SECTION 6. TRANSMITTER BUILDING AND TOWER

SECTION 6. TRANSMITTER BUILDING AND TOWER

6-1. Building

According to the Site Planning, a study was made on the transmitter buildings and engine-generator houses for the 22 sites (24 stations). A study was made to plan to use common buildings and its result is as follows:

(1) Transmitter building:

- a) Common use of the existing TV station building. . . . . .6 sites
- b) Common use of a new TV station building to be constructed in future. . . . . .2 sites
- c) Construction of a new transmitter building. . . . . .15 sites

(2) Generator building:

- a) Common use of the existing engine-generator house. . . . . .5 sites
- b) Common use of a new TV engine-generator house to be constructed in future. . . .2 sites
- c) Construction of a new engine-generator house . . . . .15 sites

The list of station buildings for each site is shown in Table 6-1.

Table 6-1. List of Station Buildings

Station	Construction Site	Transmitter Building	Engine Generator House
KOTA KINABALU	Bt. Lawa Mandau	Construction of a new station building (standard type)	
KUDAT	Bt. Kelapa	Construction of a new station bulding (standard type)	
SANDAKAN	Trig Hill	Construction of a new station building (standard type)	
TAWAU	Mt. Andrassy	Construction of a new station building (standard type)	
LAHAD DATU	Mt. Silam	Construction of a new station building (standard type)	
TAMBUNAN/ KENINGAU	Layang-Layang	Construction of a new station building	Construction of a new engine-generator house
RANAU		Common use of the existing TV station building	
SIPITANT	Bt. Tampalagus	Common use of the new TV station building	Construction of a new engine-generator house
PENSIANGAN	G. Antulai	Common use of the new TV station building	Common use of a new engine-generator house to be constructed
TENOM	G. Paling-Paling	Common use of the new TV station building	Common use of a new engine-generator house to be constructed

Station	Construction Site	Transmitter Building	Engine Generator House
NABAWAN	Sikatin	Construction of a new station building (standard type)	
KUCHING	G. Serapi	Construction of a new station building	
BANDAR SRI AMAN	Bt. Temudok	Construction of a new station building	Common use of the existing engine-generator house
SIBU	Bt. Singalang	Construction of a new station building (standard type)	
MIRI	Bt. Lambir	Common use of the existing TV station building	Common use of the existing engine generator house
BINTULU	Bt. Nyabau	Common use of the existing TV station building	Common use of the existing engine-generator house
LIMBANG	Bt. Mas	Common use of the existing TV station building	Common use of the existing engine generator house
SARIKEI SARATOK	Bt. Kayu Malam	Construction of a new station building (standard type)	
KAPIT	Kapit	Common use of the existing TV station building	Common use of the existing engine-generator house
BAREO	Bareo	Construction of a new station building (standard type)	
BELAGA	Belaga	Construction of a new station buidling (standard type)	
PELAMAU	Bt. Pelamau	Construction of a new station building (standard type)	
BATU	Bt. Batu	Construction of a new station building (standard type)	

6-1-1. New station bulding to be constructed

(1) Site

Among the FM transmitter buildings in the 15 stations to be constructed, TAMBUNAN/KENINGAU station is sited between the existing FM transmitter building and the existing heliport. As this site is uneven, it is necessary to prepare a site of about 150 m². In the 5 stations of NABAWAN, BAREO, BELAGA, PELAMAU and BATU, a site of about 900 m² (including the site for steel tower) must be prepared.

In KUCHING station, the existing engine-generator house will be removed and an FM transmitter building will be constructed in its place.

In SIBU and SARIKEI stations, a site of about 400 m² must be secured within or adjacent to the existing microwave relay site.

In the other 6 stations, it is possible to construct their buildings witin the existing TV sites. Among the engine-generator houses in the 15 stations, those in 13 stations are inside the same new transmitter buildings to be constructed, but in the following 2 staions, independent engine generator houses will be constructed.

The engine-generator house to be used in common by TAMBUNAN/KENINGAU station and RANAU station will be constructed within the existing power station site, and the engine-generator house in SIPITANG station will be constructed adjacent to the engine-generator house at the existing TV site.

(2) Scale of transmitter building

The new FM transmitter buildings to be constructed are of the same standard type regardless of the FM transmitter output power, with the exception of the 3 stations of TAMBUNAN/KENINGAU, KUCHING, and BANDAR SRI AMAN that need a special plan because of restrictions on the site disposition.

The standard type of FM transmitter building is designed to have a larger that plane area and a less number of floors from the economic point of view.

The standard type of FM transmitter building has two stories; the first floor has an engine-generator room, and the second floor has a FM transmitter room.

KUCHING station has three stories because its available site is narrow.

The first floor has an engine-generator room, the second floor has a transmitter room and the third floor has a combiner room. Two FM transmitter buildings of TAMBUNAN/KENINGAU and BANDAR SRI AMAN station have been planned to construct an one-story building. The new engine-generator house, which is independent from FM transmitter buildings, to be constructed has one-story where two engine-generator units can be accommodated.

	Dimensions	Number of Stories	Total Floor Area	Remarks
Standard Type of FM Transmitter Building	15m x 10m	2	300m²	–
TAMBUNAN/KENINGAU	12m x 7m	1	84m²	Wooden building
KUCHING	8.5m x 5.5m	3	124.0m²	–
BANDAR SRI AMAN	12m x 7m	1	84m²	–
Engine-Generator House	8m x 6m	1	48m²	–

(3) Structure

The FM transmitter buildings except TAMBUNAN/KENINGAU station are of rigidly-framed reinforced concrete structure, and their walls are of laid bricks.

BAMBUNAN/KENINGAU station is so unfavorably located that it is hard to construct the building by reinforced concrete, and wooden structure has been designed for it in the same way as the existing TV/FM transmitters building.

A study on the structural strength against earthquakes has not been conducted, 20 ton/m² is applied in common to every site for the allowable yield strength of each proposed sites.

(4) Materials, construction method and finish

Materials easily available in Malaysia will be used, and the construction method generalized in Malaysia will be employed. The finish of the buildings is effected on the same level as that of the existing TV station buildings; the wall is of mortar and paint finish, the floor is of mortar or vinyl tile finish depending on the use and the roof is of waterproof mortar finish.

(5) Building facilities

The transmitter room is air-conditioned, and the generator room is farcedly ventilated by fan. Rainwater will be used for miscellaneous service water for lavatories, etc. Septic tanks and permeation basins are equipped for sewage and drainage. As electric facilites, lighting and electrical outlet for facilities for each room, power supply for air conditioner and ventilator wiring rack and grounding for transmitter are provided.

6-1-2. Station building for common use

(1) Site where the existing TV transmitter building is used in common. The FM transmitters and associated racks are installed in the existing TV transmitter room.

The combiners are installed in the two stores adjacent to the transmitter room. Therefore, the wall between the two stores will be removed to remodel them into a room. The capacity of the air conditioner in the transmitter room will be increased in accordance with a calorific value within the FM transmitter. The wiring rack, grounding, etc., will be additionally installed according to needs. Since the existing independent power generator house equipped with power generator unit for FM transmitter already has an extra space, there will be no need to remodel the existing building.

(2) If the TV transmitting station house to be newly built is put to common use.

It will be necessary to secure a space of about 100 m^2 within the TV transmitting station building for installation of FM transmitter. Also, in case the power generating unit is to be installed for exclusive FM use, it will be necessary to secure a space of 60 m^2.

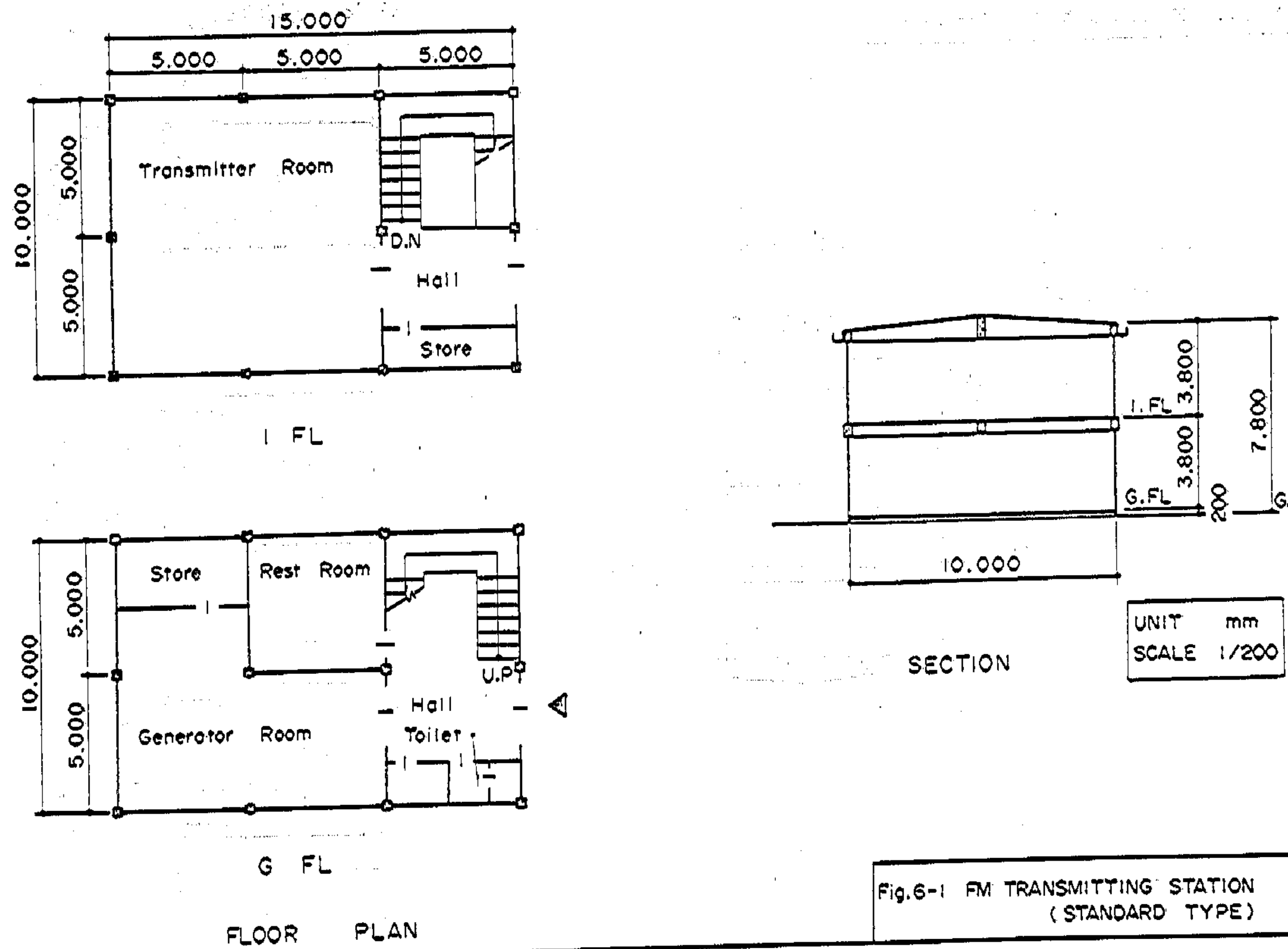


Fig.6-1 FM TRANSMITTING STATION (STANDARD TYPE)

