CHAPTER 4 IMPROVEMENT PLAN OF TRANSMITTING FACILITY

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4 - 1 Radio Transmitting Facility

4-1-1 Transmitting Facility for RN-I Broadcasting

The construction plan shall be based on Basic Technical Principles as stipulated in the latest CCIR Recommendation

Radio broadcasting service in the Republic of Indonesia is presently carried out by means of short wave (SW) transmitter and medium wave (MW) transmitter. In the past, SW transmitters have been dominantly employed to cover the wide spread country with a small number of broadcasting facilities in the course of broadcasting network expansion. As the result, it is true that the present state of radio wave dissemination are widely thin.

To improve the present state, the following improvement will be carried out during the period of this plan increasing the density electromagnetic wave distribution in respective service areas of each broadcasting station and by building up this effort to all stations in the country.

4-1-2 Merit and Demerit of SW and MW Broadcasting Service

(1) SW broadcasting service makes use of the broadcast signals reflected by the ionospheric layers and return to the surface of the earth. The broadcast signals are usually not sufficiently distributed over the intermediate area around the transmitting station. In addition, it is necessary to change transmitting frequencies so as to keep stable reception condition throughout the year in spite of signal reflecting condition by ionosphere varies depending on seasons and day and night.

Since a doublet type antenna is widely used as a shortwave transmitting antenna at present has directivity, the condition of radio signal dissemination wave varies with azimuth of antenna orientation.

(2) Since MW broadcasting service utilizes that vertically polarized signal which propagate along the surface of the earth, an approximately circular service area centring around a broadcasting station can be secured. Therefore, in the daytime, an approximately circular (somewhat deforms due to earth conductivity and others) area of a radius determined by that station transmitting power output can be served by the stable broadcasting signals. However, MW broadcasting signals are also reflected by the ionospheric layers in the nighttime and reflected signals are received clearly by rural listeners living in the remote area. At the same time, interference at night by other stations also increases resulting in the degradation of receiving condition in the fringe area of daytime service area provided by the surface wave.

(3) As stated above, since MW and SW broadcasting services have each merits and demerits respectively, favourable broadcasting services can be realized by adequately combining both MW and SW broadcasting signals for utilizing propagation characteristics of each band signal effectively.

4-1-3 Improvement of RN-I Service

The following improvement scheduled to execute in the period of this plan,

(1) MW transmitters shall be newly installed in stations where MW transmitters have not yet been installed. The output power of these newly built transmitters will be as shown below depending on the size of their service area.

For IFRB-registered seven (7) stations, the registered power output will be employed.

To another five (5) stations not yet registered, the same frequencies (already IFRB-registered) as of the stations already practically in operation in Indonesia will be allocated, while their outputs being within allocated output power limit to the above registered station.

10 kW MW Broadcasting transmitter................ 6 stations

Bukittinggi, Sorong, Fak-Fak, Nabire, Manokwari, and Ternate

5 kW MW Broadcasting transmitter.................... 5 stations

Palangkaraya, Kupang, Gorontalo, Wamena, and Serui

2 kW MW Broadcasting transmitter.................... 1 station

Dili

Priority of installation shall be as indicated in the Table 2-4-1, in consideration of the improvement plan of SW transmitting facilities.

(2) Superannuated SW transmitters shall be renewed for the purpose of maintaining or improving existing SW broadcasting services.

10 kW SW Broadcasting transmitter	12 stations
50 kW SW Broadcasting transmitter	11 stations

The number of stations which are to be installed new transmitters in every fiscal year is as shown in Table 2-4-2.

(3) Improvement plan of SW broadcasting antenna systems.

In the eastern region of Indonesia the degree of dependence on SW broadcasting service is high because assigned service area to each station are generally large. At present, however, radio signals radiated from each station are not sufficiently distributed in each broadcasting service area. This is mainly because the SW transmitting antenna systems in each station are not appropriate. Thus, it is necessary to improve those antenna systems. At the same time, antenna radiation pattern should be modified to conform to the shape of each service area by re-arranging SW transmitting antenna systems in the following stations.

KALIMANTAN Province

Pontianak, Banjarmasin, and Samarinda

SULAWESI Province

Ujung Pandang, and Manado

MALUKU Province

Ambon

IRIAN JAYA Province

Sorong and Jayapura

As the first step, modification of antenna system shall be tried at Pontianak and Ambon for proving the effect of improvement. Then, the similar techniques will be applied to other stations.
The following items should be noticed in the time of improvement.

a. Radiation pattern should be match with the shape of an objective station's service area as near as possible.
b. The antenna system should be devised so that the optimum elevation angle corresponding to the dimension of the service area can be obtained.
c. The feeder system should be improved so that output power of the transmitter is effectively supplied to the antenna system.

Generally, the transmitting antenna for domestic shortwave broadcasting service should be designed

a. to produce more or less uniform field.
b. with no skip zone.
c. as high value as possible throughout the reception area, and beyond this area the field strength should decrease as rapidly as possible.
d. the antenna should be designed economical in design and simple in operation.

In many cases, the conductivity of the ground is such that the efficiency and the diagram may be degraded if an earth mat is not placed under the array. This earth mat should consist of a number of parallel wires, spaced 0.1 lambda apart and run parallel to the dipoles. The length of the wires and the number of wires should be such that the earth mat extends half lambda beyond the extremities of the array when viewed in plane.

Example of the simple antenna system for transmission test applicable to each station are listed in Table 2-4-3.

(4) Measures for establishing the realization of 24-hour service system of RN-I.

All transmitting facilities must be counter measured so that broadcasting transmitters can be continuously operated for realizing the 24-hour service. There are 28 stations where MW transmitter is installed without standby at present and 7 stations where two transmitters are provided but the outputs of those stand-by transmitters are only 1/10 or less of the main transmitters; reaching total 35 stations. Of these stations, however, seven stations using parallel running type transmitters can be handed at the stations having standby transmitters. Therefore, the number of stations which require actual countermeasures is 28.

4-1-4 Expansion Plan of RN-I Service Area

Although there is a plan to construct seven (7) new local stations to expand radio broadcasting service area, it is expected that radio wave receiving conditions can be fairly improved by the above described improvement.

The following table shows relationship between the proposed sites and stations by which improvement of receiving condition can be expected in the vicinity of the proposed sites.

Proposed Site		Station to be Improved
TASIKMALAYA	-----	Cirebon, Bandung, and Purwokerto
ENDEH	-----	Kupang
TUAL	-----	Ambon
SINGKAWANG--	-----	Pontianak
SINTANG	-----	Pontianak
PANGKALPINANG	----	Palembang
SERANG	-----	Jakarta

(1) As for the fast expansion of RN-I programme to the area which is not adequately served until now, simple low power solid state MW transmitting system shall be constructed, operated by stable

power supply system and provided with stable programme relay system such as SRO (Sound Receive Only Earth Station) or off-air relay receiver.

(2) In advance to the above construction, more intensive field survey shall be conducted on the field strength of existing transmitting stations as well as the site conditions.

4-1-5 Construction Plan of Transmitting Facilities for RN-II Service

To extend RN-II service to Nusantara station during the period of the 4th 5-year development plan.

The following transmitting facilities shall be constructed as follows:

(1) Installation of additional MW transmitter for RN-II programme service.

MW broadcasting facilities will be newly provided in accordance with the IFRB-registered frequencies and output powers assigned to Nusantara stations. The allocated frequencies and power outputs to those stations are listed up in the following table.

NUSANTARA		RN-I	RN-II
I	MEDAN	855 kHz/100 kW	819 kHz/10 kW
II	YOGYAKARTA	1,107 kHz/ 10 kW	972 kHz/20 kW
III	BANJARMASIN	1,134 kHz/ 50 kW	765 kHz/ 5 kW
IV	UJUNG PANDANG	630 kHz/100 kW	1,359 kHz/10 kW
V	JAYAPURA	1,053 kHz/ 10 kW	828 kHz/ 5 kW

As seen above, IFRB-registered output powers are not enough for RN-II service and it can cover only to the city area and its suburb where broadcasting station is located.

(2) Plan to use a part of Existing SW Broadcasting Facilities

At present, two to four SW frequencies are allocated to each Nusantara station and are being used for RN-I as shown in Table 2-4-5. If a part of existing SW transmitters may be transferred to RN-II by improving antenna system and by increasing SW transmitter output powers, RN-II service will be better than the case of MW broadcasting only.

An example of transfer plan at each Nusantara station is shown in Table 2-4-5. However, this plan is no more than a tentative plan because most of the transferable transmitters are superannuated.

(3) Plan to use jointly MW and SW Broadcasting

In this plan, MW transmitter newly installed for RN-II service as described in (1) and transferred SW transmitters are used jointly to further improve the above two plans. This plan can have the area as large as the area covered by SW broadcasting. Combination plan of MW and SW transmitters is as shown in Table 2-4-6.

4-1-6 Installation Plan of Power Supply System in Response to The Provision of Additional Transmitters.

Utmost efforts should be made to use city power for the power supplies required for additional transmitting facilities which are to be provided as mentioned in the preceding subsections. However, if it is difficult in some areas due to the situation of city power supply, station-owned generating facilities shall be installed.

4-1-7 Plan for Additional ST Link System

To send out the broadcasting programmes of RN-II from local station, it is necessary to increase the programme transmission lines between studios and transmitting stations.

4-1-8 Construction of High Power SW Transmitting Station for Overseas Service

A short wave transmitting station shall be newly constructed for intensifying overseas broadcasting service.

The outline of the facilities is as follows:

(1). Location

The location shall be chosen to have better site condition than those of Cimanggis. It is necessary to make site surveys as well as map survey to find out the best available site with respect to the technical standards described in Chapter 8, Section 8-7.

(2) Intended service area will be Asean Countries, North and South-East Asia, South Pacific, North and South America, Middle East, Europe and Africa.

(3) Transmitting System

The final target of the scale of this system will be as follows :

a. Two sets of 500 kW for distances greater than 8,000 km.
   Two sets of 250 kW for distances 4,000 - 8,000 km.
   Two sets of 100 kW for distances less than 4,000 km.
b. Able to transmit at least 2 different programmes at the same time.
c. Transmitting antenna, feeder and feeder switching systems.
d. Power supply system with standby engine generators.

(4) Construction costs in this plan period are summed up for the basic construction work such as land acquisition, land levelling, flood water drainage, access road, extension of electric power supply line, main building, antenna tower and some of the transmitters.

4 - 2 Installation Plan of FM Transmitting Facility

FM transmitting facilities will be installed in 39 regional stations during this plan period for the RN-III programme service. Installation will be conducted under the following basic specifications.

(1) Frequencies allocated to FM broadcasting service are in the VHF band and as propagation characteristics of FM broadcasting signal resemble to that of television broadcasting signal. Therefore, FM transmitting facilities, as a rule, will be installed in the same location as the television transmitting station.

(2) FM transmitting antennas will be mounted on existing television antenna towers whenever possible. At stations which have plans to rebuild its television transmitting tower, it will be designed to also accommodate an FM antenna.

(3) The effective radiation power of the FM transmitter will be set at a level such that FM stereophonic broadcasting will, at least, cover the same service area as that of the present television broadcasting, and transmitter output, antenna gain and feeder will be selected to meet this requirement.

(4) Highest priority of FM transmitting facility installations will be given to the Nusantara stations and to other stations, order of priority will be distributed as throughout each fiscal year by

reviewing the condition of FM programme transmission line and programme production facility plan, etc.

4-2-1 FM Transmitting Facility

(1) Output power of FM transmitters installed in each station will be about 1/2 of the output power of television video transmitters by the following reasons.

a. To allow good reception of FM stereophonic broadcasting in the same area covered by present television broadcasting.

b. The FM transmitting antenna will be mounted on the television tower.

c. The calculation of the required power of FM transmitter is as follows:

Minimum usable field strength in rural area:

TV	55dB (V/m)	CCIR 417-2
FM monophonic	48dB (V/m)	CCIR 412-3
FM stereophonic	54dB (V/m)	"

As the nominal power output of video transmitter is presented by the peak output value of synchronizing pulse and when this is converted to average power, will be 0.6 times (-2.2dB) that of the nominal power output of video transmitter. Furthermore, as there is a -1dB difference in the required field strength, this makes the total -3.2dB and if we assume the transmitting antenna gain to be the same, an FM transmitter of about half the nominal power output of a TV transmitter should satisfy the condition in the above.

d. The FM transmitter outputs of each station determined by this calculation and the order of priority in installation are given in Table 2-4-7. The number of stations installed for each fiscal year together with their output power ranks are given in Table 2-4-8.

e. STL will be 1 set of wide bandwidth programme transmission link in UHF or SHF band including standby equipment.

For convenience in maintenance, the transmitter output will be standardized to 30W and ERP necessary for link span will be adjusted by choosing suitable gain of the transmitting/receiving antenna.

4 - 3 Installation Plan of TV Transmitting Facility

For the purpose of expanding the television service to the area where not receiving enough benefit of television broadcasting service, 50 stations will be constructed during the plan period at the rate of 10 stations a year.

These new stations will be of small scale and for servicing regional cities and their surrounding area. They will be appropriate to install under the following conditions.

a. They will be unattended stations.
b. Service area will be limited to the level of city, town or village; and transmitter output will be around 100 watts.
c. City power sources will be used whenever possible and to eliminate the effect of voltage fluctuation and shutdown of power supply , the transmitters will be operated by floating charge type storage batteries.
d. Stations where city power is not available, the use of solar batteries will be considered.
e. A remote control system will not be employed but a start-up system activated by the detection of input signal to the transmitter and clock starting system will be used in combination.
f. Switching between the main and stand-by transmitter will be the automatic switching type by detecting the transmitter output.
g. In place of a remote supervising system for monitoring the operating condition of the station, a simple method will be taken whereby a suitable person in the service area (TV repair shop, etc.) can be assigned as a monitor.
h. Overall system must be highly reliable.
i. Considerations shall be taken to reserve enough space for accommodating transmitting facilities including additional antenna and transmitter for the TVN-II service.

Expected population in the new coverage area are estimated as shown in Table 2-4-9.

Table 2-4-1

Installation Plan of New MW Transmitting Stations

OUTPUT POWER	STATION	FISCAL YEAR 84/85	85/86	86/87	87/88	88/89
10 kW	BUKITTINGGI		○			
	SORONG	○				
	TERNATE			○		
	MANOKWARI					○
	FAK-FAK				○	
5 kW	PALANGKARAYA	○				
	KUPANG	○				
	SERUI			○		
	WAMENA				○	
2 kW	DILI	○				
	(SUB TOTAL)	4	1	2	2	1

TOTAL : 10

Table 2-4-2

Improvement Plan of Short wave Transmitter

Nusantara	Station	84/85	85/86	86/87	87/88	88/89
I	Medan			50 kW		
	Pekanbaru			10 kW		
	Jambi				10 kW	
	Palembang					50 kW
II	Yogyakarta		50 kW			
	Cirebon				10 kW	
	Madiun					10 kW
	Denpasar			10 kW		
	Singaraja					10 kW
	Mataram				10 kW	
III	Banjarmasin	50 kW				
	Pontianak		50 kW			
	Parangkaraya				50 kW	
	Samarinda	50 kW				
IV	Ujung Pandang			50 kW		
	Manado		50 kW			
	Kendari	10 kW				
V	Jayapura	50 kW				
	Ambon	50 kW				
	Biak		10 kW			
	Nabire			10 kW		
	Fak-Fak					10 kW
	Merauke		10 kW			
Number of Transmitter	10 kW	1	2	3	3	3
	50 kW	4	3	2	1	1
Total		5	5	5	4	4

Total : 23

Table 2-4-3

Example of the Simple Anenna System for Transmission Test

Note: L = *Lamda*

TRANSMITTING STATION	FREQUENCY	POWER OUTPUT	ANTENNA TYPE	AZIMUTH	HEIGHT	PHASE	EARTH MAT	RADIATION PATTERN
PONTIANAK	3,995 kHz	10 kW	HR 1/1	170° – 350°	0.2L	reflector L/4 apart	Yes	A
BANJARMASIN	5,970	10	HR 1/1	75° – 255°	0.2L	"	"	"
SAMARINDA	6,135	10	– –	100° – 280°	0.2L	10° slew to West	"	B
UJUNG PANDANG	4,720 4,751	50 20	– –	80° – 260°	0.2L	10° slew to East	"	B
MANADO	5,990	10	– –	140° – 320°	0.2L	10° slew to NW	"	B
AMBON	7,140	10	=	85° – 265°	0.4L	same phase	"	C
SORONG	4,875	10	=	30° – 210°	0.2L	" "	"	C
JAYA PURA	6,070	20	HR 1/1	140° – 320°	0.2L	reflector L/4 apart	"	A

Table 2-4-4

Installation of MW Standby Transmitter

Nusantara	Station	84/85	85/86	86/87	87/88	88/89
I	B.Aceh			10 kW		
	Padang				10 kW	
	Jambi		10 kW			
	Benkulu		5 kW			
	Tj.Pinang	10 kW				
	Tj.Karang		5 kW			
II	Yogyakarta	50 kW				
	Bandung				10 kW	
	Cirebon			10 kW		
	Malang					10 kW
	Surakarta		10 kW			
	Purwokerto				10 kW	
	Jember					10 kW
	Sumenep				10 kW	
	Denpaear	10 kW				
	Singaraja				1 kW	
	Mataram					10 kW
III	Pontianak	25 kW				
	Samarinda		25 kW			
IV	Manado			10 kW		
	Kendari					10 kW
	Palu		10 kW			
V	Jayapura	10 kW				
	Biak			10 kW		
	Merauke					10 kW
	Ambon		10 kW			
Number of Transmitter	1 kW	-	-	-	-	-
	5 kW	-	2	-	1	-
	10 kW	3	4	4	4	5
	25 kW	1	1	-	-	-
	50 kW	1	-	-	-	-
Total		5	7	4	5	5

Total : 26

Table 2-4-5

<u>Transmitting Facilities for National II Service</u>

	STATION	MW TRANSMITTER (NEW) FOR SHORT DISTANCE		SW TRANSMITTER (TRANSFERRED) FOR LONG DISTANCE SERVICE	
		FREQUENCY	POWER OUTPUT	FREQUENCY	POWER OUTPUT
I	MEDAN	819 kHz	10 kW	( )	20 kW
II	YOGYAKARTA	972 kHz	20 kW	5,047 kHz	20 kW
III	BANJARMASIN	765 kHz	5 kW	3,250 kHz	20 kW
IV	UJUNG PANDANG	1,359 kHz	10 kW	4,751 kHz	20 kW
V	JAYAPURA	828 kHz	5 kW	6,070 kHz	20 kW

Transferring Plan of Existing SW Transmitter for RN-II Service

Table 2-4-6

Station	Existing SW Transmitter for RN-I: Freq. (kHz)	Existing SW Transmitter for RN-I: Pwr. (kW)	Improvement Plan of Transmitter: 84/85	85/86	86/87	87/88	88/89	Transferring for RN-II service
Medan	4765	50			○			
	4765	20			●	→	→	→△*
	3375	7.5						
Yogyakarta	7190	50		○				
	7100	7.5						
	5047	20		●	→	→	→	→△
	2350	1						
Banjarmasin	5790	10	○(50kW)					
	3250	20	●	→	→	→	→	→△
	2430	0.15						
Ujung Pandang	9550	7.5			○(50kW)			
	4751	20			●	→	→	→△
	4720	50						
	3214	0.3						
Jayapura	9610	10	○(50kW)					
	9610	1						
	6070	20	●	→	→	→	→	→△
	2940	0.5						

○ : Renewal
Existing one will be used for stand-by.

●→△ : Transferring

Table 2-4-7-(1)

Construction Schedule of FM Transmitting Station

No	RRI Station	TV Tx Station	Pwr. (kW) TV	Pwr. (kW) FM	Fiscal Year 84/85	85/86	86/87	87/88	88/89	
1	Jakarta		20	10						
2	Medan	Bandarbaru	10	5	○					
3	Banda Aceh		1	0.5		○				
4	Pekanbaru		10	5	○					
5	Padang	G. Gompong	5	3				○		
6	Jambi		10	5		○				
7	Palembang		10	5	○					
8	Bengkulu		1	0.5			○			
9	Tj.Karang	G.Betung	1	0.5					○	
10	Sibolga		1	0.5						△
11	Bkt.Tinggi	Pandaisikat	5	3				○		
12	Tj.Pinang	P.Batam	5	3						△
13	Yogyakarta		10	5	○					
14	Bogor	(Ps.Sumbul)	0.03	0.1						△
15	Bandung	G.Nagrak	5	3		○				
16	Cirebon		0.5	0.3			○			
17	Semarang	Gombel	5	3			○			
18	Madiun	G.Pandan	5	3					○	
19	Malang	G.Gebug	0.3	0.3				○		
20	Surakarta	Wungurejo	1	0.5					○	
21	Surabaya		10	5	○					
22	Purwokerto	Depok	5	3			○			
23	Jember	G.Gending	1	0.5					○	
24	Sumenep	G.Brengik	1	0.5						△
25	Denpasar	Bkt.Bakung	5	3	○					
26	Singaraja	Kintamani	1	0.5						△
27	Mataram	Seganteng	1	0.5			○			
28	Banjarmasin		10	5	○					
29	Pontianak		10	5		○				
30	Palangkaraya		10	5			○			
31	Samarinda		0.1	0.5		○				
32	Balikpapan		1	0.5				○		
33	Ujung Pandang		1	0.5	○					

Table 2-4-7-(2)

34	Palu		1	0.5					○	
35	Kendari		1	0.5					○	
36	Gorontalo		0.3	0.3					○	
37	Manado	Makaweimben	5	3	○					
38	Kupang	Oben	10	5				○		
39	Dili		0.1	0.1					○	
40	Jayapura	G.Polemak	1	0.5	○					
41	Ambon	Bkt.Gresir	5	3		○				
42	Ternate		1	0.5				○		
43	Sorong		0.1	0.1			○			
44	Fak-Fak		0.1	0.1						△
45	Manokwari		0.3	0.3					○	
46	Biak		0.3	0.3				○		
47	Serui		0.1	0.1						△
48	Nabire		0.3	0.3						△
49	Wamena		0.05	0.1						△
50	Merauke		0.3	0.3						△

Stations marked △ will be constructed after the 4th five-year period.

Table 2-4-8

Construction Plan of FM Transmitting Station

Output Power Rank \ Fiscal Year	1 84/85	2 85/86	3 86/87	4 87/88	5 88/89	Total
5 kW	6	2	1	1	-	10
3 kW	2	2	2	2	1	9
0.5 kW	2	2	2	2	5	13
0.3 kW	-	-	1	2	2	5
0.1 kW	-	-	1	-	1	2
Total	10	6	7	7	9	39

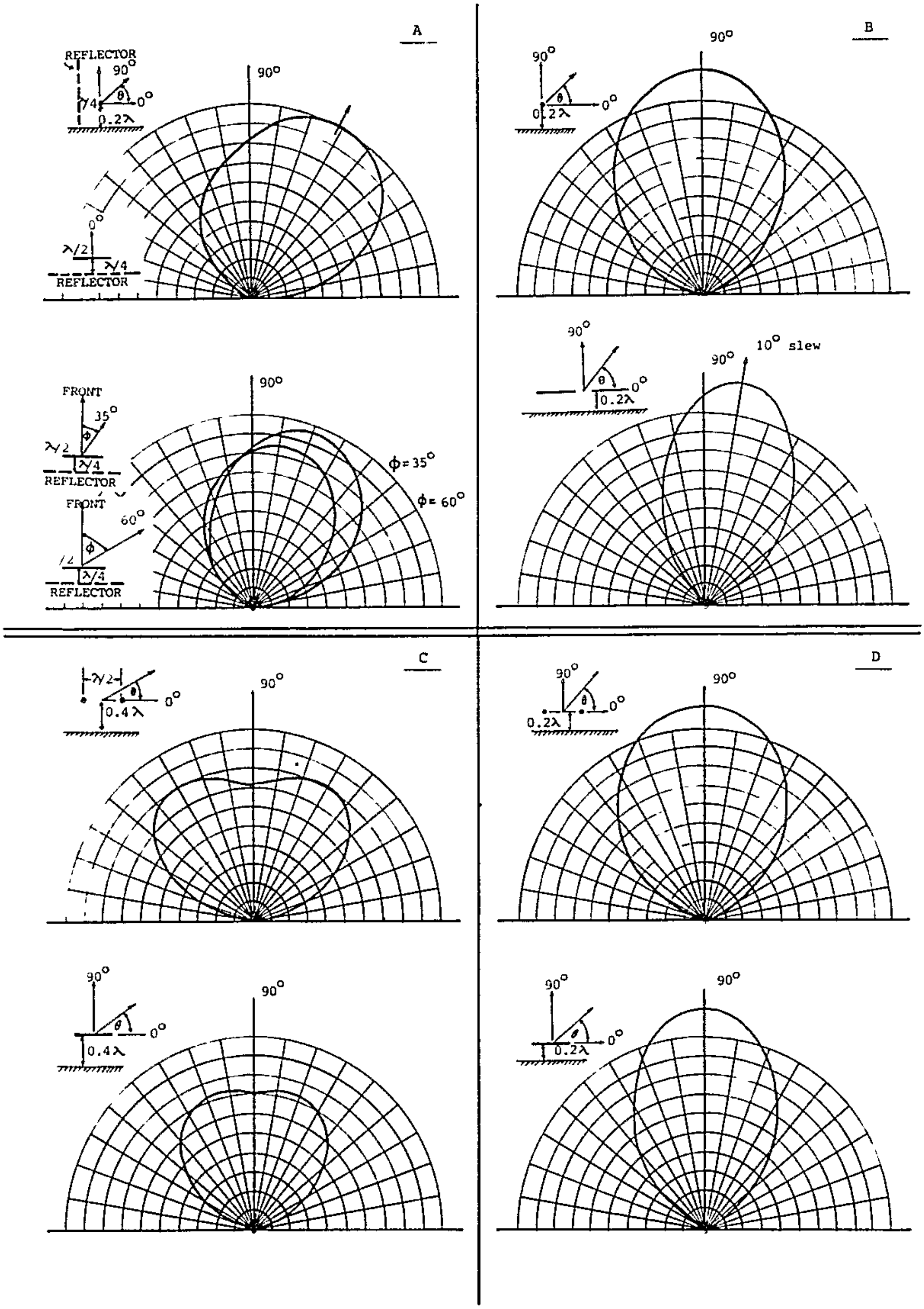
Table 2-4-9

Population Coverage of Planned TVN-I Relay Stations

NO.	PROPINSI	KABUPATAN	LOKASI	ESTIMATED POPULATION IN THE SERVICE AREA	TOTAL
1.	N.T.T.	ALOR	KALABAHI	21,000	
2.	N.T.T.	NGADA	BAJAWA	35,000	
3.	N.T.T.	SUMBA BARAT	WAIKABUBAK	35,000	
4.	ACEH	ACEH BARAT	SINABANG	30,000	
5.	LAMPUNG	LAMPUNG SELATAN	PADANGCERMIN	201,000	
6.	KALTENG	KOTAWARINGIN TIMUR	SAMPIT	42,000	
7.	BENGKULU	BENGKULU UTARA	IPUH	20,000	
8.	KALBAR	SAMBAS	SINGKAWANG	54,000	
9.	SULUT	SANGIR TALAUD	P.BEO	43,000	
10.	JAMBI	BUNGOTEBO	MUARABUNGO	46,000	
11.	SUMATERA BARAT	SOLOK (SUMATERA BARAT	MUARALABUH	61,000	
12.	RIAU	RIAU KEPULAUAN	P.BINTAN	58,000	
13.	SUMATERA SELATAN	MUSI BANYUASIN	SEKAYU	69,000	
14.	JAWA BARAT	PANDEGLANG	PANDAGLANG BARAT(SAKETI)	110,000	
15.	JAWA TENGAH	BREBES	BIMIAYU	190,000	
16.	SULSEL	MAMUJU	MAMUJU	33,000	
17.	JAWA TIMUR	TRENGGALEK	TRENGGALEK	113,000	
18.	MALUKU	MALUKU TENGGARA	SAUMLAKI	22,000	
19.	KALTENG	BARITO SELATAN	BUNTOK	23,000	
20.	KALBAR	SAMBAS	BENGKAYANG	54,000	
21.	IRIAN JAYA	FAK-FAK	KAIMANA	9,000	
22.	MALUKU	HALMAHERA TENGAH	SANANA	11,000	
23.	ACEH	ACEH TENGGARA	BLANGKEJERAN	32,000	
24.	SUMUT	NIAS	TELUKDALAM	64,000	
25.	JAWA BARAT	GARUT	PAMENGPEUK	232,000	
26.	LAMPUNG	LAMPUNG UTARA	LIWA	83,000	
27.	SUMATERA BARAT	PESISIR SELATAN	PESISIR SELATAN	59,000	
28.	SULTENG	POSO	AMPANA	28,000	
29.	BENGKULU	BENGKULU UTARA	MUKO-MUKO	20,000	
30.	SULTA	BUTON	BOEPINANG	48,000	
31.	KALTENG	MURANG RAYA	PURUKCAU	16,000	
32.	SUMSEL	MUSI RAWAS	LUBUKLINGGAU	33,000	
33.	MALUKU	MALUKU UTARA	TOBELO	70,000	
34.	ACEH	ACEH BESAR	SABANG	32,000	
35.	IRIAN JAYA	JAYAPURA	SARMI	18,000	
36.	JAWA TIMUR	TUBAN	TUBAN	119,000	
37.	SUMUT	DAIRI	SINDIKARANG	60,000	
38.	SULSEL	BULUKUMBA	BULUKUMBA	90,000	
39.	SULTRA	LOLAKA	KOLAKA UTARA	31,000	
40.	JAWA BARAT	PANDEGLANG	PANDEGLANG SELATAN	110,000	
41.	SULUT	BOLAANGMONGONDOW	PINOLOSIAN	48,000	
42.	SUMBAR	PADANG/PARIAMAN	PARIAMAN	88,000	
43.	JAWA TENGAH	CILACAP	MAJELANG	210,000	
44.	RIAU	INDRAGIRI HILIR	TEMBILAHAN	57,000	
45.	SULSEL	MAJENE	MAJENE	52,000	
46.	KALTENG	GUNUNG MAS	KUALAKURN	9,000	
47.	TIM TIM	ERMERA	ERMERE	21,000	
48.	ACEH	ACEH SELATAN	BLANGPIDI	47,000	
49.	IRIAN JAYA	SORONG	TEMINABUAN	20,000	
50.	KALTENG	SERUYAN	KUALAPEMBUANG		2,977,000

Fig. 2-4-1

Vertical Radiation Pattern of Typical Shortwave Transmitting Antenna



CHAPTER 5 CONSTRUCTION PLAN OF TRANSMITTING STATION

CHAPTER 5 CONSTRUCTION PLAN OF TRANSMITTING STATION

This chapter examines the site for transmitting stations which are to be newly installed transmitting facilities described in CHAPTER 4.

5 - 1 Construction and Improvement Plan of MW and SW Transmitting Facility

For the expansion of the domestic radio broadcasting service, the following broadcasting facilities shall be newly installed , but as they are built in the premise of existing transmitting station, installation of new stations will not be necessary.

(1) Installation plan of MW transmitters in the stations where no MW transmitter is equipped.

MW transmitters will be installed in the 12 stations which are not equipped with MW transmitters. These stations are already equipped with SW transmitting facilities and basic facilities such as land, building and power supply system are all arranged. No serious problem of mutual interference will be foreseen between the SW transmitting facility and MW transmitter when it is installed in the same premise. Furthermore there are merits that it will be convenient in means of operation, such as saving of operation staff, common use of ST link and station keeping facilities. Therefore in principle, the MW transmitter will be better to install in the same site.

For the stations where expansion of land and construction of additional station buildings are necessary, they shall be examined in detail at the time of construction.

(2) Reinforcement plan of output power of SW transmitters and replacement plan of aged transmitters

Reinforcement of output power and replacement of transmitter shall be carried out on stations indicated in Table 2-4-2. As the facilities will be installed in the premise of the existing stations, construction of new stations will not be necessary.

