CHAPTER 3 Contents of the Project

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3-1 Objectives

The Government of Zimbabwe considers TV broadcasting as a medium indispensable for national development and for enhancement of the people's living standard.

However, the greater part of the existing transmitters (for TV-1 broadcasts) at the TV transmitting stations in the nation's major cities were set up during the 1960s and up to 1980. As a result, because of superannuation, their functions have suffered and the deterioration in effectiveness has caused the downgrading of transmitting output which, in turn, has led to the shrinkage of the broadcast service area. Moreover, there has been a trend toward a gradual increase in the frequency of suspensions of broadcasting service caused by deterioration in the function of component parts. The current condition in Zimbabwe, therefore, is that TV broadcasting is prevented from playing its role in full owing to a number of reasons, such as the uncertainty of normal operation and services in broadcasting due to the inadequacy of facilities as outlined above.

Especially with regard to the Harare Station, the improvement of installations is urgently requested, in view of its being an important station charge of the metropolitan broadcasting service.

Furthermore, the Harare Station is at present the only station broadcasting TV-2 (educational broadcasting), but the equipment it is currently using for TV-2 is the transmitter which had originally been intended for installation at a small local station (the Matopos Station; 1kW, manufactured in 1976 in West Germany). That transmitter also is in a superannuated condition similar to the equipment used for TV-1.

The Government of Zimbabwe maintains the policy of strengthening the foundation of national development by promoting education and human resources development and enhancing the people's living standard through the broadcasting of school-broadcast programmes, adult-education programmes and cultural programmes. So, in line with this policy, there is the need to rectify the inadequacy in facilities as mentioned above for TV-2 as well.

In short, the objective of the Project is to renew the broadcasting facilities for TV-1 and TV-2 in order to resolve the problems caused by the inadequacy of the existing facilities at the Harare Station.

3-2 Study and Examination of the Request

3-2-1 Examination of the Necessity and Appropriateness of the Project

The Government of Zimbabwe realizes the importance of the roles to be played by TV broadcasting as a means of achieving the objectives of the Five-Year National Development Plan which is currently being pushed ahead. Hence, the Government gives high priority to this Project among the various policies it is implementing.

The Harare Station's existing transmitting facilities consist of TV-1 (for general programmes) and TV-2 (for educational programmes). In the Project, the renewal of these transmitting facilities is to be the object of examination. In examining the appropriateness of the requested plans, it is necessary to consider the following factors.

(1) That the transmitting output of both TV-1 and TV-2 have dropped due to superannuation of equipment and that, with the progressive shrinkage of service area, the number of breakdowns has also been increasing.
That, due to such reasons as that some of the spare parts are no longer manufactured, the maximum service life of either of the two transmitters would only be about 4-5 years even if good maintenance were to be kept up by the ZBC in the coming years.

(2) TV-2 not only supplements school education but is extremely useful for the education of children and adults through the system of communal viewing of TV (see Note 1) at the growth-points.
As mentioned in 2-2-2 (1), the shortage of teachers (see Table 2-2-2) has increasingly been posing a grave problem. Under these circumstances, the school-broadcast programmes of TV-2 would supplement the contents of essons taught in the classrooms and would be of great significance in alleviating the teacher shortage. Besides, through the interactive effects of the classes given by teachers and the educational programmes viewed in classrooms, significant effects can be expected.

As a result of the renewal of transmitter for TV-2, the educational programmes on the TV-2 will come to be offered extensively and equitably

to the suburbs of Harare city as well. Moreover, the renewal of TV-2 facilities is expected to have the wide-ranging effect of spreading to the areas surrounding Harare effective use of educational programmes at schools as well as at the community TV viewing centres as at the 12 locations in Harare which are run with equipment (see Note 2) supplied from overseas.

On the other hand, general TV (TV-1) also has already become indispensable for the people's lives as a means of supplying information on health, hygiene, entertainment and government notices. The knowledge to be obtained from the large volume of information and great variety of programmes provided by TV broadcasts fully responds to the people's basic human needs (BHN) and contributes considerably to education and human resources development. And this, in turn, leads to the vitalization of residents and local communities and the enhancement of living standards and development of each district.

From the above, it is considered that simultaneous renewal of equipment for both TV-1 and TV-2 desirable.

[Note 1] Common TV Viewing Centre: Planned to be set up at 28 growth-points in Harare city. At present, such a centre is already in operation at 12 locations.

[Note 2] In 1987, a total of 300 TV sets were supplied by Yugoslavia. These receivers are currently in use at Community TV Viewing Centres at 12 locations in Harare city, as a part of the plan to set up 28 such centres in that city. Some of those receivers have reportedly been installed at schools.

3-2-2 Examination of Execution and Operation Plans

As regards the assignment of staff after implementation of this Project, it is considered that there will be no need to increase the number of staff members who are to be directly concerned with the Project. The reasons are that this Project involves only the renewal of the existing facilities and therefore, after the Project is implemented, it will be quite possible to operate the renewed facilities with the present scale of work force.

On the other hand, regarding operational expenses, with Zimbabwe having overcome its economic slump in 1986 and 87, the financial condition of the ZBC has been improving and its deficits decreasing, as can be seen from Table 2-1-5. Furthermore, along with the expansion of the broadcast service area, an increase is expected in the ZBC's revenues from licence fees and it is expected that the government subsidy to supplement deficits will also decrease accordingly.

3-2-3 Relations to Similar Projects or Other Aid Projects

The Japanese government on August 16, 1989 concluded an E/N with the Government of Zimbabwe to provide the latter with the sum of 39 million yen in cultural grant aid for use by the ZBC in purchasing equipment for the production of TV programmes.

The equipment to be provided consists of:

1. News-gathering system
   (hand-held camera, video monitor, etc.) 2 sets
2. Editing system
   (VTR for in-studio editing, video monitor, etc.) 1 set
3. Lighting equipment 1 set

The work to install these systems is scheduled for either April or May in 1990.

The above-mentioned systems consist of equipment for outside coverage including news-gathering activities and equipment for use in editing the programme materials thus gathered. By newly setting up a consistent system covering the entire process from material-gathering to editing, reinforcement can be achieved of outside TV coverage activities (coping effectively with the ever-diversifying contents of materials gathered and reinforcing a system capable of coping in a timely fashion with the occurrence of any news event) and the ZBC's readiness to handle any emergency.

As for the editing equipment, its efficient operation can be counted on, since it is of a system that is capable of dealing effectively with the editing of independently-produced programmes as well.

3-2-4 Elements of the Plan

This Project is composed of two services, viz., TV-1 (CH.5, General TV) and the TV-2 (CH.8, Educational TV). (See Fig. 2-1-5; Layout of Existing Equipment.) The outputs from TV-1 and TV-2 transmitters are combined with the 2-channel combiner and the combined output is then fed to the antenna via the feeder cable.

As mentioned in CHAPTER 2-1-3 (3) above, there is a wide gap between TV-1 and TV-2 in their service areas because of the difference between the two in the output of their transmitters. Both of the two transmitters have become superannuated and the ZBC is anxious about the routine operation of these transmitters in the future. Moreover, as for TV-2, because of the small output of its transmitter, it has been impossible to obtain good picture quality for this channel in the suburbs of Harare. Hence, in the suburban area, too, there is the need of expanding the service area in order to ensure effective used of educational programmes in schools and to develop conditions for the setting up of community viewing centres.

3-2-5 Examination of the Requested Facilities and Equipment

The equipment and facilities that are to be supplied through grant-aid cooperation at the Harare Station are as follows:

1. Transmitter Systems
   VHF 5kW Transmitter (including stand-by transmitter, dummy load and accessories.)
2. Programme Input Equipment
3. Measuring Equipment
4. Feeder Cable for Transmitting Antenna
5. Stand-by Power Source Facility
6. Spare Parts
7. Materials and Equipment for Construction Work

The outline of the main facilities and equipment are as follows:

(1) VHF 5kW Transmitter System (including dummy load, accessories and a stand-by transmitter)

1) TV-1 . . . . . 1 set

- Channel: 5 (174-181MHz)
- Transmitting Power: visual/aural (5kW/0.5kW)
- Complete Existing/Stand-by, switcher System
  : 5kW Transmitter × 2
- Composition of the Transmitter: All Solid-state type

2) TV-2 . . . . . 1 set

- Channel: 8 (195-202MHz)

Other items are the same as for TV-1.

3) Channel Combiner . . . . . 1 set

This is equipment to combine the transmitting outputs of CH.5 and CH.8 and feed the signals out to the antenna in order to make common use of the antenna.

4) Dummy load . . . . . 2 sets

For use in testing the transmitters

5) Existing/Stand-by Transmitters Switcher . . . . . 2 sets

Switching can be done either automatically or manually.

(2) Programme Input Equipment (P.I.E.) . . . . . 2 sets

1) Monitoring of video/audio quality of pictures of transmitter input and output.

2) The equipment has such functions as distribution of video signals and restriction of audio modulation degree.

3) It is capable of simple characteristic measurement of video and audio in the course of day-to-day maintenance.

4) A hum-canceler which has the function of lowering or eliminating the power-source noise (hum) overlapping the input video signal is added.

5) Since a new transmitter building is to be constructed in a location separated from the existing transmitter building, programme transmission cables are necessary between the existing and the new transmitter building.

(3) Measuring Equipment . . . . . 1 set

Securing of radio waves of good quality is impossible without measuring equipment that fits the transmitting equipment.
In this Project, the measuring equipment will be allocated in the necessary types and quantities.

(4) Feeder for Transmitting Antennas . . . . . 1 set

1) In accordance with the increase in transmitting output, the feeders will be changed to copper-corrugated cables with their size increased from the 1-5/8" (39D) in current use to 3-1/8" (77D),so as to achieve improvement in power capacity and a decease in transmission loss.

2) In connection with 1) above, the junction box and the branch cables connected to the junction box will be replaced with those of the air-filling type. The transmitting antenna system is shown in Fig. 4-4-7.

(5) Stand-by Power Source . . . . . 1 set

A power generator run with a 450kVA diesel engine will be installed so that, in the event of stoppage of service of the city power source, power may be fed to all of the TV facilities and studios at the Harare Station.

(6) Spare Parts . . . . . 1 set

Since the supplying of spare parts takes time, measures will be taken so that the spare parts for those portions without a redundancy system may, in particular, be allocated in as large a quantity as possible.

(7) Materials and Equipment for Construction Work . . . . . 1 set

3-3 Outline of the Project

As a result of the examination made on the content of the request as outlined in the previous section and also based on the outcome of the consultations held with the Zimbabwean side, the basic design shall be conducted with regard to the transmitting equipment for the Harare Station, with the following items specified as the objects of this Project.

The main items of equipment are as follows:

(1) Transmitter System . . . . . 2 sets
VHF 5kW Transmitters
(including stand-by transmitter, dummy load and accessories)

(2) Programme Input Equipment . . . . . 2 sets

(3) Measuring Equipment . . . . . 1 set

(4) Feeder Cables for Transmitting Antenna . . . . . 1 set

(5) Stand-by Power Source Facilities . . . . . 1 set

(6) Spare Parts . . . . . 1 set

(7) Materials and Equipment for Construction Work . . . . . 1 set

The transmitter system for TV-1 and TV-2 is shown in Fig.4-4-4.
The transmitters and exciters are shown in Fig.4-4-5 and Fig.4-4-6.

3-3-1 Implementing Organization

The implementing organization for this Project is the ZBC which is under the jurisdiction of the Ministry of Information, Posts and Communications. The organization, etc., of the ZBC are as explained in CHAPTER 2.

3-3-2 Management Plan and Staff Plan

The Project shall be confined to the increase in output and renewal of transmitters, stand-by power source facilities and antenna feeder systems. As for the management, operation and maintenance of the technical facilities, the methods adopted heretofore may be continued to be used.

Consequently, there shall be no change in such aspects as the work system and number of staff members.

3-3-3 Outline of the Facilities

As given in 3-3 above.

3-3-4 Locations and Conditions of the Places where Transmitting Equipment is to be Installed

The outline of the new transmitter building and the engine generator building in which transmitting equipment is to be installed under the Project is as follows (Refer to Fig. 4-4-1); the construction of these buildings is to be undertaken by the ZBC side at its expense and is due to be completed within eight months after the conclusion of the E/N.

(1) Transmitter Building

As shown in Fig. 4-4-8, the new transmitter building will be constructed near the present transmitter building. The scheduled area of the site is about 125m². Because the construction site is located on a slightly inclined piece of land and also because such lines as programme transmission cables and earthing lines already exist there, it is necessary to be very careful when the ground is levelled for construction of the new building.

(2) Engine Generator Building

As shown in Fig. 4-4-9, the new engine generator building will be constructed adjacent to the new transmitter building. The scheduled area of the site is about 45m². In selecting the site, the possibility of noise causing trouble to the studios and the neighbouring residential areas was considered. The selection was

also made in such a way as to avoid a location right below the stay of the tower.

3-3-5 Maintenance and Management Plans

(1) Operation, Maintenance and Management System

The operation, maintenance and management of the facilities after the implementation of the Project will be undertaken by the Technical Department of the ZBC. It is considered that the ZBC staff will be fully capable of operating and maintaining the facilities after their installation, making effective use of the knowledge and experience they will have gained through practical training during the period of installation of the equipment. Besides, through their participation in training courses conducted overseas, the ZBC staff have already gained a certain level of knowledge about the installations which are to replace the existing superannuated ones.

(2) Operation, Maintenance and Management Expenses

The new annual expenses that will become necessary as a result of implementation of this Project are estimated at 106,000 ZD (about 6,780,000 yen). The breakdown of these expenses is as follows:

- Additional power charges resulting from the increase in output of the transmitters:
  15kW × 10 h/day × 365 days × 1.91 ZD/kWh = 105,000 ZD/year

- Fuel charges for the engine generator as a stand-by power source:
  (30ℓ/per check-up × 52 weeks + 200ℓ × twice/year)
  × 0.63ZD/ℓ = 1,200ZD/year

As to the annual expenses needed for maintenance, which would depend on the conditions of use of the equipment, the environment and other factors, there is the need to estimate them at about 1% of the total value of the broadcasting facilities, in view of experiences with similar projects in the past and experiences in Japan.

However, the expenses actually required for the maintenance of the existing superannuated a quipment are more than the above-mentioned new

equipment maintenance figure and there seems to be no need of increasing the budget for maintenance as a result of implementation of this Project.

CHAPTER 4 Basic Design

CHAPTER 4 Basic Design

In conducting the present basic design, the study team consulted with Deputy Director-General O.O. Chekeche of the ZBC which is under the jurisdiction of the Ministry of Information, Posts and Communications. As a result of these consultations, it has been agreed that the present grant-aid cooperation shall be confined to the transmitting facilities at the Harare Station.

4-1 Design Policy

Based on the results of the recent basic design survey, this Project will be carried on under the following basic policies, taking into account the importance of TV broadcasting for the benefit of the society, the necessity of installing broadcasting facilities that are highly reliable, and the ZBC's desire to ensure that the new system to be established at the Harare Transmitting Station will become the model for the transmitting systems to be adopted by the ZBC in the future.

(1) In the design of the facilities, sufficient consideration will be given to ensuring that the system to be established is one that conforms to the actual conditions of the ZBC's operation and that the system is easy to operate and economical in operation, maintenance and management. Due consideration will also be given to ensuring that the system to be established is one that can easily cope with future expansion and the introduction of new technologies. Particularly, in view of the frequent occurrence of thunderbolts, consideration will be given to the adoption of a switching system by which the equipment in use can be switched to a stand-by unit in case of emergency.

(2) The specifications of the equipment shall be in conformity with the CCIR's technical standards and sufficient consideration will be given to their durability, electrical and mechanical stability and safety. Special consideration will be given to the reliability, operatability and economy of the equipment.

The allocation of spare parts will be made in a rational manner so as to ensure efficiency of maintenance and management of the equipment.

(3) In order to ensure that the objectives of the Project are attained in a most rational and efficient manner, careful examination will be made of the Project from various angles and, at the same time, an appropriate level will be set for the Project as one that is being carried out under the Japanese government's grand aid programme.

4-2 Basic Design of Transmission Facilities

4-2-1 Transmitting Facilities

The existing transmitters for TV-1 (CH.5) and TV-2 (CH.8) are currently operated with a transmission output of under 2kW and about 700W, respectively. As for TV-1, because the amplification unit of the transmitter was assembled by the ZBC itself, its overall reliability is rather low. On the other hand, as for TV-2, the output is so small that it has not been able to obtain a satisfactory broadcasting service area.

In order to adequately cover the city of Harare, in which a remarkable concentration of population is in progress, and its neighbouring areas, and also to broadcast stable signals of good quality, it is necessary to renew the transmitters and increase their output. For this reason, the designing of installations has been done as follows:

(1) Considering the interference and disturbance of radio waves with the neighbouring countries and adjacent stations, it has been judged that a transmission output of 5kW will be appropriate. (When offsetting is done to improve the Ratio of wanted-signal/unwanted-signal, the level of 32-40dB should be satisfied.)

(2) As for the transmitter, a two-set system comprising an existing in-use transmitter and a stand-by will be adopted. This is a system that, in the case of failure of the transmitter in use, enables the station to maintain the broadcast by switching to the stand-by transmitter and to repair the failed equipment while the transmission is still going on. See Fig. 4-4-4.

(3) As for the equipment, an all solid-state type using semiconductors will be adopted so as to enhance reliability and, at the same time, make it a system that is easy to maintain and manage.

(4) The existing transmitter building is used in common with four radio (FM) transmitters and so there is no space to accommodate the two-system TV transmitters and their accessories to be installed under this Project. For that reason, a transmitter building will be newly constructed by the Zimbabwean side. In order to prevent dust, high temperatures and vibrations, all of which are external factors

causing degradation of the reliability of equipment, anti-dust and anti-vibration measures will be taken for the new building which will also be equipped with air conditioning and other facilities. In other words, every effort will be made to improve the environment in which the transmitters are to be installed.

There is, on the other hand, a plan to expand the transmitter room in current use. However, this would require the construction work of moving the various additional facilities (such as transformers, fans, air-duct, programme transmission cables) which are in current use. If such factors as the high rate of occurrence of accidents during the construction work and the required matching of the newly-installed portion with the existing portions of the facilities were considered, it would be more advantageous to newly construct an independent transmitter building than to expand the existing one.

4-2-2 Programme Input Equipment

(1) Signal Input Equipment

a) Function

- Monitoring of quality of the TV input signals.
- Dividing of the visual input signal.
- Restriction of over-modulation of the audio signal.

b) Contents of the equipment

- Jack panel of the visual and audio signal.
- De-modulator of the visual and audio signal.
- Divider of the visual and audio signal.
- Limiter of the audio amplitude.