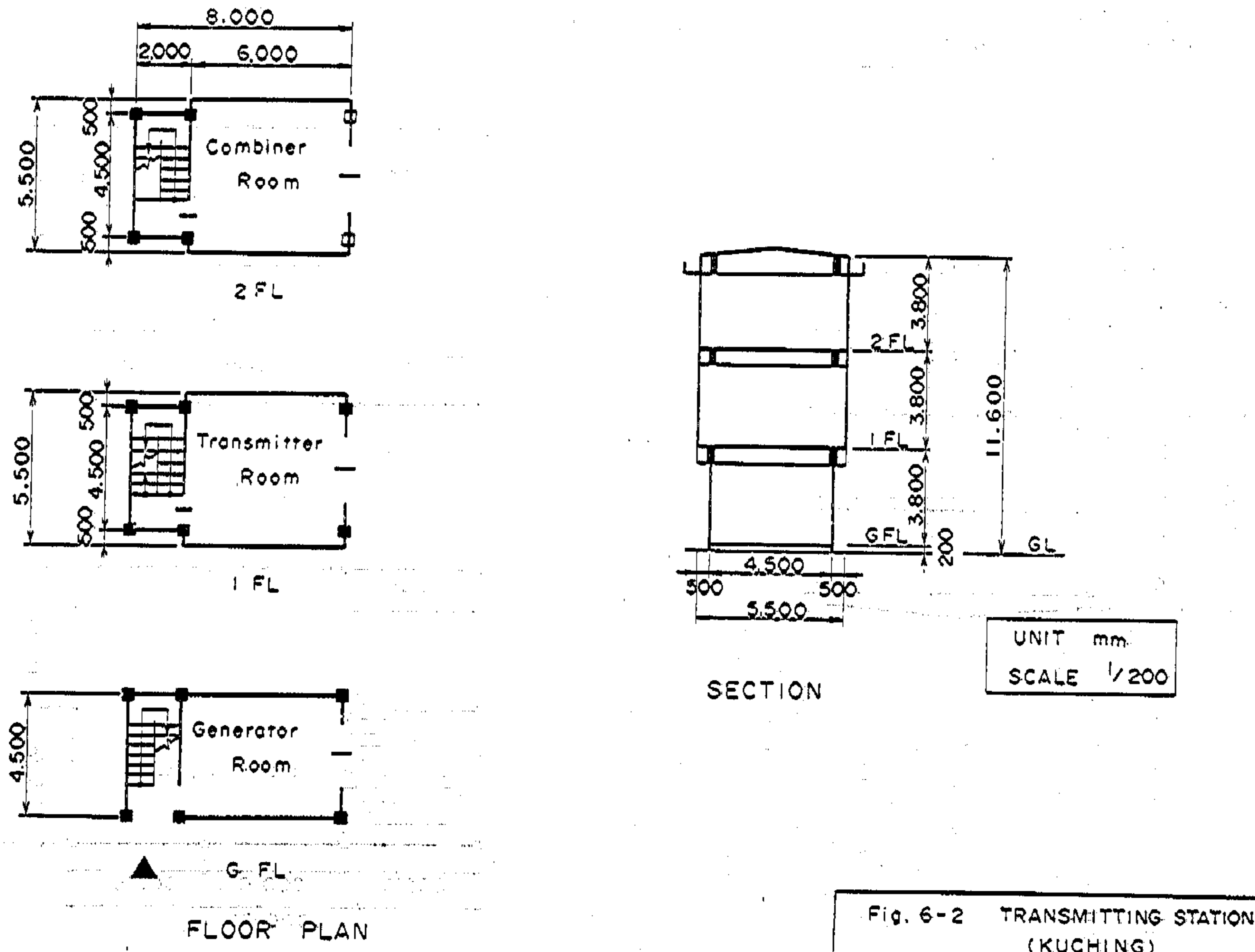


Fig. 6-2 TRANSMITTING STATION (KUCHING)

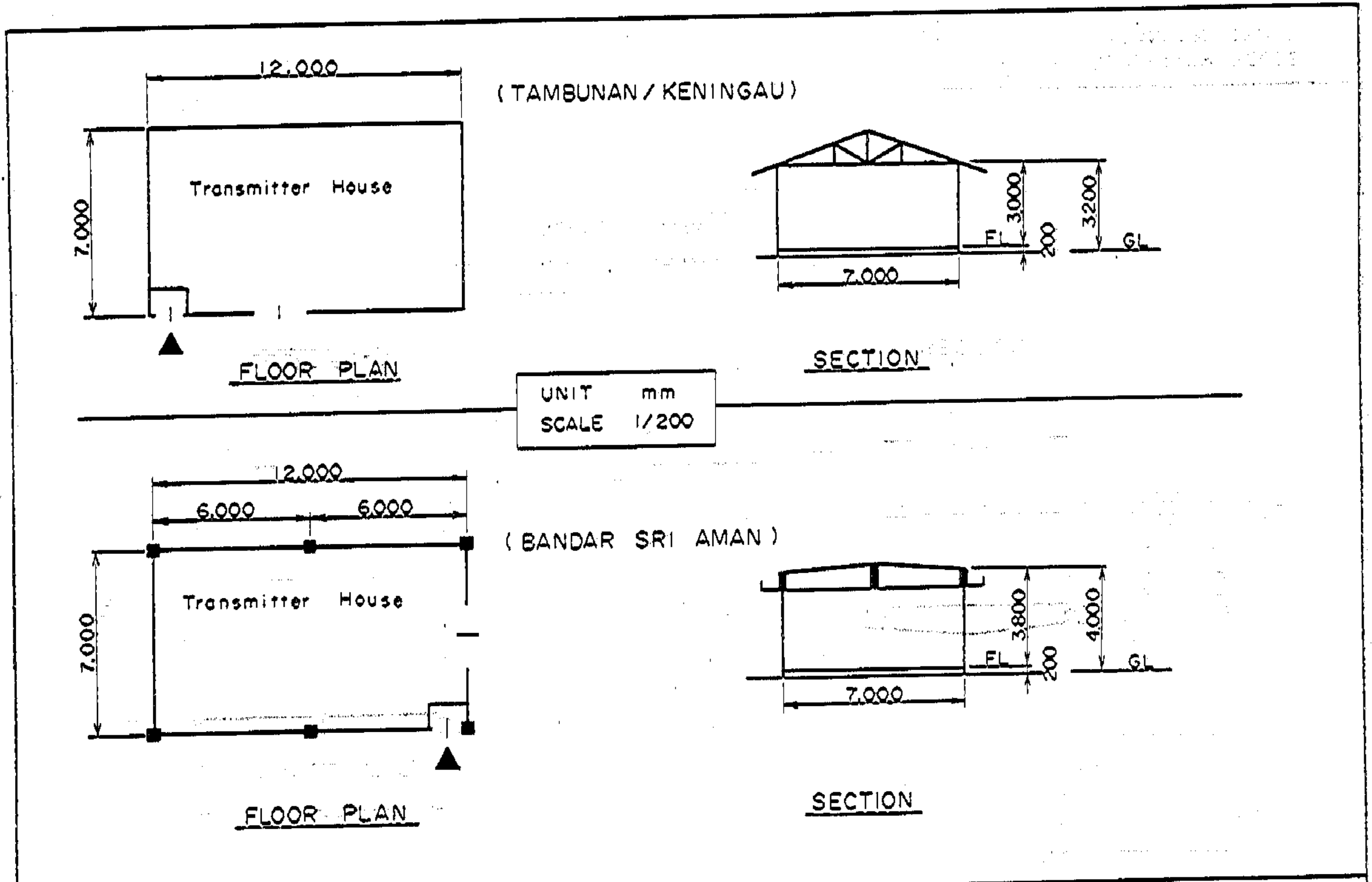
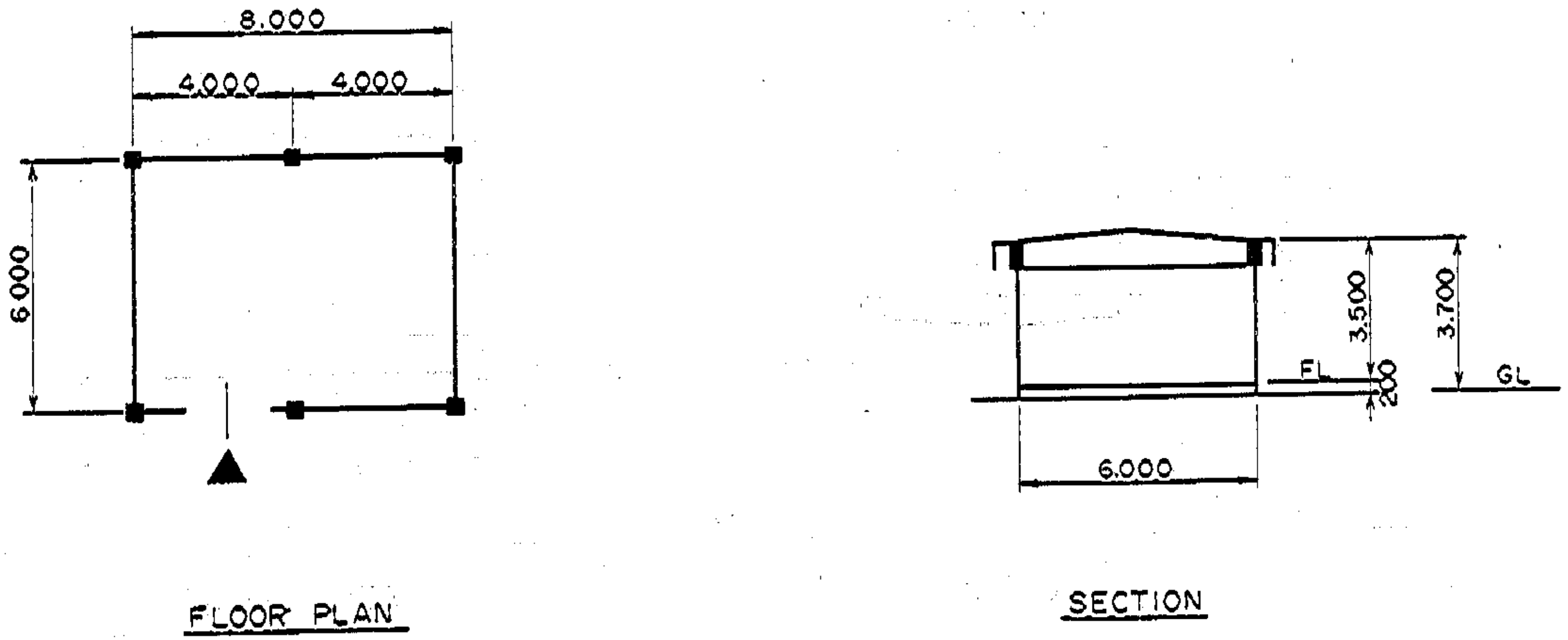
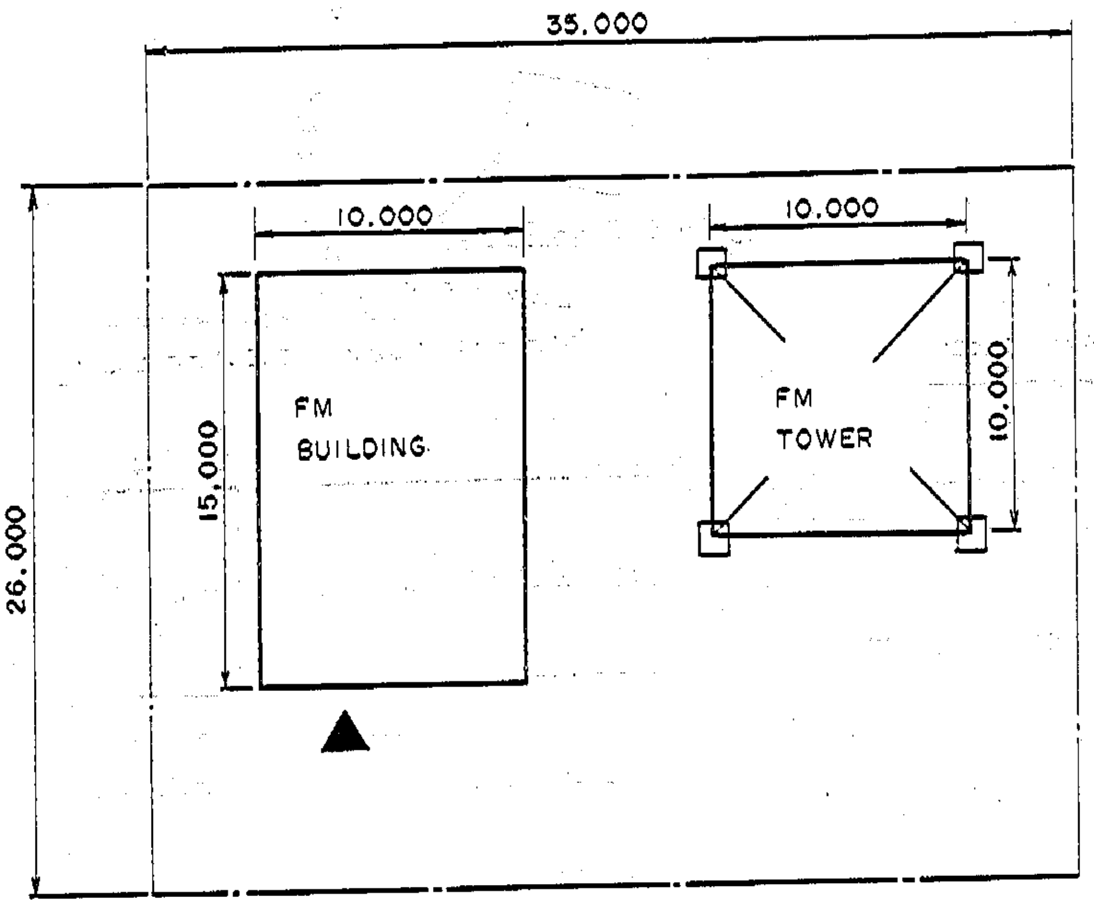


