

No	Procedure	No	Procedure
1st.		2nd.	

Figure 2.6-1-4: Starting up of the Analyzer

⑤ Warm up

After starting up measurement equipment, do the warm up operation for more than 30 minutes, to stabilize the operation and the output signal of the equipment.

⑥ Connect Modulator and Analyzer

Modulator output port impedance is 75 ohm. Analyzer input port is 50 ohm. When you connect them, you must use the impedance matching adapter. If you do not use it, errors will occur in the measurement result.

Connecting them is carried out in accordance to the procedure below and Figure 2.6-1-5.

1st. Install the Impedance matching adapter to the Analyzer input port.
2nd. Connect the attenuator to Modulator output port.
3rd. Connect the extension cable to the attenuator.
4th. Connect the extension cable to the Impedance matching adapter.

No	Procedure	No	Procedure
1st.		2nd.	

No	Procedure	No	Procedure
3rd.		4th.	

Figure 2.6-1-5: Connecting Modulator and Analyzer

⑦ Self-check of the Analyzer

The Analyzer is provided with the respective hardware and the application of the self-check function.

Self-check is carried out in accordance to the procedure below and Figure 2.6-1-6.

Example of self-check result is as shown Figure 2.6-1-7 and Figure 2.6-1-8.

1st. Push [shift] key.

2nd. Push [8] key.

3rd. Window of the “system menu” appears on the right side of the screen.
Push [Self-Test].

4th. A few seconds later, the self-check result are displayed in the centre of the screen. On the Self-Test Results, “PASSED/OK” will be displayed each item. Voltage information results will be displayed in a black color if “Passed” the Self-Test. If any item on the Self-Test results displays “Failed” or if voltage information is displayed in red letters, it means analyzer hardware is abnormal. In this case, check the Analyzer with reference to the manual or makes an inquiry to the manufacturer.

5th. After check the Self- Test result, Push [Enter].

6th. Push [Application Self Check]

7th. A few seconds later, the application self-check result are displayed in the centre of the screen. On the self-test results “PASSED/OK” will be displayed each item. If “Failed” or information of red letters is displayed, it means application is abnormal. In this case, check the Analyzer with reference to the manual or makes an inquiry to the manufacturer.

8th. If it is normal push [Enter], self-check test is finished.

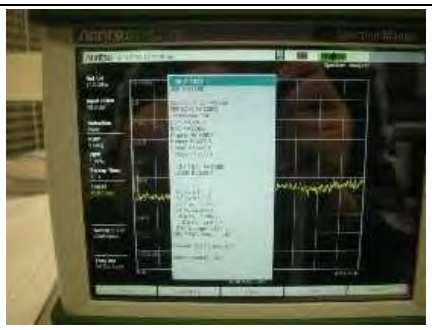
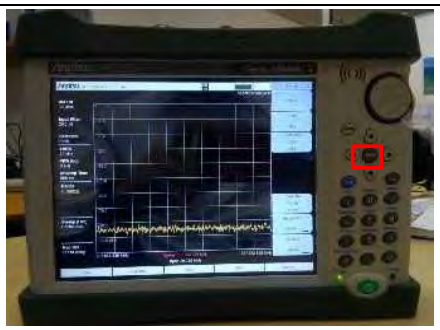
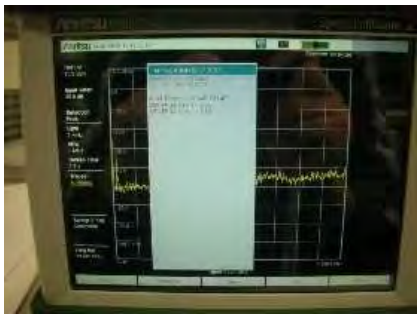
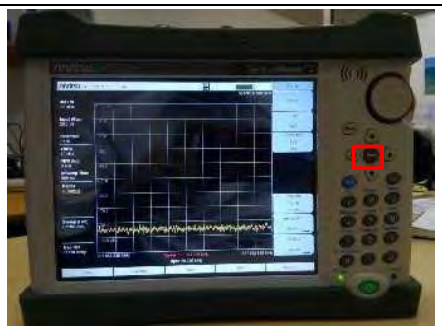
No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	
5th.		6th.	
7th.		8th.	

Figure 2.6-1-6: Self-check procedure

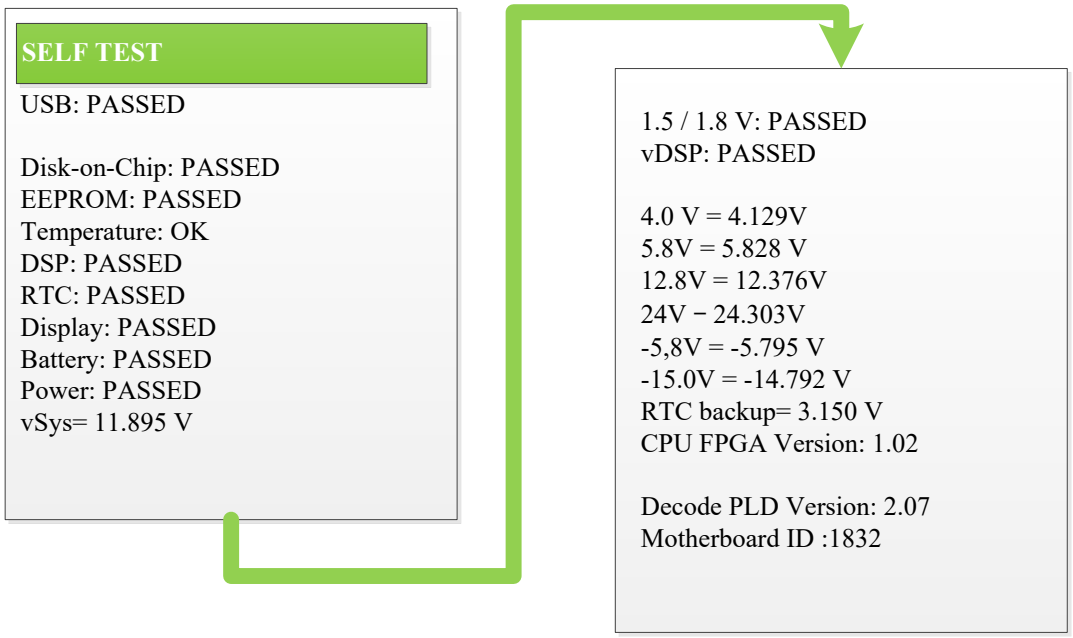


Figure 2.6-1-7: Example of hard ware self-check result

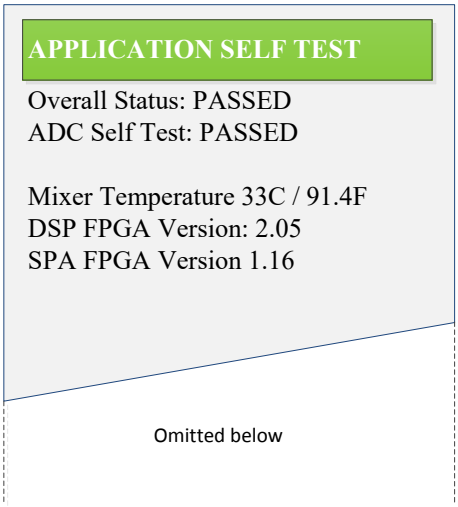


Figure 2.6-1-8: Example of application self-check result

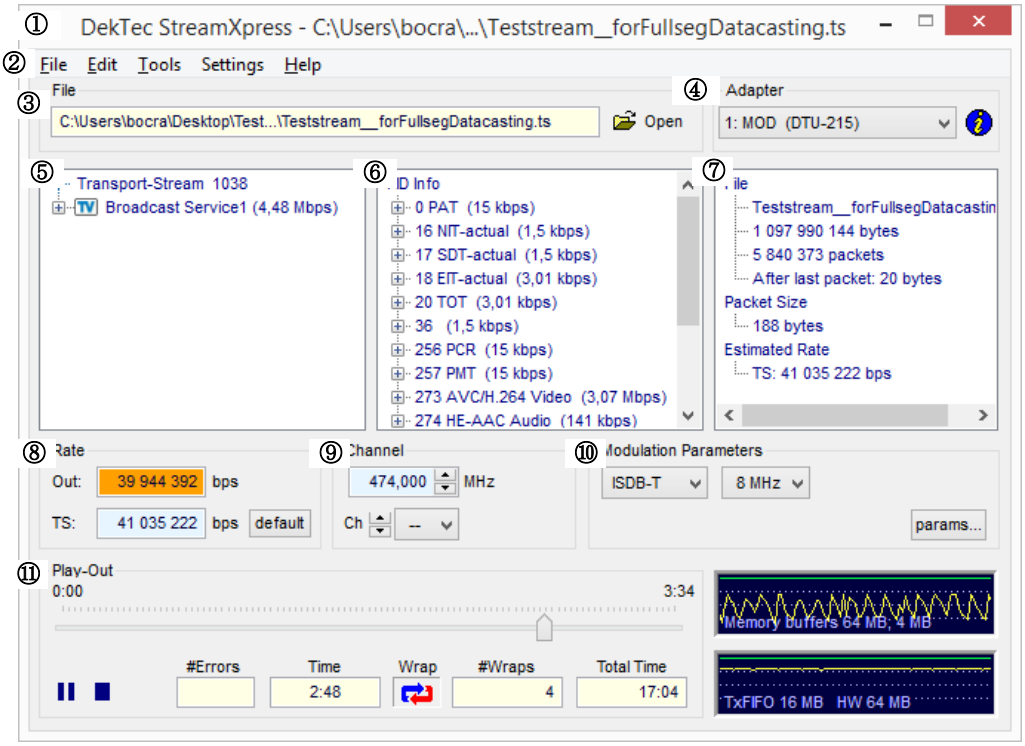
⑧ Set up test signal at transmitter

Setting of the test signal is carried out by using the software “StreamXpress” that is installed on the Transmitter.

The software basic screen is as shown in Figure 2.6-1-9.

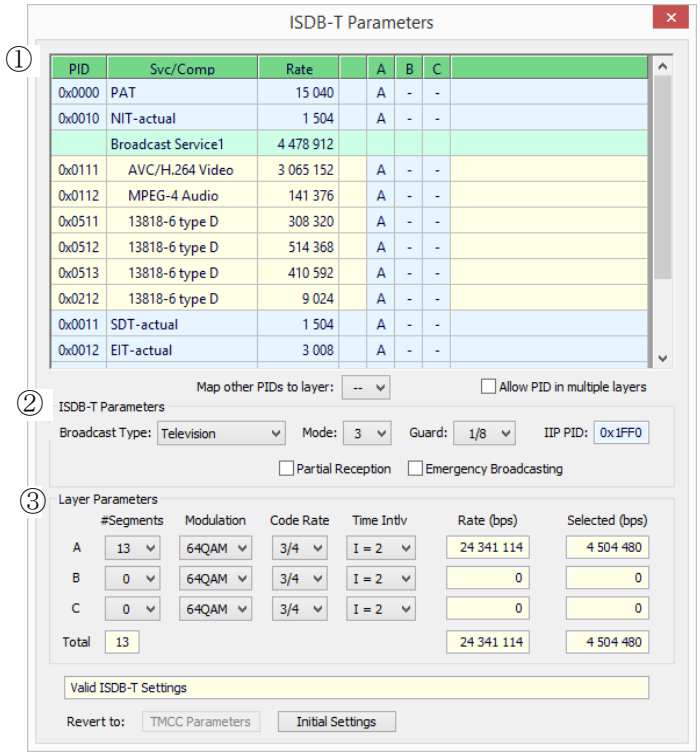
The output signal parameter setting screen is as shown in Figure 2.6-1-10.

Output signal level setting screen is as shown in Figure 2.6-1-11.



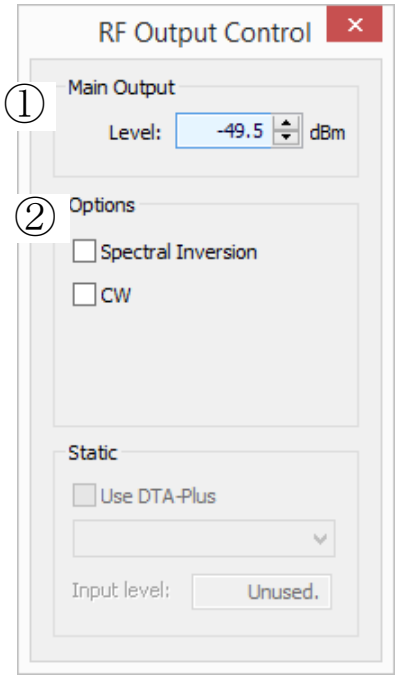
① Software name and a file information in use.
② Main menu
③ Location and name of the file in use
④ Name of the test signal generator which is connected.
⑤ Information of the file in use.
⑥ Information of the file in use.
⑦ Information of the file in use.
⑧ Bit rate of the test signal
⑨ Frequency of the test signal
⑩ Modulation and bandwidth of the test signal.
⑪ Control menu of the test signal output.

Figure 2.6-1-9: StreamXpress basic screen



① Detail information of the test signal.
② Detail information of the test signal modulation
③ Layer information of the test signal.

Figure 2.6-1-10: Output signal parameter setting



① Control menu of the test signal output.
② Setting option menu. It is not necessary to use.

Figure 2.6-1-11: Output signal level setting screen

Test signal configuration is as shown in Table 2.6-1-1.

Table 2.6-1-1: Test signal configuration

No	Modulation	CH (Frequency)	output
1	16QAM	21CH (Fc 474MHz)	-78.4 dBm
2		34CH (Fc 578MHz)	
3		48CH (Fc 690MHz)	

Setting of the test signal No1 in Table 2.6-1-1 is carried out in accordance to the procedure below and Figure 2.6-1-12.

1st. Enter [File] in the main of the StreamXpress.
2nd. Enter [Open] in the sub-menu that appears after 1st.
3rd. Choose the location (Folder) [TestStream] on desk top.
4th. Choose the file “Teststream_forFullsegDatacasting”.
5th. Click the frequency information and input “474.000” and enter.
When Frequency is 578MHz, input “578.000” and enter.
When Frequency is 690MHz, input “690.000” and enter.
6th. Choose the “8MHz” in Modulation Parameters.
7th. Enter “Parameters”.
8th. Check and choose Modulation configuration “16QAM” in the sub-menu that appears after 7th.
After that, Click X mark of the sub-menu window upper right.
When you want to use 64QAM, choose Modulation configuration “64QAM” in the sub-menu.
9th. Enter [Setting] in the main menu the StreamXpress
10th. Enter [RF Output Control] in the sub-menu that appears after 9th.
11th. Set the output level is -39.5.
12th. Click the play button, Test signal will be transmitted.
To stop the test signal you click on the pause button.

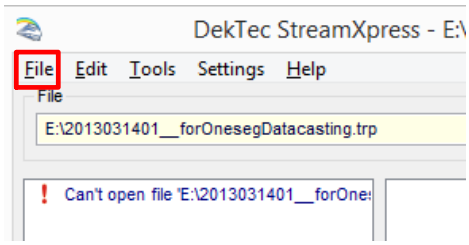
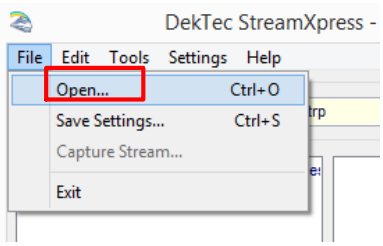
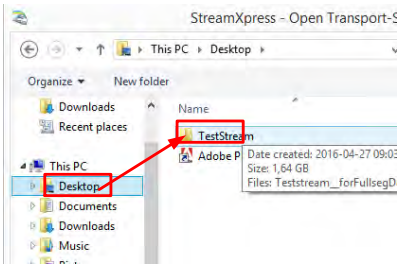
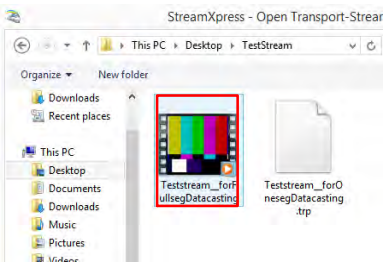
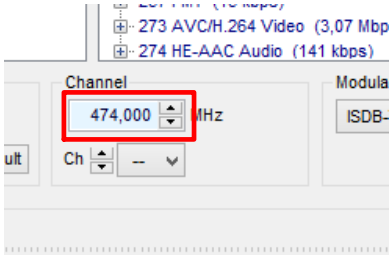
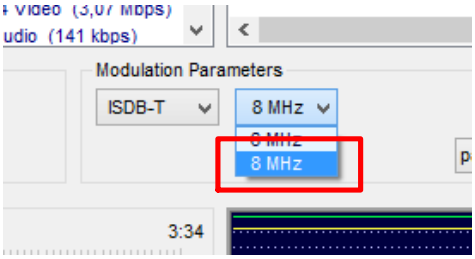
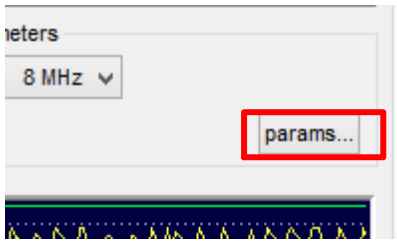
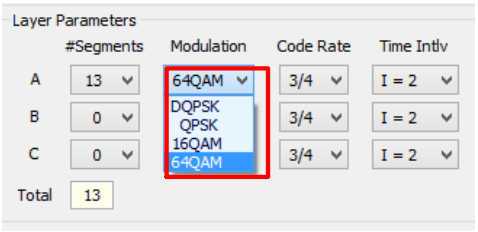
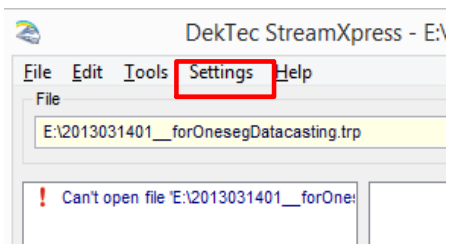
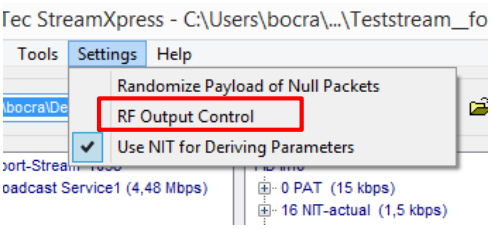
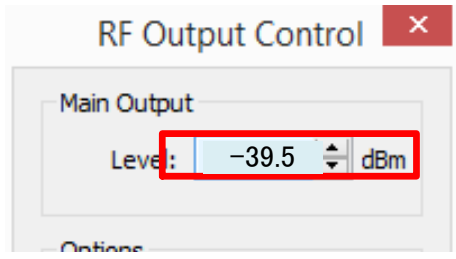
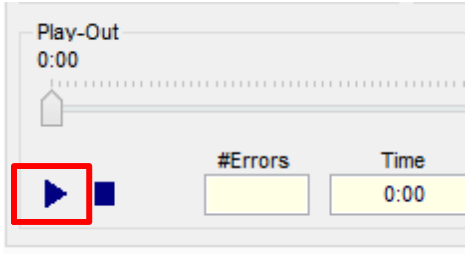
No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	
5th.		6th.	
7th.		8th.	
9th.		10th.	
11th.		12th.	

Figure 2.6-1-12: Test signal configuration procedure

Changing the frequency of the test signal should be carried out in accordance to the procedure below and Figure 2.6-1-13.

1st. Click the frequency information; input the desired Frequency and Press enter. When changing the frequency there is no need to stop the signal stream.

2nd. Check if the bandwidth is “8MHz”. If a different bandwidth is selected, select “8MHz”.

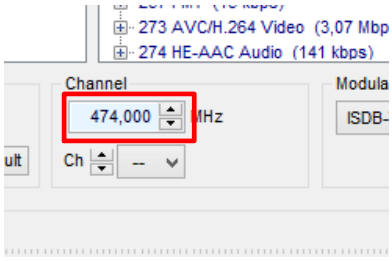
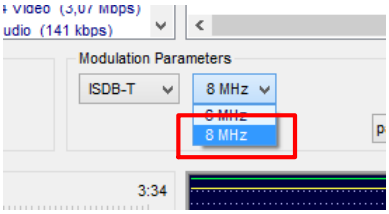
No	Procedure	No	Procedure
1st.		2nd.	

Figure 2.6-1-13: Changing of the test signal frequency.

⑨ Starting up ISDB-T measurement at the Analyzer

Starting up ISDB-T measurement software is carried out in accordance to the procedure below and Figure 2.6-1-14.

1st. Push [shift] key.

2nd. Push [9] key.

3rd. Window of the “Mode menu” appears on the right side of the screen. Choose [ISDB-T Analyzer].

4th. A few seconds later, the ISDB-T Analyzer is displayed in the screen. If ISDB-T Analyzer started up normally, go to next.

No	Procedure	No	Procedure
1st.		2nd.	

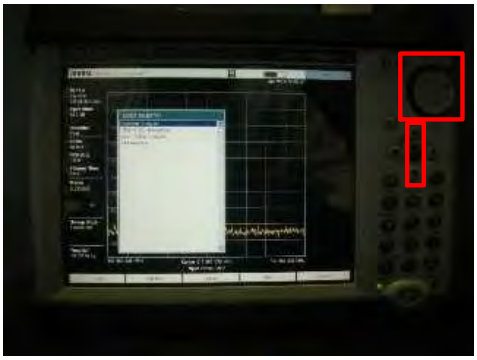
No	Procedure	No	Procedure
3rd.		4th.	

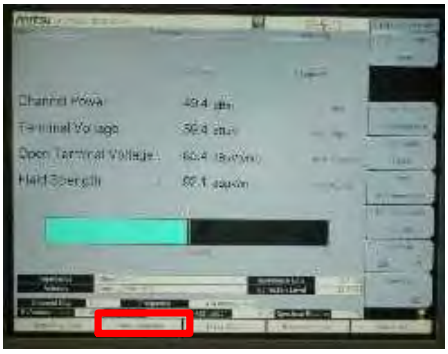
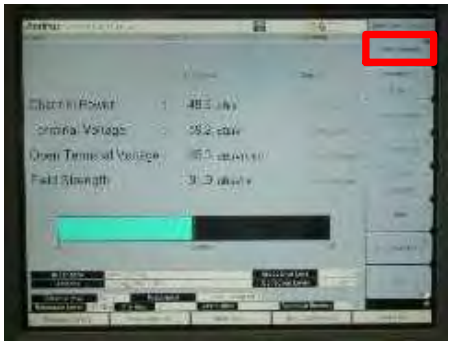
Figure 2.6.1-14: Startup of ISDB-T analyzer

⑩ Offset value

Modulator and Analyzer are connected using an impedance converter. The impedance Converter will add some losses to the test signal. An Offset value equivalent to the loss introduced by the impedance converter must be set in the analyzer. If the offset value is not set, Test result will get an error.

Setting of the offset value is carried out in accordance to the procedure below and Figure 2.6-1-15.

1st. Push [Meas Selection]. But if the operation is already at Field Strength, start from 3rd.
2nd. Push [Field Strength].
3rd. Push [Meas Setup].
4th. Push several times [Impedance] and choose [Other].
5th. Push [Impedance Loss] that appears under the Impedance.
6th. [Impedance Loss Editor] menu appear in the screen. Input the offset value: 2.0 dB and push the enter key. (Use the numeric key or dial key)

No	Procedure	No	Procedure
1st.		2nd.	

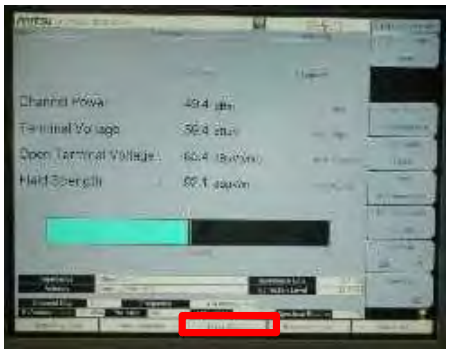
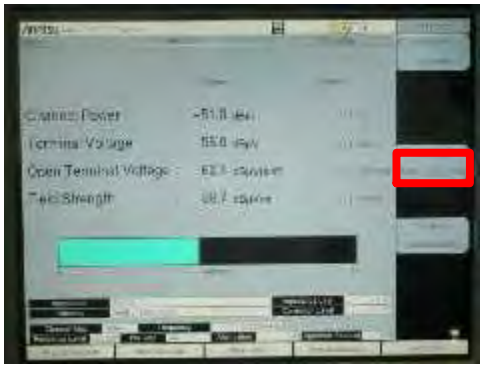
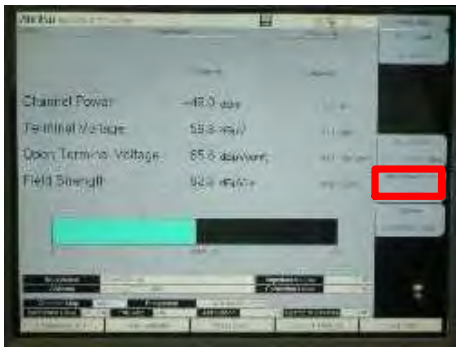
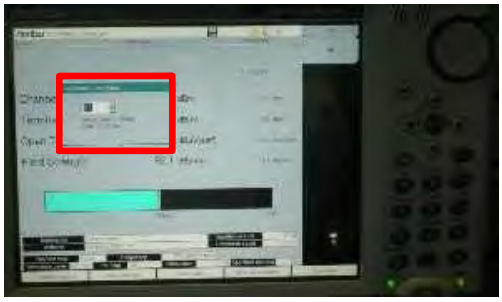
No	Procedure	No	Procedure
3rd.		4th.	
5th.		6th.	

Figure 2.6-1-15: Setting of the offset value

⑪ Threshold of the test signal

Quality of test signal can be determined by measuring the MER and output level.
Threshold values are as shown in Table 2.6-1-2.
When changing the frequency of the test signal, Threshold shall remain the same as shown in Table 2.6-1-2.

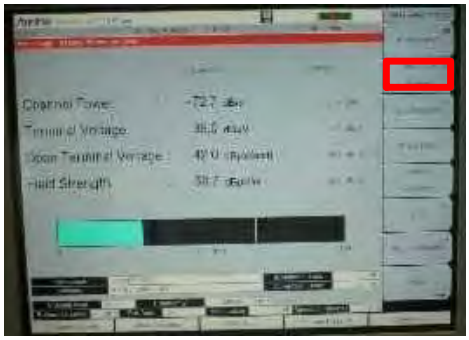
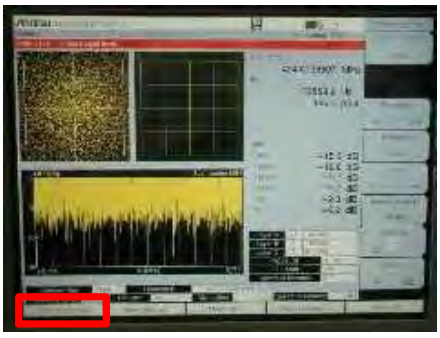
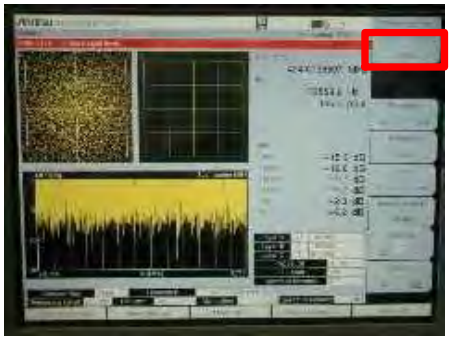
Table 2.6-1-2: Test signal threshold value

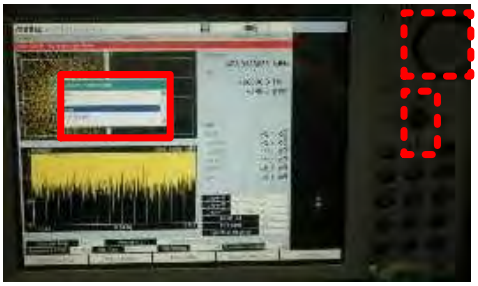
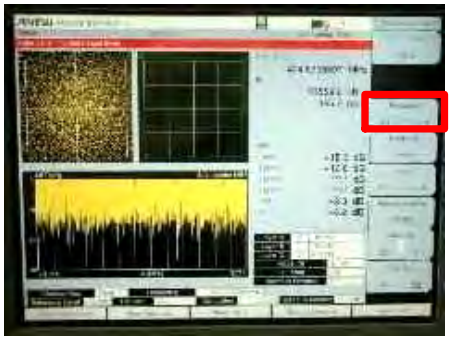
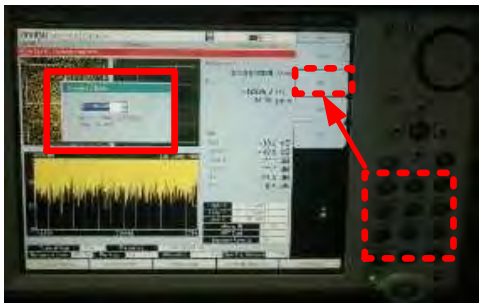
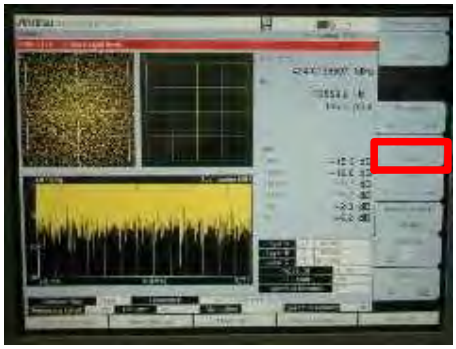
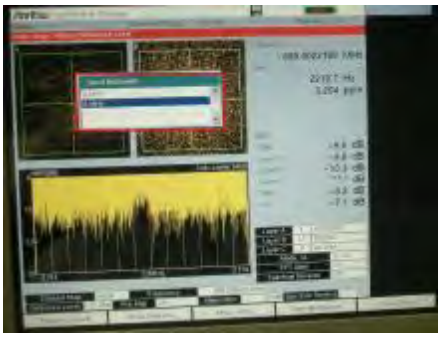
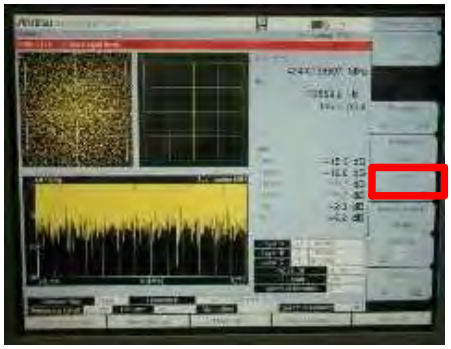
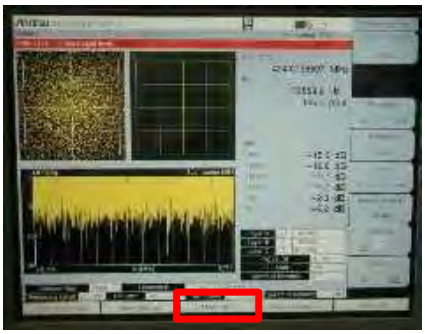
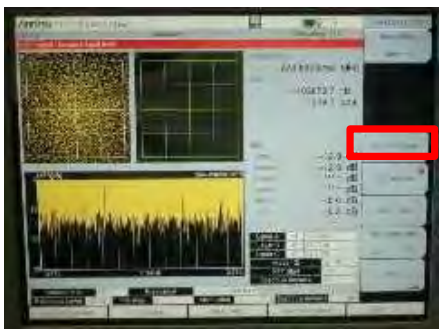
No	Modulator output		Threshold value	
	Channel (Frequency)	Output level	MER (Total)	Output level
1	21CH (474MHz)	-78.4 dBm	More than 34dB	-78.4 dBm±2dBm
2	34CH (578MHz)			
3	48CH (690MHz)			

⑫ Measurement of the test signal

The measurement of the test signal is carried out in this order; MER measurement and then Output level measurement.
MER measurement is carried out in accordance to the procedure below and Figure 2.6-1-16.

1st. Push [Meas Selection].
2nd. Push [Modulation Analysis].
3rd. Push [Frequency/Level].
4th. Push [Channel Map].
5th. A few seconds later, the Select Channel Map menu is displayed in the centre of the screen. Choose [None].
6th. Push [Frequency]
7th. A few seconds later, the Frequency Editor window is displayed in the centre of the screen. Input the frequency and Push the MHz key.
8th. Push [Bandwidth]
9th. A few seconds later, the Bandwidth Editor menu is displayed in the centre of the screen. Choose [8MHz].
10th. Push [Auto Reference]
11th. Push [Meas Setup]
12th. Push [Detect Parameter]
13th. A few seconds later, you will get the measurement. Check and record the total MER value.

No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	

No	Procedure	No	Procedure
5th.		6th.	
7th.		8th.	
9th.		10th.	
11th.		12th.	

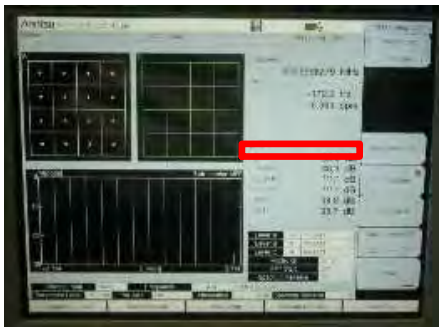
No	Procedure	No	Procedure
13th.			

Figure 2.6-1-16: Measurement of the MER

Next go to the Measurement of the output level.
The Measurement of the output level is carried out in accordance to the procedure below and the Figure 2.6-1-17.

1st. Push [Meas Selection].
2nd. Push [Field strength].
3rd. Check and record output level.

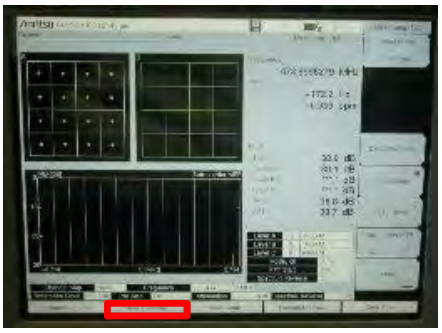
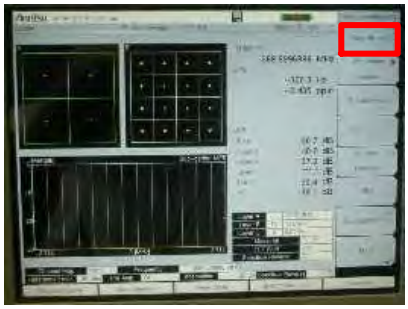
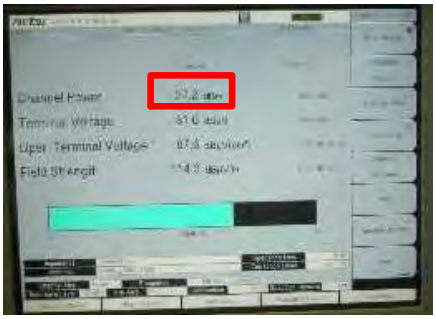
No	Procedure	No	Procedure
1st.		2nd.	
3rd.			

Figure 2.6-1-17: Field strength measurement

After measurement of MER and output level, change to the next channel and go back to the Measurement of the test signal procedure 6th (Omit 8th and 9th).
Measure the test signal again.

⑬ Check the measurement result
Check for any abnormal value the measure leakage or omission on the measurement result sheet.
If there are any found, make corrections.

⑭ Preparation finish
When the measurement result satisfies the threshold, that preparation is complete.

2.6-2 Abnormal occurrence

If the measurement result does not satisfy the threshold, check the measurement equipment.
The Equipment Checking procedure is carried out in accordance to Figure 2.6-2-1.
If Check Result does not satisfy the threshold abort the technical assurance check.
When the measurement equipment failure is suspected, contact the manufacturer.