(3) Improvement plan of SW transmitting antenna

As the antennas will be erected in the premises of existing stations, there is no plan of construction of new station.

(4) Installation plan of standby MW transmitters for 24-hour broadcasting service of RN-I programmes

As the standby MW transmitters will be installed in the existing station premise, construction of new station will not be necessary.

(5) Installation plan of MW transmitter for the new RN-II broadcasting service

As the additional MW transmitter will be installed in the existing station premise, construction of new stations will not be necessary.

5 - 2 Construction of High Power SW Transmitting Station for Overseas Service

To reinforce the overseas services beamed to ASEAN countries, North and South East Asia, South Pacific, North and South America, Middle East, Europe and Africa, a new SW transmitting station shall be established.

In case two set each of 500kW, 250kW and 100kW SW transmitters are to be installed, the following conditions shall be satisfied in selecting the station site.

a. As a high gain directional transmitting antenna is to be installed toward six directions at least to cover the above mentioned service areas, a flat land measuring 2,000m X 2,000m (4,000,000m^2) shall be secured.

b. A land space of about 10,000m^2 shall be secured within the premises of station for accommodating buildings for transmitting facilities such as transmitter house, power plant house, antenna-feeder switchover house, transmitter control room, maintenance room and test room, etc., and another land space for accommodating buildings for operating staff office rooms and dormitories.

c. To operate one set each of 500kW, 250kW and 100kW SW transmitter, 1,200kVA, 800kVA and 350kVA power supply will be needed. The total necessary capacity should be decided based on the regular operation mode of transmitter in accordance with the transmission schedule. 5,000kVA power supply system will be sufficient for full load operation mode. If such amount of power cannot be supplied by commercial power source, 2 set each of 2,000kVA, 1,000kVA and 500kVA engine generators designed for continuous operation will be needed in place of city power source.

d. For daily operation of overseas service, 2 circuits of order wire between Jakarta and the transmitting station and 5 programme transmission lines (7kHz bandwidth) will be needed.

5 - 3 Construction Plan of FM Transmitting Facilities

As the FM transmitting facilities are planned to be installed in the premise of existing TV stations, and expansion of transmitter room and power plant room will be only required, there is no plan of building new stations.

As for the polarization of FM Broadcasting Signal, horizontal polarization should be generally used in consideration of the following reasons;

a. Though some advantages can be expected in band 9 (UHF band) by use of orthogonal polarization, in VHF/FM sound broadcasting, no advantages should be expected in cases where the polarization of the receiving antennas are random.

b. The median values of discrimination of 18 dB will be usually be realized only at roof level but this value may be reduced to 13 dB or less at street level. Furthermore, this value may be reduced more in densely populated area where the receiving antenna is surrounded by obstacles.

5 - 4 Construction Plan of New TV Transmitting Station

(1) As described in Chapter 4, 10 stations per year, a total of 50 stations will be newly constructed during the period of the plan. Although the transmitting point of each station shall be decided through a careful field survey, the transmitting power output of each station shall be around 100 W.

(2) The TV programmes being sent from Jakarta via Palapa shall be received by TVRO and reproduced TV programmes are supplied to the transmitter.

(3) The directivity of the transmitting antenna shall be decided in observing the shape of required service area from the transmitting point. As for a standard design, a unidirectional Yagi antennas shall be used.

(4) The site location of the TV station shall be near the city area due to the following reasons.

a. Even the transmitting power output is small, a sufficient electric field intensity can be obtained all over the target service area by use of directional antenna.

b. As unattended operation is available, it is not necessary to stay operation staff always in the station.

c Periodical maintenance and management can be performed at an interval of 3 months or more.

d. City electric power can be utilized easily.

e. It will be easy to entrust TV engineers living in the service area to supervise the operational condition of the transmitting station.

(5) The population in the newly developed coverage area is estimated 2,977,000 persons as shown in Table 2-5-1. This corresponds to about 2% of all the population, that is, 63% of the present coverage will be increased to nearly 65%. It will be very profitable that 3 millions of people who could not share in the benefit of TV broadcasting service will be able to view TV programmes.

Table 2-5-1-(1)

Construction Plan of Relay Stations for TVN-I Service

Planned Site	Location		Population	Programme Transmission		Ch.	Remarks
	Long.	Lat.		By	From		
D.I.Aceh							
Sinabang	96E22	2N28	30,000	TVRO		9	
Sabang	95E1[illegible]	5N53	32,000	Off-air	B.Aceh	9	
Blangpidie	96E5[illegible]	3N44	47,000	TVRO		10	
Blangkejeren	97E2[illegible]	3N59	32,000	"		8	
Sumatra Utara							
Sidikarang*	98E18	2N45	60,000	TVRO		4	S.Jarunjung Fv: 43 dBf
Telukdalam	97E48	0N34	64,000	"		7	
Sumatra Barat							
Muaralabuh	101E04	1S30	61,000	TVRO		10	
Pariaman*	100E07	0S36	88,000	Off-air	G.Gompong	11	G.Gompong Fv: 45.8 dBf, P.Q:**3
Painan Selatan	100E47	1S47	59,000	TVRO		8	

Table 2-5-1-(2)

Riau							
Tembilahan	103E07	0S21	57,000	Off-air	Rengat	6	
P. Bintan	104E27	1S07	58,000	"	P.Batam		
Jambi							
Muarabungo*	102E07	1S29	46,000	TVRO		6	Any Channel Unreceivable
Sumatra Selatan							
Sekayu*	103E50	2S53	69,000	Off-air	Prabumulih	4	Purabumulih Fv: 57.4 dBf, PQ: 2
Lubuklinggau	102E52	3S17	33,000	"	T.Tinggi	6	T.Tinggi Fv: 49.1 dBf, PQ: 3^-
Benkulu							
Ipuh	101E29	3S17	20,000	TVRO		8	
Muko-Muko	101E07	2S34	20,000	"		4	
Lampung							
Padancermin*	105E09	5S36	201,000	TVRO		10	
Liwa	104E05	5S02	83,000	"		8	

Table 2-5-1-(3)

Jawa Barat							
Pandegelang Barat	105E57	6S24	110,000	TVRO		11	
Pameumpeuk	107E43	7S38	232,000	"		6	
Pandegerang Selatan*	106E16	6S34	110,000	"		4	Any Channel Unreceivable
Jawa Tengah							
Bumiayu	109E02	7S14	190,000	TVRO		11	
Majenang*	108E45	7S18	210,000	"		7	Any Channel Unreceivable
Jawa Timur							
Tuban*	111E02	6S53	119,000	TVRO		6	Surabaya: Unmesurable, PQ: ·2
Trenggalek*	111E42	8S03	113,000	"		8	G.Pandan: Unmesurable, PQ: 2

Table 2-5-1-(4)

Kalimantan Barat							
Singkawan	108E59	0N54	54,000	TVRO		6	
Bengkayang	109E28	0N49	54,000	"		11	
Kalimantan Tengah							
Sampit	112E58	2S32	42,000	Off-air	Palangkaraya	6	
Buntok	114E49	1S44	23,000	"	Palangkaraya	4	
Purukcau	114E34	0S37	16,000	TRVO		9	
Kualakurun	113E50	1S08	9,000	Off-air	Palangkaraya	6	
Kualapembuang	112E33	3S23		TVRO		4	
Sulawesi Utara							
Pinolosian	124E07	0N23	48,000	TVRO		10	
P.Beo	126E48	4N14	43,000	"		5	
Sulawesi Tengah							
Ampana	121E35	0S52	28,000	TVRO		4	

Table 2-5-1-(5)

Sulawasi Tenggara							
Kolaka Utara	121E17	3S53	31,000	TVRO		8	
Boepinang	121E35	4S47	48,000	"		7	
Sulawesi Selatan							
Majene	118E59	3S32	52,000	TVRO		8	
Bulukumba	120E12	5S34	90,000	"		6	
Mamuju	118E53	2S41	33,000	"		4	
Nusa Tenggara Timur							
Kalabahi	124E31	8S13	21,000	TVRO		6	
Bajawa	120E58	8S47	35,000	"		9	
Waikabubak	119E25	9S38	35,000	"		5	
Maluku							
Saumlaki	131E19	7S59	22,000	TVRO		6	
Tobelo	128E00	1N43	70,000	"		5	
Sanana	125E59	2S03	11,000	"		7	

Table 2-5-1-(6)

Irian Jaya							
Sarmi	138E45	1S52	18,000	TVRO		9	
Teminabuan	132E01	1S27	20,000	"		8	
Kaimana	133E46	3S40	9,000	"		9	
Timor Timur							
Ermere	125E24	8S45	21,000	TVRO		10	

Longitude and latitude point out the location of city or town.

Programme transmission system should be decided after precise survey.

* Measured point at the second field survey

** Picture Quality

CHAPTER 6 FREQUENCY ALLOCATION PLAN

CHAPTER 6 FREQUENCY ALLOCATION PLAN

6 - 1 MW Broadcasting

New frequency allocation is necessary only for the 12 regional stations which have not MW transmitters and are to be newly equipped with MW transmitting equipment.

(1) The operating frequency and the maximum transmitting power output of the following 7 stations are already registered by IFRB Table 2-6-1 as shown in the following list.

Bukittinggi	1512 kHz	10 kW
Palangkaraya	1197 kHz	5 kW
Kupang	1107 kHz	5 kW
Sorong	909 kHz	10 kW
Fak-Fak	774 kHz	10 kW
Ternate	891 kHz	10 kW
Dili(Atambua)	711 kHz	2 kW

(2) As for the 5 stations which have not registered in IFRB, their operation frequencies and power outputs shall be decided in the following way.

1) The operating frequencies are selected among the frequencies which the Indonesian government has registered in IFRB and has allocated to some stations. If those frequencies will not cause co-channel or adjacent channel interference to the existing stations and planned stations.

2) Frequency allocation shall be made in accordance with the following CCIR technical standard.

- o Minimum field strength required -- 70 dB/ V/m
- o Radio wave propagation curves used for the calculation:

  surface wave -- CCIR Rec. 368-2

  space wave -- propagation curve for south to north path adopted at Cairo conference.

  Protection ratio according to CCIR REC. 449-2

  co-channel -- 30 dB

  adjacent channel -- 4 dB

According to the technical standards, the minimum distance between the stations necessary for avoiding interference is calculated for each transmitting power as indicated in Tables 2-6-1 and 2-6-2, and the operating frequency of an existing station which is located further than the calculated minimum separation distance is selected. The result is shown in Table 2-6-3, 2-6-4.

The selected operating frequencies and the power outputs for the non-registered 5 stations are thus selected as mentioned above. These station shall be immediately resisted to IFRB.

6 - 2 SW Broadcasting

As SW broadcasting station is planned to dismantle gradually as MW broadcasting equipment increases, no SW stations shall be newly installed during the period of this plan. However, SW reception will be improved by reconstruction SW antennas, replacing worn-out transmitters with new ones and changing some frequencies.

As the frequencies used for overseas SW broadcasting service are only 11,790 kHz and 15,150 kHz, new frequency channel in the 31 and 13 metre band will be added.

The frequencies to be allocated to the new SW transmitting stations shall be registered as soon as possible when the most suitable frequencies were chosen for the services as described in Chapter 4, section 4-1-8 in consultation with the results of 1984 WARC conference.

6 - 3 FM Broadcasting

(1) As all FM stations except Jakarta Station will be newly built, frequencies for these stations are allocated as follows.

a. Three frequencies are allocated to each FM station, in considering that new broadcasting systems will be added in the future.

b. The frequency band for the FM broadcasting service which are being used for ST links will be replaced with those in the UHF band or SHF band in the future. However, these frequencies which will not be interfered with newly allocated shall be continuously used for a while

c. Special attention was paid to the frequency allocation for FM stations which location is near the FM stations in the neighbouring countries, so that mutual interference will not occur.

(2) The technical standard used for allocation of FM frequencies are as follows.

a. Frequency spacing between stations is 200 kHz
b. In principle, of the total 101 channels for FM broadcasting service allocated to Indonesia, the lower half part (ch 1 -ch 49) is used and the upper half part is reserved for future plans.
c. As for a plural number of stations in the same area, frequencies are allocated with 800 kHz spacing. However, as for the third frequency to allocate, the spacing is 1 MHz in order to avoid mutual interference among the three frequencies.
d. To avoid interference between two stations located in a different areas, the necessary frequency spacing are fixed as indicated in Table 2-6-7.
e. The minimum separation distance between the co-channel station is indicated as in Table 2-6-8.
f. According to the above mentioned technical standards, the frequencies indicated in Table 2-6-9 were allocated to the FM stations which are planned.

6 - 4 TV Broadcasting

In Indonesia, the channel of Band-1 are allocated to some of the existing TV stations, but in this plan, the 8 channels in Band-III shall be used as far as possible instead of the channels in Band-I (CH-2 and CH-3).

NOTE: As the frequencies of Band-I are too low, abnormal propagation is apt to occur and it causes unexpected interference at far distant area.

The number of TV stations sharing the same TV channel in 43 stations at maximum in Indonesia as shown in Table 2-6-11. However, if the channel allocation is devised, up to about 100 stations could be shared the same channel as seen in the actual examples in foreign countries.

(1) Frequency allocation for new TV stations

Besides band III, band IV and V shall be allocated for newly planned TV stations hereafter, however, in this plan period for the 50 TV stations which are planned to be newly constructed in this plan period, the channel of Band-III will be allocated as shown in Table 2-5-1(1) - 2-5-1(6) except for P.Bintan station which is located near Singapore.

The above channel allocation were made along with the result of studies on the protection of co-channel and adjacent channel interference in consultation with the present conditions of signal dissemination of existing TV station which have been actually measured during the 2nd field survey period.
In the above channel allocation planning, the interference protection ratio of co-channel stations was set at 45dB. However, even if co-channel interference may occur, the grade of interference could be improved by adopting the off-set carrier system as shown in Table 2-6-11.

(2) Frequency allocation for TVN-II Stations

If the channels of Band-III are allocated to the 8 TV stations in accordance with the same principle as above, it shall become as Table 2-6-12. As indicated in the note of this Table, it is foreseen that there may be adjacent channel interference between Ch-11 of MEDAN station and Ch-10 of SIMARJARUNJUNG station. In addition, co-channel interference trouble between YOGYAKARTA and GOMBEL stations may occur.

Therefore, further detailed field survey shall be needed to find out some solution for those expectable problems.

MW Radio Stations Registered in IFRB (A)

1	2	4	6	7	12	13	14
540 (2)	Bandung	107E34 06S57	5	7.4	139	4	2200 - 1700
630 (12)	Ujung Pandang	119E28 05S09	100	22.1	234	4	2100 - 1600
693 (19)	Madiun	111E31 07S36	10	10.4	108	4	2200 - 1700
693 (19)	Palembang	104E45 02S59	50	17.4	110	3	2200 - 1700
693 (19)	Sorong	131E17 00S50	2	3.4	108	5	2000 - 1500
711 (21)	Atambua	121W49 19S12	2	3.0	50	7	2100 - 1600
720 (22)	Ambon	128E10 13S41	10	10.4	93	4	2000 - 1500
738 (24)	Jember	113E45 08S07	2	3.4	100	4	2200 - 1700
747 (25)	Bengkulu	102E20 03S46	10	10.4	100	4	2200 - 1700
756 (26)	Purwokerto	109E12 07S26	10	10.4	99	4	2200 - 1700
765 (27)	Banjarmasin	114E33 03S22	5	7.4	100	4	2100 - 1600
774 (28)	Bandung	107E34 06S57	10	10.4	97	4	2200 - 1700
774 (28)	Fak-Fak	132E17 12S55	10	10.4	97	5	2000 - 1500
783 (29)	Tj. Karang	105E18 05S22	5	7.4	96	5	2200 - 1700
801 (31)	Semarang	110E29 06S58	10	10.4	94	5	2200 - 1700
810 (32)	Merauke	140E22 08S30	5	7.6	104	6	2000 - 1500
819 (33)	Medan	98W39 03N35	10	10.4	66	5	2200 - 1700
819 (33)	Merauke	140E22 08S30	5	7.4	92	6	2000 - 1500
828 (34)	Jayapura	140E39 02S37	5	7.4	90	6	2000 - 1500
837 (35)	Atambua	124E49 09S12	2	3.4	90	7	2100 - 1600
855 (37)	Medan	96E39 03N35	100	22.1	163	5	2200 - 1400
864 (38)	Cirebon	108E43 06S45	2	3.4	87	5	2200 - 1700
873 (39)	Fak-Fak	132E17 02S55	5	7.4	84	5	2000 - 1500
873 (39)	Surakarta	110E50 07S32	2	3.4	75	5	2200 - 1700
891 (41)	Malang	112E45 07S59	10	10.4	84	4	2200 - 1700
891 (41)	Ternate	127E23 00N48	10	10.4	84	6	2000 - 1500
900 (42)	Samarinda	117E09 00S30	25	16.1	150	4	2100 - 1600
900 (42)	Jakarta	106E45 06S23	10	10.4	83	5	2200 - 1700
909 (43)	Sorong	131E17 00S50	10	10.4	82	5	2000 - 1500
918 (44)	Surabaya	112E45 07S14	10	10.4	82	4	2200 - 1700
927 (45)	Pekanbaru	101E30 00N33	50	19.1	162	4	2200 - 1700
954 (48)	Kendari	122E36 03S57	10	10.4	78	5	2100 - 1600
963 (49)	Biak	121E40 01S11	2	3.4	78	5	2000 - 1500
963 (49)	Jember	113E45 08S07	10	10.4	78	4	2200 - 1700
972 (50)	Yogyakarta	110E24 07S48	20	13.4	77	5	2200 - 1700
981 (51)	Endeh	121E40 08S51	5	7.4	76	5	2100 - 1600
999 (53)	Jakarta	106E53 06S14	300	26.9	150	5	2200 - 1700

1008 (54)	Madiun	111E31 07S36	10	10.6	84	4	2200 - 1700
1017 (55)	Kupang	123E38 10S13	2	3.4	74	7	2100 - 1600
1035 (57)	Palu	119E52 00S54	10	10.4	73	6	2100 - 1600
1035 (57)	Tj. Karang	105E18 05S22	5	7.4	73	6	2200 - 1700
1044 (58)	Ambon	128E10 13S41	10	10.4	72	4	2000 - 1500
1044 (58)	Sibolga	98E48 01S42	10	10.4	71	5	2200 - 1700
1053 (59)	Jayapura	140E39 02S37	10	10.4	71	6	2000 - 1500
1080 (62)	Singaraja	115E04 08S06	10	10.4	70	5	2100 - 1600
1089 (63)	Endeh	121E40 08S51	2	3.4	69	5	2100 - 1600
1089 (63)	Cirebon	108E34 06S45	10	10.4	69	5	2200 - 1700
1098 (64)	Jambi	103E39 01S36	10	10.4	68	3	2200 - 1700
1098 (64)	Sumenep	113E51 07S01	10	10.6	105	6	2200 - 1600
1107 (65)	Yogyakarta	110E24 07S48	10	10.4	68	5	2200 - 1700
1107 (65)	Kupang	123E38 10S13	5	7.4	67	7	2100 - 1600
1116 (66)	Biak	136E04 01S11	10	10.6	100	5	2000 - 1500
1116 (66)	Pekanbaru	101E30 00N33	10	10.4	68	4	2200 - 1700
1125 (67)	Palu	119E53 00S54	5	7.4	64	6	2100 - 1600
1134 (68)	Banjarmasin	114E33 03S22	50	19.1	132	4	2100 - 1600
1161 (71)	Kendari	122E36 03S57	5	7.4	64	5	2100 - 1600
1170 (72)	Semarang	110E29 06S58	50	17.4	64	5	2200 - 1700
1170 (72)	Ternate	127E23 00N48	2	3.4	64	6	2000 - 1500
1179 (73)	Padang	100E25 01S00	10	10.4	64	5	2200 - 1700
1197 (75)	Palangkaraya	113E11 02S02	5	7.4	63	6	2100 - 1600
1206 (76)	Denpasar	115E14 08S40	10	10.4	62	5	2100 - 1600
1215 (77)	Jakarta	106E45 06S23	10	10.4	61	5	2200 - 1700
1233 (79)	Pontianak	109E16 00S05	50	17.6	70	5	2100 - 1600
1242 (80)	Bogor	106E47 06S36	10	10.4	60	5	2200 - 1700
1251 (81)	B. Aceh	95E20 05N30	10	10.4	61	5	2200 - 1700
1251 (81)	Mataram	116E08 08S36	10	10.4	60	4	2100 - 1600
1269 (83)	Pontianak	109E16 00S05	10	10.4	60	5	2100 - 1600
1287 (85)	Palembang	104E45 02S59	50	17.0	159	3	2200 - 1700
1305 (87)	Manado	124E55 01N32	10	10.4	65	5	2100 - 1600
1305 (87)	Palangkaraya	113E11 02S02	5	7.4	57	6	2100 - 1600
1323 (89)	Malang	112E45 07S59	2	3.4	57	4	2200 - 1700
1332 (90)	Jakarta	106E45 06S23	10	10.4	56	5	2200 - 1700
1341 (91)	Tj. Pinang	104E28 00N55	5	7.4	56	5	2200 - 1700
1359 (93)	Ujung Pandang	119E28 05S09	10	10.4	55	4	2100 - 1600
1377 (95)	Sumenep	113E51 07S01	2	3.4	55	6	2200 - 1700

Table 2-6-1-(3)

1404 (98)	Jakarta	106E53 06S14	10	10.4	54	5	2200 - 1700
1413 (99)	Pangkalpinang	106E09 02S05	5	7.4	53	5	2200 - 1700
1422 (100)	Singaraja	115E04 08S06	10	10.4	53	5	2200 - 1700
1449 (103)	Bengkulu	103E20 03S46	5	7.4	52	4	2200 - 1700
1449 (103)	Samarinda	117E09 00S30	10	10.6	60	4	2100 - 1600
1467 (105)	Tj. Pinang	104E28 00N55	10	10.4	52	6	2200 - 1700
1476 (106)	Surakarta	110E50 07S32	50	19.1	100	5	2200 - 1700
1503 (109)	Jambi	103E39 01S36	10	10.6	58	3	2200 - 1700
1512 (110)	Bkt. Tinggi	100E20 00S17	10	10.4	33	5	2200 - 1700
1530 (112)	Padang	100E25 01S00	5	7.4	51	3	2200 - 1700

Column 1: Assigned channel frequency (kHz)
Channel number; this number is shown in brackets.

Column 2: Name of transmitting station.

Column 4: Geographical coordinates of the transmitting station in degrees and minutes.

Column 6: Carrier power (kW)

Column 7: Maximum radiation in dB relative of a c.m.f. of 300V or an e.m.r.p. of 1kW, determined from the nominal power of the transmitter and the theoretical gain of the antenna without allowing for miscellaneous losses.

Column 12: Height of antenna (metres) for a simple vertical antenna only.

Column 13: Ground conductivity in millisiemens/metre (mS/m)

Column 14: Hours of operation (GMT) in hours and minutes, e.g., 0730-1800, 0000-2400, 0500-0230.

Note:

This table is listed only registered stations in Indonesia. Therefore, some of the columns are negrected as follows:

Column 3: Symbol designating the country or the geographical are in which the station is located. In case of Indonesia, it shows "INS".

Column 5: Necessary Bandwidth (kHz);the value in kHz is preceded by the Symbol A, B, C or D indicating the adjacent channel protection ratio that is to be employed in calculating the usable field strength. All of the stations in this table are shown as "A18".

Column 8: Azimuth of maximum radiation in degrees (clockwise) from True North.

Column 9: Azimuths defining the sector of limited radiation in degrees (clockwise) from True North.

Column 10: Maximum agreed radiation in the sector , in dB relative to a c.m.f. of 300V or an d.m.r.p. of 1kW determined from the nominal power of the transmitter and the theoretical gain of the antenna without allowing for miscellaneous losses.

As the antennas for all of the MW stations in Indonesia are non-directional type, no designation is shown in the Column 8, 9 and 10.

Column 11: Type of antenna. The symbol A indicates a simple vertical base-fed antenna and the symbol B any other type of antenna. All of the stations in this table are shown as "A".

MW Radio Stations Registered in IFRB (B)

Site Name	Location		Freq.	Pwr.	Freq.	Pwr.	Freq.	Pwr.
	Long.	Alt.	(kHz)	(kW)	(kHz)	(kW)	(kHz)	(kW)
Medan	98E39	3N35	855	100	819	10		
B. Aceh	95E20	5N35	1251	10				
Bkt. Tinggi	100E20	0S17	1512	10				
Pekanbaru	101E30	0N33	927	50	1116	50		
Jambi	103E39	1S36	1098	10	1503	10		
Padang	100E25	1S00	1179	10	1530	5		
Bengkulu	102E20	3S46	747	10	1449	5		
Tj. Karang	105E18	5S22	783	5	1035	5		
Sibolga	98E48	1S42	1044	10				
Tj. Pinang	104E28	0N55	1467	10	1341	5		
Pangkalpinang	106E09	2S05	1413	5				
Yogyakarta	110E24	7S48	972	20	1107	10		
Bandung	107E34	6S57	774	10				
Semarang	110E29	6S58	1170	50	801	10		
Surakarta	110E50	7S32	1476	50	873	2		
Surabaya	112E45	7S14	585	100	918	10		
Denpasar	115E14	8S40	1206	10				
Mataram	116E08	8S36	1251	10	855	5		
Bogor	106E47	6S36	1242	10				
Cirebon	108E34	6S45	1089	10	864	2		
Purwokerto	109E12	7S26	756	10				
Madiun	111E31	7S36	693	10	1008	10		
Jember	113E45	8S07	963	10	738	2		
Malang	112E45	7S59	891	10	1323	2		
Sumenep	113E51	7S01	1098	10	1377	2		
Singaraja	115E04	8S36	1080	10	1422	10		

Table 2-6-2-(2)

Banjarmasin	114E33	3S22	1134	50	765	5			
Pontianak	109E16	0S05	1233	50	1269	10			
Palangkaraya	113E11	2S02	1197	5	1305	5			
Samarinda	117E09	0S30	900	25	1449	10			
Ujung Pandang	119E28	5S09	630	100	1359	10			
Manado	124E55	1N32	1305	10					
Kendari	122E36	3S57	954	10	1161	5			
Palu	119E52	0S54	1035	10	1125	5			
Kupang	123E38	10S13	1107	5	1017	2			
Atambua	124E49	9S12'	711	2	837	2			
Gorontalo*	123E04	0N32							
Endeh	121E40	8S51	981	5	1089	2			
Jayapura	140E39	2S37	1053	10	828	5			
Sorong	131E17	0S50	909	10	693	2			
Biak	136E04	1S11	1116	10	963	2			
Merauke	140E22	8S30	810	5	819	5			
Ambon	128E10	3S47	720	10	1044	10			
Fak-Fak	132E17	2S55	774	10	873	5			
Manokwari*	134E04	0S57							
Nabire*	135E30	3S22							
Serui*	136E15	1S53							
Wamena*									
Ternate	127E23	0N48	891	10	1170	2			
Jakarta	106E45	6S23	999	300	900	10	1215	10	
"	"	"	1332	10	1404	10			

* Not yet registered

(Longitude and latitude point out the location of city or town.)

Table 2-6-3

Minimum Separation Distance Between Stations (Co-channel Interfernce)

Interfering Station / Own Station	FREQ (kHz)	300 kW	100 kW	50 kW	20 kW	10 kW	5 kW	2 kW	1 kW
1 kW	700	4050	3150	2650	2250	1650	1550	1350	1050
	1000	4035	3135	2635	2235	1635	1535	1335	1035
	1500	4025	3125	2625	2225	1625	1525	1325	1025
2 kW	700	4060	3160	2660	2260	1660	1560	1360	
	1000	4045	3145	2645	2245	1645	1545	1345	
	1500	4030	3130	2630	2230	1630	1530	1330	
5 kW	700	4075	3175	2675	2275	1675	1575		
	1000	4055	3155	2655	2255	1655	1555		
	1500	4035	3135	2635	2235	1635	1535		
10 kW	700	4090	3190	2690	2290	1690			
	1000	4060	3160	2660	2260	1660			
	1500	4040	3140	2640	2240	1640			
20 kW	700	4110	3210	2710	2310				
	1000	4075	3175	2675	2275				
	1500	4050	3150	2650	2250				
50 kW	700	4150	3250	2750					
	1000	4090	3190	2690					
	1500	4060	3160	2660					
100 kW	700	4160	3260						
	1000	4100	3200						
	1500	4070	3170						
300 kW	700	4190							
	1000	4130							
	1500	4090							

Table 2-6-4

Minimum Separation Distance Between Stations (Adjacent Channel Interference)

Own Station \ Interfering station	FREQ (kHz)	300 kW	100 kW	50 kW	20 kW	10 kW	5 kW	2 kW	1 kW
1 kW	700	950	650	540	180	155	150	125	110
	1000	935	635	525	125	110	105	85	80
	1500	925	625	515	85	55	70	60	55
2 kW	700	960	660	550	190	165	160	135	
	1000	945	645	535	135	120	115	95	
	1500	930	630	520	90	60	75	65	
5 kW	700	975	675	565	205	180	175		
	1000	955	655	545	145	130	125		
	1500	935	635	525	95	85	80		
10 kW	700	990	690	580	220	195			
	1000	960	660	550	150	135			
	1500	940	640	530	100	90			
20 kW	700	1010	710	600	240				
	1000	975	675	565	165				
	1500	950	650	540	110				
50 kW	700	1050	750	640					
	1000	990	690	580					
	1500	960	660	550					
100 kW	700	1060	760						
	1000	1000	700						
	1500	970							
300 kW	700	1090							
	1000	1030							
	1500	990							

Table 2-6-5

Distance Between Planned and Existing MW Stations (Registered)

Planned Site			Co-channel				Adjacent channel			
Name	Freq. (kHz)	Pwr. (kW)	Station	Pwr. (kW)	Dist. (km)	Required Min.Dist. (km)	Station	Pwr. (kW)	Dist. (km)	Required Min.Dist. (km)
Dili	711	2	Davao (PHL)	5	1700	1560	Ambon	10	600	165
Ternate	891	10	Malang	10	1860	1690	Jakarta	10	2370	195
			Dumaguete (PHL)	10	880	1690	Samarinda	25	1100	
Fak-Fak	774	10	Bandung	10	2770	1690	Tj. Karang	5	1970	180
			Marawi (PHL)	1	1620	1650	Banjarmasin	5	1900	180
Sorong	909	10	Tawi Tawi (PHL)	5	1390	1675	Surabaya	10	2140	195
							Pekanbaru	50	3260	580
Kupang	1107	5	Yogyakarta	10	1480	1655	Biak	10	1720	130
			Davao (PHL)	1	1890	1535	Pekanbaru	10	2700	130
							Jambi	10	2400	130
							Sumenep	10	1100	130
Palangkaraya	1197	5	Kudat (PHL)	10	980	1655	Denpasar	10	730	130
			Davao (PHL)	5	1590	1555				
Bkt. Tinggi	1512	10	Chiang Rai (THA)	10	2070	1640	Jambi	10	380	90

Table 2-6-6

Distance Between Planned and Existing MW Stations (Unregistered)

Planned site			Co-channel				Adjacent channel			
Name	Freq. (kHz)	Pwr. (kW)	Station	Pwr. (kW)	Dist. (km)	Required Min.Dist. (km)	Station	Pwr. (kW)	Dist. (km)	Required Min.Dist. (km)
Manokwari	1098	10	Jambi	10	3350	1660	Yogyakarta	10	2750	135
			Sumenep	10	2400	1660	Kupang	5	1600	130
			Mandulu (PHL)	10	2200	1660	Endeh	2	1650	120
							Cirebon	10	2950	135
Nabire	1179	10	Padang	10	4000	1660				
			Tadan (PHL)	10	1700	1660				
Serui	1269	5	Pontianak	10	3050	1655				
			Kidapawan (PHL)	5	1560	1555				
Wamena	1341	5	Tj. Pinang	5	3900	1555	Jakarta	10	3550	125
			Roxas (PHL)	1	2400	1535				
Gorontalo	1503	5	Jambi	10	2030	1635	Bkt. Tinggi	10	2550	85
			Cebu (PHL)	1	1060	1535				