Fig. 6-3 FM TRANSMITTING STATION



UNIT	mm
SCALE	1/200

Fig. 6-4 GENERATOR HOUSE (STANDARD TYPE)



UNIT	mm
SCALE	1/400

Fig. 6-5 FM SITE PLAN
(STANDARD TYPE)

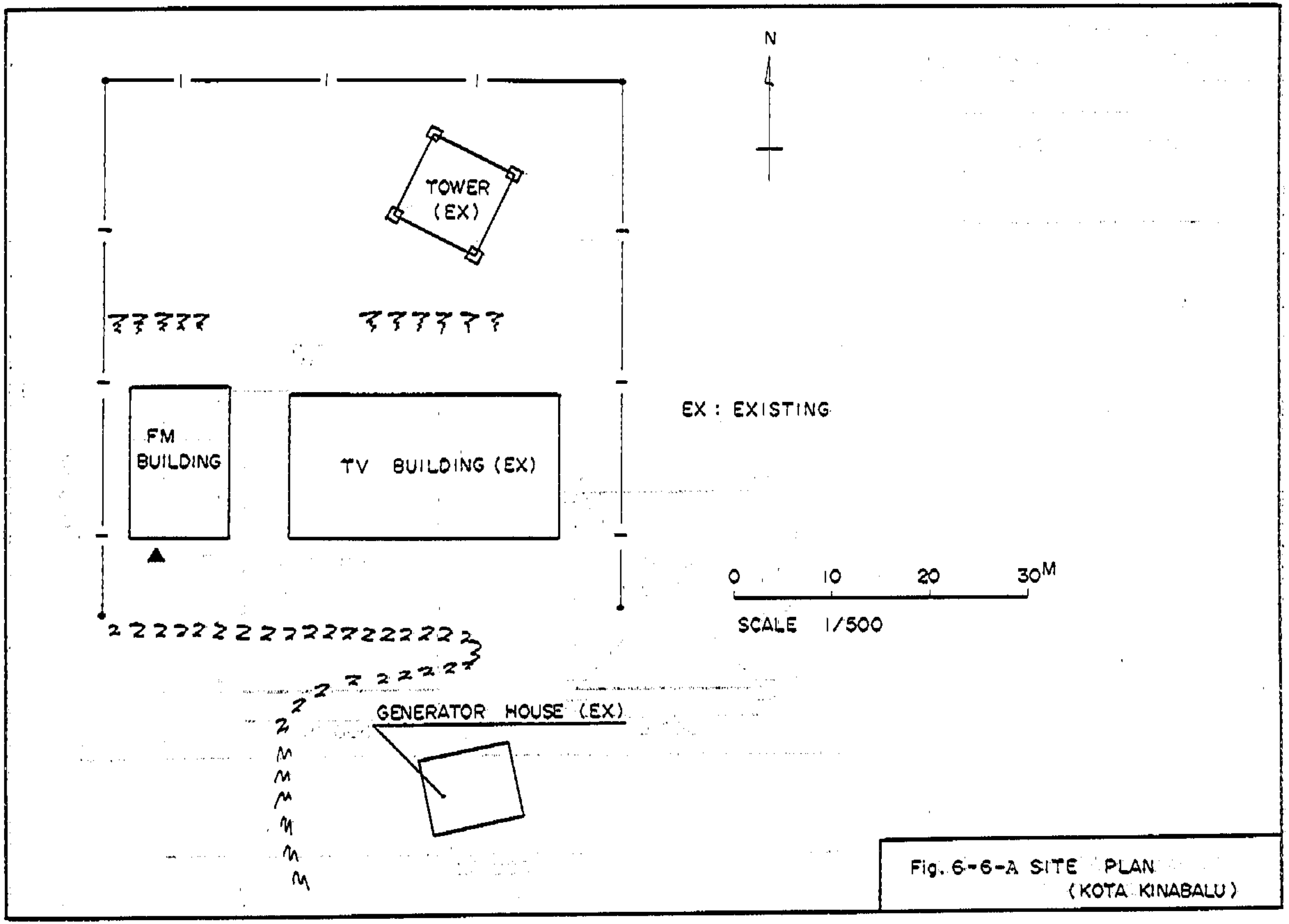


Fig. 6-6-A SITE PLAN
(KOTA KINABALU)

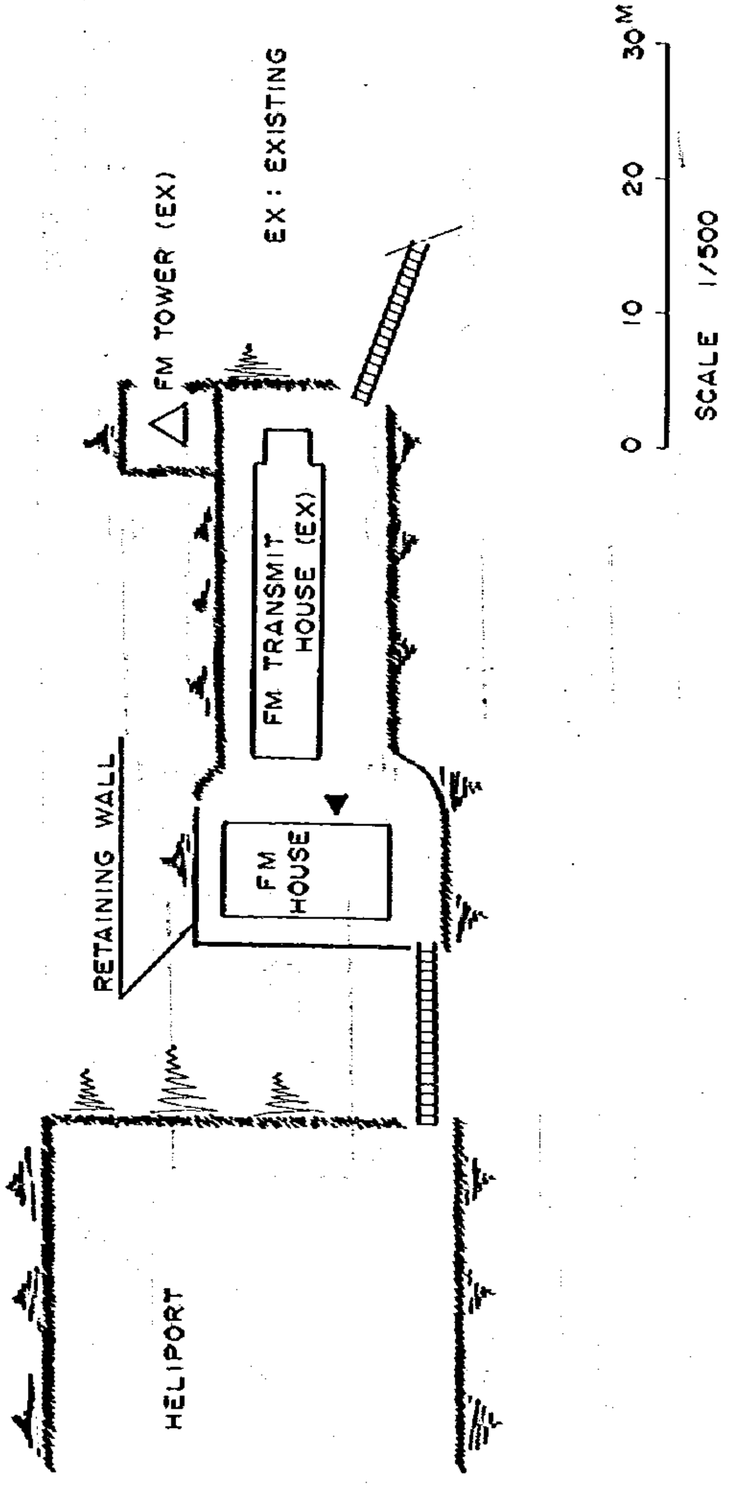


Fig. 6-6B Layang - Layang Site Plan

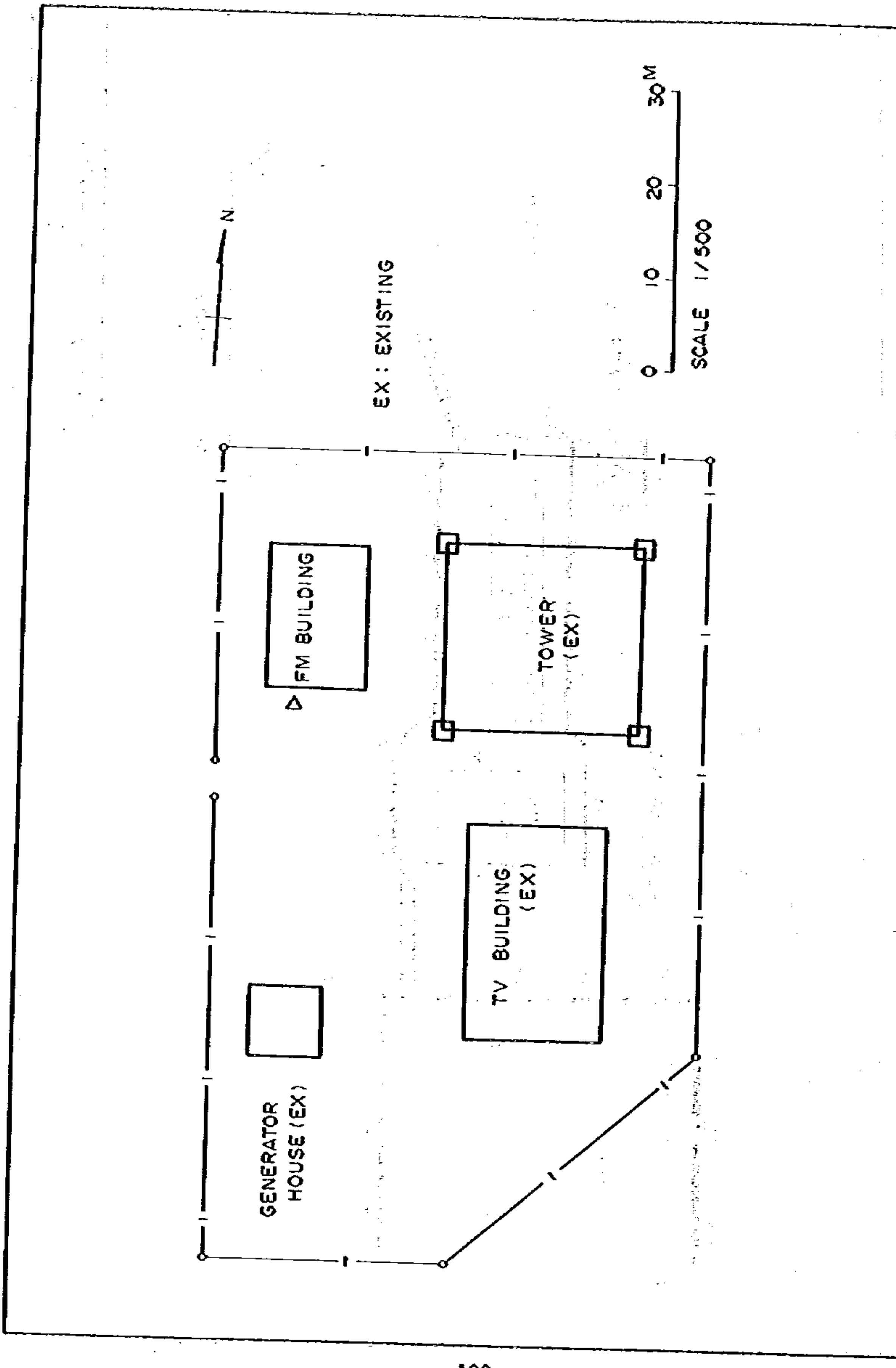


Fig. 6-7 SITE PLAN (KUDAT)