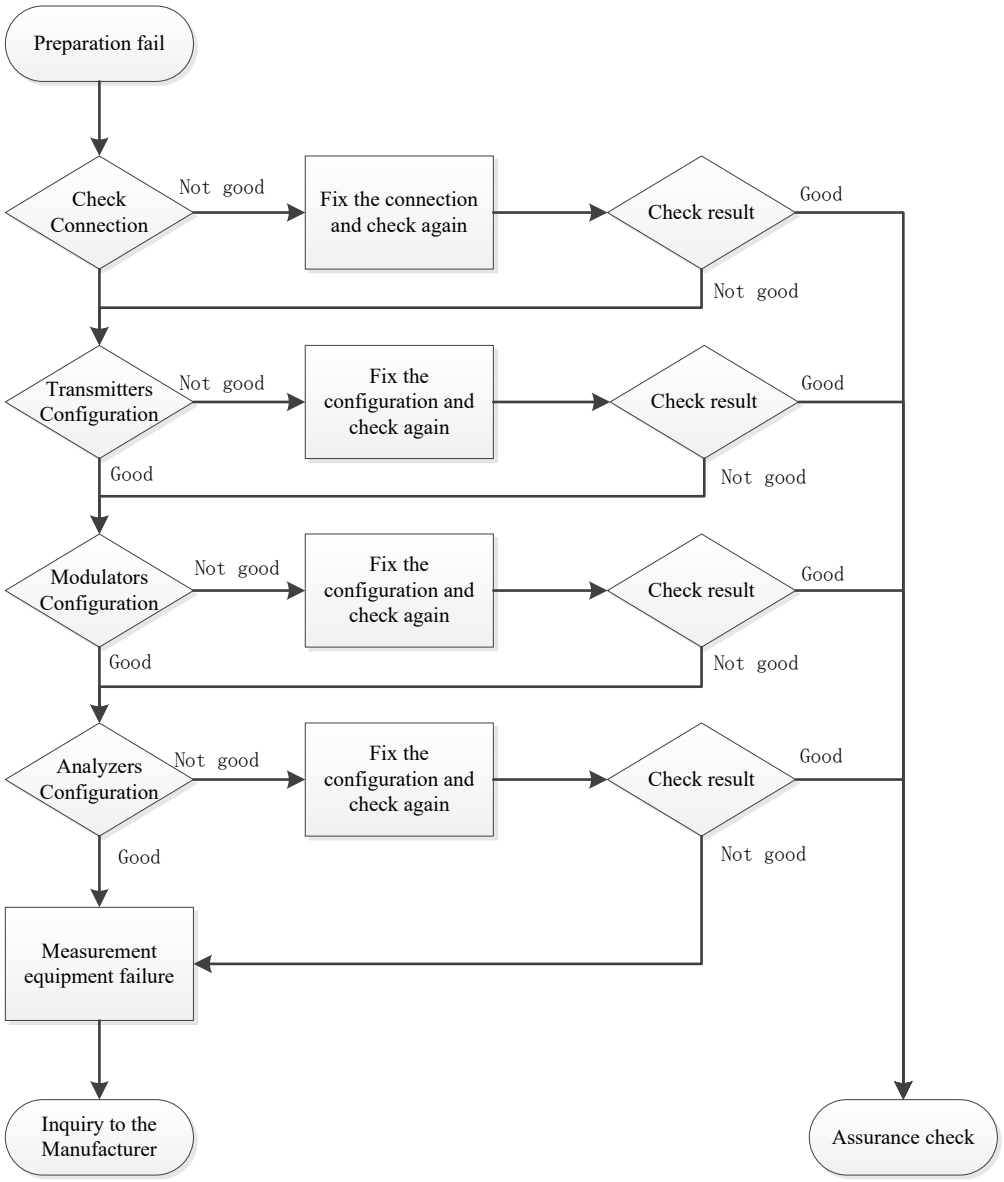


Figure 2.6-2-1: Example of failure check work flow

2.6-3 Preparation for the measurement of DPMR

① Overview of the preparation

Overview of the preparation is as shown Figure 2.6-3-1.

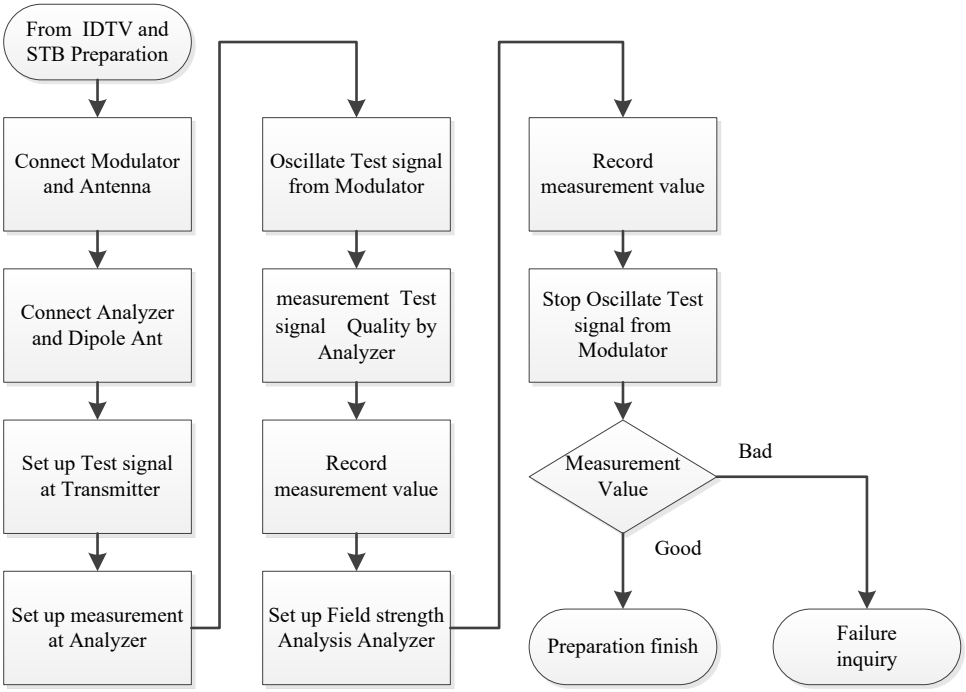


Figure 2.6-3-1: Preparation work flow (DPMR)

② Connect Modulator and Antenna

Connection of Modulator and Tx-Antenna is carried out in accordance to the procedure below and the Figure 2.6-3-2.

1st. Connect the Impedance matching adapter to the Modulator output port.
2nd. Connect the BNCJ-NJ convertor to the Tx-Antenna input port.
3rd. Connect the Impedance matching adapter and the BNCJ-NJ convertor
4th. Set the antenna on a desk.

No	Procedure	No	Procedure
1st.		2nd.	

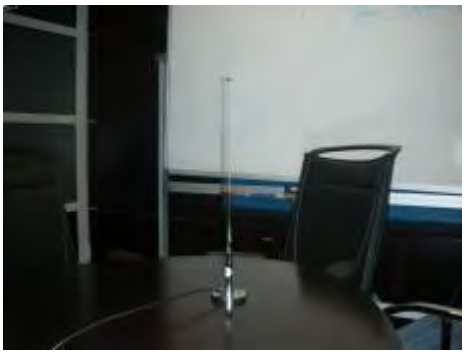
No	Procedure	No	Procedure
3rd.		4th.	

Figure 2.6.3-2: Connection of Modulator and the Tx-Antenna

③ Adjustment of Tx-Antenna

The length of the Tx-Antenna must be adjusted according to the test signal frequency.

Adjustment of Tx-Antenna length is carried out in accordance to Figure 2.6-3-3 and Table 2.6-3-1.

Tx-Antenna length can be adjusted in two ways.

A. Extending only the narrow part of the diameter.

B. Extending the thick part of the diameter.

There will be No effect on the frequency characteristics by both procedures.

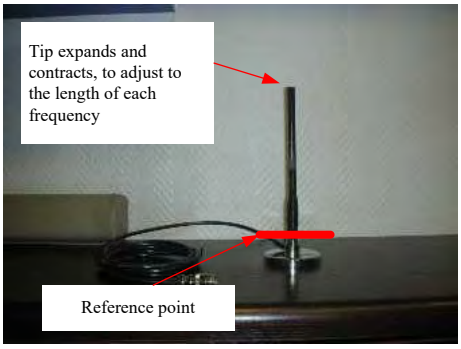
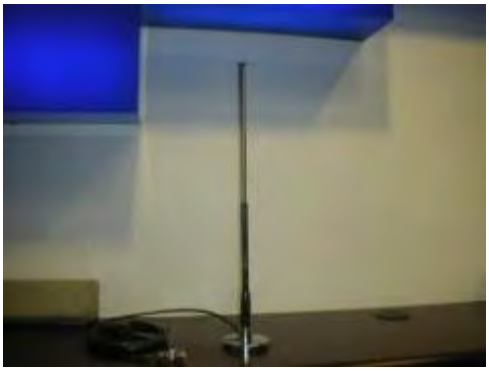
No	Operation	No	Operation
①	 Reference point of the Antenna	③	 Extending the narrow part
②	 Extending	④	 Extending the thick part

Figure 2.6-3-3: Adjusting the Tx-Antenna

Table 2.6-3-1: Frequency and Tx-Antenna length list

No	Channel	Frequency(MHz)	Antenna length(cm)
1	21	474	39.4
2	22	482	38.3
3	23	490	37.2
4	24	498	36.1
5	25	506	35
6	26	514	34.5
7	27	522	34
8	28	530	33.5
9	29	538	33
10	30	546	32.5
11	31	554	32
12	32	562	31.5
13	33	570	31
14	34	578	30.5
15	35	586	30
16	36	594	29.5
17	37	602	30
18	38	610	29.5
19	39	618	29.05
20	40	626	28.6
21	41	634	28.15
22	42	642	27.7
23	43	650	27.25
24	44	658	26.8
25	45	666	26.35
26	46	674	25.9
27	47	682	25.45
28	48	690	25

④ Connect Analyzer and Antenna

Connection of the receiving antenna and Analyzer is carried out in accordance to the procedure below and Figure 2.6-3-4.

1st. Attach the antenna of the Analyzer RF In connector
2nd. Press the Meas Selection main menu key
3rd. Press the Field Strength sub menu key in the Meas Selection (1/2) menu.
4th. Press the Meas Setup main menu key to open the Meas Setup menu.
5th. Press the Antenna (Correction Level) submenu key to open the Select Antenna box
6th. Scroll through to the desired Anritsu antenna model number by using the Up/

arrow keys or the rotary knob. Highlight the antenna model number: 2000-1747-R, and then press Enter.

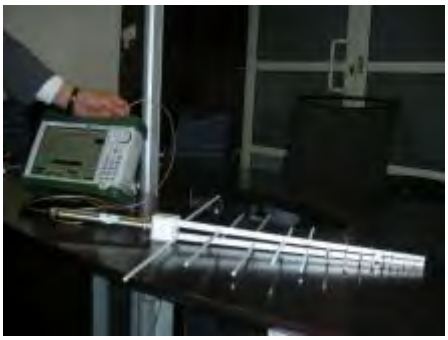
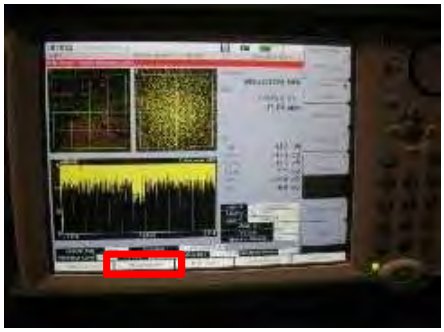
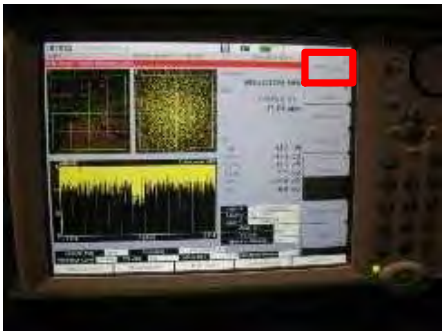
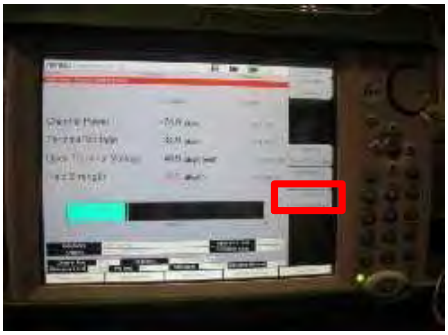
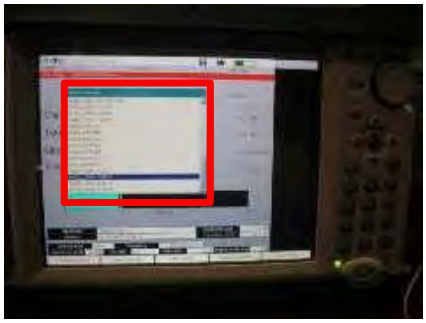
No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	
5th.		6th.	

Figure 2.6-3-4: Connection of Analyzer and receiving antenna.

⑤ Set up test signal at transmitter

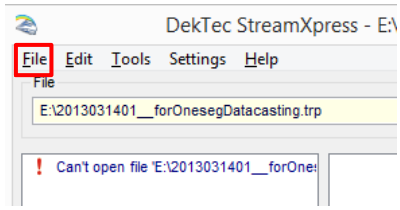
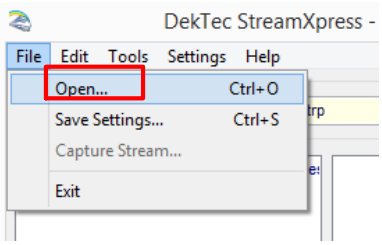
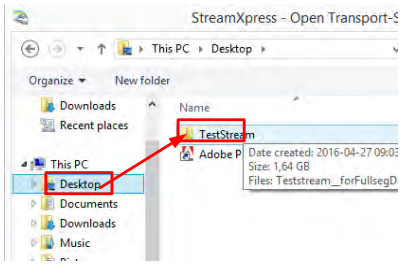
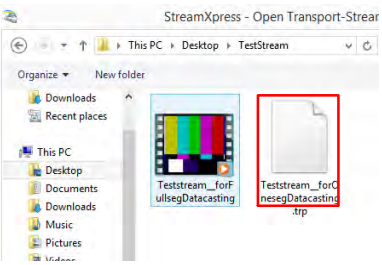
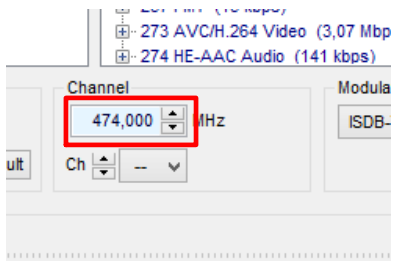
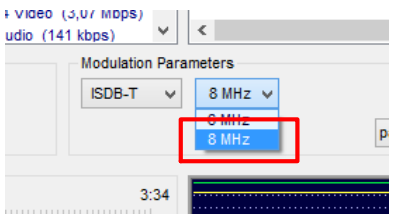
The test signal information is as shown in Table 2.6-3-2.

Table 2.6-3-2: Test signal Information (DPMR)

No	Modulation	CH (Frequency)	Output
1	16QAM	21CH (Fc 474MHz)	-30 dBm
2		34CH (Fc 578MHz)	
3		48CH (Fc 690MHz)	

Setting of the test signal No.1 in Table is carried out in accordance to the procedure below and Figure 2.6-3-5.

1st. Click [File] in the main of the StreamXpress.
2nd. Click [Open] in the sub-menu that appears after the 1st.
3rd. Choose the location [TestStream] on desktop.
4th. Choose the file “Teststream_forOnesegDatacasting”.
5th. Click the frequency information and input “474.000” and press enter.
When Frequency is 578MHz, input “578.000” and press enter.
When Frequency is 690MHz, input “690.000” and press enter.
6th. Choose the “8MHz” in the Modulation Parameters. And press enter.
7th. Click “Parameters”.
8th. Check and choose Modulation configuration, Layer A is QPSK and Layer B is 16QAM in the sub-menu that appears after 7th.
After that, Click X mark of the sub-menu window upper right.
9th. Click [Setting] in the main menu the StreamXpress
10th. Click [RF Output Control] in the sub-menu that appears after ⑨.
11th. Set the output level to -30.
12th. Click the play button. Test signal is transmitted.
To stop the test signal, click on the pause/stop button.

No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	
5th.		6th.	

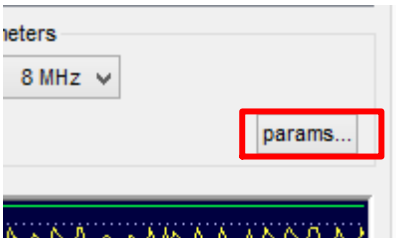
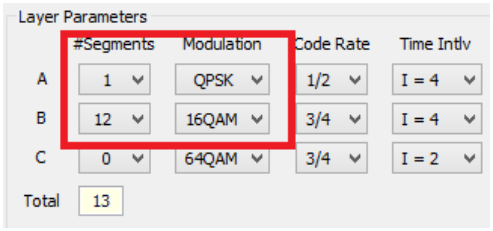
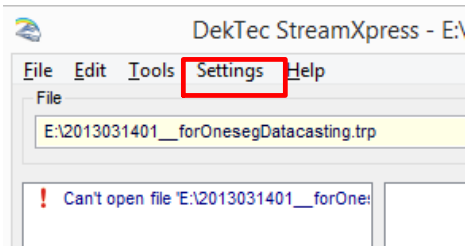
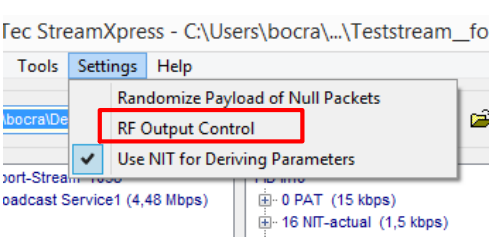
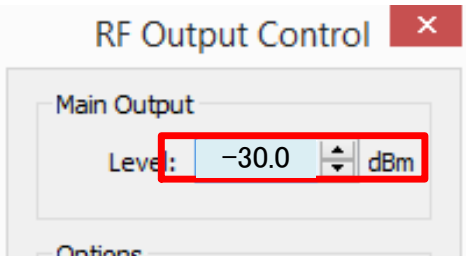
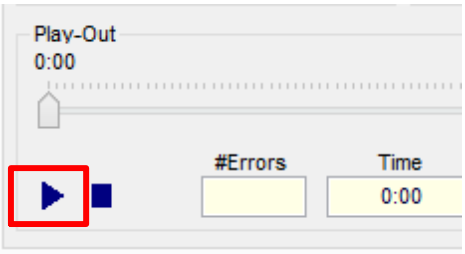
No	Procedure	No	Procedure
7th.		8th.	
9th.		10th	
11th.		12th.	

Figure 2.6-3-5: Test signal configuration procedure for DPMR.

⑥ Threshold of the test signal

Quality of test signal can be determined by measuring the MER and receiving level of the test signal.

Threshold values are as shown in Table 2.6-3-3.

When changing the frequency of the test signal, Threshold shall remain the same as shown in Table 2.6-3-3.

Table 2.6-3-3: Test signal threshold value

No	Modulator output		Threshold value	
	Channel(Frequency)	Output level	MER (Total)	Receiving level
1	21CH (474MHz)	-30 dBm	More than 15dB	-78.4 dBm±2dBm
2	34CH (578MHz)			
3	48CH (690MHz)			

⑦ Measurement of the test signal

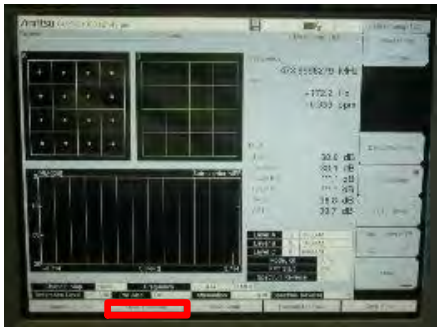
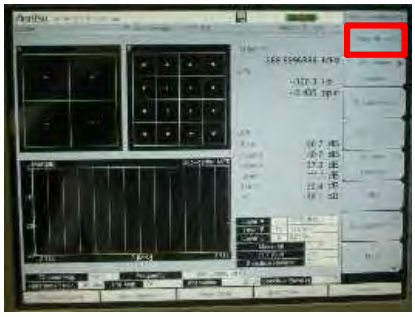
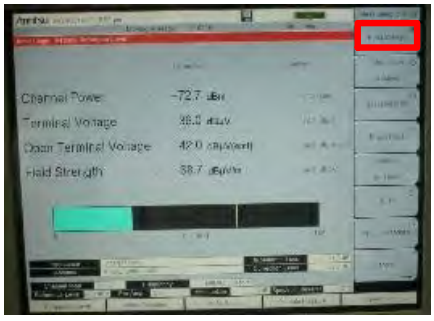
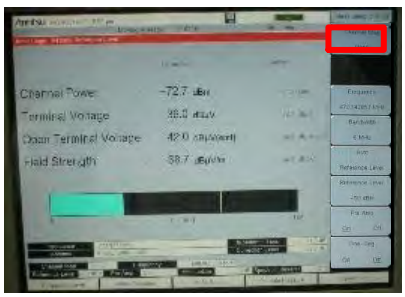
The distance between the Tx-Antenna and the receiving antenna should be more than

1.5m. And ensure there are no obstacles between them.

The receiving level measurement is carried out in accordance to the procedure below and Figure 2.6-3-6.

1st. Push [Meas Selection].
2nd. Push [Field strength].
3rd. Push [Frequency/Level].
4th. Push [Channel Map].
5th. A few seconds later, the Select Channel Map menu is displayed in the centre of the screen. Choose [None].
6th. Push [Frequency]
7th. A few seconds later, the Frequency Editor window is displayed in the centre of the screen. Input the frequency.
8th. Push [Bandwidth]
9th. A few seconds later, the Bandwidth Editor menu is displayed in the centre of the screen. Choose [8MHz].
10th. Push [Auto Reference]
11th. A few seconds later, you will get the measurement result.
Check and record the Field strength value.

When you do not get the result greater than or equal to the threshold, adjust the modulator output. And check receiving level again.

No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	

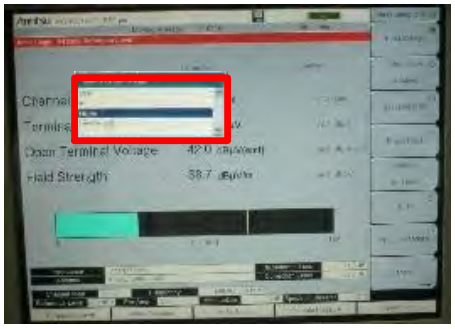
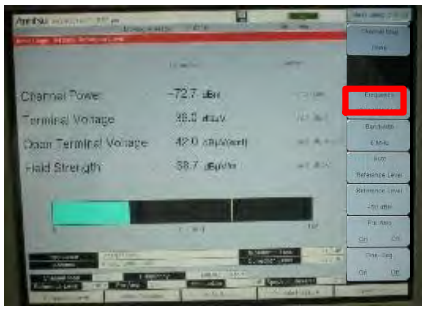
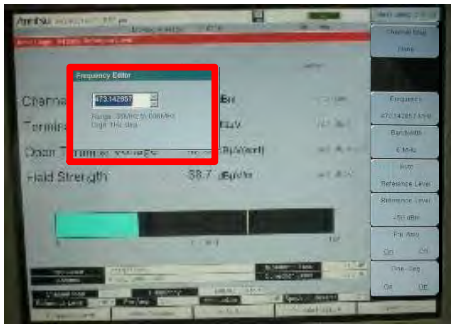
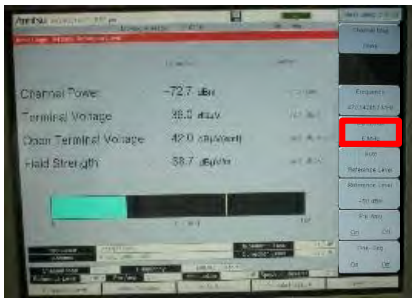
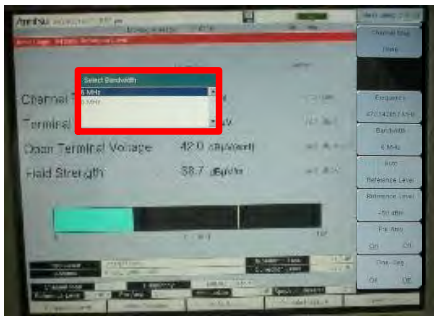
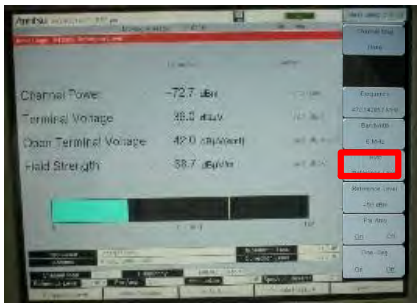
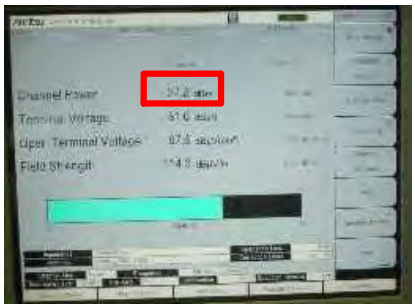
No	Procedure	No	Procedure
5th.		6th.	
7th.		8th.	
9th.		10th.	
11th.		.	

Figure 2.6-3-6: Measure the receiving level of the test signal

Next go to the Measurement of the MER.

The Measurement of MER is carried out in accordance to the procedure below and Figure 2.6-3-7.

1st. Push [Meas Selection].

2nd. Push [Modulation Analysis]

3rd. Check and record the total MER value.

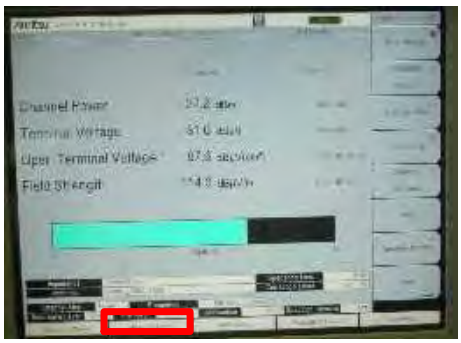
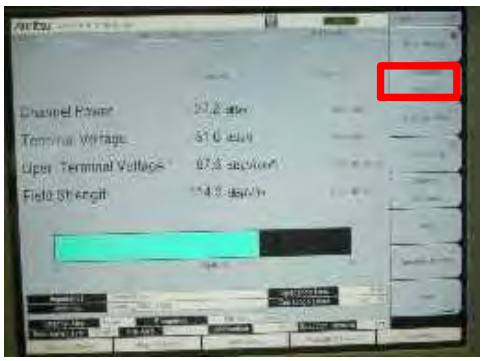
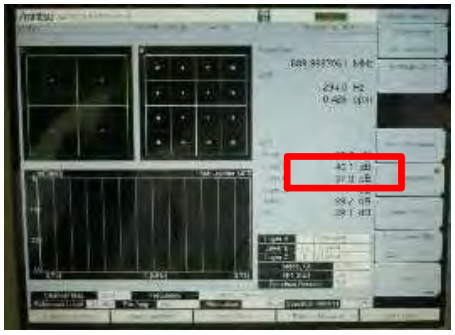
No	Procedure	No	Procedure
1st.		2nd.	
3rd.			

Figure 2.6-3-7: Measure the MER of the test signal

After measurement of output level and MER, change to the next channel and go back to the Measurement of the test signal procedure 6th (Omit 8th and 9th).
Measure the test signal again.

⑧ Preparation finish
If the measurement result satisfies the threshold, preparation is complete.

⑨ Abnormal occurrence
If the measurement result does not satisfy the threshold, check measurement equipment with reference to chapter 2.6-2.

2.7 Technical assurance check

2.7-1 Overview of the Technical assurance check

① The contents of the Technical assurance check
The technical assurance check is divided into; basic function check, electrical function check and Data broadcasting receiving function check.
The basic function check does not need to use the measurement equipment.
The electrical function check requires the measurement equipment.

The Data broadcasting receiving function check requires the measurement equipment.

② The number of engineers.
For fairness secure and error prevention, the technical assurance check is preferable to be carried out by two or more engineers.

③ Preparation of Sample
Warmup the sample device for more than30 minutes to stabilize its operation

2.8 Technical assurance check IDTV

2.8-1 Procedure (IDTV)

The technical assurance check is done in this order; basic function, check the electrical function and then lastly check the data broadcasting receiving function check.
Operation of IDTV is done with reference to the attached manual.

2.8-2 Basic function check (IDTV)

Test items are as shown Table 2.8-2-1.

Table 2.8-2-1: Basic function check test items

No	Item	Specification /Description/functionality	Test Source	Result
1	On/Off button	Switches the IDTV power on or off.	-	Available Not available
2	Languages	English is the official language. IDTV Operational Manual should be in English. Setswana is optional.	-	English and Setswana Only English No manual
3	Remote Control Unit (hereinafter: RCU)	Commands and execute the full IDTV functions.	-	Full function (CH Vol PS EPG and Data) limited (CH Vol PS) function NO RCU
4	RCU BATT type	Using AA or AAA batteries.	-	AA

No	Item	Specification /Description/functionality	Test Source	Result
		(check batt size)		AAA Not compliant
5	Channels	The IDTV software must recognize and store up to 100 programs selectable at random per user's requirements.	-	Available Not available
6	Warranty	The IDTV shall carry a minimum of 12 months (1 Year) warranty	-	Written in the manual Not written in the manual
7	Operations Manual	Clear and easy to understand with basic trouble shooting and pictorial illustrations.	-	Available Not available NO manual
8	Power plugs	BS 1363, 4573, 546-3pin	-	compliant Not compliant
9	Serial Interface	RS 232 or USB Or any port for upgrades	-	available Not available

The basic function check is carried out in accordance to the procedure below.

① Power Turn on/off
Repeat the power turning on and turning off 5times.
If all five times was successful, IDTV comply with the specification.
If at least one attempt out of 5 attempts of power on/off is not successful, IDTV does not comply with the specification.

② Languages
To check which language(s) is being used in the manual
Either
1) English and Setswana
2) Only English
3) Other languages
4) No manual

③ RCU Function
Check the RCU functions.
RCU can control;
1) Channels,

2) Volume level,
3) EPG,
4) Power on/off
5) Data broadcasting

If RCU can perform all the above listed functions then it has Full Functionality
RCU comply with the specification.)

Limited Function is when- RCU can control channels, volume level and power turning on/off (RCU comply with the part of the specification.)
If NO RCU, Record NO RCU.

④ RCU Battery
To check the type of battery that is supplied with RCU.
Records are AA, AAA or other type of battery.

⑤ Number of channel
Select the channel from 1 to 100, to verify the operation of the IDTV.
If all channel could operate, IDTV comply with the specification.
If any channel failed, IDTV does not comply with the specification.

⑥ Warranty
To verify the contents of the warranty that has been described in the manual.
It is specified for the warranty of one year (12 months) after purchase. Written in the manual
There is no description of any warranty. Not written in the manual

⑦ Manual
The contents of the manual are easy to understand, and, to check whether there is a simple troubleshooting content that has been graphically.
Verify result then be in 3 ways.
It is easy to understand and there is a simple troubleshooting content that has been graphically. It is Available.
It is difficult to understand and there is a difficult troubleshooting content or no troubleshooting. It is Not Available.
If No manual was. There is NO Manual.

⑧ Electric power connector
To check the standard of the power terminal that is being used.
Example of power terminals are as shown in Figure 2.8-2-1

BS 1363, 4573, 546-3pin, when one of this connectors is being used. IDTV comply with the specification.
If other standards are adopted, IDTV does not comply with the specification.

BS1363

BS4573

BS 546 – 3pin

Figure 2.8-2-1: Example of power terminal

⑨ Interface
To verify the connection terminal that to use upgrade the OS of the IDTV.
Example of connection terminals are as shown in Figure 2.8-2-2.

RS232C, USB, or any other port that can be used for update, IDTV comply with the specification.
If No port, IDTV does not comply with the specification.

RS232C

USB

Etc. (Ethernet)

Figure 2.8-2-2: Example of connection terminal

2.8-3 Electrical function check (IDTV)

Test items are as shown in Table 2.8-3-1.

Table 2.8-3-1: The electrical function check test item list

No	Item	Specification /Description/functionality	Test Source	Result
1	Auto Search	The unit will perform an automatic search for	Broadcasting wave or	Available Not

No	Item	Specification /Description/functionality	Test Source	Result
		channels. (Manual search optional)	Modulator output	available
2	On Screen Display	Presents the channel program Number or Program guide on the screen.	Broadcasting wave or Modulator output	-
3	Electronic Programme Guide (EPG)	Lists the schedules, displays them on screen once operated.	Broadcasting wave or Modulator output	Available Not available
4	Signal strength and Quality level	Indicates signal strength and quality level (Reception).	Broadcasting wave or Modulator output	Available Not available
5	Modulation	In compliance with the GE06 Channeling Plan of Rec. ITU-R BT.1306 System C or ITU-R BT.1877 64 and 16 QAM and OPSK	Modulator output	Available all Available in parts Not Available
6	Frequency	UHF (470-690MHz), and VHF (174-230MHz) Optional	Modulator output	UHF and VHF Only UHF
7	Input signal	0 dBm to -78.4dBm	Modulator output	

Procedure of electrical function check is as shown in Figure 2.8-3-1.

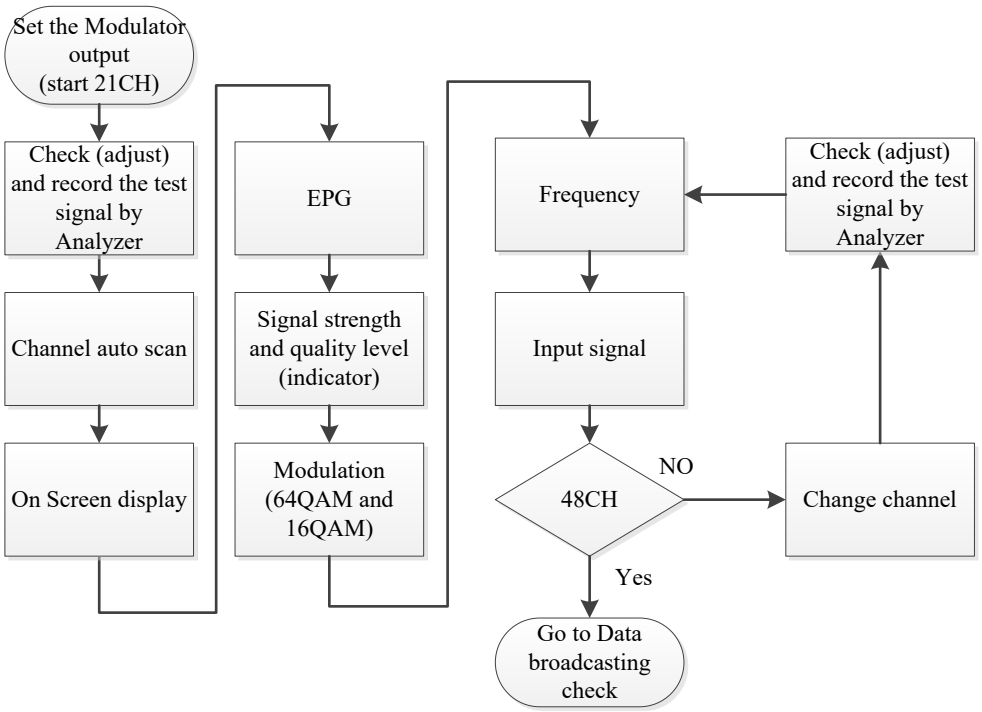


Figure 2.8-3-1: Procedure of electrical function check (IDTV)

Configuration of the test signal is as shown in Table 2.9-3-2.

Table 2.8-3-2: Configuration of the test signal

No	Item	Configuration	Remarks
1	TS source	Teststream_forFullsegDatacasting	-
2	Modulator output	-78.4dBm	-
3	Modulation	16QAM 64QAM QPSK	-
4	Channel	21~48	-
5	Frequency	474.000~690.000MHz	-

The electrical function check is carried out in accordance to the procedure below.