All the units mentioned above will be accommodated in a single rack. And by adding such measuring equipment as an AMSBA (AM Side-Band Analyzer) and waveform monitor, the signal input equipment will have the function of measuring performance in addition to the monitoring function.

(2) Device to Improve Noise (power-source hum) Level of transmission-line equipment. The project team, in order to solve the current problem

relating to the phenomenon of power-source noise, has brought up the question of imbalance of power-source load and has requested the ZBC to investigate the problem and to improve the present conditions. Every effort will be made to solve this problem by installing a hum canceler in addition to taking measures to balance the load.

(3) Along with the construction of a new transmitter building, it is necessary to change the programme-transmission cable routes between the station and the studios.
Because of the tight schedule of use for broadcasts, the changing of the routes of the existing cables is extremely difficult and there is every technical danger of disrupting operations. So, in this Project, a new cable will be laid. The cable to be adopted will be of specifications that protect the TV signals from electromagnetic induction from outside which causes power-source noise. By using such a cable along with the device mentioned in (2) above, measures will be taken to cope with power-source noise.

4-2-3 Antenna Equipment

The high-frequency power of the output of the transmitters for TV-1 and TV-2, 5kW each, will be fed to the existing antenna through a 2-channel combiner.

A 3-1/8" feeder cable will be adopted in place of the 1-5/8" feeder cable in current use because, with the latter, there is some concern about power capacity when a total of 10kW is simultaneously fed for TV-1 and TV-2. The lowering of transmission loss on the cable is another objective of adopting the 3-1/8" feeder cable. Along with the above mentioned replacement, the 1-5/8" 8-outlet junction box, which is connected with the feeder cable, will also be changed to a 3-1/8" junction box. The feeder cable to be adopted will be of an air-tight type, in which the interior of the cable is filled with dry air by means of a dehydrator. As a result of the adoption of the above-mentioned type of feeder cable, it is expected that rusting inside the cable and moisture infiltration will be prevented and the stabilization of performance and enhancement of reliability of the feeder cable will be achieved.

4-2-4 Power-source Facilities

While in normal circumstances city power will be used to cover the need of the transmitting station, stand-by power source facilities will be installed, including an engine generator with sufficient capacity, to secure the transmission and studio functions even when the power supply from the city power source is suspended.

The above-mentioned facilities consist of a diesel-engine power generator, a battery with a charger for starter use and a fuel tank (about 350 liters). Its capacity shall be 450kVA and the power generated shall be 230V/380V, on a 3-phase, 4-wire system and 50Hz.

The facilities shall be of a system in which starting and stopping can be done either automatically or manually from a control board installed in the generator room.

4-2-5 Spare Parts and Measuring Equipment

(1) Spare Parts

Necessary spare parts shall be allocated so that repairs may be done quickly whenever a failure occurs.

(2) Measuring Equipment

For proper maintenance and management of equipment and facilities, it is essential for a broadcasting organization to allocate the necessary amount of equipment for the measurement of the condition of transmitters and antenna and also for the measurement of field intensity.

4-3 Composition of Transmitting Facilities

As a result of the basic design conducted to determine the most appropriate type of transmitting facilities in accordance with the design policy as mentioned in 4-1 above, it has been concluded that the equipment to be provided under this Project shall be as follows:

4-3-1 List of Equipment to be Provided Under the Project

(1) Transmitter

1)	VHF 5kW Transmitter	CH.5 × 2 sets CH.8 × 2 sets
2)	VHF 5kW Dummy load	CH.5 × 1 set CH.8 × 1 set
3)	VHF 5kW 2-Channel Combiner	1 set
4)	Coaxial Change-over Switch	2 sets
5)	Blower, Air-duct	4 sets
6)	Automatic Voltage Regulator and Distribution Board	2 sets

(2) Programme Input Equipment

1)	Programme Input Equipment (including hum-canceler)	2 sets
2)	Programme Transmission Cable (with spare cable)	2 sets

(3) Measuring Equipment

1)	AM Side-band Analyser	1 set
2)	300MHz Oscilloscope	1 set
3)	Frequency Counter	1 set
4)	TV Pattern Generator	1 set
5)	Measuring Receiver (Field Intensity Meter)	1 set
6)	Wave Monitor	1 set
7)	Audio Distortion Meter	1 set
8)	Digital Volt Meter	1 set
9)	Picture Monitor	1 set
10)	RF Power Meter	1 set
11)	Insulation Resistance Meter (Meger)	1 set

12)	RF Analyser	1 set
13)	Vector Scope	1 set
14)	FM Linear Detector	1 set
15)	Accurate DC-resistance Meter	1 set

(4) Antenna, Feeder Cable

1)	3-1/8" Feeder Cable	Aprox.180m
2)	3-1/8" 8-Outlet Junction Box	1 set
3)	7/8" Branch Cable	8 ea
4)	7/8" 5-Outlet Junction Box	8 sets
5)	Dehydrator	1 set

(5) Stand-by Power Source

1)	Diesel Engine Power Generator	1 set
2)	Control Panel	1 set

(6) Spare Parts

1)	For Transmitters	1 set
2)	For Feeder Cables	1 set
3)	For Stand-by Power Source Facility	1 set

(7) Installation Materials 1 set

4-3-2 Construction Work to be Conducted at the Expense of the Government of Zimbabwe.

(1) Construction of a new transmitter building
(2) Construction of a new engine generator building
(3) Laying of power-supply cable (including programme transmission cable)

4-4 Basic Design Chart

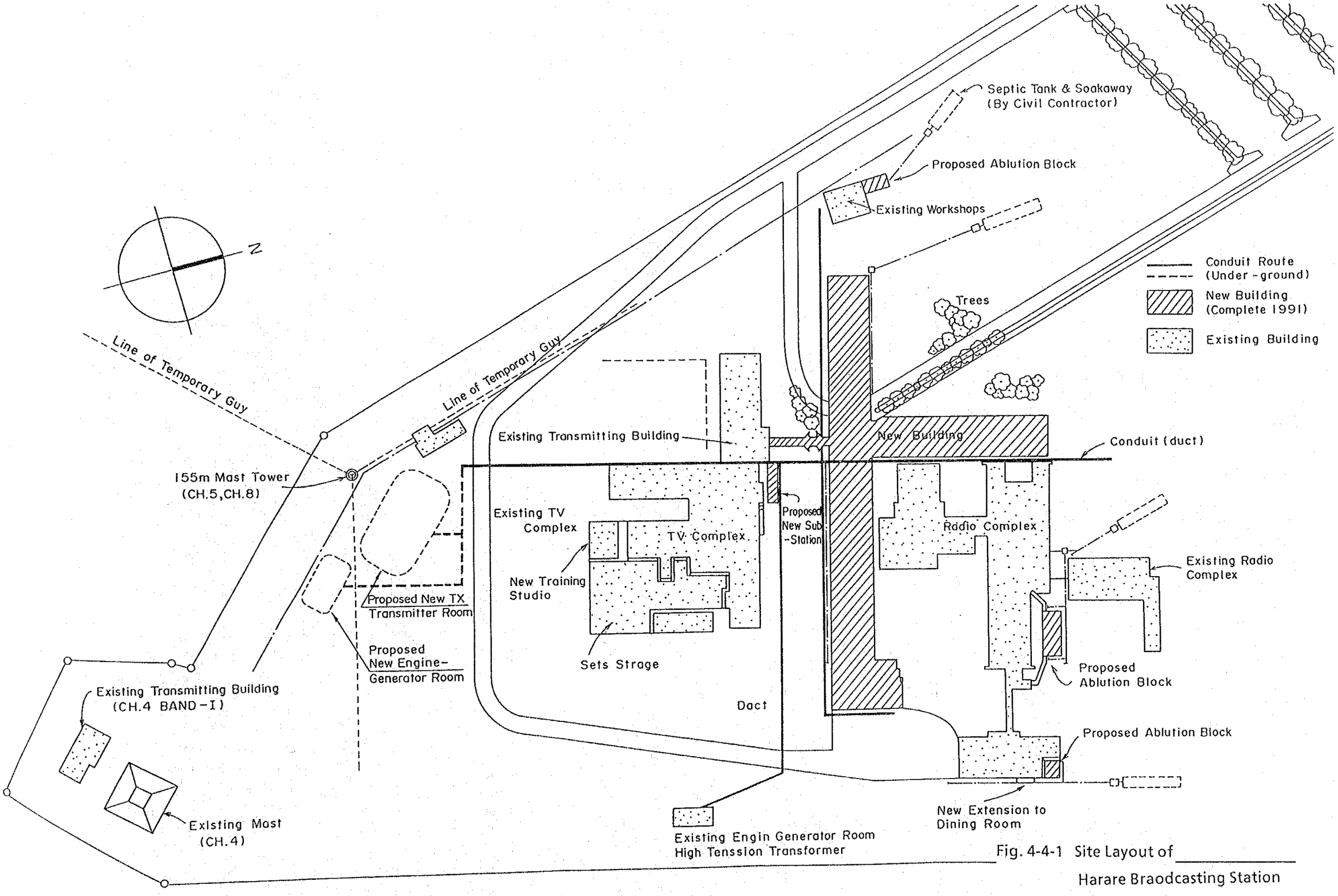
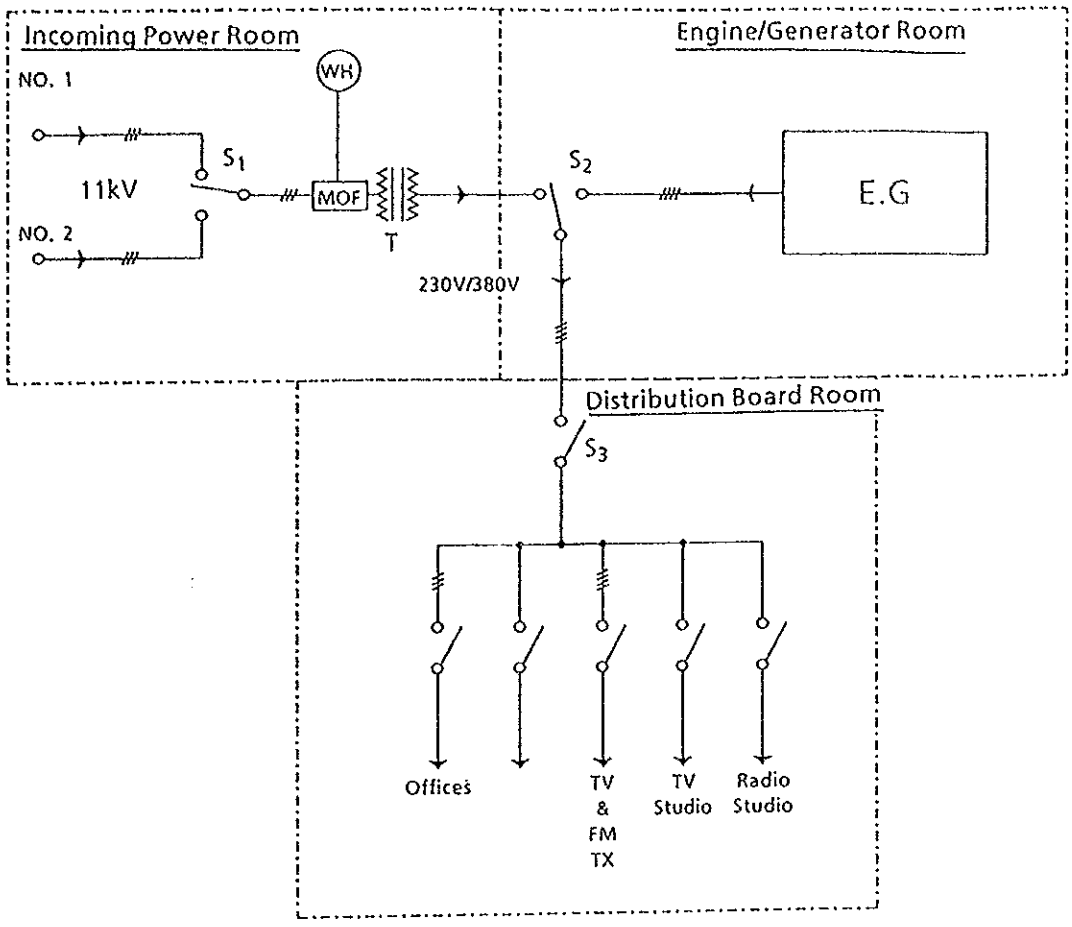


Fig. 4-4-1 Site Layout of Harare Braodcasting Station



Power Distribution System

S_1 : Incoming City Power System (No. 1 / No. 2) Changeover Switch

S_2 : City / Generator Power Changeover Switch

S_3 : Main Switch of Load

T : Incoming Power Transformer (50Hz)
Primary: 11kV, Δ Connection, 3 Phase 3 Wire System
Secondary: 230/380V, 人 Connection, 3 Phase 4 Wire System

E.G : Engine Generator, 50kVA, 50Hz, 230V/380V, 人 Connectio
Manufactured by PETTER, 1962

(WH) : Watt-Hour Meter

MOF : Meter Out-Fit

—///— : 3 Phase 3 wires

—////— : 3 Phase 4 Wires

Fig. 4-4-2 Power Distribution System (1)

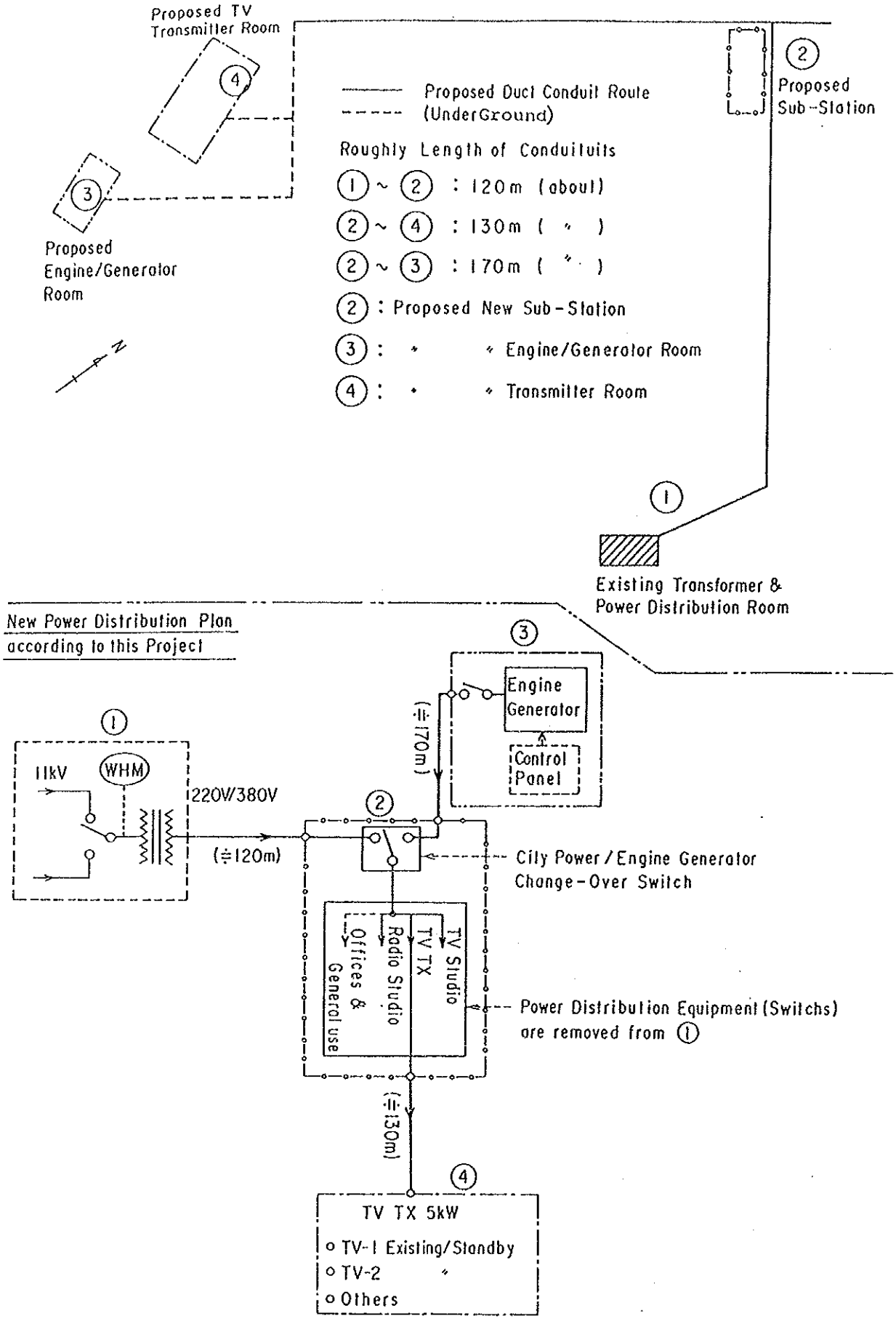


Fig. 4-4-3 Power Distribution System (2)