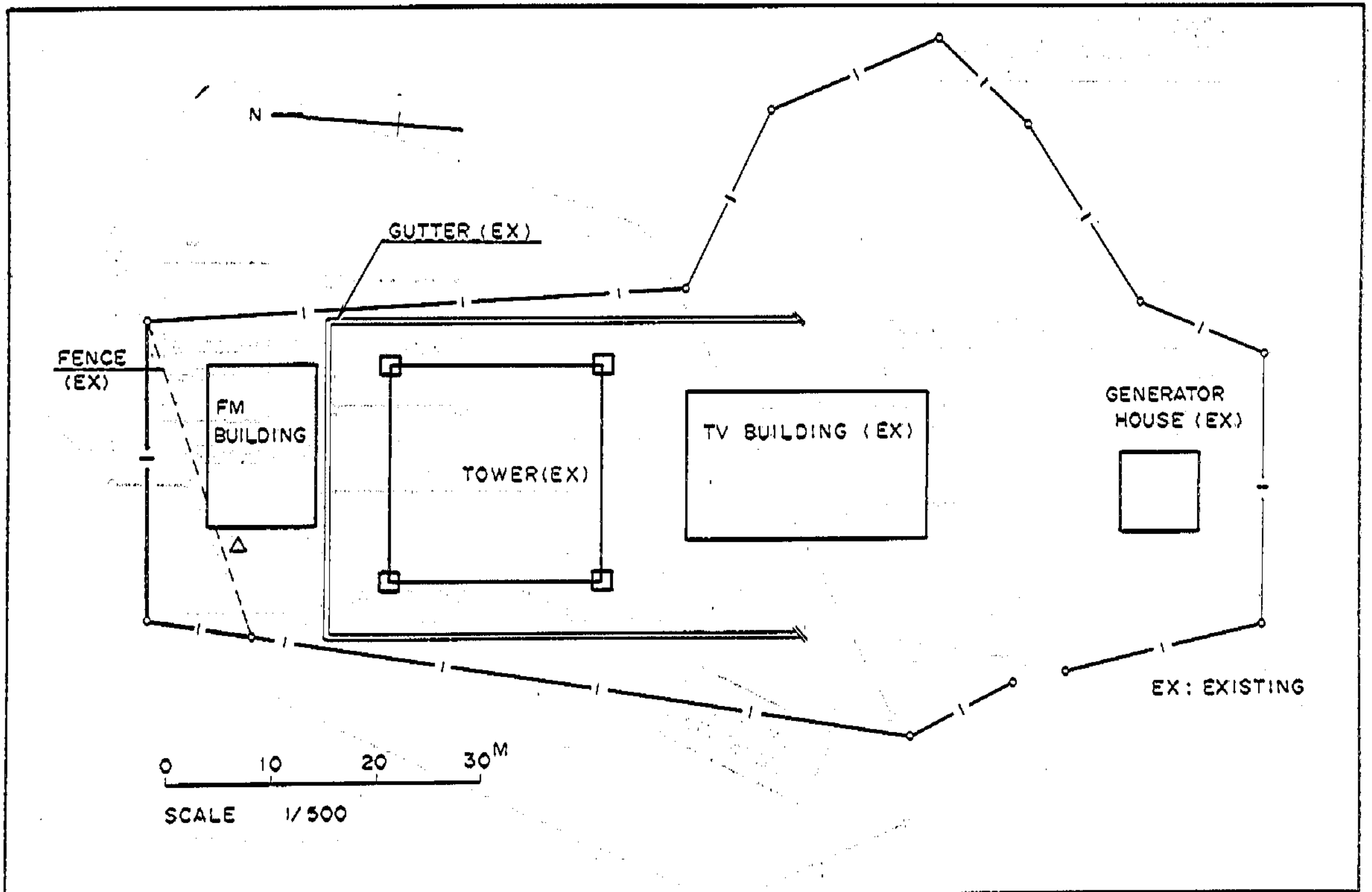


Fig. 6-8 SITE PLAN
(SANDAKAN)

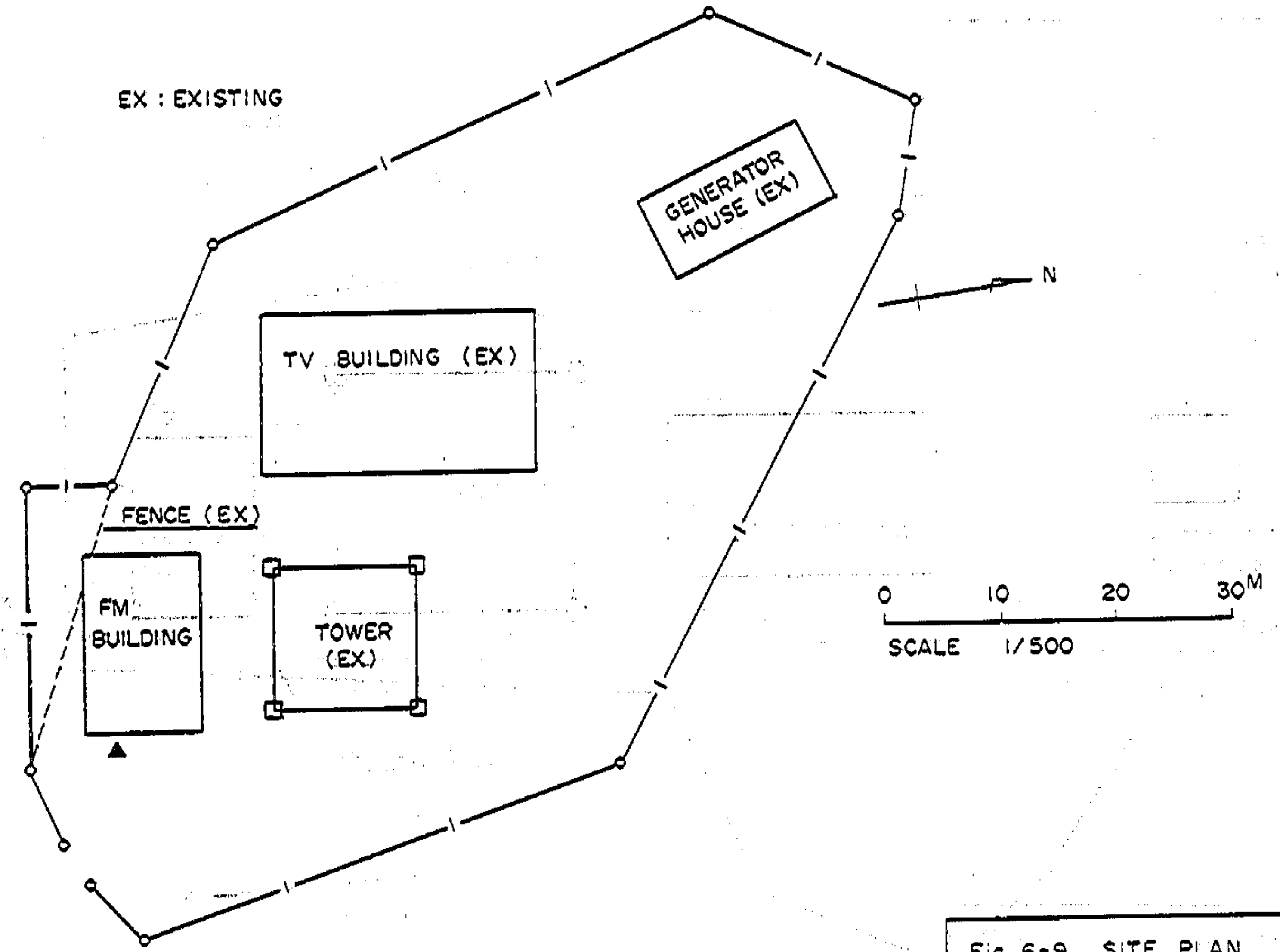


Fig. 6-9 SITE PLAN
(TAWAU)

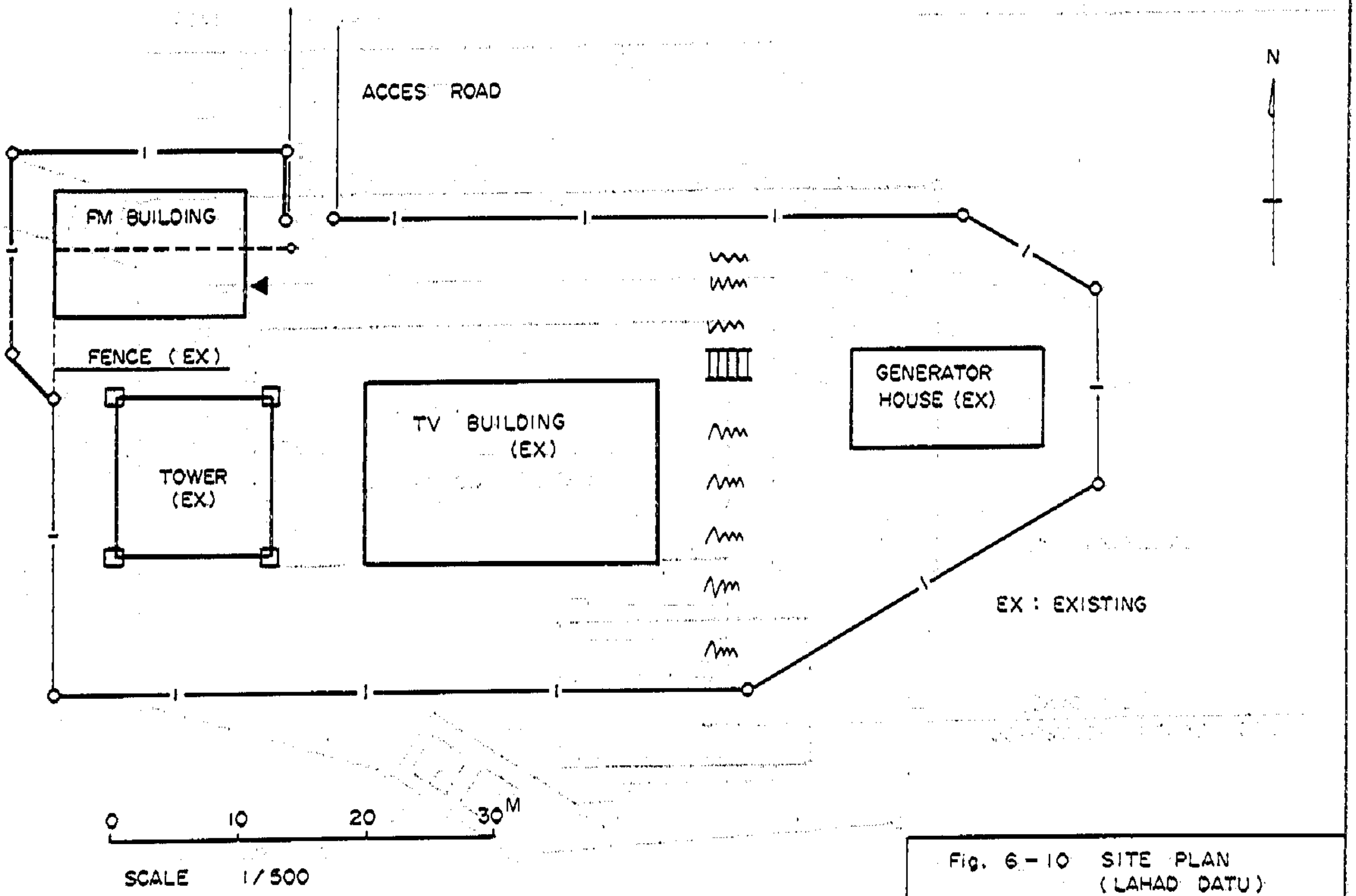


Fig. 6 - 10 SITE PLAN
(LAHAD DATU)