Table 2-6-7

Minimum Frequency Separation between Two FM Transmitting Stations

Group	Station	Serui	Wamena	Nabire	Fak-fak	Manokwari	Merauke	Biak	Sorong	Bkt Gresir	Gn Polemak	Kintamani	Gorontalo	Seganteng	Bkt Bakung	Ternate	Oben	Dilly	Kendari	Palu	Manado	Ujung Pandang	Balik papan	Palang Karaya	Pontianak	Banjarmasin	Gn Brengik	Bogor	Depok	Cirebon	Wungrejo	Gn Pandan	Gn Gending	Gn Gebug	Gn Negrak	Gombel	Surabaya	Yogyakarta	Sibolga	P.Batam	Jambi	Bengkulu	Gn Betung	Pekanbaru	Palembang	Pandai Sikat	Gn Gompong	Banda Aceh	Bandarbaru	Jakarta
		V										IV											III				II												I											
I	Jakarta																											4		1					2				1				2							4
I	Bandarbaru																																																4	
I	Banda Aceh																																															4		
I	Gn Gompong																																													3	4			
I	Pandai Sikat																																										1		4				
I	Palembang																																						1	1		1		4					
I	Pekanbaru																																										4						
I	Gn Betung																																									4							
I	Bengkulu																																								4								
I	Jambi																																						2	4									
I	P Batam																																						4										
I	Sibolga																																					4											
II	Yogyakarta																																		2		4												
II	Surabaya											1																									4													
II	Gombel																																		4														
II	Gn Negrak																										3							4															
II	Gn Gebug																									3					2		4																
II	Gn Gending											2			2																		4																	
II	Gn Pandan																									2					4																		
II	Wungrejo																													4																			
II	Cirebon																										2	2	4																				
II	Depok																										1	4																					
II	Bogor																										4																						
II	Gn Brengik											2			1										1		4																							
III	Banjarmasin																							1	2	4																								
III	Pontianak																							1	4																									
III	Palangkaraya																							4																										
III	Balikpapan																						4																											
IV	Ujung Pandang																					4																												
IV	Manado																				4																													
IV	Palu																			4																														
IV	Kendari																		4																															
IV	Dilly																	4																																
IV	Oben																4																																	
IV	Ternate															4																																		
IV	Bkt Bakung													2	4																																			
IV	Seganteng											2		4																																				
IV	Gorontalo												4																																					
IV	Kintamani											4																																						
V	Gn Polemak										4																																							
V	Bkt Gresir									4																																								
V	Sorong				1				4																																									
V	Biak	2				1		4																																										
V	Merauke						4																																											
V	Manokwari	1				4																																												
V	Fak-fak			1	4																																													
V	Nabire			4																																														
V	Wamena		4																																															
V	Serui	4																																																

NOTE : FIGURE SHOWS THE GRADE OF FREQUENCY SEPARATION

1: 200 kHz
2: 400 kHz
3: 600 kHz
4: 800 kHz

Table 2-6-8

Minimum Separation Distance (km) between Co-channel FM Stations

Own Station / Interfering Stati	10 kW	5 kW	1 kW	0.5 kW	0.3 kW	0.1 kW
10 kW	345					
5 kW	325	320				
1 kW	280	275	260			
0.5 kW	265	260	235	235		
0.3 kW	250	245	220	220	215	
0.1 kW	230	225	225	200	195	190

Note : 1. H = 300 m, K = 4/3
2. PROTECTION 54 dB
(CCIR REC. 412 - 2)

Frequency Allocation Plan for FM Transmitting Station

No.	RRI Station	TVRI Tx Station	Pwr. (kW)	f - 1 Ch	f - 1 Freq. (MHz)	f - 2 Ch	f - 2 Freq. (MHz)	f - 3 Ch	f - 3 Freq. (MHz)
1	Jakarta		10						
2	Medan	Bandarbaru	5	1	87.9	5	88.7	10	89.7
3	Banda Aceh		0.5	1	87.9	5	88.7	10	89.7
4	Pekanbaru		5	3	88.3	7	89.1	12	90.1
5	Padang	G.Gompong	3	1	87.9	5	88.7	10	89.7
6	Jambi		5	2	88.1	6	88.9	11	89.9
7	Palembang		5	1	87.9	5	88.7	10	89.7
8	Benkulu		0.5	1	87.9	5	88.7	10	89.7
9	Tj.Karang	G.Betung	0.5	3	88.3	7	89.1	12	90.1
10	Sibolga		0.5	2	88.1	6	88.9	11	89.9
11	Bkt.Tinggi	Pandaisikat	3	40	95.7	44	96.5	49	97.5
12	Tj.Pinang	P.Batam	0.5	4	88.5	8	89.3	17	91.1
13	Yogyakarta		5	1	87.9	5	88.7	10	89.7
14	Bogor	*	0.1	23	92.3	52	98.1	92	106.1
15	Bandung	G. Nagrak**	3	3	88.3	7	89.1	12	90.1
16	Cirebon		0.3	40	95.7	44	96.5	49	97.5
17	Semarang	Gombel	3	3	88.3	7	89.1	12	90.1
18	Madiun	G. Pandan	3	38	95.3	42	96.1	47	97.1
19	Malang	G.Gebug	0.3	40	95.7	44	96.5	49	97.5
20	Surakarta	Wungrejo	0.5	40	95.7	44	96.5	49	97.5
21	Surabaya		5	1	87.9	5	88.7	10	89.7
22	Purwokerto	Depok	3	2	88.1	6	88.9	11	89.9

23	Jember	G.Gending	0.5	3	88.3	7	89.1	12	90.1
24	Sumenep	G.Brengik	0.5	37	95.1	41	95.9	46	96.9
25	Denpasar	Bkt.Bakung	3	5	88.7	9	89.5	14	90.5
26	Singaraja	Kintamani	0.5	35	94.7	39	95.5	44	96.5
27	Mataram	Seganteng	0.5	7	89.1	11	89.9	16	90.9
28	Banjarmasin		5	1	87.9	5	88.7	10	89.7
29	Pontianak		5	1	87.9	5	88.7	10	89.7
30	Palangkaraya		5	40	95.7	44	96.5	49	97.5
31	Samarinda		0.5	38	95.3	42	96.1	47	96.9
32	Palikpapan		0.5	40	95.7	44	96.5	49	97.5
33	Ujung Pandang		0.5	1	87.9	5	88.7	10	89.7
34	Palu		0.5	1	87.9	5	88.7	10	89.7
35	Kendari		0.5	1	87.9	5	88.7	10	89.7
36	Gorontalo		0.3	1	87.9	5	88.7	10	89.7
37	Manado	Makaweimben	3	1	87.9	5	88.7	10	89.7
38	Kupang	Oben	5	1	87.9	5	88.7	10	89.7
39	Dili		0.1	1	87.9	5	88.7	10	89.7
40	Jayapura	G.Polemak	0.5	5	88.7	9	89.7	14	90.5
41	Ambon	Bkt.Gresir	3	1	87.9	5	88.7	10	89.7
42	Ternate		0.5	1	87.9	5	88.7	10	89.7
43	Sorong		0.1	1	87.9	5	88.7	10	89.7
44	Fak-Fak		0.1	2	88.1	6	88.9	11	89.9
45	Manokwari		0.3	2	88.1	6	88.9	11	89.9
46	Biak		0.3	1	87.9	5	88.7	10	89.7
47	Serui		0.1	3	88.3	7	89.1	12	90.1
48	Nabire		0.3	3	88.3	7	89.1	12	90.1

49	Wamena		0.1	1	87.9	5	88.7	10	89.7
50	Merauke		0.3	1	87.9	5	88.7	10	89.7

Station name of TVRI is omitted where RRI station is in the same city.

* No suitable TV transmittint station is around Bogor, FM transmitter shall be installed in RRI Bogor station.

** Especially for Bandung station, precise survey shold be taken.

Table 2-6-10

Frequency Allocation for FM Transmitter Station in Indonesia

(in consideration of frequency allocation plan in the neighbouring country)

Planned Station			Nearest Foreign Station			Distance (Approx) (Km)	Remarks
Name	Kw	Freq. (MHz)	Name (Malaysia)	Kw	Freq. (MHz)		
Pontianak	5	87.9 88.7 89.7	Kuching	1	88.1 88.9 89.9 90.7 91.9 92.7	230	a.Min.freq.separation 200KHz b.Required Distance (In case of Co-cannel)
Pekanbaru	5	88.3 89.1 90.1	MT.Ophir	0.5	93.7 94.9 95.7 96.7 97.5 100.5	250	a. 3.6MHz b. 260Km
Medan (Bandarbaru)	5	87.9 88.7 89.7	G.Jerai	1	96.7 97.5 98.7 99.5 100.5 101.3	360	a. 7.0MHz b. 325Km

1. No Interference can be foreseen by the reason described above. (Remarks)
2. Co-channel relation will not appear in this 5-year plan period.

Table 2-6-11

Present Condition of
TV Channel Utilization

Channel NO.	NUMBER OF TV STATION					
	TRANSMITTER POWER OUTPUT					sub total
	10kw	5kW	1kW	0.5-1kW	less than 0.5kW	
2	-	-	-	-	1	1
3	-	-	2	-	5	7
4	1	1	10	2	29	43
5	3	3	5	-	13	24
6	1	3	7	1	19	31
7	2	3	6	2	21	34
8	3	2	3	-	10	18
9	3	2	6	-	18	29
10	-	-	4	-	2	6
11	1	1	2	-	-	4
sub-total	14	15	45	5	118	197

Table 2-6-12

Protection Ratio Against Co-channel Tropospheric Interference

CONDITION		PROTECTION RATIO
1.	a) Carrier frequencies separated by less than 1,000 Hz. b) carrier frequency is not synchronized.	45 dB
2.	Nominal carrier frequencies separated by 1/3, 2/3, 4/3 or 5/3 of the live frequencies and with non-precision offset.	30 dB
3.	Carrier frequencies separated by 1/2 or 3/2 of the live frequency and with non-precision offset.	27 dB
4.	Precision offset	22 dB

CCIR Rec. 418-3

Table 2-6-13

Channel Allocation for TVN-II Station

Station		Channel		Power Output
		2nd	1st	
1	Medan (Bandarbaru)	11*	5	10 kW
2	Palembang	11	9	10 kW
3	Yogyakarta	4*	8	10 kW
4	Surabaya	4	9	10 kW
5	Denpasar (Bkt. Bakung)	10	8	5 kW
6	Balikpapan	11	9	1 kW
7	Ujung Pandang	11	4	1 kW
8	Manado (Makaweimben)	11	5	5 kW

* Channel allocation should be decided after carrying out the precise measurement and examination on the field strength and interference in the service area of own station and surrounding stations.

CHAPTER 7 ESTABLISHMENT PLAN OF INTERCOMMUNICATION NETWORK

CHAPTER 7 ESTABLISHMENT PLAN OF INTERCOMMUNICATION NETWORK

7 - 1 The Importance of Intercommunication Network for Broadcasting Activity

Needless to say, it is indispensable to provide an advanced intercommunication means for keeping smooth, swift and accurate business contact among the stations when broadcasting service expand to nationwide scale. Especially, the importance of intercommunication network for broadcasting activities in RRI and TVRI will be utmost because the territory of Indonesia are so widely spread out and broadcasting stations are also scattered over the archipelago from Jayapura to Banda Aceh.

Hitherto, SSB telecommunication network has been mainly utilized together with the use of public telephone and telegraph for the business contact between the RRI stations.

However, such means of telecommunications are not always meet with the requirement of modernized broadcasting operation in many ways. Therefore, it is necessary to improve and modernize the intercommunication network by full use of the most advanced telecommunication system such as Palapa system and terrestrial microwave system.

Before discussing on the selection and constitution of intercommunication network, it will be needed to define on the various ways of the use of intercommunication lines by each sector in the broadcasting station.

7 - 2 Definition of Intercommunication Network

The following items will be the typical usage of such intercommunication network.

(1) Intercommunication lines for management operation
Such type of telephone conversations as business contact on the programme scheduling, programme planning, programme production, gathering of programme materials and general

management operation are widely exchanged between the various sectors in the broadcasting station. The mode of telecommunications are generally not so high urgent and each demands are not so regularly occur but random demands occur intermittently all through the day and night and the communicating party and the flow of message are not always fixed.

(2) News transmission lines

Generally, telephone lines can be used for the transmission of news material and order or instruction on the news gathering. However, the degree of urgency is extremely high and the direction of message flow is larger in ratio for those from regional stations to the central station.

(3) Telecommunication lines for the maintenance service

The telecommunication lines used for maintenance service to prevent interruption of broadcasting service and for routine maintenance service will be the same as the general management operation as mentioned in item (1), but such usage of telecommunication line as for asking urgent countermeasures to the equipment failure, the demand to the telecommunication line will be the highest degree of urgency. This type of operation will be needed, in most cases, between key station and remote station located on top of the isolated mountain where the public telephone lines cannot be used.

(4) Intercommunication lines for programming operation

Telecommunication lines for the operation of programme distribution or exchange between the stations are the same as item (1). However, for the switching instruction in relation to the programme transmission arrangement, urgency and reliability will especially be required and in some cases the network must be constituted between multiple number of stations.

(5) Data transmission lines for management operation

This kind of special lines will be necessary for sending and receiving of operational data between the stations in consultation with the line availability. In most cases, there will not be no objections even if the telecommunication lines are available only on inconvenient time zone such as early in the morning or late at night. In the near future, it will be necessary to provide a high speed network which is capable of telex, facsimile and data transmission.

7 - 3 Constitution of the Operational Intercommunication Network

It is not so economical even if it is possible to set up intercommunication network only by utilizing the public telephone lines to meet with the various demands as mentioned above. On the contrary, the use of exclusive telecommunication lines will be more useful and effective due to the following reasons.

a. Instant calls can be made even between stations located far apart.
b. The other party station and counterpart can be called directly just by dialing.
c. The line stability is good and there is no cross talks from other telephone lines.
d. Facsimile, telex and data transmission is possible.
e. Instructions from headquarters can be relayed to all broadcasting stations at one time from central station by use of the simultaneous calling device.

Broadcasting stations connected to this exclusive network will be those in which a certain number of telephone calls will occur throughout the day. They are as listed below and their locations are shown in Figure 2-7-1 and 2-7-2.

Radio
- o DEPPEN RTF Headquarters
- o RRI National Station
- o Chimangis broadcasting station
- o Kebayoran "

(The above in Jakarta)

- o Nusantara station (5 stations)
- o Regional-I station (26 stations)
- o Regional-II station (17 stations)

TV
- o DEPPEN RTF Headquarters
- o TVRI Headquarters (Senayan)
- o Regional TV stations provided with TV studios
- o Regional TV stations provided with MPU
- o Principal TV stations in major cities of each region

In regards to telecommunication line between the master TV station and its relay station or between off-air relay station which are not connected to the exclusive network, the demands for business contact are very few in the normal operational condition but sometime requires urgent contact when troubles happen in the station. Therefore, other communication means than telephone line such as SSB communication network or UHF radio telephone link might be rather convenient.

7 - 4 Installation of Exclusive Intercommunication Network

a. Direct dialing exclusive network will be constructed between the central station, Nusantara station and 8 television stations (with local studios). (Stage 1)

b. This exclusive network will be expanded to 9 television stations with MPU. (Stage 2)

c. The exclusive network will further be expanded to the Regional-I broadcasting station and to 9 stations where the 2nd MPU installation will be made. (Stage 3)

d. The installation work of Stage 2 and 3 will be proceeded taking into account of their operational condition.

7 - 5 Installation of Branch Line Other than Trunk Line

a. Branch communication lines will be provided by use of conventional SSB link until permanent branch is completed.

b. UHF link will be installed for maintenance service between television relay stations in Jawa island.

Fig 2-7-1

TELEPHONE NETWORK FOR DAILY OPERATION

(1ST PHASE)

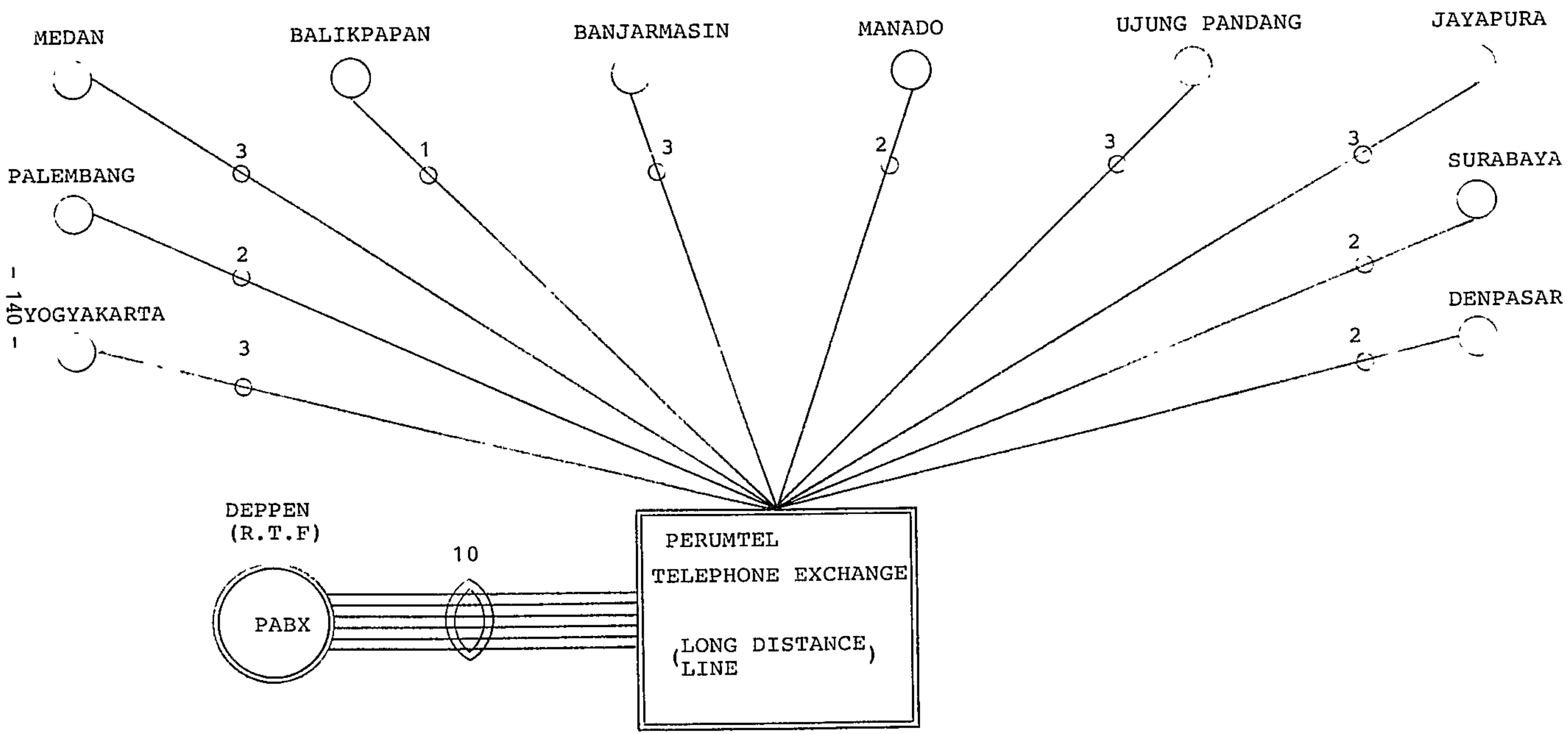
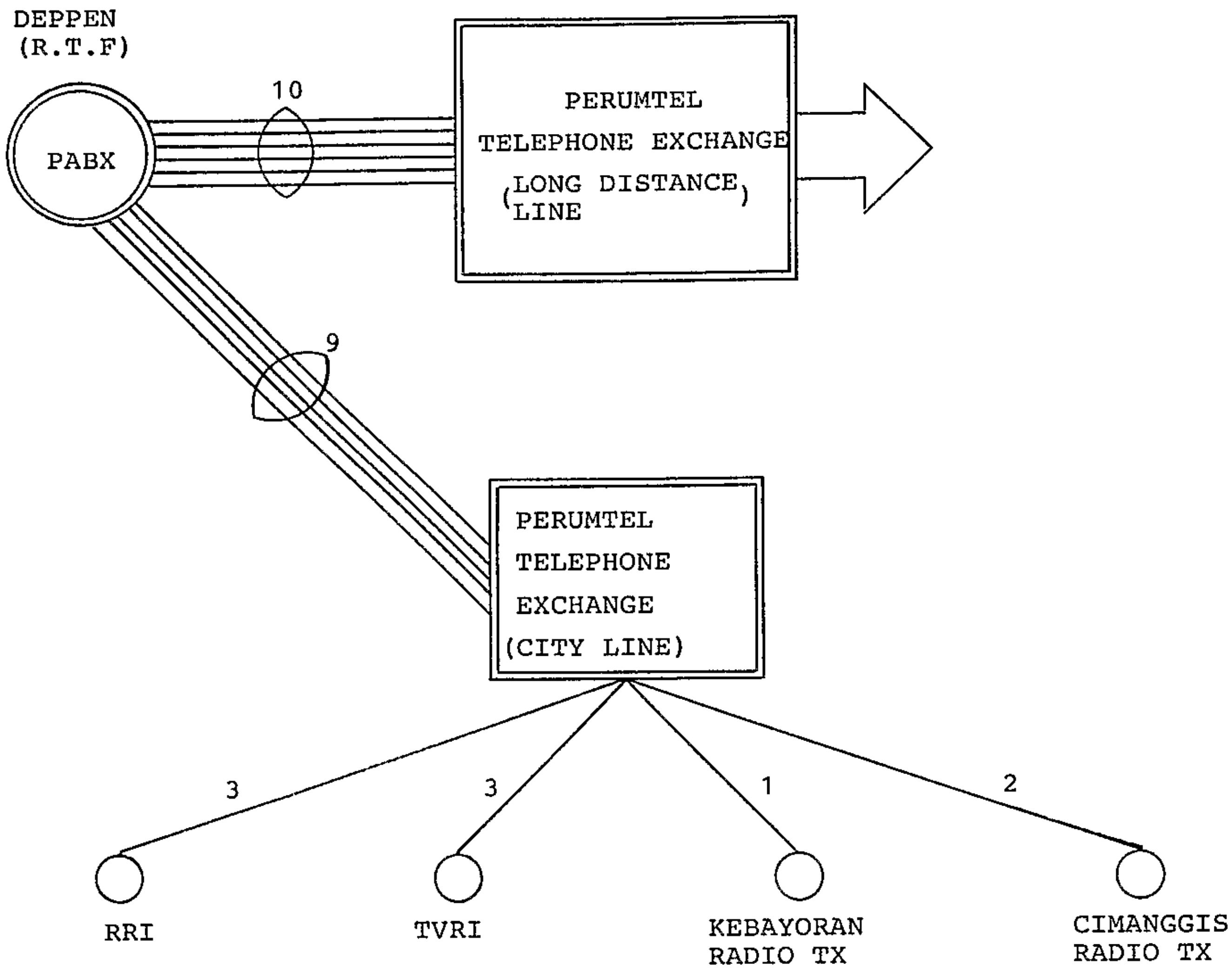


Fig 2-7-2

TELEPHONE NETWORK FOR DAILY OPERATION
(1ST PHASE)



CHAPTER 8 TECHNICAL STANDARDS TO BE APPLIED FOR PREPARATION, PLANNING PROCUREMENT CONSTRUCTION, OPERATION AND MAINTENANCE OF BROADCASTING FACILITY

CHAPTER 8 TECHNICAL STANDARDS TO BE APPLIED FOR PREPARATION, PLANNING PROCUREMENT CONSTRUCTION, OPERATION AND MAINTENANCE OF BROADCASTING FACILITY

8 - 1 Application of International Technical Standards for Broadcast

In order that the countries of the world can use the broadcasting waves effectively without interfering each other, international regulations are established with regard to the manner of radiation (transmitting power, frequency, antenna, frequency stability and occupied bandwidth, etc.) of broadcasting waves.

In addition, for international exchange of radio and TV programmes, a certain standard is established on the items such as TV standard systems, video recording, sound recording and programme transmission systems to maintain smooth operation of international programme exchange.

In Indonesia, in the case of procuring broadcasting equipment from abroad, the technical standards, of course, are referred to for selection of equipment. The broadcasting technical standards are used as criteria in the activities of daily programme production, recording, reproducing and transmission, to keep the broadcasting quality within a certain range. The broadcasting technical standards will also be the useful gauge in the maintenance work.
The broadcasting technical standards related to the various activities of broadcasting are described as follows.

8 - 2 Standards Related to Sound Recording

The standards related to sound recording techniques, are prescribed in CCIR REC. 408-4. An excerpt of it is shown in the Table 2-8-1.

8 - 3 Standards Related to the Radio Programme Transmission line.

The characteristics of radio programme transmission required to long distance transmission lines are prescribed as CCITT REC. J-23 and J-21 for AM broadcasting programme and FM broadcasting programmes(monaural, stereophonic). The main points are introduced in Table 2-8-2 and 2-8-3, respectively.

8 - 4 Standards Related to AM Radio Broadcasting

The technical standards related to radio broadcasting waves are the most important ones in order to avoid mutual interference between the stations not only in the country but also with the stations in the foreign countries. Therefore, the staff in charge of planning must be sufficiently familiar with those standards. Abstracts from CCIR REC. 447-2, REC. 560-1, REC. 794-1, REP. 457-2 are quoted as Table 2-8-4 to Table 2-8-6.

8 - 5 Standards Related to FM Broadcasting

As for technical standards related to radiation of FM broadcasting waves, abstracts from CCIR REC. 412-3, REC 450-1 are quoted as Table 2-8-7 and 2-8-8, respectively.

8 - 6 Standards Related to PAL Colour TV Broadcasting

As for technical standards related to the following items, abstracts from CCIR REC. are quoted as Table 2-8-9 to Table 2-8-11, respectively.

a. Monitoring of colour TV broadcasting signal
b. Recording and reproducing of colour TV programmes on magnetic tape.
c. Transmission of colour TV Signal

8 - 7 Site Location for MW or SW High Power Transmitting Station

The Location shall be chosen with respect to the results of site surveys as well as map surveys to find out the best available site to comply with these conditions.

a. Sufficient space and flatness of the land
b. Suitable soil conditions such as good earth conductivity, soil strength against pressure.
c. Availability of drainage canal for flood control.
d. Availability of access road.
e. Availability of power supply with stable and sufficient capacity.
f. Security

g. Telecommunication facilities.

h. Distant from residential land

i. Distant from other services such as airport, telecommunication stations etc.

8 - 8 Maintaining of Original Signal Quality during the Signal Transmission from Broadcasting Station to Receivers in the Service Area

During the original programmes travel along with the signal path (studio -- continuity room -- ST link -- Transmitting station --radiation as broadcast signal -- propagation -- reception--restored sound and picture) as shown in Fig. 2-8-1, original signal are suffered from various disturbances such as distortion, noise. Therefore, it is generally very difficult to restore original programmes at receiving point without any degradation. In order to minimize such deterioration in reproduced sound and picture so that all of the audience could be served with perfect programmes as near as original signal produced at studio, every effort should be placed to keep the quality of broadcast signal as similar as possible at every checking point. To achieve this, the quality of sound and picture should be checked at point 1 through 4 in the figure and if some degradation are found, immediate countermeasure should be taken.

For checking the quality of sound and picture at each check point during the broadcasting operation, a monitor speaker and video monitor will be the important tools. Therefore, it should be kept in good operating condition and maintained correctly calibrated condition.

Table 2-8-1

RECOMMENDATION 408-4 * (Abstracts)

STANDARDS OF SOUND RECORDING ON MAGNETIC TAPE FOR THE INTERNATIONAL EXCHANGE OF PROGRAMMES

(Question 52/10, Study Programme 52A/10)

(1951-1953-1956-1959-1963-1966-1970-1974-1982)

○ **Beginning of a programme**

The programme material should be preceded by a reference signal of 1000 Hz recorded at a level of 9 dB below maximum permitted programme peaks.

On monophonic tapes, this reference signal should have a duration of about 10 s, with a pause of about 5 s before the start of the programme modulation.

On stereophonic tapes, this reference signal should be recorded in the *A*-(left) channel for about 5 s, then in both channels for about 10 s, with a pause of about 5 s before the start of the programme modulation.

○ *Amplitude/frequency response of the two channels*

The tolerances on the amplitude/frequency response of the two channels *A* and *B* shall be as follows:

40	to	125 Hz :	+2	to −3	dB
125	to	630 Hz :	+1	to −1	dB
630	to	1250 Hz :	+0.5	to −0.5	dB
1250 Hz	to	10 kHz:	+1	to −1	dB
10	to	15 kHz:	+2	to −3	dB.

○ *Difference in recorded level between tracks*

In the frequency range of 125 to 10 000 Hz, a difference in level of 1.5 dB is admissible. Beyond these limits, a progressive increase up to 2 dB is admissible at 40 and 16 000 Hz.

○ *Phase difference between tracks*

In the frequency range from 250 to 4000 Hz, the maximum phase difference should be 15°. Outside these frequency limits, a progressive increase of this value is admissible; it can reach 30° at 40 Hz and 65° at 16 000 Hz.

○ *Crosstalk*

In the frequency range from 250 to 4000 Hz, crosstalk should not exceed −35 dB. Outside these frequency limits, a progressive increase up to −20 dB at 40 Hz and −25 dB at 16 000 Hz is admissible.

○ *Weighted signal-to-noise ratio*

The weighted signal-to-noise ratio of the *A*, *B* and *M* signals should be at least 51 dB.

Note. – This value represents the difference in level between the noise measured with the meter and weighting network defined in Recommendation 468 and a signal, the amplitude of which corresponds to the maximum level of programme peaks indicated.

○ *Non-linearity distortions*

The total percentage harmonic distortion of the *A*, *B* and *M* signals should be less than or equal to the following values:

2% from 40 Hz to 125 Hz
1.6% from 125 Hz to 8 kHz.

Recommendation J.23 [1), 2)]

Table 2-8-2

PERFORMANCE CHARACTERISTICS OF NARROW-BANDWIDTH SOUND-PROGRAMME CIRCUITS (Abstracts)

(amended at Geneva, 1980)

Circuits of medium quality for monophonic transmission

The CCITT

unanimously recommends

that, taking into account the definitions in § 1, narrow-bandwidth sound-programme circuits should satisfy the requirements for monophonic transmission laid down in §§ 2 and 3.

1 Definitions

In this Recommendation the narrow-bandwidth sound-programme circuits include:

7 kHz type circuits,

The requirements in § 3 should be met by the hypothetical reference circuit as defined in CCIR Recommendation 502-1 [3].

2 Requirements at audio interconnection points

2.1 *Measurement of characteristics*

When measuring the characteristics of a circuit, the output should be terminated with a 600 ohm nonreactive load.

2.2 *Impedance and matching conditions*

The audio-frequency input impedance should be 600 ohms balanced; the tolerance on this value is a matter for further study

It is provisionally recommended that the output impedance be balanced with respect to earth and be so low that the output level in the nominal transmission range does not decrease by more than 0.3 dB if the open-circuit output is loaded with 600 ohms. This output impedance is intended for connection to a nominal load impedance of 600 ohms.

For amplifiers which are intended for direct connection to audio programme lines, the reactive part of the output impedance should be restricted. A maximum value of 100 ohms for the series reactance part of the output impedance at frequencies in the transmitted range is provisionally recommended.

2.3 *Relative level*

The relative level on a sound-programme circuit at the audio-frequency amplifier output should be fixed at +6 dBrs [4)]

3 Performance of the hypothetical reference circuit

The values given should be met by circuits operating with analogue techniques. However, the international circuits which have equipments designed before the adoption of this Recommendation may have parameters different from those given here in § 3.

Special additional parameters concerning digital transmission are under study.