① Channel auto scan

Input the broadcasting wave or the Modulator output signal (channel 21) to IDTV, Carry out a channel auto scan.

When it is successful, IDTV complies with the specification.

When channel auto scan is not successful, IDTV does not comply with the specification.

When there No automatic scan function, IDTV does not comply with the specifications

Take a photo of the check result (progress bar).

② On Screen display

Input the broadcasting wave or the modulator output (channel 21) to IDTV, Check display of the Channel number or program information.

When channel number or program information is displayed, IDTV comply with the specification.

When channel number or program information is not displayed, IDTV does not comply with the specification.

Take a photo of the check result (one channel).

③ EPG

Input the broadcasting wave or the modulator output (channel 21) to IDTV,

Display the EPG.

When EPG is displayed, IDTV comply with the specification.

When no EPG is displayed, IDTV does not comply with the specification.

And Take a photo of the check result.

If there is no EPG service, this check can be omitted.

④ Signal strength and Quality level (Indicator)

Input the broadcasting wave or the modulator output (channel 21) to IDTV, Check the signal strength and quality level.

Check result then be 2 ways.

When signal strength and quality level is available, IDTV comply with the specification.

When signal strength and quality level are not successful or when there is No function, IDTV does not comply with the specification.

Take a photo of the check result.

⑤ Modulation

Input the Modulator output signal set to 64QAM 16QAM and QPSK signal (channel 21) to IDTV.

To check the IDTV receive function.

When IDTV can receive all modulation, IDTV comply with the specification.

When IDTV cannot receive at least one modulation, IDTV does not comply with the specification.

And comments

⑥ Frequency

Input the Modulator output signal to IDTV, starting from Channel 21 up to channel

48 (470MHz to 690MHz).
To check the IDTV receive function.
When the IDTV receives all channels, it complies with the specification.
If it cannot receive at least one channel, it does not comply with the specification.

⑦ Input signal
Input the Modulator output signals to IDTV, starting from each channel from Channel 21 up to channel 48. 21th channel to 48th channel (470MHz to 690MHz)
Observe the IDTV for one minute, to check the image quality.
No block noise and no black out, IDTV comply with the specification.
If there is block noise or black out, IDTV does not comply with the specification.
Take a photo of the check result.

When you finish the Input signal check, change the channel then go back to ⑤ Frequency check and start again.
When finished with the last channel (48ch), go to the Data Broadcasting check.

2.8-4 Data Broadcasting Check (IDTV)

① Overview of Data Broadcasting Check
Data broadcasting receiving function is not defined in the technical standards.
However, it is preferable that IDTV is equipped with a data broadcasting receiving function.
The result of the data broadcasting check does not affect the type approval.
Check items are as shown in Table 2.8-4-1

Table 2.8-4-1: Data broadcasting receiving function and check items

No	Function that must be provided in the data broadcast receiving.	Check items in Test Centre							
		Start Data Broadcasting	SD Overlay	SD Splash	Update information at SD Top	Playing Sound	Control window size in SD	Control window size in HD	Finish to show Broadcasting
1	Display SD and HD Data broadcasting	○	○	○	○	—	○	○	—
2	Control display and not display	○	○	○	○	—	○	○	○
3	Display each mono media (Text Graphic Animation and Sound)	—	○	○	○	○	—	—	—
4	Display Overlay and Small size.	—	—	—	—	—	○	○	—
5	Force display or Time controlled display	—	—	○	—	—	—	—	—
6	Moving the Focus or Shift the window.	○	—	○	—	—	—	—	○
7	Update an information	—	—	—	○	—	—	—	—

The meaning of the ○ mark in the table means that the test items can check the function that must be provided in the data broadcasting reception.

The meaning of the — mark in the table means that the test items cannot check the function that must be provided in the data broadcasting reception.

② Test signal configuration

Test signal configuration is as shown in Table 2.8-4-2

Table 2.8-4-2: Data broadcasting test signal configuration.

No	Test data file name	Modulation	Output channel (Frequency)	Output level
1		16QAM	21CH（Fc 474MHz）	-78.4 dBm ± 2dB
2			Any channel	

③ Start-up and Display of Data Broadcasting

Start-up and Display of Data Broadcasting is carried out in accordance to the procedure below and Figure 2.8-4.1.

1st. Push the Data button on RCU

2nd. Check to go SD overlay IDTV

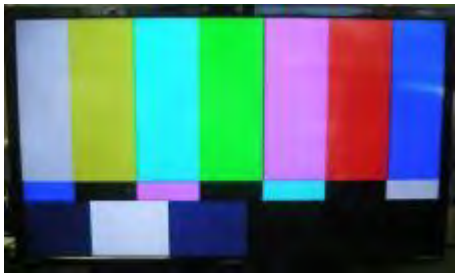
No	Procedure	No	Procedure
1st.	 Before push Data button	2nd.	 Result

Figure 2.8-4-1: Start and Display of Data Broadcasting

④ Check SD Overlay

Checking of the SD Overlay is carried out in accordance to the procedure below and Figure 2.8-4-2.

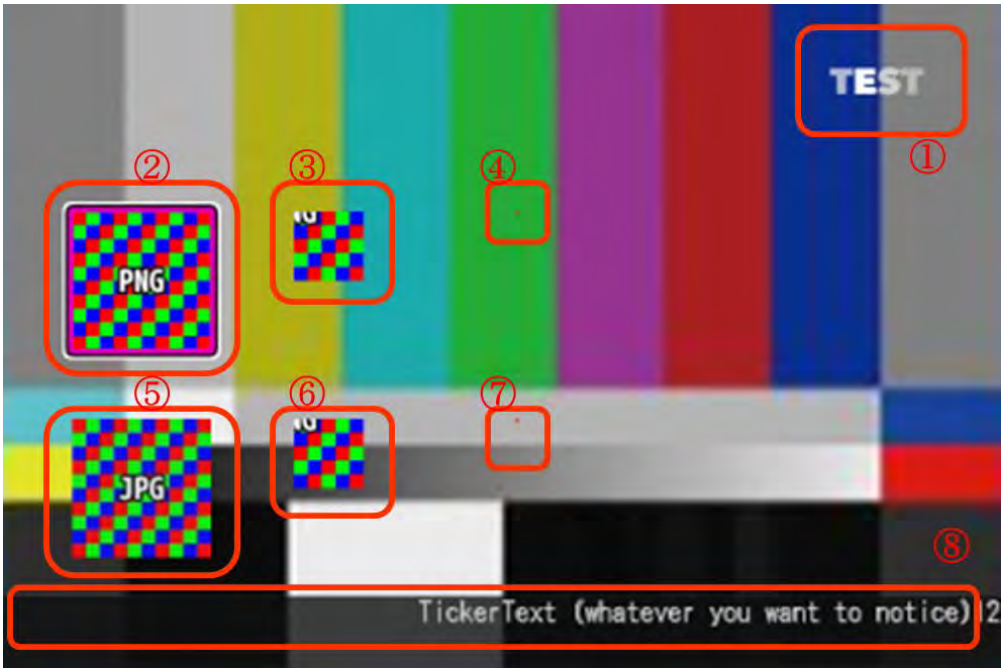


Figure 2.8-4-2: Checking the SD Overlay

1st. Check if "TEST" logo is displayed (Animation).
2nd. Check if full size PNG is displayed or not.
3rd. Check if 1/4 clipped PNG is displayed or not.
4th. Check if 4x4pixel clipped PNG is displayed or not.
5th. Check if full size JPG is displayed or not.
6th. Check if 1/4 clipped JPG is displayed or not.
7th. Check if 4x4pixel clipped PNG is displayed or not.
8th. Check if ticker text is displayed and moved from right to left

⑤ Checking of the SD splash

Checking of the SD splash is carried out in accordance to the procedure below and Figure 2.8-4-3.

1st. Push "OK" button on RCU.
2nd. Check "SD Splash" on the screen.
3rd. Check SD Splash go to SD top automatically after 5 seconds.
4th. Check SD Top. No 3rd. is a good example. No 4th. is a bad example.

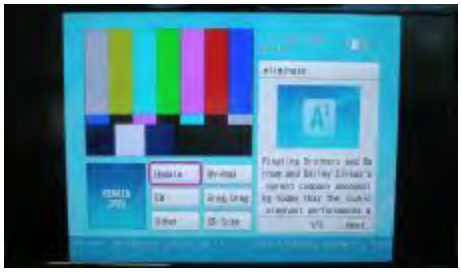
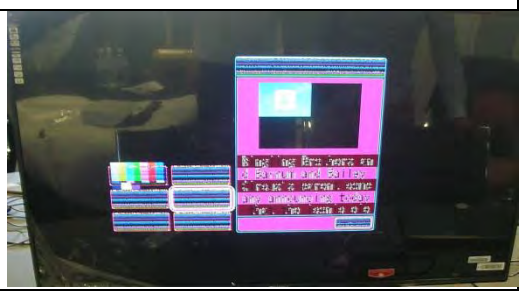
No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	

Figure 2.8-4-3: Go to SD top from SD Splash

⑥ Update information

Checking of the Update information is carried out in accordance to the procedure below and Figure 2.8-4-4 below .

1st. Observe the ARTICLE-A, Check if it changes to Article-B automatically.
2nd. Observe the ARTICLE-B, Check if it changes to Article-A automatically.

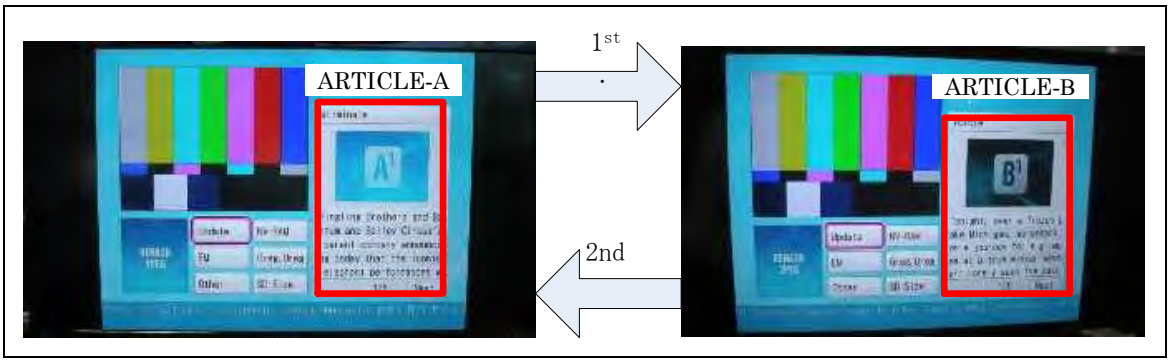


Figure 2.8-4-4: Update information

⑦ Check Sound

Checking of the sound function is carried out in accordance to the procedure below and Figure 2.8-4-5.

1st. Select and push “Other” in the SD Top menu.
2nd. Select and push “Music” in the other menu.
3rd. Select and push “AIFF Play” in the other menu. And check the sound.
4th. Select and push “AAC 32KHz (monaural) Play” in the other menu. And check

the sound.

5th. Select and push “AAC 32KHz (stereo) Play” in the other menu. And check the sound.

6th. Select and push “AAC 48KHz (monaural) Play” in the other menu. And check the sound.

7th. Select and push “AAC 48KHz (stereo) Play” in the other menu. And check the sound.

8th. Select and push “TOP” in the other menu. Go back to Top menu.

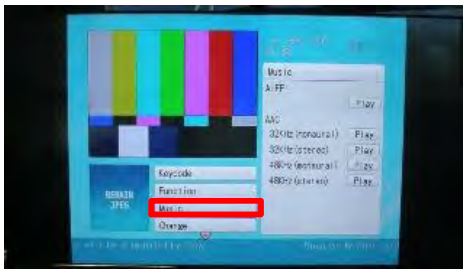
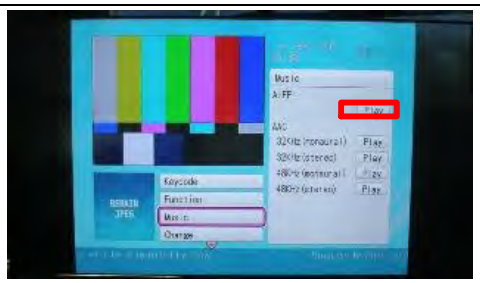
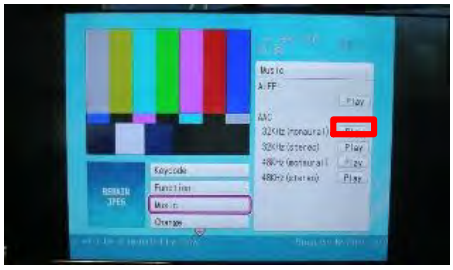
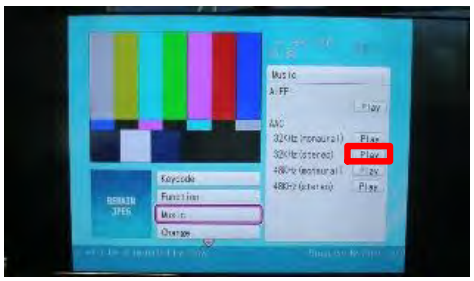
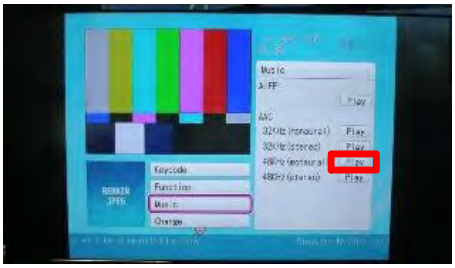
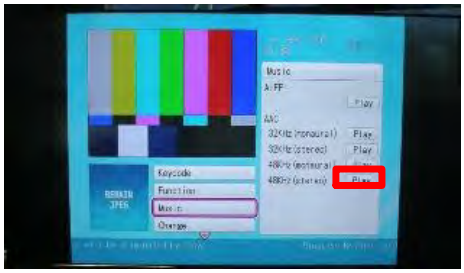
No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	
5th.		6th.	
7th.		8th.	

Figure 2-8-4-5: Checking the sound function.

⑧ Control SD display size

Checking of the Control SD display size is carried out in accordance to the procedure below and Figure 2-8-4-6.

1st. Select and push “SD SIZE” in the SD Top menu.
2nd. Check SD SIZE on the screen.
3rd. Push “Green button” and SD Size will increase. Try it 7 times; SD size will increase 7 times.
4th. Push “Red button” and SD Size will reduce. Try it 7 times; SD size will be reduced 7 times.

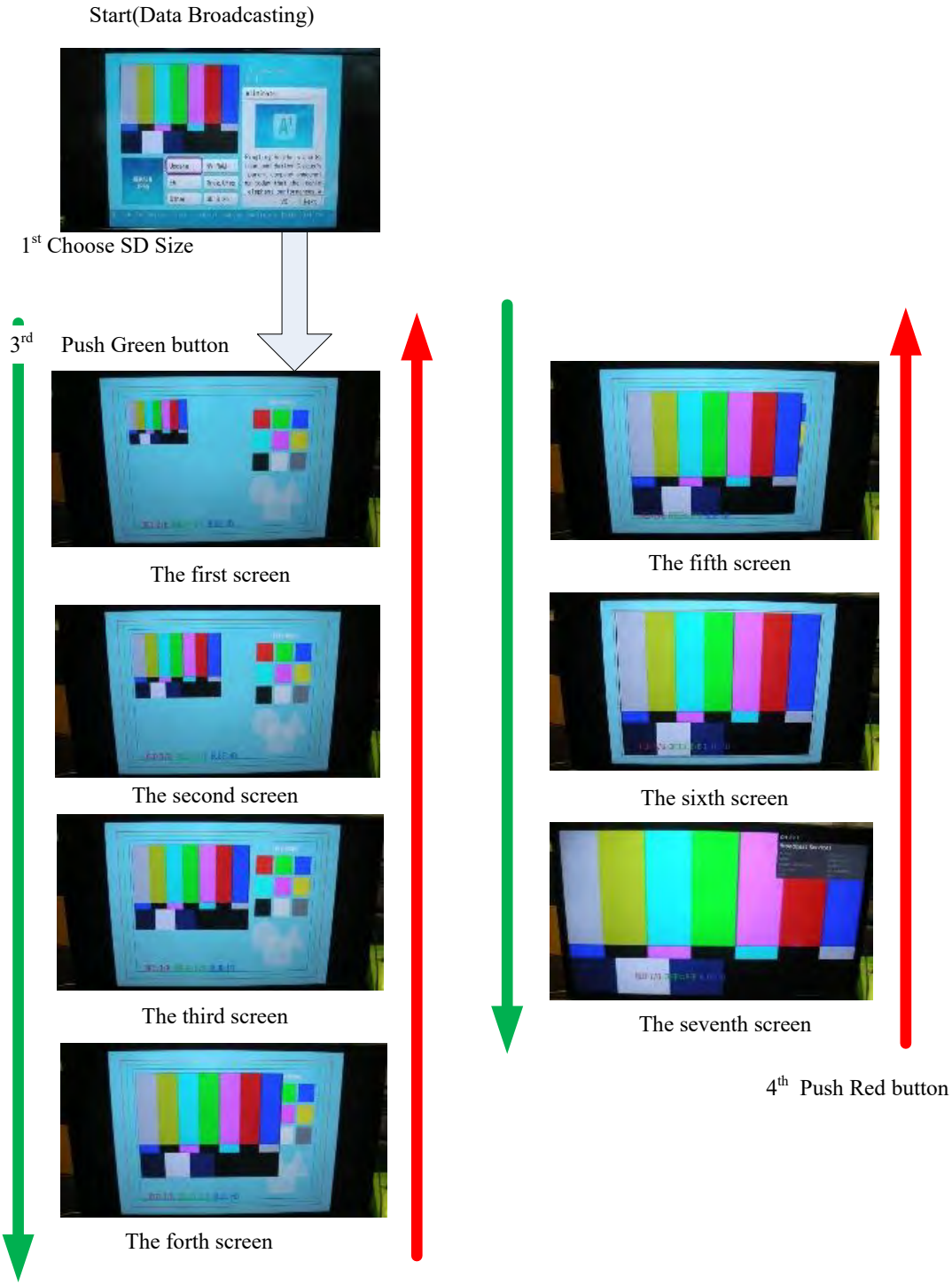


Figure 2.8-4-6: Control SD display size

⑨ Control HD display size

Check the Control HD display size is carried out in accordance to the procedure below and Figure 2.8-4-7.

1st. Push “Blue button” on the RCU.
2nd. Observe SD SIZE moving to HD SIZE.
3rd. Push “Green button” and HD Size will increase. Try it 9 times; HD size will increase 9 times.
4th. Push “Red button” and HD Size will reduce. Try it 9 times; HD size will be reduced 9 times.

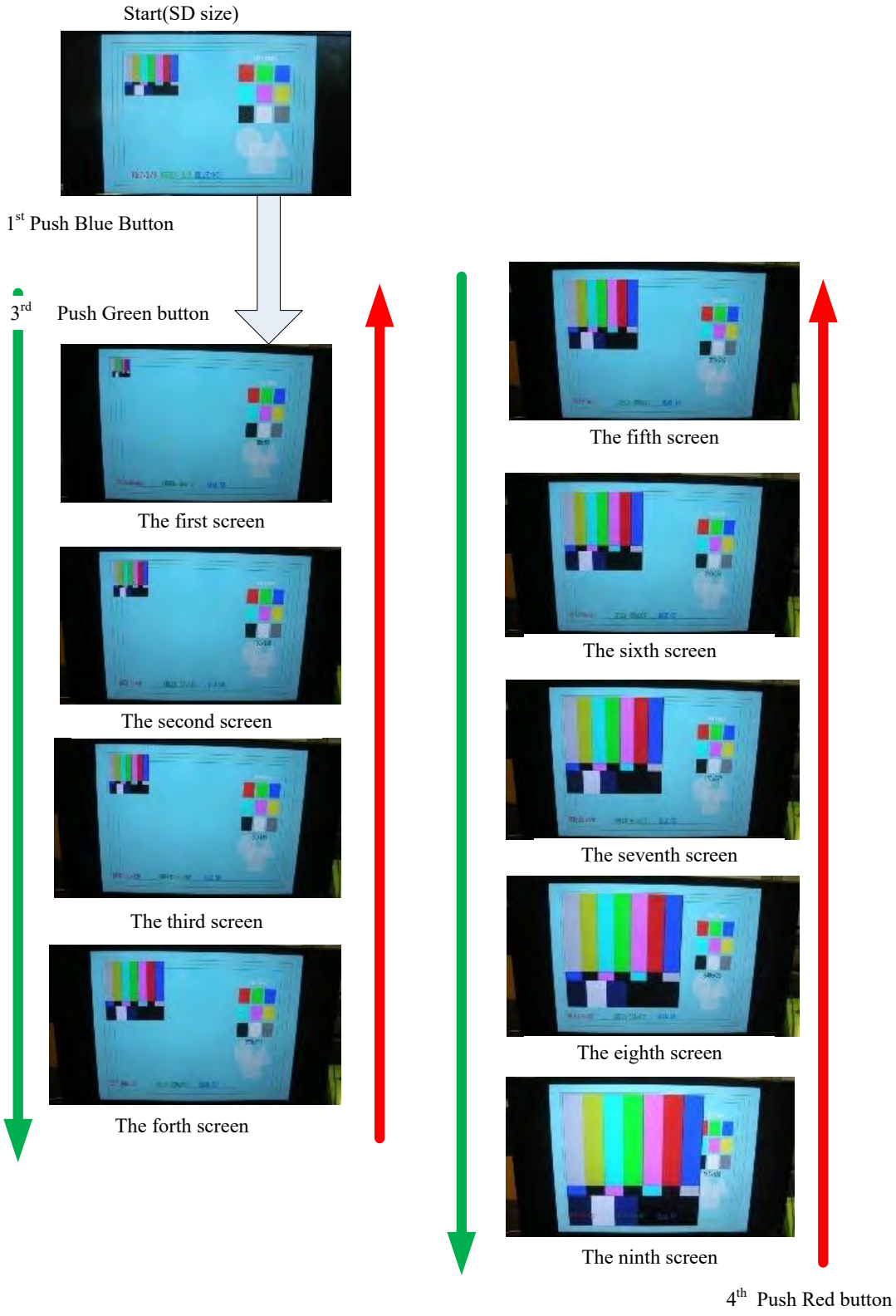


Figure 2.8-4-7: Control HD display size

⑩ Finish Data Broadcasting

To Check the Finishing function of Data Broadcasting follow the procedure below and Figure 2.8-4-8.

1st. Push “Data” on the RCU.
2nd. Close the Data broadcasting menu and go back to normal screen.

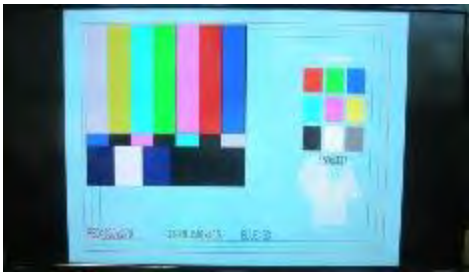
No	Procedure	No	Procedure
1st.		2nd.	

Figure 2.8-4-8: Finish the Data Broadcasting.

2.9 Technical assurance check STB

2.9-1 Procedure (STB)

The technical assurance check is done in this order; basic function, check the electrical function and then lastly check the data broadcasting receiving function check.
Operation of STB is done with reference to the attached manual.

2.9-2 Basic function check (STB)

Test items are as shown Table 2.9-2-1.

Table 2.9-2-1: Basic function check test items (STB)

No	Item	Specification /Description/functionality	Test Source	Result
1	On/Off button	Switches the STB power on or off.	-	Available Not available
2	Languages	English is the official language; STB Operational Manual should be in English. Setswana is optional.	-	English and Setswana Only English No manual
3	Remote Control IR	Commands and execute the full STB functions.	-	Full function (CH Vol PS EPG and Data) limited (CH Vol PS) function NO RCU

No	Item	Specification /Description/functionality	Test Source	Result
4	Remote Control IR BATT type	Using AA or AAA batteries. (check batt size)	-	AA AAA Not compliant
5	Channels	The STB software must recognize and store up to 100 programs selectable at random per user's requirements.	-	Available Not available
6	Warranty	The STB shall carry a minimum of 12 months (1 Year) warranty	-	Written in the manual Not written in the manual
7	Operations Manual	Clear and easy to understand with basic trouble shooting and pictorial illustrations.	-	Available Not available NO manual
8	Power plugs	BS 1363, 4573, 546-3pin	-	compliant Not compliant
9	Connectors	Rear Panel	-	compliant Not compliant
10	Serial Interface	RS 232 or any port for upgrades	-	available Not available

The basic function check is carried out in accordance to the procedure.

① Power Turn on/off
Repeat the power turning on and turning off 5times.
If all five times was successful, STB comply with the specification.
If at least one attempt out of 5 attempts of power on/off is not successful, STB does not comply with the specification.

② Languages
To check which language(s) is being used in the manual
Either
1) English and Setswana
2) Only English
3) Other languages
4) No manual

③ RCU Function
Check the RCU functions.
RCU can control;

1) Channels,
2) Volume level,
3) EPG,
4) Power on/off
5) Data broadcasting

If RCU can perform all the above listed functions then it has Full Functionality (RCU comply with the specification.).
Limited Function is when- RCU can control channels, volume level and power turning on/off (RCU comply with the part of the specification.)
If NO RCU, Record NO RCU.

④ RCU Battery
To check the type of battery that is supplied with RCU.
Records are AA, AAA or other type of battery.

⑤ Number of channel
Select the channel from 1 to 100, to verify the operation of the STB.
Check result then be 2 ways.
If all channel could operate, STB comply with the specification.
If any channel failed, STB does not comply with the specification.

⑥ Warranty
To verify the contents of the warranty that has been described in the manual.
It is specified for the warranty of one year (12 months) after purchase. Written in the manual
There is no description of any warranty. Not written in the manual

⑦ Manual
The contents of the manual are easy to understand, and, to check whether there is a simple troubleshooting content that has been graphically.

It is easy to understand and there is a simple troubleshooting content that has been graphically. It is Available.
It is difficult to understand and there is a difficult troubleshooting content or no troubleshooting. It is NO Available.
If No manual was. It is NO Manual.

⑧ Electric power connector
To check the standard of the power terminal that is being used.

Example of power terminals are as shown in Figure 2.9-2-1.
BS 1363, 4573, 546-3pin when one of these connectors is being used. STB comply with the specification.
If other standards are adopted, STB does not comply with the specification.

BS1363

BS4573

BS 546 – 3pin

Figure 2.9-2-1: Example of power terminal

⑨ Connectors
Check the Connectors position on the STB.
All connectors are arranged on the backside of STB. It is complying.
If some of the connectors are arranged in a location other than the backside of the STB. It is not complying.
However, USB port does not be included this check item.

⑩ Interface
To verify the connection terminal that to use upgrade the OS of the STB.
Examples of interface ports are as shown in Figure 2.9-2-2
RS232C, USB, or any other port that can be used for update, STB comply with the specification.
If No port, STB does not comply with the specification.

RS232C

USB

Etc. (Ethernet)

Figure 2.9-2-2: Example of connection terminal

2.9-3 Electrical function check (STB)

Test items are as shown in Table 2.9-3-1.

Table 2.9-3-1: The electrical function check item

No	Item	Specification /Description/functionality	Test Source	Result
1	Auto Search	The unit will perform an automatic search.	Broad casting wave or Modulator output.	Available Not available
2	Video Output	PAL I is the video signal for Botswana and most analogue TV sets have PAL I inputs	Broad casting wave or Modulator output.	Available Not available
3	Aspect Ratio	4:3 and 16:9	Broad casting wave or Modulator output.	Available Not available
4	On Screen Display	Presents the channel program Number or Program guide on the screen.	Broad casting wave or Modulator output.	
5	Electronic Programme Guide (EPG)	Lists the schedules, displays them on screen once operated.	Broad casting wave or Modulator output.	Available Not available
6	Signal strength and Quality level	Illuminates when broadcast signal is good and yellow when weak or poor quality (reception)	Broad casting wave or Modulator output.	Available Not available
7	Modulation	In compliance with the GE06 Channeling Plan of Rec. ITU-R BT.1306 (ITU Region 1 Equivalent-Optional) 64 and 16 QAM and OPSK	Modulator output	Available all Available in parts Not Available
8	Frequency	UHF (470-690MHz), and VHF (174-230MHz) Optional	Modulator output	UHF and VHF Only UHF
9	Input signal	0 dBm to -78.4dBm	Modulator output	

Procedure of electrical function check is as shown in Figure 2.9-3-1.

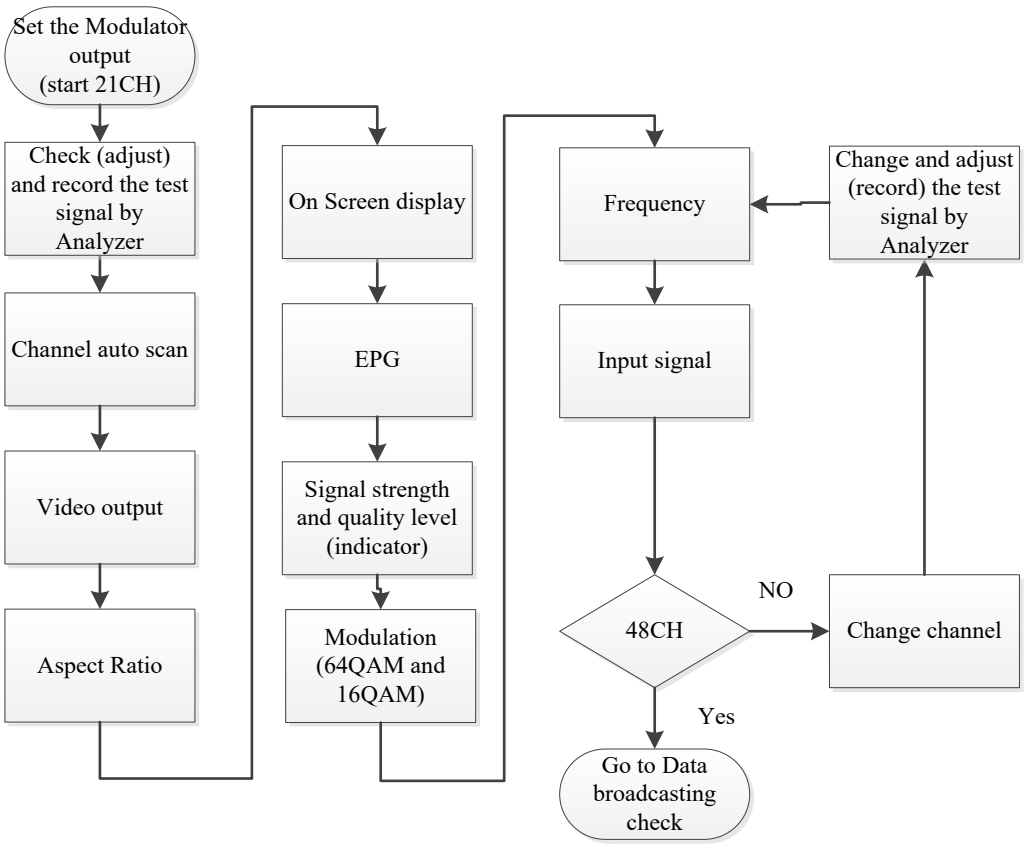


Figure 2.9-3-1: Procedure of electrical function check (STB)

Configuration of the test signal is as shown in Table 2.9-3-2.

Table 2.9-3-2: Configuration of Test Signal

No	Item	Configuration	Remarks
1	TS test data	Teststream_forFullsegDatacasting	
2	Modulator output	-78.4dBm	
3	Modulation	16QAM 64QAM and QPSK	
4	Output channel	21~48	
5	Output frequency	474.000~690.000MHz	

The electrical function check is carried out in accordance to the procedure below.

① Channel auto scan

Input the broadcasting wave or the Modulator output signal (channel 21) to STB, Carry out a channel auto scan.

When it is successful, STB complies with the specification.

When channel auto scan is not successful, STB does not comply with the specification.

When there No automatic scan function, STB does not comply with the specifications
Take a photo of the check result (progress bar).

② Video Output
Input the broadcasting wave or the Modulator output signal (channel 21) to STB.
Observe the Monitor for one minute, to check the image quality.
No block noise and no black out, STB comply with the specification.
If block noise or black out happened, STB does not comply with the specification.
Take a photo of the check result.

③ Aspect Ratio
Input the broadcasting wave or the Modulator output signal (channel 21) to STB.
Change the aspect ratio between 4:3 and 16:9 and check the result.
If4:3 and 16:9, both ratios display correctly. STB complies with the specification.
If 4:3 and 16:9, do not display correctly. STB does not comply with the specification.
Take a photo of the check result.

④ On Screen display
Input the broadcasting wave or the Modulator output signal (channel 21) to STB.
Check display of the Channel number or program information.
When channel number or program information is displayed, STB comply with the specification.
When channel number or program information is not displayed, STB does not comply with the specification.
Take a photo of the check result (one channel).

⑤ EPG

Input the broadcasting wave or the Modulator output signal (channel 21) to STB,
Display the EPG.

When they are displayed, STB comply with the specification.
When they are not displayed, STB does not comply with the specification.
If there is no EPG service, this check can be omitted.
Take a photo of the check result.

⑥ Signal strength and Quality level (Indicator)

Input the broadcasting wave or the Modulator output signal (channel 21) to STB.
Check the signal strength and quality level.
When signal strength and quality level is available, STB comply with the specification.
When signal strength and quality level are not successful or when there is No function, STB does not comply with the specification.
Take a photo of the check result.

⑦ Modulation

Input the Modulator output signal set to 64QAM 16QAM and QPSK signal (channel 21) to STB.
To check the STB receive function.
When the STB can receive all modulation, it complies with the specification.
When it cannot receive at least one modulation, it does not comply with the specification.
And comments.

⑧ Frequency

Input the Modulator output signal to IDTV, starting from Channel 21 up to channel 48 (470MHz to 690MHz).
To check the STB receive function.
When the STB receive all channels, it complies with the specification.
If it cannot receive at least one channel, it does not comply with the specification.

⑨ Input signal

Input the Modulator output signals to IDTV, starting from each channel from Channel 21 up to channel 48. 21th channel to 48th channel (470MHz to 690MHz)
Observe the IDTV for one minute, to check the image quality.
No block noise and no black out, it comply with the specification.
If there is block noise or black out, it does not comply with the specification.

Take a photo of the check result.

When you finish Input signal check, you change a frequency (up to 1 channel), Go back to ⑨ Frequency check and check again.
When you finished last channel (48ch FQ 690MHz), Go to the Data Broadcasting check.

2.9-4 Data Broadcasting Check (STB)

① Overview of Data Broadcasting Check

Data broadcasting receiving function is not defined in the technical standards.
However, it is preferable that STB is equipped with a data broadcasting receiving function.
The result of the data broadcasting check does not affect the type approval.
Check items are as shown in Table 2.9-4-1

Table 2.9-4-1: Data broadcasting receiving function and check items

No	Function that must be provided in the data broadcast receiving.	Check items in Test Centre							
		Start Data Broadcasting	SD Overlay	SD Splash	Update information at SD Top	Playing Sound	Control window size in SD	Control window size in HD	Finish to show Broadcasting
1	Display SD and HD Data broadcasting	○	○	○	○	—	○	○	—
2	Control display and not display	○	○	○	○	—	○	○	○
3	Display each mono media (Text Graphic Animation and Sound)	—	○	○	○	○	—	—	—
4	Display Overlay and Small size.	—	—	—	—	—	○	○	—
5	Force display or Time controlled display	—	—	○	—	—	—	—	—
6	Moving the Focus or Shift the window.	○	—	○	—	—	—	—	○
7	Update an information	—	—	—	○	—	—	—	—

The meaning of the ○ mark in the table means that the test items can check the function that must be provided in the data broadcasting reception.

The meaning of the — mark in the table means that the test items cannot check the function that must be provided in the data broadcasting reception.