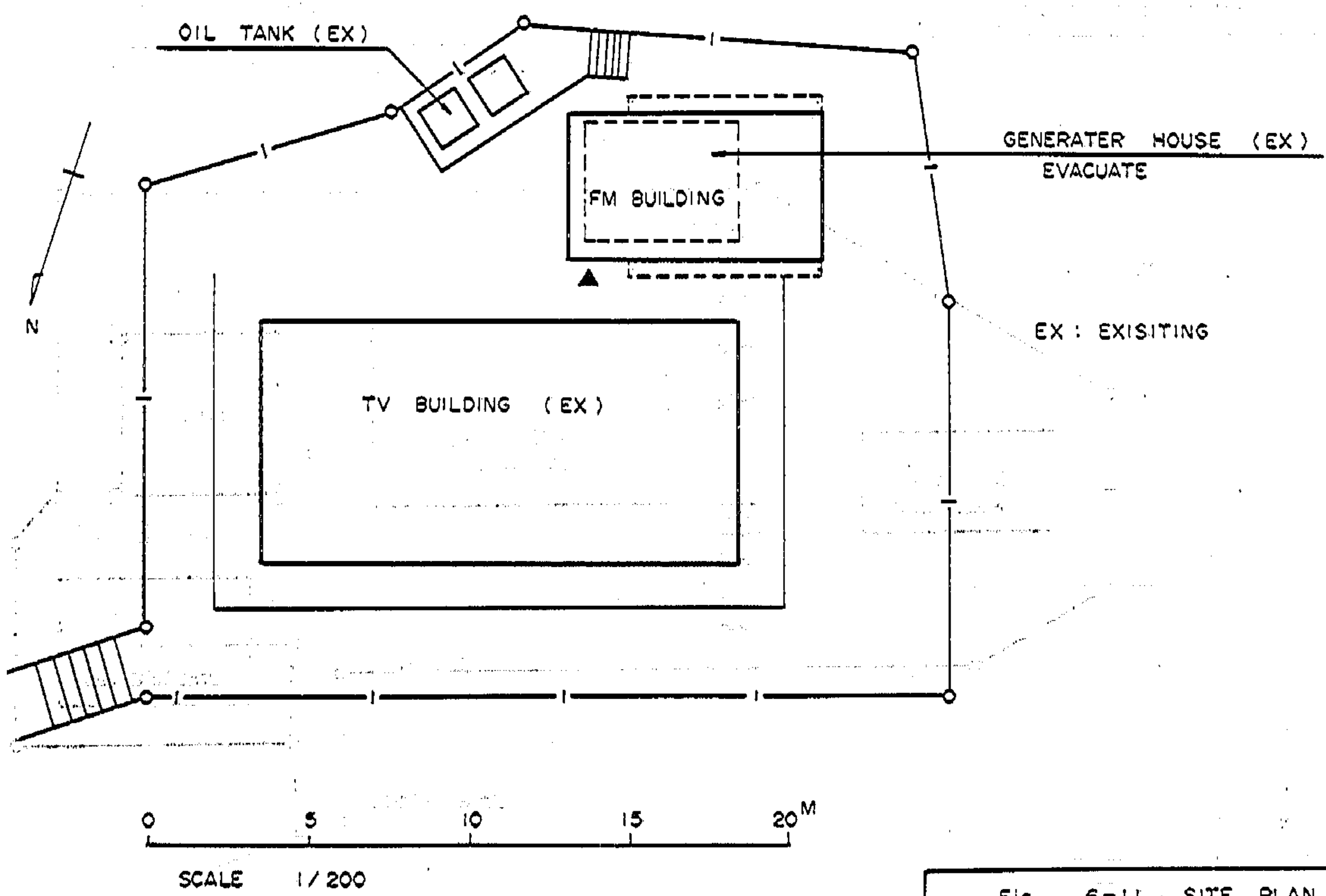


Fig. 6-11 SITE PLAN
(KUCHING)

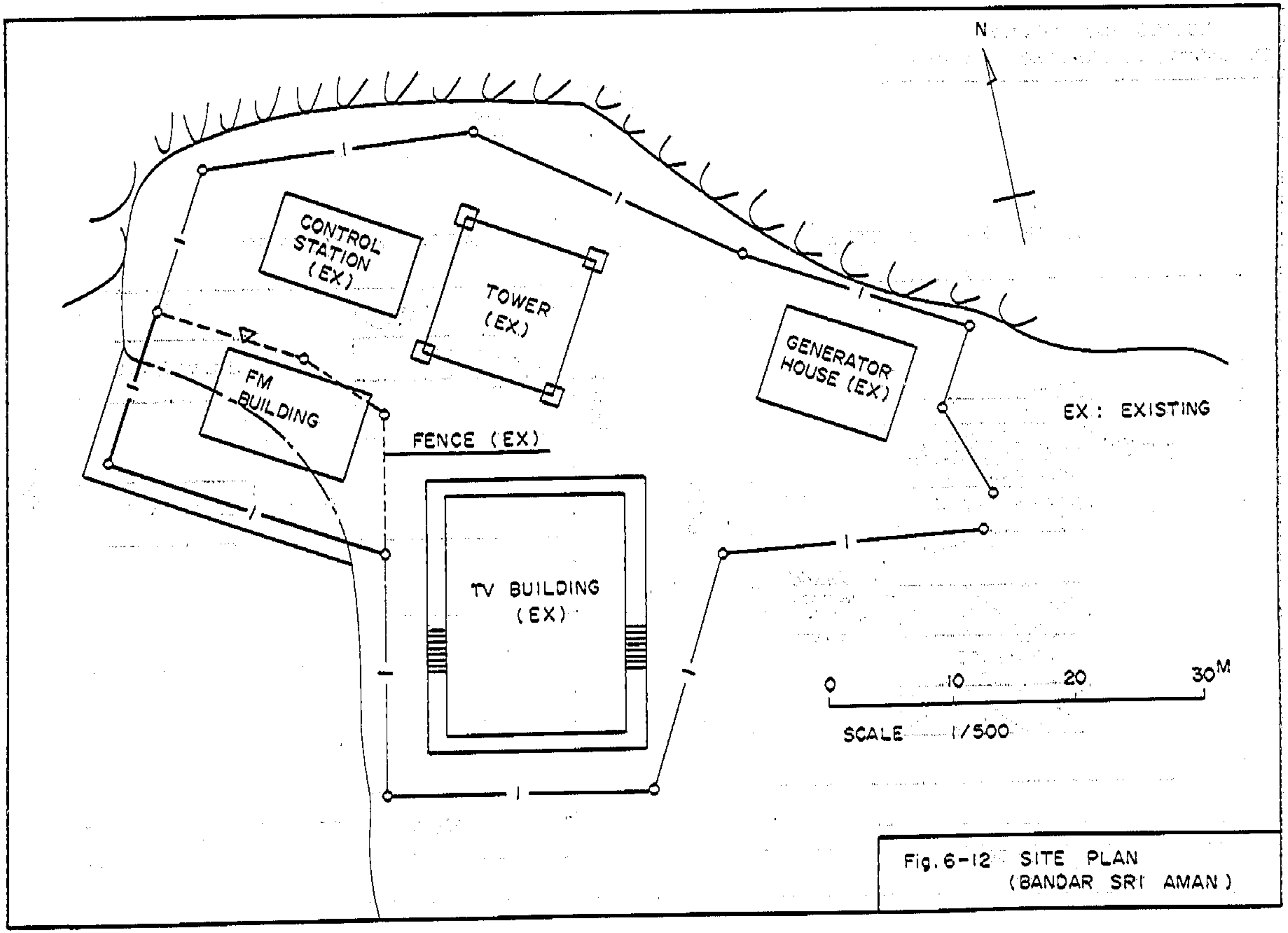


Fig. 6-12 SITE PLAN (BANDAR SRI AMAN)

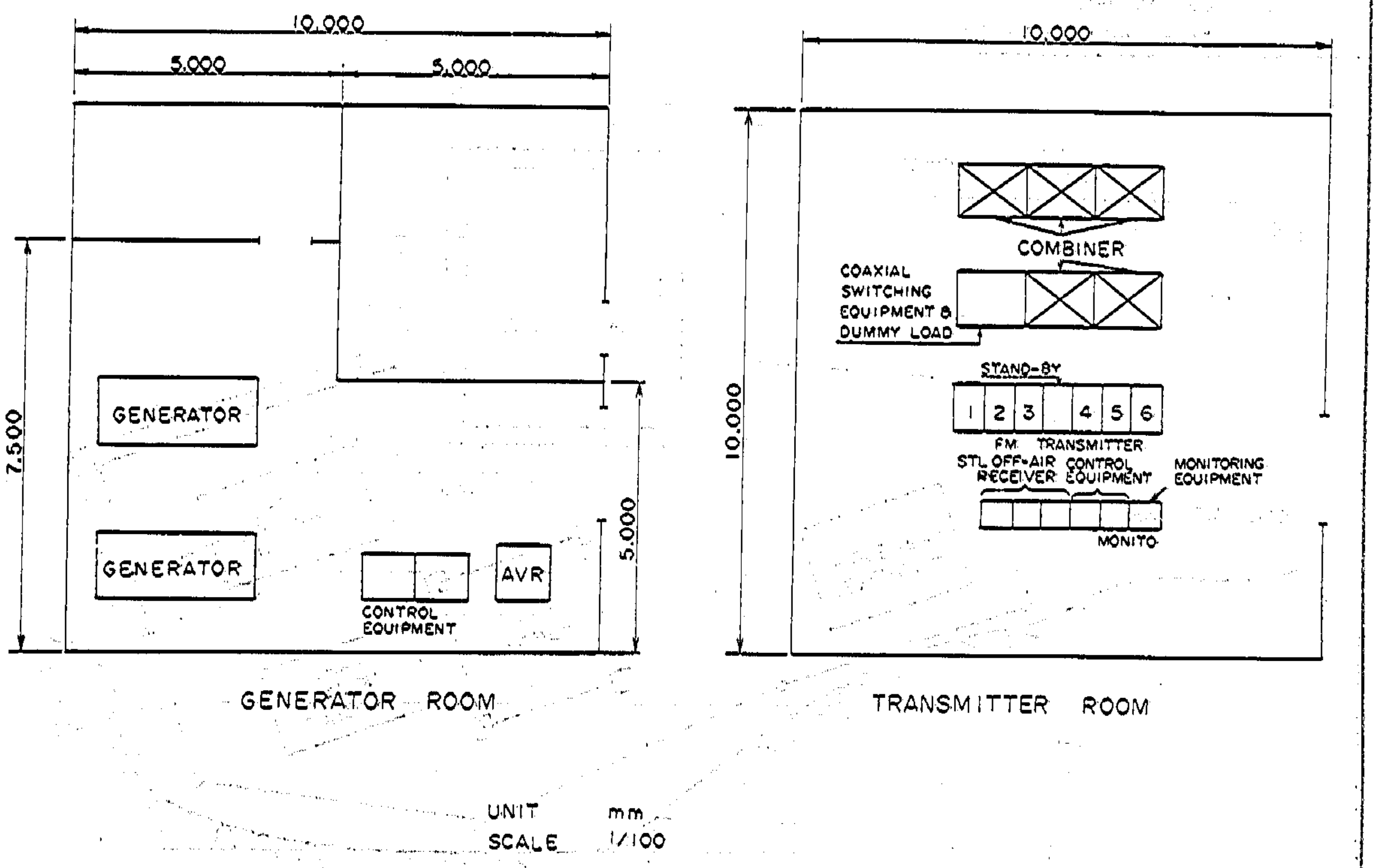
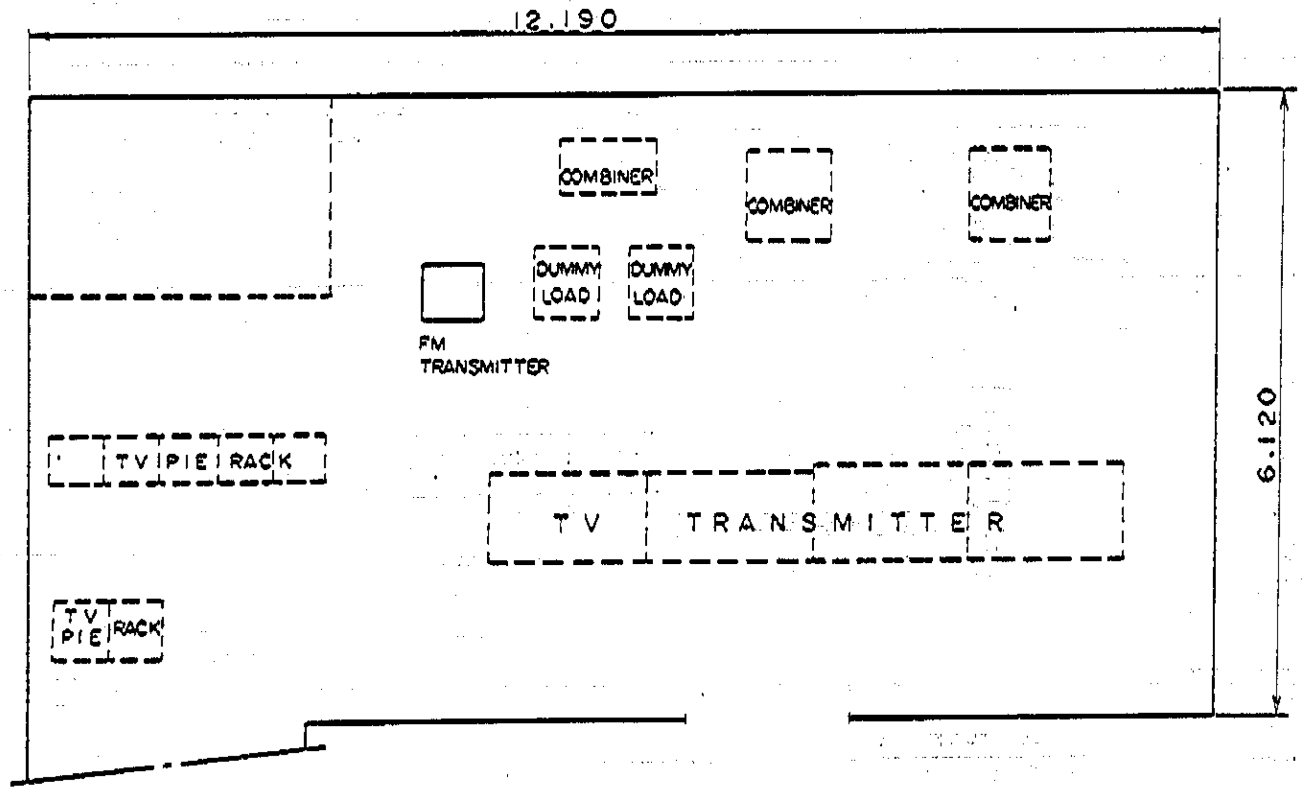