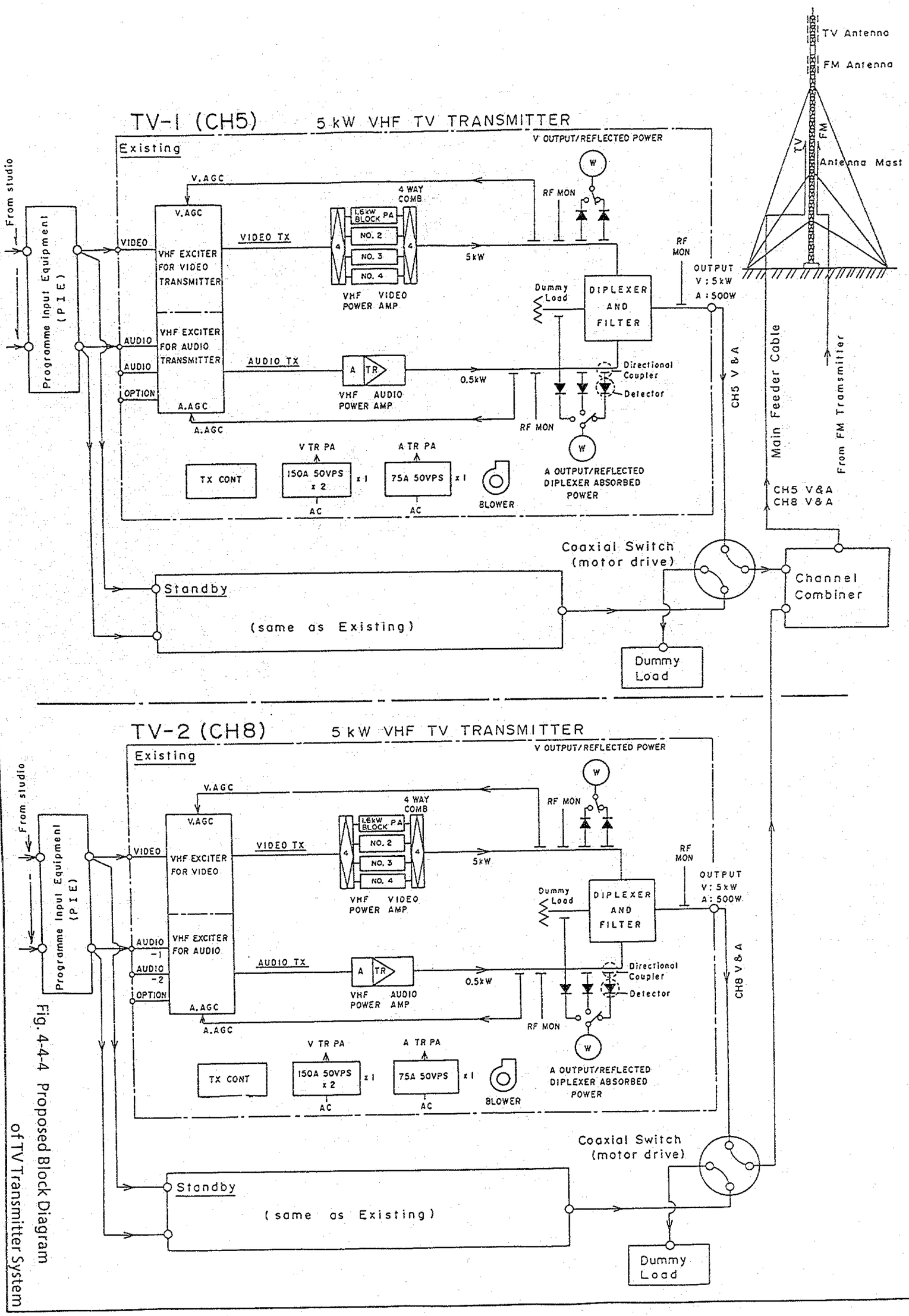


Fig. 4-4-4 Proposed Block Diagram of TV Transmitter System

5 kW VHF TV TRANSMITTER

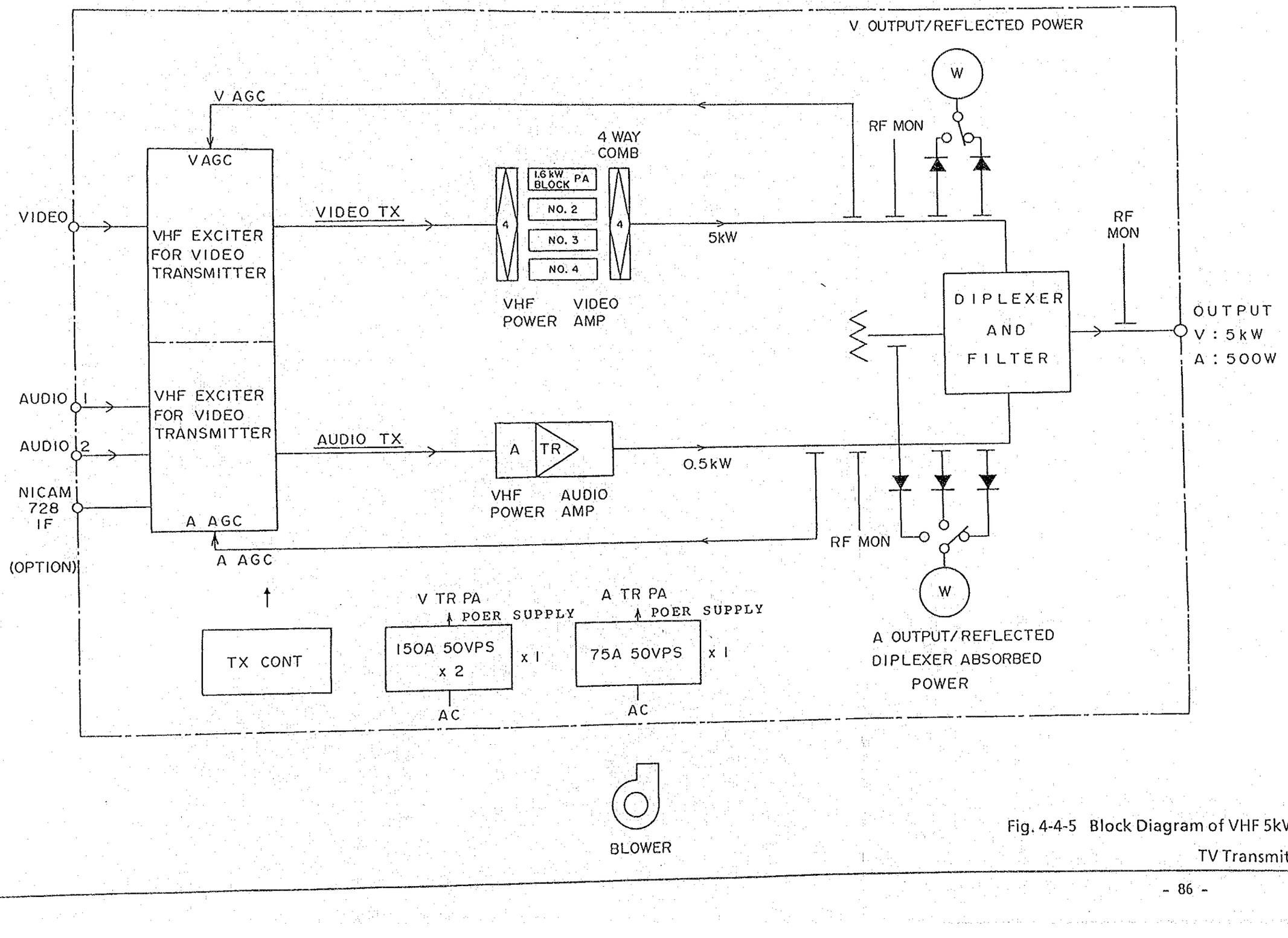


Fig. 4-4-5 Block Diagram of VHF 5kW TV Transmitter

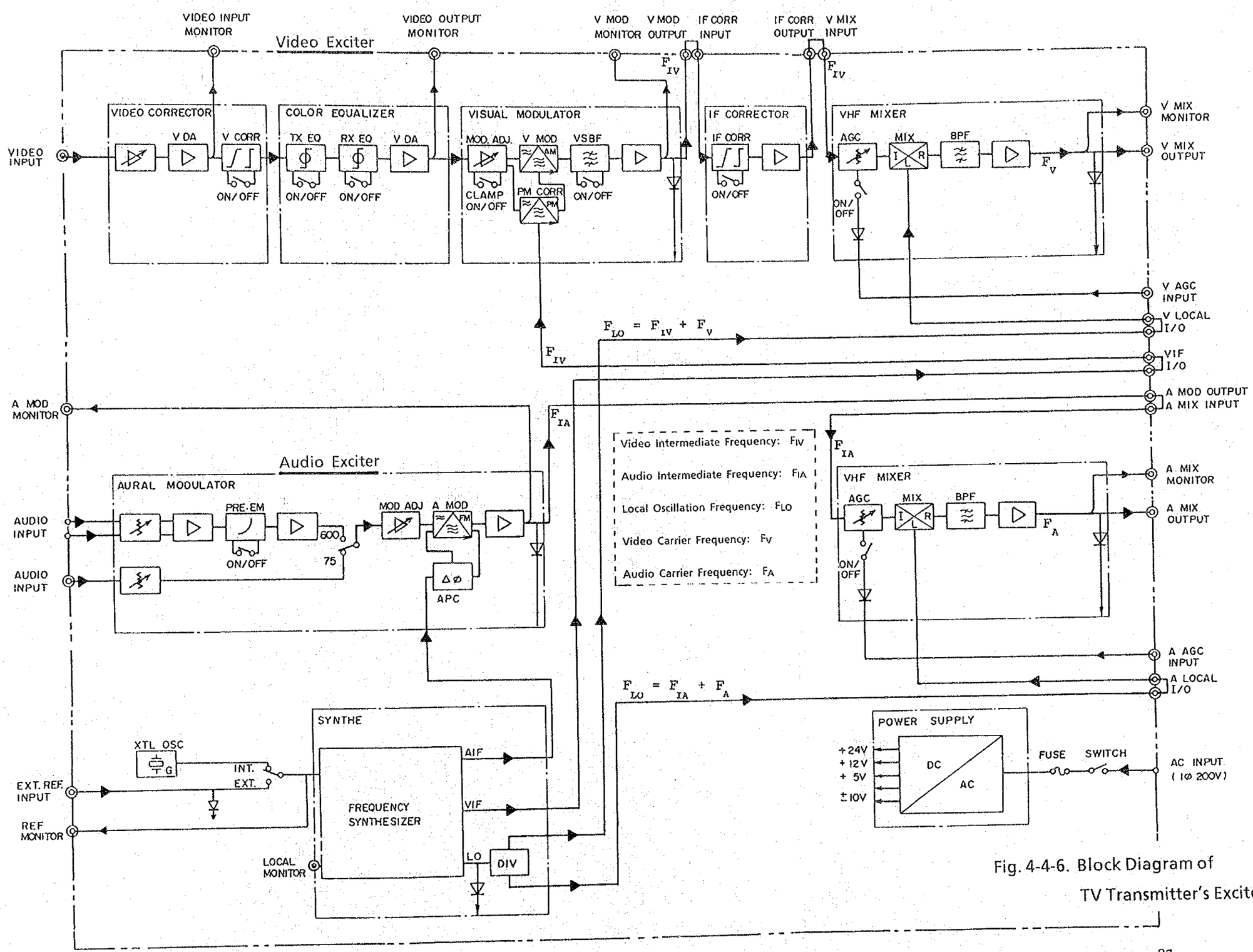


Fig. 4-4-6. Block Diagram of TV Transmitter's Exciter

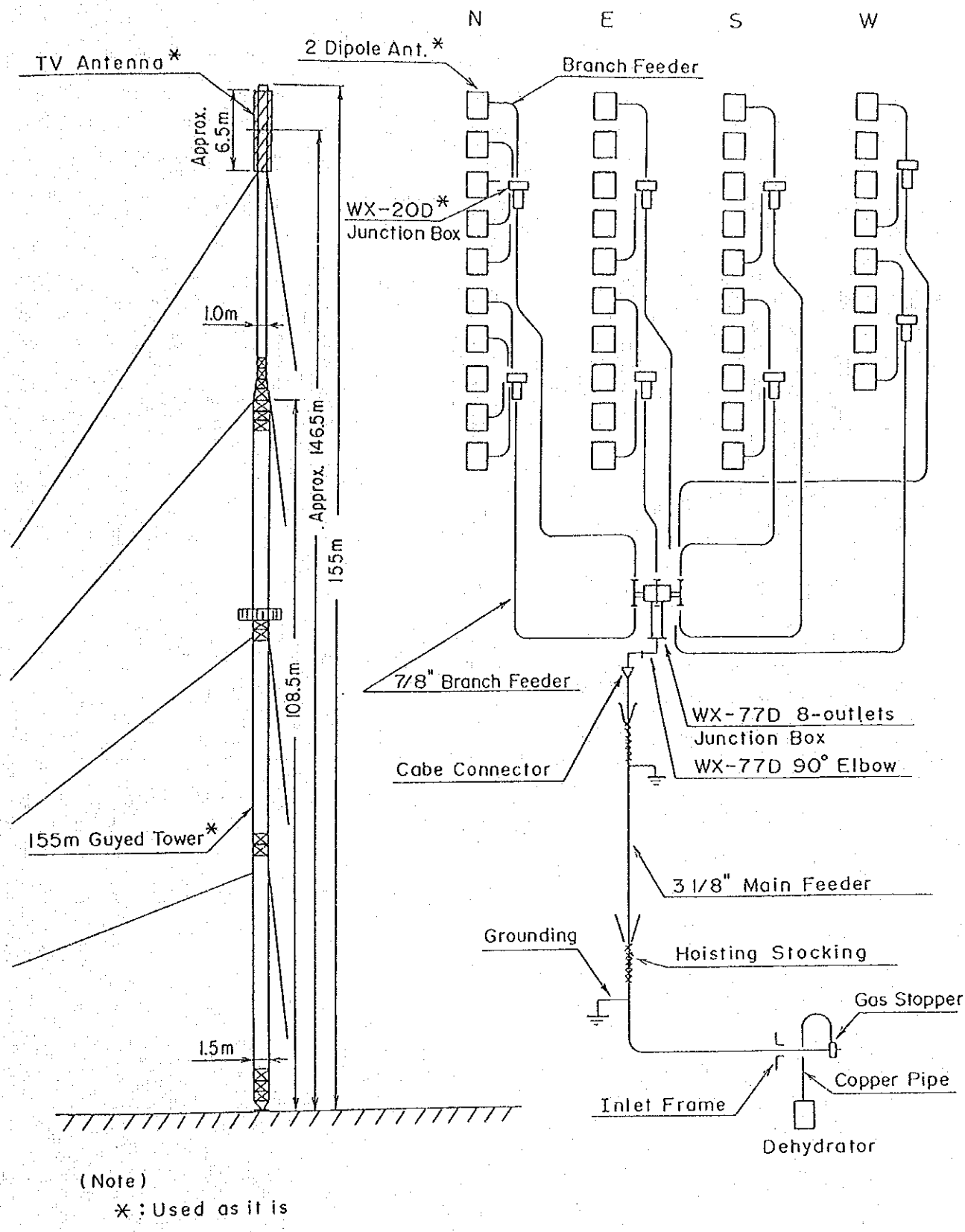


Fig. 4-4-7 Transmitting Antenna System of Harare TV Station

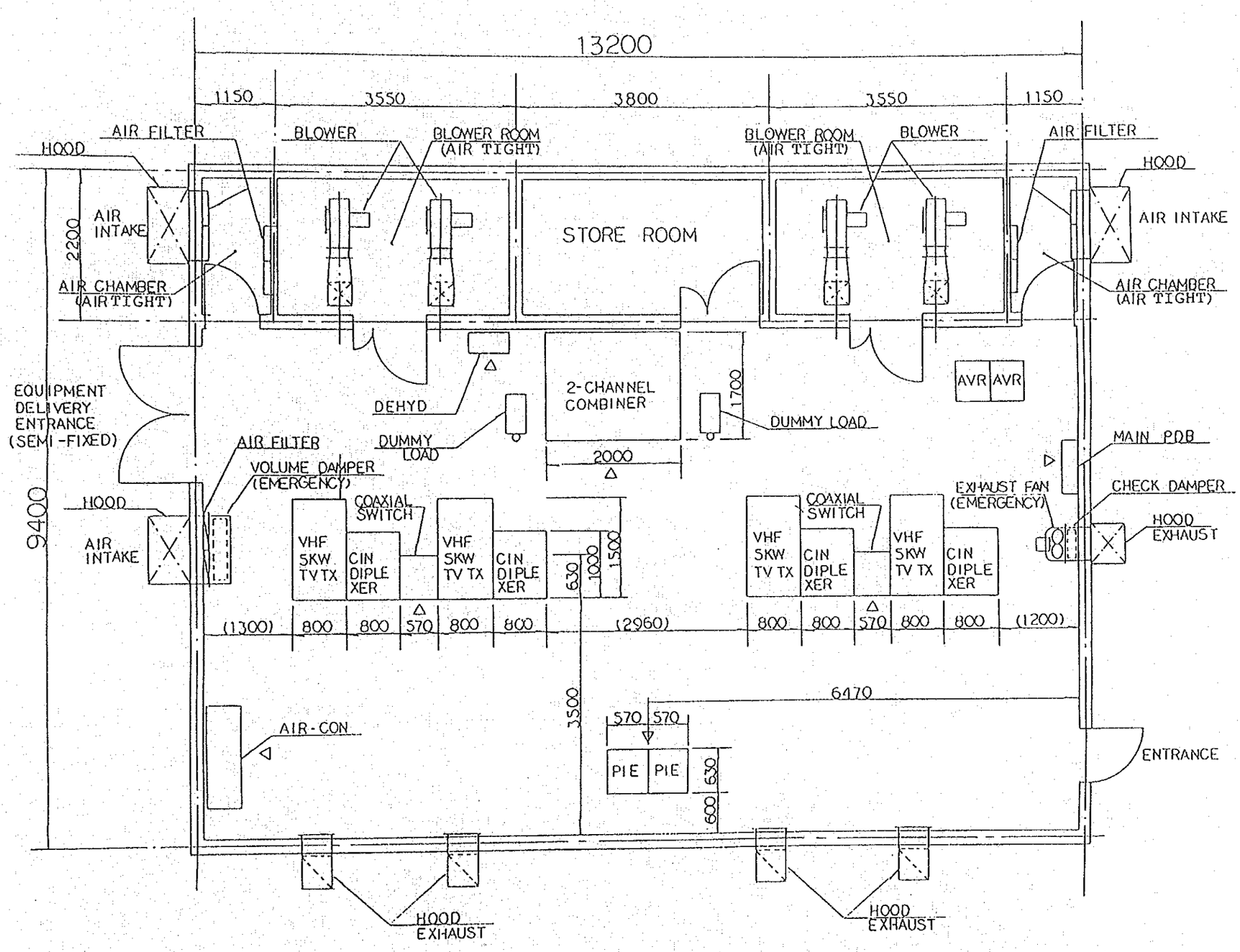


Fig. 4-4-8 Proposed Layout of TV Transmitter Equipment in Transmitter Room

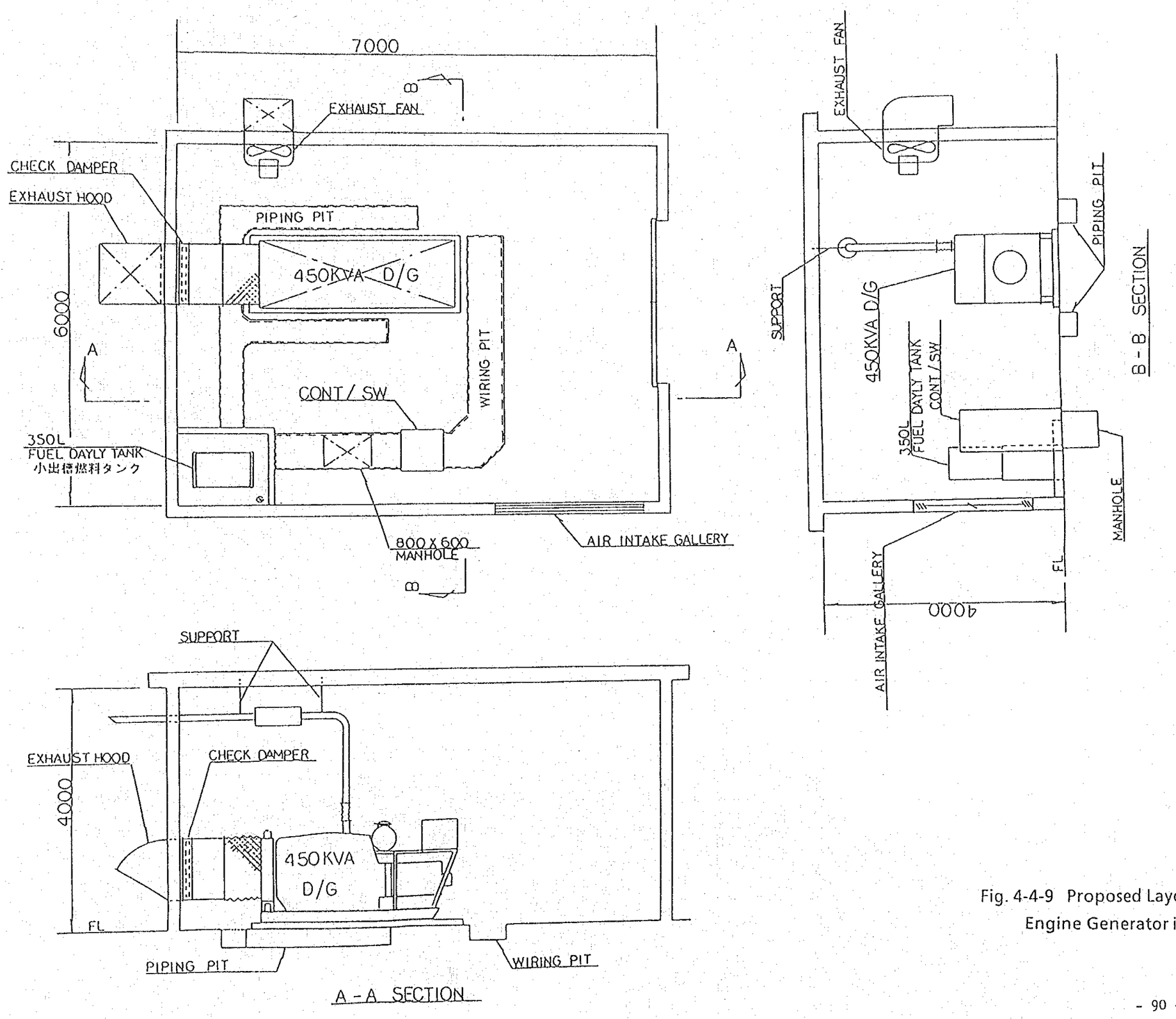


Fig. 4-4-9 Proposed Layout of
Engine Generator in Generator Room

4-5 Construction Plan

4-5-1 Implementing Body

The implementation of this Project shall be undertaken by the Zimbabwean Broadcasting Corporation (ZBC) which is under the jurisdiction of the Ministry of Information, Posts and Communications.

Furthermore, the supervision of the work to install the facilities to be provided under this Project and the operation of the equipment after the implementation of the Project shall be taken charge of by the Engineering Department of the ZBC.

4-5-2 Division of Responsibilities for the Construction Work

The responsibilities for the construction work to be conducted under the Project shall be shared by the two governments as follows:

(1) Responsibilities to be Borne by the Japanese Government.

The responsibilities to be borne by the Japanese government are the providing of consulting services concerning such matters as the detailed design and construction work supervision relating to the Project, the supplying (including transportation) of various items of equipment as listed below, and the conducting of work to install such equipment.

1) VHF 5kW TV Transmitters (including stand-by transmitter, dummy load, accessories)
2) Programme Input Equipment
3) Measuring Equipment
4) Antenna Feeder Cables
5) Stand-by Power Source Facilities
6) Spare Parts
7) Installation Materials

(2) Construction work for which the responsibility shall be borne by the Zimbabwean side.

1) Construction of a new transmitter building.

2) Construction of a new engine generator building

3) Laying of power-supply cable and programme transmission cable(concrete trough to be used).

4) Construction work following the completion of the above-mentioned new buildings, such as water supply and telephones, and the procurement of furniture and utensils.

5) Conducting of procedural work and the payment of expenses required, such as:
   a) Expenses for making necessary bank arrangements.
   b) Expenses for tax-exemption procedures
   c) Necessary procedures to be taken with regard to customs clearance and inland transport.
   d) Taking of necessary tax-exemption procedures concerning import duties, domestic taxes and other financial charges imposed in Zimbabwe on Japanese nationals who are engaged in the implementation of the Project in accordance with the authorized contract.
   e) Provision of conveniences required in connection with the entry into, and stay in, Zimbabwe of the above-mentioned Japanese nationals so as to enable them to carry out their duties relating to the Project.
   f) Maintenance and supervision to ensure appropriate and effective operation of the equipment to be provided under the Project.

6) Others
   Procurement of materials and equipment, and the conducting of construction work to be carried out outside the scope of the present grant-aid cooperation.

4-5-3 Construction Supervision Plan

In this Project, the assembly, adjustment and installation of TV transmitters and the related TV transmitting systems including power-source facilities, all of which require the command of high technologies, will be carried out.

Consequently, in order to complete the construction work smoothly and efficiently within the designated work period, it is necessary to send the right specialist engineers at the right time. In any project, the transportation of materials and equipment is an important factor that affects the length of the construction period. Since the present project involves transportation of especially delicate electronic equipment,special attention needs to be given to the means of transport and the handling of the cargo. Because Zimbabwe is an inland country, sufficient attention should be given also to the fact that all cargo from outside the country needs to be transported through a third country.

For such reasons as them mentioned above, it is essential to select contractors that have considerable experience in the work concerned and, at the same time, to make a thorough study of the construction schedule so that a detailed construction plan may be set up in advance. For that purpose, it is important for the Japanese side to exchange information with the Zimbabwean side and to cooperate so that the construction work may be carried out smoothly as a joint effort.

The consultants will conduct the detailed design, assign appropriate personnel to attend to the supervision of the construction work, and will do their utmost to ensure the smooth progress of the construction work by keeping in close touch not only with the organizations concerned on the Japanese side but also with those on the Zimbabwean side. And also, to prevent the occurrence of troubles or accidents, the consultants will do their utmost to ensure the smooth progress of the work and will, at the same time, offer appropriate guidance and advice in a timely manner once any problem arises in the course of implementation of the Project.

4-5-4 Plans for Procurement of Materials and Equipment

Transmitting equipment and the facilities and installation materials that accompany such equipment will be procured in Japan.

The transmitting equipment and installations will first be assembled in Japan as units or as systems, inspected (at the factory concerned) and transported to Zimbabwe after having been disassembled where necessary. Upon arrival in Zimbabwe, the equipment or systems will be properly installed and adjusted.

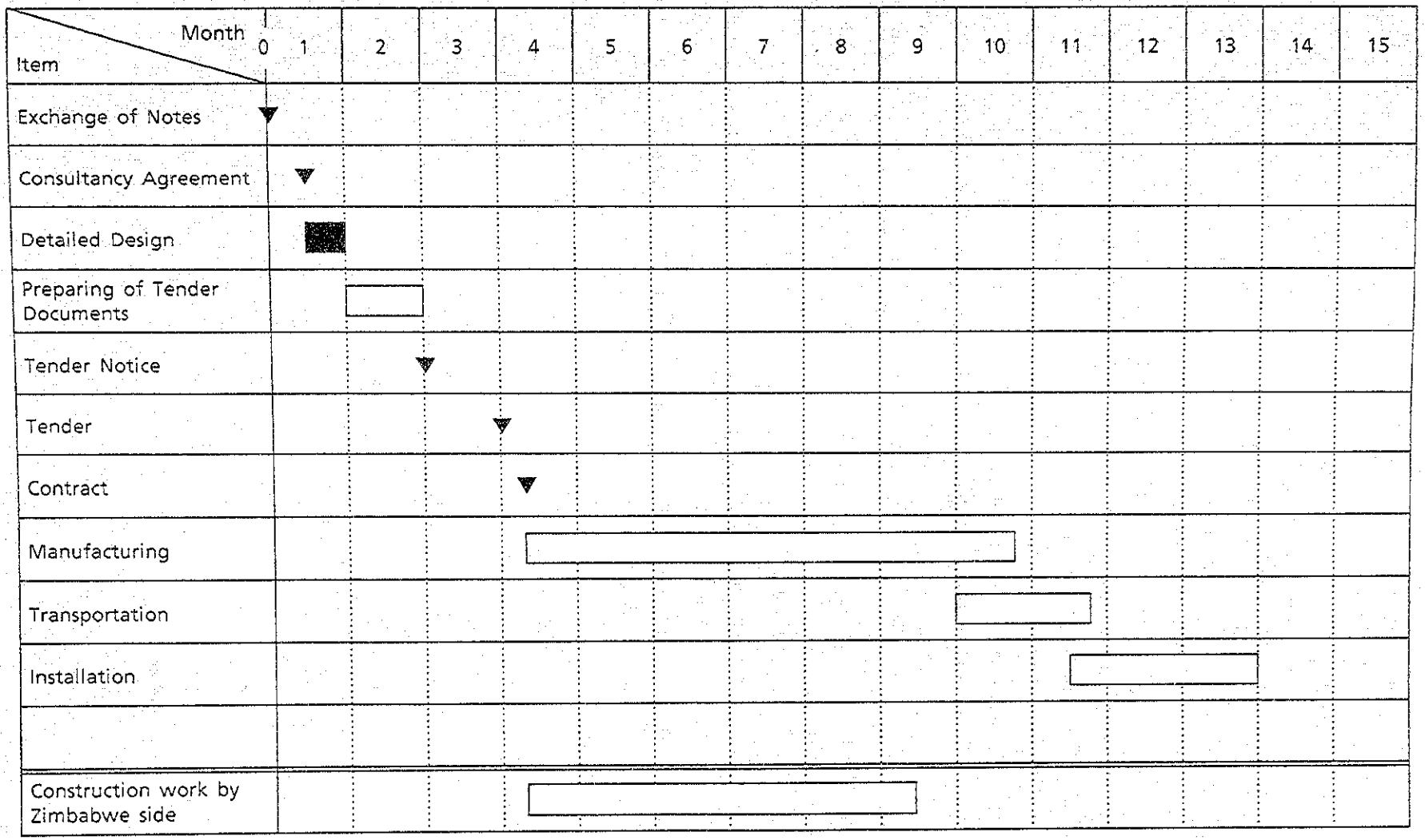
4-6 Implementation Schedule

The following procedures are necessary before this Project is carried out. After the E/N is concluded between the governments of Zimbabwe and Japan, the selection of a Japanese consulting company of Japan will be made by the Government of Zimbabwe. After that, a designing and supervision contract will be signed between the ZBC representing the Zimbabwean side and the Japanese consulting company and this will be followed by the detailed design, preparation of tender documents and conducting of the tendering process.

After the tendering process is completed and its outcome is examined, a construction contract will be concluded and the procurement of materials and equipment will be started. About ten months will be required for the procurement of materials and equipment and for the installation of the equipment in Zimbabwe. It is essential that the transmitter building and the engine generator building, both of which are to be constructed by the Zimbabwean side, are completed at least one month and a half before the day on which the transmitting equipment provided by the Japanese side is scheduled to be brought in.

The outline of the implementation schedule is shown in Table 4-6-1.

Table 4-6-1 Implementation Schedule



4-7 Estimated Operational Expenses

Operational Expenses to be Borne by the Zimbabwean side. The total amount of operational expenses to be borne by the Zimbabwean side is estimated at about 450,000 ZD (29 million Yen)

The breakdown is as follows:

(1)	Construction of a new transmitter building	($125m^2$)	250,000 ZD
(2)	Construction of a new engine generator building	($45m^2$)	90,000 ZD
(3)	Construction and installation work related to the laying of power-supply cable, telephone lines, etc.		110,000 ZD
		Total:	450,000 ZD
			(29 million yen)