② Test signal configuration

Test signal configuration is as shown in Table 2.9-4-2

Table 2.9-4-2: Data broadcasting test signal configuration.

No	Test data file name	Modulation	Output channel (Frequency)	Output level
1		16QAM	21CH（Fc 474MHz）	-78.4 dBm ± 2dB
2			Any channel	

③ Start and Display of Data Broadcasting

Start and Display of Data Broadcasting is carried out in accordance to the procedure below and Figure 2.9-4-1.

1st. Push the Data button on RCU

2nd. Check to go SD overlay IDTV

No	Procedure	No	Procedure
1st.	 Before push Data button	2nd.	 Result

Figure 2.9-4-1: Start and Display of Data Broadcasting

④ Check SD Overlay

Checking of the SD Overlay is carried out in accordance to the procedure below and Figure 2.9-4-2.

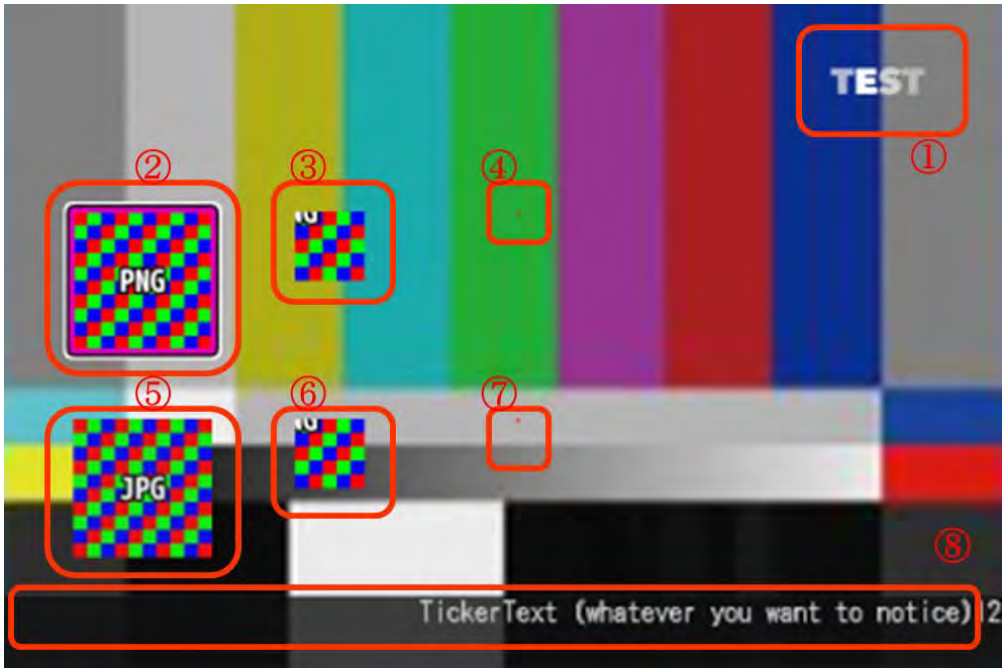


Figure 2.9-4-2: Checking the SD Overlay

1st. Check if "TEST" logo is displayed (Animation).
2nd. Check if full size PNG is displayed or not.
3rd. Check if 1/4 clipped PNG is displayed or not.
4th. Check if 4x4pixel clipped PNG is displayed or not.
5th. Check if full size JPG is displayed or not.
6th. Check if 1/4 clipped JPG is displayed or not.
7th. Check if 4x4pixel clipped PNG is displayed or not.
8th. Check if ticker text is displayed and moved from right to left

⑤ Checking of the SD splash

Checking of the SD splash is carried out in accordance to the procedure below and Figure 2.9-4-3.

1st. Push "OK" button on RCU.
2nd. Check "SD Splash" on the screen.
3rd. Check SD Splash go to SD top automatically after 5 seconds.
4th. Check SD Top. No 3rd. is a good example. No 4th. is a bad example.

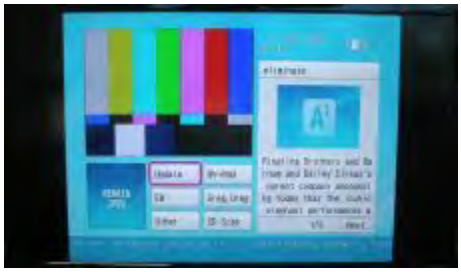
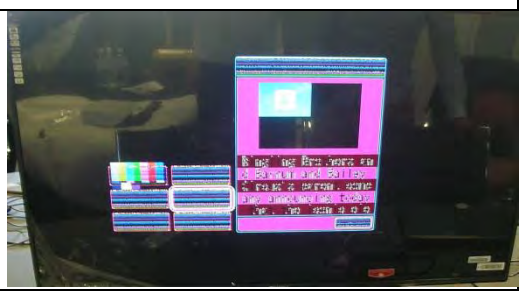
No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	

Figure 2.9-4-3: Go to SD top from SD Splash

⑥ Update information

Checking of the Update information is carried out in accordance to the procedure below and Figure 2.9-4-4 below.

1st. Observe the ARTICLE-A, Check if it changes to Article-B automatically.
2nd. Observe the ARTICLE-B, Check if it changes to Article-A automatically.

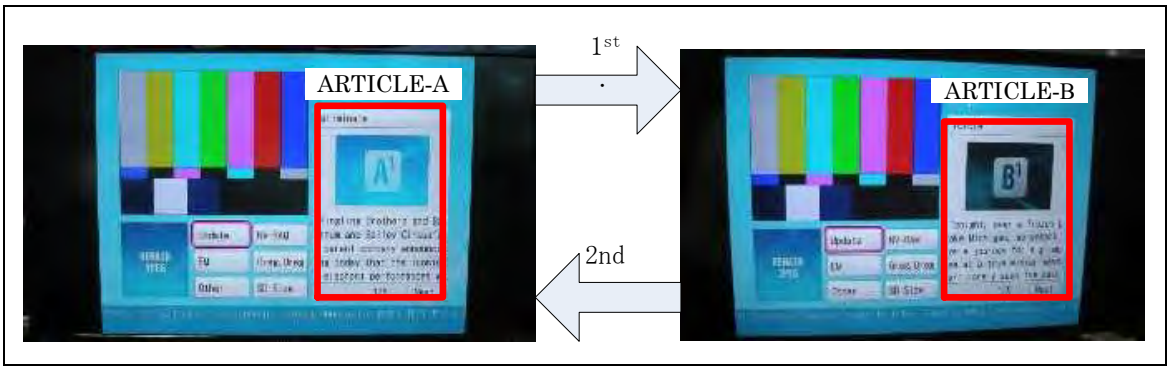


Figure 2.9-4-4: Update information

⑦ Check Sound

Checking of the sound function is carried out in accordance to the procedure below and Figure 2.9-4-5.

1st. Select and push “Other” in the SD Top menu.
2nd. Select and push “Music” in the other menu.
3rd. Select and push “AIFF Play ” in the other menu. And check the sound.
4th. Select and push “AAC 32KHz (monaural) Play” in the other menu. And check the sound.

5th. Select and push “AAC 32KHz (stereo) Play” in the other menu. And check the sound.

6th. Select and push “AAC 48KHz (monaural) Play” in the other menu. And check the sound.

7th. Select and push “AAC 48KHz (stereo) Play” in the other menu. And check the sound.

8th. Select and push “TOP” in the other menu. Go back to Top menu.

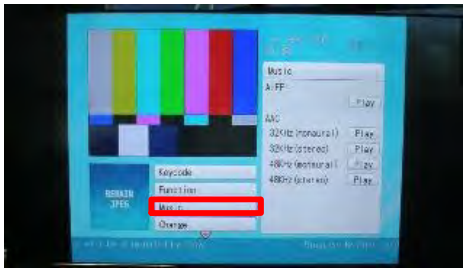
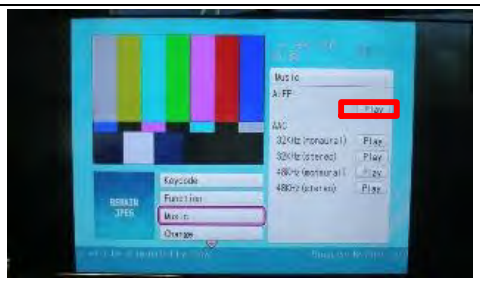
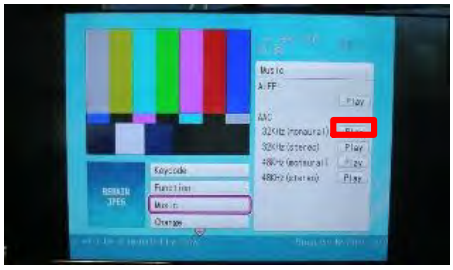
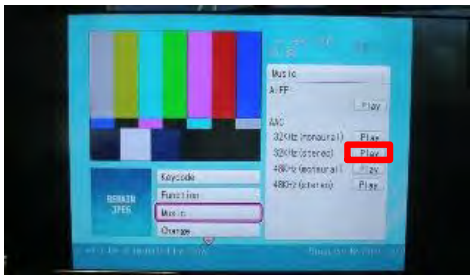
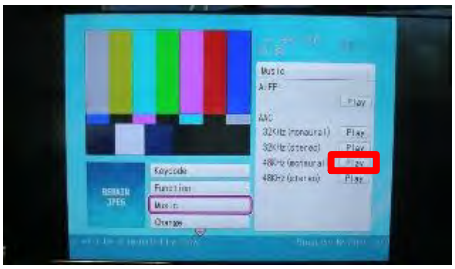
No	Procedure	No	Procedure
1st.		2nd.	
3rd.		4th.	
5th.		6th.	
7th.		8th.	

Figure 2-9-4-5: Checking the sound function

⑧ Control SD display size

Checking of the Control SD display size is carried out in accordance to the procedure below and Figure 2-8-4-6.

1st. Select and push “SD SIZE” in the SD Top menu.
2nd. Check SD SIZE on the screen.
3rd. Push “Green button” and SD Size will increase. Try it 7 times SD size will increase 7 times.
4th. Push “Red button” and SD Size will reduce. Try it 7 times SD size will be reduced 7 times.

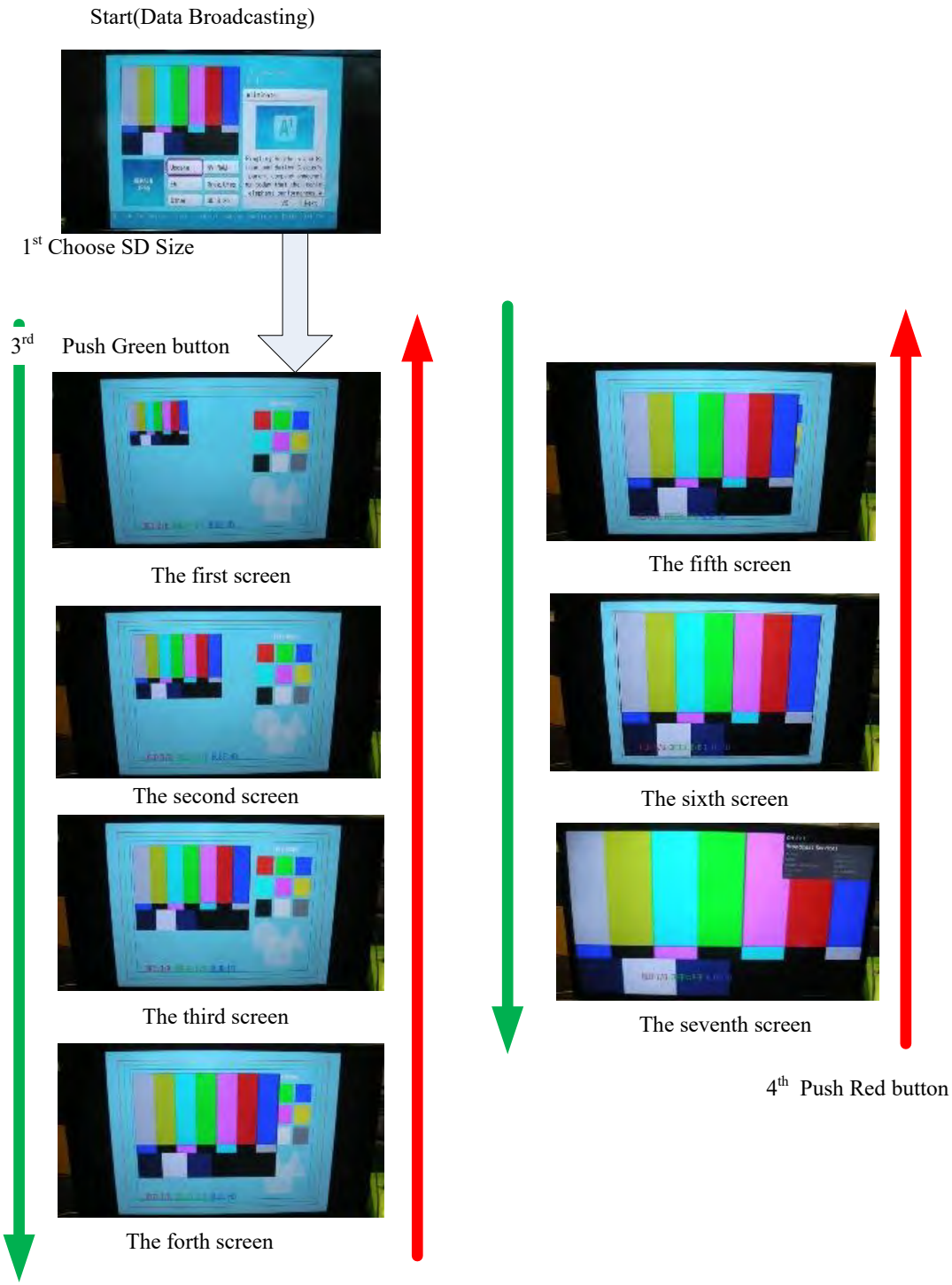


Figure 2.9-4-6: Control SD display size

⑨ Control HD display size

Check the Control HD display size is carried out in accordance to the procedure below and Figure 2.8-4-7.

1st. Push “Blue button” on the RCU.
2nd. Observe SD SIZE moving to HD SIZE.
3rd. Push “Green button” and HD Size will increase. Try it 9 times; HD size will increase 9 times.
4th. Push “Red button” and HD Size will reduce. Try it 9 times; HD size will be reduced 9 times.

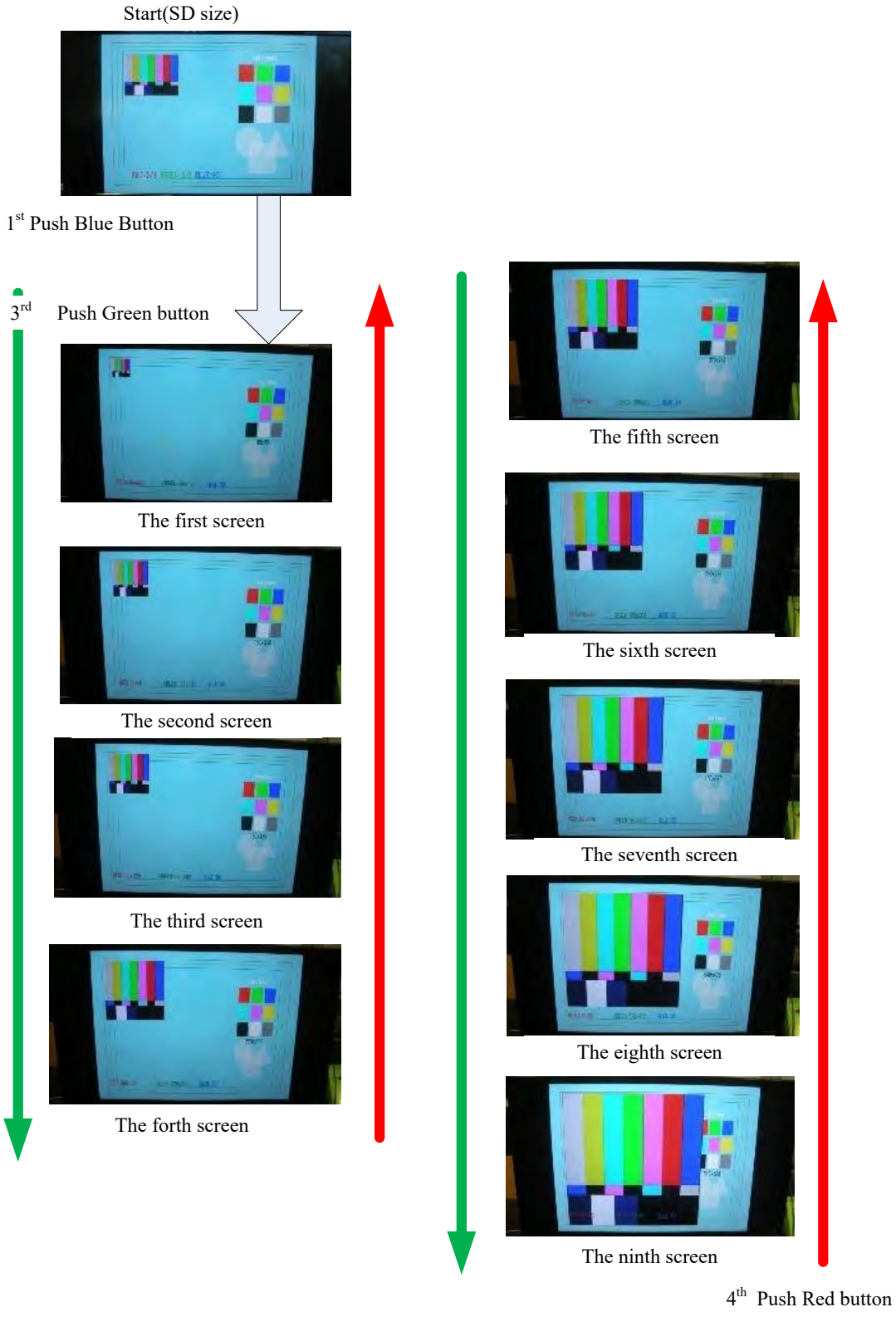


Figure 2.9-4-7: Control HD display size

⑩ Finish Data Broadcasting

Checking of the Finish Data Broadcasting is carried out in accordance to the procedure below and Figure 2.9-4-8.

1st. Push “Data” on the RCU.

2nd. Close the Data broadcasting menu and go back to normal screen.

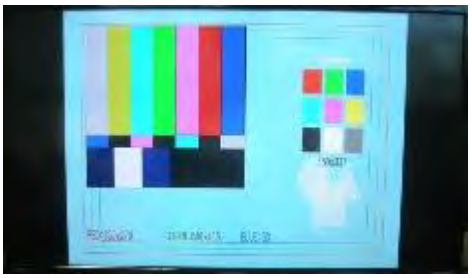
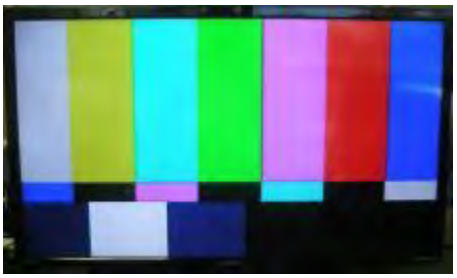
No	Procedure	No	Procedure
1st.		2nd.	

Figure 2.9-4-8: Finish the Data Broadcasting.

2.10 Technical assurance check DPMR

2.10-1 Procedure (DPMR)

The technical assurance check is done in this order; basic function and the electrical function check.

The data broadcasting receiving function check is omitted. Because, the function does not define in the technical standards.

Operation of DPMR is done with reference to the attached manual.

2.10-2 Basic function check (DPMR)

Test items are as shown Table 2.10-2-1

Table 2.10-2-1: Basic function check test items (DPMR)

No	Item	Specification /Description/functionality	Source	Result
1	Languages	DPMR Operational Manual should be in English. Setswana is optional.	-	English and Setswana Only English No manual
2	Warranty	The DPMR should carry a minimum of 1 year (12 months) warranty	-	Written in the manual Not written in the manual

No	Item	Specification /Description/functionality	Source	Result
3	Operations Manual	Clear and easy to understand with basic trouble shooting and pictorial illustrations. Basic manual in package. If a person can check the manual on website only, It result will be Not Available.	-	Available Not available

The basic function check is carried out in accordance to the procedure.

① Languages
To check which language(s) is being used in the manual
Either
1) English and Setswana
2) Only English
3) Other languages
4) No manual

② Warranty
To verify the contents of the warranty that has been described in the manual.
It is specified for the warranty of one year (12 months) after purchase. Written in the manual
There is no description of any warranty. Not written in the manual

③ Manual
The contents of the manual are easy to understand, and, to check whether there is a simple troubleshooting content that has been graphically.
Verify result then be 3 ways.
It is easy to understand and there is a simple troubleshooting content that has been graphically. It is Available.
It is difficult to understand and there is a difficult troubleshooting content or no troubleshooting. It is NO Available.
If No manual was. It is NO Manual.
If the manual is only available on the manufacturer's website, it regarded as "No Manual", therefore does not comply.

2.10-3 Electrical function check (DPMR)

Test items are as shown in Table 2.10-3-1.

Table 2.10-3-1: The electrical function check test items

No	Item	Specification /Description/functionality	Source	Result
1	Auto Search Manual Search (optional)	The unit will perform an automatic search for channels or can be selected manually (optional)	Broadcasting wave or Modulator output	available Not available
2	Modulation	Full seg: Comply with Recommendation ITU-R BT.1306 System C or **I**TU-R BT.1877 One seg: QPSK	Modulator output	Available all Available in parts Not Available
3	Frequency	UHF (470-690MHz), VHF (174-230MHz) Optional	Modulator output	Available Not available
4	Input signal	Full seg: 0 dBm to -78.4 dBm One seg: no specific	Modulator output	Available Not available

Tx-Antenna length must be adjusting for each test signal frequency.
Adjusting the Tx-Antenna length, refer to the Figure 2.6-2-1 and the Table 2.6-2-1.

Procedure of electrical function check is as shown in Figure 2.10-3-1.

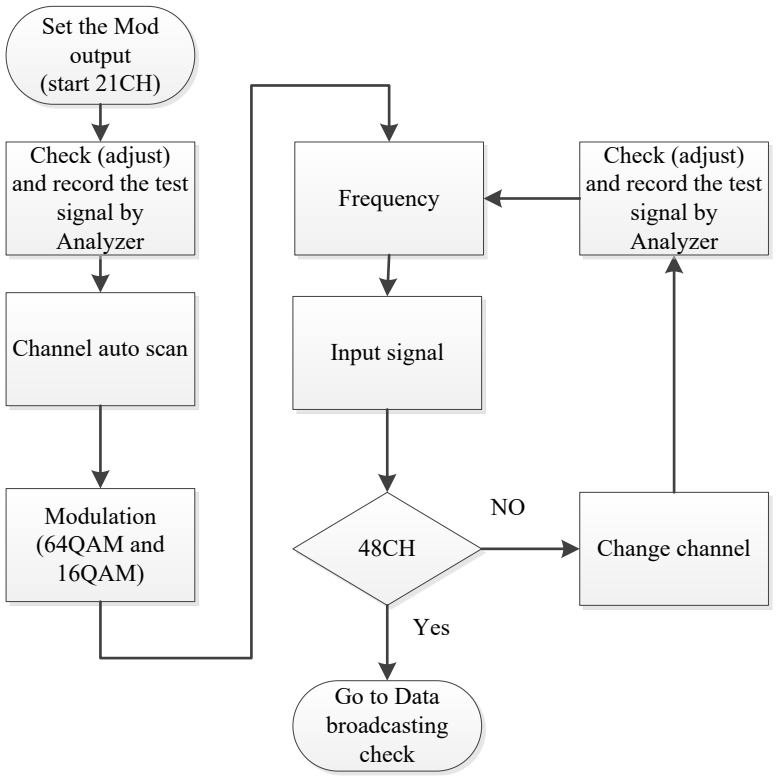
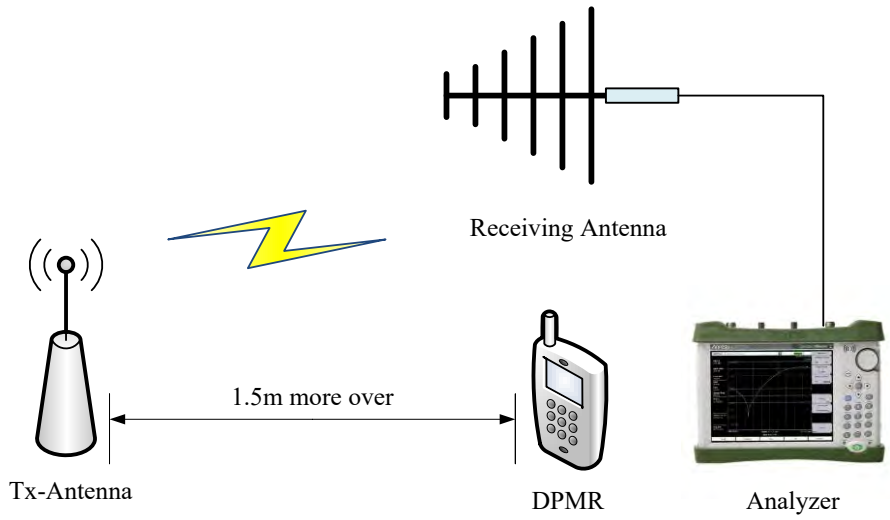


Figure 2.10-3-1: Procedure of electrical function check (DPMR)

Placement of the Tx-Antenna and DPMR is as shown in Figure 2.10-3-2 and Figure 2.10-3-3.



TX-Antenna Receiving Antenna and DPMR set vertically

There are no obstacles between TX-Antenna and other equipment's(Receiving Antenna and DPMR)

Figure 2.10-3-2: Placement of the Tx-Antenna and DPMR

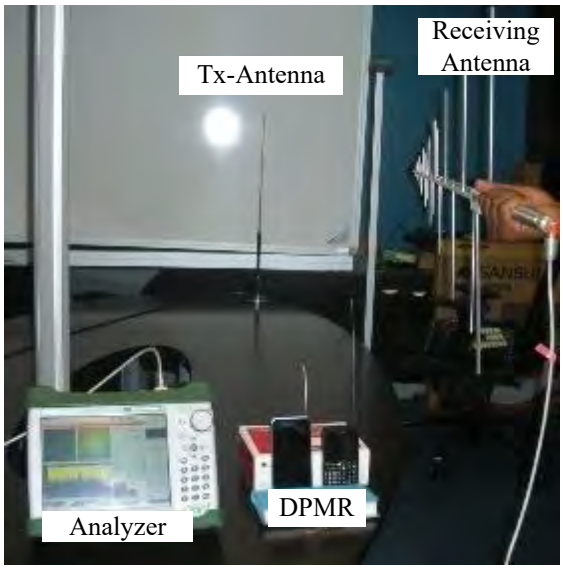


Figure 2.10-3-3: Arrangement Example of the Tx-Antenna, DPMR and Receiving Antenna.

Configuration of the test signal is as shown in Table 2.10-3-2

Table 2.10-3-2: Configuration of the test signal (DPMR)

No	Item	Configuration	Remarks
1	TS source	Teststream_forOnesegDatacasting	
2	Modulator output	-33dBm	
3	Modulation	16QAM 64QAM QPSK	
4	Channel	21~48	
5	Frequency	474.000~690.000MHz	

The electrical function check is carried out in accordance to the procedure below.

① Channel auto scan
Receive the broadcasting wave or the Modulator output signal (channel 21).
Carry out a channel auto scan.
When it is successful, DPMR complies with the specification.
When channel auto scan is not successful, DPMR does not comply with the specification.
When there No automatic scan function, DPMR does not comply with the specifications
Take a photo of the check result.

② Modulation
Receive the Modulator output signal set to 64QAM 16QAM and QPSK signal

(channel 21). .
To check the DPMR receive function.
When the DPMR can receive all modulation, it complies with the specifications.
When it cannot receive at least one modulation, it does not comply with the specifications.
And comments

③ Frequency
Receive the Modulator output signal starting from Channel 21 up to channel 48 (470MHz to 690MHz).
To check the DPMR receive function.
When the DPMR receive all channels, it complies with the specification.
If it cannot receive at least one channel, it does not comply with the specification.

④ Input signal
Receive the Modulator output signal, starting from each channel from Channel 21 up to channel 48. .
Observe the Monitor for one minute, to check the image quality.
No block noise and no black out, it comply with the specification.
If there is block noise or black out, it does not comply with the specification.
When the image quality is poor at the original input level, increased output level to ensure the threshold value of the image quality is improved.
Take a photo of the check result.

When you finish Input signal check, you change a frequency (up to 1 channel), Go back to Frequency check and check them again.
When you finished last channel (48ch FQ 690MHz), Technical assurance check is finish.

2.10-4 Data Broadcasting (DPMR)

Data broadcasting function does not be included the specification. Test Centre does not check this function.

2.11 Examination of the technical assurance checks result.

After the technical assurance check, a person who is not in charge of the technical assurance check (hereinafter: Inspector) carries out an examination of the check result.
In examination, When the Inspector notices an omission, clerical error, forgot any technical assurance check item(s), the inspector should instruct for a redo of the technical assurance check or revision of the technical test results sheet.

When the check result has no problem, Inspector approves it and sends it to BOCRA. Work flow of the examination is as shown in Figure 2.11-1.

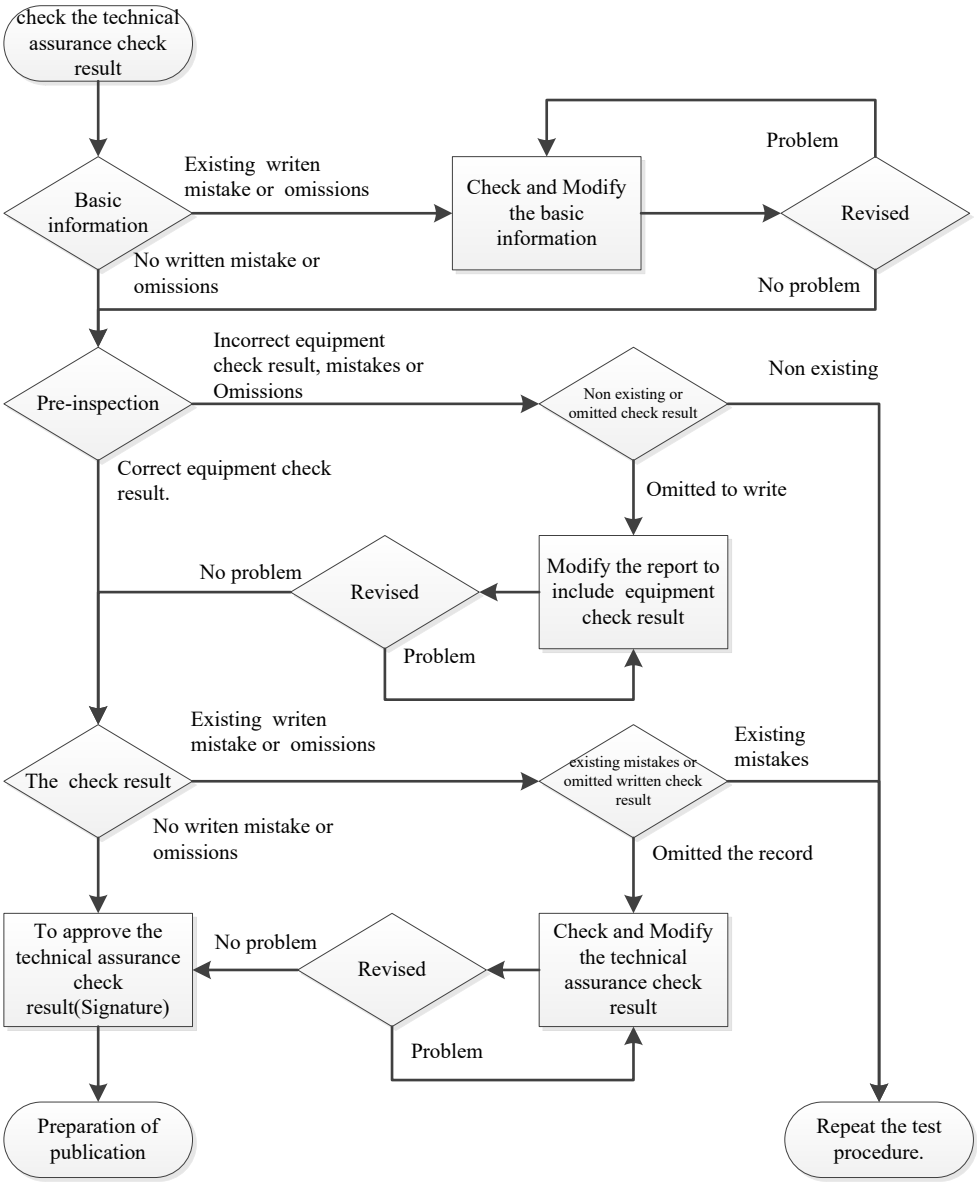


Figure 2.11-1: Work flow of the examination

2.12 Return of the sample

When receiving the instruction of the sample return from BOCRA, Test centre is to return as soon as possible.

Chapter 3 Publication

3.1 Overview of Publication

Publicized Document, Publication period, and Published method are as shown in Table 3.1-1.

Table 3.1-1: Publicized Document, Publication period, and Published method list

No	Document	Publication period	Published method	Remarks
1	Operation manual for Test Centre	As long as the Test Centre is in operation	Published on the BOCRA intranet	Revised of the manual will be done from time to time.
2	Check_result_sheet_IDTV	5 years	Published on the BOCRA intranet	-
3	Check_result_sheet_STB	5 years	Published on the BOCRA intranet	-
4	Check_result_sheet_DPMR	5 years	Published on the BOCRA intranet	-
5	Summary of the check_result _IDTV	5 years	Published on the BOCRA website	-
6	Summary of the check_result _STB	5 years	Published on the BOCRA website	-
7	Summary of the check_result _DPMR	5 years	Published on the BOCRA website	-

3.2 Procedure of Publication

The technical assurance check result shall be publicized immediately after issuance of the type approval certificate.

Method of publishing; Test centre uploads the summary of the technical assurance check result on BOCRA's website.

Chapter 4 Preservation of the document

4.1 Purpose of the preservation of the document

Save the document relating to the test centre in order to ensure the fairness of operation.

4.2 Procedure of document storage

The document is stored in the original or electronic data.

4.3 Preservation of the documents and their retention period

Types and retention period of the document to be saved is as shown in Table 4.3-1.

Table 4.3-1: Documents list and the retention period

No	Document name	Retention period	remarks
1	Operation manual for Test Centre	As long as the Test centre is in operation	Revised of the manual will be done from time to time.
2	Check_result_sheet_IDTV	10 years	
3	Check_result_sheet_STB	10 years	
4	Check_result_sheet_DPMR	10 years	
5	Summary of the check_result__IDTV	5 years	
6	Summary of the check_result _STB	5 years	
7	Summary of the check_result _DPMR	5 years	
8	Certificate of Calibration MS2712E	5 years	
9	Antenna Calibration Certificate	5 years	

4.4 Work after the lapse of the retention period.

Document that has passed the retention period is discarded.