Fig. 6-13 FLOOR LAYOUT FM TRANSMITTING STANDAD TYPE STATION



UNIT mm
SCALE 1/69

Fig. 6-14 FLOOR LAYOUT FM TRANSMITTING RANAU STATION

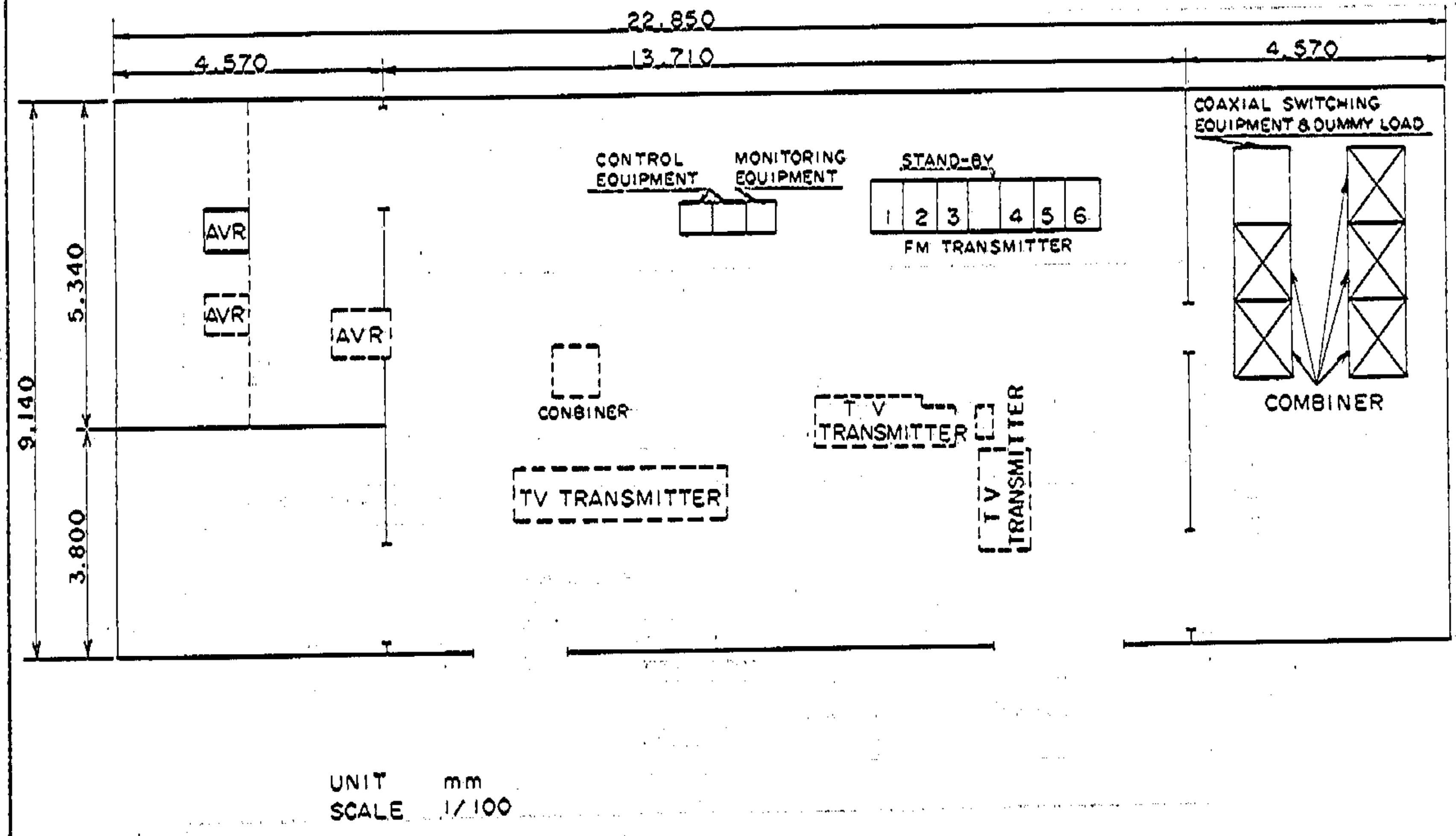


Fig. 6-15 FLOOR LAYOUT FM TRANSMITTING SIPITANG LIMBANG STATIONS

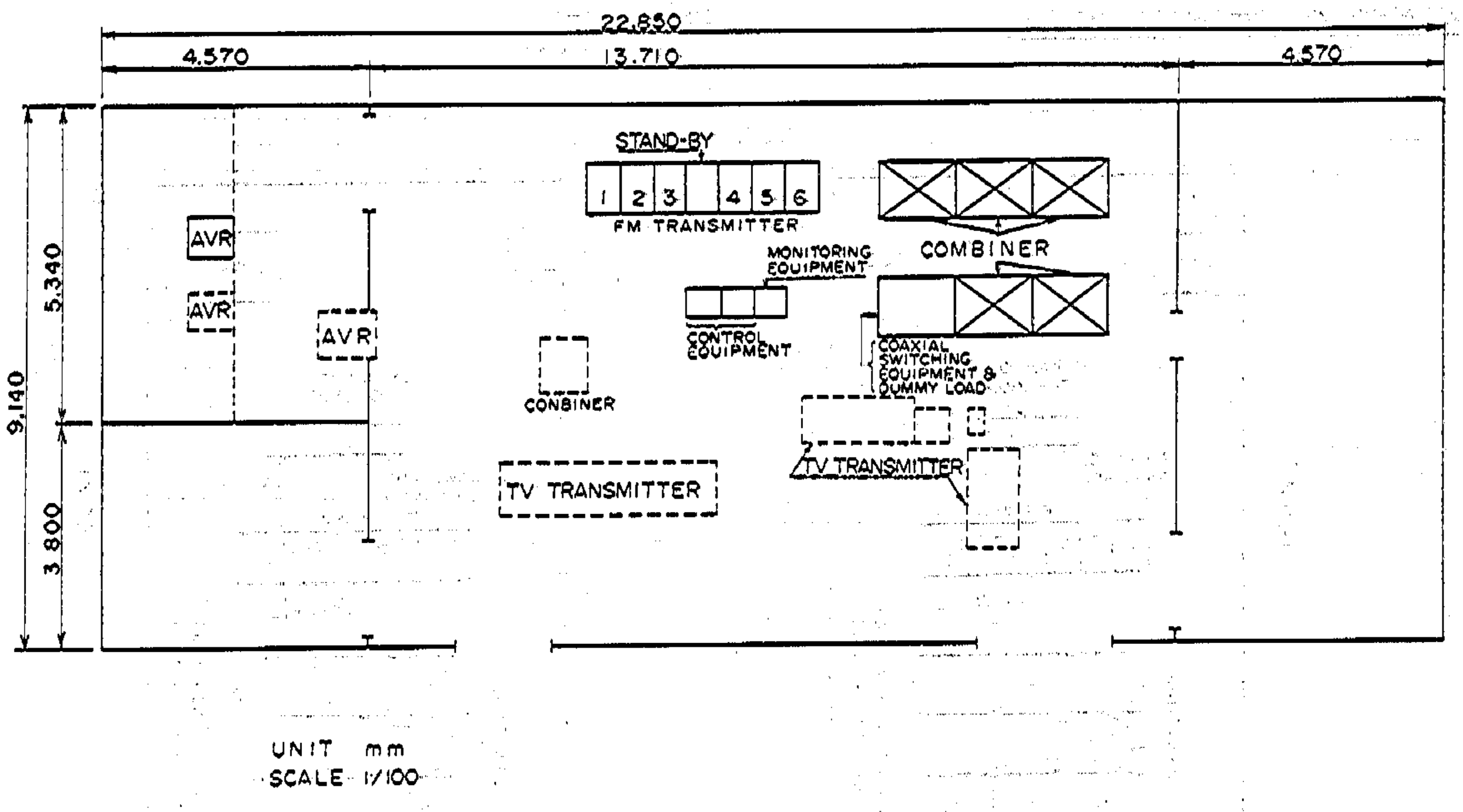
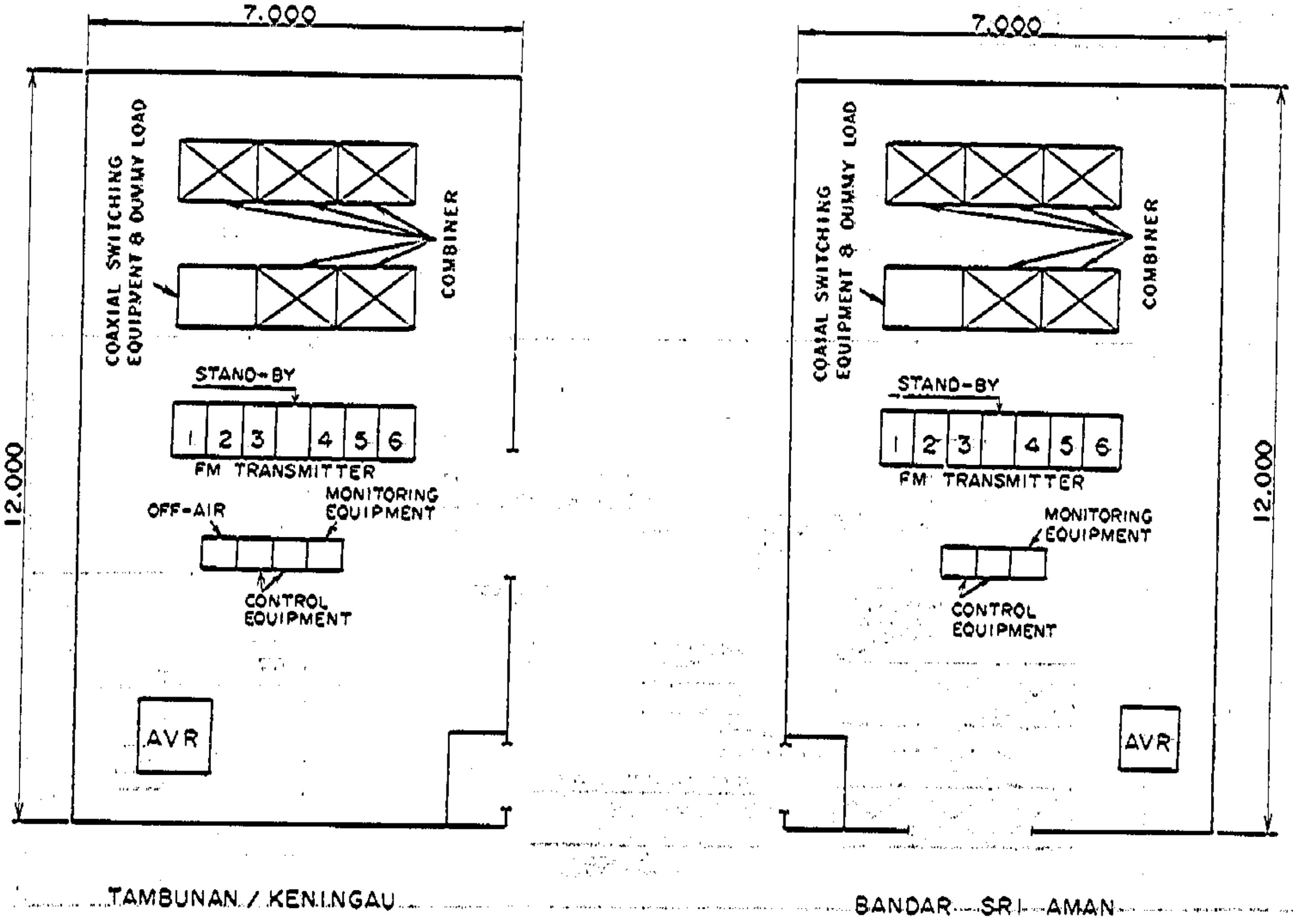