Regarding the above-mentioned total of 450,000ZD, which corresponds to about 2.2% of the ZBC's annual budget, there seems to be no worry about securing the funds or about construction work because, for one thing, the budget to be secured is in domestic currency.

CHAPTER 5 Project Evaluation

CHAPTER 5 Project Evaluation

In Zimbabwe, TV broadcasting has an extremely large role to play as a driving force to attain the targets set under the Five-Year National Development Plan.

In that respect, it is of great significance to renew the superannuated transmitting facilities at the Harare Transmitting Station and boost their output as a project implemented with Japanese grant-aid financial cooperation. That is because, through such renewal and reinforcement of the transmitter facilities at the Harare Station, the expansion of the broadcast service area can be achieved, so that TV signals of high quality can be delivered to the residents on the outskirts of the city of Harare, the area where the population has been steadily increasing.

The implementation of this Project is expected to bring about the following effects:

(1) Through the renewal and boost in output of the transmitter, great improvements will be seen in various parts of the facilities as shown in Table 5-1, thus enabling the station to secure TV transmissions of high quality.

(2) As shown in the following table which gives a comparison of the broadcast service areas before and after the implementation of the Project, both the population coverage and area coverage will dramatically increase in the area centering around Harare city as a result of the expansion of the broadcast service area following the implementation of the Project.

Comparison of Broadcast Service Areas

Service Area / Media	Broadcast Service Area			
	Population (in 10,000 persons)		Area km² (Figures in ( ) are radius in km)	
	Present	After Project	Present	After Project
TV - 1	110	147	11,300 (60)	25,450 (90)
TV - 2	90	147	9,500 (55)	25,450 (90)

Remark : Estimated values are calculated on condition that broadcasts are received with a 4m antenna. If the antenna were raised to 10m, good-quality pictures would become obtainable at a location almost 100km away from the originating station.

This expansion of broadcast service area following the implementation of the Project is shown in Fig. 5-1. As a result of this expansion, it will become possible for the many residents in the suburbs of Harare to obtain a rich volume of information and TV programmes designed to help improve their living standard.

(3) After implementation of the Project, the replaced transmitters are scheduled to be transferred to a regional station. So the Project can also contribute to the reinforcement of regional broadcasting facilities.

(4) As the broadcast service area is expanded to the suburbs of Harare city and the elimination of poor-reception areas progresses, the remaining poor-reception areas will become smaller and increasingly scattered. In serving such remaining poor-reception areas in the future, it is expected that the construction of low-power transmitting stations using the economical method of relaying broadcast transmissions will increasingly be adopted as the easy way of achieving the objective.

Furthermore, a way will be devised also for the introduction of the regional community viewing system using solar-battery-powered receiving equipment.

(5) The renewal and increase in output of the transmitters for TV-2 will expand the influence of educational broadcasting in school education and adult education through the expansion of the broadcast service area and will, at the same time, play a major role in the development of human resources for participation in the implementation of the National Development Plan. The Government of Zimbabwe, since independence, has been placing great emphasis on education of the people. In fact, nearly 20% of the entire national budget is allocated to cover educational expenses. As a part of the measures to promote education, educational broadcasting is considered indispensable. As the saying goes, "Seeing is believing." Educational broadcasting, which makes effective use of the special features of television, is capable of spreading knowledge much more efficiently than newspaper or radio. TV is especially effective in educating those with a low level of literacy.

A plan has been drawn up in the meantime to conduct a system of community viewing organized mainly at schools (and at other key locations in municipalities, shopping centres, post offices, etc.) at a total of about 28 locations in Harare city under the guidance of the Ministry of Information, Posts and Communications. Of these 28 locations, 12 are already in operation. Radio (No.4) has already been conducting educational broadcasts nationwide and such broadcasts are being received very favorably.

(6) The following effects can be expected to be brought about in connection with the implementation of the Project.

1) At present, the ZBC's department in charge of producing studio-programmes is conducting the renewal of equipment and improvements of facilities including interior remodelling of rooms. When such improvements and remodelling work have been completed, one may expect to see an increase in the independent production of programmes by the ZBC and in the broadcasts of domestic and foreign news. At the same time, it will become possible for the ZBC to further diversify its programmes. These, along with the increase in output and renewal of transmitters, will enable an increasing number of residents to

obtain a rich volume of information and programmes that are related to their daily lives.

2) On the other hand, the import license system (under which import duties are imposed on goods bought overseas and brought into Zimbabwe for personal use) has been relaxed considerably and the duty-exemption limit has been raised from 500 ZD to 5,000 ZD (1 ZD = about 64 yen). Consequently, it has now become easier for people to bring into Zimbabwe goods bought overseas. This, naturally, is good news for those who eagerly desire to obtain a TV receiver. Therefore, it is expected that as the broadcast service area expands as a result of implementation of the Project, the desire to buy TV receivers will be given further momentum and this will then lead to a substantial increase in the spread of TV receivers in Zimbabwe, which, in turn, will help stabilize the ZBC's balance of income and expenditures.

As mentioned above, this Project, when implemented, can be expected to contribute greatly to national development through the provision of all types of programmes through stable and high-quality transmissions to the densely populated area around Harare city. The resultant influence and effects will extend over an extremely wide range of society. Hence, the Government of Zimbabwe is placing great expectations on this Project and it is considered that its implementation with Japanese grant aid is most appropriate.

Table 5-1 Comparison between Current and After-renewal Conditions of Transmitting Equipment at the Harare Station

Item	Existing Equipment	New Equipment	Remarks
TRANSMITTER			
Composition	Single-set system	Existing/Stand-by 2-set system	A comparison with equipment of same performance shows that the new equipment is 2.2 times superior to that in current use in reliability (Mean time Before Failure; time indication). (See Appendix 7)
Output	{ Under 2kW (TV-1) Under 0.7kW (TV-2)	5kW	
Output amplifier	Vacuum tube (TV-1)	Output transistor	Because of its being all solid-state, the reliability of the new equipment will be enhanced.
Output switcher	None	Automatic/manual switching system	See notes in the "Control system" column.
Dummy load	None	Air-cooled type	Necessary for confirmation of correct output, calibration of output meter, and for other purposes.
Automatic voltage regulator	None	Provided	This unit holds down the fluctuation of power-source voltage, keeps the voltage constant, and stabilizes the action of the transmitter.