Chapter 5 Document format collection

5.1 Check_result_sheet_IDTV

The Technical assurance check sheet(IDTV)、Ver1.0

Basic Information

Applicant		Serial Number	
Sample device name		Checking date	(day month year)
Product Number			

Engineer 1 (Signature) _____

Engineer 2 (Signature) _____

Measurement Equipment

Modulator output signal（Test signal check）

No	Channel	Centre Frequency (MHz)	Output Level(dBm)	MER(Total)
1	21	474		
14	34	578		
28	48	690		

Output Level：Reference is -78.4dBm±2dB

MER： Reference is more over 30dB

Pre-inspection result Good Bad

Comments

The Technical assurance check result

Basic Function

No	Item	Description/functionality	Result	Comments
1	On/Off button	Switches the IDTV power on or off.	Available Not available	
3	Languages	English is the official language; IDTV Operational Manual should be in English. Setswana is optional.	English and Setswana Only English Other languages No manual	
4	Remote Control Unit	Commands and execute the full IDTV functions.	Full function (CH Vol PS EPG and Data) limited	

No	Item	Description/functionality	Result	Comments
			(CH Vol PS) function NO RCU	
5	Remote Control Unit BATT type	using AA or AAA batteries. (check batt size)	AA AAA Not compliant	
6	Channels	The IDTV software must recognize and store up to 100 programs selectable at random per user's requirements.	Available Not available	
7	Warranty	The IDTV shall carry a minimum of 12 months (1 Year) warranty	Written in the manual Not written in the manual	
8	Operations Manual	Clear and easy to understand with basic trouble shooting and pictorial illustrations.	Available Not available	
9	Power plugs	BS 1363, 4573, 546-3pin	compliant Not compliant	
10	Serial Interface	RS 232 or USB Or any port for upgrades	Available Not available	

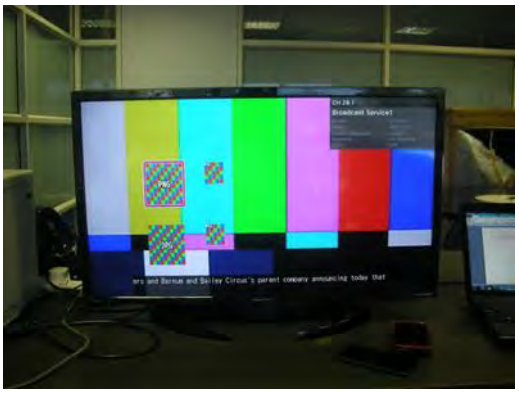
Comments

Electric Function

No	Item	Description/functionality	Result	Comments
1	Auto Search	The unit will perform an automatic search for channels. (Manual search optional)	Available Not available	
2	On Screen Display	Presents the channel program Number or Program guide on the screen.	Available Not available	
3	Electronic Program Guide (EPG)	Lists the schedules, displays them on screen once operated.	Available Not available	
4	Signal strength and Quality	Indicates signal strength and quality level	Available Not available	

No	Item	Description/functionality	Result	Comments
	level	(Reception).		
5	Modulation	In compliance with the GE06 Channeling Plan of Rec. ITU-R BT.1306 System C or ITU-R BT.1877 64 and 16 QAM and OPSK	Available all Available in parts Not Available	

Photo （Sample）

Auto Search	On Screen Display
	
Signal strength and Quality level	Input signal
	

Comments

Electric Function (Frequency and Input signal)

No	Channel	Centre Frequency (MHz)	Modulator output (measurer value)		Frequency	Input signal	Remarks
			Output Level	MER (Total)			
1	21	474			Good	Good	
2	22	482			Bad		
3	23	490					
4	24	498					
5	25	506					
6	26	514					
7	27	522					
8	28	530					
9	29	538					
10	30	546					
11	31	554					
12	32	562					
13	33	570					
14	34	578					
15	35	586					
16	36	594					
17	37	602					
18	38	610					
19	39	618					
20	40	626					
21	41	634					
22	42	642					
23	43	650					
24	44	658					
25	45	666					
26	46	674					
27	47	682					
28	48	690					

Comments

Data Broadcasting Function

No	Large item	Description/functionality	Result	Remarks
1	Start Data Broadcasting	Start Broadcasting	Available Not available	
2	SD Overlay	Test logo animation	Good/ Not Good	
3		Display Full PNG	Display/ Not display	
4		Display 1/4 clipped PNG	Display/ Not display	
5		Display 4x4pixel clipped PNG	Display/ Not display	
6		Display Full JPG	Display/ Not display	
7		Display 1/4 clipped JPG	Display/ Not display	
8		Display 4x4pixel clipped JPG	Display/ Not display	
9		Display Ticker text	Display/ Not display	
10	SD Splash	Display SD splash	Display/ Not display	
11		Go to next window after 5 seconds	Went/ Not got	
12		Display SD Top	Good/ Not display or Graphic is not good	
13	Update information at SD Top	Update an information	Updated/ Not	
14	Playing Sound	Play AIFF sounds	Play/ Not play	
15		Play 32KHz(monaural)	Play/ Not play	
16		Play 32KHz(stereo)	Play/ Not play	
17		Play 48KHz(monaural)	Play/ Not play	
18		Play 48KHz(stereo)	Play/ Not play	
19		Play Go back to SD TOP	GO/ Not go	
20	Control window size in SD	Go to the SD SIZE	GO/ Not go	
21		6 steps expansion the color bar	Work/ Not work	
22		6 steps reduction the	Work/ Not work	

No	Large item	Description/functionality	Result	Remarks
		color bar		
23	Control window size in HD	Go to the HD SIZE	GO/ Not go	
24		6 steps Expansion the color bar	Work/ Not work	
25		6 steps Reduction of the color bar	Work/ Not work	
26	Finish to show Broadcasting	Back to normal	Work/ Not work	

Comments

Confirmation of the checking result

No	Confirmation items	Confirmation result
1	Write mistake and omissions in Basic information	Good / Not good
2	Write mistake and omissions in Measurement Equipment Pre-inspection	Good / Not good
3	Write mistake omissions and forgot check item in the technical assurance check result	Good / Not good

Confirmation date (day month year) _____

Signature of the person responsible_____

Published to date _____

5.2 Check_result_sheet_STB

The Technical assurance check sheet(STB)、Ver1.0

Basic Information

Applicant		Serial Number	
Sample device name		Checking date	(day month year)
Product Number			

Engineer 1 (Signature) _____

Engineer 2 (Signature) _____

Measurement Equipment Pre-inspection

Modulator output signal（Test signal check）

No	Channel	Centre Frequency (MHz)	Output Level(dBm)	MER(Total)
1	21	474		
14	34	578		
28	48	690		

Output Level：Reference is -78.4dBm±2dB

MER : Reference is more over 30dB

Pre-inspection result Good Bad

Comments

The Technical assurance check result

Basic Function

No	Item	Description/functionality	Result	Comments
1	On/Off button	Switches the IDTV power on or off.	Available Not available	
2	Languages	English is the official language; IDTV Operational Manual should be in English. Setswana is optional.	English and Setswana Only English Other languages No manual	
3	Remote Control Unit	Commands and execute the full IDTV functions.	Full function (CH Vol PS EPG and Data) limited (CH Vol PS) function NO RCU	

No	Item	Description/functionality	Result	Comments
4	Remote Control Unit BATT type	using AA or AAA batteries. (check batt size)	AA AAA Not compliant	
5	Channels	The IDTV software must recognize and store up to 100 programs selectable at random per user's requirements.	Available Not available	
6	Warranty	The IDTV shall carry a minimum of 12 months (1 Year) warranty	Written in the manual Not written in the manual	
7	Operations Manual	Clear and easy to understand with basic trouble shooting and pictorial illustrations.	Available Not available	
8	Power plugs	BS 1363, 4573, 546-3pin	compliant Not compliant	
9	Serial Interface	RS 232 or USB Or any port for upgrades	Available Not available	

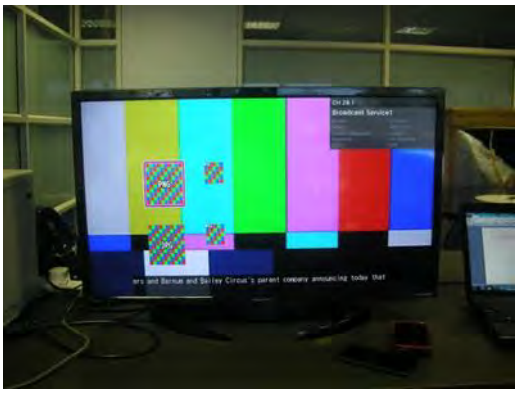
Comments

Electric Function

No	Item	Specification /Description/functionality	Result	Comments
1	Auto Search	The unit will perform an automatic search.	Available Not available	
2	Video Output	PAL I is the video signal for Botswana and most analogue TV sets have PAL I inputs	Available Not available	
3	Aspect Ratio	4:3 and 16:9	Available Not available	
4	On Screen Display	Presents the channel program Number or Program guide on the screen.	Available Not available	
5	Electronic Program Guide (EPG)	Lists the schedules, displays them on screen once operated.	Available Not available	
6	Signal	Illuminates when broadcast	Available	

No	Item	Specification /Description/functionality	Result	Comments
	strength and Quality level	signal is good and yellow when weak or poor quality (reception)	Not available	
7	Modulation	In compliance with the GE06 Channeling Plan of Rec. ITU-R BT.1306 (ITU Region 1 Equivalent-Optional) 64 and 16 QAM and OPSK	Available all Available in parts Not Available	

Photo （Sample）

Auto Search	On Screen Display
	
Signal strength and Quality level	Input signal
	

Comments

Electric Function (Frequency and Input signal)

No	Channel	Centre Frequency (MHz)	Modulator output (measurer value)		Frequency	Input signal	Remarks
			Output Level	MER (Total)			
1	21	474			Good	Good	
2	22	482			Bad		
3	23	490					
4	24	498					
5	25	506					
6	26	514					
7	27	522					
8	28	530					
9	29	538					
10	30	546					
11	31	554					
12	32	562					
13	33	570					
14	34	578					
15	35	586					
16	36	594					
17	37	602					
18	38	610					
19	39	618					
20	40	626					
21	41	634					
22	42	642					
23	43	650					
24	44	658					
25	45	666					
26	46	674					
27	47	682					
28	48	690					

Comments

Data Broadcasting Function

No	Large item	Description/functionality	Result	Comments
1	Start Data Broadcasting	Start Broadcasting	Available Not available	
2	SD Overlay	Test logo animation	Good/ Not Good	
3		Display Full PNG	Display/ Not display	
4		Display 1/4 clipped PNG	Display/ Not display	
5		Display 4x4pixel clipped PNG	Display/ Not display	
6		Display Full JPG	Display/ Not display	
7		Display 1/4 clipped JPG	Display/ Not display	
8		Display 4x4pixel clipped JPG	Display/ Not display	
9		Display Ticker text	Display/ Not display	
10	SD Splash	Display SD splash	Display/ Not display	
11		Go to next window after 5 seconds	Available Not available	
12		Display SD Top	Good/ Not display or Graphic is not good	
13	Update information at SD Top	Update the information	Updated/ Not play	
14	Playing Sound	Play AIFF sounds	Play/ Not play	
15		Play 32KHz(monaural)	Play/ Not play	
16		Play 32KHz(stereo)	Play/ Not play	
17		Play 48KHz(monaural)	Play/ Not play	
18		Play 48KHz(stereo)	Play/ Not play	
19		Play Go back to SD TOP	GO/ Not go	
20	Control window size in SD	Go to the SD SIZE	GO/ Not go	
21		6 steps expansion the color bar	Work/ Not work	
22		6 steps reduction the color bar	Work/ Not work	
23	Control window	Go to the HD SIZE	GO/ Not go	

No	Large item	Description/functionality	Result	Comments
24	size in HD	6 steps Expansion the color bar	Work/ Not work	
25		6 steps Reduction of the color bar	Work/ Not work	
26	Finish to show Broadcasting	Back to normal	Work/ Not work	

Comments

Confirmation of the checking result

No	Confirmation items	Confirmation result
1	Write mistake and omissions in Basic information	Good / Not good
2	Write mistake and omissions in Measurement Equipment Pre-inspection	Good / Not good
3	Write mistake omissions and forgot check item in the technical assurance check result	Good / Not good

Confirmation date (day month year) _____

Signature of the person responsible_____

Published to date _____

5.3 Check_result_sheet_DPMR

The Technical assurance check sheet(DPMR)、Ver1.0

Basic Information

Applicant		Serial Number	
Sample device name		Checking date	(day month year)
Product Number			

Engineer 1 (Signature) _____

Engineer 2 (Signature) _____

Measurement Equipment Pre-inspection

Modulator output signal（Test signal check）

No	Channe l	Centre Frequency (MHz)	Output Level(dBm)	MER(Total)
1	21	474		
2	34	578		
3	48	690		

Output Level：Reference is -78.4dBm±2dB

MER : Reference is more than 15dB

Pre-inspection result Good Bad

Comments

The Technical assurance check result

Basic Function

No	Item	Description/functionality	Result	Comments
1	Languages	English is the official language; DPMR Operational Manual should be in English. Setswana is optional.	English and Setswana Only English Other languages No manual	
2	Warranty	The DPMR shall carry a minimum of 12 months (1 Year) warranty	Written in the manual Not written in the manual	
3	Operations Manual	Clear and easy to understand with basic trouble shooting and pictorial illustrations.	Available Not available	

Comments

Electric Function

No	Item	Specification /Description/functionality	Result	Comments
1	Auto Search	The unit will perform an automatic search.	Available Not available	

Photo

Auto Search	

Comments

Electric Function (Frequency and Input signal)

No	Channel	Centre Frequency (MHz)	Modulator output (measurer value)		Frequency	Input signal	Remarks
			Output Level	MER (Total)			
1	21	474			Good	Good	
2	22	482			Bad		
3	23	490					
4	24	498					
5	25	506					
6	26	514					
7	27	522					
8	28	530					
9	29	538					
10	30	546					
11	31	554					
12	32	562					

No	Channel	Centre Frequency (MHz)	Modulator output (measurer value)		Frequency	Input signal	Remarks
			Output Level	MER (Total)			
13	33	570					
14	34	578					
15	35	586					
16	36	594					
17	37	602					
18	38	610					
19	39	618					
20	40	626					
21	41	634					
22	42	642					
23	43	650					
24	44	658					
25	45	666					
26	46	674					
27	47	682					
28	48	690					

Comments

Confirmation of the checking result

No	Confirmation items	Confirmation result
1	Write mistake and omissions in Basic information	Good / Not good
2	Write mistake and omissions in Measurement Equipment Pre-inspection	Good / Not good
3	Write mistake omissions and forgot check item in the technical assurance check result	Good / Not good

Confirmation date (day month year) _____

Signature of the person responsible_____

Published to date _____

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Supported by Japan International Cooperation Agency (JICA)
Project for Implantation of the Digital Migration Project (DiMT)

Separate Volume -7
Call centre operation manual

Call Centre Manual

July 2016

Department of Broadcasting Services

Ministry of State President

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ABBREVIATIONS

ASO	Analogue Switch Off
BTCL	Botswana Telecommunication Corporation Limited
BTV	Botswana Television
DBS	Department of Broadcasting Services
DPMR	Digital Portable and Mobile Receiver
DSO	Digital Switch Over
DTTB	Digital Terrestrial Television Broadcasting
EWBS	Emergency Warning Broadcasting System
FAQ	Frequently Asked Questions
HDTV	High Definition Television
IDTV	Integrated Digital Television
ISDB-T	Integrated Service Digital Broadcasting - Terrestrial
PCI	Project Implementation Committee
STB	Set Top Box

CHAPTER 1. INTRODUCTION

The general public often has difficulty grasping the concept of Digital Terrestrial Television Broadcasting (DTTB) because it is a new technology. The government may explain to people that the current use of TVs can be continued only if necessary equipment is obtained. Despite such explanation, however, many people still consider that they must purchase a new TV after migration from analogue to digital broadcasting. This problem actually occurred in the countries where digital migration is already completed. People understand DTTB to varying degrees and ask a wide variety of questions about this new technology. It is must for the government to provide support with attention to details when digital migration is chosen as a national policy. Launch of a call centre is an optimal method for providing careful and appropriate answers for individual questions.

Even when the signals are weak, analogue broadcasting can be watched with deteriorated quality. However, digital broadcasting cannot be watched because the screen blocks noise, freezes or blacks out if the signals are weak and/or sufficient signal quality cannot be received. Furthermore, the addition of an Set-Top-Box (STB) to the current analogue TV system is required to watch DTTB. Moreover, the use of an outdoor antenna instead of an indoor antenna or some other measure is required to prevent weak reception. Although this kind of information is being provided to the Botswanan people through the mass media such as TV, radio, and newspapers as well as posters and pamphlets before digital migration, they will end up having insufficient understanding if any unfamiliar terms are used. In Japan, too, a call centre was operated from the start till the completion of digital migration, in order to provide support to viewers with attention to details.

The launch of a call centre is an effective and necessary measure to

gain understanding of people on digital migration.

All in all, the ultimate customer assistance experience right in the comfort of their homes in order to enjoy the digital technology is the most important function of the Digital Migration Call Centre.

CHAPTER 2. CALL CENTRE MISSION AND TASK

2.1 CALL CENTRE MISSION

In order to receive digital broadcasting, there are several items that need to be prepared by the viewer. It is easily understood that not all the viewers can prepare by themselves, particularly in case of those who are not good at dealing with electrical equipment or elder people who are not familiar with the digital device. It is necessary to provide support to these people and respond to their various sorts of questions in a sincere and accurate manner.

ISDB-T that has been adopted by the government of Botswana enables to provide extra services such as data broadcasting and interactive services in addition to the conventional audio and visual contents. Data broadcasting makes it possible to provide information with regard to weather, traffic and other local information while watching the normal television programs. One of the areas where BTV puts effort is on the provision of the government information by data broadcasting. This also enables people living in the rural area to access the public information instantaneously and narrow down the information gap between urban and rural areas.

Through the operation of the call centre, it aims to contribute to the smooth digital migration by providing necessary support to the viewers.

2.2 CALL CENTRE TASK

The task is to make or take telephone calls on behalf of an organization in order to fulfil viewers' requirements. The task can be to provide services and support viewers to carry out a debt management function.

- Telephone correspondence and consultation
  In response to the questions asked by the viewers, the call centre provides information anytime with regard to digital migration, gives advice to be able to watch digital broadcasting, and prevents the viewer from getting confused.

- Recording and creating data base
  The call centre records the conversation, inputs data of the viewer in the excel file and produces database for quick response. The database is used for effective and quick response to the viewer and provides support for the viewer to watch digital broadcasting as early as possible.

- Creation of web page for digital migration
  The call centre provides service in many different ways. Among all the services, the call centre creates and maintains website which provides information with regard to digital broadcasting. The questions raised by the viewer are collected and publicized on the website. The viewer can obtain necessary information anytime as per their need.

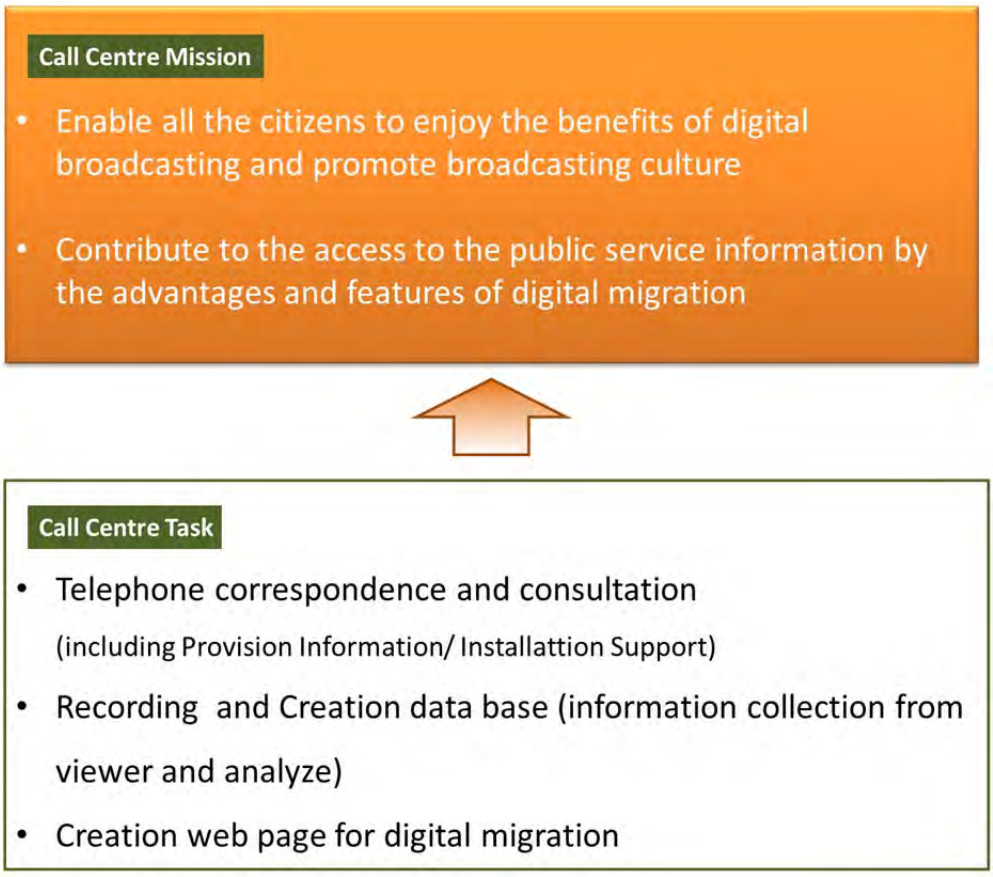

Figure 2-1 Call Centre Mission and Task

CHAPTER 3. MANUAL FOR CORRESPONDENCE

3.1 CALL CENTRE OPERATION STRUCTURE

The staff of the call centre consists of the operators who answer the phone and the engineers who provide answers to the technical questions. The manager is placed above the operator and manages the operators as well as the call centre.

Establishment of call centre shall be carried out under the direction of the Project Implementation Committee (PCI) which conducts DBS and Botswana Telecomunications Corporation Limited (BTCL). It is necessary to form an organisation and start up in a short period of time. In order to develop the environment, the PCI instructs the organisation responsible to prepare the necessary equipment. At the same time, PCI selects an engineer with more than 10 years' of experience to be responsible for the call centre, in accordance with Figure 2-1.

The manager of the call centre should hold a full time position. He/she should not hold a position in other departments as they are responsible to respond to the emergency cases. Under the manager, operators are placed who are obliged to report daily works to the manager whether there is any particular case or not. In addition to those full time positions, engineers should be hired in a part time position with the responsibility to respond to the technical questions from the viewers by providing advice to the operators.

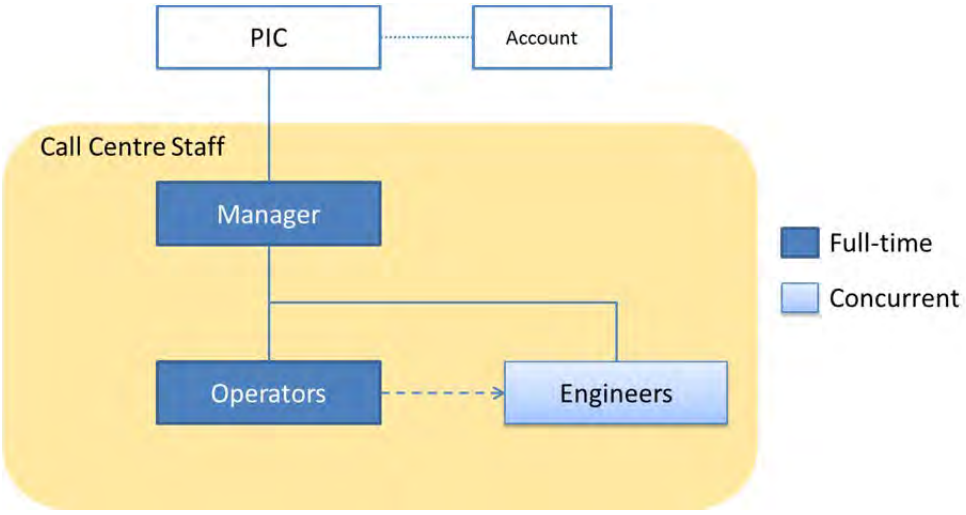

Figure 3-1 Operational Structure

3.2 TELEPHONE CORRESPONDENCE AND CONSULTATION

3.2.1 PREPARATION FOR ANSWERING CALL

One of the points that must be considered in operating the call centre is to understand that the viewers who make a call to the centre have some problems or questions, and the response should be prepared bearing that in mind. For the smooth implementation of digital migration, the cooperation from the viewer is necessary. It is the viewers who purchase and install equipment required to watch digital television. In order to provide accurate information and promote understanding, the following points must be considered:

- Prompt answer

  Most of the viewers who use the call centre expect that they are answered without being kept on hold. In particular, after the digital receiver becomes available in the market, it is assumed that immediate response is required by the viewers who are not able to watch television. It is very important that the call must be answered promptly without keeping the caller waiting.

  When the inquiry is about technical problems or claims, it is difficult

for the operator to provide right answer. In this case, it is recommended that the operator transfer the call through to the right person or decide immediately whether call back is required. The duration of one call should be for less than five minutes, so that service can be provided to as many viewers as possible.

- Think from the caller's position

  Many of the viewers who use the call centre do not have technical background. Therefore, the technical terms should be avoided. If it is necessary to use technical terms, it should be explained by using as simple word as possible. Not all the users of the call centre can explain their questions in a logical manner. In particular, the questions asked by the user, who does not have basic knowledge on the new technology of digital broadcasting, are usually vague. Therefore, it is important to listen carefully, consider from the caller's position and understand that he/she really needs the information.

- Recording

  It is important to record the conversation on the phone. The reason behind is not only to check the answers provided but to improve the quality of the call centre service. The operator is encouraged to keep the record apart from the voice recording.

  <u>Recording for checking the answer provided</u>

  If the answer provided to the user is not clear, it might mislead the user depending on the level of knowledge and result in claims. In order to avoid claims and prepare for the claim, it is necessary to record the conversation.

  <u>Recording for improving the quality of service</u>

  As described above, depending on the level of education, knowledge,

and the environment where the user is placed, there is a possibility that the answer is not correctly understood. If the call centre is regarded as unreliable, the viewer may seldom call and the digital migration information might not be communicated accurately to the viewer. In order to avoid this, it is important to record the conversation and review the service periodically.

- Collect data and use it effectively
  The manager of the call centre should check the answering table that is prepared by the operator on a daily basis. By collecting and analyzing these data, it can be used for the promotion of digital receivers and review of ASO plan. If there are any questions that are asked more frequently than others, it should be referred to DBS or BOCRA and the answer should be examined and shared in the call centre. In addition, the question should be uploaded on the website as FAQ category.

- Periodical meeting once a week
  In order to share information to all, a periodical meeting should be held at least once a week. In the meeting, list up the items and issues to be addressed and examine how to respond on the phone.

Answering phone is different from face to face communication. It is difficult to figure out the actual intension of the viewers such as if they need information about digital migration or are anxious about digital migration, or are making complaints. If it is face to face communication, it is possible to understand the emotion and attitude from their expression and it will be easy to correspond appropriately following each situation. Particular attention should be given to how to phrase things. In answering phone, it is substantial to understand that the viewers are calling because they have questions to be answered. Therefore, the

operator should try to listen to the viewer to understand the true intention of the question.

It is assumed that the viewer might have questions of anxiety or claims. In order not to stimulate the viewer and create an environment where the viewer feels easy to speak, it is important to view situation from his or her perspective and choose the words which they can easily understand. Even in case of the claims, it should be answered sincerely and not being careless or remiss. By understanding exactly what the viewer wants to know and providing appropriate advice, the call centre can greatly contribute to the smooth digital migration.

Though skills and technic of communication will be explained in the next chapter, the basic technic for answering phone is as follows:

Six major points in answering phone:

i Give first priority to the satisfaction of the viewer

In case that the users are not satisfied with the answer provided by the call centre, it is probable that they would not call again even if they have questions. It will thus make smooth digital migration difficult. Hence, it is important to meet the needs of the viewer when answering the phone.

ii Answer in clear and succinct manner; and do not speak fast

It is important to speak clearly as the viewer might mishear or have difficulty in hearing the voice. If the operator speaks fast, the viewer may not be able to hear. In order to prevent misunderstanding, it is recommended that the operator speaks clearly in an appropriate speed.

iii Be a skilled listener

Not all the viewers can explain their problems in a clear manner. It is thus important to listen carefully and understand the exact information they need.

iv Use simple and common words to explain

It is assumed that the viewer varies in age, the level of knowledge, and gender. Therefore, it is important to use the simple and understandable term for everyone.

v Be sincere even to claims from the viewers

Among the viewers, there are some who are not supportive of digital migration. Even to those who are not satisfied with digital migration, it is important to answer in bright and sincere manner and promote an accurate understanding of digital migration.

vi Always bear in mind that the success of smooth digital migration is shouldered by the call centre tasks

The viewer regard call centre as the contact point of digital migration. The manner of the call centre influences the impression of the viewer over digital migration. Thus, it is important that the staff of the call centre recognize that they are the representatives of digital migration and carry out the task properly.

3.2.2 CALL CENTRE OPERATION FLAW

The important points in running the call centre are to correctly understand the question or problem of the viewer and provide accurate information. Providing different answers by different operators must be avoided under any circumstances.

For those general questions such as whether the television needs to be replaced in digital migration or what benefits are there in digital migration, the operators should be trained to answer correctly.

At the beginning of the conversation, it should be informed that the conversation is being recorded in order to improve the quality of service. Next, information regarding the viewer calling should be recorded. The record sheet is maintained in excel sheet. The further details of the recording sheet are described in the next section. Then, the questions are answered. The operators answer the general questions of progress of digital migration, and availability of digital receiver.

In case of questions regarding reception situation such as difficulty to watch digital broadcasting even after the installation of equipment, the questions should be addressed to transmitting engineers or the local branches where the viewer resides.

With regard to the question of how to install digital receivers and data broadcasting, the questions should be addressed to data broadcasting engineers. To the questions about program of BTV, it should be addressed to public relations department of DBS. To the questions regarding claims and involving political issues such as digital migration policy and ASO timing, the operators should not judge them rather address it to the manager.

The example of answering phone is shown below in the table and flow chart.

Table 3-1 Example of Correspondence

	Contents	Action
1	Answer in three calls	-
2	Introduce that you are calling to DBS call centre	-
3	Inform that conversation is recorded in order to improve the quality of the service	-
4	Confirm the name	Recording Sheet
5	Confirm the location where the viewer is calling from	Recording Sheet
6	Confirm the age	Recording Sheet
7	Confirm the questions	Recording Sheet
8-1	To the questions such as the progress of digital migration, availability of digital receivers, necessary equipment to receive digital broadcasting	Answer
8-2	Answer to the questions with regard to poor reception	Confirm whether the receivers are appropriately installed · If it is, the question should be addressed to transmitting engineer · If not, provide guidance to install or address the question to data broadcasting engineer
8-3	Questions regarding the contents and how to use data broadcasting	It should be addressed to data broadcasting engineer
8-4	Questions regarding the contents of BTV	It should be addressed to public relation department of DBS
8-5	Questions regarding political issues such as the viewer does not understand the necessity of digital migration or claims that he/she cannot purchase digital receiver.	It should be addressed to the manager
9	Any questions that are difficult to answer in given time	Confirm the viewer's contact and call back within 3 days.

The call centre will be operated according to the flow chart mentioned below.

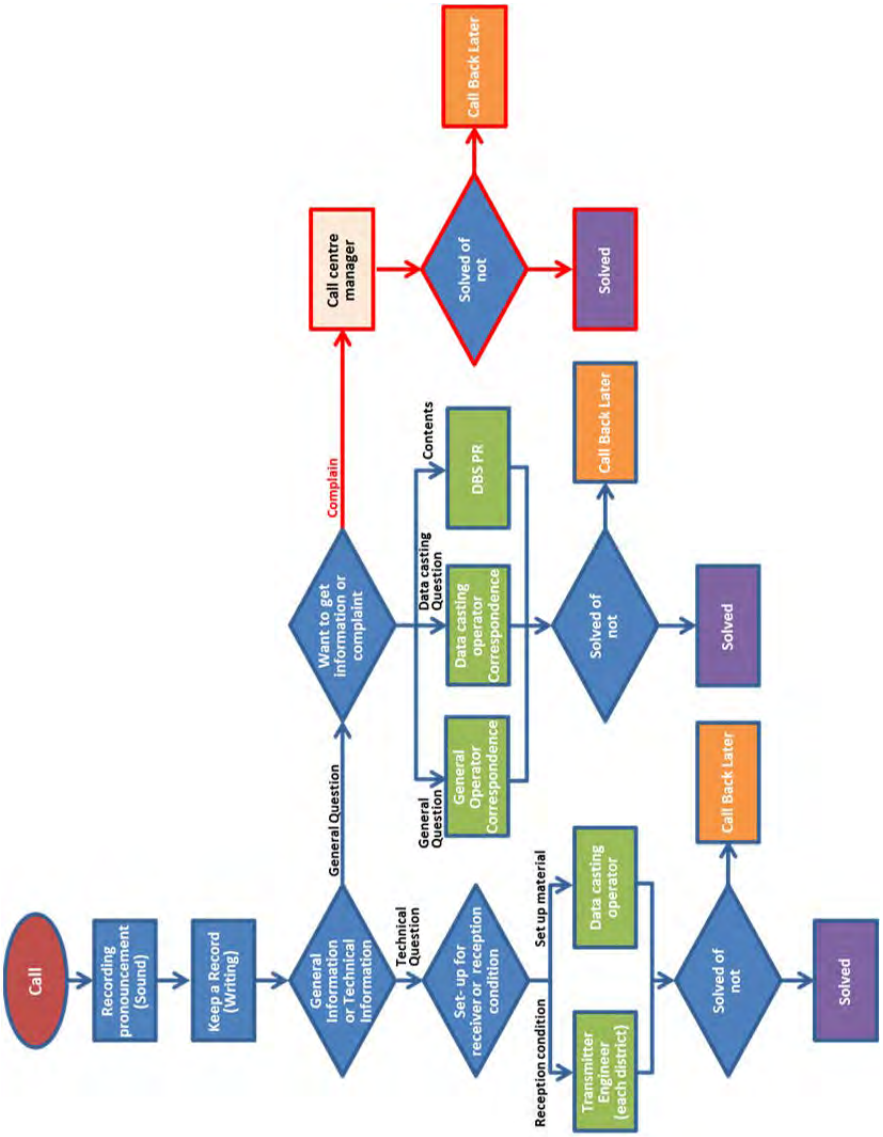

Figure 3-2 Call Centre Flowchart

3.2.3 RECORDING SHEET

Apart from the recording by device, operator should record the information in paper.

Date, time, duration of the conversation, age, gender, location of the viewer should be recorded in the recording sheet. In the remark, any

particular issues and/or claims should be recorded.The information should be shared in the format prepared on excel file and be stored in database. The call centre manager should manage the database and understand daily works. The manager should also maintain record in a daily basis in addition to the recording sheet. The number of questions answered, the number of questions that need to be called back, and the number of claims should be recorded in the daily report.

By keeping the daily responses in database, it is possible to analyze the information that the viewer requires, including the hurdles in promoting digital migration so on and so forth. By doing that, it is possible to be prepared in advance and prepare a basic policy to the hindering factors in promoting smooth digital migration. It is recommended that the person-in-charge should be assigned to the database work since it needs considerable amount of work.

In the recording sheet, the answer should not be recorded. With regard to the answer for the frequently asked questions, the manager of the call centre prepares exemplary answers and updates FAQ section on the website.

The example of the recording sheet is shown below in table 3-2.

Table 3-2 Recording sheet (Correspondence)

Date, Year: 1 September, 2016 Operator: Faith S.

No.	Start	End	Duration	Age	Sex	Residence	Question	Details	Complain
1	10:05	10:10	5 min.	40-49	F	Gaborone	When will we get information about STB?	They did not get any information about STB such as price, place of purchase.	
2	10:35	10:38	3 min.	20-25	F	Francistown	I want to watch more programs	The contents of BTV are not interesting to her.	
3	11:30	11:45	15 min.	50-59	M	Ghanzi	Will the government provide STB?	He cannot understand why he has to buy STB by himself, because it is one of government issues. He doesn't want digital migration.	✓
4	12:50	13:10	20 min.	30-39	M	Nxamasere	After digitalization, can I watch BTV?	It is difficult to watch TV in the area which he lives. The picture isn't clear.	✓
5	15:10	15:20	10 min.	40-49	M	Maun	We should use outdoor antenna, but I cannot set it up.	Before he set up outdoor antenna by himself, which was soon broken. He cannot find any engineer near his house.	