Fig.6-16 FLOOR LAYOUT FM TRANSMITTING KAPIT STATION



UNIT mm
SCALE 1/100

Fig. 6-17 FLOOR LAYOUT FM TRANSMITTING STATIONS TAMBUNAN/KENINGAU BANDAR SRI AMAN

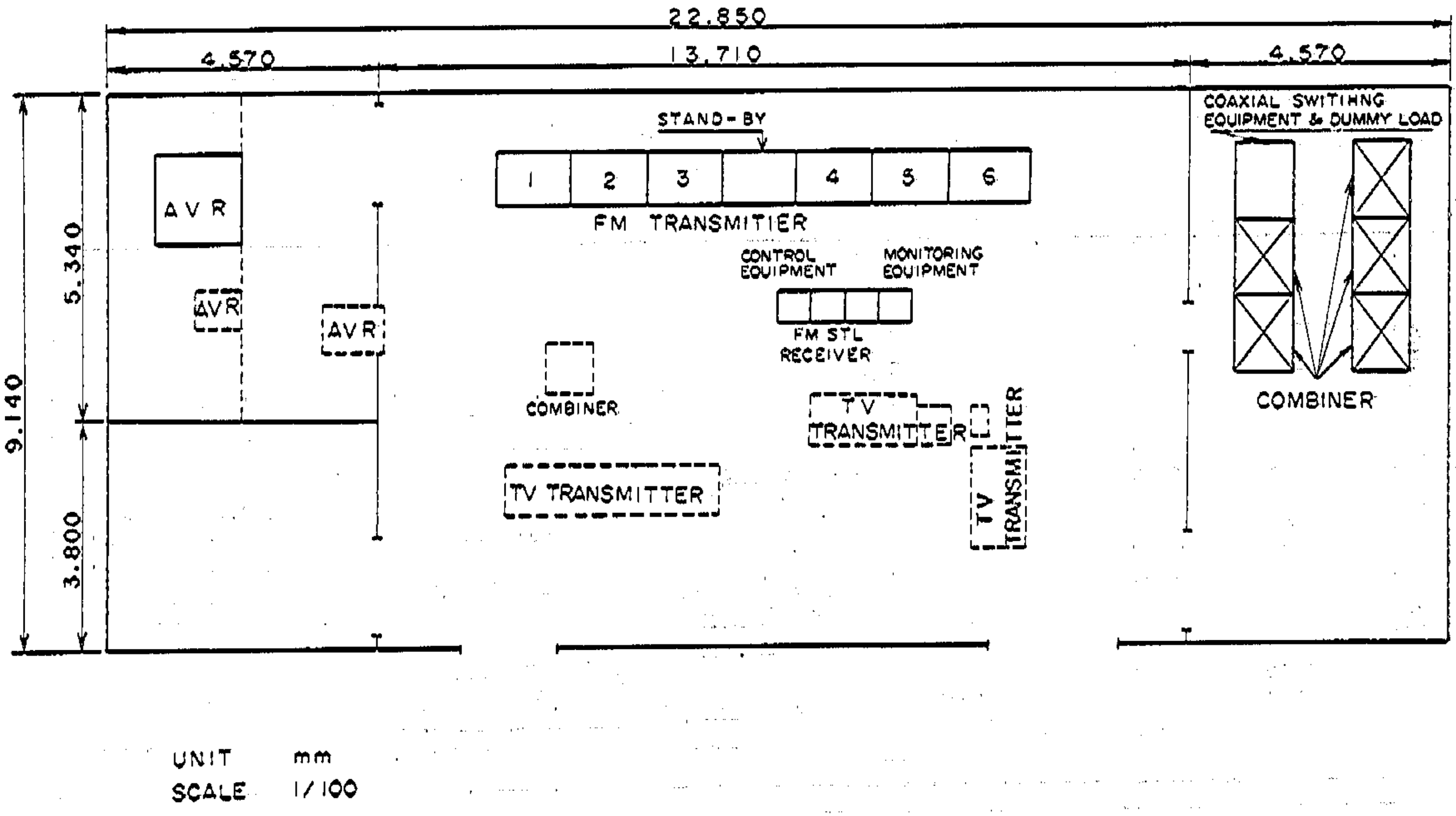
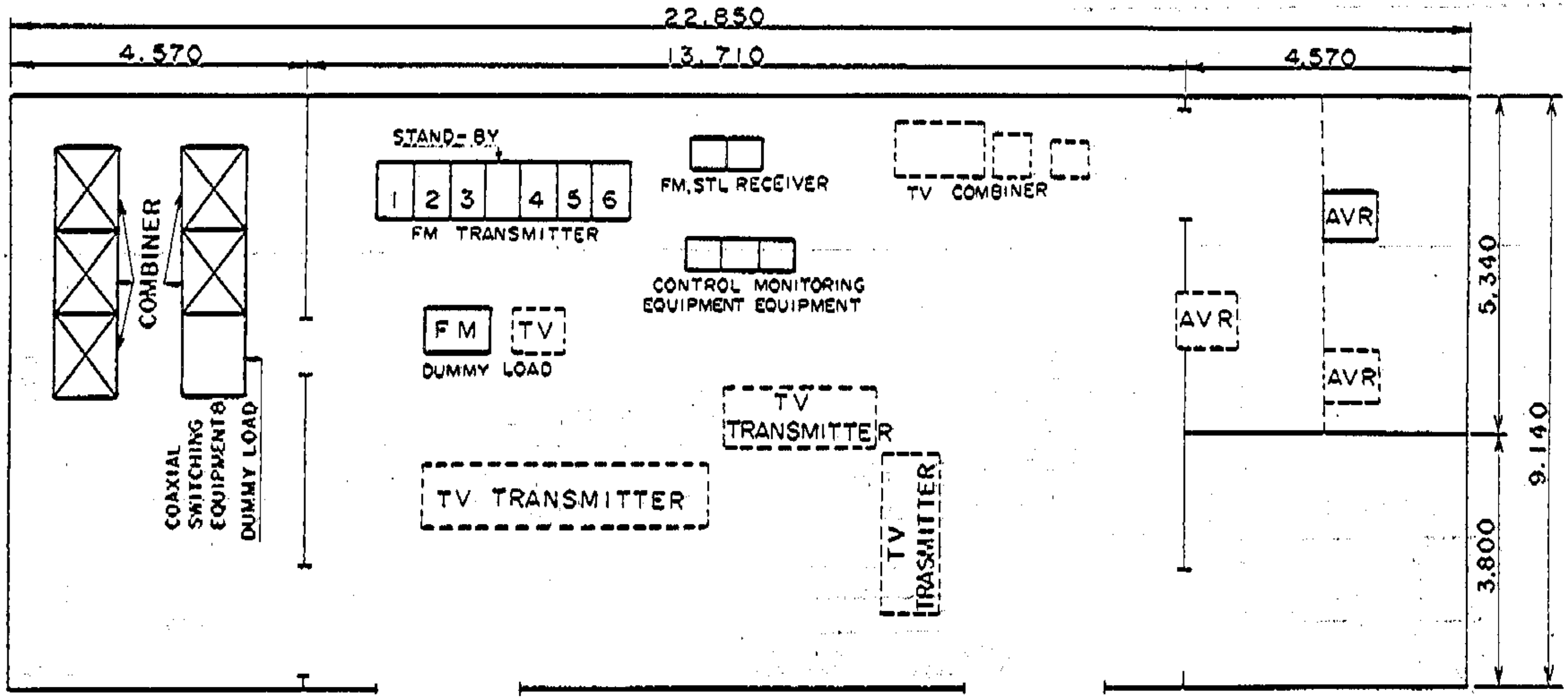


Fig. 6-18 FLOOR LAYOUT FM TRANSMITTING BINTULU STATION



UNIT mm
SCALE 1/100

Fig. 6-19 FLOOR LAYOUT FM TRANSMITTING MIRI STATION (Bt. Lambir)

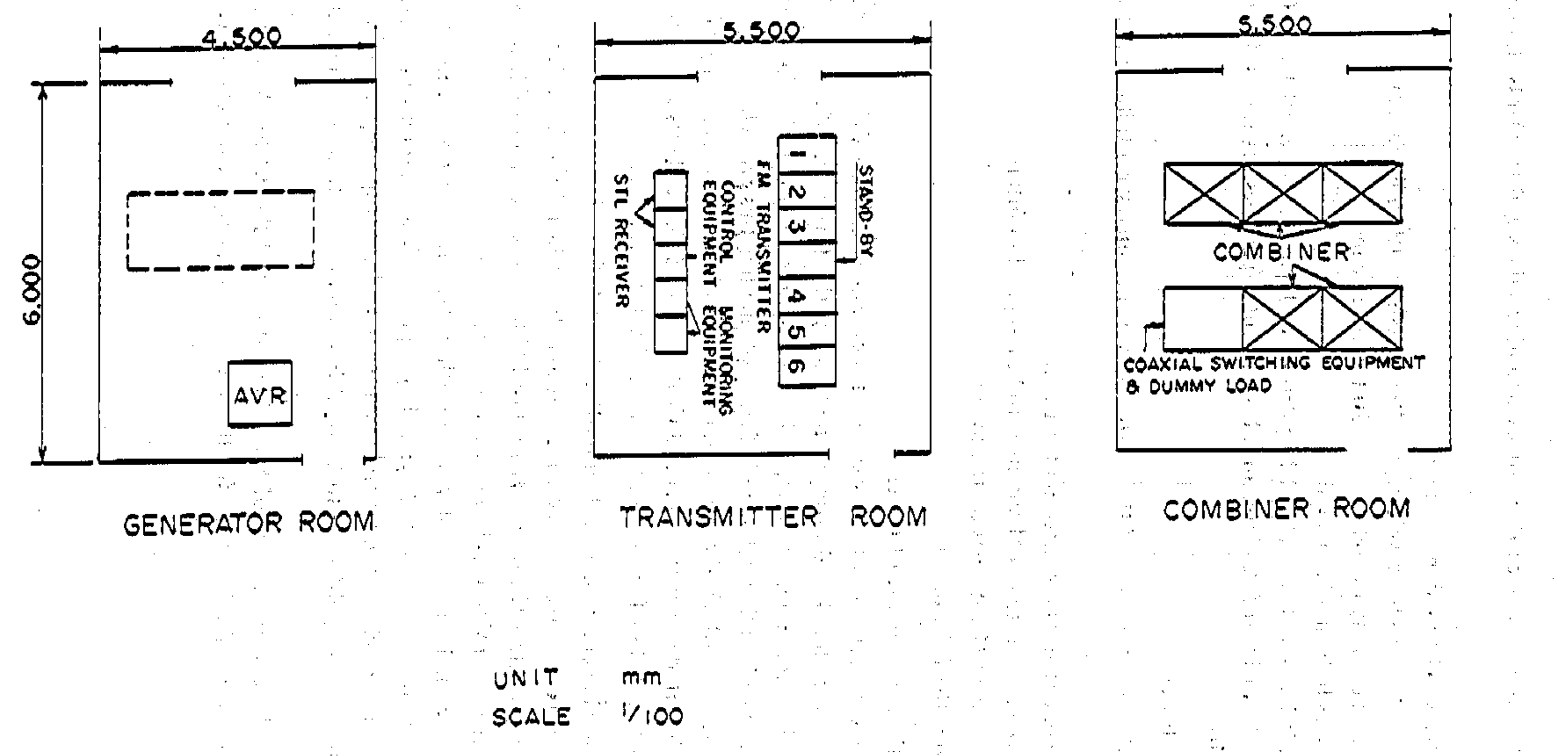


Fig. 6-20 FLOOR LAYOUT FM TRANSMITTING KUCHING STATION

6-2. Steel towers

The design of steel towers was carried out by adopting values and standards shown in following items.