Item	Existing Equipment	New Equipment	Remarks
Control system	Manual	· Control Functions Capable of automatic/remote-control/manual operation ① Capable of automatic start/stop ② Automatic stop when the antenna system is in trouble. ③ Automatic switching to stand-by unit or stop when transmitter system is in trouble. ④ Removal of power-source hum ⑤ Measurement of characteristics of input/output signals	Since the new equipment has a built-in automatic monitor, it is capable of being remotely or manually operated in addition to possessing automatic functions as mentioned in the left column.
Channel combiner	(1) Small capacity (2) Structurally fragile	① Renewed into large capacity ② Renewed into a unit that is sturdy and of high standard	Equipment that combines the output from transmitters for TV-1 (CH5) and TV-2 (CH8) without mutual interference and sends the combined output to the antenna.

Item	Existing Equipment	New Equipment	Remarks
PROGRAMME INPUT EQUIPMENT			
Programme Input Equipment	None	· Functions ① Monitoring of input/output of video/audio signals ② Distribution of video/audio signals ③ Amplification of sound and control of modulation degree	Also called "PIE". Since the new equipment has many functions, it is very effective for routine maintenance and detection of equipment failures.
ANTENNA EQUIPMENT			
Main feeder lines	Diameter 39mm	Diameter 77mm	To be replaced when the antenna is replaced and the transmitter output is increased.
Branch cable	Diameter 20mm (8)	Diameter 20mm (8)	To be replaced.
8-outlet Junction box	Input 39mm Output 20mm	77mm 20mm	To be replaced.
5-outlet Junction box	Input 20mm Output 8mm	The same as left (Air-tight type)	To be replaced

Item	Existing Equipment	New Equipment	Remarks
Dehydrater	None	Provided	· The equipment is effective in filling the feeder cable with dry air so as to prevent entry of moisture. As a result of the repair to be done under the Project, it will become possible to fill air even into the 20mm branch cable and thus the reliability of the antenna system will be enhanced substantially.
STAND-BY POWER-SOURCE			
Output	50kVA	450kVA	· A diesel-engine generator · Because of small output, the present equipment is capable of feeding power only to a part of the studio/transmitter at the time of stoppage of powr supply from the city power. · The new equipment is capable of feeding the power to the entire installation.
Control system	Manual	Manual/automatic	· The existing equipment can be switched only manually to the stand-by power source at the time of failure of commercial power source. · With the new equipment, the above-mentioned switching can be done automatically and automatic start/stop is feasible.

Item	Existing Equipment	New Equipment	Remarks
Time required for switching	About 20-30 min.	Within one minute	Because the existing equipment lacks automatic functions and its capacity is small, it needs select load. Consequently, the switching from city power to the stand-by power source takes time.
Fuel consumption	About 20ℓ/hour	60ℓ/hour	The fuel consumption ratio of the new equipment is extremely good as compared with the existing equipment.
MEASURING EQUIPMENT			
Measuring equipment	Although the station has most of the equipment required for routine maintenance work, such as an oscilloscope, voltmeter, wattmeter, simple oscillator, and circuit tester, it lacks equipment needed for the measuring of CCIR standard characteristics.	One set of instruments capable of measuring at least all of the characteristics as defined by CCIR standards will be provided.	• When measuring equipment breaks down, there are many cases where it becomes necessary to calibrate the equipment in comparison with the equipment that serves as the standard, instead of merely replacing the defective component part of the equipment. In that case, the equipment in trouble sometimes needs to be sent abroad for repair and this often takes much time including the time required for such procedures as sending the equipment back and forth. • The ZBC strongly requests that, under the Project, the current problem of shortage of measuring equipment be solved.

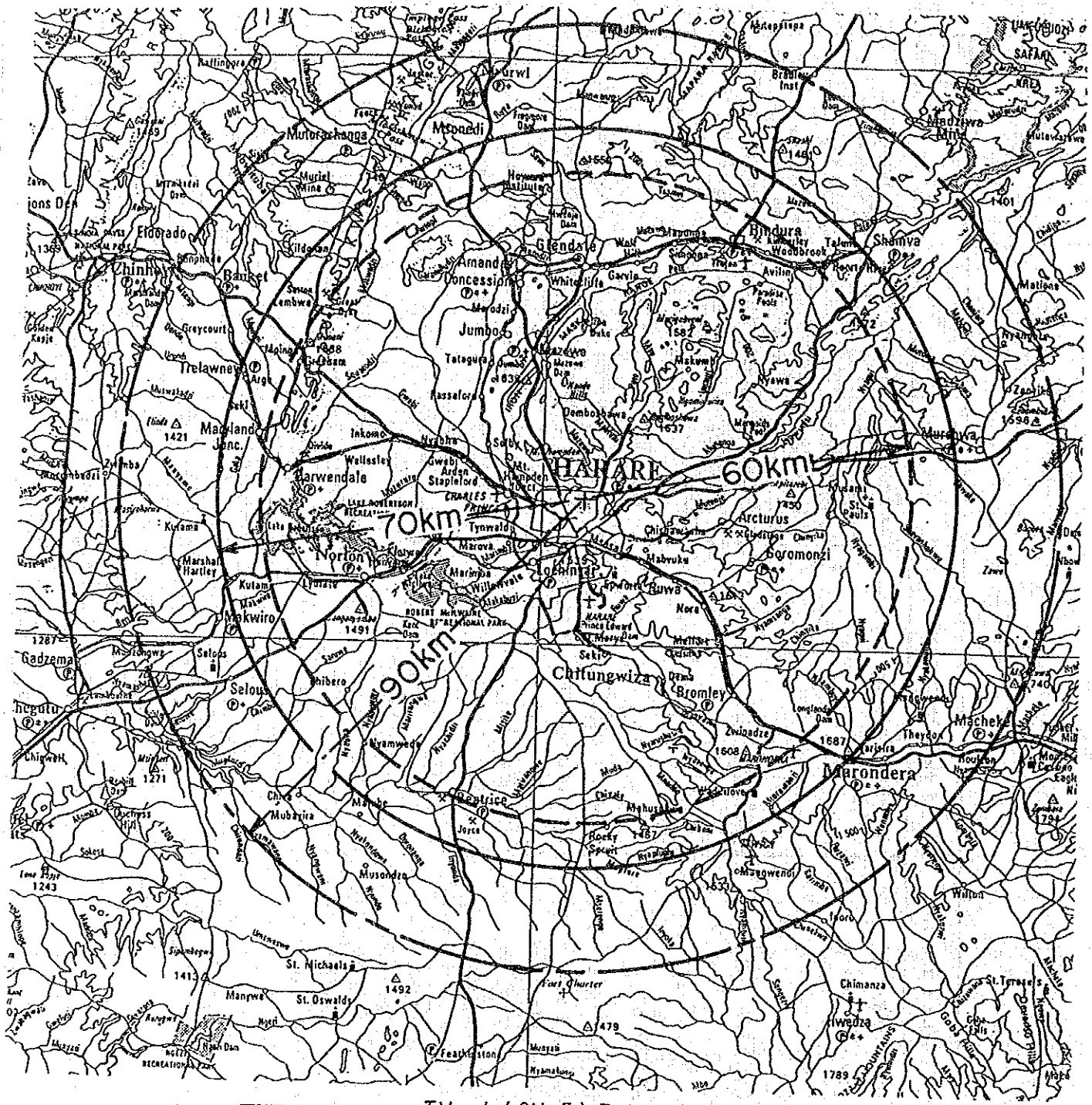


Fig. 5-1 Proposed Service Areas of Harare TV Station

CHAPTER 6 Conclusions and Recommendations

CHAPTER 6 Conclusions and Recommendations

6-1 Conclusions

In Zimbabwe, TV broadcasting is considered extremely important as a means of national development.

However, the transmitting facilities at the ZBC Harare Transmitting Station, which broadcasts programmes to the metropolitan area, have already reached an advanced stage of superannuation and, as a result of degradation of characteristics, the transmission output has dropped considerably.

Meanwhile, the purchasing of spare parts continues to be extremely difficult and the production of some spare parts has ever been suspended. Moreover, owing to the shortage of foreign exchange, the ZBC is unable even to purchase stand-by equipment. As a result, there have occurred frequent cases of long accidental broadcast suspensions owing to breakdowns. It is with the objective of renewing, and increasing the output of the transmitting facilities system so as to improve this situation that this Project has been planned. Based on the result of the most recent field study, a series of analyses has been made from various considerations angles, such as the essentialness of the Project, problems that require special attention in installing the equipment and facilities, and the beneficial effects that can be expected as a result of implementation of the Project. Consequently, the conclusion has been reached that the most appropriate steps to be taken will be to renew the transmitters in current use for TV-1 and TV-2 into all solid-state 5kW transmitters using semiconductors under the existing/stand-by switching system.

The implementation of the Project is expected to lead to expansion of the broadcast service area and establishment of a better reception environment across a wide area around Harare. As a result, people in the suburbs of Harare city will be able to enjoy programmes of great variety, including those of governmental information, youth education [Note], culture, adult education, economy and agreculture. Thus, the ZBC is expected to play a major part in the education and training of people who will contribute to the development of the nation, through enhancement of people's living standard and in the promotion of industries.

The ability of the ZBC as the implementing organization for the Project to operate, maintain and manage an operational organization, including its technological capability and suitable work force, is sufficiently high and it is therefore considered that the operation, maintenance and management of the technical facilities after implementation of this Project will be conducted in an appropriate manner.

From the foregoing, it can be judged that the implementation of the Project with Japan's grant-aid cooperation will be most appropriate and it is hoped that the Project will be carried out at the earliest possible opportunity.

Incidentally, the ZBC desires to make the new facilities at the Harare Station a model for transmitting systems to be adopted in the future and therefore this project can be expected to serve as a part of technological transfers from Japan to Zimbabwe.

[Note] As to the essentialness of educational TV broadcasting by TV-2, please refer to 2-3-2 (2) "Educational TV in Harare" and 3-2-1 "Necessity and Appropriateness of the Project."

6-2 Recommendations

(1) Operational System After Implementation of The Project

In order to maintain in good condition the installations improved under this Project and to conduct stable operation of the installations over a long period, establishment of a reinforced system of maintenance and management is most essential. In view of the ZBC's present technological level and the know-how it has accumulated over the years, it is considered that the transfer of technologies for the maintenance of the equipment can be achieved with relative ease by means of on-the-job training conducted during the period of installation of equipment. Also, in order to further build up the pool of the ZBC's technical staff, there is the need to carry on on-the-job and overseas training on a routine basis and, at the same time, to educate and increase the number of lecturers for training courses.

Although there will be no substantial changes in the operational system, the reliability of equipment will be dramatically enhanced because the old vacuum-tube type units will be replaced with a transmitter of the latest type with higher output and of an all solid-state type using semiconductors. With enhanced reliability, the time required for maintenance is reduced and so it is desired that the surplus hours thus produced will be utilized effectively for such purposes as the conducting of preventive maintenance or the training of personnel to cope with new technologies.

Furthermore, as a result of the enhanced reliability of the equipment, no need would arise for the purchase of spare parts during the initial 3-4 years after installation of the new equipment. But as to the measures to be taken after that, it is necessary to examine and plan for the purchasing of spare parts, budgetary arrangements, etc.

(2) Execution of Construction Work for Which the Zimbabwean Side is Responsible

As for the construction work for which the Zimbabwean side is responsible, its outline is as shown in 4-5-2, Division of Construction Work. Above all, it is essential to complete the construction of the buildings for transmitters and the stand-by power source equipment on

schedule as stipulated in this Project. This is an indispensable premise to ensure smooth progress of the Project. Furthermore, in carrying out the construction work as mentioned above, careful attention must be given to such matters as prior confirmation and supervision of construction work so that no damage is caused to the existing underground programme-transmission cables and power supply cables.

APPENDICES

NO. 1 Minutes of Discussions

MINUTES OF DISCUSSIONS
ON
THE REHABILITATION PROJECT FOR THE ZBC TV TRANSMITTER SYSTEM
IN
THE REPUBLIC OF ZIMBABWE

In response to the request of the Government of the Republic of Zimbabwe, the Government of Japan decided to conduct a basic design study on the Rehabilitation Project for the ZBC TV Transmitter System (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Zimbabwe the study team headed by Mr. Junichi AOKI, Special Advisor for International Cooperation Division, Ministry of Posts and Telecommunications from November 16 to December 7, 1989.

The team had a series of discussions on the Project with the officials concerned of the Government of the Republic of Zimbabwe headed by Mr. O.O.Chekeche, Deputy Directer General, Zimbabwe Broadcasting Corporation (ZBC) and conducted a field survey in Harare TV Transmitting Station.

As a result of the study and discussions, both parties agreed to recommend to their respective Government that the major points of understanding reached between them, attached herewith, should be examined toward the realization of the Project.

Harare, November 24, 1989

Mr. Junichi AOKI
Team Leader,
Basic Design
Study Team,
JICA

Mr. O.O.Chekeche
Deputy Director General,
Zimbabwe Broadcasting
Corporation,
Zimbabwe

1. OBJECTIVES OF THE PROJECT

The objectives of the Project are to provide necessary equipment and facilities for the TV Transmitters in the Harare Transmitting Station in order:

1) To improve the TV broadcasting service.
2) To provide strong and reliable TV signals in and around Harare.

2. IMPLEMENTING AGENCY

The Implementing Agency for the Project is Zimbabwe Broadcasting Corporation (ZBC) under the Ministry of Information, Posts and Telecommunications.

3. PROJECT SITE

The site of the Project is located at Harare Transmitting Station shown in ANNEX-1.

4. REQUEST BY THE GOVERNMENT OF ZIMBABWE

The Japanese Study Team will convey to the Government of Japan the intention of the Government of the Republic of Zimbabwe that the former takes necessary measures to cooperate in implementing the Project and provide the facilities and equipment listed in ANNEX-2 for TV Transmitting Station in Harare under the Japanese Grant Aid Programme.

5. JAPAN'S GRANT AID PROGRAMME

1) The Zimbabwe side has understood the system of Japan's Grant Aid Programme explained by the Team which includes a principle for use of a Japanese Consultant firm and Japanese contractors for the implementation of the Project.
2) The Zimbabwe side will undertake to ensure the necessary budget and personnel for the proper and effective operation and maintenance of equipment and facilities provided under the Grant Aid Programme.

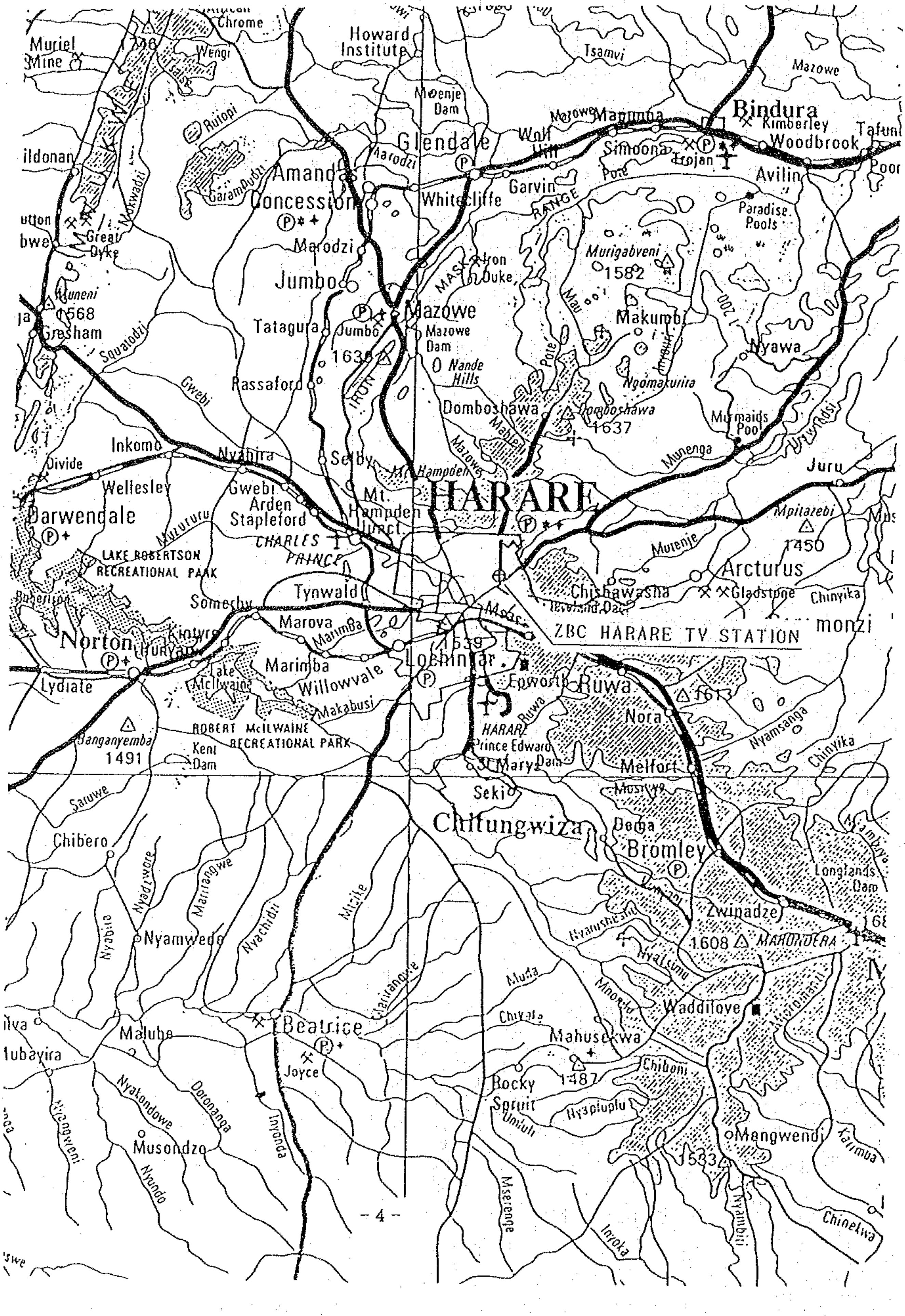
6. NECESSARY MEASURES TAKEN BY ZIMBABWE

The Government of Republic of Zimbabwe will take the necessary measures listed in ANNEX-3 on condition that the Grant Aid Programme by the Government of Japan is extended to the Project.

7. REPORT

10 copies of the final report will be submitted to the Zimbabwe side at the end of May, 1990.