If any incident occurs during the conversation, it is must to report the incident to the manager. The manager who was reported should record the incident in the daily report and manage the incidents. In the incident management, it is possible to find the viewer raising the same questions several times and thus preventive measures should be prepared.

In the daily report, the condition of the telephone line must be reported; and the incoming calls and condition must be controlled to avoid delay in answering the calls. The condition of corresponding of the calls must be recorded as follows. 1) Excellent: When all the calls are answered smoothly. 2) Good: Even though some calls are disconnected or connections are not clear, most of the calls are handled without problems. 3) Poor: When many calls are disconnected, are unclear and operators are unable to deal with the problems of the viewers.

The numbers of the calls must be recorded; 1) 10:00 – 12:00 2) 12:00 – 17:00 3) 17:00 – Closing time

The result of the calls must be recorded by all the operators as: 1) Done 2) Must call back 3) Complain, etc.

An example of the Daily report is shown in table 3-3.

Table 3-3 Daily Report

Date, Year: 1 September, 2016

Name James B.				
Operator Name	AM: Faith S., Thida M., Motti N, Maria P PM: Faith S., Thida M., Motti N, Nancy C. Night : Nancy C., Patrick S., Tommy J., Mikel S.			
Line Condition	AM: [Excellent] Good Poor PM: [Excellent] Good Poor Night: Excellent [Good] Poor			
Number of Call	AM : 15 PM : 17 Night : 13			
Result	Done: 3		Call Back/Continue: 2	
No.	Operator	Correspondence No.	Summary of Accident	Condition
1	aa aa	3	The phone was cut while holding for the answer	Done/[Call back]/Continue
2	bb bb	5	Call back was not done because the contact was unknown	Done/Call back/[Continue]
3	ee ee	2	It is not convincing that STB needs to be purchased by individual in order to watch television after digital migration	[Done]/Call back/Continue
4	aa aa	5	I don't have enough money to purchase STB.	Done/Call back/[Continue]
5	dd dd	4	I would like to know the exact time when digital broadcasting becomes available in my region	[Done]/Call back/Continue
6	gg gg	1	It is not clear when will STB be available in the market	[Done]/Call back/Continue
7	ee ee	4	I cannot get through to you.	[Done]/Call back/Continue
8	hh hh	2	The answer of the operator does not seem appropriate	Done/[Call back]/Continue

3.2.4 COMPLAINT

3.2.4.1 TYPE OF COMPLAINT

Complaints are possibly raised during the call centre operation. The evaluation of the call centre by the viewer depends on how the complains are treated. Complaints can be categorized into three. Treatment of each category is explained as follows:

A) Emotional complaints

The viewer who are not satisfied with digital migration and about the process and progress raises complaints. In such cases, listen carefully and understand the reasons why the viewer is unsatisfied. Even when the complaints do not have any ground, opt to just listen. Once the viewer releases his or her frustration, they will be satisfied.

B) Complaints that need solution

When the complaints are raised against the misconducts of the call centre and for the improvement and concrete measurements, listen carefully and understand the solution which the viewer needs. Also, inform what the call centre can do and cannot do; and give him or her a better understanding of the question.

C) Complaint from Complainer

When the complaints are of unreasonable demand and are not based upon fact, the operator should not answer by oneself, rather transfer the call to the manager.

3.2.4.2 COMPLAIN POINT OF ANSWER

Below are the points for the operators on how to deal with callers who make complaints. It is for the operator's reference to avoid increase in the discontent of the viewer.

- Give back channel and repeat the words of the viewer
  The back channel and repeat of the words gives the impression that the operators are listening to the viewers.

- Answer with an appropriate interval
  If the viewer becomes too emotional, they often cannot calmly listen to the operator. In order to give time to calm down, it might be useful to call back after considering the answer.

- Avoid objection to the viewer
  If the operator objects to the viewer, it even disturbs the emotion of the viewer and increases dissatisfaction. Hence, objection should be prohibited.

- Avoid use of assertive words
  When assertive words are used, it often leads to difficulty in dealing with the viewer later. Thus, the answer should be provided in an unassertive manner

- Do not speak with speculation
  If the operator cannot understand the question or speculates, there might be a case that the operator answers with yes to the question which is not yes. It is important not to answer to the question which the operator does not have an answer for, and call back after they confirm the answer.

If any incident occurs during the conversation, it is must to report the incident to the manager. The manager who was reported should record the incident in the daily report and manage the incidents. In the incident management, it is possible to find the viewer raising the same questions several times and thus preventive measures should be prepared.

3.2.5 WEB PAGE

3.2.5.1 CONTENTS OF WEB PAGE

It is planned to launch a website of the call centre as a part of viewer support. Website is an useful tool that the viewer can access anytime they need information. In addition to that, the website can display videos and images to explain the set-up of the equipment. Therefore, it is in some cases more explanatory than the telephone call where the operator provides verbal explanation.

There is limited number of operators and telephone lines. There is a possibility that enough attention is not given to the viewer at the beginning of establishment of the call centre, right after the digital receivers become available in the market and before analogue switch off (ASO) takes place because of the concentration of inquiries. In this case, website can provide alternative solutions by mentioning typical problems and their answers. It also advertises the call centre itself.

The questions that are brought to the call centre will be publicized on the website as frequently asked questions. The information will be updated once a week according to call centre recording sheet.

The example of the category of information publicized on the website

is shown in Figure 3-3. The category described here covers all the information necessary for digital migration. By publicizing the availability of digital receivers and location where the viewer can purchase those, it is possible to promote the digital receiver. By browsing an appropriate installation method of the receiver purchased, the viewer can smoothly enjoy digital broadcasting. It is also important to periodically publicize necessary information regarding the progress of digital migration.

Furthermore, it should be described on the front page of the website that the call centre service is available free of charge. Also the information about prevention of fraud using the call centre and treatment of private information should be mentioned.

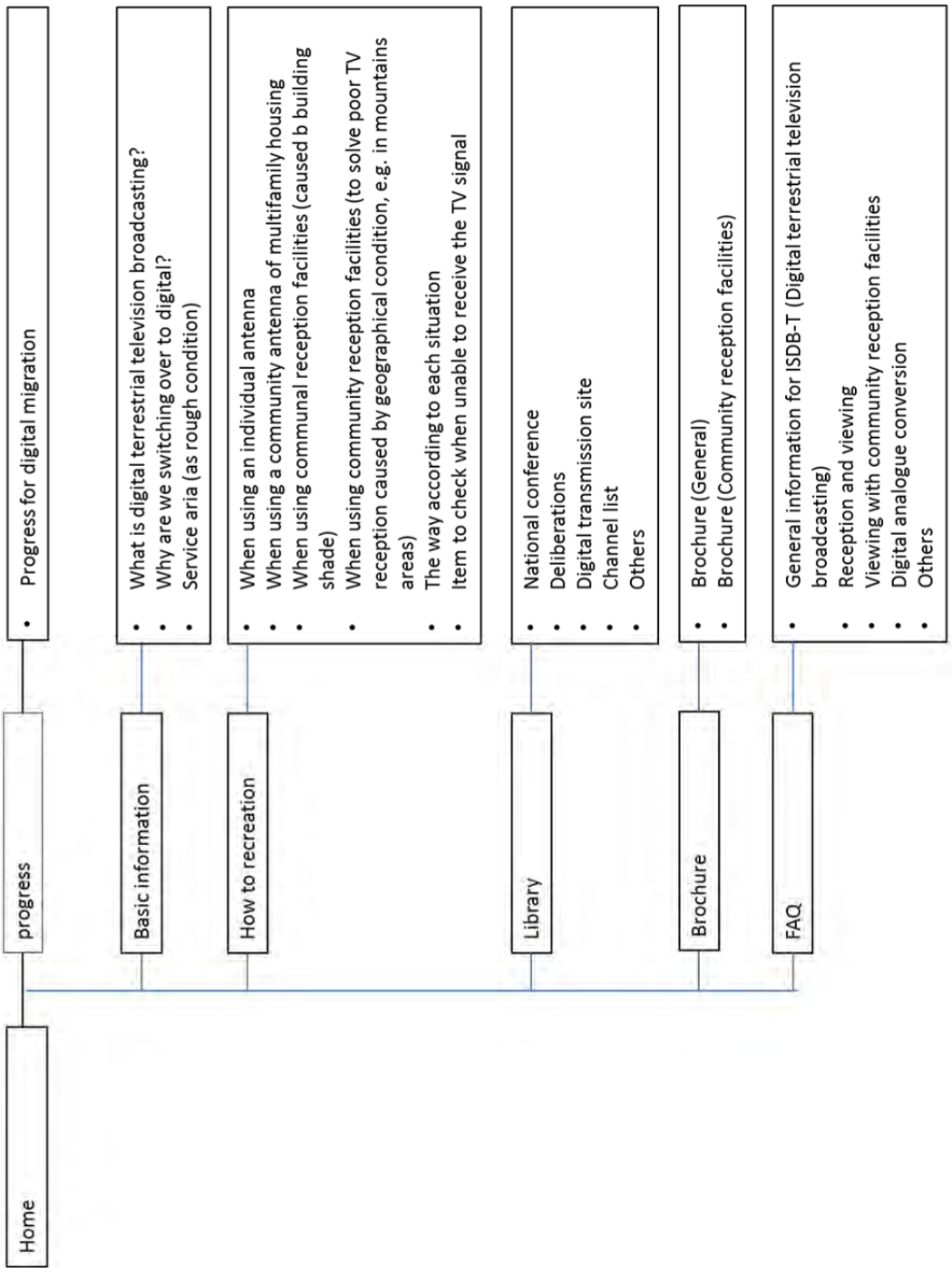

Figure 3-3 Site map of Call Centre website (Supposition)

3.2.5.2 GUIDANCE TO WEB PAGE

It is assumed that the methods of browsing the website can be included in the questions. In this case, the answer should be provided promptly. The front page of the website is the homepage. Introduction should be given as the viewer goes back to the front page and then they should be led to the webpage with the information they need.

Home: Entrance of web page. Here is a link to each pieces of information of the website. If the viewer clicks the link, it goes to the webpage. In addition, important notice about digital migration and latest news are presented on this page.

Progress: Provide information about the transmitting situation of each digital transmitting station and progress of digital migration. With regard to the digital receiver, such as development status of digital receiver, it can be publicized on the receiver page.

Basic Information: Provide general information such as what is digital broadcasting, why digital migration is happening. Under the layer of basic information, necessary preparation to watch digital broadcasting is publicized.

Receiver: Introduce necessary equipment to watch digital broadcasting. The price of each equipment is shown on this page.

- *Set up:* publicize how to install digital receiver and outdoor antennas
- *Digital Portable and Mobile Receiver (DPMR):* publicize how to receive digital broadcasting with portable device and how to set up the device. Also mention areas where reception is poor

- *Data casting:* provide information about how to set up and watch data broadcasting

Library: Library link is provided to go to each page

- *National conference:* provide the record of meeting about digital migration
- *Transmitter station:* provide information about domestic digital transmitting station. To the question that the viewer cannot watch digital broadcasting, this page is introduced and the viewer is guided to adjust the direction of the antenna to the transmitting antenna
- *Milestone:* publicize the digital migration plan in the future

Brochure: publicize the brochures leaflet about digital migration

FAQ: provide answers to the frequently asked questions. If the question is general and the user has access to the internet, the web service should be introduced even to the user of the call centre.

The procedure of the guidance is shown in the following table:

Table 3-4 Web Page Guidance

	Procedure	Page to be introduced 1	Page to be introduced 2
1	Front page	Home	
2	Ask the information they need	-	
3	Guide to the page where the information is	-	
	· Progress of digital migration	Progress	
	· Ground of digital migration	Basic information	
	· Change in digital migration	Basic information	
	· Necessary items for digital migration	Basic information	Receiver

	Procedure	Page to be introduced 1	Page to be introduced 2
	· Types of digital receivers	Basic information	Receiver
	· Places where the viewer can purchase digital receivers	Basic information	Receiver
	· Price of digital receivers	Basic information	Receiver
	· How to install digital receivers	Basic information	Set up
	· Type of antennas	Basic information	Set up
	· How to install outdoor antennas	Basic information	Set up
	· How to view digital broadcasting with portable device	Basic information	Digital Portable and Mobile Receiver (DPMR)
	· How to watch data broadcasting	Basic information	Data casting
	· Information about details of digital migration	Library	National conference
	· Whether digital broadcasting is available in the place of residence	Library	Transmitter station
	· Information about the background of digital migration till date	Library	National conference
	· Information about future plan	Library	Milestone
	· Access to brochure	Brochure	
4	FAQ is introduced and urge to refer to that	FAQ	

3.2.5.3 UPDATE OF WEB PAGE

If the web page design is changed, the placement of information will also change, which might confuse users. Therefore, as this web page is for limited duration, the design principle should not be changed; only the information should be updated. The main updates to be made are: the progress of the digital migration, receiver's information, and FAQ extracted through call centre correspondence. In addition, the brochures such as a DTTB information brochure and how to install receiver brochure will be published from time to time in PDF format. If analog switch off is decided, the information will be published in the web page at an early stage.

It is basic to update frequency once a week. With regard to crucial information, such as analog Tomanami, update should be made as soon as the information is obtained. Table 3-5 marks the update frequency and major updates :.

Table 3-5 Web Page Update Contents and Frequency

Category	Update contents	Update frequency
Progress	Progress of digital migration	When there is a major change, review the contents at the timing of the periodic update.
Basic Information ・Receiver	Receiver's market guidance	When the receiver is on the market it will be immediately updated. Also, the guidance to the new product should be published during periodic update.
Basic Information ・Receiver	Installation of the receiver	When the receiver is on the market, update the information promptly.

Category	Update contents	Update frequency
home	Time of the analogue switch off	Immediately update once analogue switch off date is decided.
FAQ	FAQ update	Update every week
Brochure	The brochures regarding DTTB information, receiver's information, how to install receiver.	Periodic updates will be made when call centre obtains additional information

When web page becomes accessible to the public, an unspecified number of users get the information.

If the wrong information has been updated, there is a risk that the information would spread out. Therefore, call centre manager is responsible for the updates and instructions. In addition, the update is always approved by the PIC, to ensure update content is right and appropriate.

Call centre manager summarizes the information of DTTB including the extraction of the FAQ, once a week. If the key words such as "digital migration", "STB", "Receiver" are searched for in the recording sheet of the data summarized in Excel, related questions are extracted. If the frequency of particular question asked is more than 20% of the total, it should be posted on the FAQ section. For the questions which are asked for about 10% to 20% of the total, call centre should decide if it is to be published on the FAQ section. If the question is asked for less than 10%, forego its publication.

A call centre manager makes the manuscript of the FAQ and

confirms contents from the DTTB project manager in DBS. Confirmation of the content is carried out by e-mail to ensure same level of understanding.

After the content's confirmation is completed, approval request is sent by e-mail to the PIC members.

Once the request is approved, update request is sent to the web page administrator.

The update schedule and procedure are shown in the following figure:

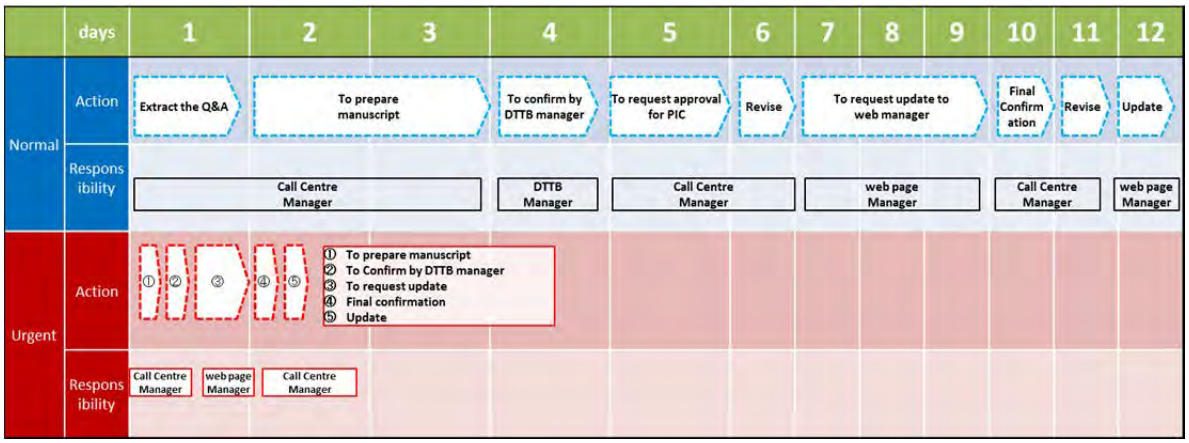

Figure 3-4 Web Page Update Schedule

Table 3-6 Update Procedure

Day	Action
Day 1	Extract the questions from the database which are publicized on the website and confirm whether the information requested last time is reflected on the website
Day 2-3	Preparation of manuscript for web page
Day 4	Place request on an appropriate section to confirm the manuscript.
Day 5	Place request for approval to the member of PCI by email.
Day 6	Confirm the content again; if there are any comments made in the approval stage, reflect upon the comments and place request for approval again.
Day 7-9	Request update to the manager of web page
Day 10	Confirmation following web design
Day 11	Revise
Day 12	Update

Even after the completion of digital migration, it is assumed that there will still be some viewers who will not have replaced their receivers with digital ones. Owing to that, at least for one year after the completion of digital migration, the website will still be made available. However, assuming that the update of information will not occur, the update work of the website ends with the completion of digital migration.

Because the term is limited, if the design of the website is changed, it might cause confusion. Therefore, the design of the website should not be changed and only information should be updated.

3.2.6 RELATIONSHIP BETWEEN TELEPHONE CORRESPONDENCE AND WEB PAGE

As described in 2.2 section, Call Centre Task, the main task of the call centre can be divided into three parts: answering viewer's questions through phone, recording the conversation with the viewers and providing web service.

The operators who received call from the viewer will put it through to appropriate sections. In order to prevent claims and accidents, the difficult questions should be addressed to the manager.

Owing to the limited number of the operator, there might be a case when the viewer has to wait for a long time. The web service makes it possible for the viewer to access information whenever they need. Therefore, the web service is very much effective. Apart from recording by device, filing of the memo is recommended to share the information among the staff member of the test centre. The frequently asked questions will be publicized on the website as FAQ. The important points in answering phone and about website will be described later.

The component of the call centre task is shown in Figure 3-5. Although the flow chart with regard to answering phone is described in Figure 3-2; difficult questions, technical questions and questions of a particular region should be addressed to appropriate sections and should not be answered by the operators.

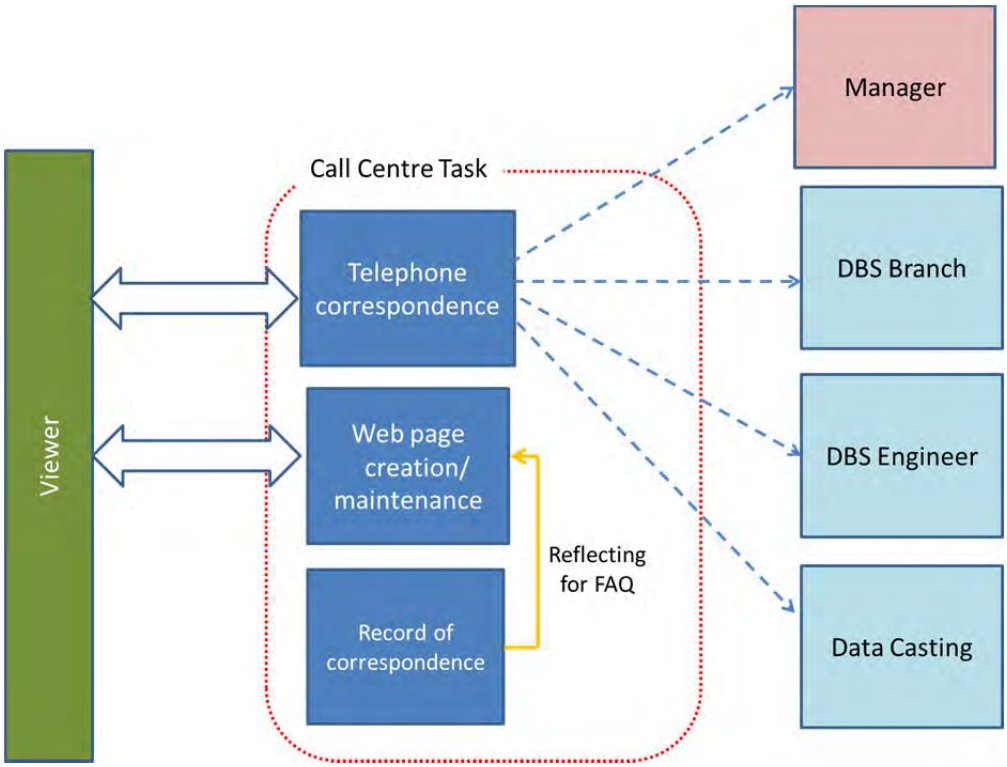

Figure 3-5 Call Centre Operation Structure

There are both advantages and disadvantages of the website and call centre services. In case of telephone operator, it is possible to obtain necessary information through the conversation even when sometimes it is not clear what information the viewer wants. In addition, it is possible to provide specific answer to the viewer through one to one communication. However, there is also a possibility that the viewer cannot reach to the call centre due to the limited number of telephone lines and service time.

On the other hand, website service does not have any limitation in terms of service hour. The viewer can access website anytime they want and obtain information. The information provided is visual and quantity is larger than that provided by telephonic communication. However, the viewer needs to have access to the internet. In two stage services, the viewer can choose the service that matches their situation. In case the

user of the call centre lives in an urban area with access to the internet, the introduction of the website service is highly effective.

Table 3-7 Compare Call correspondence and web page

	Telephone Correspondence	web page
advantage	· In case when the user cannot explain their questions clearly and/or questions are vague, it is possible to gain clear concept by asking 5W1H "Who", "What", "Why", "When", "Where" and "How" repeatedly and clear the questions the viewer has. · It is possible to answer the questions specific to the viewer.	· Since there is no constraint on service hour, the viewer can access information any time they need. · Since the homepage provides the latest information and contents of the website, the viewer can obtain additional information as well. · It is possible to obtain pictorial and visual information.
Disadvantage	· It is difficult to correspond properly during busy hours · There is a constraint in service hour · The viewer cannot obtain more information than what they asked for	· It is impossible to access without internet connection. · It is difficult to access without computer literacy.

3.3 COMMUNICATION SKILL

a. Listening Skill

Listening is a powerful skill that is rarely used. Especially in a high stress environment, it is easy to get caught up in rapid fire mode and neglect the very fundamental coaching skills: hearing and understanding. However, listening is an art form and is worth spending some time perfecting to master it. It will help staff's managerial abilities and enhance their productivity, and will also help staff strengthen relationships with their colleagues. In call centre coaching, try the following tips to improve staff's listening capabilities:

Focus:

Avoid interruption as no one wants to be interrupted. Chances are, the operator finds it annoying and so does the person whom operators are speaking to.

Pause before you respond:

Oftentimes, when operator needs a moment to formulate his/her thoughts before responding, he/she winds up saying something different which is sometimes inappropriate. To avoid saying something inappropriate, the operator should rather pause for few seconds, and respond thoughtfully.

Paraphrasing shows the operator understands:

Finally, to ensure operator understands what the other person meant to say, repeat the key points and ask the person to confirm that's what he/she really meant.

Lighten up a bit. One may find it surprising that one of the key tools in effective call centre coaching is humor. Humor is important because it

is closely tied to your attitude and ability to read a situation. Be careful, of course, about when it's appropriate to crack a joke or lighten the mood, and ensure you don't offend or insult someone at the expense of few laughs.

i Communicate the importance of effective listening

- Allows a caller to feel acknowledged, accepted and understood.
- Encourages the caller to be more open and share information.
- Promotes cooperation between the agent and caller.
- Helps to build stronger relationship.
- Leads to learning about the customer's opinions, desires and needs.
- Reduces confusion and misunderstandings.

ii Undergo periodic training to reinforce effective listening behaviors.

- Include call recordings that demonstrate the effectiveness of listening behaviors.
- Allow agents to point out why the listening behaviors were effective.
- Identify barriers to good listening behaviors and ways to overcome it.
- Use call centre training programs that will enhance listening behaviors.
- Identify employees that exemplify good listening behaviors and introduce them to other employees.

b. 6 C's of Communication

What does it take to make a communication successful?

Everyone of you have your own opinions regarding comunication. In fact, there are few important aspects that make it effective enough to persuade any human mind.

The 6 C's are essential in all forms of communication, including informal communication. The 6 C's can make you an effective communicator and also an effective speaker.

6 C's to improve communication skills

1. Completeness

   Completeness means that the message should possess all important and necessary information that is required, to evoke the action you desire from the decoder. The message must possess all proven facts and figures along with the information.

2. Conciseness

   Conciseness is very important in communication. Lengthiness should be avoided considering people's patience to read or listen. Once they lose their patience, they become restless and try to evade you. As a result, the major point behind communication is lost. To maintain the reader's or the listener's patience, conciseness in communication is substantial. As people say, "Short and Sweet" is preferred.

3. Clear

   Clarity of information is of prime importance. Message should be simplified to make it easy to understand. You may use illustrations, demonstrations, and examples to make your message clear.

4. Courtesy

   An ideal business conversation starts and ends with courtesy showing goodwill. Courtesy means valuing decoder's feelings and emotions regarding the message, which can be accomplished by showing courteous gestures like polite words,

appreciation, thoughtfulness, tactfulness, and showing respect. If the encoder is rude, then accomplishing business communication and opportunities are rather slim.

5. Consideration

Consideration means putting oneself in the place of the decoder while composing a message and comprehending his/her reaction. It refers to visualizing the decoder's problems, mindset, emotions and his response. It involves understanding basic human behavior and using it to maintain a good rapport with the decoder.

6. Correctness

While encoding the message, if the encoder and the decoder have complete comprehensive knowledge about message, then it makes the communication much easier. The encoder must be aware of the current status, knowledge and educational background possessed by the decoder. Correctness in message helps to build confidence. Mistakes in communication reflect poorly on the professional image and interpretation skills.

CHAPTER 4. PRESERVATION DOCUMENTS

Recording sheet and the Daily Report created on the basis of telephonic conversation should be stored in accordance with the official document retention period determined by the law of Botswana.

Storage should be done in paper or electronic form.

Retention period of each document shall be as follows:

- Recording Sheet 10 years
- Daily Report 10 years

As personal information is included, the document should be incinerated after the end of storage period.

CHAPTER 5. STAFF TRAINING

In order to provide an appropriate answer, the staff members of the call centre need to have accurate knowledge and skills. As described in 3.1, Call Centre Policies, it is necessary that the answers should be provided in simple and plain words because all the viewers do not necessarily have technical knowledge. Even the training should be conducted using those words.

During the training stage before the start of the operation, the training should include the basics of digital migration, and installation method of digital receivers. In addition, the equipment for the test centre is specialized for that purpose. The functions should be learnt through the training. OJT should be introduced to learn the basics of the telephone manner, to avoid using rude words and enhance the effectiveness of the training.

The purpose of the training is to enable the operators of the test centre to smoothly answer the questions of the viewer. It targets the operator and is implemented under the supervision of PIC.

The lecturer should be the project leader of digital migration to give information on basics of digital migration. The other lecturer should be from BTCL, hired on contract basis to operate the test centre, to teach how to use call centre equipment and how to answer phone.

Training program is shown in the following table:

Table 5-1 Training Program (Example)

	Content		Lecturer	Purpose
Day 1	Basics of digital migration	・ Why is digital migration needed ・ Milestone of digital migration ・ Necessary equipment for digital migration ・ Relevant ministries and agencies ・ About ISDB-T ・ About data broadcasting	Leader of digital migration project	Understand why digital migration is necessary, features of ISDB-T and why Botswana adopted different broadcasting standards form neighboring countries.
	How to use necessary equipment for watching digital broadcasting	・ STB ・ Antenna type and how to install it ・ Character or indoor and outdoor antenna	Leader of digital migration project	Explain what kinds of equipment is needed to watch digital broadcasting and how to install them; information will be given to even those who have not seen digital broadcasting equipment before
Day 2	How to use call centre equipment	・ How to use telephone ・ About recording device ・ Transfer of phone	BTCL	Learn how to use call centre equipment

	Content		Lecturer	Purpose
	Basic telephone manner	・ Phrasing ・ Voicing ・ Clear and succinct manner	BTCL and PR officer	Learn telephone manner including method of delivery and way to make good impression
Day 3	Role play	・ Role play should be carried out in pair and introduced by using the actual equipment	Leader of digital migration project/PR officer	Practice telephone manner in pairs. Review how to operate equipment by using actual equipment. Conduct role play several times and change pairs. Practice in front of the participants, evaluate each other and establish the telephone manner
	Test for understanding	・ Evaluate the understanding by using the basic knowledge on digital migration (paper exam)	Leader of digital migration project	Confirm the basic knowledge about digital migration through written examination. If

	Content		Lecturer	Purpose
				there is any question that is not answered correctly, the question is explained again for correct understanding

The staff training should be conducted periodically so that all staff can gain the latest information. The periodical training also aims to improve the quality of service. In particular, at the beginning of the operation, the training should be conducted at least once a month. Since the training is conducted while the operation is ongoing, the training should limit to a day only and progress of digital migration should be dealt with.

By reviewing periodically, it is possible to provide accurate and necessary information; and understand what problems the viewer has, and improve the service quality.

Tentative annual schedule for the training is shown below. From the beginning to the six month of call centre operation, the training will take place every month. After this period, it is advised to plan the training according to the situation.

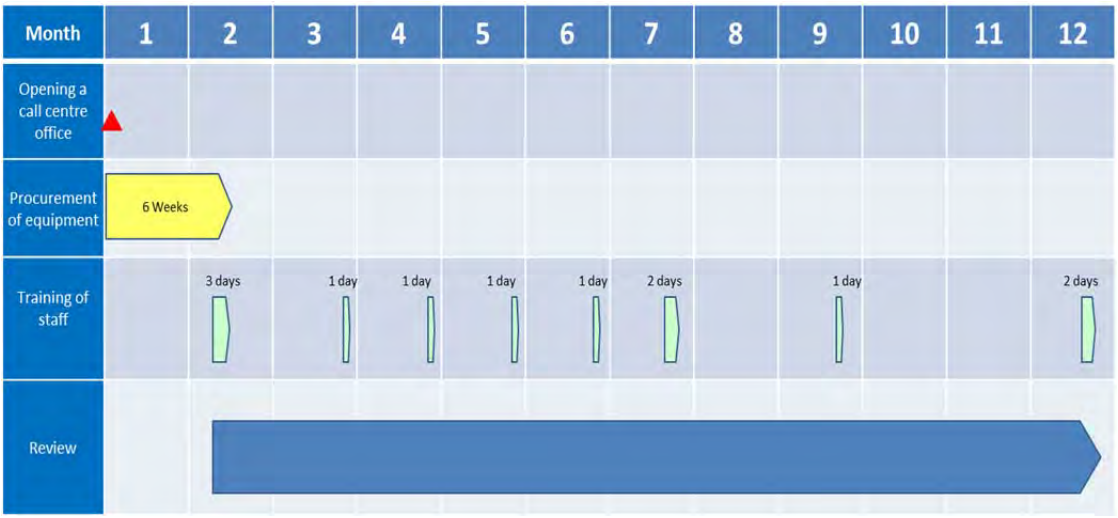

Figure 5-1 Annual Training Plan (Tentative)

CHAPTER 6. FREQUENCY ASKED QUESTIONS

The frequently asked questions are shown below.
FAQ can be divided into four categories:

1. General information
   General information consists of five sub categories: Basic information, DTTB services, Milestone, Benefit and Fee. This category explains about digital migration.

2. Receiver's information
   Receiver's information consists of five sub categories: Receiver's basic information, STB, Digital Portable and Mobile Receiver (DPMR), Price and Satellite. This category explains about receiver's equipment.

3. Data broadcasting
   This category gives information on data broadcasting.

4. Technical information
   Technical information consists of four sub categories: Set-up, Reception, Electric Program Guide (EPG) and Others. This category gives technical information on how to watch DTTB.

The information can be entered in excel file and then distributed. The answer can be provided promptly by using the search function.

Table 6-1 FAQ (General Information)

Sub Category	No.	Question	Answer
Basic Information	1	What is Digital Migration?	It is a global process involving the switch from analogue to digital broadcasting signal.
Basic Information	2	Why do we need to migrate?	To release valuable spectrum that can be used for other services and to reap the benefits of migration.
Basic Information	3	What is the difference between analogue TV and digital TV?	In analogue TV, one channel uses a dedicated frequency to broadcast due to the large bandwidth the analogue signal requires. In Digital TV, however, the signals can be compressed, thus allowing for more channels to be broadcasted in the same bandwidth.
Basic Information	4	What is the difference between digital TV (DTTB) and satellite TV?	Digital TV uses a network of transmitter to relay the signal for whole country. The broadcast signal is sent to the various towers and if you are within the area covered by a tower, then you will receive the broadcast services. Satellite TV uses a satellite in the sky. The broadcast signal is sent to the satellite and you receive a signal via satellite.
Basic Information	5	Will there be high definition TV (HD TV) on DTTB?	Yes. However you need a high definition TV if you want to watch high definition.
Basic Information	6	What is high definition TV (HD	High definition TV (HD TV) in wide screen format (16:9)

Sub Category	No.	Question	Answer
		TV)?	provides the highest resolution and picture quality of all digital broadcast formats. Combined with digitally enhanced sound technology, HD TV sets new standards for sound and picture quality in television.
Basic Information	7	Can digital TV be watched at home?	In case of the concrete method to watch digital television, please contact the nearest DBS branches.
Basic Information	8	Will this technology broadcast other channels?	According to the world law, countries are supposed to broadcast within the confines.
Basic Information	9	Has migration been done anywhere else in the world?	Yes, most countries are going through DTT migration to ensure on-going co-ordination and protection from interference.
Basic Information	10	Why do you terminate analogue broadcasting?	In order to make utmost use of the limited spectrum. Currently the number of spectrum is decreasing. If analogue broadcasting is terminated and shift to DTTB is completed, approximately one third of spectrum that is used for television services can be freed. The freed spectrums can be used for other effective purposes such as telecommunications.
Basic Information	11	I do not agree on the termination	It is a global process involving the switch from analogue to

Sub Category	No.	Question	Answer
		of analogue broadcasting	digital broadcasting signal. The termination is important to release valuable spectrum that can be used for other services and to reap the benefits of migration.
Service	1	Is BTV going to appear on DSTV?	BTV will not disrupt the existing channel 289 on DSTV.
Service	2	Is the STB limited to BTV only?	This is only done for BTV and other terrestrial channels.
Service	3	Is E-Botswana going to be part of the migration?	E-Botswana will continue its broadcast to the audience.
Milestone	1	When do we change from analogue to digital?	Simultaneous broadcasting already started from 17th June, 2015. However after analogue switch off (ASO), you cannot watch TV program without digital receivers compatible with DTTB.
Milestone	2	When does analogue broadcasting terminate?	The date of ASO has not been fixed yet. It will be informed once it has been fixed. Note: For staff operation, the date will be informed once it has been decided.
Benefit	1	What are some of the benefits brought about by digital migration?	・ Create revenue for film industry. ・ Enhance sound and pictures quality on television. ・ Create room for channel. ・ Able to receive disaster warning using EWBS.

Sub Category	No.	Question	Answer
Benefit	2	How is the migration beneficial to the people of Botswana?	The migration will provide opportunities for community partnerships for productions.
Fee	1	Will there be a subscription fee?	There will not be any extra costs besides the one-time purchase of the STB.
Fee	2	Will I need to pay a subscription fee for DTTB?	No, for DTTB, you don't need any subscription fee.