3.1 *Nominal bandwidth*

7 kHz type circuits: 0.05 to 7 kHz

3.2 *Insertion gain at 0.8 or 1 kHz*

This parameter is defined at a sending level of −12 dBm0 in accordance with Recommendation N.21 [4]

a) *Adjustment error*

Less than ± 0.5 dB

b) *Daily variation*

Less than ± 0.5 dB

3.3 *Gain/frequency response referred to 0.8 or 1 kHz*

This parameter is defined at a sending level of −12 dBm0 in accordance with Recommendation N.21 [4]

a) *7 kHz type circuits*

0.05 to 0.1 kHz: +1 to −3 dB
0.1 to 6.4 kHz: +1 to −1 dB
6.4 to 7 kHz: +1 to −3 dB

3.4 *Difference of group delay between the minimum value and the values at given frequencies*

a) *7 kHz type circuits*

0.05 kHz: < 80 ms
0.1 kHz: < 20 ms
6.4 kHz: < 5 ms
7 kHz: < 10 ms

3.5 *Maximum weighted noise level*

This parameter is defined by terms of a weighting network and a quasi-peak measuring instrument in accordance with CCIR Recommendation 468-2 (which is reproduced at the end of Recommendation J.16):

7 kHz type circuits −44 dBq0ps

Note 1 – If an r.m.s. measuring instrument is used, the measured value will be about 5 dB less than that for the quasi-peak measurement.

Note 2 – If the weighting network defined in the Recommendation cited in [5] is used, the measured value will be about 4 dB less.

Note 3 – Suitable values for unweighted noise cannot be recommended with precision, because such values depend upon the characteristics of the circuit noise. However, if an unweighted noise measurement is performed upon a sound-programme circuit just complying with the requirements for weighted noise and single tone interference, then the worst values expected to be found are −35 dBq0s or −40 dBm0s, and in most cases the values obtained will be several decibels better.

3.6 *Single tone interference*

This parameter (measured selectively) should not exceed (−73 − Δps) dBm0s. Δps is the correction for the frequency being considered which is given by the weighting characteristic in CCIR Recommendation 468-2 (which is reproduced at the end of Recommendation J.16).

3.7 *Disturbing modulation by power supply*

The highest-level unwanted side-component due to modulation of a sound-programme signal caused by interference from conventional a.c. line power supply sources should not be greater than −45 dB relative to the level of a sine-wave measuring signal applied to the sound-programme circuit (in accordance with CCIR Recommendation 474 [6]). The value for higher frequencies has to be determined (see CCIR Report 495-1 [7] and Study Programme 17F/CMTT [8]).

3.8 *Non-linear distortion*

Total harmonic distortion measured with fundamental signals at +9 dBm0:

- below 0.1 kHz: < 2%
- above 0.1 kHz: < 1.4%.

Third order difference tone measured at 0.18 kHz using signals of 0.8 and 1.42 kHz each at +3 dBm0: < 1.4%.

3.9 *Error in reconstituted frequency*

Less than 1 Hz.

Note – A maximum error of 1 Hz is in principle acceptable where there is only a single transmission path between the signal source and the listener.

When the broadcast network is composed of two or more parallel paths, e.g. commentary and separate sound channels, or radio broadcast from different transmitters on the same frequency, unacceptable beats may occur unless zero error can be assured. The CCITT is studying methods of effecting this in all recommended systems.

3.10 *Intelligible crosstalk ratio*

3.10.1 The near- or far-end crosstalk ratio (for speech) between two sound-programme circuits or between a telephone circuit (disturbing circuit) and a sound-programme circuit (disturbed circuit) should be at least 74 dB for the range 0.5 kHz to 3.2 kHz. For the range below 0.5 kHz and above 3.2 kHz it should be 74 dB reducing in value at a rate of 6 dB per octave.

3.10.2 The near- or far-end crosstalk ratio between a sound-programme circuit (disturbing circuit) and a telephone circuit (disturbed circuit) should be at least 65 dB.

3.11 *Error in amplitude/amplitude response*

This parameter is defined by a step level signal −6/+6 dBm0 at 0.8 or 1 kHz: < 0.5 dB.

PERFORMANCE CHARACTERISTICS OF 15-kHz TYPE SOUND-PROGRAMME CIRCUITS [1]

(Geneva, 1972; amended at Geneva, 1976 and 1980) (Abstracts)

Circuits for high-quality monophonic and stereophonic transmissions

The CCITT

unanimously recommends

that, taking account of the definition in § 1 below, high-quality monophonic and stereophonic sound-programme transmissions should satisfy the requirements laid down in §§ 2 and 3 below.

1 Definition

When the hypothetical reference circuit defined in Recommendation J.11 is composed of three "sound-programme carrier sections" the requirements indicated below should be met.

2 Requirements at audio interconnection points

2.1 *Measurement of characteristics*

When making measurements of the characteristics of a circuit, these should be made with the output terminated with a 600-ohm non-reactive load.

2.2 *Impedance and matching conditions*

The audio-frequency input impedance should be 600 ohms balanced; the tolerance on this value is a matter for further study.

It is provisionally recommended that the output impedance be balanced with respect to earth and be so low that the output level in the nominal transmission range does not decrease by more than 0.3 dB if the open-circuit output is loaded with 600 ohms. This output impedance is intended for connection to a nominal load impedance of 600 ohms.

This clause alone would not, however, rule out a large difference in the reactive parts of the output impedances of a stereophonic pair, and this in turn could lead to difficulties in meeting the limits of § 3.2.2 below. This aspect needs further study.

For amplifiers which are intended for direct connection to audio frequency sound-programme lines, the reactive part of the output impedance should be restricted. A maximum value of 100 ohms for the series reactance part of the output impedance at frequencies in the transmitted range is provisionally recommended.

2.3 *Relative level*

The relative level on a sound-programme circuit at the audio-frequency amplifier output should be fixed at +6 dBrs [2].

3 Performance of the hypothetical reference circuit for 15 kHz-type sound-programme circuits

The values given correspond to circuits operating with analogue techniques and are expected to be met on such transmission systems. Special additional parameters concerning digital techniques are under study (see § 4 below).

3.1 *Parameters for monophonic sound-programme transmission*

3.1.1 Nominal bandwidth: 0.04 to 15 kHz.

3.1.2 Insertion gain at 0.8 or 1 kHz: this parameter should be measured at a sending level equivalent to −12 dBm0 as specified by the CCITT for setting up sound-programme circuits.

3.1.2.1 Adjustment error: not to fall outside the range ± 0.5 dB.

3.1.2.2 Variation during 24 hours: not to exceed ± 0.5 dB.

If the broadcasting organizations wish to have closer tolerances, it is necessary for the receiving broadcasting organizations to insert additional timing attenuators.

3.1.3 The gain/frequency response referred to 0.8 or 1 kHz should comply with the following limits:

0.04 to 0.125	kHz:	+0.5 to −2.0 dB
0.125 to 10	kHz:	+0.5 to −0.5 dB
10 to 14	kHz:	+0.5 to −2.0 dB
14 to 15	kHz:	+0.5 to −3.0 dB

For the combined effect of three modulator and demodulator equipments, a tolerance of ± 0.5 dB from 0.125 to 10 kHz is considered the closest that can be met by equipments in practice. If broadcasting organizations wish to have closer tolerances, it is necessary for the receiving broadcasting organization to insert additional equalizers

This response should be measured using a test level of −12 dBm0.

3.1.4 The difference between group delay at the given frequency and the minimum value of group delay should not exceed the following limits:

0.04 kHz:	55 ms
0.075 kHz:	24 ms
14 kHz:	8 ms
15 kHz:	12 ms

3.1.5 *Maximum weighted noise level*

−42 dBq0ps.

This parameter is defined in terms of a weighting network and a quasi-peak measuring instrument in accordance with CCIR Recommendation 468-2, which is reproduced at the end of Recommendation J.16.

3.1.8 *Nonlinear distortion*

There are certain difficulties in giving a general recommendation on nonlinearity, due to restrictions imposed by the CCITT on the levels and durations of test tones (see especially Recommendations N.21 [7] and N.23 [8]). Pending progress with other test methods, the following tests are recommended.

3.1.8.1 Harmonic distortion factors measured with single-tone test signals at +9 dBm0s should not exceed the limits given in Table 1/J.21.

TABLE I/J.21

Frequency of test-tone (kHz)	Total harmonic distortion (%)	Second harmonic and third harmonic measured selectively (%)
0.04 to 0.125	1	0.7
0.125 to 7.5	0.5	0.35

3.1.10 *Intelligible crosstalk ratio*

3.1.10.1 The intelligible crosstalk ratio from other sound-programme circuits or from a telephone circuit into a sound-programme circuit should be measured selectively in the disturbed circuit at the same frequencies as those of the sinusoidal test signal applied to the disturbing circuit, and should not be less than the following values:

0.04 kHz: 50 dB
0.04 to 0.5 kHz: oblique straight-line segment on linear-decibel and logarithmic-frequency scales
0.5 to 5 kHz: 74 dB
5 to 15 kHz: oblique straight-line segment on linear-decibel and logarithmic-frequency scales
15 kHz: 60 dB.

3.1.10.2 The near- or far-end crosstalk ratio between a sound-programme circuit (disturbing circuit) and a telephone circuit (disturbed circuit) should be at least 65 dB.

3.2 *Additional parameters for stereophonic programme transmission*

3.2.1 The difference in gain between A and B channels should not exceed the following values:

0.04 to 0.125 kHz: 1.5 dB
0.125 to 10 kHz: 0.8 dB
10 to 14 kHz: 1.5 dB
14 to 15 kHz: 3 dB

3.2.2 The phase difference between the A and B channels should not exceed the following values:

0.04 kHz: 30°
0.04 to 0.2 kHz: oblique straight-line segment on linear-degree and logarithmic-frequency scales
0.2 to 4 kHz: 15°
4 to 14 kHz: oblique straight-line segment on linear-degree and logarithmic-frequency scales
14 kHz: 30°
15 kHz: 40°

3.2.3 The crosstalk ratio between the A and B channels should not be less than the following limits:

3.2.3.1 Intelligible crosstalk ratio, measured with sinusoidal test signal from 0.04 to 15 kHz: 50 dB.

3.2.3.2 Nonlinear crosstalk ratio [4] from 0.04 to 15 kHz: 60 dB.

Table 2-8-4

RECOMMENDATION 447-2 *

SIGNAL-TO-INTERFERENCE RATIOS IN SOUND BROADCASTING

Definitions

(Question 44/10, Study Programme 44A/10)

(1966-1978-1982)

The CCIR

UNANIMOUSLY RECOMMENDS

that, when considering problems of interference in sound broadcasting, the following definitions should be used:

1. *The audio-frequency* (AF) *signal-to-interference ratio* is the ratio (expressed in dB) between the values of the voltage of the wanted signal and the voltage of the interference, measured under specified conditions, at the audio-frequency output of the receiver.

This ratio corresponds closely to the difference in volume of sound (expressed in dB) between the wanted programme and the interference.

2. *The audio-frequency* (AF) *protection ratio* is the agreed minimum value of the audio-frequency signal-to-interference ratio considered necessary to achieve a subjectively defined reception quality.

This ratio may have different values according to the type of service desired.

3. *The radio-frequency* (RF) *wanted-to-interfering signal ratio* is the ratio (expressed in dB) between the values of the radio-frequency voltage of the wanted signal and the interfering signal, measured at the input of the receiver under specified conditions.

For example, in the case of amplitude-modulation wanted and interfering transmissions (carrier with double sideband), the chosen values will be the effective radio-frequency voltages that correspond to the wanted and interfering carriers.

4. *The radio-frequency* (RF) *protection ratio* is the value of the radio-frequency wanted-to-interfering signal ratio that enables, under specified conditions, the audio-frequency protection ratio to be obtained at the output of a receiver.

The specified conditions include such diverse parameters as: spacing Δf of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, frequency deviation, carrier frequency tolerance, etc.), A.F. signal characteristics (bandwidth, dynamic compression, etc.), receiver input level as well as the receiver characteristics (selectivity and susceptibility to cross-modulation, etc.)

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* This Recommendation should be brought to the attention of the CMV

Table 2-8-5

RECOMMENDATION 560-1 * (Abstracts)

RADIO-FREQUENCY PROTECTION RATIOS IN LF, MF AND HF BROADCASTING

(Question 44/10, Study Programme 44A/10)

(1978-1982)

The CCIR

UNANIMOUSLY RECOMMENDS

that the radio-frequency protection ratios for sound broadcasting in bands 5 (LF), 6 (MF), and 7 (HF) as given in §§ 1 and 2 should be applied

1. Radio-frequency protection ratio in bands 5 (LF) and 6 (MF)

The radio-frequency protection ratio (as defined in Recommendation 447), for co-channel transmissions (± 50 Hz) should be 40 dB when both the wanted and the unwanted signals are stable (ground-wave).

When the wanted signal is stable and the unwanted signal fluctuates (including short-term fluctuations), the radio-frequency protection ratio should be 40 dB at the reference time (see Annex I to Recommendation 435) for at least 50% of the nights of the year. This protection ratio corresponds to the ratio of the wanted field strength and the annual median value of the hourly medians of the interfering field strength at the reference time.

The protection so defined is provided:

- for 50% of the nights at the reference time;
- for more than 50% of the nights at times other than the reference time;
- for 100% of the days during daylight hours.

The radio-frequency protection ratio values specified above will permit a service of excellent reception quality. For planning purposes, however, lower values may be required. In this respect, proposals have been made by some countries and organizations (see Report 794).

Note 1. – The minimum usable field strength to which this protection ratio of 40 dB applies varies in the different regions and with frequency Within the European zone, this minimum is of the order of 1 mV/m.

Note 2. – In the United States of America, when the wanted and unwanted signals are stable (ground-wave), the radio-frequency protection ratio for co-channel transmissions is 26 dB. When the unwanted signal is fluctuating (sky-wave), the same protection ratio is applied for 90% of the nights of the year, computed for the second hour after sunset. The minimum usable field strength is either 100 or 500 μV/m, depending upon the class of service.

2. Relative radio-frequency protection ratio curves in bands 5 (LF), 6 (MF) and 7 (HF)

The relative radio-frequency protection ratio is the difference, expressed in decibels, between the protection ratio when the carriers of the wanted and unwanted transmitters have a frequency difference of Δf (Hz or kHz) and the protection ratio when the carriers of these transmitters have the same frequency

Once a value for the co-channel radio-frequency protection ratio (which is equal to the audio-frequency protection ratio) has been determined, then the radio-frequency protection ratio, expressed as a function of the carrier-frequency spacing, is given by the curves of Fig. 1 (see also Annex I):

- curve A, when a limited degree of modulation compression is applied at the transmitter input, such as in good quality transmissions, and when the bandwidth of the audio-frequency modulating signal is of the order of 10 kHz;
- curve B, when a high degree of modulation compression (at least 10 dB greater than in the preceding case) is applied by means of an automatic device and when the bandwidth of the audio-frequency modulating signal is of the order of 10 kHz;
- curve C, when a limited degree of modulation compression (as in the case of curve A) is applied and when the bandwidth of the audio-frequency modulating signal is of the order of 4.5 kHz;
- curve D, when a high degree of modulation compression (as in the case of curve B) is applied by means of an automatic device and when the bandwidth of the audio-frequency modulating signal is of the order of 4.5 kHz

* Further information is given in Report 794.

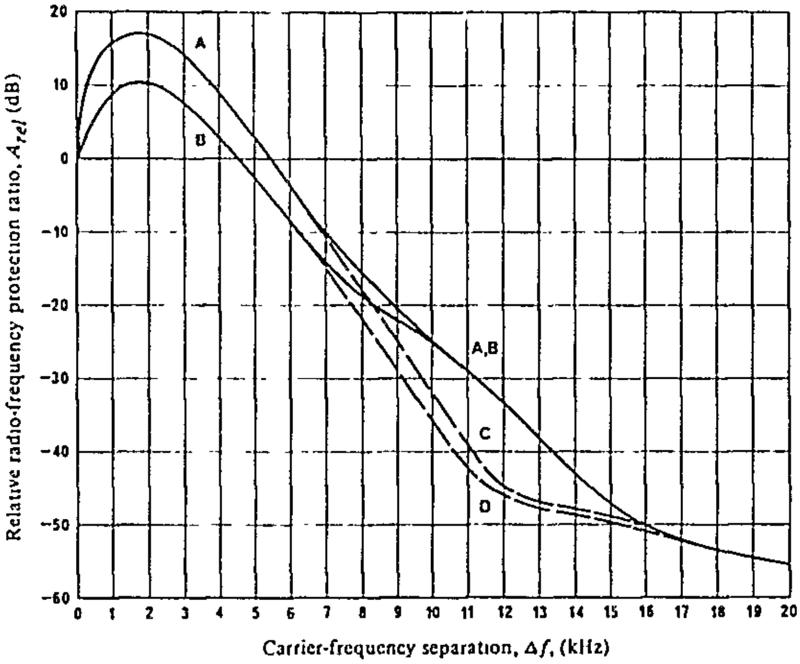


FIGURE 1 - *Relative value of the radio-frequency protection ratio as a function of the carrier-frequency separation*

The curves A, B, C and D (see also Annex I) are valid only when the wanted and unwanted transmissions are compressed to the same extent. They have been obtained mainly from measurements and calculations with a reference receiver representative of good quality receivers used for reception in bands 5 (LF) and 6 (MF) The overall frequency response curve of the European Broadcasting Union (EBU) reference receiver used passes through −3 dB, −24 dB and −59 dB at 2 kHz, 5 kHz and 10 kHz, respectively, [Petke, 1973].

REPORT 457-2

NECESSARY BANDWIDTH OF EMISSION IN LF, MF, AND HF SOUND BROADCASTING

(Question 44/10, Study Programme 44A/10)

(1970-1974-1982)

1. Introduction

In an amplitude-modulation double-sideband sound broadcasting system the bandwidth of emission is approximately twice the audio-frequency bandwidth of the programme and, therefore, greatly influences the quality of reception. On the other hand, for a given frequency separation between adjacent channels, a limitation of the bandwidth of emission is desirable to avoid mutual interference.

The difference between the transmitted bandwidth for amplitude-modulation sound broadcasting and the receiver bandwidth has led to research [CCIR, 1966-69a and b; Netzband and Süverkrübbe, 1968; Süverkrübbe, 1969; Petke, 1973] aimed at improving the whole transmission system. It appears that it would be useful to fix values for the audio-frequency bandwidth of the programme to be radiated as well as for the overall response of the receivers and to obtain these values by the use of band-limiting filters. If both these bandwidths are nearly equal and are suitably related to the channel spacing the transmission system provides for the full utilization of the transmitted bandwidth as well as for the most favourable protection against adjacent channel interference [Eden, 1967].

2. Assessment of the necessary bandwidth of emission

Obviously the bandwidth of emission as well as the passband of the receivers should be chosen in such a way that there is no unnecessary impairment of reception quality or any increase in adjacent channel interference [Netzband and Süverkrübbe, 1968] In this respect a good solution would be to make the channel spacing, the bandwidth of emission and the receiver passband of equal value. Moreover, ideally there should be rectangular limitation of the bandwidth of emission and the received selectivity curve and no non-linear distortion in the transmitter. Under these conditions no adjacent channel interference would occur.

In general, however, these requirements are not met. In many cases the bandwidth of emission exceeds the channel spacing by a considerable amount. It can be seen from Recommendation 560 that excessive adjacent channel interference will result from such operational conditions. Hence, it can be concluded that this type of interference can be reduced if the bandwidth of emission is adapted to the channel spacing.

3. General considerations

3.1 There exists a well-known interrelation between system bandwidth, carrier spacing and adjacent-channel radio-frequency protection ratio [Süverkrübbe, 1969; Petke, 1973].

3.2 The theoretically obtainable optimum value of protection against adjacent channel interference can be assessed by using an ideal receiver with rectangular passband characteristics. In this case the radio-frequency protection ratio is mainly determined by non-linear distortion in the transmitter.

3.3 A theoretical study of the energy spectrum including out-of-band radiation caused by transmitter non-linearities is contained in [Kettel, 1968]. Experimental investigations of the energy spectrum of a high-power transmitter operating in band 6 (MF) [CCIR, 1966-69c] show that the term occupied bandwidth as defined in Article 1, No. 147 of the Radio Regulations does not give an adequate indication of the effects of bandwidth limitation on adjacent channel interference

4. Relationship between AF bandwidth, RF protection ratio and channel spacing

4.1 *Measurement results*

Measurements of the radio-frequency protection ratios for the case of various values of audio-frequency bandwidths, which are equal at both transmitter and receiver, and at different channel spacings have been carried out in the Federal Republic of Germany [Suverkrubbe, 1969] using the objective two-signal measuring method given in Recommendation 559 and Report 794 For the measurements a high quality commercial receiver with an almost ideal passband characteristic was used The interrelation between the parameters involved is shown in Fig 1. For a given channel spacing there are many pairs of values of audio-frequency bandwidths and adjacent channel protection ratios If, however, two of the parameters have been chosen, the third is definitely fixed.

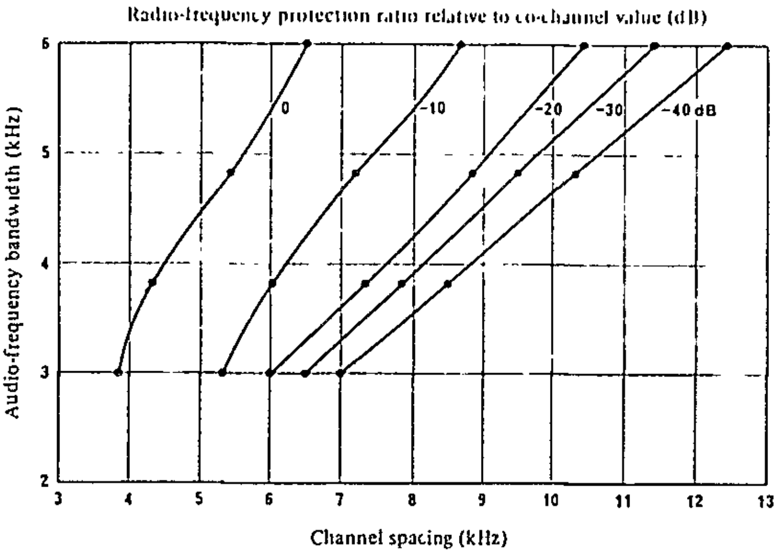


FIGURE 1 - *Use of the frequency spectrum*

4.2 *Computation results*

The relationship between system bandwidth, adjacent channel protection ratio and channel spacing can be determined by means of the numerical method (Recommendation 559).

Studies carried out were based on the assumption that both the carrier spacing and the adjacent channel protection ratio are predetermined values. Using Recommendation 560, a relative value of the radio-frequency protection ratio of −26 dB corresponding to a channel spacing of 9 kHz has been assumed. Thereby due account has been taken of the characteristics of current types of receivers

Any amplitude-modulation sound-broadcasting system has, in principle, the same effect on the reception quality as a low-pass filter. Amplitude-modulation systems designed in conformity with the channel spacing and protection ratio requirements mentioned above may, therefore, differ to some extent in bandwidth and rate of cut-off of the overall amplitude/frequency response. The investigations carried out were, therefore, extended to cover this aspect of the problem of the quality of reception.

It was assumed that the influence on the overall amplitude/frequency response of the entire system was equally distributed between the transmitting and receiving ends. This approach should, however, be considered as a first attempt only and additional studies will have to be carried out for different conditions. As a result of the calculations made it was found that any one of the three overall amplitude/frequency response curves shown in Fig. 3 would provide satisfactory adjacent-channel protection in an 9 kHz channelling system. The curves of Fig. 2 present pairs of values for the bandwidth, *b*, and rate of cut-off, a_0, required at either end of the AM sound-broadcasting system. The solid curve is only valid if use is being made of a notch filter in the receiver to eliminate the beat-note between adjacent channel carriers, whereas the broken line applies to the case where there is no notch filter. The particular points in Fig. 2 numbered ①, ② or ③ correspond to terminal equipment characteristics that would provide the overall amplitude/frequency response curves, A, B or C, respectively, in Fig. 3.

The results obtained are in close agreement with Fig 1 which should be considered to provide limiting values, since it applies to the ideal case of rectangular passband characteristics. The system bandwidth thus decreases rapidly with decreasing rate of cut-off

4.3 *Listening tests*

The influence of reproduction quality of an amplitude-modulation sound-broadcasting system with 9 kHz channel spacing and a relative protection-ratio value of −26 dB for adjacent channel interference can be simulated by using three specified low-pass filters The passband characteristics of these filters are those of curves A, B and C in Fig. 3

Subjective listening tests then show quite clearly that a better subjective quality impression can be obtained with frequency response curves A and B than with curve C. However, the difference in quality obtained with curves A and B is very small, a fact which may be of considerable economic interest, since the rate of cut-off of the receiver is 20 dB/octave less with curve B than with curve A

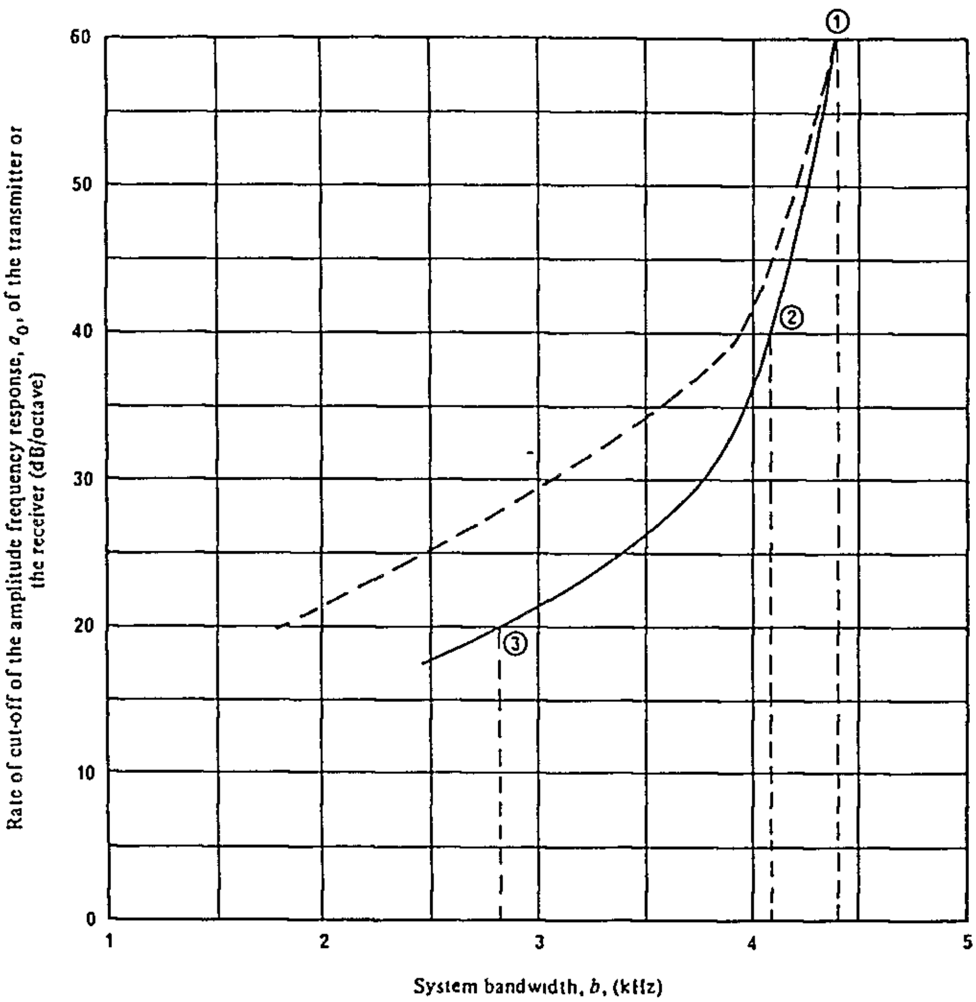


FIGURE 2 - *Characteristics of an amplitude-modulation sound-broadcasting system for optimum quality of reproduction*

Basic assumptions.

Channel spacing: 9 kHz

Relative adjacent-channel protection ratio: − 26 dB

———— characteristics including the effect of a notch filter for elimination of the carrier beat

— — — — characteristics without notch filter

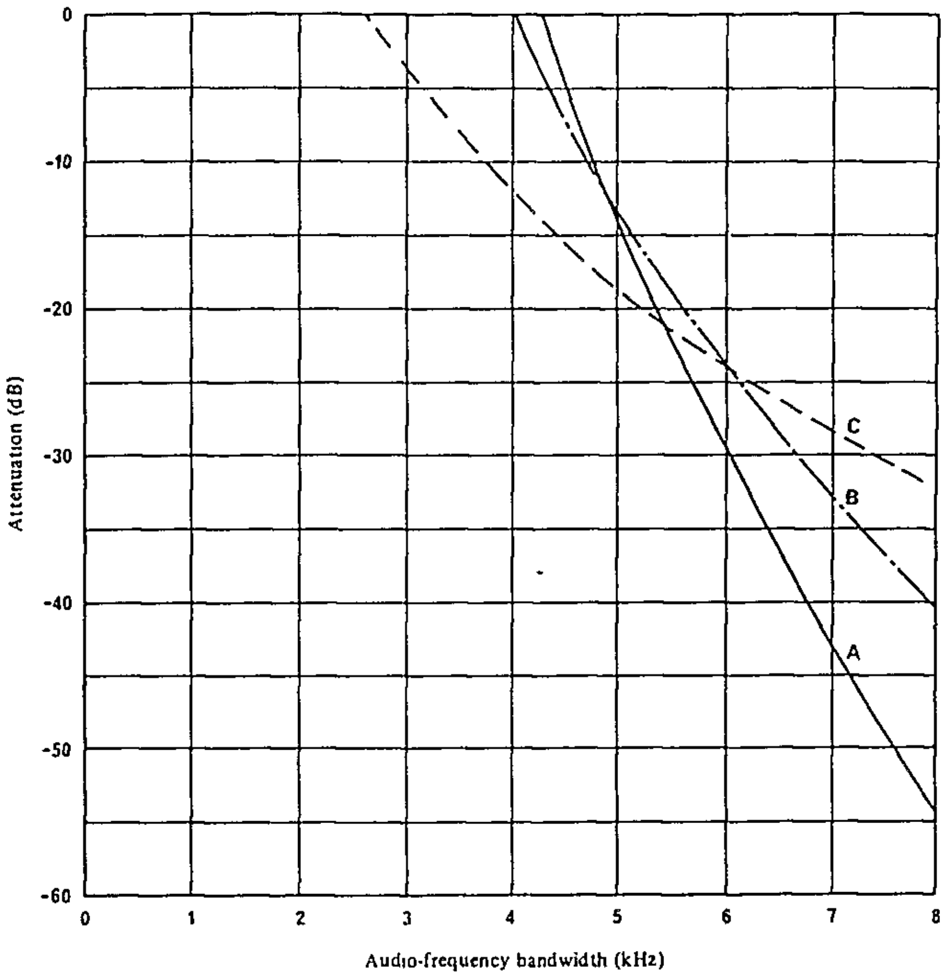


FIGURE 3 – *Overall amplitude/frequency response for an amplitude-modulation sound-broadcasting system for optimum quality of reproduction*

Curve A overall rate of cut-off for system – 120 dB per octave
B : overall rate of cut-off for system – 80 dB per octave
C : overall rate of cut-off for system – 40 dB per octave

5. Radio-frequency and intermediate-frequency passband characteristics of current types of receiver

Receiver characteristics have been collated in various countries and are partly reproduced in Report 333 (New Delhi, 1970). Radio-frequency and intermediate-frequency passband values between the 6 dB points are quoted ranging between 5 and 10 kHz. It should be noted that the reproduced audio-frequency bands are about half these values. The highest values mentioned are those of "first category" receivers in the U.S.S.R [CCIR 1966-69d] with variable selectivity.