ANNEX-1 THE SITE OF THE PROJECT (HARARE TX STATION)



ANNEX-2 EQUIPMENT AND FACILITIES REQUESTED BY ZIMBABWE

The existing equipment will be rehabilitated by replacing it with the following items;

1) 5kW TV Transmitter systems with necessary units, dummy load and all associated accessories (Including Standby Transmitter)

2) Programme Input Equipment

3) Measuring Equipment

4) Feeder cable (Including Junction Box)

5) Power Supply Equipment (Including Standby Generator)

6) Spare parts

7) Installation materials

ANNEX-3 NECESSARY MEASURES TAKEN BY ZIMBABWE

1. To provide data and informations necessary for detailed design
2. To carry out necessary works of buildings for installation of the equipment provided under the Grant Aid Programme
3. To ensure prompt unloading, customs clearance of the equipment under the Grant Aid Programme, if any, to support at ports of desembarkation in neighboring country
   The custom duties and sales taxes of the equipment will be the responsibilities of the Government of the Republic of Zimbabwe
4. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Zimbabwe respect to the supply of the products and services under the verified contractors
5. To accord Japanese nationals whose services may required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry to Zimbabwe and stay there in for the performance of their work
6. To maintain and use properly and effectively the equipment purchased under the Grant Aid Programme
7. To provide facilities for distribution of electricity, drainage, communications and security
8. To provide necessary permissions, licences and other authorizations for carrying out the Project
9. To admit the intermittence of the broadcasting service in Harare Station on the installation work, if necessary
10. To bear advising commissions of Authorization to Pay (A/P) and payment commissions to the Japanese foreign exchange bank for the Banking Arrangement (B/A)
11. To bear all the expenses other than those to be borne by the Grant Aid Programme, necessary for the execution of the Project

NO. 2 Staffing of the Basic Design Study Team

Team member of Basic Design Study in Zimbabwe are as follows:

Name	Assignment	Present Post
Mr. Junichi AOKI	Team Leader	Special Advisor for International Cooperation, International Cooperation Division, Ministry of Posts and Telecommunications
Mr. Motomu UCHIMURA	Grant Aid Cooperation, Project Coordinator	Official, Grant Aid Division, Ministry of Foreign Affairs
Mr. Manabu YANAGISAWA	Broadcasting Plan (Survey Leader)	International Department, All Japan Radio & Television Engineering Services Co., Ltd. (AJTS)
Mr. Shunro TAKAGI	Transmitting Facilities	International Department, (AJTS)
Mr. Akira FUJIMOTO	Antenna System (Cost Estimation)	International Department, (AJTS)

NO. 3 Study Schedule

No	Date	Govenment Officials	Survey Team
1	Nov. 14 (Tue)	Lv. Narita 13:40 Ar. London 17:35 (BA 008)	
2	15 (Wed)	Lv. London 21:10 (BA 053)	
3	16 (Thu)	Ar. Harare 15:00 Meeting with Embassy of FJapan	
4	17 (Fri)	Courtesy call to Ministry of Information, Posts and Telecommunications ZBC Survey, Discussion	
5	18 (Sat)	Preparation of making the minutes of discussion Measurement of field intensity in Harare Data filling	
6	19 (Sun)	Measurement of field intensity in Harare Data filling	
7	20 (Mon)	Survey of Harare studio and transmitting station Data collection	
8	21 (Tue)	Ditto	
9	22 (Wed)	Measurement of field strength in east side of Harare	
10	23 (Thu)	Meeting with ZBC for making the Minutes of Discussions	
11	24 (Fri)	Signing in minutes Reporting to Embassy of Japan	
12	25 (Sat)	Lv. Harare 22:05 (BA 052)	Data collection and filling
13	26 (Sun)	Ar. London 06:10	Review of survey schedule
14	27 (Mon)	Lv. London 14:30 (BA 007)	Study of Tx equipment layout in Tx building and generator building
15	28 (Tue)	Ar. Narita 11:25	Programme, Finance, Administration Discussion of point of field survey
16	29 (Wed)		Programme transmission line Data collection
17	30 (Thu)		Survey of Antenna and Tower
18	Dec. 1 (Fri)		Measurement of field intensity around N-West and North of Harare
19	2 (Sat)		Data collection
20	3 (Sun)		Preparation of field measurement
21	4 (Mon)		Measurement of field intensity around south of Harare

No	Date	Govenment Officials	Survey Team
22	Dec. 5 (Tue)		Power source facilitieis Discussion with ZBC
23	6 (Wed)		Inquiry of training for engineering staff Reporting to Embassy of Japan
24	7 (Thu)		Final discussion with ZBC Lv. Harare 22:05 (BA 052)
25	8 (Fri)		Ar. London 06:10
26	9 (Sat)		Lv. London 14:30 (BA 007)
27	10 (Sun)		Ar. Narita 13:30

NO. 4 List of Interviewees

Ministry of Information, Posts and Telecommunications

Mr. J. Z. Tsimba	Director of Information
Mrs. A. T. Mapanga	Assistant Secretary

Ministry of Finance, Economic Planning and Development

Mrs. Banu	Assistant Secretary
Ms. E. T. Ruparanganda	Japan Desk Officer

Ministry of Foreign Affairs

Mr. B. Marowa	Japan Desk Officer

Zimbabwe Broadcasting Corporation (ZBC)

Mr. O. O. Chekeche	Deputy Director General
Mr. David Woodward	Assistant Director General: Engineering & Technical Service
Mr. Grey Tichatonga	Assistant Director General: Programmes, News and Current Affairs
Mr. Dominic Mandhizha	Assistant Director General: Administration and Personnel
Mr. Ian Mcphee	Director: Transmitter, Planning Installation & Development
Mr. Ron Mhende	Director: Engineering, Radio and TV Studios
Mr. A. D. Brenchley	Director: Consultant: Administration and Personnel
Mr. I. L. Kadungure	Director: Marketing
Mr. Job G. Jonhera	Director: TV Programmes
Mr. O. Z. Gumbo	Senior Controller: Management Accounting
Mr. John L. Mashingaidze	Senior Controller: Administration and Personnel
Mr. W. P. Mugumbate	Deputy Controller: Administration and Personnel
Mr. B. K. Zakeyo	Controller: Licensing
Mr. Samuel Moyo	Acting Chief Engineer: Transmitter

Mr. Evans Makondo	Executive Training Officer
Mr. Steven Mtize	Senior Superintendent Engineer: Transmitter
Mr. Tom Dhliwayo	Senior Superintendent Engineer: Planning Installation & Development
Mr. B. T. Mufunde	Technical Stores Officer
Mr. Ben Mutyasira	Maintenance Engineer

Zimbabwe Electricity Supply Authority (ZESA)

Mr. C. P. W. Johnson	Senior Maintenance Engineer

Embassy of Japan

Mr. Ken IKEBE	Ambassador Extraordinary Plenipotentiary
Mr. Hiroyuki EGUCHI	Councilor
Mr. Yukio KAWAJIRI	First Secretary

NO. 5 Measurement of Field Intensity

The measured data of the Field Strength at Harare TV Transmitting Station are as follows.

① Existing TV Channel at Harare TV Staion

T V - 1

- Band-Ⅲ 5CH
  (Tx Output: 2.0~1.5kW)
- Band-Ⅰ 4CH
  (Tx Output: 0.2kW
  Carrier Frequency:
  Visual 62.25MHz
  Aural 67.75MHz)

T V - 2

- Band-Ⅲ 8CH
  (Tx Output: 0.7kW)

CH.No.	fp	fs
E-2	48.25	53.75
2A	49.75	55.25
3	55.25	60.75
4	62.25	67.75
5	175.25	180.75
6	182.25	187.75
7	189.25	194.75
8	196.25	201.75
9	203.25	208.75
10	210.25	215.75
11	217.25	222.75
12	224.25	229.75

(
- European CH Band-Ⅲ
  Except: France, Italy & Monaco
- Difference of Carrier Frequency
  between Visual/Aural: 5.5MHz
)

② Reception Evaluation

In order to compare and judge the reception conditions easily, the following "SINPO Code" is used internationally.

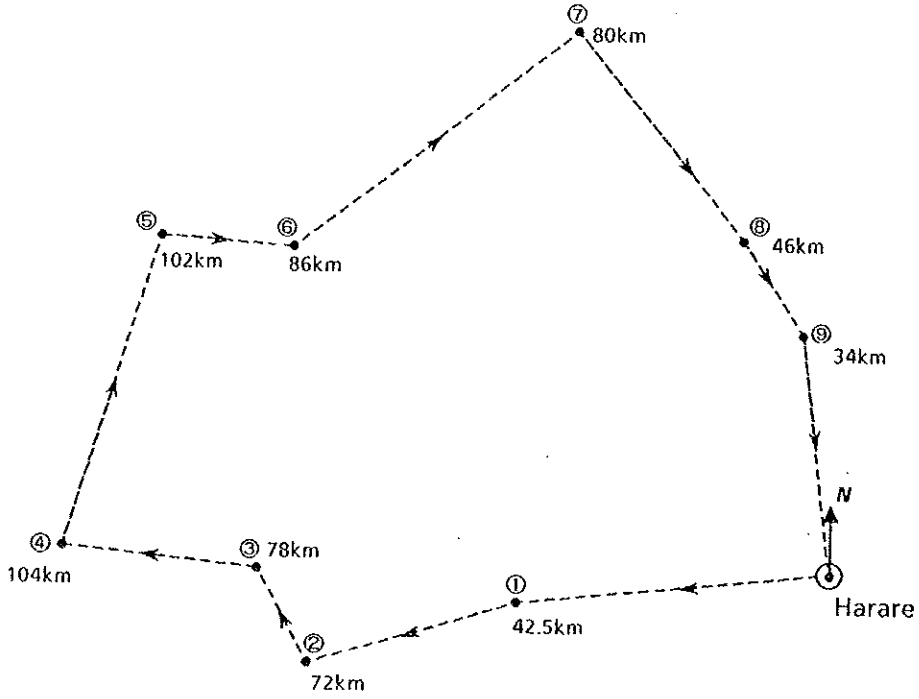
SINPO Code

Item / Ranking	S	I	N	P	O
	Strength of Reception Signal	Phenomena that Degrade the Quality of Reception Signal			Overall Read-ability
		Interference	Noise	Propagation	
5	Excellent	nil	nil	nil	Excellent
4	Good	Slight	Slight	Slight	Good
3	Fair	Moderate	Moderate	Moderate	Fair
2	Poor	Severe	Severe	Severe	Poor
1	Barely Audible	Extreme	Extreme	Extreme	Unusu-able

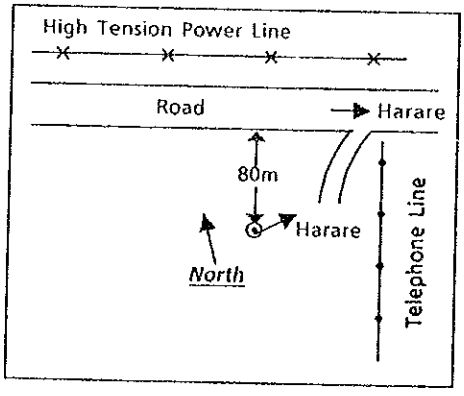
In case the evaluation doesn't exactly correspond to each raking, put a "+" or "−" on the evaluated figure.

Measurement of Field Strength

(West & North of Harare City) (Dec. 1st, 1989)

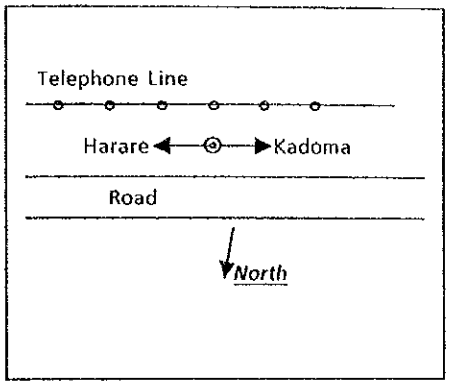


Location	Distance from Harare	Time of Measurement	Measured Value in (dBμ/m)		
					Video / Audio
① Norton town	42.5km (about)	11:00~11:15	CH5:	64/59.6 (H_2=4m)	65/60 (H_2=5m)
			CH8:	53/36.5	

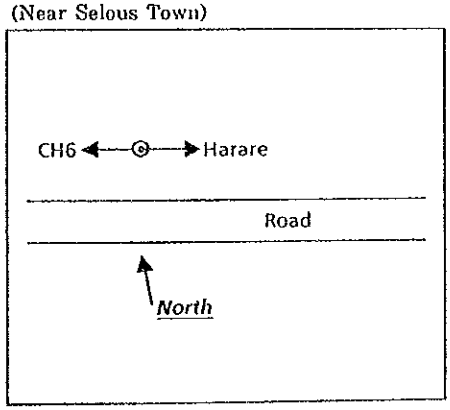


◉ Check Point

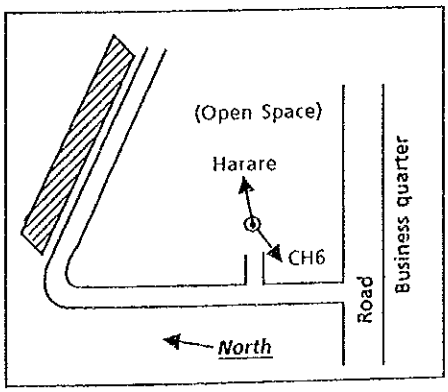
Location	Distance from Harare	Time of Measurement	Measured Value in (dBμ/m)
② Serui Village (Small)	72km (about)	11:30~11:45	CH5: 42/36.5 (H2=4m) 43/ (H2=5m) CH8: 32/no



③ Martindal Catholic School Entrance (Near Selous Town)	78km (about)	11:55~12:00	CH5: 40.2/37 CH8: 31/no CH6: 42/28 (Kadoma)



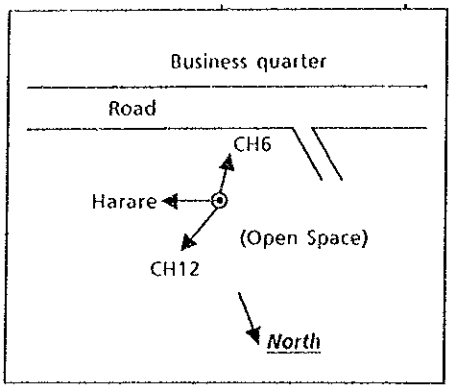
④ Chegutu	104km (about)	12:25~12:35	CH5: 30/27 CH8: 22/no CH6: 47.8/35.5



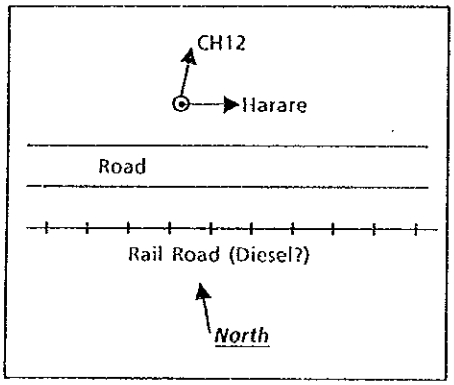
[Reference]

If receiving antenna of 10m & 8 element YAGI is used, good picture (Grade 3 or more) will be able to get.

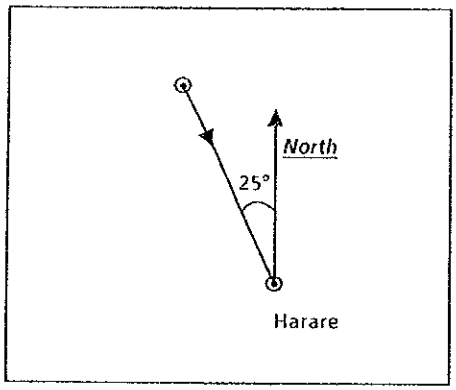
Location	Distance from Harare	Time of Measurement	Measured Value in (dBμ/m)	
⑤ Chinboyi	102km (about)	14:30~14:45	CH5:	46/41.5
			CH8:	no
			CH12:	46/46 (Mutorashanga)
			CH6:	18/no



⑥ Banket	86km (about)	14:50~15:00	CH5:	46/40
			CH12:	57.6/55.3

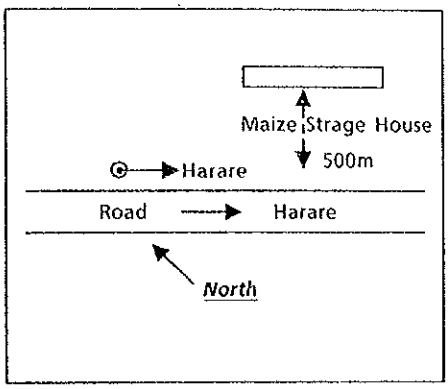


⑦ Mutorashanga Tx Station (Translator)	80km (about)	15:50~16:30	CH5:	85.5/81
			CH8:	77.5/34.8 (?)