Table 6-2 FAQ (Receiver's Information)

Sub Category	No.	Question	Answer
Basic Information	1	Will I need any additional equipment to receive DTTB?	You will need a Set-Top-Box (STB) or Integrated TV for ISDB-T and an antenna.
Basic Information	2	What do I need to acquire to prepare for the switch over?	You need to acquire either Set-Top-Box (STB) or an Integrated Television set with an outdoor or an antenna.
Basic Information	3	Will I need to buy a new television set to receive DTTB?	You can use the current analogue TV, however you should prepare a receiver to receive DTTB.
Basic Information	4	Where can we get Digitally ready devices? (Set Top Box, Integrated TV sets, cell phones)	The announcement will be made in due course.
Basic Information	5	Will it be necessary to throw away old TV sets in favor or the integrated ones?	Old TV sets will still function well with Set-Top-Box (STB)s.
Basic Information	6	What will happen to the current TV?	You can still use it to set up STB.
Basic Information	7	What will happen to the current decoders?	Satellite decoders are not affected by digital migration. However, without Set-Top-Box (STB), one will not be able to

Sub Category	No.	Question	Answer
			view Digital Television and enjoy the benefits.
Basic Information	8	Is it the case that the analogue television does not work anymore?	If you would like to watch digital broadcasting with your analogue television, Set-Top-Box (STB) is required.
Basic Information	9	What kind of receiver do we need?	We have 3 types of receivers, Set-Top-Box (STB), Integrated TV (IDTV) and Digital Portable and Mobile Receiver. STB is required to set up digital broadcasting in analogue TV. IDTV can be watched without STB.
Basic Information	10	What is the difference between Set-Top-Box (STB) and Integrated Digital TV (IDTV)?	Set-Top-Box (STB) is external conversion device for receiving and viewing DTTB for an analogue TV whereas; IDTV receives ISDB-T DTTB through an external antenna.
STB	1	Why do I need a Set-Top-Box (STB)?	Without the STB, one will be unable to display the digital services on one's personal TV set. However, the signal will be received through the aerial antenna.
STB	2	Is the STB limited to BTV only?	This is only done for BTV and other terrestrial channels.
STB	3	Where can the Set-Top-Box (STB) be	You can buy it in the electric shop. However, the STB is not available in the Botswana

Sub Category	No.	Question	Answer
		purchased?	market at present. Government will announce its availability in market.
STB	4	Why do I need a Set-Top-Box (STB)?	Although you will be able to receive the signal through your aerial antenna, without the STB, Integrated TV for ISDB-T will not be displayed. The STB decodes the digital signal received via standard aerial antenna and supplies the TV set with a video signal.
STB	5	If I have two more TV sets in the house, will I need same number of Set-Top-Box (STB) as TV sets?	Yes, if you want each TV set to individually broadcast different channels at the same time.
STB	6	If I have DSTV decoder, do I need to buy another decoder?	This technology targets only Digital Terrestrial Transmission. Satellite TV will not be affected.
STB	7	If I have DSTV decoder, do I need to buy another decoder?	This technology targets only Digital Terrestrial Transmission. Satellite TV will not be affected.
DPMR	1	If I am using my phone to watch the digital television, will my airtime be charged?	There will be no charge because it is free to air signal.
Price	1	What are the	Prices will range between $20

Sub Category	No.	Question	Answer
		expected prices of the Set-Top-Box (STB)?	-$60
Price	2	Will the Set-Top-Box (STB) be given freely?	The STB will be sold and not given freely.
Price	3	Will I need to pay subscription fee every month like DSTV?	The air service is free of charge; however one-time purchase of the Set-Top-Box (STB) is only required.
Satellite	1	Will the Set-Top-Box (STB) be connected to the Dish to get the signal, since many households use phillibao?	STB will not be used to connect to satellite dish.
Satellite	2	Will BTV appear on DSTV?	BTV will not disrupt the existing channel 289 on DSTV.

Table 6-3 FAQ (Data Broadcasting)

Sub Category	No.	Question	Answer
Data Broadcasting	1	What is data broadcasting?	Data broadcasting is referred to as broadcasting which mainly transmits data, for example characters, sharps, still pictures, images and sound. It can be used for viewing news, movies, advertisements, etc.

Table 6-4 FAQ (Technical Information)

Sub Category		Question	Answer
Set-up	1	How to set up the receiver?	Please refer to your receiver's manual or contact the electric appliance shop.
Set-up	2	The TV is not working even if I set it up properly	You should check again to connect. If it is connected properly, you should prepare outdoor antenna or configuration of TV.
Set-up	3	How does a person figure out whether their TV is compatible to the STB?	The TV set must have audio and video inputs or alternatively must have a RF input or a HDMI input.
Set-up	4	Do we need an outdoor antenna for receiving digital broadcasting?	There is a case that an indoor antenna is not enough for reception. It is more certain if you prepare UHF antenna outside of the house. In case you cannot receive with an outdoor antenna, please ask the nearest DBS branch
Set-up	5	I understand that we need digital television, STB, UHF antenna. How much do these cost?	With regard to the cost, please contact the electric appliance shop
Set-up	6	What is HDMI terminal? Is it a must to have HDMI?	HDMI (High-Definition Multimedia Interface) is a proprietary audio/video interface for transferring digital video data and audio data with one cable.

Sub Category		Question	Answer
			Conventional Analogue signal can be used instead of HDMI interface. However, HDMI will give you better quality of picture than analogue interface.
Set-up	7	How to install STB?	Please install as follows: Installation of Antenna Cable connection between Antenna and STB with Coaxial cable Connector of STB: Antenna input Cable: If you use 300ohm twin lead feeder, please connect 300 ohm to 75 ohm Impedance converter Cable connection between STB and TV. Please connect between output of STB and input of TV set. There are a few kinds of signal format. You should connect with same kinds of cable as TV set. Power cable connection to AC outlet Power on STB and TV set. For more details, please refer to your STB's manual or contact the electric appliance shop.
Reception	1	Even after preparing all necessary equipment, the	Please contact the nearest DBS branch

Sub Category		Question	Answer
		television does not display anything. The neighboring electric shop cannot solve it.	
Reception	2	Will there be support trainees who can help when the signal is lost?	Public Education will address some of the questions if such situation arises.
Reception	3	I cannot receive digital broadcasting properly	Please contact the nearest DBS branch
Reception	4	I have installed all equipment, yet cannot watch digital broadcasting	Please contact the nearest DBS branch
Program guide	1	What is electronic program guide?	A guide showing programs that can be displayed on a TV set using an STB or IDTV. It displays the now and next programs or TV schedule for a day or more at a time.
Others	1	I cannot solve the problem by myself	Please contact the nearest DBS branch

APPENDIX 1 RECORDING SHEET

Date, Year: , 2016 Operator:.

No.	Start	End	Duration	Age	Sex	Residence	Question	Details	Complain
1									
2									
3									
4									
5									
6									

APPENDIX 2 DAILY REPORT

Date, Year: , 2016

Name:				
Operator Name	AM: PM: Night :			
Line Condition	AM: Excellent Good Poor PM: Excellent Good Poor Night: Excellent Good Poor			
Number of Call	AM : PM : Night :			
Result	Done: 3		Call Back/Continue: 2	
No.	Operator	Correspondence No.	Summary of Accident	Condition
1				Done/Call back /Continue
2				Done/Call back /Continue
3				Done/Call back /Continue
4				Done/Call back /Continue
5				Done/Call back /Continue
6				Done/Call back /Continue
7				Done/Call back /Continue
8				Done/Call back /Continue

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Project for Implantation of the Digital Migration Project (DiMT)

Separate Volume -8
Procurement plan of HD studio systems

Procurement Plan of HD Studio Systems

July 2016

Department of Broadcasting Services

Ministry of State President

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ABBREVIATIONS

BETV	Botswana Educational Television
BTV	Botswana Television
CiaB	Channel in a Box
DBS	Department of Broadcasting Services
DiMT	Digital Migration in Television
DTT	Digital Terrestrial Television
DTTB	Digital Terrestrial Television Broadcasting
ENPS	Electronic News Production System
HDTV	High Definition Television
ISDB-T	Integrated Service Digital Broadcasting-Terrestrial
MAM	Media Asset Management
MoESD	Ministry of Education and Skills Development
SDTV	Standard Definition Television
SNMP	Simple Network Management Protocol
STL	Studio to Transmitter Link

Chapter 1 Introduction

1.1 Background

The government of Botswana has adopted ISDB-T as Digital Terrestrial Television (DTT) standard. One of the advantages of Digital Terrestrial Television Broadcasting (DTTB) is a wider bandwidth of transmitting in frequency range for one channel. Effective use of this bandwidth has two directions. One is multichannel and another is high quality picture. BTV is planning to adopt the latter i.e. High Definition Television (HDTV). HDTV can provide a better quality of picture, giving incentives and benefits to the viewers to migrate to digital in Botswanans.

BTV has already started DTTB simultaneously with conventional analogue terrestrial broadcasting. However program production system format only supports Standard Definition Television (SDTV). With regard to HD program production, if Master Control Room, TV studio, HD editing systems and necessary equipment and facilities to produce and transmit programs were not urgently procured, it is difficult to produce and broadcast HD programs. While conducting both analogue and digital broadcasting, the whole system except transmitting stations, STL and Data broadcasting system has to be upgraded to HD. It is very important to carefully examine the procedure of upgrading facilities and interfaces in order not to disrupt the broadcasting services.

Comprehensive procurement plan is necessary to upgrade the program production system to HD in a quick and efficient manner.

1.2 Purpose of Procurement Plan for HD Studio Equipment

Broadcasting system in BTV is a large integrated system with a video signal routing system connecting most of the systems and an integrated control system which controls many devices including playout server and routing system. For upgrading the existing SD broadcasting system to HD, not only each sub system e.g. studio, server, but also video signal routing system between each system have to be upgraded to HD. In addition, the integrated control system has to be replaced because it has been more than ten years since it was installed.

The purpose of this plan is to support smooth upgrading of the large integrated broadcasting system in BTV with preparation to the changing over plan without disrupting broadcasting services, master schedule and rough budget estimation.

Scope of this plan is not only news studio (Studio1) system and production studio (studio2) system but also master control system with playout server, video routing system, broadcasting sever system based on file base operation and integrated control system.

1.3 Analysis of Existing Broadcasting System in BTV

Existing Program production system of BTV is shown on Figure 1.3-1.

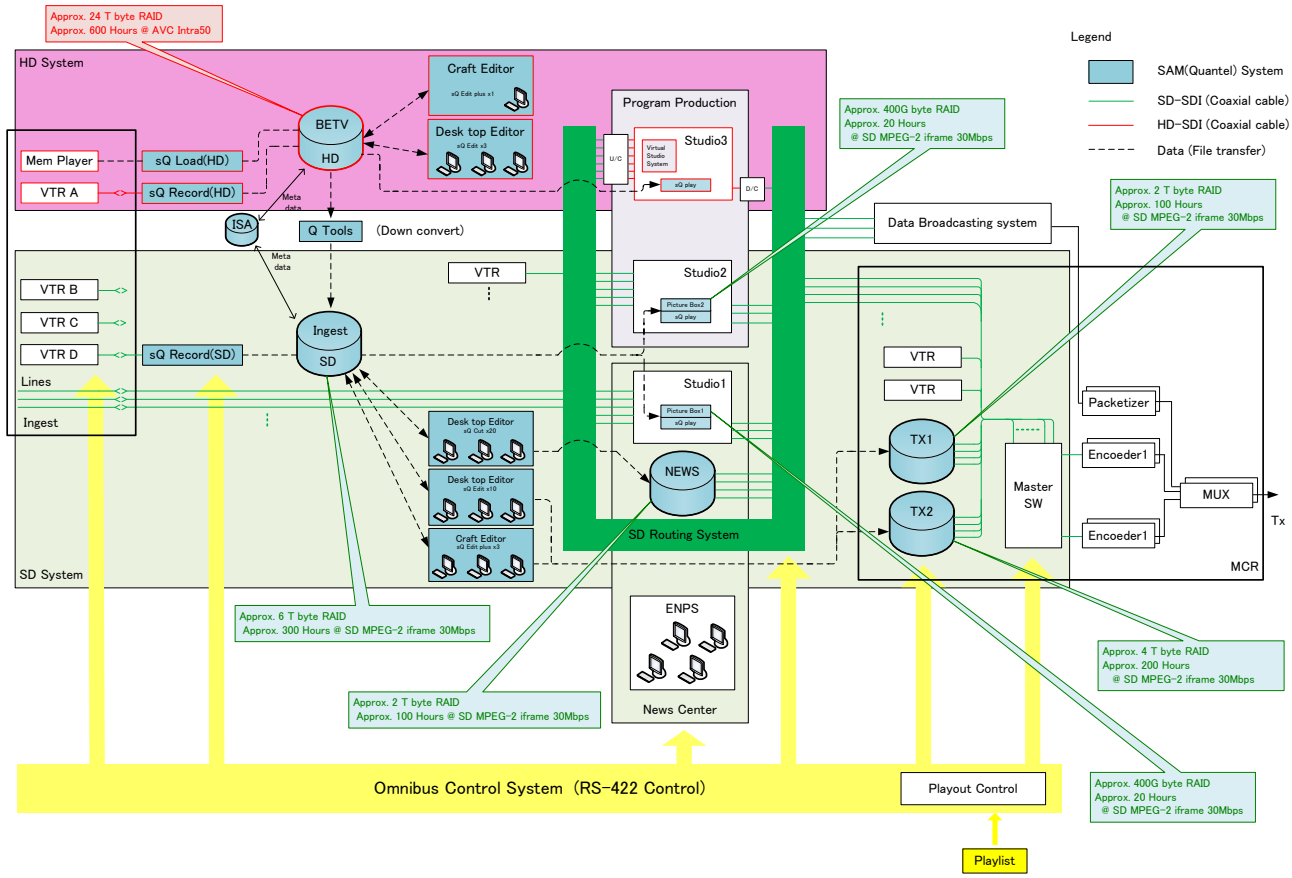

Figure 1.3-1 BTV Existing Broadcasting System

Some parts coloured in pink have been already upgraded to HD format. These parts belong to the Ministry of Education and Skills Development (MoESD) and consist of Studio 3 and Broadcasting Server system. On the other hand, most of the equipment belonging to BTV is still in SD format. However, even though most of the system consists of SD format equipment, a File based program production workflow with Broadcasting Server system and a Non-Linear Editing terminal hooked up to servers through the network have been introduced in BTV.

1) Control System

Most of the parts, i.e. Master switcher for playout, Routing system and VTRs in program production system are controlled by a centralized integrated control system by Serial control signal. The control terminals of this system are installed in Sub-control room for each studio and master control room. This control system was introduced as the control system for both Servers and off line system such as players of magnetic tape, and still plays an active role in ingesting to server, routing control and Automatic playout control with play list. This is the system by “OmniBus System” and it has been operating for more than ten years, so it needs total replacement.

2) Routing System

House format of BTV existing system is SD-SDI separate Stereo Analog Audio. Coaxial cable for SD-SDI and two audio cables for Analog Stereo Audio Signal are connected separately between systems. Routing system established by 128x128matrix switcher produced by Philips which is ageing and needs to be replaced. Because of separate stereo analogue system, both Routing Switcher for Video and for Audio are required for routing.

3) Recording Media

Even though broadcasting server system has been introduced, conventional off line operation also still remains with 1/2 inch VTR tape, 1/4 inch VTR tape and memory device. HD Studio also has 1/2 HD VTR (HDCAM).

4) Broadcasting Server system / Non Linear Editing system

There are two server systems in BTV. One is SD based Server system which was installed more than 10 years ago, and another is HD based Server system which was installed by MoESD in recent years. The two systems were integrated by the Quantel Company (currently named SAM). They are connected together and have a common data base of video contents. In addition, video contents can be transferred through HD/SD transcoder between them.

SD Server system consists of Ingest Server which ingests video materials, News Server for news production and playout, Tx Server for playout from master control room and Non-linear editing terminals. Ingest Server is a kind of video material server which ingests video materials from Video tapes, memory, lines from satellite through encoding device and sharing video material to editing terminal for editing. After editing, contents are transferred to news server or Tx server for playout.

Configuration of Tx Server is made redundant by main and standby server. Editing terminals are 20 sets of cut edit terminals which are for simple editing of the news, 10 sets of standard editing terminals and 3 sets of craft edits for the purpose of high performance editing. Playout control terminals for SD server system are installed in Studio1 and Studio2. In addition, Local storage servers hooked up to the server system are installed in studio1 and 2. Capacity of each server are approximately 300 hours for Ingest server, 100 hours for News server, 100 hours and 200 hours for playout servers and 20 hours for Each local storage of studio 1 and 2 at the picture level Mpeg-2 iframe 30Mbps.

News room computer system called Electronic News Production System (ENPS) has been put in place for News program production. Device control protocol of ENPS is Media object Server (MOS) protocol and connected to News Server system through MOS Gateway for communication between both systems. Video picture in News Server system can be monitored from ENPS System.

HD Server system consists of BETV Server which ingests video materials, three sets of Standard editing terminals and one set of craft editor. This system can ingest video file directly from memory device through Firewire interface in addition to SDI signal from player. Capacity of server is approximately 600 hours for BETV Server at the picture level AVC Intra 50Mbps.

5) Playout System

Master switcher of BTV has 16ch primary inputs and is controlled by the control system mentioned on item 1) above. In addition to the above main and sub Tx servers, VTRs and lines from satellite are played out to master switcher. Outputs of master switcher are connected to encoder for digital terrestrial broadcasting.

6) Studio System

There are three Studios in BTV. Two of them, studio 1 and Studio 2 are SD System. Studio 1 is for News production with 3 sets of Camera chain and 2 M/E 19 primary inputs Production switcher. Studio 2 is for Program production with 5 sets of camera chain and 3M/E 27 primary inputs Production switcher.

Only Studio 3 which was equipped by MoESD has been upgraded to HD. Studio 3 is program production studio with 5 camera chains, 3M/E production switcher and virtual studio system also.

7) Video Archive

Video archive system has not been introduced/ installed yet. Video contents are archived in the shelf with magnetic video tapes. In years to come, keeping player for magnetic video tapes in good condition is going to be more difficult than today. Introducing Archive system is also important for BTV to operate HD system.

1.4 Trend of Broadcasting Equipment (What's coming next to HD)

More than ten years have passed since HDTV had been introduced in Japan. HD format has become common enough and affordable in the field of equipment for program production e.g. studio camera, production switcher, routing device and video monitors. Most of the TV sets in the market also support HD format. Furthermore the Japanese government goes forward "Smart Japan ICT strategy" which includes promotion of Ultra High Definition (UHD) format in preparation for Tokyo Olympic in 2020. UHD is a video format which has higher definition than HD e.g. 4K, 8K. 4K has four times definition of HD format. In addition to UHD, High Dynamic range (HDR) which is video format with wider dynamic range of luminance level has been started to study for introduction in the moviemaking fields.

On the other hand, program production systems which can handle these high quality pictures need wider bandwidth signal distribution lines. Bit rates of signal distribution

system in each system are shown in Table 1.4-1. Non compressed serial digital video signals are transmitted between equipment with coaxial cables in video production system. Commonly used Coaxial cable can handle up to 3G bps, so single cable is enough for connecting between equipment in both SD and HD systems.

Table 1.4-1 Television Standards

Name	Standard	Bit rates	Example video format
SD-SDI	SMPTE 259M	270 Mbps	480i, 576i
HD-SDI	SMPTE 292M	1.5 Gbps	1080i, 720p
4K	SMPTE 2036	12Gbps	4Kp60

However, 4K video production system needs four set of coaxial cables per one signal line to transmit 4K video data between equipment, so the system is complex.

Full 4K system is not popular enough and it's only used in special purpose studio and production in Japan. Video Camera and production switcher supporting 4K format and some other devices are available in the market, but production system supporting 4K is not popular enough because of high bit rate of the signal.

Video data transfer system over IP has been proposed as one of the solutions of high bit rates video signal system. However, there are several protocols and it will take time until the standard is established and become common.

And a cycle for replacement of broadcasting system is almost ten years or so because of life span of equipment, so system upgrading to UHD will be suitable at the next time.

Chapter 2 Policy of procurement

2.1 Over all (including procurement interval of broadcasting equipment)

Overall system Block diagram for HD upgrade is shown in Figure 2.1-1.

File based program production work flow has been introduced to BTV, so upgrading equipment to HD can be proceeded by following the present work flow of BTV. House format of Video / Audio signal shall be HD-SDI embedded audio (SMPTE 292M). One coaxial cable is enough for transmitting HD-SDI Embedded audio signal between equipment. The control system shall be integrated into the control system as same as the existing system.

Number of transmitting channel shall be four channels with one redundant channel for four transmitting channels. In case of emergency, transmitting lines will be changing over to redundant channel by the routing switcher.

For master control system, “Channel in a Box” (CiaB) system which has no conventional master switcher shall be introduced.

Media Asset Management (MAM) system which is a management system for video contents shall be introduced for the purpose of re-use of video contents in the future in addition to the present file based workflow with server system. MAM system also has the function of interface between Archive System.

Production server system and News server system shall be upgraded by following the structure of the existing system. For News production, not only News server system but also ENPS system should be updated for keeping interface between both systems in software version.

Systems to be up grade are as follows:

1. Master Control Room (MCR)
   Including Integrated Control system, Sync system and clock system
2. HD-SDI Embedded Audio Routing system
3. Production Studio system
4. News Studio System
5. Broadcasting Server system with editing terminals
6. Media Asset Management (MAM) system
7. Archive system

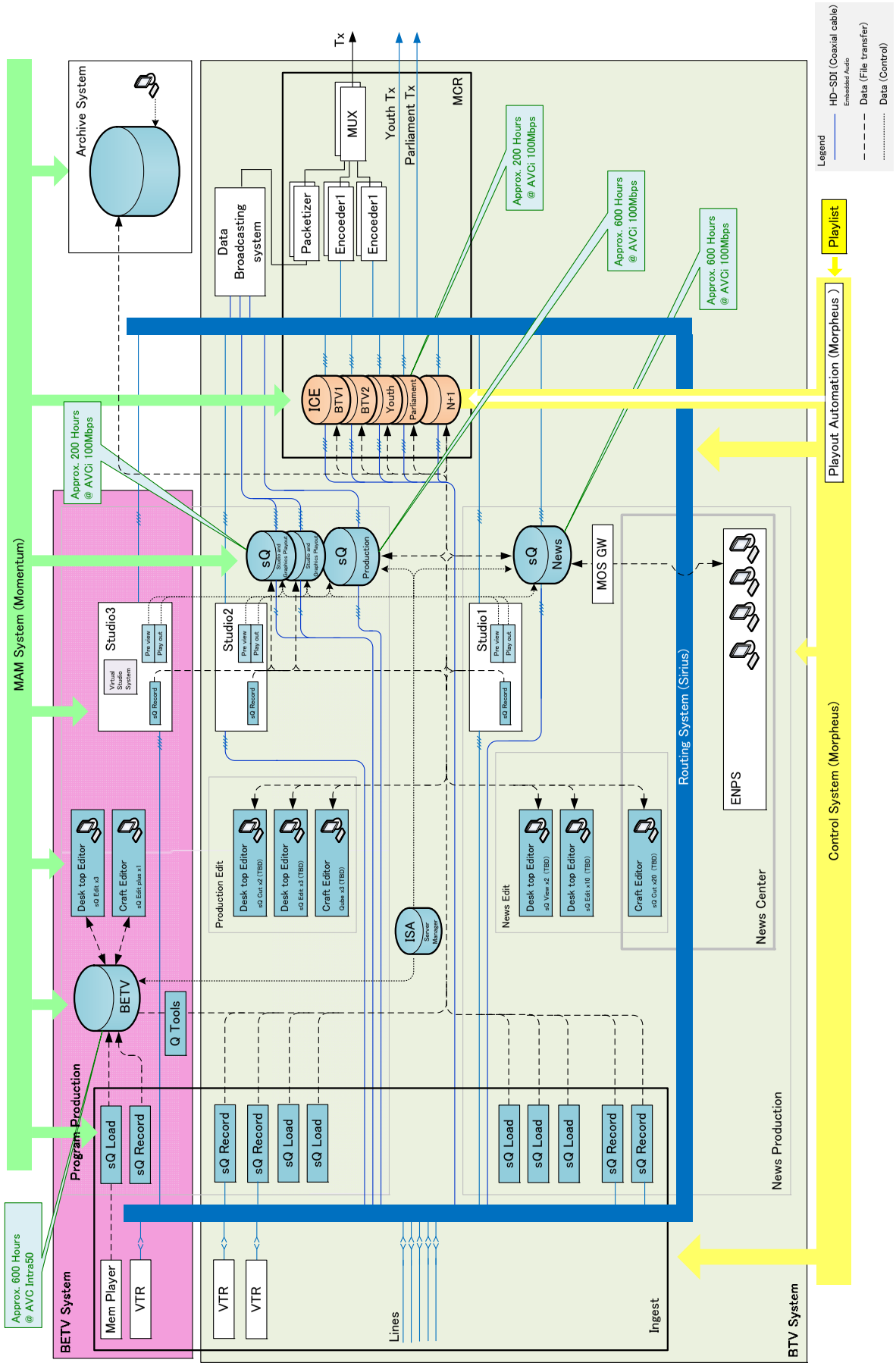

Figure 2.1-1 Overall System Diagram for HD upgrade plan

2.2 Broadcasting Server System with Editing Terminals

File based work flow has already been introduced into the existing SD system of BTV. HD upgrading system can follow the existing system structure. Approximately 600 hours or more capacity for both Program production Server and News server which ingest video contents and accessed from non-linear editing terminal are recommended. Each server shall have an encoder device for ingesting from HD-SDI base band device e.g. conventional VTR and interface device for file ingestion from Ethernet e.g. output of memory player. Ingest from base band device takes actual time of video contents. On the other hand, file ingest can be handled with the speed twice or more faster than that of the base band. Ingest for shorter time contributes to efficient work flow.

Non-linear editing terminals consisting of simple cut edit, normal edit and craft edit hooked up to Servers are needed as same as the existing SD system. After completion of editing, contents shall be transferred to Playout server via the network. News Server should be able to be accessed from ENPS system through MOS gateway as the existing SD system. For keeping good relation of software version between both systems, ENPS system also requires version upgrade.

Two Graphics and playout server for three studios i.e. studio 1, 2 and 3 are recommended instead of conventional VTR for studio production. Two control terminals of these servers i.e. preview and playout control terminal are needed for each studio. Video signal will be routed by a routing system. Each studio needs encoder devices for ingesting to servers.

In new HD upgrading system, MAM system for management of video contents is needed. MAM system shall promote effective re-use of video contents and has a function of interface to archive system.

2.3 Playout System

Conventional playout system with master switcher handling base band video signals has been giving way to Channel in a Box (CiaB) playout system. CiaB becomes widespread in the world not only small CATV stations but also large key broadcasting station with the developments in IT technologies. CiaB solution is the playout system without conventional master switcher, each transmitting line has own playout server which is connected directly.

Video signal processing for playout on base band video signal in conventional master switcher will be handled in Playout server which is specially designed for CiaB solution with software processing. Inserting station logo / Time, downstream key and mix effect with 3D effect can be done inside of Playout server. Signals of Live broadcasting / Line feeds from outside are also connected to the transition line through playout server for signal processing. Comparison between conventional and CiaB solution Playout system overview is shown on Figure 2.3-1. Playout system in CiaB system is more simple and affordable than conventional one. CiaB solution has been main stream of Master control system and Playout server for CiaB solution with enough performance record in the field is available in the market. For this procurement plan, CiaB solution is recommended.

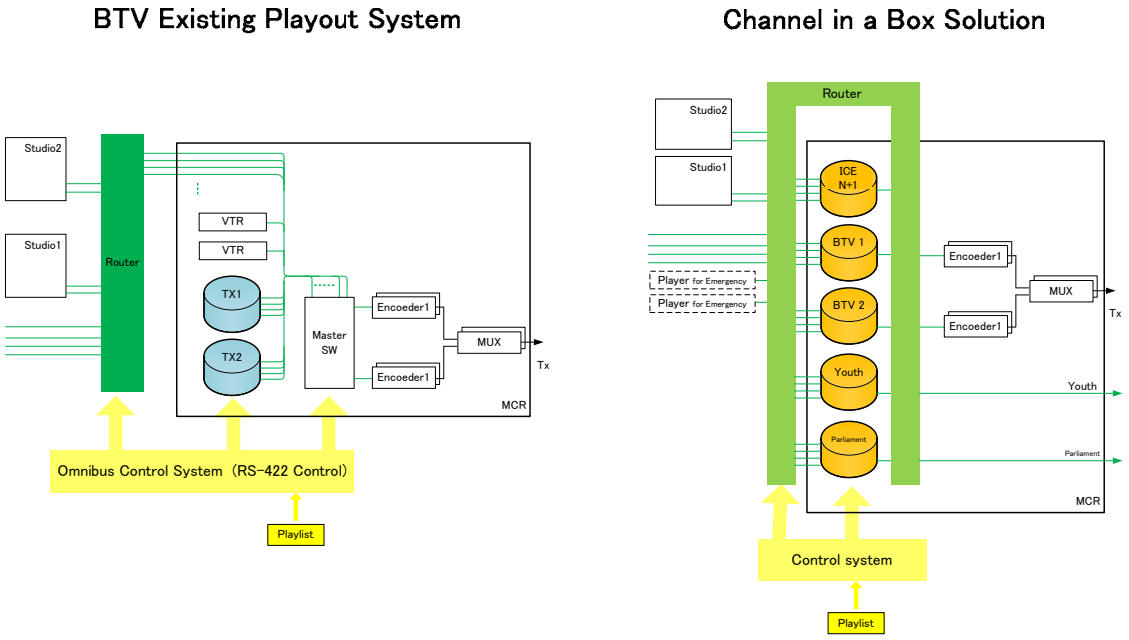

Figure 2.3-1 Comparison between Conventional and CiaB Playout System

Playout system needs highest reliability and simple & high reliable operation in case of emergency in broadcast station. CiaB playout server becomes reliable enough with highly developed IT technologies. User interface innovation also makes it possible to improve reliable operation.

CiaB Playout server has redundant power supply and RAID system. On the subject of improvement of reliability, N+1 CiaB playout server which is redundant server for N channels Playout servers can contribute to keeping higher reliability as total playout system in affordable cost. Playout system is under integrated control system. In addition to automatic playout control with playlist, manual operation by control terminal and conventional hardware switching panel are also needed in case of emergency.

Existing BTV playout system has two transmitting channels in SD format; one of two was redundant line but now is used for second channel for transmitting. The current playout operation has no redundant line. HD upgrading plan has 4 channel playout in HD format with one redundant line for four channels.

Playout signals are connected to two encoders for ISDB-T, Youth, and Parliament through routing system. In case of emergency, signal line shall be changing over to N+1 redundant playout server.

2.4 Studio Systems

News Studio (Studio1) and Production Studio (Studio2) system aim to upgrade current SD base system to HD with the same system architecture as existing system. Key feature of each system are shown in Table 2.4-1.

Table 2.4-1 Key Feature for Studio Systems

Feature	News Studio (Studio 1)	Production Studio (Studio 2)
Number of Camera	3 sets	5 sets
Zoom Lens	17 times or more	21 times or more
Prompter system	2 sets	-
Production switcher	2 M/E 19primary inputs or more	3 M/E 27 primary inputs or more
Audio Mixer	24 faders or more	32 faders or more

Signal interface format between the equipment shall be the uncompressed serial digital signal supported by ITU-R. The audio system shall be the digital system supported by AES/EBU format / MADI. The sampling rate of the audio signal shall be 48 kHz.

1) Digital Camera System:
   The studio camera shall be 3-chips Sensor devices and portable for the studio use. S/N ratio shall be more than 56dB and zoom lens shall be equipped.

2) Graphics and Playout Server and Playout Control Terminals:
   Graphics and playout Server which are hooked up to the network and can swap files from / to Production server / News Server shall be equipped. This Graphics and Playout Server shall be under control of the integrated control system.
   Playout control terminal of Graphics and playout Server, News server and Production server shall be equipped for controlling each server for the purpose of use contents stored in Servers in studio production.

3) Digital Production Switcher / Effecter:
   The digital video switcher shall have HD-SDI interfaces for In/Out terminals and primary inputs including a video effect generator with downstream key function and 3 dimensional special video effects function.

4) Digital Audio System:
   The audio mixer shall have input and faders on the Table 2.4-1 with backup power supply for emergency. The sampling rate shall be 48 kHz.

5) Prompter System
   Two sets of Prompter in News studio system shall be connected to ENPS system through MOS gateway for receiving script data.

2.5 Routing System and Control System

House format of video signal should be HD-SDI embedded Audio. Routing system in BTV shall be multi-format system supporting 3Gbps-SDI, AES/EBU and MADI Digital audio in addition to HD-SDI embedded audio. Function of embedded / de-embedded should also be equipped.

Video signal format converter should be equipped to convert various kinds of video signal formats from satellite for receiving to system.

Transmission media which is handled by routing system should be not only conventional coaxial cable but also optical fibre.

Control system of Routing and playout should be an integrated system with automatic playout function by play list. Operation terminal of control system should be equipped in the control room of each sub system. Conventional control panel for routing switcher are also needed for emergency case.

Multi-Viewer system is desired for Video Monitoring. This system can reduce cost and expand flexibility of system design.

Monitoring system for observing conditions and statuses of equipment is highly recommended. Simple Network Management Protocol (SNMP) protocol which is commonly used all over the world in system monitoring is recommended.

Chapter 3 Procedure of Replacement

3.1 Procedure for Changing Over

Most of the items need to be replaced for HD upgrading except Studio 3 which has been upgraded to HD. Replacements in two phases are proposed in order to keep continuing the broadcasting services.
Brief overview of replacement is follows:

1st Phase: Playout system, Control System and Routing System
2nd Phase: Studio System (News and Production), Server System

Concrete plan for changing over is the installation of new playout system in media conversion room in advance after removal of existing equipment in 1st phase.
New playout system has to work with new playout server and control system. After starting to playout, existing system can be removed. After removal of existing master control room, the space can be used for expansion of rack room as central apparatus room.
Even though video signal format is SD, Program production system in BTV is a large system which is file based with an integrated control system and automatic playout system. This is an integrated system with complex communication of Video signal, network for video file transfer and control signal. Establishment of new HD playout system before removal of existing SD system is fundamental to broadcast without interruption. In this plan, new playout system shall be installed in advance in the place of existing media conversion system which is less frequently used. This room has enough space for Master control room and located next to existing master control room. After finishing establishment of new HD playout system and routing system, replacement of each system shall be done one after another.

3.2 Preparation for Changing Over

For keeping space for new master control room, existing Media Conversion Room shall be moved to a temporary room.
After changing over to new HD playout system, all contents shall be transmitted from CiaB playout server. Before changing over to new playout system, most of the contents except live program and program from lines should be playout from the existing SD playout server for the preparation of migration to the new system.

3.3 New Playout System

CiaB is the system without conventional master switcher. Inserting station logo and other video processing on master switcher shall be done inside of CiaB playout server. Transporting picture data e.g. station logo, operation training of inserter from remote control system / local operation terminal should be done in advance.

3.4 Completion of Replacement

After completion of installation of new HD CiaB playout Server, each sub system will be upgraded one after another. The whole system after the completion of HD upgrading is shown in Figure 2.1-1. In order to work properly, the following steps are expected to finish the HD upgrade.

1) Connection of Control / Sync Cables from Master Control Room (MCR)
   MCR composed of Playout system, control system, sync system, and clock system. Control system, sync system and clock system will be connected with signal / Control lines to sub systems after completion of installation of each system. For starting Transmutation from new CiaB playout server, connections of these signals are needed.

2) Routing System and Cable Wiring between Systems
   Routing switcher and room to room connecting cable wiring should be needed for the activation of each sub system.

3) Studio System
   Production studio and News studio should be upgraded one after another.

4) Broadcasting Server System and Editing Terminals
   Concreate detailed changing over plan is needed. With regard to News Server system, it is important to synchronize to the replacement of ENPS system.

5) MAM System
   This is an additional function to the existing system. After recovering usual operation, it will start to operate including archive.