It is known that there are many receivers with even smaller passbands than those mentioned in the above references. It has, however, been indicated that in some areas there exist receivers with larger passbands

6. Use of bandwidth limitation in operational practice

Even though the use of bandwidth limitation has been common practice for many years, the public reaction to the effect on programme quality has been negligible. On the other hand, improved reception has been reported in many cases where adjacent channel interference had previously been severe

According to the Geneva Plan, a large number of transmitters are not operating in bands 5 (LF) and 6 (MF) with a limited bandwidth. In the LF band 50.6% of the total number of transmitters has a bandwidth of emission equal to or less than 10 kHz, whereas in the MF band this value is only 31.3%.

7. A bandwidth-saving overtone transmission and reception system

A new method has been described [Gassman, 1972 and 1973], applicable in bands 5 (LF), 6 (MF) and 7 (HF), which allows improved sound quality at the receiver while the audio-frequency modulating signal is restricted in bandwidth. The system is based on the fact that the human ear is unable to identify overtone frequencies above about 4 kHz in relation to the fundamental tone.

The improvement of the sound quality is effected by the addition of artificial overtones generated in the receiver. The amplitudes of the overtones are controlled by a pilot tone at the upper end of the audio-frequency passband. The pilot tone carries the information on the amplitude of the overtones and the necessary synchronizing signal in the form of a single-sideband modulation.

8. Out-of-band spectrum of double-sideband sound-broadcasting emissions

Recommendation 328, § 3.5.1, gives the limit curves for the level of the out-of-band radiation of amplitude modulated double-sideband broadcast emissions. The curves have no fixed relation to the level of the carrier since this relation depends on:

- the modulation factor of the transmitter (r.m.s. value);
- the necessary bandwidth of the emission;
- the bandwidth of the spectrum analyser.

However, the limit curves have a fixed relationship to the maximum level of the sideband components which depends only on the power distribution within the sidebands.

Detailed information on the corresponding values is contained in Report 325.

9. Necessary bandwidth of emissions in band 7 (HF)

9.1 Listening tests have been made on the quality of reception obtainable on short waves and the effects of a reduction of the necessary bandwidth. From these tests it has been deduced that, although there will be some loss in quality if the audio-frequency band is limited, this loss is not serious. Studies in band 6 (MF) have shown that there is a relationship between system bandwidth, carrier spacing and the adjacent-channel radio-frequency protection ratio. Receivers used for reception in band 7 (HF) will, in general, have the same selectivity characteristics as those used for reception in band 6 (MF).

9.2 In band 7 (HF), 5 kHz channelling is common. Some administrations considered it desirable that the bandwidth of the audio-frequency modulating signal used in band 7 (HF) should be 4.5 kHz and should in no case exceed 5 kHz. This matter requires further study.

10. Conclusions

10.1 Figure 1 shows the relationship between the adjacent-channel radio-frequency protection ratio, the channel spacing and the audio-frequency bandwidth and assumes that the audio-frequency bandwidth of the radiated programme is the same as that reproduced by the receiver. When two of the three parameters are selected, the third is definitely fixed. In general the channel spacing will be given and a particular value of radio-frequency protection ratio will be required. Then the full audio-frequency bandwidth as taken from Fig. 1 can be transmitted but full use of the bandwidth of the radiated signal can only be made if the receivers have selectivity characteristics corresponding to that of the audio-frequency filter at the transmitter.

10.2 The predetermination of values of channel spacing and adjacent-channel protection ratio in an amplitude-modulation sound-broadcasting system is equivalent to a determination of the quality of audio-frequency reproduction. For example, in the case of 9 kHz channel spacing and −26 dB adjacent-channel protection ratio, Fig. 2 shows that, with reasonable values for the rate of cut-off, an audio-frequency bandwidth of 4.4 kHz can hardly be exceeded. Moreover, it is evident from this figure that decreasing rates of cut-off imply decreasing values of audio-frequency bandwidth.

From subjective listening tests it is apparent that, within the predetermined limits shown in Fig. 2, the reception quality mainly depends on the audio-frequency bandwidth. However, when approaching the limits, a slight increase in audio-frequency bandwidth may imply a substantial increase in rate of cut-off, whereas the increase in reception quality may hardly be noticeable.

Similar studies for 8 and 10 kHz channel spacings led to corresponding results showing the same tendencies. The apportionment of the overall amplitude/frequency response equally to the transmitter and receiver does not necessarily correspond to optimum conditions. On the contrary, computations indicate that the adjacent-channel protection ratio is more sensitive to a modification of the amplitude/frequency response at the receiving end than at the transmitting end of the system. From an economic point of view, however, it may be undesirable to improve receiver selectivity. Further studies are necessary before a final decision can therefore be made.

RECOMMENDATION 412-3 *

PLANNING STANDARDS FOR FM SOUND BROADCASTING AT VHF

(Question 46/10, Study Programme 46L/10)

(1956-1959-1963-1974-1978-1982)

The CCIR

UNANIMOUSLY RECOMMENDS

that the following planning standards should be used for frequency-modulation sound broadcasting in band 8 (VHF):

* The Director, CCIR, is requested to bring this Recommendation to the attention of the IEC, so that it may inform manufacturers of FM receivers accordingly Serious difficulties have been encountered in introducing stereophonic FM services planned according to the standards given in this Recommendation Special attention should be directed to § 2 3 which sets out the problems which will arise if the required design characteristics of such receivers are not met.

1. Minimum usable field strength

In the presence of interference from industrial and domestic equipment (for limits of radiation from such equipments refer to Recommendation 433, which gives the relevant CISPR recommendations) a satisfactory service requires a median field strength (measured 10 m above ground level) of at least:

1.1 *for the monophonic service:*

48 dB(μV/m) in rural areas,

60 dB(μV/m) in urban areas,

70 dB(μV/m) in large cities;

1.2 *for the stereophonic service:*

54 dB(μV/m) in rural areas,

66 dB(μV/m) in urban areas,

74 dB(μV/m) in large cities.

Note. – In the absence of interference from industrial and domestic equipment, a field strength (measured 10 m above ground level) of at least 34 dB(μV/m) or 48 dB(μV/m) can be considered to give an acceptable monophonic or stereophonic service, respectively. These field-strength values apply when an outdoor antenna is used for monophonic reception, or a directional antenna with appreciable gain for stereophonic reception (pilot-tone system, as defined in Recommendation 450).

2. Protection ratios

2.1 The radio-frequency protection ratios required to give satisfactory monophonic reception for 99% of the time, in systems using a maximum frequency deviation of ± 75 kHz, are those given by the Curve M2 in Fig. 1. For steady interference, it is desirable to provide the higher degree of protection, shown by the Curve M1 in Fig. 1 (see Annex I).

The protection ratios at important values of the frequency spacing are also given in Table I.

The corresponding values for monophonic systems using a maximum frequency deviation of ± 50 kHz are given in Fig. 2.

2.2 The radio-frequency protection ratios required to give satisfactory stereophonic reception for 99% of the time, for transmissions using the pilot-tone system and a maximum frequency deviation of ± 75 kHz, are given by Curve S2 in Fig. 1. For steady interference (see Annex I), it is desirable to provide a higher degree of protection, shown by Curve S1 in Fig. 1. The protection ratios at important values of the frequency spacing are also given in Table I.

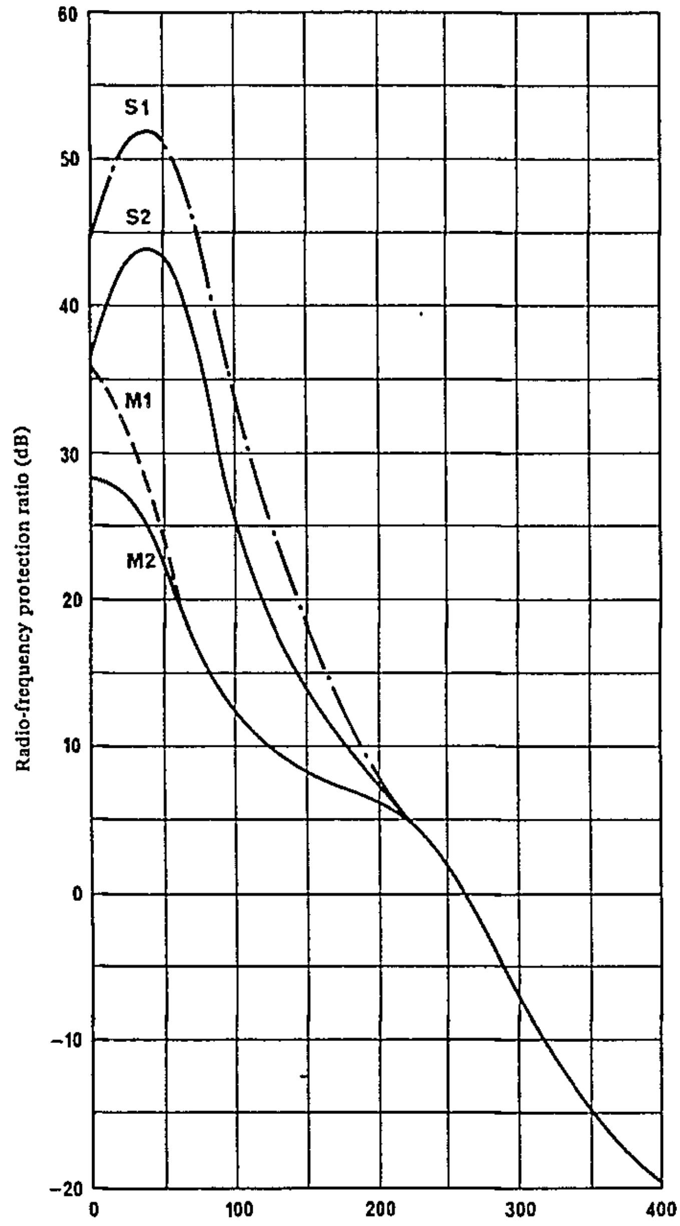


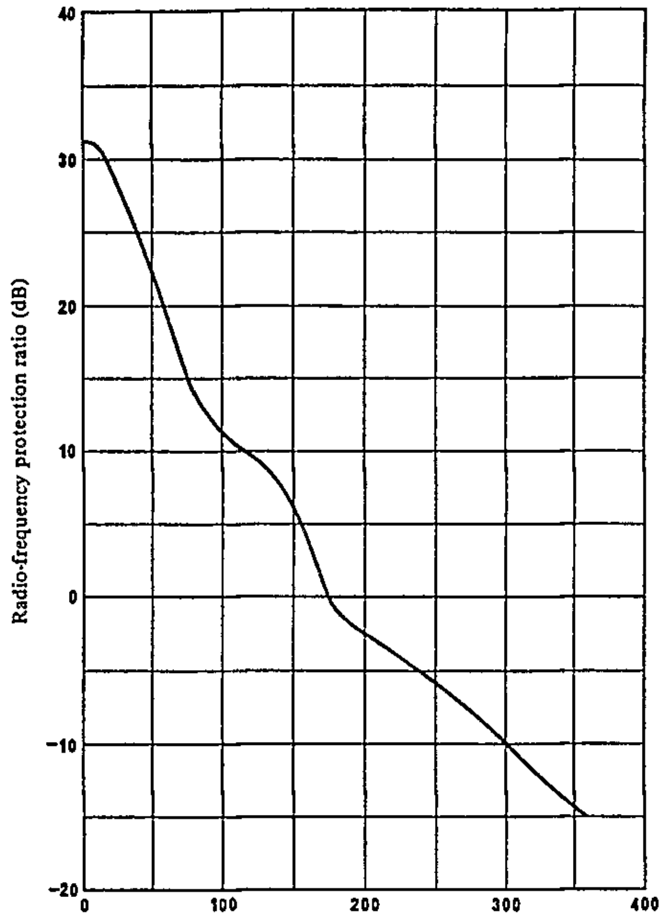
FIGURE 1 – *Radio-frequency protection ratio required by broadcasting services in band 8 (VHF) at frequencies between 87.5 MHz and 108 MHz using a maximum frequency deviation of ± 75 kHz*

Curve M1 : monophonic broadcasting; steady interference

Curve M2 : monophonic broadcasting; tropospheric interference (protection for 99% of the time)

Curve S1 : stereophonic broadcasting; steady interference

Curve S2 : stereophonic broadcasting; tropospheric interference (protection for 99% of the time)



Frequency difference between wanted and interfering transmitters (kHz)

FIGURE 2 – *Radio-frequency protection ratios for monophonic sound broadcasting in band 8 (VHF) using a maximum frequency deviation of ± 50 kHz*

Tropospheric interference (protection for 99% of the time)

TABLE 1

Frequency spacing, (kHz)	Radio-frequency protection ratio (dB)			
	Monophonic		Stereophonic	
	Steady interference	Tropospheric interference	Steady interference	Tropospheric interference
0	36	28	45	37
25	31	27	51	43
50	24	22	51	43
75	16	16	45	37
100	12	12	33	25
150	8	8	18	14
200	6	6	7	7
250	2	2	2	2
300	− 7	− 7	− 7	− 7
350	− 15	− 15	− 15	− 15
400	− 20	− 20	− 20	− 20

2.3 The protection ratios for stereophonic broadcasting assume the use of a low-pass filter following the frequency-modulation demodulator in the receiver designed to reduce interference and noise at frequencies greater than 53 kHz in the pilot-tone system and greater than 46.25 kHz in the polar-modulation system. Without such a filter or an equivalent arrangement in the receiver, the protection-ratio curves for stereophonic broadcasting cannot be met, and significant interference from transmissions in adjacent or nearby channels is possible.

2.4 Data systems or other systems providing supplementary information, if introduced, should not cause more interference to monophonic and stereophonic services than is indicated by the protection-ratio curves in Fig. 1 (see Report 463). It is not considered practicable in the planning to provide additional protection to data services or other services providing supplementary information signals.

Note 1. – The protection-ratio curves in Fig. 1 were originally determined by subjective evaluation of interference effects. As subjective tests are rather time-consuming an objective measuring method was developed (see Report 796) and found to yield results which are in fair agreement with those of subjective tests.

Note 2. – In determining the characteristics of the filters whose phase response is important in the preservation of channel separation at high audio frequencies, reference should be made to Report 293, particularly Table I and Figs. 2, 3 and 4.

Note 3 – The protection ratios for steady interference provide approximately 50 dB signal-to-noise ratio. (Weighted quasi-peak measurement according to Recommendation 468, with a reference signal at maximum frequency deviation.) See also Report 796.

RECOMMENDATION 450-1

TRANSMISSION STANDARDS FOR FM SOUND BROADCASTING AT VHF

(Question 46/10)

(1982)

The CCIR

UNANIMOUSLY RECOMMENDS

that for FM sound broadcasting in band 8 (VHF) the following transmission standards should be used:

1. Monophonic transmissions

1.1 *RF signal*

The radio-frequency signal consists of a carrier frequency-modulated by the sound signal to be transmitted, after pre-emphasis, with a maximum frequency deviation equal to:

± 75 kHz or ± 50 kHz.

1.2 *Pre-emphasis of the sound signal*

The pre-emphasis characteristic of the sound signal is identical to the admittance-frequency curve of a parallel resistance-capacitance circuit having a time constant of:

50 µs or 75 µs

Note 2. – In Europe, the pre-emphasis is 50 µs. In the United States, it is 75 µs

2. Stereophonic transmissions

2.1 *Polar-modulation system*

2.1.1 *RF signal*

The radio-frequency signal consists of a carrier frequency-modulated by a baseband signal, known in this case as the "stereophonic multiplex signal", with a maximum frequency deviation equal to:

± 75 kHz or ± 50 kHz (see Note 1, § 1).

2.1.2 *Stereophonic multiplex signal*

This signal is produced as follows:

2.1.2.1 A signal M is formed equal to one half of the sum of the left-hand signal, A, and the right-hand signal, B, corresponding to the two stereophonic channels. This signal, M, is pre-emphasized in the same way as monophonic signals (see § 1).

Note 1. – M is a "compatible" signal in the sense that the stereophonic transmission may be received by a monophonic receiver equipped for the same maximum frequency deviation and the same pre-emphasis.

2.1.2.2 A signal S is produced equal to one half of the difference between signals A and B mentioned above. This signal, S, is pre-emphasized in the same way as signal M. The pre-emphasized signal, S, is used for the amplitude modulation of a sub-carrier at 31.25 kHz; the spectrum of the amplitude-modulated sub-carrier is formed so that the sub-carrier amplitude is reduced by 14 dB and the spectral components of the given modulating signal appear to be transformed as follows:

$$\overline{K}(f) = \frac{1 + j\,6.4\,f}{5 + j\,6.4\,f}$$

where f is equal to each frequency component in kHz.

2.1.2.3 The stereophonic multiplex signal is the sum of:

- the pre-emphasized signal, M;
- the sideband spectral components which are the product of amplitude-modulated unsuppressed carrier by a pre-emphasized signal S additionally transformed from the law $\overline{K}(f)$:
- the sub-carrier with the amplitude reduced by 14 dB.

2.1.2.4 The amplitudes of the various components of the stereophonic multiplex signal, referred to the maximum amplitude of that signal (which corresponds to the maximum frequency deviation) are:

- signal M: maximum value 80% (A and B being equal, and in phase);
- signal S: maximum value 80% (A and B being equal but of opposite phase);
- reduced sub-carrier at 31.25 kHz; maximum residual amplitude 20%.

2.1.2.5 The frequency modulation is arranged in such a way that positive values of the multiplex signal correspond to a positive frequency deviation of the main carrier and negative values to negative frequency deviation.

2.2 *Pilot-tone system*

2.2.1 *RF signal*

The radio frequency signal consists of a carrier frequency-modulated by a baseband signal, known in this case as the "stereophonic multiplex signal", with a maximum frequency deviation equal to:

± 75 kHz or ± 50 kHz (see Note 1, § 1).

2.2.2 *Stereophonic multiplex signal*

This signal is produced as follows:

2.2.2.1 A signal M is formed equal to one half of the sum of the left-hand signal, A, and the right-hand signal, B, corresponding to the two stereophonic channels. This signal, M, is pre-emphasized in the same way as monophonic signals (see § 1) (see Note 1, § 2).

2.2.2.2 A signal S is produced equal to one half of the difference between signals A and B mentioned above. This signal, S, is pre-emphasized in the same way as signal M. The pre-emphasized signal, S, is used for the suppressed-carrier amplitude modulation of a sub-carrier at 38 kHz ± 4 Hz.

Note 2. – The same effect is obtained by pre-emphasizing the left-hand signal A and the right-hand signal B before encoding. For technical reasons this procedure is sometimes preferred.

2.2.2.3 The stereophonic multiplex signal is the sum of:

- the pre-emphasized signal, M;
- the sidebands of the suppressed sub-carrier amplitude modulated by the pre-emphasized signal, S;
- a "pilot signal" with a frequency of 19 kHz exactly one-half the sub-carrier frequency.

2.2.2.4 The amplitudes of the various components of the stereophonic multiplex signals referred to the maximum amplitude of that signal (which corresponds to the maximum frequency deviation) are:

- signal M: maximum value 90% (A and B being equal and in phase);
- signal S: maximum value of the sum of the amplitudes of the two sidebands: 90% (which corresponds to A and B being equal and of opposite phase);
- pilot signal: 8 to 10%;
- sub-carrier at 38 kHz suppressed: maximum residual amplitude 1%.

2.2.2.5 The relative phase of the pilot signal and the sub-carrier is such that, when the transmitter is modulated by a multiplex signal for which A is positive and $B = -A$, this signal crosses the time axis with a positive slope each time the pilot signal has an instantaneous value of zero. The phase tolerance of the pilot signal should not exceed ± 3° from the above state. Moreover, a positive value of the multiplex signal corresponds to a positive frequency deviation of the main carrier.

2.2.3 *Baseband signal in the case of a supplementary signal transmission*

If, in addition to the monophonic or stereophonic programme, a supplementary monophonic programme and/or supplementary information signals are transmitted and the maximum frequency deviation is ± 75 kHz, the following additional conditions must be met:

2.2.3.1 The insertion of the supplementary programme or signals in the baseband signal must permit compatibility with existing receivers, i.e. these additional signals must not affect the reception quality of the main monophonic or stereophonic programmes.

2.2.3.2 The baseband signal consists of the monophonic signal or stereophonic multiplex signal described above and having an amplitude of not less than 90% of that of the maximum permitted baseband signal value, and of the supplementary signals having a maximum amplitude of 10% of that value.

2.2.3.3 For a supplementary monophonic programme, the sub-carrier and its frequency deviation must be such that the corresponding instantaneous frequency of the signal remains between 53 and 76 kHz.

2.2.3.4 For supplementary information signals, the frequency of any additional sub-carrier must be between 15 and 23 kHz or between 53 and 76 kHz.

2.2.3.5 Under no circumstances may the maximum deviation of the main carrier by the total base signal exceed ± 75 kHz.

REPORT 628-2

AUTOMATIC MONITORING AND CONTROL OF TELEVISION OPERATION

(Question 15/11)

(1974-1978-1982)

1. Use of insertion reference signals (IRS) in the television studio complex

1.1 *Purpose of insertion reference signals*

Study Programme 12A/11 recognizes the possibility of using insertion signals as a reference and certification tool for adjustment of the waveform characteristics of a distorted programme signal, so that the original characteristics of the picture may be restored Such insertion signals are called "insertion reference signals"

1.2 *Insertion points*

Insertion reference signals are inserted on the video signal at all certification points, that is, at all points where qualified personnel are present who can verify that the technical parameters of the programme signal are correct, and that the content of the programme picture, as seen on a picture monitor, is also correct The insertion reference signals stay with the programme signal at all times, and may only be erased and replaced at recertification points down-stream (if any)

As an example, the outputs of film and slide scanners, television cameras or vision mixers, etc., can be certification points; at these points technical personnel check that the inserted IRS are undistorted and that the programme signal parameters are correct In particular, they verify that the level of the programme peak white does not exceed the level of the white bar in the IRS

1.3 *Correction points*

Automatic correctors that can correct most of the linear distortions of the IRS signals are available on the market The correctors may be used for instance automatically to correct luminance level, chrominance level burst amplitude and sync amplitude, etc

An automatic correction by means of IRS can be effected on the output of the switcher in the continuity suites that feed the distribution networks of television links, in this way, all signals distributed on the networks conform to the standard and to the artistic intention of the programme director. It should be noted that in the USA particular insertion reference signals (VIR) are fed throughout the television system, down to the user's television receiver, which could incorporate an IRS correction circuit

Manual correction with IRS may be carried out at recertification points; this occurs in the case of a studio vision mixer that corrects, switches on the output and recertifies a remote signal such as one coming from a film scanner.

IRS may also be used to advantage to trim the alignment of television tape-machines when playing programme tapes. The output of television tape-machines can thus be considered to some extent as a correction point

1.4 *Waveform of the national insertion reference signals*

Many countries believe that the waveforms adopted for IRS should preferably be the same as certain of the waveforms adopted for international insertion test signals (ITS) [CCIR, 1978-82a] However, it may not be necessary to adopt all the ITS waveforms for certification purposes [CCIR, 1978-82b; Zaccarian, 1978] Other countries prefer to use a different and much simpler waveform for the insertion reference signal In any case, it is important to make sure that, at the input to the international distribution network, the IRS are deleted after they have been used to make the necessary corrections. This is in order to ensure that there is no possibility of confusion with ITS which may subsequently be inserted, in accordance with Recommendation 473.

The EBU has recommended [CCIR, 1978-82a] that its member organizations operating with 625-line 50 field television systems and wishing to introduce IRS should employ the signals shown in Figs. 1 and 2 (taken from Recommendation 473), preferably inserted in lines 17 and 330 respectively. If, for reasons of economy, it is desired to use only one of these signals, the signal shown in Fig. 1 should be inserted only in line 17, or alternatively, the signal shown in Fig. 2 should be inserted only in line 330.

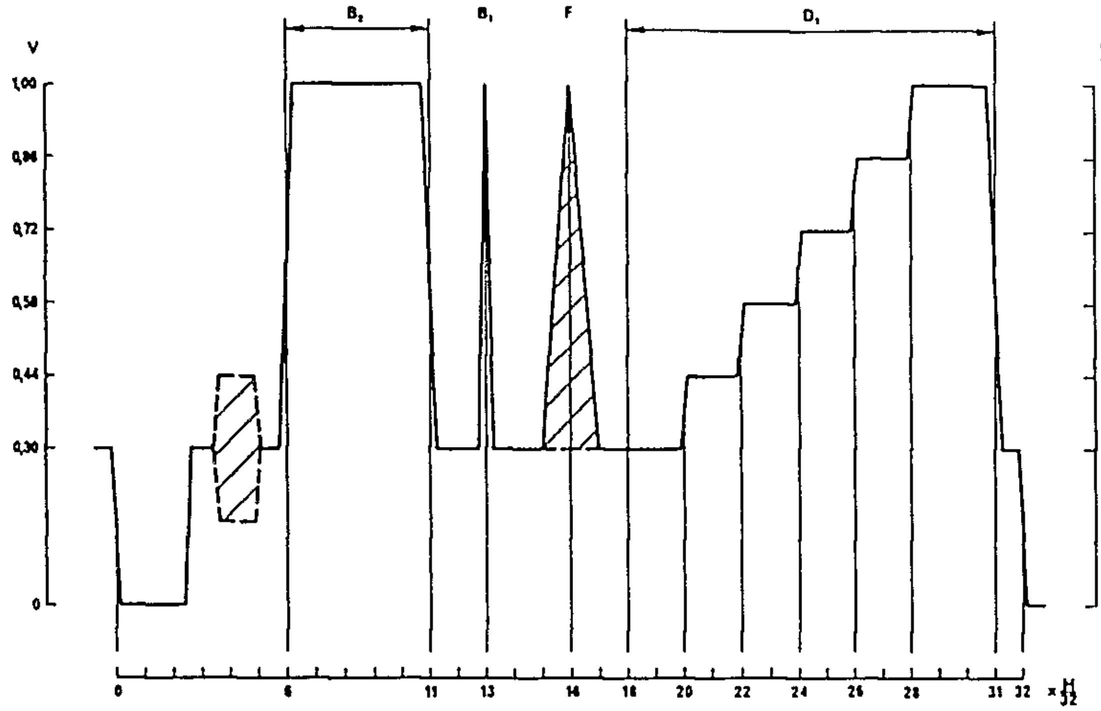


FIGURE 1 – *IRS signals recommended by the EBU for insertion in line 17*

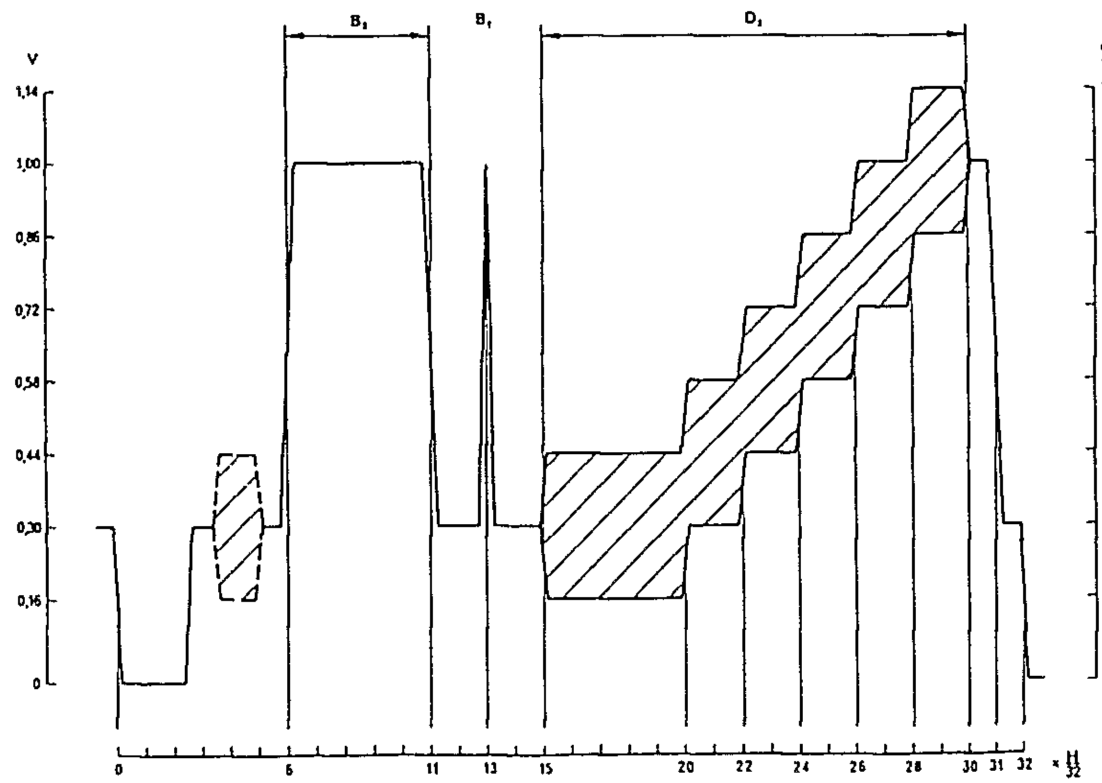


FIGURE 2 – *IRS signals recommended by the EBU for insertion in line 330*

2. Use of insertion test signals (ITS) for the automatic monitoring of television transmitting stations

During recent years, it has been the custom to design transmitting stations for unattended operation. This has led to a growing demand for automatic measuring systems capable of checking transmitter performance and providing alarms and status information for control stations This automatic equipment is generally arranged to measure important characteristics of the television signal such as the synchronizing pulses, blanking intervals and the main features of an insertion test signal located in the field-blanking period. The equipment may also check the frequency of the vision and sound carriers and, in some cases, the continuity of the sound channel may be checked by detecting the presence of a super audio pilot signal. In the case of transposers, the insertion test signal measurement results may be regarded as sufficient evidence of correct operation of the sound channel.

The facilities needed for the automatic monitoring of a network of broadcasting stations may either be located at each of the stations to be monitored, or, in another method, a central master station may employ a more comprehensive system which is able to make measurements by direct reception of the remote stations. While the transmitter is in programme service, it is convenient to monitor the radio-frequency signal by feeding the measuring system from a high quality receiver or demodulator. A similar set of measurements may be needed for the point to point link network which distributes the signal to the main transmitting stations. Both sets of measurements may often be performed by the same operational system which is able therefore to supervise the link networks as well as the transmitters.

The recent emergence of the integrated circuit micro-processor has led to the design of equipment which allows wholly digital measuring techniques to be applied to on-site test line parameter analysis and noise measurement [James and Watson, 1975]. This approach results not only in greater versatility, but affords appreciable economies in both size and cost over comparable analogue measuring equipment capable of taking executive corrective action.

Report 411 discusses automatic methods of measuring and supervising video test signals. The methods decribed are equally applicable to the monitoring of transmitting stations.

RECOMMENDATION 469-3 (Abstracts)

STANDARDS FOR THE INTERNATIONAL EXCHANGE OF TELEVISION PROGRAMMES ON MAGNETIC TAPE

(Question 18/11, *Study Programme* 18M/11)

(1970-1974-1978-1982)

The CCIR

UNANIMOUSLY RECOMMENDS

that the magnetic recordings used for the international exchange of television programmes should meet the following standards.

© Specification for programme sound recording

o *General*

The sound reference level shall correspond to a recorded short circuit flux of 100 ± 10 nWb/m of track width, (r.m.s.), at 1000 Hz. (In some countries, a 400 Hz reference tone is used.) Normal operational practice will result in programme peaks corresponding to a maximum short circuit flux between 250 and 310 nWb/m, (r.m.s.), i.e. about 9 dB above reference level. These maximum recorded levels correspond to the subjective overload level for television tape materials currently used for the international exchange of programmes.