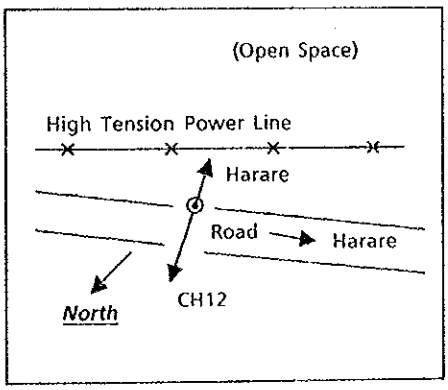


Those values are not Field Strength but Receiver Input Voltag. Receiving Antenna Height: 30m or more?
Receiving Antenna Gain: 8dB (about)

Location	Distance from Harare	Time of Measurement	Measured Value in (dBμ/m)	
⑧ Around Concession City	46Km (about)	17:05~17:10	CH5:	48/42
			CH8:	35.5/30.7
			CH12:	45/39.5

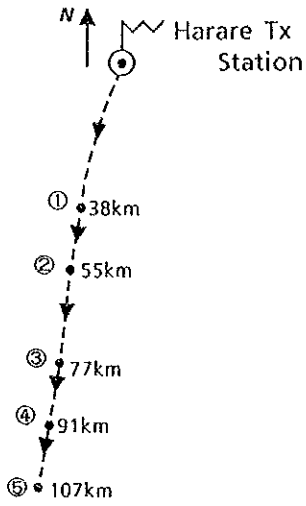


⑨ Around Mazowe Town	34Km (about)	17:35~17:45	CH5:	62/55
			CH8:	47/33.5
			CH12:	45.5/36.2

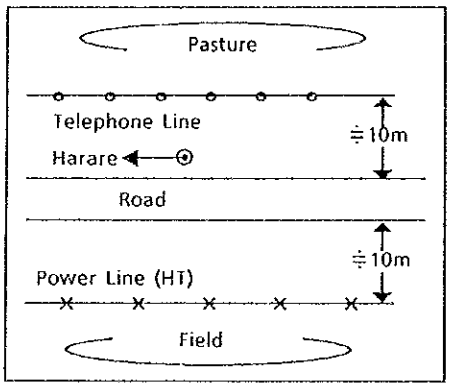


Measurement of Field Strength (Dec. 4th, 1989)

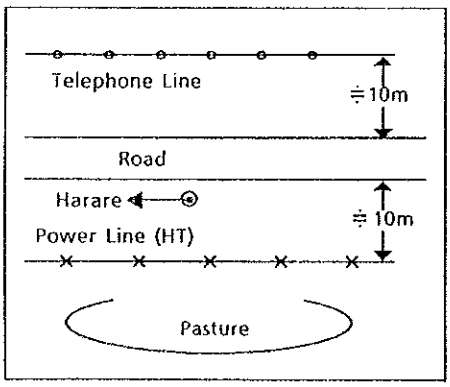
(South of Harare City)



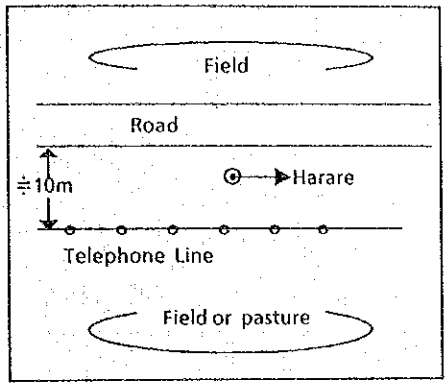
Location	Distance from Harare Tx Station	Time of Measurement	Measured Value in (dBμ/m)		
				→ Visual	→ Aural
① Iridor (Small Village)	38km	11:44~11:55	CH5:	53.5	49.5
			CH8:	46.9	32.7



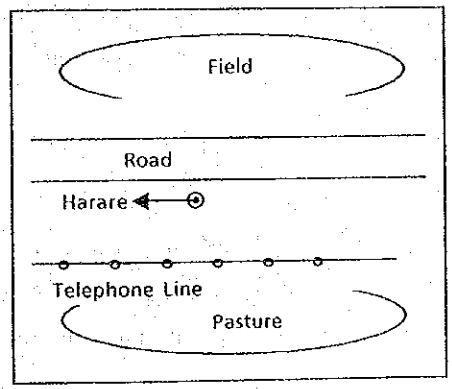
② TAVI STOCK Estates	55km	12:00~12:05	CH5:	47	41.5
			CH8:	40	31



Location	Distance from Harare	Time of Measurement	Measured Value in (dBμ/m)
③ Mant Lavia (Small Village)	77km	12:20~12:25	CH5: 50.7/46.5 CH8: 43.3/31.3 CH12: CHIVU no (F_V: 231.25 MHz, F_A: 236.75 MHz)



④ Dover Estate Stone (Small Village)	91km	12:35~12:45	CH5: 39.5/34.0 CH8: 31.8/30.5 CH12: (CHIVU Station) no signal

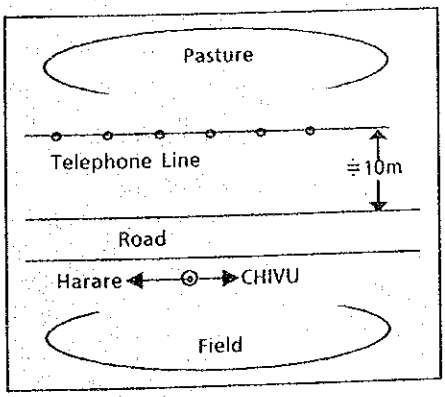


• Check picture quality by TV Receiver

CH5: 3- (8 elements antenna, about 4m, Random Noise)

If antenna height 10m, grade 3 will be obtained.

⑤ Feather Stone (KWESFONTEN RD) (Small Village)	107km (about)	13:05~13:10	CH5: 32.5/ CH8: no signal CH12: CHIVU. no signal



NO. 6 Equipment Failure and Maintenance

1. Countermeasures against Equipment Failure

The following three types of failures are recognized considered (Refer to Bathtub Curve).

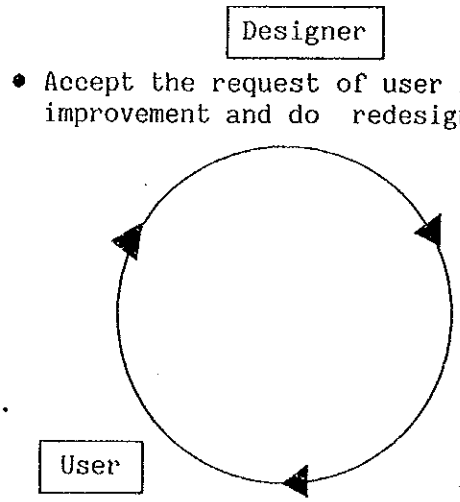
(1) Initial Failure

After operating newly installed equipment for a while (a relatively short time) a great number of small failures are apt to occur due to defective design, bad operational environment, etc. This period is called the "Initial Failure Period," or the "Debugging Period," and such failures are to be repaired immediately so that they will not cross the feed-back circle as in the following figure.

To avoid this,

a) Collect and analyse the reliable data.

b) Especially pay attentionto the environment of the equipment(vibration, temperature, humidity, water seepage, gas and lightning damage, etc.).



(2) Random Failure

After the initial failure in cleared up, the period that the equipment operates stably is called the "Random Failure Period." The occurrence of failure in this period is really accidental, and the failure rate will be low.

It is to be noted that the average failure interval of the random failure period is called MTBF (Mean Time Between Failures) and is an index of equipment reliability.

This kind of failure can be avoided in advance by performing appropriate preventive maintenance.

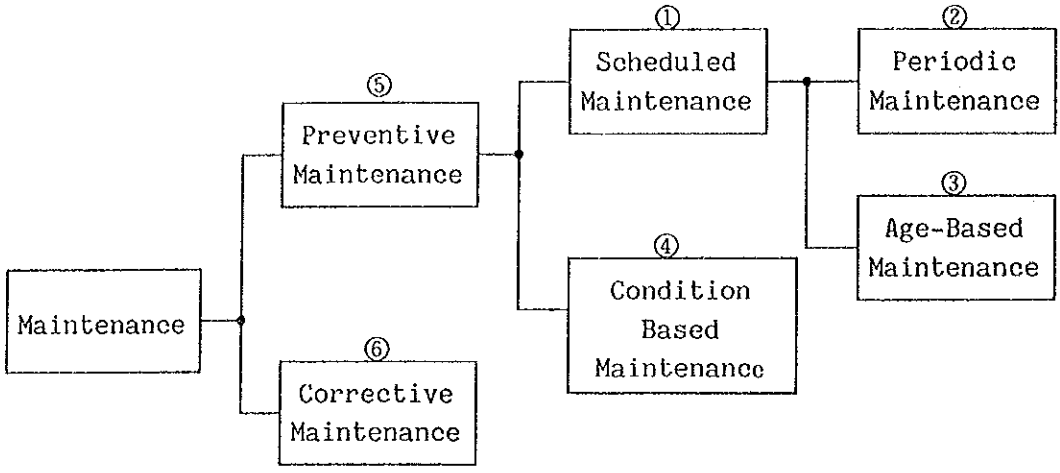
(3) Wear-out Failure

When the random failure period of equipment has ended and the use of the equipment is still continued, the equipment will enter the "Wear-out Period" during which failure increases rapidly.

By applying appropriate preventive maintenance, equipment in the wear-out failure period can be returned to the random failure period to some extent, but with a great increase in the number of failures the maintenance cost will also increase rapidly, so the replacement of superannuated equipment is often the most economical strategy.

2. Equipment Maintenance

(1) Classification of Maintenance



(2) Explanation of Maintenance

1) Scheduled Maintenance (Shown in classification ①)

- Preventive maintenance that is performed according to a time schedule.
- It could be called "point" maintenance.

(Example)

Maintenance Item	Period (one year)												Remarks
	1	2	3	4	5	6	7	8	9	10	11	12	
Air Filter	×	×	×	×	×	○	×	×	×	×	×	○	Inspected monthly (×) Exchanged every six months (○).
Cooling water	○	×	△	×	△	×	△	×	△	×	△	×	Inspected every other month (×). Water supplied every other month (△). Water changed once a year (○).

2) Periodic Maintenance (Shown in classification ②)

- This maintenance is appropriate for equipment that is used regularly.

  For example, periodic inspections of automobiles and ships.

3) Age-Based Maintenance (Shown in classification ③)

- This is appropriate for equipment that is used irregularly or intermittently.
- Appropriate for equipment for which the time of use is indicated by an integrating wattmeter or time-recorder.

4) Condition-Based Maintenance (Shown in classification ④)

- Maintenance that is conducted by supervising a monitor.

  Maintenance that is conducted by "line" against the "Scheduled Maintenance" ①.

  For example, to find equipment abnormalities by observing various meters in the cockpit of an airplane, or using an automatic monitoring system for the surveillance of radio/television transmitters.

5) Preventive Maintenance (Shown in classification ⑤)

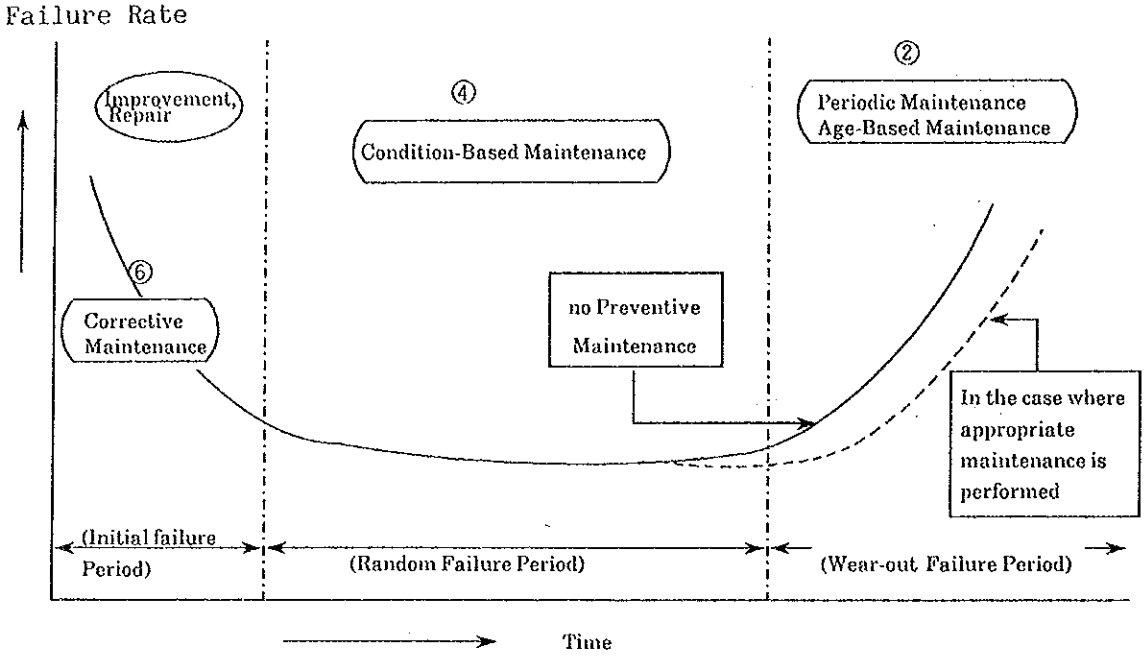
- Maintenance that is performed in advance of the occurrence of the failure of equipment or parts, etc.

  The above items ①- ④belong to this category.

6) Corrective Maintenance (Shown in classification ⑥)

- Maintenance that is performed after the occurrence of a failure.

(3) In the figure effective maintenance carried out according to the Bathtub Curve is shown.



Effective Maintenance that is Performed in Accordance with the Bathtub Curve.

NO. 7 Redundancy System and Reliability of Transmitters

With the rise in reliability of transmitters since 1960, the operation of transmitting stations in advanced countries has been converted into unattended operation to reduce the operational costs.

In addition, with the development of semi-conductors and related equipment, digital techniques have been introduced in the control of transmitters so that automatic control and remote control of transmitters can be performed easily.

In order to shorten the failure period of transmitters as much as possible, the method of operating two transmitter units in parallel, and switching between the two transmitters is widely used.

These days it is common sense to prepare a spare transmitter against transmitter failures.

In the accompanying pages various redundancy systems for transmitters and typical spare transmitter systems are shown.

Fig. 1 Comparison of a Typical Standby Transmitter System for Radio Transmitters

Fig. 2 Comparison of Two Standby Transmitter Systems for Radio Transmitters.

For reference, Fig. 2 shows the reduction in combined power output when a failure occurs in amplifier units which are operated in parallel. It can be seen that the influence upon power output is relatively small. This is the merit of operating amplifier units in parallel.

In most of the recent power amplifiers, several amplifier units are frequently operated in parallel to obtain a high power output. In this case, as the power source of each unit is separated, if one of the units happens to fail, broadcasting can be continued with no suspension of broadcast signal but with only a small reduction in power.

The [A] in Fig. 3 is when the amplitude of one of the parallel units becomes half (−6dB), and the reduction in the combined amplifier is as follows:

When there are four units $A[dB]=20\log\frac{3+0.5}{4}=1.158dB$;

When there are two units $A[dB]=20\log\frac{1+0.5}{2}=2.5dB$.

[B] is when the phase of one of the parallel units has shifted by 60°, and the reduction of the combined amplitude is as follows:

When there are four units

$$B[dB]=20\log\frac{\sqrt{(4-1)^2+1+2(4-1)\cos 60°}}{4}=0.90dB$$

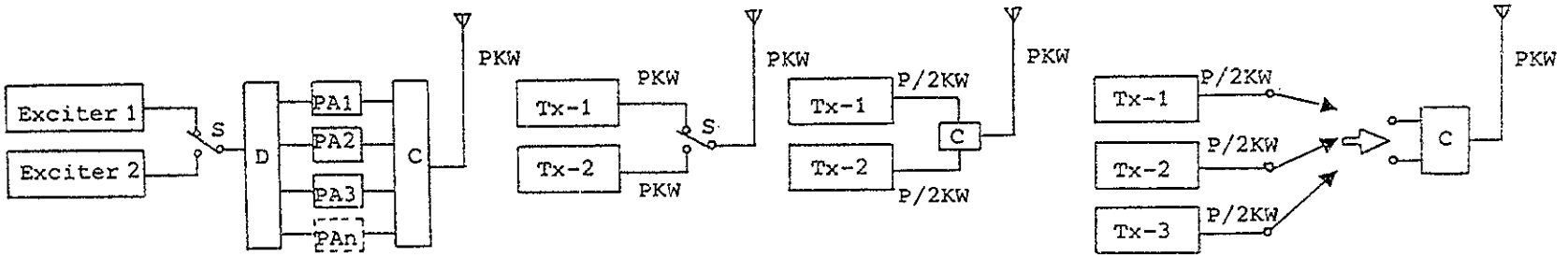
[P] is when one or more parallel units have failed, and the reduction in power output is as folows:

When there are four units $P=PO\left(\frac{4-1}{4}\right)^2=0.56$

Usually, in the case where the output is 10 kW, it reduces to 5.6 kW

Comparison of Standby System (TV Transmitter)

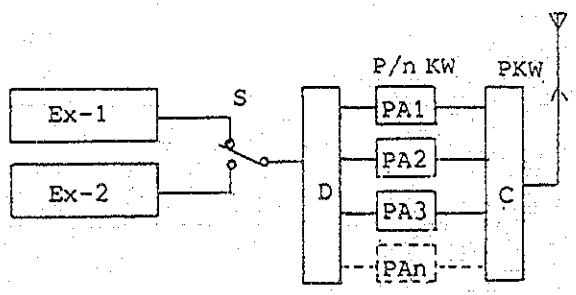
Fig.1

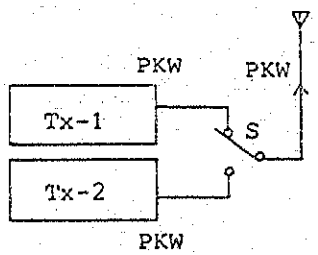


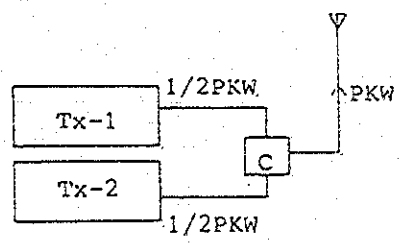
Construction (System)	Younger stage: 2-TX Switching Final stage: Parallel of power amplifiers	2-TX Switching system	2 parallel system	2 parallel 1 standby system
Application	◦ Mostly used for Translator station (For 100W - 1KW)	◦ Used for 100W - 1KW ◦ Some time more than 10KW	◦ Used for 10KW or more	◦ Key station ◦ Big power station (20KW or more)
Reliability MTBF (Times)*	2.2	2.2	1.55	3.3
Remarks	S : Switch D : Distributor C : Combiner *MTBF of single Tx take as 1 ◦ Exciter stage output power about 50 mW (Synch peak) ◦ PA1 : Power Amplifier PAn (Many parallel PA units system)	◦ Very popular and simple system for standby ◦ When the existing TX failed, automatically switch over to standby ◦ Maintenance of the failure is easy even in servicing time	◦ Popular and simple system for standby ◦ When one Tx failed, power is to decrease 1/4	◦ Usually 2 parallel operation when one of them out of order, automatically switch over to the standby, therefore 3 combinations are obtained (Tx-1 - Tx-2, Tx-2 - Tx-3, Tx-3 - Tx-1) ◦ Automatic control circuit for those combinations are complicated

Comparison of Standby System (FM Transmitter)

Fig.2

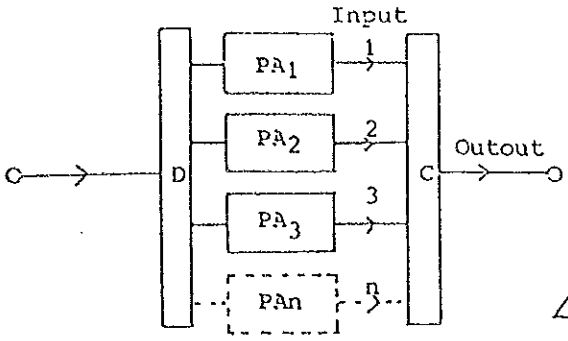






Construction (System)	Exciter: 2-EX Switching Final stage: Parallel PA units	2-TX Switching	2 parallel
Application	100W - 5KW	100W - 5KW 10KW or more	10KW or more
Reliability (MTBF)*	2.2	2.2	1.55
Remarks	Ex-1, Ex-2 : Exciter (Output power≒50mW) D : Distributor C : Combiner PA1-PAn : Power Amplifier S : Switch * MTBF of single Tx take as I	◦ Very popular and simple system for the standby ◦ Maintenance of the failure is easy even in servicing time	◦ Popular and simple system for the standby ◦ When one Tx failed, power is to decrease 1/4