Chapter 4 Schedule for Procurement of HD equipment

4.1 Procurement Cycle for Equipment in BTV

Procurement of equipment is executed on the flow shown in Figure 4.1-1. Procurement of HD upgrading has been planned in two financial years in 2016 and 2017. In addition, direct appointment procurement from DEGA Broadcast Systems which was taking care of the existing SD equipment in BTV has been planned because of an actual performance about installation, service and maintenance.

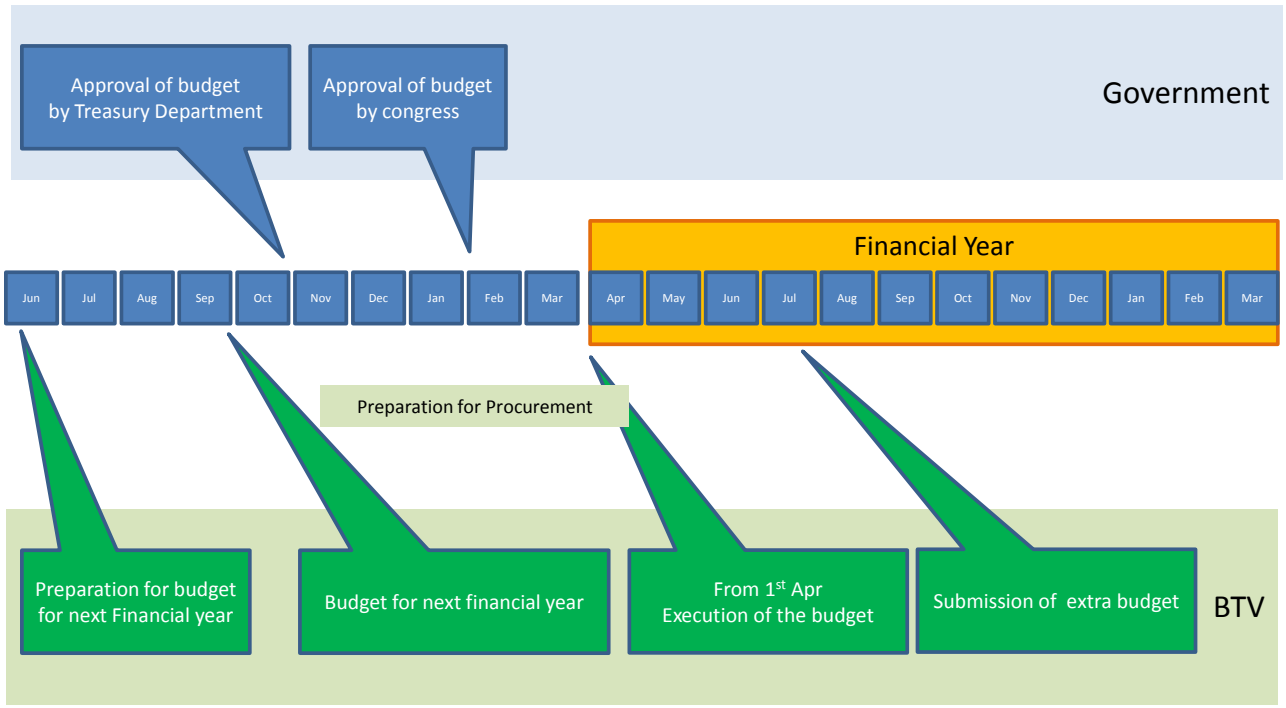

Figure 4.1-1 Procurement Cycle in Botswana

4.2 Master schedule for procurement

Implementation for HD upgrading is planned in FY2016 and 2017 as shown Figure 4.2-1 bellow.

Implementation of new HD playout system in advance will make it possible to broadcast without interruption. Furthermore, concreate plan for updating each sub system should be shared across program production staff and on the other hand Operation plan of program production should also be prepared to avoiding confusion.

New playout system will be CiaB system. Most of the contents except live program and program from lines shall be played out from CiaB playout Server. If some contents are still played out from VTR in the existing SD system, that operation should be changed to full server playout operation with the existing SD server for the preparation of migration to the new system. CiaB is the system without conventional master switcher. Insertion of the station logo and other video processing on master switcher shall be done inside of CiaB playout server. Transporting picture data e.g. station logo, operation training of inserter

from remote control system / local operation terminal should be done in advance.

It is important for the introduction of MAM system to prepare management rule about video contents. BTV has already introduced file based work flow for video production and has enough experience for it. On the other hand, MAM system is a new one which is the system for effective re-use of video contents. In order to promote effective utilization of the system at an early date, it is indispensable to prepare management rules of video contents in advance.

Archiving for video contents in existing system is shelf archive with magnetic tapes. For design of developed archive system, archive policy and system specification for the system e.g. size of archive system, management plan for video archive, work flow for archiving / retrieving should be studied in advance. Video archive system will keep important video contents with the history of Botswana in the future.

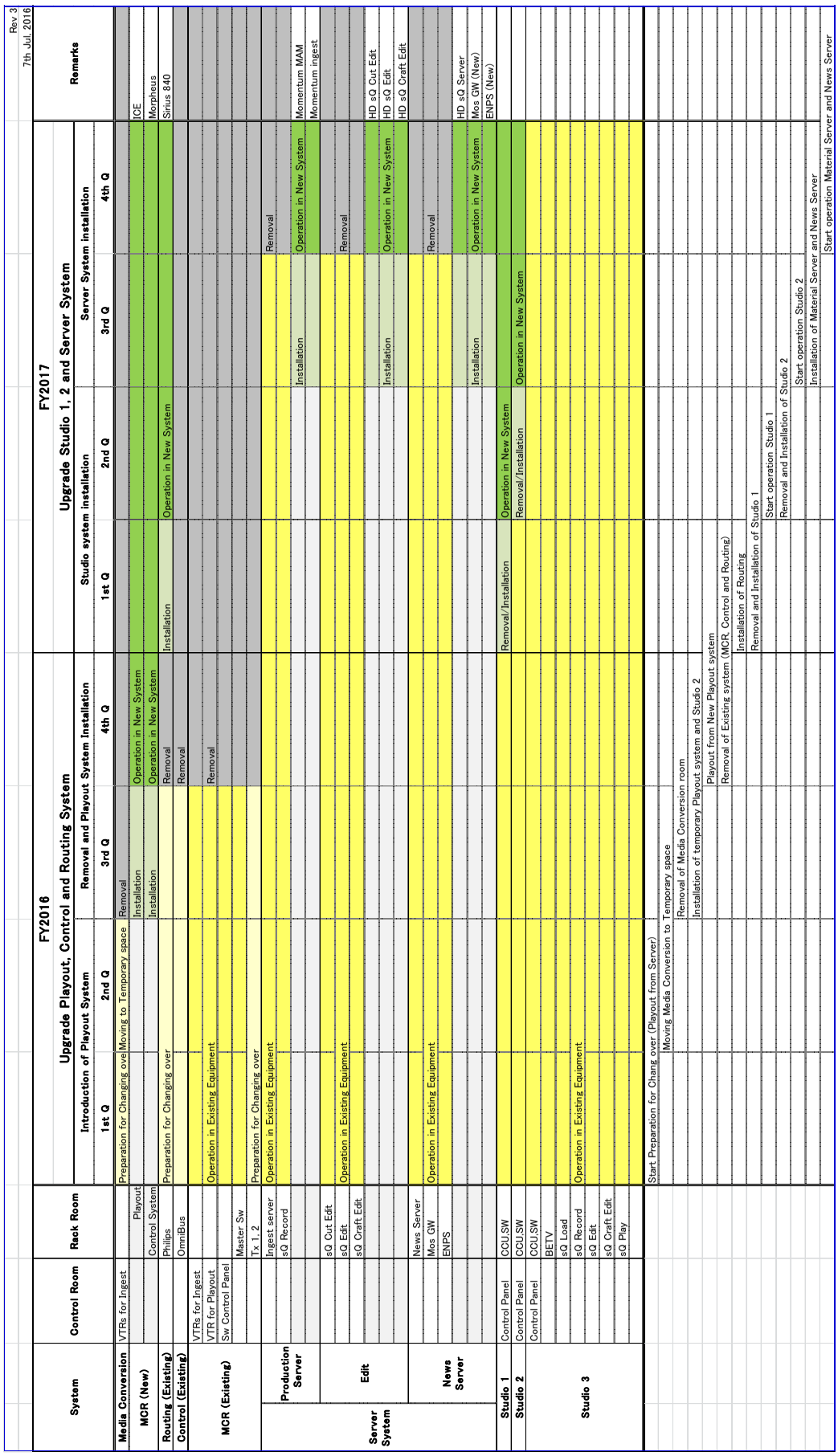

Figure 4.2-1 Change Over Schedule

Chapter 5 Budget for the Procurement of HD Equipment

5.1 Budget Estimation for Procurement

Based on following Bill of Quantity on Table 5.3-1, rough estimation of the total amount of HD upgrading budget is about 10mil USD. Breakdown of the estimation is shown on table 5.1-1. Amount of money for the procurement depends on the grade of equipment to be chosen. The values on the Table are one of rough estimation based on the case of the past.
For bringing the same work flow as existing system with HD format into reality, Items prioritized 'A' are necessary. MAM system and Archive system are additional systems with prioritized 'B'. However both of systems are highly recommended to introduce in this plan, because Tape based archive shall be difficult to use in the near future and MAM system has efficiency as gateway to Archive system.

Table 5.1-1 Breakdown of Budget estimation (USD)

System	Hardware (Conventional Equipment)	Software & Hardware (IT Products)	Installation (Including installation materials & operation training)	Sub total	Priority (IT Products)
FY 2016					
1. Master Control Room	910,000	530,000	610,000	2,050,000	**A**
1.1. Control system with Playout Automation	80,000	160,000	160,000	400,000	A
1.2. Playout Server HW and Routing Control IF	180,000	170,000	100,000	450,000	A
1.3. Network system peripherals	50,000	200,000	100,000	350,000	A
1.4. Baseband Video System peripherals	300,000	-	100,000	400,000	A
1.5. Test Signal Generator	30,000	-	15,000	45,000	A
1.6. Sync Signal System	30,000	-	15,000	45,000	A
1.7. Monitor System (A/V)	100,000	-	50,000	150,000	A
1.8. Room to Room Intercom System	30,000	-	15,000	45,000	A
1.9. Master Clock	30,000	-	15,000	45,000	A
1.10. OA Tally System	30,000	-	15,000	45,000	A
1.11. Alarm Monitoring System	50,000	-	25,000	75,000	A
2. Routing system	250,000	360,000	170,000	780,000	**A**
				2,830,000	
FY 2017					
3. Production Studio	2,000,000	-	200,000	2,200,000	**A**
4. News Studio	1,700,000	-	170,000	1,870,000	**A**
5. Server system	840,000	1,120,000	550,000	2,510,000	**A**
5.1. Postproduction Server	210,000	210,000	110,000	530,000	A
5.2. News Production server system	260,000	470,000	220,000	950,000	A

(including ENPS)					
5.3. Graphics and Studio playout server system	320,000	320,000	160,000	800,000	A
5.4. System Management Server	30,000	80,000	40,000	150,000	A
5.5. File I/O interface	20,000	40,000	20,000	80,000	A
6. MAM system	70,000	170,000	200,000	440,000	**B**
6.1. MAM System Software		120,000	200,000	320,000	B
6.2. Interface software for MAM System	20,000	50,000		70,000	B
6.3. MAM System Hardware	50,000			50,000	B
7. Archive system		200,000	150,000	350,000	**B**
7.1. Archive Management Server		140,000			B
7.2. Cataloguing Terminal		20,000			B
7.3. Archiver System Interface		20,000			B
7.4. Media Archiver/Retriever		10,000		7,370,000	B
7.5. Archive Media		10,000			B
Total	5,900,000	2,250,000	2,050,000	10,200,000	

5.2 Budget for Service Contract of IT Based System

In addition to HD upgrading, Service and Maintenance after installation are also very important. BTV has experience of keeping in good conditions both conventional broadcasting system and IT based system more than ten years. Conventional equipment e.g. studio camera and routing switcher which handle base band signal, they need some budget for service and maintenance. It will be almost the same rule as existing equipment.

On the other hand, it is very important and indispensable for safe operation to make service contract with IT system vender. New HD system will be a more IT based system than existing. IT based CiaB system will play a most important role in broadcasting. Most of the system is under IT based control system and connected to each other. Without service contract, even a tiny fault on IT device may cause total system paralysis. Budget for the Service contract for IT based system generally will be approximately 10 percent of system price. HD upgrading plan on Table 5.1-1 includes 2.25milion USD of IT systems. Budget for the service contract will be approximately 225,000USD per year. The first year after installation will be covered by the warranty period which is included in the system price. The next four years should be covered by Service contract, thus adding up to a total of five years after installation is shown Table 5.2-1.

Table 5.2-1 Service and Maintenance Budget Estimation (USD)

Service contract for IT System	225,000	per year (10% of IT system)
	900,000	(4 years) (1year after handing over is included in system price)

5.3 Bill of Quantity for Budget Estimation

Bill of quantity for rough budget estimation about HD upgrade is shown on table 5.3-1

Table 5.3-1 Bill of Quantity for Rough Budget Estimation

	Description	Q'té		Remarks
1	**Master Control Room**	1	lot	
1.1	Integrated Control system with Playout Automation System	1	lot	
(1)	System control and Playout Automation Software	1	lot	Morpheus Playout Automation - Software
(2)	Device Control Software	1	lot	Morpheus Media Control - Software
(3)	Control System Hardware	1	lot	Third Party Hardware for Morpheus
1)	Control System Core Hardware	1	lot	
2)	Control System Terminals (Ingest/Control)	1	lot	
3)	BXF Interface	1	set	
(4)	Routing Switcher Control Interface	3	sets	2460 Device control Hardware (Router)
1.2	Playout Server HW and Routing Control IF	1	lot	SAM Hardware (ICE Playout Servers)
(1)	Playout Server	5	sets	CiaB playout server
1)	Logo Generator Function (Software)	1	set	
2)	Time Generator Function (Software)	1	set	
3)	Inserter Function (Software)	1	set	
4)	DVE Function (Software)	1	set	
5)	Downstream key Function (Software)	1	set	
1.3	Network system peripherals	1	Set	
(1)	Layer 3 Network Switch	1	Set	
(2)	Layer 2 Network Switch	1	Lot	
(3)	System management terminal	1	Set	
(4)	Network Printer	1	Set	
1.4	Baseband Video System peripherals	1	set	
(1)	Video Audio MPX	1	lot	
(2)	Video Audio De-MPX	1	lot	
(3)	Flame Synchronizer	1	lot	
(4)	DDA, VJ, Patch cable	1	lot	
(5)	Multi Format Convertor	2	sets	
(6)	System Rack	1	lot	
(7)	Master Console	1	set	
1.5	Test Signal Generator	1	Set	
1.6	Sync Signal System	1	Lot	

	Description	Q'té		Remarks
(1)	Sync Signal Generator	2	sets	
(2)	Auto Change-over Unit	1	set	
(3)	Distribution Amplifier	1	set	
1.7	Monitor System (A/V)	1	lot	
(1)	Large LCD Video Display with multi-viewing interface	3	sets	Multi view interface should have Tally and clock indication function
(2)	Digital Waveform Monitor	1	set	
(3)	Master Video Monitor	1	set	
(4)	Air Monitor (TV set or STB)	1	Set	
(5)	Audio Monitor	1	Set	
(6)	HDD/DVD Recorder for OA recording	2	Sets	
(7)	Monitor Shelf	1	Set	
1.8	Room to Room Intercom System	1	Lot	
(1)	Main Frame (Matrix)	1	Set	
(2)	Terminal Station	1	Lot	
1.9	Master Clock	1	set	
1.10	OA Tally System	1	lot	
(1)	OA Tally Logic	1	set	
(2)	OA Tally Light	1	lot	
1.11	Alarm Monitoring System	1	lot	
(1)	SNMP Alarm Monitoring Server	1	lot	
(2)	Monitoring Terminals	1	lot	
2	HD-SDI Embedded Audio Routing System	1	lot	
2.1	HD-SDI Embedded Audio Router	1	lot	Sirius 840 (576 x 576 Frame)
(1)	Router frame	1	sets	
(2)	Input board	1	sets	
(3)	Matrix Board	1	sets	
(4)	Output Board	1	sets	
2.2	Control Panels	1	lot	
(1)	Hard ware control panels	6	sets	H/W Control Panels
(2)	Router control system	1	sets	S/W Control Panels
1)	Control software	1	set	
2)	Control terminals	1	set	
3	Production Studio System	1	lot	
3.1	Digital Camera System	1	lot	
(1)	HD Studio Camera Set	5	sets	
1)	HD Studio Camera	1	set	
2)	Camera Adaptor	1	set	

	Description	Q'té		Remarks
3)	View Finder	1	set	
4)	Tripod Attachment	1	set	
(2)	21x Zoom Lens (with Focus and Zoom Remote)	5	sets	
(3)	Camera Control Unit (with Remote Control Panel and Cable)	5	sets	
(4)	Pedestal (with Head, Pan Bar, Script Holder)	5	sets	
(5)	Camera Cable	5	sets	
1)	CCU to Camera CN Plate (Studio)	1	set	
2)	Camera CN Plate to Camera	1	set	
(6)	Camera CN Plate (for Studio)	1	set	
(7)	Test Chart Set (Gain/Resolution with Stand)	1	set	
3.2	Digital Video System	1	lot	
(1)	Digital Production Switcher with Video Effector (2D,3D)	1	set	
(2)	Video Audio MPX	1	set	
(3)	Video Audio De-MPX	1	lot	
(4)	DDA, VJ, Patch cable	1	lot	
(5)	System Rack	1	lot	
(6)	Console	1	lot	
3.3	Character Generator System	1	lot	
(1)	Character Generator	1	set	
(2)	Color Video Monitor with HD-SDI interface	1	set	
(3)	Multi-scan Display with DVI interface	1	set	
(4)	Take Switch Panel	1	set	
3.4	Digital Audio System	1	lot	
(1)	Audio Mixer	1	set	
(2)	Analog to Digital Converter	1	lot	
(3)	Digital to Analog Converter	1	lot	
(4)	Compact Disk Recorder (CD-RW)	2	sets	
(5)	Audio Monitor Speaker Panel	1	set	
(6)	Audio Effector (Delay/Effect)	1	set	
(7)	Telephone Hybrid (2ch)	1	set	
(8)	Effector Wagon	1	set	
(9)	ADA, DDA, AJ, Patch cable	1	lot	
(10)	Rack	1	lot	
(11)	Operating Table for Mixer	1	lot	
3.5	Microphone	1	lot	

	Description	Q'té		Remarks
(1)	Microphone	1	lot	
1)	Lavaliere Microphone	4	sets	
2)	Dynamic Microphone	4	sets	
3)	Condenser Microphone (for Music, Vocal)	8	sets	
(2)	Microphone Stand	1	lot	
1)	Boom Stand	8	sets	
2)	Floor Stand	8	sets	
3)	Table Stand	4	sets	
(3)	Microphone Cable	1	lot	
1)	Mic Cable:20m	10	sets	
2)	Mic Cable:10m	10	sets	
3)	Mic Cable:5m	10	sets	
4)	8 pairs Mic Multi Cable: 25m (with CN Box)	1	set	
(4)	Microphone Connector Plate	1	lot	
3.6	Sync System	1	lot	
(1)	Video Sync Signal Generator	1	set	
(2)	Video Sync Signal Distributor	1	set	
(3)	Word Sync Signal Generator	1	set	
(4)	Word Sync Signal Distributor	1	set	
3.7	Monitoring System (A/V)	1	lot	
(1)	Video Monitor Selector	1	lot	
1)	Video Monitor Routing Switcher	1	set	
2)	Select Panel for VE	1	set	
3)	Select Panel for Studio Monitor	1	set	
4)	Select Panel for LD	1	set	
(2)	Large LCD Video Display with multi-viewing interface	3	sets	Multi view interface should have Tally and clock indication function
(3)	Studio Floor Monitor (with Stand)	2	sets	
(4)	Digital Waveform Monitor	1	set	
(5)	Audio Monitor Speaker/Amp. for Mixer (Stereo, with Stand)	1	set	
(6)	Audio Monitor Speaker for VE & DR (Stereo)	1	set	
(7)	Audition Monitor Speaker (Stereo)	1	set	
(8)	Studio Audio Monitor Speaker/Amp (Stereo)	1	set	
(9)	Studio Talk back Speaker	1	set	
(10)	Studio Fold back Speaker/Amp	2	sets	
(11)	Master Video Monitor	1	set	
(12)	Air Monitor	1	set	

	Description	Q'té		Remarks
(13)	Monitor Shelf	1	set	
(14)	A/V Monitor CN Panel	1	lot	
(15)	Stereo Headphone	1	set	
3.8	Intercom System	1	lot	
(1)	Main Station (with Microphone)	1	set	
(2)	CCU Interface	1	set	
(3)	Belt Pack	2	sets	
(4)	Head Set CN panel with VR (for Ass DR, VE, CG, LD)	4	sets	
(5)	Head Set	8	sets	
(6)	Earphone for Talent	4	sets	
(7)	Studio Talk-back Speaker with Amp.	1	set	
(8)	Studio Intercom CN Panel	1	set	
3.9	On-Air Light and Tally System	1	lot	
(1)	OA Tally Logic	1	set	
(2)	OA Tally Light for Floor and Entrance	1	lot	
4	News Studio System	1	lot	
4.1	Digital Camera System	1	lot	
(1)	HD Studio Camera Set	3	sets	
1)	HD Studio Camera	1	set	
2)	Camera Adaptor	1	set	
3)	View Finder	1	set	
4)	Tripod Attachment	1	set	
(2)	17x Zoom Lens (with Focus Remote and Zoom Remote)	3	sets	
(3)	Camera Control Unit (with Remote Control Panel and Cable)	3	sets	
(4)	Pedestal (with Head, Pan Bar and Script Holder)	1	set	
(5)	Pedestal (for Prompter Camera with Head, Pan Bar and Script Holder)	2	set	
(6)	Prompter System	2	sets	
1)	Prompter	1	set	
2)	Script Camera	1	set	
3)	PC for Script	1	set	
4)	14x Zoom Lenz (with Remote Zoom Control)	1	set	
5)	Camera Adapter	1	set	
(7)	Camera Cable (each comprising the	3	sets	

	Description	Q'té		Remarks
	followings)			
1)	CCU to Camera CN Plate (Studio)	1	set	
2)	Camera CN Plate to Camera	1	set	
(8)	Camera CN Plate (for Studio)	1	set	
(9)	Test Chart Set (Gain/Resolution with Stand)	1	set	
4.2	Digital Recording System	1	lot	
(1)	Local Storage Server	4	sets	
(2)	Video Monitor	2	sets	
(3)	Audio Monitor Speaker (Rack Mount Type)	1	set	
(4)	Remote Control Unit (with Cable)	4	sets	
4.3	Character Generator System	1	lot	
(1)	Character Generator	1	set	
(2)	Color Video Monitor with HD-SDI interface	1	set	
(3)	Multi-scan Display with DVI interface	1	set	
(4)	Take Switch Panel	1	set	
4.4	Digital Audio System	1	lot	
(1)	Audio Mixer (with Backup Power Supply)	1	set	
(2)	Analog to Digital Converter	1	lot	
(3)	Digital to Analog Converter	1	lot	
(4)	Compact Disk Recorder (CD-RW)	1	set	
(5)	Audio Monitor Speaker Panel	1	set	
(6)	Audio Effector (Delay/Effect)	1	set	
(7)	Telephone Hybrid (2ch)	1	set	
(8)	Effector Wagon	1	set	
(9)	ADA, DDA, AJ, Patch cable	1	lot	
(10)	Rack	1	lot	
(11)	Operating Console for Mixer	1	lot	
4.5	Microphone	1	lot	
(1)	Microphone	1	lot	
1)	Lavaliere Microphone	4	sets	
2)	Dynamic Microphone	4	sets	
3)	Condenser Microphone (for Music, Vocal)	3	sets	
(2)	Microphone Stand	1	lot	
1)	Boom Stand (small)	2	sets	
2)	Floor Stand	4	sets	
3)	Table Stand	4	sets	
(3)	Microphone Cable	1	lot	
1)	Mic Cable:10m	10	sets	

	Description	Q'té		Remarks
2)	Mic Cable:5m	10	sets	
(4)	Microphone Connector Plate	1	lot	
4.6	ANN Cough Equipment	1	lot	
4.7	Sync System	1	lot	
(1)	Video Sync Signal Generator	1	set	
(2)	Video Sync Signal Distributor	1	set	
(3)	Word Sync Signal Generator	1	set	
(4)	Word Sync Signal Distributor	1	set	
4.8	Monitoring System (A/V)	1	lot	
(1)	Video Monitor Selector	1	lot	
1)	Video Monitor Routing Switcher	1	set	
2)	Select Panel for VE	1	set	
3)	Select Panel for Studio Monitor	1	set	
(2)	Video Monitor for News Desk	2	sets	
(3)	Large LCD Video Display with multi-viewing interface	3	sets	Multi view interface should have Tally and clock indication function
(4)	Studio Floor Monitor (with Stand)	2	sets	
(5)	Digital Waveform Monitor	1	set	
(6)	Audio Monitor Speaker/Amp. for Mixer (Stereo, with Stand)	1	set	
(7)	Audition Monitor Speaker (Stereo)	1	set	
(8)	Studio Audio Monitor Speaker/Amp (Stereo)	1	set	
(9)	Studio Talk back Speaker	1	set	
(10)	Master Video Monitor	1	set	
(11)	Air Monitor	1	set	
(12)	Monitor Shelf	1	set	
(13)	A/V Monitor CN Panel	1	lot	
(14)	Stereo Headphone	1	set	
4.9	Intercom System	1	lot	
(1)	Main Station (with Microphone)	1	set	
(2)	CCU Interface	1	set	
(3)	Belt Pack	2	sets	
(4)	Head Set CN panel with VR (for Ass DR, VE, CG,)	3	sets	
(5)	Head Set	8	sets	
(6)	Earphone for Talent	4	sets	
(7)	Studio Talk-back Speaker with Amp.	1	set	
(8)	Studio Intercom CN Panel	1	set	

	Description	Q'té		Remarks
4.10	On-Air Light and Tally System	1	lot	
(1)	OA Tally Logic	1	set	
(2)	OA Tally Light for Floor and Entrance	1	Lot	
5	Post Production Server / News Production Server System	1	lot	
5.1	Postproduction Server	1	lot	
(1)	Post production Server	1	sets	
(2)	Ingest terminal for SDI ingest	2	sets	HD-SDI encoder Device
(3)	Ingest terminal for File ingest	2	sets	
(4)	Editing terminal for Cut edit	2	set	
(5)	Editing terminal for NLE	3	sets	
(6)	Editing terminal for Craft edit	3	sets	
5.2	News Production server system	1	lot	
(1)	News production Server	1	Sets	
(2)	Ingest terminal for SDI ingest	2	Sets	HD-SDI encoder Device
(3)	Ingest terminal for File ingest	3	Sets	
(4)	Editing terminal for Cut edit	20	Set	
(5)	Editing terminal for NLE	10	Sets	
(6)	Viewer terminal for News production	2	Sets	
(7)	MOS Gateway	1	Set	
(8)	ENPS system update	1	Lot	
5.3	Graphics and Studio playout server system	1	Lot	
(1)	Graphics and Studio playout server	2	Set	
(2)	Ingest terminal for SDI ingest	3	Sets	HD-SDI encoder Device One set for each Studio
(3)	Editing terminal for Graphics	3	Sets	One set for each Studio
(4)	Preview terminal	3	Set	One set for each Studio
(5)	Playout control terminal	3	Sets	One set for each Studio
5.4	System Management Server	1	Lot	
(1)	System Database	1	Lot	
(2)	Management terminals	1	Lot	
(3)	Remote management terminals	1	Lot	
5.5	File I/O interface	1	Lot	
(1)	File I/O management system	1	Lot	
(2)	Control terminals	1	Lot	
6	Media Asset Management (MAM) System	1	lot	
6.1	MAM System Software	1	lot	Momentum - Core License Packages

	Description	Q'té		Remarks
6.2	Interface software for MAM System	1	lot	Momentum - License Options
(1)	Archive interface	4	sets	Momentum Archive Controller -
(2)	BXF Interface	2	sets	Momentum BXF Interface -
(3)	Transcoder	2	sets	Momentum Workflow Manager Transcode driver. 1-3 devices
6.3	MAM System Hardware	1	lot	
(1)	MAM Core system Hardware	1	sets	Momentum Hardware Core Packages
(2)	MAM Clients terminals	1	lot	
1)	Ingest Terminals	4	sets	
2)	Cataloging Terminals	2	sets	
3)	Picture Quality Control Terminals	2	sets	
4)	Editing Terminals	20	sets	
5)	Transcode Terminals	2	sets	
7	Archive System	1	lots	
7.1	Archive Management Server	1	Lot	
(1)	Archive Management Software	1	Set	
(2)	Archive Management Hardware	1	Set	
7.2	Cataloging Terminal	1	Lot	
(1)	Client terminal	1	Set	
(2)	Archive system Clients software	1	Set	
7.3	Archiver System Interface	1	Lot	
7.3	Media Archiver/Retriever	1	set	
7.4	Archive Media	1	Lot	

5.4 Description of each system (Key Specifications)

1) Master Control Room

This system aims to upgrade the current SD based Playout system to HD. This system consist of control system, CiaB playout server, Network system peripherals, Baseband Video System peripherals, Room to Room Intercom System, Master Clock, etc. Number of playout channels are four i.e. BTV1, BTV2, Youth and Parliament. And N+1 redundant server for four channels will be prepared. CiaB playout server does not only playout stored programs but also has added functions such as logo insertion, mix/effect and many more. Programs from the studios and from OB VAN shall be transmitted through CiaB server.

Control system:

Function:

Playout control (automatic playout with playlist)

N+1 Redundant Server control
Routing System control
Device control
System monitoring

Playout system:
- System: Channel in a Box (CiaB) system
- Number of playout channels: 4
- Redundant system: N+1 system
- CiaB Playout Server:
  - Storage capacity: 200 hours or more @ AVCi 100Mbps
  - Number of input: 4 or more (HD-SDI embedded Audio)
  - Number of output: 4 or more (HD-SDI embedded Audio)

2) HD-SDI Embedded Audio Routing System

This system aims to upgrade the current SD based separate audio routing system to HD. The system adopts HD-SDI embedded audio signal (SMPTE 292M) as the House format of BTV. Routing switcher should handle HD-SDI embedded audio signal and equipped function of embedded / de-embedded of Digital Video and audio signals.

Routing switcher:
- Input / Output Signal: HD-SDI embedded audio signal (SMPTE 292M)
- Size of matrix: 128 x 128 or more
- Function: embedded / de-embedded

Video Monitoring system: Multiview system

3) Production Studio System

This system aims to upgrade the current SD based program production Studio System (Studio 2) to HD. The system adopts five units of studio camera and its signal interface format between the equipment shall be the uncompressed serial digital signal (HD-SDI).
The audio system should be digital system supported by AES/EBU format. The sampling rate of the audio signal should be 48 kHz.

Digital Camera System:
- Studio camera:
  - Image sensor: 3-chips type
  - S/N ratio: more than 56dB
- Zoom lens: 21 times (or more).

Digital Production Switcher:
- Input / Output Signal: HD-SDI
- Number of Input: 27 or more

Number of M/E 3 or more
Digital Audio System:
Number of faders: 32 or more
Sampling rate: 48 kHz

4) News Studio System

This system aims to upgrade the current SD based News Studio System (Studio 1) to HD. The system adopts three units of studio camera and its signal interface format between the equipment should be the uncompressed serial digital signal (HD-SDI). Two of them have prompter systems which are connected to ENPS system through MOS Gateway.
The audio system should also be a digital system supported by AES/EBU format. The sampling rate of the audio signal shall be 48 kHz.

Digital Camera System:
Studio camera:
Image sensor: 3-chips type
S/N ratio: more than56dB
Zoom lens: 21 times (or more).
Digital Production Switcher:
Input / Output Signal: HD-SDI
Number of Input: 19 or more
Number of M/E 2 or more
Digital Audio System:
Number of faders: 24 or more
Sampling rate: 48kHz

5) Post Production Server / News Production Server System

This system aims to upgrade the current SD based Server Systems. The system consists of Post Production Server, News Production Server and Studio & Graphics Playout System.

Post production Server system:
Post production Server:
Storage capacity: 600 hours @ AVCi 100Mbps
Number of input: 4 or more (HD-SDI embedded Audio)
Number of output: 4 or more (HD-SDI embedded Audio)
Number of Ingest device:
Baseband ingest: 2 or more
File ingest: 2 or more
Number of editing terminals:
Cut edit: 2

Standard edit: 3
Craft edit: 3

News production Server system:

News production Server:

Storage capacity: 600 hours @ AVCi 100Mbps
Number of input: 4 or more (HD-SDI embedded Audio)
Number of output: 4 or more (HD-SDI embedded Audio)

Number of Ingest device:

Baseband ingest: 2 or more
File ingest: 3 or more

Number of editing terminals:

Cut edit: 20
Standard edit: 10

Interface: MOS Gateway for ENPS System

Studio & Graphics Playout System:

Number of Servers: 2 for three studios
Number of terminals: 6 (2 terminals for each studios)
Number of Ingest device: 3 Baseband ingest (one for each Studio)

Studio & Graphics Playout Server:

Storage capacity: 200 hours @ AVCi 100Mbps
Number of input: 2 or more (HD-SDI embedded Audio)
Number of output: 4 or more (HD-SDI embedded Audio)

6) Media Asset Management (MAM) System

This system aims to promote effective re-use of video contents. File based program production work flow has already been introduced to BTV. MAM system can provide additional value to video contents on the work flow. MAM system will work as gateway to the archive system.

Media Asset Management (MAM) System:

Functions:

Metadata entry / Revision
Proxy file playback
Contents reversion

User interface:

Cataloguing terminals
HTML5 based browser

Support device:

Post production server system
News Production server system

CiaB playout system

Interface:

Broadcast Exchange Format (BXF) interface

Archive system interface

7) Archive System

This system aims to improve current Archive with magnetic tapes in the shelves. The archive system consists of Archive management server, Cataloguing terminal, Archive system interface, media archiver/retriever and archive media. This system adopts LTO tapes for archive media.

Archive System:

Storage Media: LTO-5 or following

User interface:

Cataloguing terminals

HTML5 based browser

Interface: MAM system which is mentioned on above 6)

Chapter 6 Recommendation

6.1 Executing Procurement Procedure

HD program production system is vital to broadcast HD program. Direct appointment for procurement is already in process on the master schedule for two years; 2016 and 2017. Delay of this procedure will affect the schedule and time of completion of HD program production system. It is desirable to execute procurement procedure with a view to whole master schedule for the future.

6.2 Service and Maintenance

Daily Service and maintenance is important for continuing to broadcast stably.

Some existing equipment e.g. VTRs which need periodical replacement of worn parts will be used in new HD program production system. This equipment need periodical service and maintenance as it has always been in the past in BTV.

New system consists of equipment with no moving parts which requires periodical replacement like VTR. Redundant system gives high reliability to stable playout. Checking of Alarm monitoring system and the status indicator in each equipment is recommended for daily maintenance.

6.3 Dust Free Circumstances

Broadcast equipment need dust free circumstance. BTV has been keeping dust free condition in room for equipment. This initiative should be maintained even after implementation of HD program production system.

Equipment has air circulation fan for cooling. Filters at the air intake side of the equipment need a periodical cleaning for good cooling efficiency.

6.4 Preparation for Next Renewal / Overhaul of IT System

IT based systems are controlled by a software on the IT Hardware. The software can be updated under the service contract. On the other hand, Cycle of generation change of IT hardware is generally shorter than conventional broadcasting equipment, and if there is big generation gap on IT hardware, it may cause difficulty to update. Sometimes partial replacement of IT system may be difficult. Generally IT systems are more likely to have a shorter period of service contract as compared conventional equipment. Life time of IT based system should be taken into account; the next renovation or replacement should be done before the out of service contract.

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