Note 1. – In the case of Type B recordings a sound reference level corresponding to a short circuit flux of 90 ± 5 nWb/m is presently employed. However, the question of increasing this value to 100 nWb/m is under review

Note 2. – When the programme peaks are measured by means of a programme meter, due account should be taken of the integration time of the instrument (see Report 292)

o *Transverse-track recording*

The television programme sound shall be recorded on the audio track only. In accordance with IEC Publication 94, the recording characteristic corresponds to a time constant of 35 µs, for a speed of 38.1 cm/s (15 in/s) (Many countries use an additional time constant of 2000 µs.)

o *Type B and Type C recording*

The monophonic sound signal shall be recorded on audio track 1. For stereophonic recording, audio track 1 shall carry the left channel and audio track 2 the right channel

Note – In Type B recording, audio track 1 is the edge track and audio track 2 the inner track. In Type C recording, audio track 1 is the inner track and audio track 2 the edge track

ⓓ Specification for cue signal recording

In the case of transverse-track recording, the cue track should not contain information which needs to be reproduced for the exchange of broadcast programmes, except by mutual agreement, when a time and control code signal, or contributions to the final programme sound, such as sound effects, may be recorded on the cue track

Editing

o *Electronic editing*

Editing of tapes intended for the international exchange of programmes should be carried out electronically.

Electronic editing shall maintain an off-tape synchronizing pulse train with a phase relationship to the playback reference of the machine sufficiently close to avoid visible disturbance of the picture

o *Mechanical editing splices*

Tapes for international exchange should not contain mechanical editing splices. However, in the case of transverse-track recording only, and where, by prior arrangement, tapes are exchanged which contain such splices, the splices should be in accordance with good operational practices (see EBU Publication Tech. 3084-1975)

Composition and duration of leaders and trailers

Leader and trailer sections should be located on the tape in conformity with the sequence shown in Table I.

TABLE I

Tape section		Duration (s)	Picture	Sound (on any channel carrying programme sound)	Control track signal
Leader	Protection leader	10 (minimum)	Blank tape		
Leader	Alignment leader	60 (minimum)	Alignment signal (1)	1000 Hz at reference level (2)	Uninterrupted
Leader	Optional	5 (maximum)	Blank tape		
Leader	Identification leader	15 (minimum)	Programme identification	Spoken identification preferred, or silence	Uninterrupted
Leader	Cue-up leader	8	Black or cue (4)	Silence or cue	Uninterrupted
Leader	Cue-up leader	2	Black (4)	Silence	Uninterrupted
Programme (3)		Playing time of programme	Programme		Uninterrupted
Run-out trailer		30 (minimum)	Black (4)	Silence	Uninterrupted

(1) Examples of suitable alignment signals for transverse-track recordings in 625-lines, 50 field/s systems are given in Annex I

(2) See § 2 1

(3) Where the time and control code is recorded on the assigned longitudinal track (see § 3), the time indication of the programme start should be shown on the label accompanying the tape (see § 8 3)

(4) In the case of colour recordings the black signal should be colour black It is desirable that the colour field sequence (8 fields in PAL, 4 fields in NTSC) should continue uninterrupted in relation to the beginning and end of the programme recording

8. Programme identification

8.1 At least the following information should be supplied with each recorded television tape:

- name of the organization which made the recording;
- title of programme, or title, sub-title and episode number;
- total number of spools, and number of the spool in the sequence when the programme is contained on more than one spool;
- reference number (library number) of programme or of tape;
- total playing-time, and playing-time of the programme material recorded on the tape;
- in the case of 25.4 mm (one-inch) recording: the format, i.e., Type B or Type C;
- line and field system (625/50 or 525/60);
- in the case of transverse-track recording, the recording standard ("high band" or "low band");
- indication of the colour system, for colour recordings;
- which audio tracks have been used,
- the content of each audio track;
- in the case of Type C recordings, whether the sync. track is recorded.

The information required in § 8.1 shall be provided in at least one of the official languages of the ITU.

The information required in § 8.1 shall be provided on labels affixed both to the programme spool and its container

ANNEX

EXAMPLE OF TEST SIGNALS FOR USE IN ADJUSTING TELEVISION TAPE MACHINES

(625-line systems)

The present EBU recommendation for test signals to be used in adjusting transverse-track television tape machines for 625-line television systems, is shown below. Test signals for Type B and Type C recordings have not yet been specified.

In the original EBU recommendation for reference tapes, it is required that the recording be made on a specific type of television tape, which is chosen because it is representative of the tapes currently found in operation

1. Test signals to be recorded on the leaders of television tapes

The alignment video signal on the tape leader indicated in § 5 of this Recommendation, for adjusting the reproducing machine so that the best picture quality may be obtained, should conform with the following specifications.

1.1 for monochrome television recording and SECAM colour television recordings:

- a black-level bar, a white-level bar and, if desired, a Gaussian pulse,
- a frequency "multi-burst";
- a grey-scale or a "saw-tooth" signal.

These signals should appear simultaneously The part of the picture carrying each signal should be greater than the area scanned by one complete revolution of the head wheel:

1.2 for PAL colour television recordings:

- on the upper part (at least one third) of the picture, a conventional test pattern of colour bars;
- on the lower part (at least one third) of the picture, a uniform area having the same signal as the red bar.

Note – The colour bar signal chosen for the leader is of the type 100/0/75/0 (according to the nomenclature of Recommendation 471). In the United Kingdom it is of the type 100/0/100/0 and may be followed by a length of dubbed colour bars.

2. Signals to be recorded on the EBU reference tapes

Two types of reference tapes for television tape machines have been standardized for the member organizations of the EBU. They are intended to satisfy two different requirements:

- the physical embodiment of the recording standards used (see § 2 1);
- verification of the characteristics and rapid operational alignment of television tape-machines (see § 2 2)

Tapes of these two types shall have the following characteristics

2 1 *Primary-standard reference tape*

This tape consists of five successive parts, each of them having a duration of three minutes The different parts are recorded with the following signals occupying the full frame:

2 1 1 a multiburst signal consisting of six bursts at different frequencies, as specified by the CCIR for insertion in line 18; but preceded by a signal giving the white- and black-reference levels,

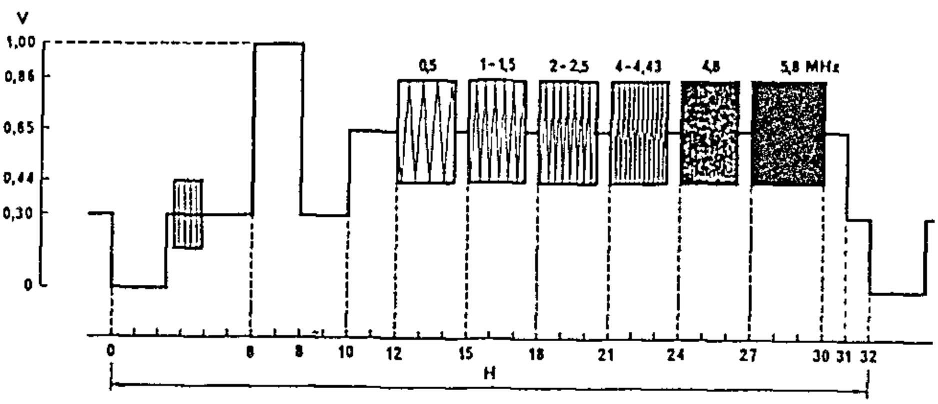


FIGURE 1

2.1.2 the signal specified by the CCIR for insertion in line 17, consisting of the following components: luminance bar, $2T$ sine-squared pulse, composite $20T$ pulse and 5-riser luminance staircase without chrominance signal;

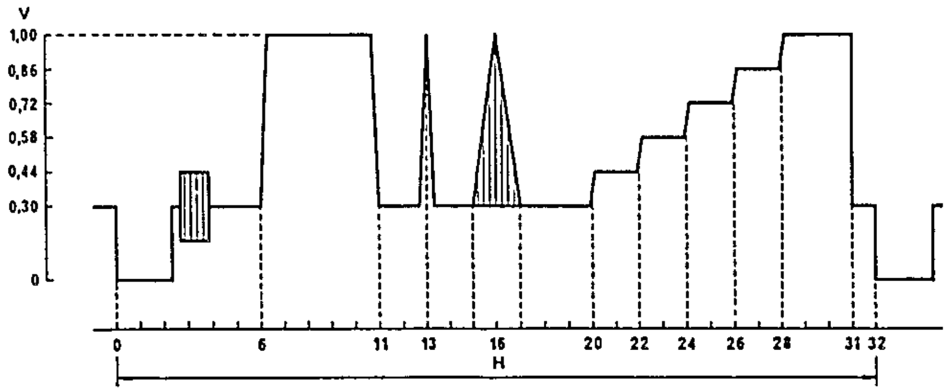


FIGURE 2

2.1.3 the signal specified by the CCIR for insertion in line 330 and consisting of the following components: luminance bar, $2T$ sine-squared pulse and 5-riser luminance staircase with superimposed sub-carrier;

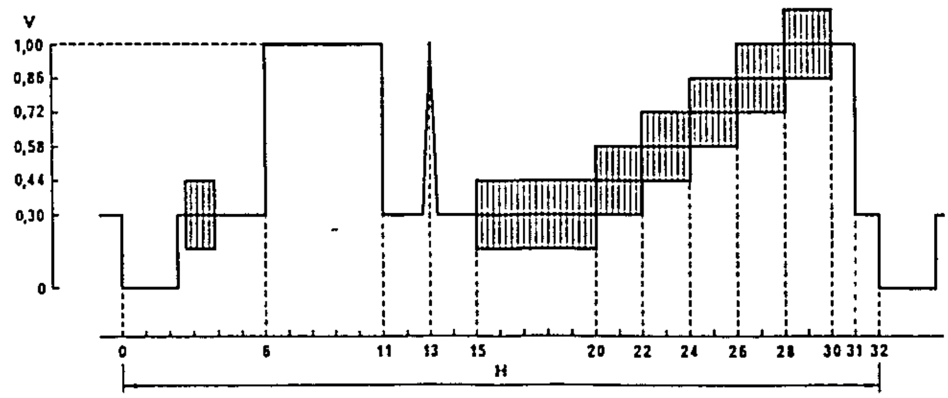


FIGURE 3

2.1.4 a uniform area generated by a sub-carrier of 0.7 V (peak-to-peak) on a luminance level of 50% of the black-to-white transition extending from the beginning to the end of the line (this signal is intended for measurements of moire and for verification of the correct reproduction of the phase of the colour sub-carrier).

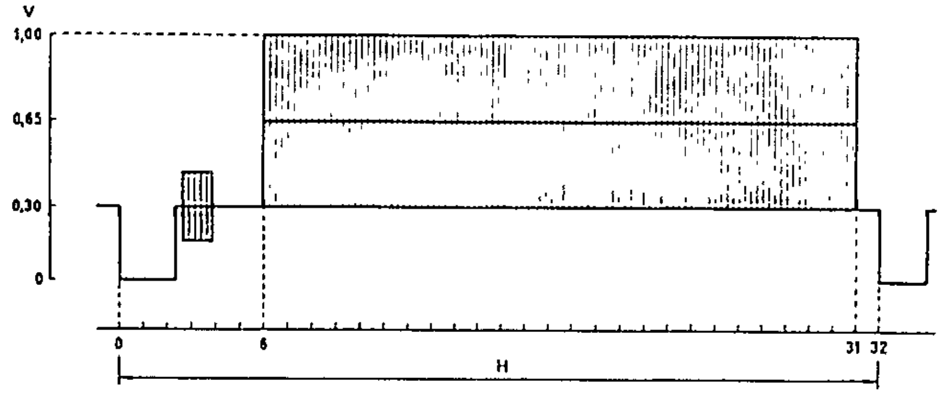


FIGURE 4

2.1.5 a uniform grey area obtained with a luminance level of 30% of the black-to-white transition (this signal is intended for noise measurement)

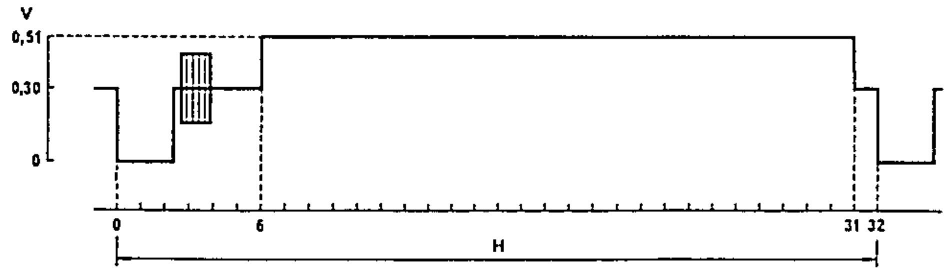


FIGURE 5

All these signals shall include the standard PAL alternating sub-carrier burst during the line-blanking interval. The phase of the sub-carrier used in § 2.1.3 and 2.1.4 shall correspond to the *B-Y* axis referred to the PAL burst.

The recording of these signals shall conform to all the characteristics specified in the relevant EBU, CCIR and IEC documents

The various recorded sections shall be separated by 15 s of black. The beginning and the end of the tape shall also consist of 15 s periods of black

The cue track shall be without any recording

The sound track shall be recorded with alternate announcements in French and English, thus "EBU reference-tape – bande-étalon de l'UER", followed by the indication of the serial number of the tape, the date of the recording and the name of the manufacturer.

2.2 *Alignment tape for quick verification of the machines*

This operational reference tape shall be recorded with a picture divided into two equal halves in the following way

2.2.1 the upper half of the picture shall consist of the CCIR insertion signal specified for line 330 repeated on each line, luminance bar, *2T* sine-squared pulse and 5-riser luminance staircase with superimposed sub-carrier;

2.2.2 the lower half of the picture shall consist of the type 100/0 75/0 colour-bar signal (conforming to Recommendation 471)

Both these signals shall include the standard PAL alternating sub-carrier burst during the line-blanking interval. The phase of the sub-carrier used in § 2.2.1 shall correspond to the *B-Y* axis referred to the PAL burst.

The recording of these signals shall conform to all the characteristics specified in the relevant EBU, CCIR and IEC documents.

The cue track shall be without any recording.

The sound track shall be recorded with alternate announcements in French and English, thus: "EBU alignment tape – bande de reglage UER", these announcements being interrupted with a few seconds of 1000 Hz tone at the reference level of 100 nWb/m as indicated in this Recommendation.

REPORT 412-3

TRANSMISSION TIME DIFFERENCES BETWEEN THE SOUND AND VISION COMPONENTS OF A TELEVISION SIGNAL

(Study Programme 21A/CMTT)

(1966-1970-1974-1978)

1. Introduction

In the early days of long-distance television transmission, when the video and sound were transmitted via different facilities, there occasionally existed a perceptible lack of simultaneity between sound and vision. Over the intervening years, the networks have been improved. Today, even though the sound and vision of a television programme may be transmitted via different facilities, the transmission velocities used, are such that little or no lack of simultaneity between sound and vision is experienced.

With the advent of satellite-communication systems, where the sound and vision signals may be transmitted via different media, difficulties may exist at the receiver location because of the lack of synchronization of sound and vision.

2. Conclusions based on observer reaction

Studies of observer reaction to non-simultaneous presentation of pictures and associated sound were reported in [CCIR, 1963-66a and b; CCIR, 1966-69]. General conclusions may be drawn from these experiments.

2.1 *Qualitative conclusions*

The observer is more sensitive to sound advances than to sound delays with respect to the correlated visible action.

Observer tolerance to sound/vision time differences varies according to the nature of the action. For example, the objectionable effects of the more easily correlated actions and sounds (such as the percussive sound produced by an object being struck) are detected at considerably shorter time differences than are lip motions of a speaker and the corresponding sounds. For scenes of people moving about, correlation between sound and action becomes more difficult for the observer to detect.

2.2 *Quantitative conclusions*

Although the conditions under which the experiments in Canada, the United States of America and the Federal Republic of Germany were conducted differed widely, the results were in broad agreement. In terms of these results, it is possible to derive some provisional figures for overall tolerance to the lack of simultaneity between the sound and the picture.

2.2.1 *Sound delayed*

For sound delayed with respect to vision, 140 ms will produce, approximately, a "just perceptible impairment" for 50% of the observers.

2.2.2 *Sound advanced*

For sound advanced with respect to vision, 70 ms will produce, approximately, a "just perceptible impairment" for 50% of the observers

2.2.3 The above figures based upon the experiments in Canada and the United States of America are more stringent than necessary in some circumstances, but they allow for some evidence that sensitivity to sound/vision time differences might be greater for some languages than for English in which the first experiments were conducted.

The experiments in the Federal Republic of Germany [CCIR, 1966-69] have confirmed the above figures using a percussion test which constitutes the most critical case. Moreover, it was found that the tolerances depend very little on the different programme material used. Hence the conclusion may be drawn that the same holds true for other programme material and languages which were not included in the tests

3. The problem of division of time differences among the links of a built-up connection

The figures cited in § 2.2 must be divided between acoustic links (sources to studio microphone, and television receiver to observer) and electrical links. The electrical links may in turn be subdivided between the broadcasting facilities and the telecommunications transmission networks Very little information is available on which a practical division may be based, but this is being studied under Question 35/11.

As an example, in the United States of America, where a variety of programme material is transmitted, it has been found economically feasible on transmission networks to limit sound delay relative to the vision component of a television programme by not more than 50 ms, and sound advance by not more than 25 to 30 ms, at the receiving location. The advance or delay of sound of a television signal that may be introduced because of the difference in transmission velocities on network facilities, can be determined. The advance or delay figures of sound indicated are primarily concerned with the long-distance portion of the network and do not include the inter-city or other contributing sources to the time difference of sound and vision components of the television signal. Other electrical and acoustic links make up the remainder of the sound/vision time difference.

4. Responsibility for making necessary corrections of time differences (Study Programme 21A/CMTT)

If the sound and vision components of a television signal are transmitted along the same route, and by the same method, there will be no perceptible time difference between the two signals. Where such common routing is not feasible Administrations are urged to provide circuits resulting in time difference values as low as possible.

If, in spite of this, considerable time differences should occur, it should normally be the responsibility of the broadcasting authorities concerned to make the necessary corrections.

This arrangement seems to be most appropriate for the following reasons:

- as the two channels only have to coincide at the source and at the destination there is a greater flexibility for routing of channels;
- in general, broadcasting authorities will have various possibilities open to them to effect such corrections so that there is no need for the Administration and/or recognized private operating agencies to provide such equipment.

5. Methods of controlling time differences between sound and vision signals on long-distance connections

In a circuit of 2500 * km, the delays are as follows:

- for an individual modulation/demodulation equipment for high-quality sound transmission over carrier links (15 kHz): less than 3 ms;
- for modulation/demodulation equipment for sound transmission on a television circuit, e.g. systems given in Report 488: a few microseconds;
- where sections forming the circuit wholly comprise one of the following transmission media:
  - free space: 8.3 ms;
  - radio-relay links: 8.4 ms;
  - coaxial pair 2.6/9.5 mm (CCITT standard): 8.9 ms;
  - coaxial pair 1.2/4.4 mm (CCITT standard): 10.0 ms;
  - loaded lines:
    - 6.4 kHz bandwidth: 52.0 ms;
    - 10 kHz bandwidth: 40.0 ms;
    - 15 kHz bandwidth: 25.0 ms.

The time differences mentioned in § 2 will not be exceeded in practical applications if the following rules are observed.

- in the case of satellite transmissions, both the picture and the sound components should be transmitted via the same satellite;
- for terrestrial transmission, the television-sound circuit should not employ significant lengths, (e.g not more than 100 km), of the following:
  - loaded circuits,
  - audio-frequency or carrier-frequency circuits, the basic delay of which is substantially increased by delay equalization.

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* The length of 2500 km corresponds to the length of the hypothetical reference circuit for television given in Recommendation 567, and also to the length of the hypothetical reference circuit for sound-programme transmission given in Recommendation 502.

6. Further work

Contributions are invited from various Administrations based on experience and practice with regard to the following:

- the minimum time-difference which is generally considered practicable to achieve in long circuits;
- new experiments which introduce conditions beyond those previously used.

With regard to methods of controlling sound/vision time differences arising on the long-distance circuits, Administrations are invited to study § 5 above to determine its suitability as a basis for a new Recommendation.

REFERENCES

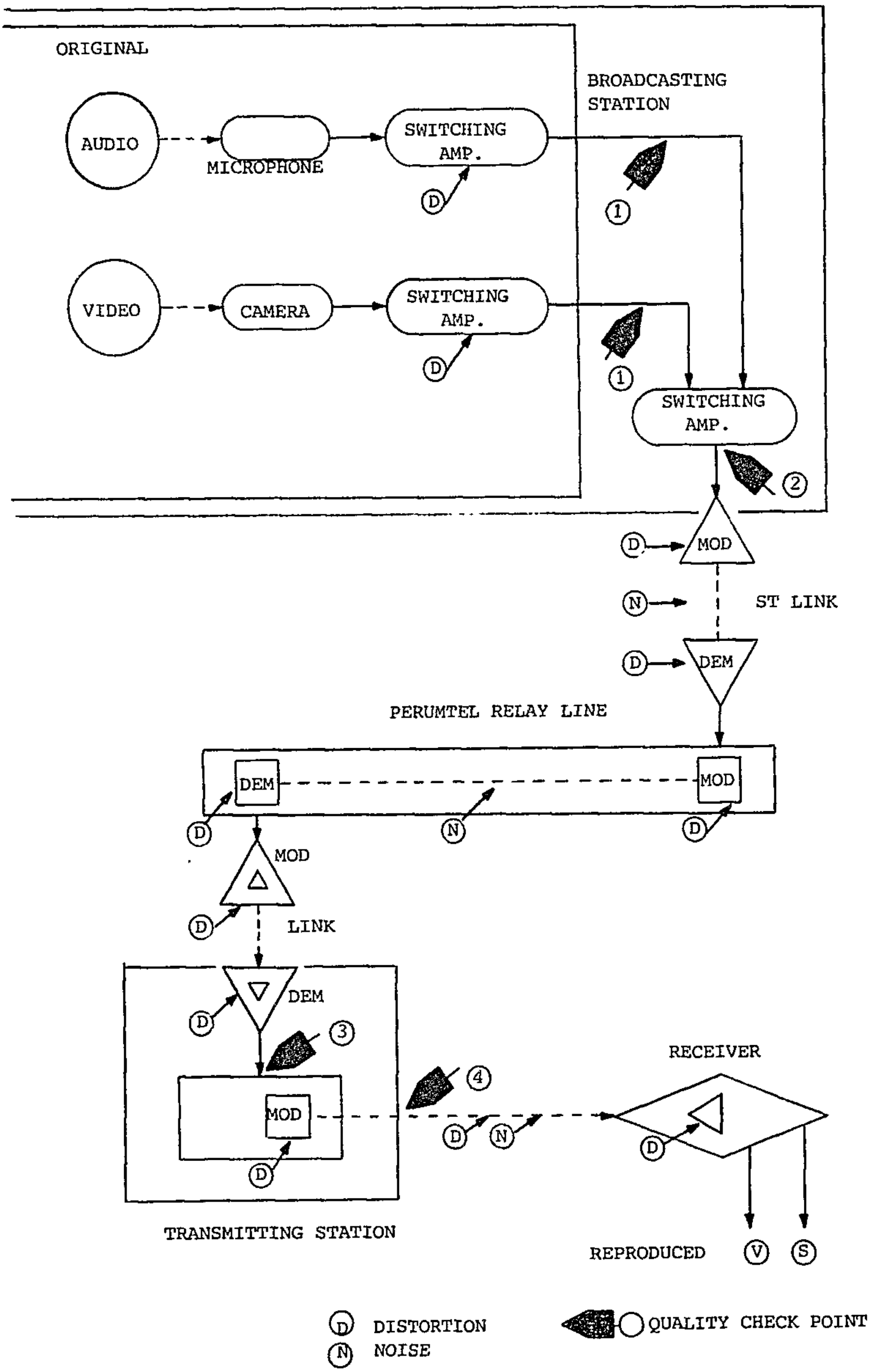
CCIR Documents

[1963-66]: a. CMTT/1 (Canada); b. CMTT/12 (United States of America)

[1966-69]: CMTT/55 (Federal Republic of Germany).

Fig. 2-8-1

Model Route of Radio/TV Signal from Station to Receiver



CHAPTER 9 PERSONNEL PLAN

CHAPTER 9 PERSONNEL PLAN

Forecast of personnel increase at the completion stage of the expansion plan will summarily be 663 persons.

9 - 1	Personnels for Transmitting Facilities				
	Increases number of personnels				353
	Breakdown is as follows:				
(1)	MW, SW Transmitting stations				161
	Low power station	3 x 38 stations =		114	
	High "	4 x 10 stations =		40	
	Jakarta				7
	Total				161
(2)	High Power SW Transmitting Station				57
(3)	FM Transmitting Stations	(3 x 37 stations	=	111)	111
(4)	TV Relay Stations	(2 x 12	=	24)	24

9 - 2	Personnel for Studio Facilities				
	Increased number of personnels				297
	Breakdown is as follows:				
(1)	Jakarta National Station				72
(2)	Regional stations				180
	Nusantara	5 x 5	stations	=	25
	Regional-I	4 x 26	"	=	104
	Regional-II	3 x 17	"	=	51
(3)	MPU operation team				45
9 - 3	Management staff for the above				13
	Grand Total				663

CHAPTER 10 CONSTRUCTION AND OPERATION COST

CHAPTER 10 CONSTRUCTION AND OPERATION COST

10 - 1 Construction Cost

The approximate total of the construction cost necessary to carry out this project is about 201,300 mRp.

The breakdown of the above is shown in Table 2-10-1, construction cost in each fiscal year is shown in Table 2-10-2, respectively.

10 - 2 Operation Cost

The increment of operation cost after the completion of the above construction project will be about 14,120 mRp.
Breakdown of operation cost are as follows;

(1) Additional operation cost for the new transmitting facilities -2,238.0 mRp

a. Extension of operating hour of MW radio transmitter

present operation cost -4,744.0 mRp
increment of operation hour = 35 %
4,744 x 0.35 = 1,660.0 mRp

b. Opening of new FM station -----338.0 mRp

for 5 kW station	21.2 x 9	=	190.8 mRp
for 3 kW station	8.4 x 8	=	67.2
for 0.5 kW or less	4.0 x 20	=	80.0
Total			338.0 mRp

c. Opening of new TV relay station

4.8 mRp x 50 = 240.0 mRp

(2) Additional operation cost for the new programme production facilities ----- 5,300.0 mRp

a. The assumable amount of increase of radio and TV programme production in this plan period are 30 % and 10 %, respectively. Additional cost based on the above assumption can be estimated as follows;

radio programme production	-----	3,300.0 mRp
TV programme production	-----	2,000.0
Total	-----	5,300.0 mRp

(3) Cost for programme transmission based on the lease of PERUMTEL telecommunication network -----4,500.0 mRp

The programme transmission network should be expanded in accordance with the 5-year plan as follows;

(i) 7 kHz radio programme transmission network
2 system

(ii) TV programme transmission network 1 system

(iii) Exclusive telephone network 1 system

Additional operation cost for the above can be estimated in consultation with the PERUMTEL tariff list.

a.	TV programme transmission line	3,520.0 mRp
b.	Radio programme transmission line	980.0 mRp
c.	Exclusive telephone network	(included in b.)

(4) Tape duplication and circulation 1,200.0 mRp

monaural tape....	30.000 rolls
stereophonic tape	50,000 "

Cost for tape purchase and circulation

15,000 Rp x 80,000 = 1,200.0 mRp

(5) Salary for additional staff 881.8 mRp

1,330,000 Rp x 663 = 881.8 mRp

(6) Grand total for the above 14,120.0 mRp

Table 2-10-1

Construction Cost

PROJECT	FOREIGN CURRENCY: EQUIPMENT COST AT INDONESIAN PORT	LOCAL CURRENCY: LAND	LOCAL CURRENCY: BUILDING & STRUCTURE	LOCAL CURRENCY: ROAD	LOCAL CURRENCY: TRANS PORTATION
1. MW. SW. TRANSMITTING FACILITIES	14,176.0		1,192.0		284.0
2. OVERSEAS SW. SERVICE	5,600.0	800.0	1,200.0	40.0	300.0
3. FM TRANSMITTING FACILITIES	15,224.0		366.0		
4. TV TRANSMITTING FACILITIES	15,324.0	1,000.0	4,000.0		
5. RADIO STUDIO FACILITIES	54,862.4		1,250.0		
6. TV STUDIO FACILITIES	26,020.0		648.0		
7. PROGRAM TRANSMISSION NETWORK	32,000.0				
SUB-TOTAL		1,800.0	8,656.0	40.0	584.0
	163,206.4	11,080.0			
CONSULTANT FEE (5%)	8,160.3	554.0			
(A) TOTAL	171.366.7	11,634.0			
(B) CONTINGENCY (10%)	17,137.0	1,163.0			
(A) + (B)	188,503.7	12,797.0			
GRAND TOTAL	201,300.7mRp				

Table 2-10-2

CONSTRUCTION COST (EQUIPMENT)

(UNIT mRp)

PROJECT	FISCAL YEAR					TOTAL
	84/85	85/86	86/87	87/88	88/89	
1. MW. SW. TRANSMITTING FACILITIES	3,428.0	3,176.0	3,472.0	2,412.0	1,688.0	14,176.0
2. OVERSEAS SW. SERVICE			560.0	5,040.0		5,600.0
3. FM TRANSMITTING FACILITIES	4,620.0	2,516.0	2,684.0	2,148.0	3,256.0	15,224.0
4. TV TRANSMITTING FACILITIES	3,189.6	3,085.6	3,033.6	3,033.6	2,981.6	15,324.0
5. RADIO STUDIO FACILITIES	7,997.2	8,288.4	15,368.8	13,683.2	9,524.8	54,862.4
6. TV STUDIO FACILITIES	2,328.0	5,584.0	8,536.0	5,376.0	4,196.0	26,020.0
7. PROGRAMME TRANS-MISSION NETWORK			16,000.0	8,000.0	8,000.0	32,000.0
SUB-TOTAL	21,562.8	22,650.0	49,654.4	39,692.8	29,646.4	163,206.4
CONSULTANT FEE(5%)						8,160.3
(A) TOTAL						171,366.7
(B) CONTINGENCY						17,137.0
(A) + (B)						188,503.7

PART Ⅲ CONSTRUCTION PLAN OF THE SECOND TELEVISION BROADCASTING NETWORK

CHAPTER 1 PROGRAMME PLAN

PART III CONSTRUCTION PLAN OF THE SECOND TELEVISION BROADCASTING NETWORK

This PART III has close relation with PART II but it is separately presented here as this TVN-II network is for servicing extremely limited area in this plan period.

CHAPTER 1 PROGRAMME PLAN

1 - 1 Presently, in Jakarta, a 30 minute English news from 18:30 p.m. is being broadcast as the Second TV Broadcasting service. Using this as the foundation, a full scale of TVN-II programmes will be served for education as well as instructional programmes and make it possible to be received in the following 8 cities during this plan period.

1.	Ujung Pandang	5.	Palembang
2.	Medan	6.	Denpasar
3.	Surabaya	7.	Balikpapan
4	Yogyakarta	8	Manado

Programmes are scheduled for 13 hours a day running from 07:00 - 17:00 WST and 19:00 - 22:00 WST.

1 - 2 Programming and Production of programmes

(1) Programmes for education and instruction are in terms of co-operation between the Ministry of Information and other Ministries respectively, under the following categories : Programme material/idea goes under the respective Ministries, while programme content, programme format, production and broadcasting go under the Ministry of Information. Research on the effect of broadcasting will be carried out in terms of joint project with the Ministry of Information.

(2) Programmes will be produced at Jakarta but with the completion of additional studios for producing TVN-I programmes, the existing television studios will be used for TVN-II programme production.

(3) The outstanding feature of educational and instructional programmes are not required rapidity, but rather, continuity and repeatability. Therefore, once programmes are produced in advance and stored the recorded tapes, it is possible to playback and send it out in accordance with the broadcast schedule at any time or rebroadcast it at a later date.

CHAPTER 2 PROGRAMME TRANSMISSION PLAN

CHAPTER 2 PROGRAMME TRANSMISSION PLAN

(1) Programmes for education and instruction are planned, programmed, and produced in accordance with the curriculum, and the recorded tape after broadcasting can be used repeatedly for the same educational course.

(2) The following two programme transmission methods can be considered under the following conditions.

Plan 1

The Method of Utilizing PALAPA Transmission Line of PERUMTEL

Simultaneous transmissions to local television broadcasting stations throughout the country is possible by this method.