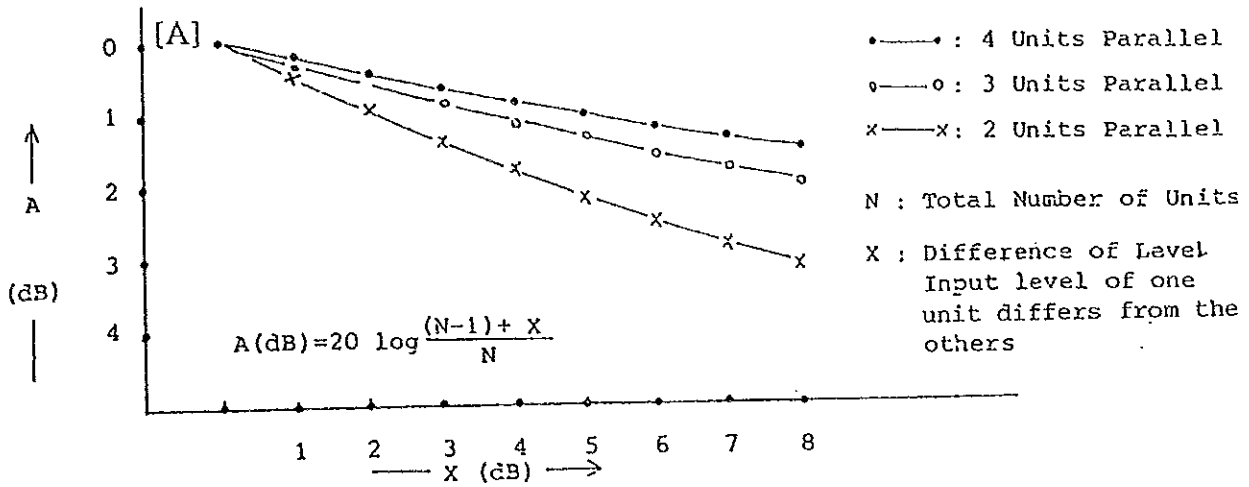
Parallel Operation of Power Amplifiers Fig.3



D : Divider

C : Combiner

PA1~PAn : Power Amplifier



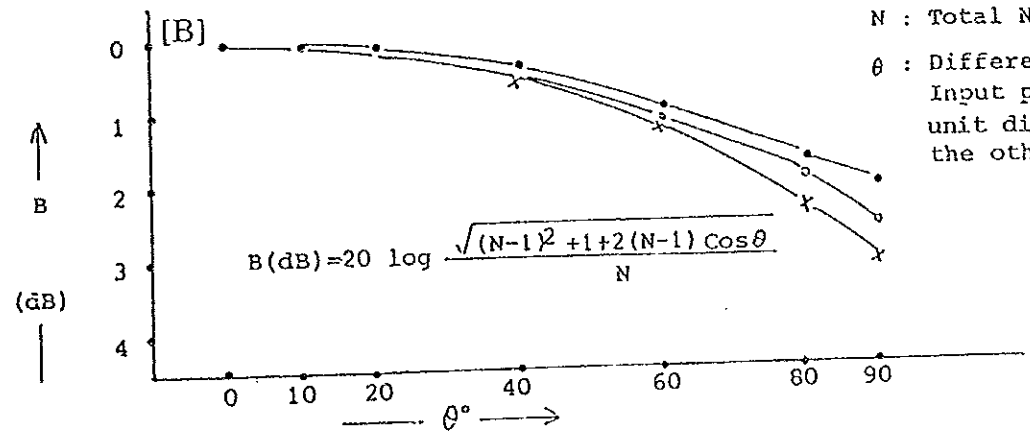
•——• : 4 Units Parallel

o——o : 3 Units Parallel

×——×: 2 Units Parallel

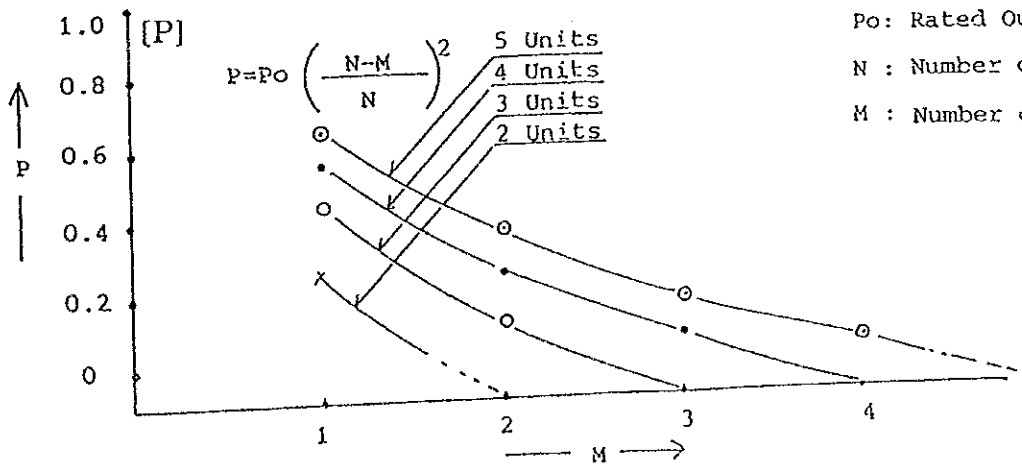
N : Total Number of Units

X : Difference of Level Input level of one unit differs from the others



N : Total Number of Units

θ : Difference of Phase Input phase of one unit differs from the others



Po: Rated Output

N : Number of PA units

M : Number of failed units

NO. 8 Maintenance Plan of Transmitting Facilities

1. Daily Maintenance:

(1) Metering of operating Transmitter

(2) Patrol

Patrol transmitter room and note the abnormal phenomenon which feel our 5 Senses, such as Smell, Noise, Flash, Vibration, Temperature, etc.

2. Weekly Maintenance:

(1) Cleaning Transmitter & related Equipment

(2) Patrol Engine-Generator Room and clean the Equipment

(3) Operating condition of Obstruction Light on the Antenna Mast

3. Monthly Maintenance:

(1) Confirm the Transmitters Output Power (Visual and Aural transmitters respectively by use dummy Load).

(2) Confirm the Visual Transmitter Band characteristics by use AM Sideband Analyzer.

(3) Test Operation Engine-Generator (Operate about 30"), Automatic Start/Stop Test, etc.

(4) Check all parts of Transmitters

a) Burnt parts

b) Leakage of Oil or Electrolyte of Capacitor

c) Loose Bolts & Nuts

d) Poor Contact of Switch or Module

e) Bearing of Blower Motor

f) Air Filter of cooling air Inlet (once/3 months)

4. Yearly Maintenance:

(1) Measurement of the characteristics of TV Tx (once/year)

a) Visual Tx

- Frequency Response
- Output Power

- Carrier Frequency, Intermediate Frequency
- Variation of Output Power
- Differential Gain
- Differential Phase
- Spurious Radiation
- Confirmation of Service Area (Check of Field Strength)

b) Aural Tx
- Frequency Response
- Output Power
- Carrier Frequency, Intermediate Frequency
- S/N (Signal to Noise Ratio)
- Distortion Factor
- Spurious Radiation
- Confirmation of Service Area (Check of Field Strength)

Result of the measured values are necessary to satisfy the CCIR standard.

(2) Test Operation of Spear Parts — such as all kind of Modules, etc.

(3) Transmitting Antenna

a) Appearance of Iron Mast and Antenna Elements (Rust, Losse Bolt & Nut, Guy Wires, Anchor Bolt & Nut, Anchor Blocks, Crack on the surface of Main Feeder, etc.) (once/year)

b) Measurement of Characteristics (once/year) (Measured from Channel Combiner Output)
- DC Resistance
- VSWR

C) Leakage of compressed Air in Main Feeder (once/year)

d) Painting of Iron Mast (once/4 years)

NO. 9 TV Frequency Schedule on Future Plan

	Present (as of 1989)				Future						
STATION	TV	CH	Visual Carrier (MHz)	Aural Carrier (MHz)	CH	Off Set	Tx or Transposer	Pol.	Visual Carrier (MHz)	Aural Carrier (MHz)	Tower Height (m)
Harare	1	5	175.25	180.75	5	20P	TX	H	175.276042	180.776042	155
〃	2	8	196.25	201.75	8	0	TX	H	199.250000	204.750000	〃
M'shanga	1	11	217.25	222.75	11	20M	TR-5 20P	H	223.223958	228.723958	155
〃	2	14	238.25	243.75	14	20M	TR-8	H	247.403958	252.903958	〃
Karoi	1	9	203.25	208.75	9	20M	TX	V	207.223958	212.723958	155
Kariba	1	5	175.25	180.75	5	0	TX	H	175.250000	180.750000	60
Kadoma	1	6	182.25	187.75	6	20P	TX	H	183.276042	188.776042	110
〃	2	9	203.25	208.75	9	0	TX	H	207.250000	212.750000	〃
Gokwe	1	7	189.25	194.75	7	20P	TR-6 20P	V	191.276042	196.776042	155
〃	2	10	210.25	215.75	10	0	TR-9	V	215.250000	220.750000	〃
Chivhu	1	12	224.25	208.75	12	20M	TR-5 20P	H	231.223958	236.723958	155
G. Fowl	1	11	217.25	222.75	11	0	TX	H	223.250000	228.750000	130
〃	2	14	238.25	243.75	14	0	TX	H	247.430000	252.930000	〃
G. Livet	1	7	189.25	194.75	7	0	TR-11	H	191.250000	196.750000	90
〃	2	10	210.25	215.75	10	20P	TR-14	H	215.276042	220.776042	〃
Rutenga	1	11	217.25	222.75	11	20M	TR-7	V	223.223958	228.723958	155
B. Bridge	1	14	238.25	243.75	14	20M	TR-11 20M	V	247.403958	252.903958	60
Mutare	1	6	182.25	187.75	6	20M	TX	V	183.223958	188.723958	60
〃	2	14	238.25	243.75	14	20P	TX	V	247.456042	252.956042	60
Rukotso	2	7	189.25	194.75	7	20M	TR-14 20P	V	191.223958	196.723958	155
〃	1	10	210.25	215.75	10	20M	TR-6 20M	V	215.223958	220.723958	〃
Gwendingwe	2	8	196.25	201.75	8	20M	TR-14 20P	H	199.223958	204.723958	90
〃	1	11	217.25	222.75	11	20P	TR-6 20M	H	223.276042	228.776042	〃
Bulawayo	1	6	182.25	187.75	6	0	TX	V	183.250000	188.750000	155
〃	2	9	203.25	208.75	9	20P	TX	V	207.276042	212.776042	〃
Matopos	1	11	217.25	222.75	11	0	TR-6	H	223.250000	228.750000	30
Gwanda	1	5	175.25	180.75	5	0	TR-11	H	175.250000	180.750000	161
〃	2	8	196.25	201.75	8	20P		H	199.276042	204.776042	〃
Kenmaur	1	12	224.25	229.75	12	20P	TX	V	231.276042	236.776042	155
Kamativi	1	5	175.25	180.75	5	20P	TX	V	175.276042	180.776042	161
〃	2	8	196.25	201.75	8	0	TX	V	199.250000	204.750000	〃
Vic. Falls	1	7	189.25	194.75	7	20M	TR-5 20P	H	191.223958	196.723958	90
〃	2	10	210.25	215.75	10	20P	TR-8	H	215.276042	220.776042	〃
Chiredzi	1	5	175.25	180.75	5	20M	TR-11 20P	V	175.223958	180.723958	155
Mt. Darwin	1	6	182.25	187.75	6	0	TR-11 20M	V	183.250000	188.750000	155

[Remarks] Existing Frequency: West Europe Channel System (Band - Ⅲ)
Color System: PAL - B
TV1: General Programme
TV2: Educational Programme (Broadcasting in Harare only, as of 1989)

20P: Offset Frequency, 20kHz (Pluse)
20M: Offset Frequency, 20kHz (Minus)
O: No offset
H: Polarization of Transmitting Antenna, HORIZONTAL
V: Polarization of Transmitting Antenna, VERTICAL

NO. 10 Finance of the ZBC

ZIMBABWE BROADCASTING CORPORATION

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 30 JUNE 1988

	Notes	1988 $		1987 $	
INCOME					
Licence revenue			6 517 371		6 122 841
Gross		6 783 865		6 377 533	
Less Post Office collection charges		266 494		254 692	
Commercial Service revenue			10 699 785		9 354 150
Gross		12 506 420		10 939 130	
Less Agents' commission		1 806 635		1 584 980	
Production revenue			793 356		648 782
Investment revenue			1 575 053		843 506
- long-term investments		109 772		20 121	
- interest		1 465 281		823 385	
Sundry			398 061		241 538
			19 983 626		17 210 817
			20 688 665		18 438 519
EXPENDITURE	1				
Programme		6 591 945		6 109 741	
Engineering and technical		2 715 784		2 409 134	
Administration, general overheads and security		4 165 214		4 182 868	
Property rent and maintenance		168 150		117 308	
Finance costs		2 434 055		2 093 633	
- exchange losses		772 535		756 812	
- interest		1 661 520		1 336 821	
Provision for contingencies		1 975 721		1 284 249	
Depreciation		2 637 796		2 241 586	
- immovable property		547 499		313 004	
- equipment		1 828 935		1 771 402	
- furniture and office equipment		31 693		25 907	
- motor vehicles		229 669		131 273	
EXCESS OF EXPENDITURE OVER INCOME TRANSFERRED TO GENERAL FUND	3		705 039		1 227 702

ZIMBABWE BROADCASTING CORPORATION

BALANCE SHEET - 30 JUNE 1988

	Notes		1988 $		1987 $
FUNDS EMPLOYED					
CAPITAL RESERVE	2		6 272 962		3 082 200
GENERAL FUND	3		10 219 317		6 477 215
FUNDS OF THE CORPORATION			16 492 279		9 559 415
LOANS	4		19 705 150		20 324 378
PROVISION FOR CONTINGENCIES	5		5 113 102		2 571 599
			41 310 531		32 455 392
EMPLOYMENT OF FUNDS					
FIXED ASSETS	6		27 645 217		22 679 639
LONG-TERM INVESTMENTS	7		1 827 895		921 067
MEDIUM-TERM INVESTMENTS			5 200 000		6 000 000
CURRENT ASSETS					
Stores	8	4 213 436		3 168 453	
Debtors	9	4 699 894		3 073 283	
Investments		6 500 000		2 250 000	
Cash resources		59 497		59 287	
		15 472 827		8 551 023	
CURRENT LIABILITIES					
Creditors	10	8 835 408		5 696 337	
NET CURRENT ASSETS			6 637 419		2 854 686
			41 310 531		32 455 392

W J KAMBA _____ Chairman

T J KANGAI _____ Director General

13 June 1989

NO. 11 Pirmary Enrollment Rates and Adult Literacy Rates in African Countries

Country	School Child (%)	Literacy Rate (Adult, %)	Country	School Child (%)	Literacy Rate (Adult, %)
Ghana	76	59/37	Egypt	78 (C)	54/22
Ethiopia	78	39	Keya	104 (C)	60/35
Mozambique	104 (C)	44/12	Algeria	81	57/32
Niger	23 (C)	14/6	Chad	29	35/8
Nigeria	98	46/23	Burikina Faso	75 (C) (F)	15/3
Central Africa	54	48/19	Congo	93 (C)	70/44
South Africa	(C)	68~29	Ivory Coast	76	45/24
Sudan	52	38/14	Libyan Arab Jamahiriya		67/30
Uganda	60		Mali	27 (C)	14/6
Cameroon	107	55/25	Mauritania	33	17.4
Tanzania	98	62/31	Moroco	80 (C)	41/18
Zaire	90 (C) (F)	74/37	Senegal	48 (C)	31/14
Zambia	96	79/58	Somalia	30 (C) (F)	11/3
Zimbabwe	130 (C) (F)	77/61			
Botswana	84 (F)	61/61			
Angola	24	36/19			
Guinea	33 (C) (F)	35/14			
Madagascar	100	68/55			

(Note) 1. Data of Primary School Enrollment Rate: as of 1986
2. Data of Literacy Rate of Adult: as of 1983
3. (C): Primary School for Compulsory Education
(F): Primary School for Compulsory Education of Free of Charge

NO. 12 List of Collected Materials

(1) NATIONAL INCOME AND EXPENDITURE REPORT 1986, 1987, 1988
(Central Statistical Office)

(2) THE PROMOTION OF INVESTMENT POLICY AND REGULATIONS 1989
(Ministry of Finance)

(3) FIRST FIVE-YEAR NATIONAL DEVELOPMENT PLAN 1986-1990 VOLUME II 1988
(The Government of Zimbabwe)

(4) STATISTICAL YEAR BOOK 1987
(Central Statistical Office)

(5) THE CENSUS OF PRODUCTION 1985/1986
(Central Statistical Office)

(6) BUDGET STATEMENT, 1989 · 1988
(Ministry of Finance)

(7) FINANCIAL STATEMENT, 1989 · 1988 · 1987
(Ministry of Finance)

(8) INVESTMENT OF REGISTER (Summary) 1988
(The Government of Zimbabwe)

(9) POPULATION PROJECTIONS OF ZIMBABWE: 1982 TO 2032
(Central Statistical Office)

(10) LABOUR & ECONOMY
(Ministry of labour, Manpower Planning and Social Welfare)

(11) RAINFALL REPORT SEASON 1982-1983
(Department of Meteorogical Services)

(12) YELLOW PAGES 1989-1990

(13) AN INTRODUCTION TO THE ECONOMICS OF TRANSFORMATION

(14) LOOK & LISTEN (TV · RADIO GUIDE)

(15) ANNUAL ECONOMIC REVIEW OF ZIMBABWE 1986

(16) GENERAL CERTIFICATE OF EDUCATION 1989

(17) A CERTIFICATE GEOGRAPHY OF ZIMBABWE

(18) GEOGRAPHY TODAY
(Human and Economic)

(19) OUR ZIMBABWE
(An Element of Political Economy)

(20) MAPS