For this operation, the television transmission line will be exclusively used for 14 hours a day, television signal modulator and demodulator at the sending terminal station (Jakarta) and the receiving terminal stations (previously mentioned 8 regional stations during this plan period) respectively, and at the same time, install a programme transmission line between the earth station and the television broadcasting stations.

Plan 2

Method by which recorded tape is distributed.

As mentioned above, educational programmes are produced and recorded in advance, in the form of a group of programmes, which can then be successively play and broadcast. This is a convenient method when the number of stations to be distribute are a few.

For this method, a copying system to make recorded tapes for distribution will be required in Jakarta TVRI station and several personnels solely to handle storage and distribution of tapes. If the number of stations to be distributed with tapes should increase, the amount of tapes to be copied will increase and the facility will become large but distribution to the 8 stations in this plan is extremely low in cost compared with to the rental fee of the PALAPA line.

(3) Upon reviewing the relative merits of these two plans, programme transmission will be carried out by the tape distribution method during the 5 year plan period and in the meantime, the provision of the PALAPA transmission network shall be proceeded. The comparison of construction cost and operation cost is shown in Table 3-2-1.

(4) Each one set of STL equipment will be provided for Medan to Bandarbaru, Denpasar to Bkt. Bakung and Manado to Makaweimben. Stand-by equipment will be provide for Manado but for Medan and Denpasar, existing standby equipment will be used as standby for both of TVN-I and TVN-II commonly (see Fig. 3-2-1).

Table 3-2-1

Cost Comparison for Five Years Operation

I. VIDEO TAPE DISTRIBUTION SYSTEM

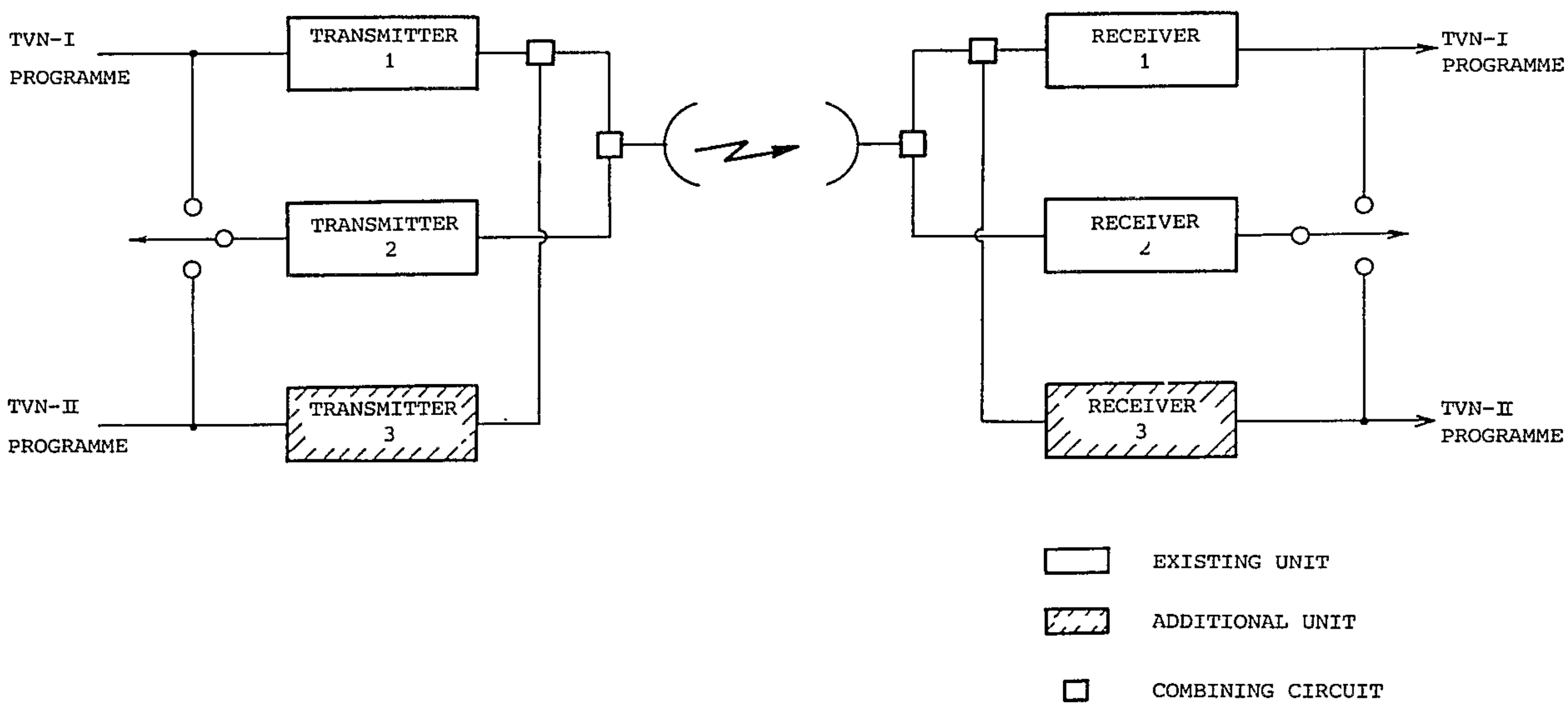
1. Construction Cost 17,578 mRp	2. Operation Cost per Year 4,065.6 mRp	3. Total Cost for Five Years Operation 20,328 mRp
a. Video Tape Duplication System at Jakarta 8,500,000 $	a. Tape Distribution Cost 550.0 mRp	
b. Playback VTR at 8 Local Stations 10,200,000 $	b. Depreciation Account 3,515.6 mRp	
c. Total 18,700,000 $ ▼ 17,578 mRp	c. Total 4,065.6 mRp	
d. Five Years Instalment 3,515.6 mRp		

II. VIDEO SIGNAL DISTRIBUTION SYSTEM VIA PALAPA NETWORK

1. Rental Fees to be paid to PERUMTEL 836,6 mRp	2. Operation Cost per Year 14,690 mRp	3. Total Cost for Five Years Operation 77,633 mRp
a. Palapa Transponder 750,000 $/year	a. Up-link (Jakarta) 73,000 $/year	
b. TX Terminal Equipment 25,645 $/year	b. Down-link (8 local stations) 14.8 m$/year	
c. RX Terminal Equipment 113,600 $/year	c. Microwave Link (9 stations) 755,500 $/year	
d. Total 889,660 $/year ▼ 836.6 mRp/year	d. Total 15,628,500 $/year ▼ 14,690 mRp/year	

Fig. 3-2-1

Common Standby STL System



CHAPTER 3 STUDIO FACILITY PLAN

CHAPTER 3 STUDIO FACILITY PLAN

3 - 1 Studio Facilities

Eight studios will be available for producing TV programmes at the time when all installation works for 4 studios in the new studio building as mentioned in chapter 3 of Part II complete. So, some number of studios will become able to use exclusively for the production of TVN-II programmes. Therefore, new production studios for TVN-II programmes will not be provided in Jakarta Central Station during this plan period.

3 - 2 Programme Continuity Facility

3 programme continuity rooms are needed, 2 for TVN-I and one for TVN-II, but facilities for 2 programme continuity rooms are being provided and additional facilities for one programme continuity room is still needed in the new Jakarta TVRI Production Studio.

3 - 3 Programme Duplication Facility for the Duplication of TVN-II Programmes

Two sets of tape duplication systems will be installed which consist of a one inch VTR as the master machine and a set of eight U-matic VTR (3/4 inch) as the slave machines.

CHAPTER 4 TRANSMITTING FACILITY PLAN

CHAPTER 4 TRANSMITTING FACILITY PLAN

4 - 1 Transmitting Facilities

The transmitting facilities for broadcasting TVN-II programmes will be the same scale as for TVN-I programmes.

4 - 2 TV Transmitting Station

Transmitting facilities will be built within the existing TV stations for TVN-I broadcasting. Antenna tower, power supply system and other facilities will be shared with both transmitting system.

Table 3-4-1 shows technical data of existing transmitting facilities and available items for the TVN-II transmitting facility.

Table 3-4-1

Existing TVN-I Transmitting Station at the Planned of TVN-II

Station	Location			Ch	Pwr. (kW)	Ant. Tower *1	Power Supply *2
	Long.	Lat.	Alt. (m)				
Medan (Bandarbaru)	98E33	3N17	760	5	10		△
Palembang	104E46	2S59	3	9	10	○	△
Yogyakarta	110E22	7S46	137	8	10		○
Surabaya	112E43	7S18	6	9	10	×	○
Denpasar (Bkt.Bakung)	115E12	8S49	130	8	5	○	△
Balikpapan	116E51	1S14	85	9	1	×	○
Ujung Pandang	119E27	5S06	3	4	1	×	○
Manado (Makaweimben)	124E57	1N18	1080	5	5	△	○

*1 ○ Antenna commonly usable

△ Tower commonly usable

× Necessary new tower and antenna

*2 ○ Enough

△ Necessary increasing power of engine generator

CHAPTER 5 FREQUENCY ALLOCATION PLAN

CHAPTER 5 FREQUENCY ALLOCATION PLAN

5 - 1 The channel to be allocated to the transmitter for the TVN-II broadcasting service will be at least two channels apart from existing television channels but in case when no interference to the reception of existing broadcasting service is foreseen, an alternate channel can be allocated and the existing antenna can be shared by the two broadcasting services (TVN-I & II).

5 - 2 The relation between channels of existing transmitters and that of the TVN-II transmitters, and the possibility of the use of the same antenna for both transmitter are shown in Table 3-5-1.

5 - 3 From the results obtained in the 2nd field survey, it is presumed that some hindrance might be occurred in Medan and Yogyakarta in the implementation plan of above frequency assignment, although slight modification is made on the used frequency channels and transmitting station's e.r.p., etc., that are operating around the territory of TVN-II station under planning. If it is confirmed that the allocation of channel in Band III is difficult, use of channel in UHF Band (Band IV or V) will be considered.

A plan is underway to serve with tandem connection of off-air relay stations in Ujung Pandang area for TVN-II broadcasting, however only UHF channels have to be inevitably allocated to these stations. An example of UHF channel allocation plan is shown in Table 3-5-2.

Table 3-5-1

Channel Allocation for TVN-II Station

Station		Channel		Power Output
		2nd	1st	
1	Medan (Bandarbaru)	11*	5	10 kW
2	Palembang	11	9	10 kW
3	Yogyakarta	4*	8	10 kW
4	Surabaya	4	9	10 kW
5	Denpasar (Bkt. Bakung)	10	8	5 kW
6	Balikpapan	11	9	1 kW
7	Ujung Pandang	11	4	1 kW
8	Manado (Makaweimben)	11	5	5 kW

* Channel Allocation should be decided after precise measurement and examination including for surrounding stations.

Table 3-5-2

Channel Allocation for 7 Relay Stations around Ujung Pandang

Station		Ch.	Pwr. Output
1	G. Loka	39	1 kW
2	Sinjai	41	0.3 kW
3	Tj. Butung	43	1 kW
4	G. Makadae	47	3 kW
5	Sengkang	51	1 kW
6	Baraka	53	1 kW
7	Buntutabang	49	0.15 kW

CHAPTER 6 PERSONNEL PLAN

CHAPTER 6 PERSONNEL PLAN

6 - 1	Operation Personnel	
(1)	Personnel for research assistance and planning production	62 persons
(2)	Personnel for production package (including technical, artistical, etc.)	82 persons
(3)	Personnel for programme continuity	
	a) Jakarta TVRI Studio	4 persons
	b) Regional Studios	16 persons
6 - 2	Personnel for Transmitting Stations	32 persons
6 - 3	Personnel for Management Staff	4 persons
	Total	200 persons

CHAPTER 7 CONSTRUCTION AND OPERATION COST

CHAPTER 7 CONSTRUCTION AND OPERATION COST

7 - 1 Construction Cost

(1) Construction cost for the TVN-II broadcasting service will be about 6,170 mRp.

(2) The breakdown of the above are shown in Table 3-7-1, annual construction cost for each fiscal year is listed up in Table 3-7-2.

7 - 2 Operation Cost

Annual total at the end of this plan period 2,610.9 mRp

Breakdown

(1)	Transmitting operation	149.6	mRp
(2)	Programme production operation	1,644	mRp
(3)	Distribution of video tapes	550	mRp
(4)	Personnel cost	267.3	mRp
	Total	2,610.9	mRp

Table 3-7-1

Construction Cost of TVN-II Transmitting Facilities

PROJECT	FOREIGN CURRENCY	LOCAL CURRENCY			
	EQUIPMENT COST AT INDONESIAN PORT	LAND	BUILDING & STRUCTURE	ROAD	TRANS-PORTATION
SECOND TV TX	5,248.0		96.0		
SUB-TOTAL	5,248.0	-	96.0	-	-
		96.0			
CONSULTANT FEE (5%)	262.4	4.8			
(A) TOTAL	5,510.4	100.8			
(B) CONTINGENCY (10%)	551.0	10.1			
(A)+(B)	6,061.4	110.9			
GRAND TOTAL	6,172.3 m Rp				

Table 3-7-2

Construction Plan of TVN-II Transmitting Station

Station	Fiscal Year				
	84/85	85/86	86/87	87/88	88/89
Medan			②		
Palembang				⑤	
Yogyakarta				④	
Surabaya			③		
Denpasar				⑥	
Ujung Pandang			①		
Balikpapan					⑦
Manado					⑧

Numerical number shows the order of priority.

PART Ⅳ ESTABLISHMENT PLAN OF THE INTEGRATED MAINTENANCE SYSTEM AND THE CONSTRUCTION OF MAINTENANCE CENTRE

GENERAL DESCRIPTION

PART IV ESTABLISHMENT PLAN OF THE INTEGRATED MAINTENANCE SYSTEM AND THE CONSTRUCTION OF MAINTENANCE CENTRES

GENERAL DESCRIPTION

1. INTRODUCTION

It is required to invest a large amount of fund and to construct many kinds of broadcast equipment, facilities and building for the accomplishment of nationwide broadcasting networks. Then, after the completion of construction works, it is naturally required to continue the periodic and non-periodic maintenance services for keeping the equipment in good operating conditions and accordingly reasonable amount of budget should be summed up at the time of planning for the project. Furthermore, after the elapse of time, renewal of superannuated facilities which is faced with the final stage of system life becomes inevitably necessary.

Accordingly, so far the broadcasting service is continued, even the coverage becomes up to 100 % with the completion of installation works, it is required to continue adequate maintenance work and repeated renewal installations.

Moreover, at the time of planning of the above annual renewal works, it is necessary to introduce newly developd electronics technology into the replacing equipment as much as possible for the effective use of fund allotted and for better operating performance and maintenance service.

To execute the work mentioned above, at present Bina Teknik and Sarana Teknik of Directorate RRI, TVRI and FILM share the works, however it can be said that the smooth processing of these works have not always been carried out due to the insufficient personnels and the inadequate administration system.

A new proposal which intend concentration of above engineering works through the introduction of new organization "RTF Engineering Centre" to establish overall facilities' installation, administration and maintenance functions including technological development on broadcasting equipment and its related system, is given in Fig. 4-0-1.

However, it might be difficult to change the organizational structure all at once to such a final state within a limited time period, therefore the RTF Engineering Centre should concentrate its activities only on the set up of Maintenance Centre as the first stage within the frame-work of the 4th 5-year development plan.
The functions of Maintenance Centre will be as follows:

Functions of the Maintenance Centre

(1) Establishment of Maintenance Plan
(2) Facilities' information and data service
(3) Centralized spare parts custody control
(4) Establishment of workshop function
(5) Measuring equipment and its calibration

At first, above five functions have to be organized under the supervision of "RTF Engineering Centre" and the staff those engaged in the above works should be appointed from present Sarana Teknik and maintenance sections in the three organizations, i.e., Directorate RRI, TVRI and Film.

Other new Division "Technological Development", should provide with the following functions, reflecting the innovative development in the broadcast engineering.

(1) Technical standard
(2) Transmission Technology
(3) Production equipment/system
(4) Coadunation with technological organization and Institution

2. MAINTENANCE WORK OF BROADCASTING FACILITIES

With regard to broadcasting equipment/facilities, firstly it will be planned for the expansion of networks and renewal installations in the Planning Division and then designed, ordered and installed by the Design and Construction Division. After the completion of installation, it is put into operation by Operation Division of each broadcasting station, and all of the administrative works are transferred to the Facilities Administration Division and these transferred equipment/facilities are put under the control of the Facilities Administration Division.

Information/data for each equipment/facilities are stored in the Memory of Computer and if some of the warning indication is obtained through computer processing, adequate countermeasure is taken by the staff of Workshop or the operation staff of each station under the instruction of each Maintenance Centre. Routine preventive maintenance is carried out under the same condition.

Maintenance Centre proposed here covers the works shown in Fig. 4-0-2.

3. INTERFACE BETWEEN EXISTING ORGANIZATION AND MAINTENANCE CENTRE

In consideration with the amount of information/data to handle with, a computer is introduced for the effective works of Central Maintenance Centre supported with peripheral devices as shown in Fig.-3. During the period of 4th 5-year development plan, major job of Maintenance Centre is to handle with the facilities information/data and to support the repairing work for equipment/facilities. The information/data summerized by computer is submitted to the persons in charge.

As for the maintenance work of facilities, administrative staff of the RTF Engineering Centre could analyze the information/data updated daily by each site and data are reflected upon the routine maintenance work, preventive maintenance plan and urgent maintenance work and at the same time necessary information and data are delivered to Directorate RRI, TVRI and Film executives.
These information and data can be used by the staff of Directorate RRI, TVRI and Film as supporting material.

Input and output of information/data are aiming at the real-time-processing through intelligent terminals finally, however, with the physical constraint of present imperfect communication network, information/data are processed with printed or written papers, and the transmission to the on-line-processing system with intelligent terminals will be gradually realized step by step following the extension of communication network. Flow of the jobs among each Division and Maintenance Centres is shown in Fig. 4-0-3.

4. NECESSITY OF MAINTENANCE CENTRE AND ITS ROLE

From the results obtained through the sites survey, it was found that the present status of broadcasting facilities have some bottlenecks for maintaining and operation as in the following;

1) Non-unified facilities with various types are distributed.
2) Superannuated equipment are increasing.
3) Extremely lack of skilled technicians.
4) Systematic maintenance service is not yet sufficiently established for keeping facilities.
5) Procurement of spare parts from the Domestic Market are extremely limited.
6) Extreme shortage of budget for maintenance of facilities.
7) Data on facilities are not yet processed and arranged systematically.
8) Maintenance standards are not yet fully established.

To settle the problems, further study should be made based on the overall planning including new installations and renewals of facilities/systems. If renewal of facilities are made without settling the above, effects of the investment might be reduced in some cases. In some stations, there are equipment in failure which might be recovered their functions with adequate repair works and parts supplies.

Accordingly, to make such systematic serving system of facilities, it is required to establish the Maintenance Centre which provide the function of engineering implementation work start from the planning to the maintenance work on the whole facilities distributed in the country.

Due to the fact that maintenance engineers and adequate spare parts are a scarce resource, it should be managed in such a way that it will be available for integrated Radio, TV and Film maintenance service.

So, it is recommended to unify the management of those resources by the RTF Engineering Centre.

Fig.4-0-1

Organizational Structure of RTF Engineering Centre

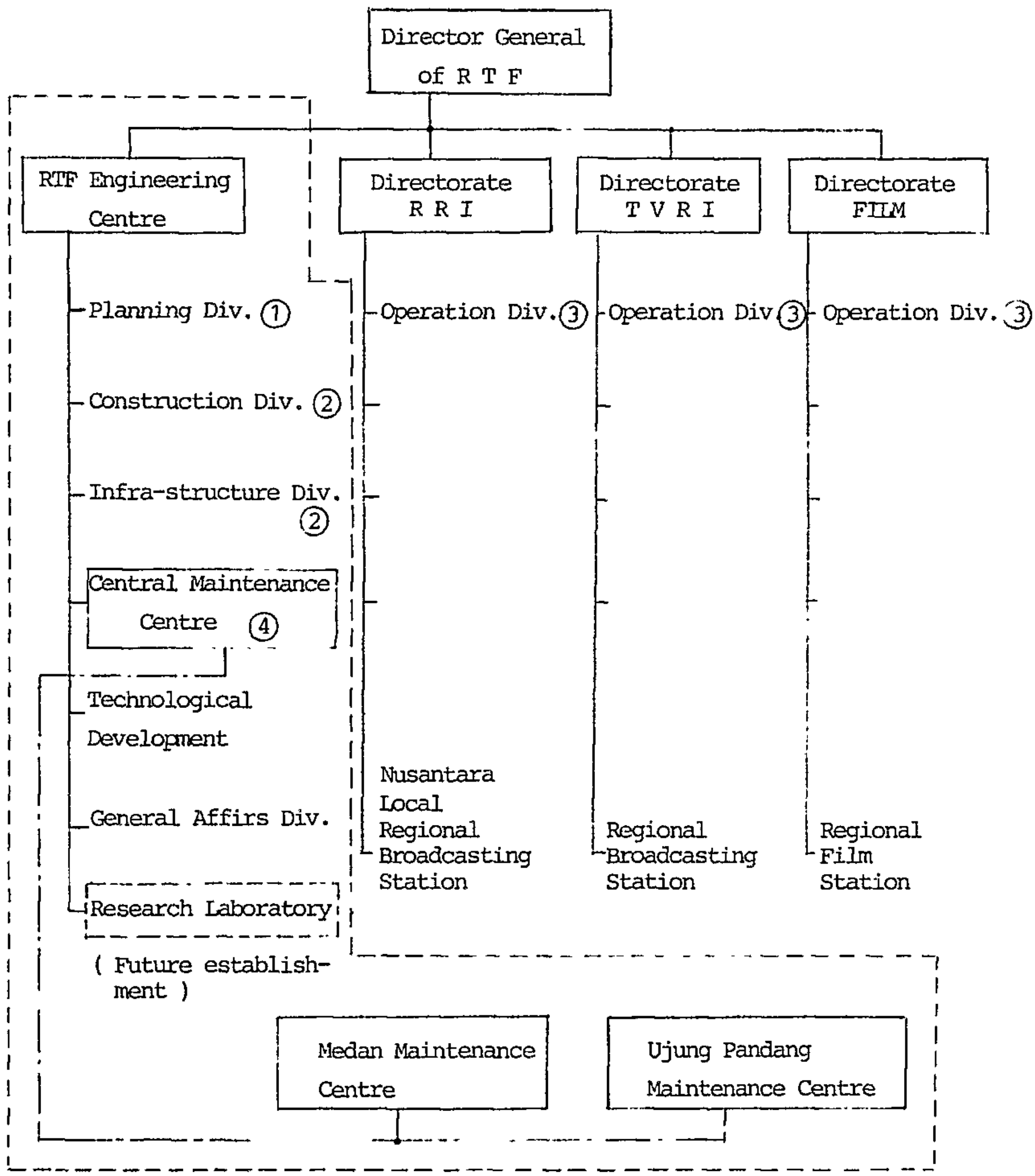


Fig. 4-0-2

Job of RTF Engineering Centre

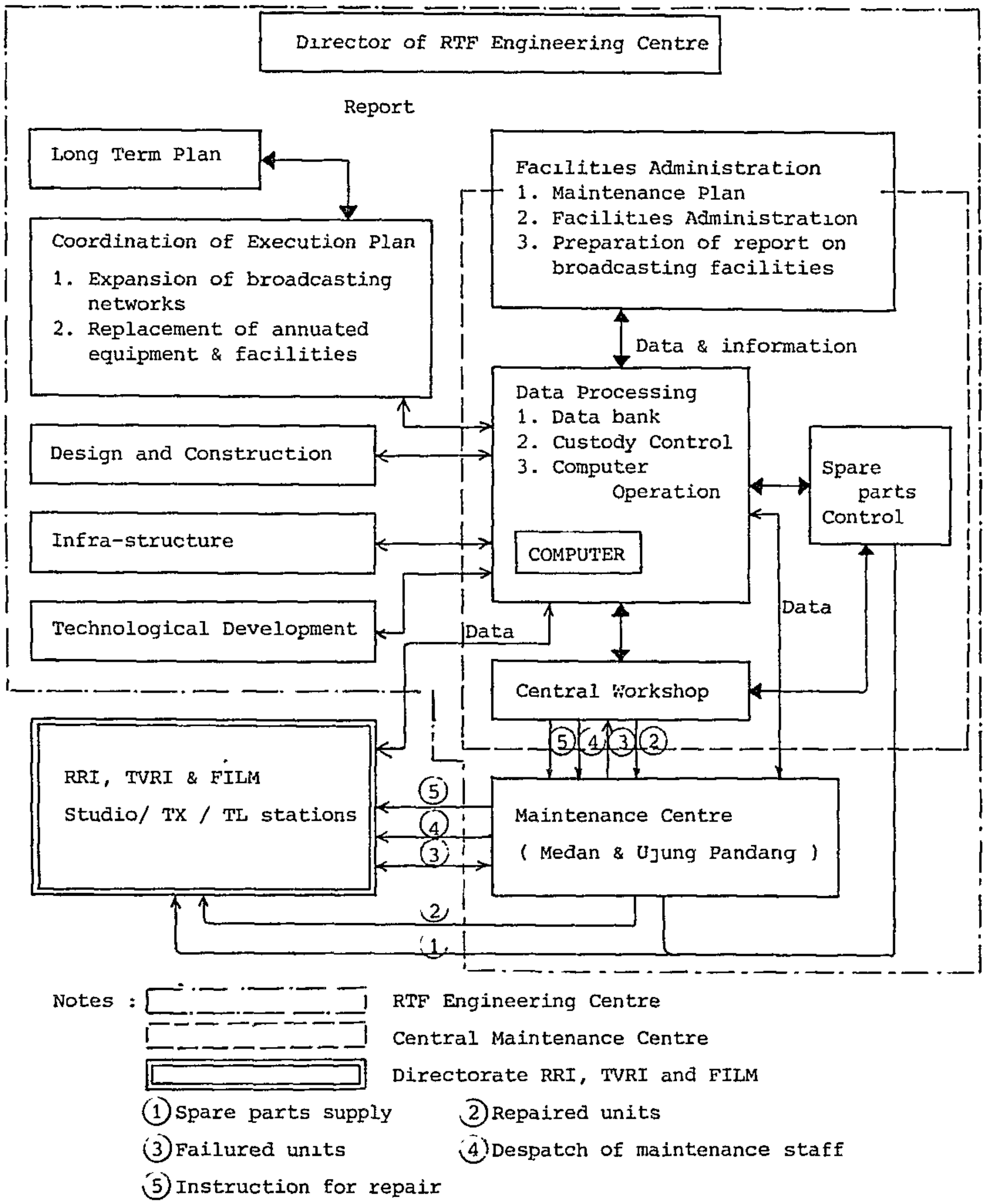
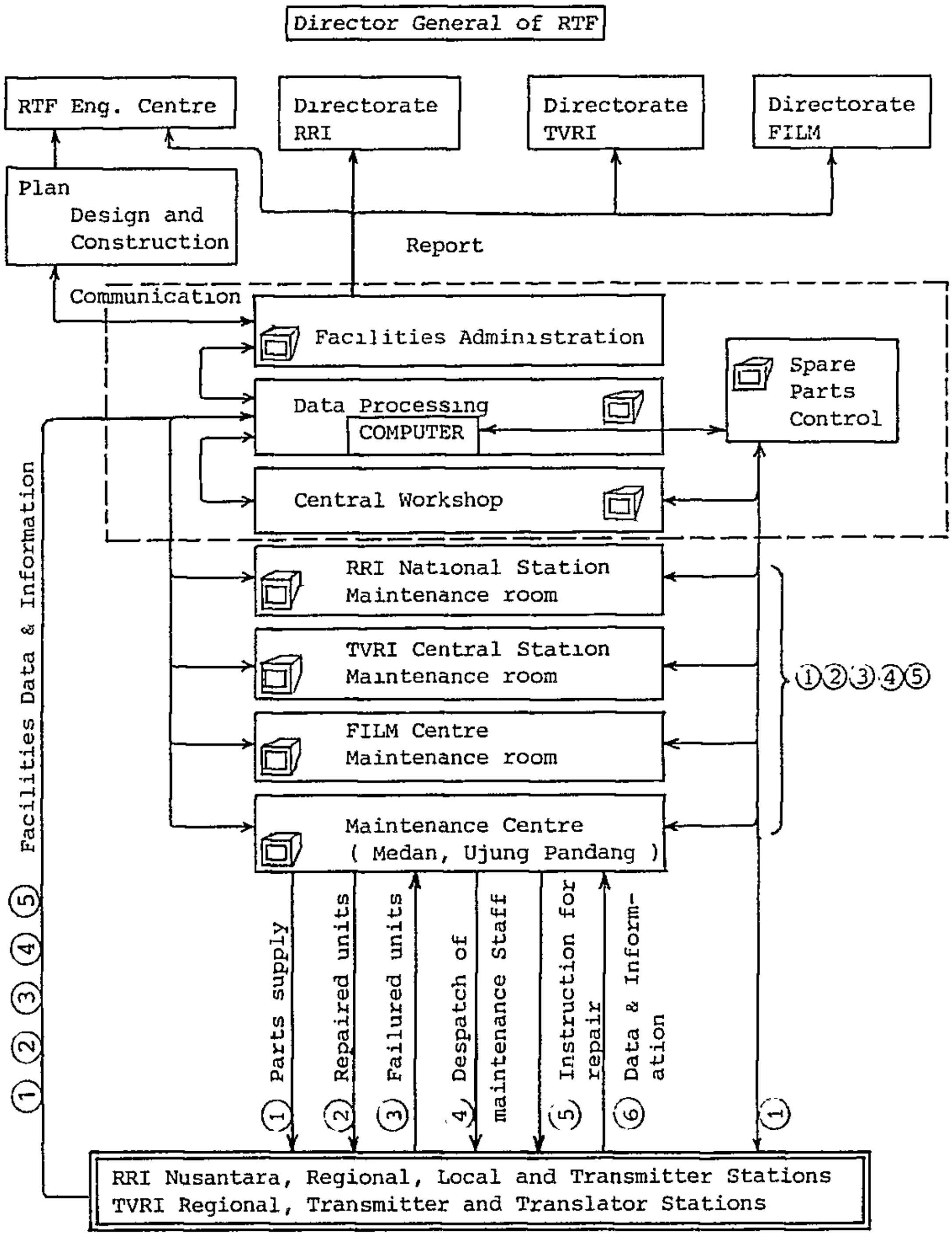


Fig. 4-0-3

Flow of the Jobs among Each Division and Maintenance Centre



Note: Enclosed with dotted line shows the jobs of Central Maintenance Centre.

CHAPTER 1 NEED OF ESTABLISHMENT OF AN INTEGRATED MAINTENANCE SYSTEM

CHAPTER 1 NEED OF ESTABLISHMENT OF AN INTEGRATED MAINTENANCE SYSTEM

Introduction

Not only facilities in the field of broadcasting engineering but all kinds of mechanical equipment, as well as biological substance, have a mechanical or a biological life. Fig. 4-1-1 shows a statistical model allegedly reflecting a chronological trend of such impediments as illnesses and failures during the life. That is, the initial failures after start-up of machineries or wear-out failures correspond to the increasing illness and deaths of human beings in the childhood or advanced age period, respectively. In the case of human being, these patients are treated by individual physicians and large general hospitals with support of medical research institutes or medical university for educating doctors. Fig. 4-1-2 shows an analogy between technical facilities and medical infra-structure. In the figure, Maintenance engineers involved in trouble shooting lie scattered in various places as medical practitioners are positioned. Meanwhile functions of a Maintenance Centre corresponding to a general hospital capable of treating any illness with most modern medical facilities is rather required in developing countries than in developed countries. From the fact being few engineers for maintenance in developing countries, stationing of them in every station is of difficult matter for the present. In the Republic of Indonesia, broadcasting facilities for themselves are becoming quite comparable to those in developed countries in terms of their number and scale, unfortunately except the maintenance function organizationally established as a large general hospital. An elaborate study on the current situation reveals that facilities are not fully exposed to a professional overall check and repair, and remain in such state as a sickly person only depending on diagnosis and treatment by a medical practitioner (equivalent to repair work by maintenance staff in case of broadcasting facilities). The Maintenance Centre recommended herein provides with the various functions explained in Chapter 3 and an important basis for establishment future technical research institute.

When the maintenance centre and MMTC, which is now under way, start operations and research function are more enhanced, the modernization in broadcasting technology may be forwarded one more step nearer on the way to catch-up the same level of progress in the developed countries.

The foregoing explains conceptually the necessity of establishment of maintenance centre in comparison with the necessity of medical centre in the medical field. Then, Fig. 4-1-3 describes the fact that the timely adequate maintenance work enables machineries to work for a long period free from failures with intended performance preserved. The fundamentals of the maintenance are to aim at increasing life of facilities keeping failures minimum at a least expense through efficient use of personnel and materials, and for the purpose the conception of the maintenance centre focuses on the introduction of appropriate management system and its operation.

Following the completion of the first stage plan (Establishment of MMTC), RTF Engineering Centre has been organized to meet the present situation as of the second stage plan by establishing new divisions, Maintenance Centre and Technical Development Division, within the structure of RTF Engineering Centre.

Accordingly, the Maintenance Centre is required to keep in close contact with new Technical Development Division through offering of information, data and so on, and the Technical Development Division has the responsibility in developing the engineering facilities for the modernization and also to pursue the study of latest trends in broadcast engineering to submit the reports to the Director of RTF Engineering Centre.

Continuation of reporting is required until the establishment of the function of research institute.

A new maintenance system must be introduced as a part of the 2nd stage plan in accordance with the establishment of the integrated administration of the three organizations RRI, TVRI and Film. (MMTC has been planned as the 1st stage plan of the integration)

Accordingly, there are undoubtedly many touch questions to do with in prerequisite conditions, transitional actions, problem solving and so on.

In order to establish efficient and scheduled maintenance of radio and television broadcasting facilities and centralized facilities information collection system, Deppen has been already organized "Pusat Pembinaan Teknik Radio, Televisi dan Film (PPTRTF) in March 1984. In the following explanation, the maintenance centre means PPTRTF.

1 - 1 Maintenance Work of Broadcasting Facilities.

In Fig. 4-1-4 organizational structure of Engineering Directorate, position of Maintenance Centre and its mutual inter-relations are shown.
The operation department in the figure is included in the programme production department in the central broadcasting station. Generally the introduction of facilities is studied in the planning division, then designed and constructed by the facilities division, and delivered to a local station in charge of its operation upon completion. After the operation commences, maintenance staff of the operation department is responsible for routine maintenance and minor repair work, while relatively difficult works are left to the maintenance centre. Failures unable to be remedied by them are entrusted to specialized contractors.

Generally, cooperative maintenance is done by the locally stationed staff under supervision of maintenance centre in charge.
Fig. 4-1-5 shows the outline of various works to be handled by each division, Fig. 4-1-6 shows a job-flow of maintenance planning.

The planning must be made by referring computer output on the information of facilities, requirement from each station, long term plan and new plans.

As shown in Table 4-1-1, maintenance work can be roughly classified into modifications, repairs, recoveries from failures, maintenance, and administration. (Maintenance management)

The work of the maintenance centre as outlined above will undoubtedly need a considerable period of time in addition to capital spending and staffing.

Other element underlying the conception of the maintenance centre are to minimize travelling hours of restoration staff despatched, and to utilize the communication lings effectively. Thus, three Maintenance Centres are recommended to locate in three different cities

Central Maintenance Centre in Jakarta and two Maintenance Centres in Medan and Ujung-Pandang according to territories as shown in Fig. 4-1-7.

1 - 2 Needs and Roles of the Maintenance Centre

As previously pointed out, the objects of the Maintenance Centre are to, through adequate maintenance, repairing and modification work, improve the reliability of the facilities, reduce broadcasting failures, shorten the downtime and secure the increased life of the facilities, thereby saving overall expenses including operational cost. Judging from the present status of broadcasting facilities in Indonesia, establishment and improvement of following items should be made for the ease of maintenance work.

1) nonstandard, large number of facilities
2) Few maintenance staff, actually not enough
3) Incomplete restoration system in terms of equipment and organization
4) Insufficient maintenance work by unskilled technician
5) Not up-dated maintenance work system
6) Insufficient consolidation of workshop function
7) Shortage of experts and skillful engineers
8) Long lead time to obtain parts for repair
9) Restricted outlay for maintenance resulting in frequent failures
10) Many obsolescent equipment

In view of the above, drastic improvement should take place in the maintenance work, and the equipment should be utilized to the full extent of performance through the introduction of modern maintenance facilities and consolidation of the system, and it is also essential to modernize the organizations and enhance the equipment step by step. Otherwise effective maintenance work and management of overall facilities therewith can never be anticipated.

Needless to say, broadcasting in these days in very important for the officials and citizens from the view points of daily information service, education, entertainment and so on.

Consequently, a perfect system is essential for production and transmission of programmes, preventing technical troubles and failures in broadcasting to the maximum extent as well as maintaining the quality of radiated signal. The maintenance of the facilities is extremely important in this respect.

(1) Territories of maintenance centres in charge

It is reasonable to assign the territories according to the convenience of air routes in order to split locally the maintenance and restoration work of extensively scattered stations. The air routes have been developed centering around the city of Jakarta, and accordingly the territories are splitted as shown by thick lines in Fig.-7.

Jakarta		(D.K.I. Jakarta)
	Yogyakarta	(Jawa Barat, D.I. Yogyakarta, Jawa Tengah, Jawa Timur)
	Palembang	Sumatera Selatan, Jambi, Bengkulu, Lampung)
	Denpasar	(Bali, Nusa Tenggara Barat, Nusa Tenggara Timur, Timor Timur)
	Banjarmasin	(Kalimantan Barat, Kalimantan Selatan, Kalimantan Tengah)
Medan		(D.I. Aceh, Sumatera Utara, Sumatera Barat, Riau)
Ujung Pandang		(Sulawesi Utara, Sulawesi Tengah, Sulawesi Selatan, Sulawesi Tenggara)
	Samarinda	(Kalimantan Timur)
	Ambon	(Maluku)
	Jayapura	(Irian Jaya)

The Maintenance Centres are installed in the stations in Jakarta, Medan and Ujung Pandang, and other down-stream stations mentioned above are provided with F/C Vans for the convenience of maintenance. However, no F/C Vans are allocated to Ambon, Denpasar Jayapara, Banjarmasin stations since the territory is narrower or the islands are so small that the cars cannot be effectively used, instead they are equipped with portable measuring instrument.

Fig. 4-1-1

Distribution of Failures

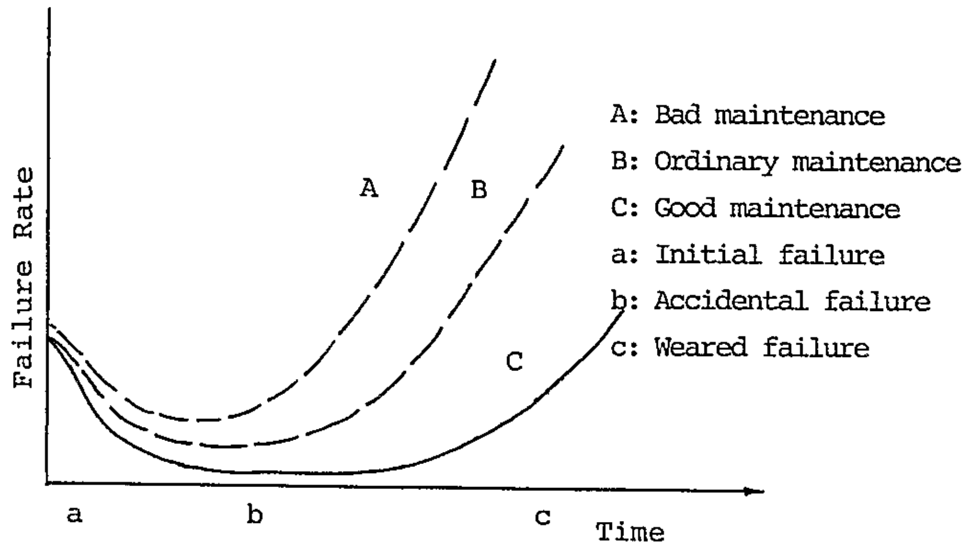


Fig. 4-1-2

Comparison on The Treatment of Sick Person and Failured Equipment

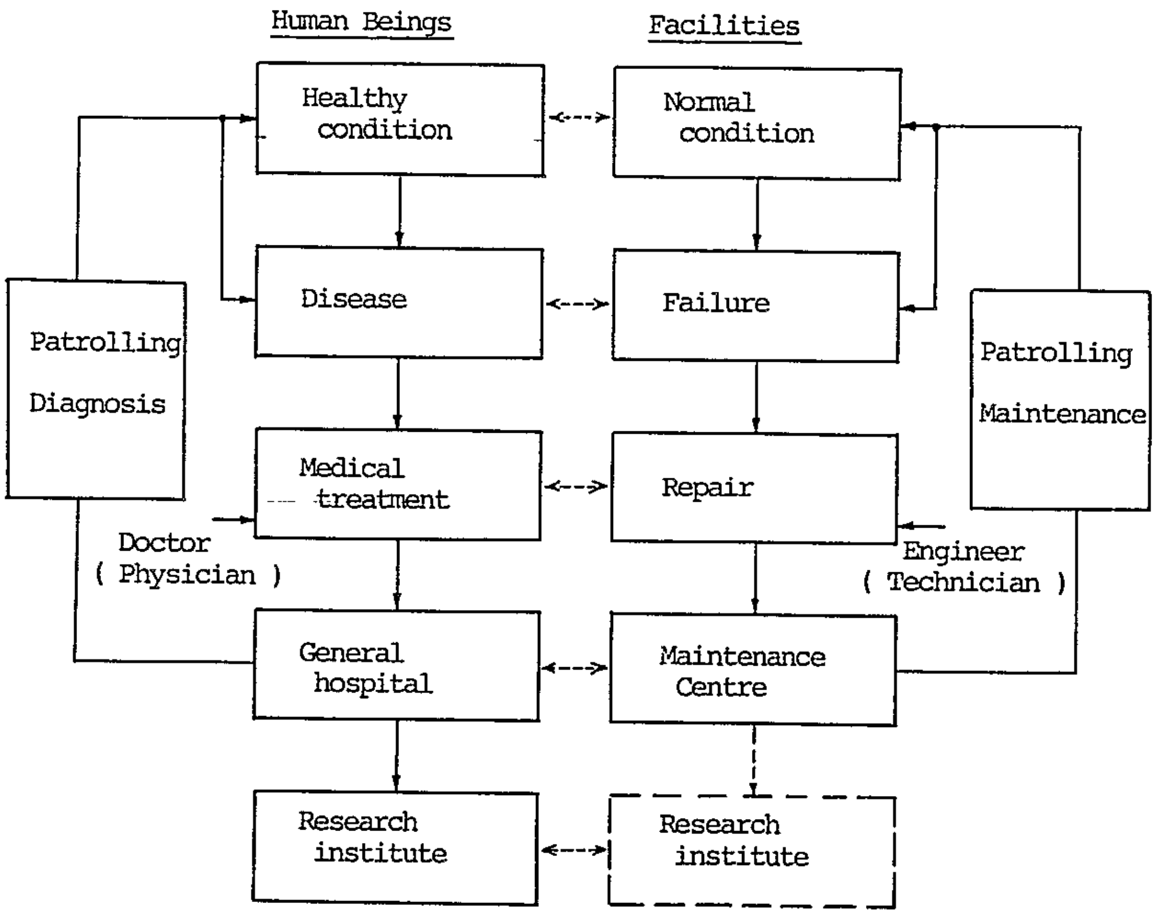


Fig. 4-1-3

Maintenance and Performance Preservation

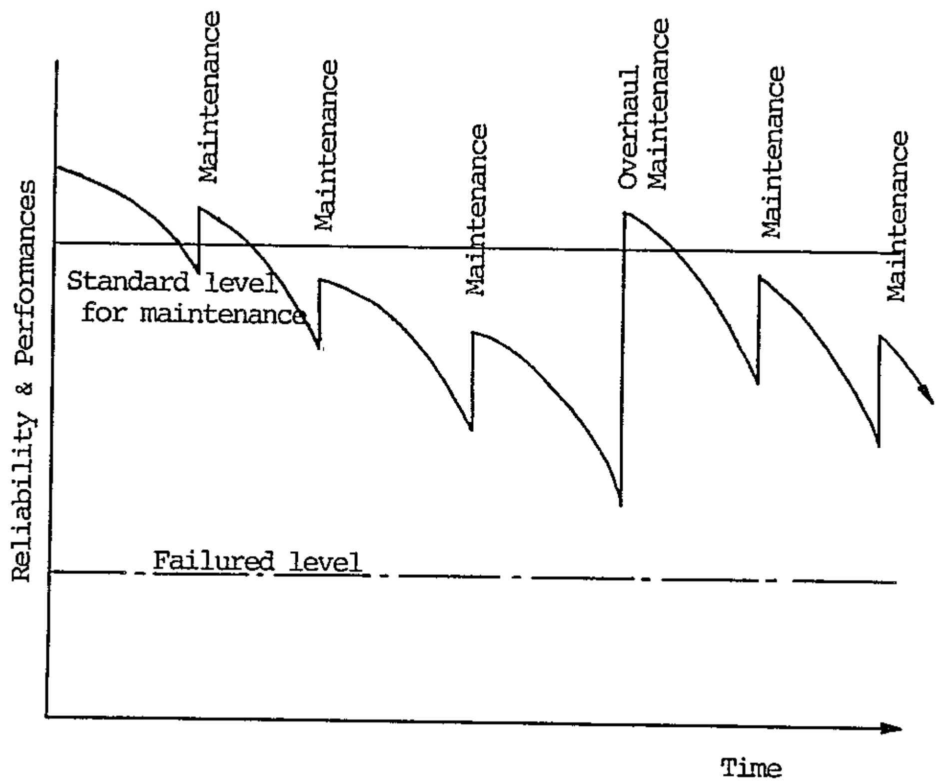
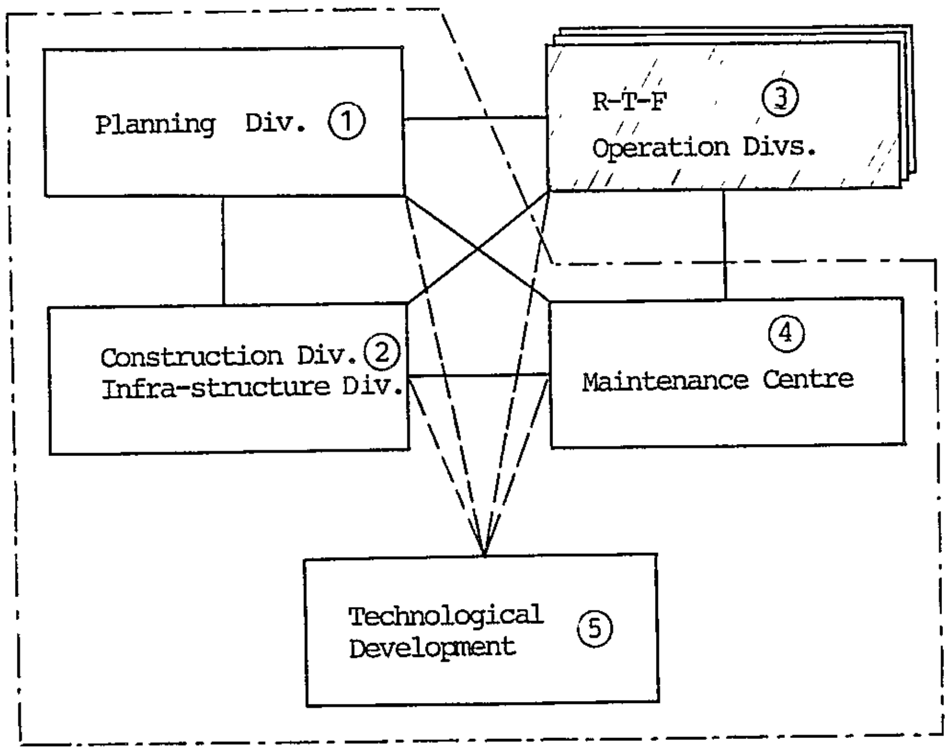


Fig. 4-1-4

Main Job of Each Division in RTF Engineering Centre



1 : Annual and long term plan

2 : All facilities and equipment for R-T-F.

3 : Operation and production in R-T-F.

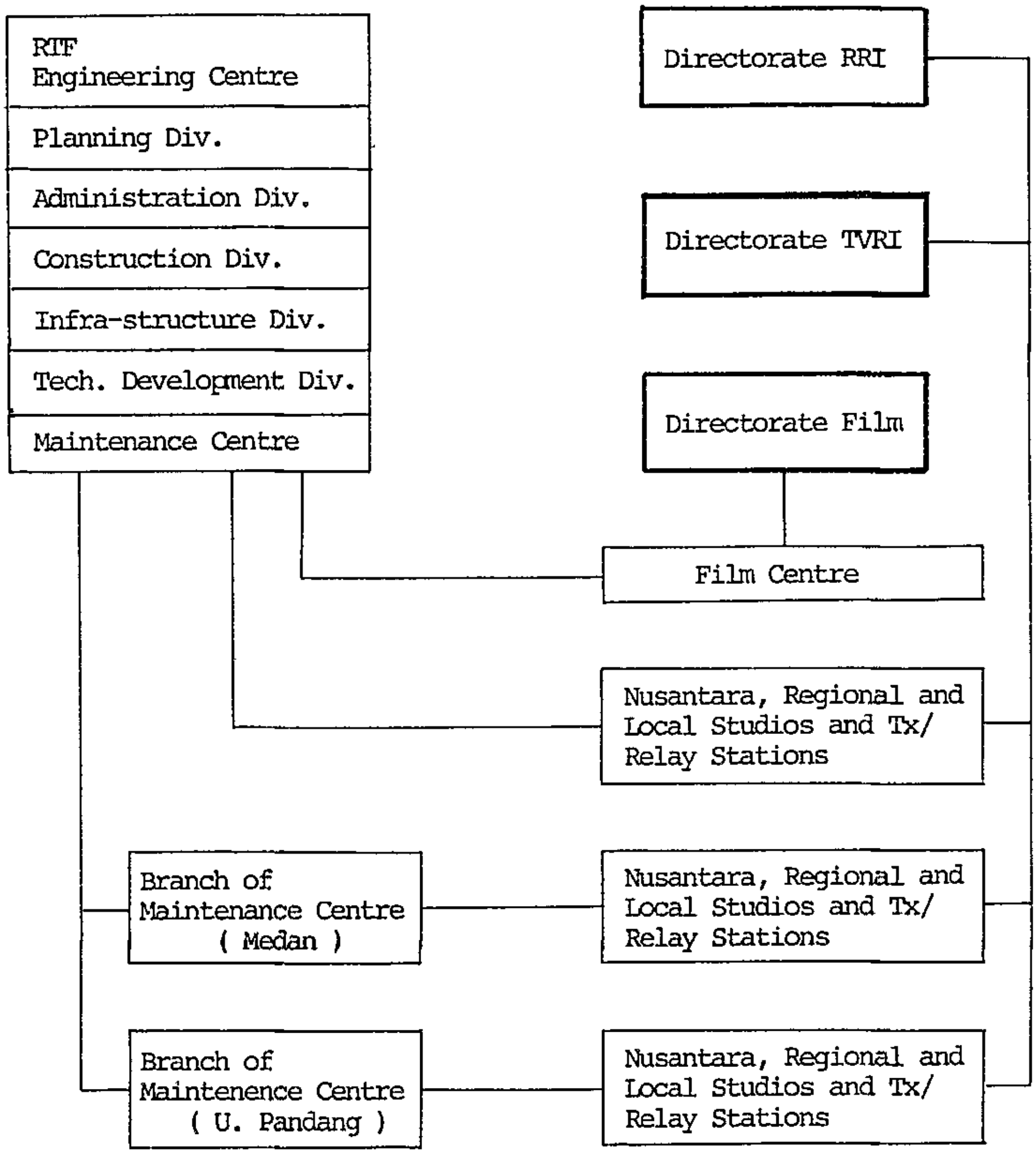
4 : Maintenance work for R-T-F.

5 : Technological development in R-T-F.

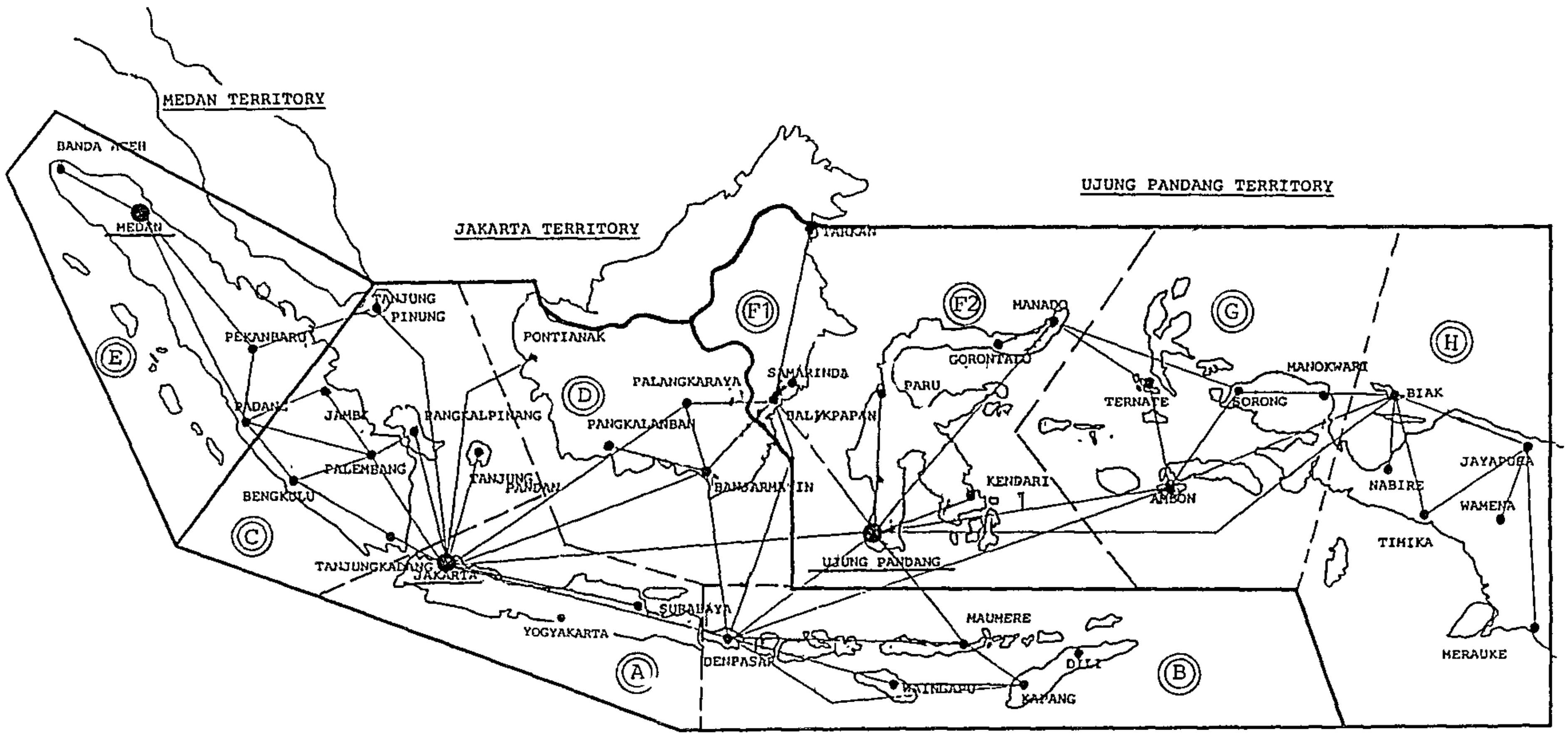
[dashed box] R-T-F Engineering Centre

Fig. 4-1-5

Job Flow for Maintenance Work



Territory of Each Maintenance Centre   Fig. 4-1-6



CHAPTER 2 ORGANIZATION AND PERSONNEL FOR INTEGRATED MAINTENANCE SYSTEM

CHAPTER 2 ORGANIZATION AND PERSONNEL FOR INTEGRATED MAINTENANCE SYSTEM

2 - 1 Preparation for Establishment of Maintenance System

In order to establish the new organization for overall maintenance system, a five year plan has been set up aiming at the completion of 1st stage transition of maintenance system at the end of the five year plan, as shown in Table 4-2-1, installation schedule is shown considering the transitional work in Indonesia, merger of Radio, TV and Film organizations, training of personnels and other factors. It core is to prepare for establishment of maintenance system by securing staff and setting up a preparatory function.

Specialized personnel (Sarana Technics, maintenance staff) should be picked up from RRI and TVRI as shown in Table 4-2-2. They constitute a professional group acquainted with every field of the broadcasting facilities and carry out the following preparatory works:

1) Control of the work belonging to the maintenance centre and coordination with other departments in new organization
2) Study on transitional procedure of the maintenance work from RRI TVRI, and FILM
3) Grasp of facilities in general
   (Investigation on the layout of existing facilities etc.)
4) Preparation of maintenance standards on equipment and facilities, and forms for technical service records and their dissemination (for data processing by computer)
5) Establishment of inter-communication system including methods and routes
6) Preparation of the instruction on failure restoration procedures
7) Investigation of spare parts, units and measuring devices
8) Preparation of maintenance plan
   (Analysis of current condition and study on the smooth transition into the future system)
9) Grasp of contractors concerned with the work
10) Preparatory work for the introduction of computer system including education of programmers

11) Preparation of a guide-book on each station
12) Preparation of imported components list and related exporters list
13) Provision of technical personnel list in each station
14) Grasp of power supply system in each station
15) Establishment of maintenance patrol procedures
16) Study of problems on modification of the maintenance centre building, and discussion with the consultant
17) Other preparatory work necessary for the establishment of the maintenance centre, etc.

Above works are enormous, but must be processed efficiently.

2 - 2 Organizational Structure and Maintenance Centre

This section deals with the outlines of broadcasting organization planned to be restructured and a position of the Maintenance Centre. To grasp the concept of maintenance work, organizational structure for maintenance and relationships among broadcasting stations are shown in Fig. 4-0-1 and 4-1-4 respectively.

The Maintenance Centres in Medan and Ujung Pandang will start functioning in the 3rd/4th year and the 4th/5th year respectively, and Central Maintenance Centre in Jakarta covers their territories until then.

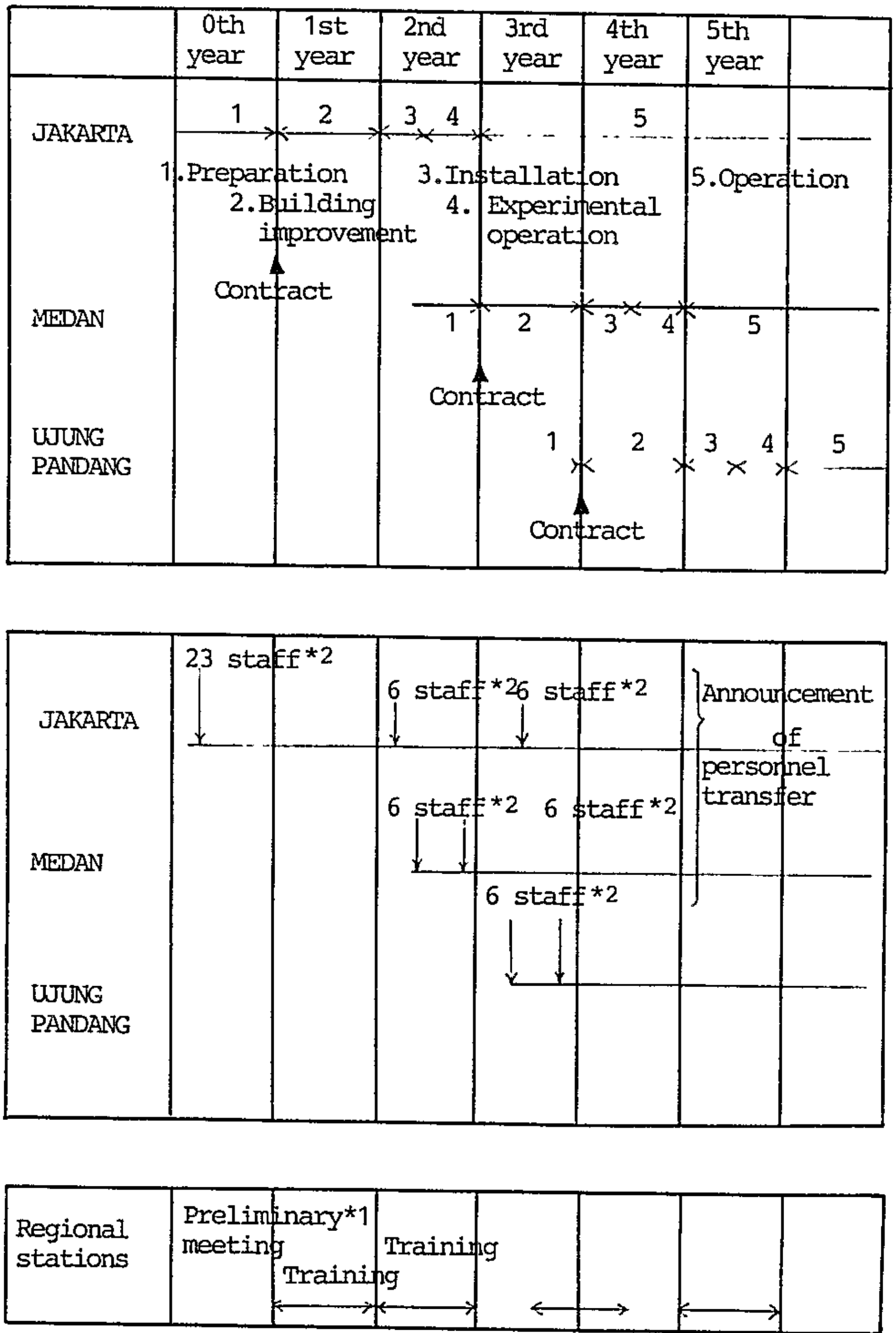
From the above view points, newly organized RTF Engineering Centre will be reasonably composed of the following divisions:

(1) Planning Division (expansion and renewal of broadcasting facilities)
(2) Design and construction Division
(Design, construction, installation and management of facilities)
(3) Maintenance Centre
(Facilities date management, data processing, parts control and repair of failure facilities)
(4) Technological Development (Introduction and development of new techniques)

Routine maintenance work and minor repairs in the Central Station (production and transmission of programmes) could be managed by maintenance staff in the Station, but the maintenance centre is in charge of relatively large scale repairs and modifications. This system is not contradictory in view of that even the Central Station is one of operational departments like local stations.

Table 4-2-1

Installation Schedule and Staff Plan



*1. Preliminary meeting with regional staff to establish maintenance center.

*2 Number of staffs are listed only Chief Class

Table 4-2-2

Staff Plan for Maintenance Centres

Staff	JAKARTA			MEDAN		UJUNG PANDANG		Total
	RRI	TVRI	FILM	RRI	TVRI	RRI	TVRI	
1. Administration	1	1	1	①		①		5
2. Studio Engineer	1	2 + ①	1	1	①	1	①	9
3. Transmitter Engineer	1 + ①	1 + ①		①	1 + ①	1 + ①	①	10
4. Information & Measure. Eng.	1 + ①	1 + ①	1	①	①	①	①	9
5. Civil Engineer	1 + ①	1			①	①		5
6. Electricity Engineer	1 + ①	1		①			①	5
7. General Engrs.	1	1 + ①		1	①	①	1	7
TOTAL	26			12		12		50

Note: Persons with circles are to move in and out from Jakarta

Number of staffs are listed only Chief Class