(1) In the case of towers to be used in common
   a) Maximum instantaneous wind velocity: 40 meters/sec. (90 miles/hour)
   b) Allowable baring capacity of soil: 20 tons/square meter

(2) In the case of towers to be newly erected
   Building Standards Laws and the related Regulations of Japan and the Steel Tower Calculation Standards set out by the Architectural Institute of Japan, besides values described in Items 1), a) and b).

6-2-1. Common use of tower

(1) With regard to the common use of the existing tower, the survey on following items was carried out.
   a) Existing state of antennas mounted on the twoer
   b) Types of other antennas than FM antennas to be mounted in future
   c) Space for mounting FM antennas on the tower
   d) Structural strength of the tower

(2) The decision on the common use of tower
   Possibility on the common use of the existing tower was confirmed examining the data above and reading the detailed drawings prepared by the tower manufacturer. For all towers to be used in common, however, it is indispensable to re-examine in details and seize the safeties shown in following items before implementing this project.
   a) Ground condition on which the tower stands and allowable bearing capacity of the soil
   b) Existence of distorted tower members and tightening condition of bolts and nuts
   c) Present state of coated surfaces of the tower members

(3) The towers to be used in common and their outlines
   a) Out of existing sixteen steel towers, fifteen towers listed in Table 6-2 are deemed to be usable in common with FM towers. The list of FM towers is shown in Table 6-4 and the outlines of micro and TV towers in Fig. 6-21 ~ 6-25.
   b) For the FM tower and antennas of Tambunan/Keningau transmitting station, the existing FM tower and spare antennas of Layang Layang transmitting station will be used.
   c) The FM tower for Kuching transmitting station is to be newly supplied, because the existing TV tower is very difficult to be used in common due to its insufficient structural strength.
   d) With regard to the existing towers of Sarikei (Saratok) and Bandar Sri Aman transmitting stations, some reinforcing work for them will be necessary in the case of common use with FM towers.

Table 6-2 Towers Used In Common

Station	Site
1. Kota Kinabalu	Bt. Lawa Mandau
2. Kudat	Bt. Kelapa
3. Sandakan	Trig Hill
4. Tawau	Mt. Andrasi
5. Lahad Datu	Mt. Silam
6. Tambunan/Keningau	Layang-Layang
7. Sipitang	Bt. Tamulagus
8. Ranau	Layang-Layang
9. Bandar Sri Aman	Bt. Temudok
10. Sibu	Bt. Singalang
11. Miri	Bt. Lambir
12. Bintulu	Bt. Nyabau
13. Limbang	Bt. Mas
14. Sarikei (Saratok)	Bt. Kayu Malam
15. Kapit	Kapit

6-2-2 Erection of new tower

(1) The design conditions for a new FM tower are as follows.

a) The FM tower for a new station is 65 meters high.

b) The tower shall be located near the FM station building.

c) The structure of the tower is a self-supporting type with a square cross-section, mounted on four reinforced concrete foundations.

d) The structural design of the tower against wind load was made according to Item 1), a), chapter 6-2 of in this SECTION.

e) For a new FM station, due regard is paid to the structural design of the tower in order that an upright tower part of 10 meters in length can be added to the top of that tower for mounting other antennas than FM ones in future.

f) The tower is to be furnished with necessary facilities, such as aviation obstruction lights, horizontal and vertical feeder racks and ladders for maintenance use, etc.

g) All members of the steel tower shall be galvanized and finished with paint as aviation obstruction markings.

(2) The FM tower for kuching transmitting station

a) The FM tower will be erected around the lower part of the existing TV tower on the roof of the existing building.

b) The tower is 13.5 meters high.

c) A minimum weight tower enough to bear FM antennas will be supplied, so as not to exert a bad influence upon the existing building by new load.

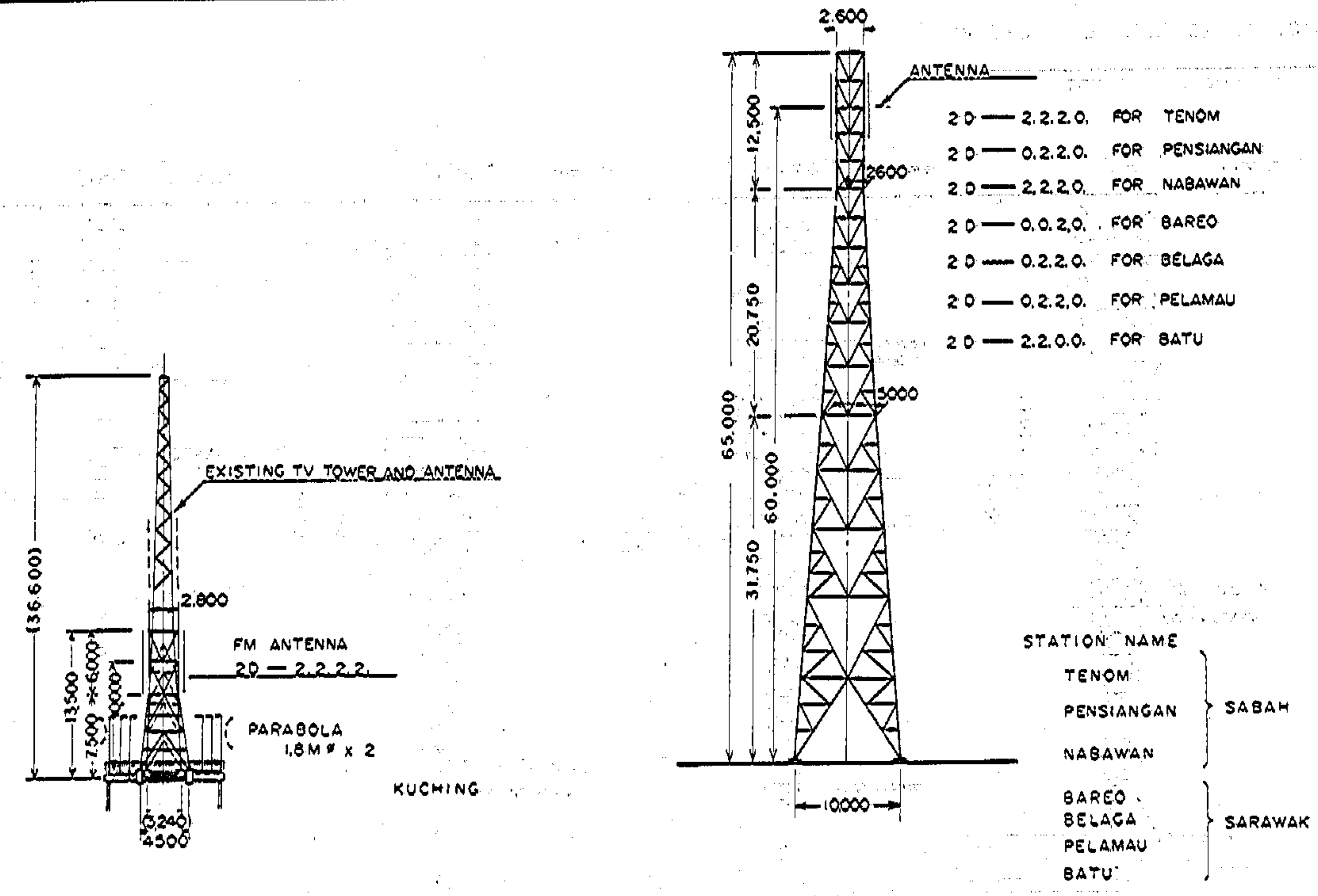
d) Parabolic antennas for STL use will be mounted on the existing gantry on the roof.

(3) The towers for new FM stations

The towers for new FM stations are shown in following Table 6-3 and their outlines in Figure 6-21 to 6-25.

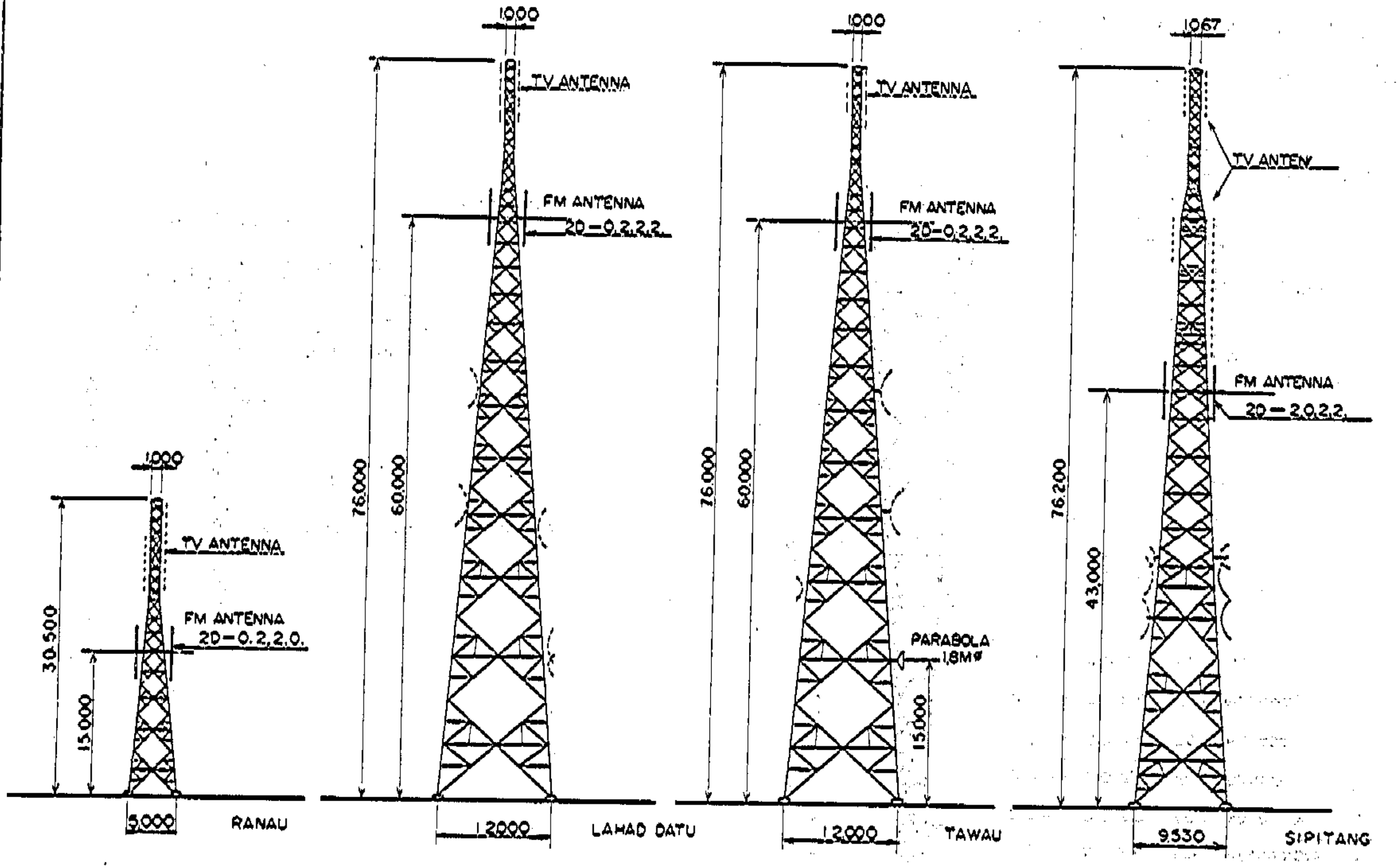
Table 6-3 Towers for New Stations

Station	Site
1. PENSIANGAN	G. ANTULAI
2. TWNOM	G. PALING-PALING
3. NABAWAN	SIKATIN
4. BAREO	BAREO
5. PELAMAU	BT. PELAMAU
6. BERAGA	BERAGA
7. BATU	BT. BATU



SCALE: 1/800 UNIT : M

Fig. 6-21 OUTLINE OF FM TOWER



SCALE: 1/800 UNIT: M

Fig. 6-22 OUTLINE OF TV TOWER

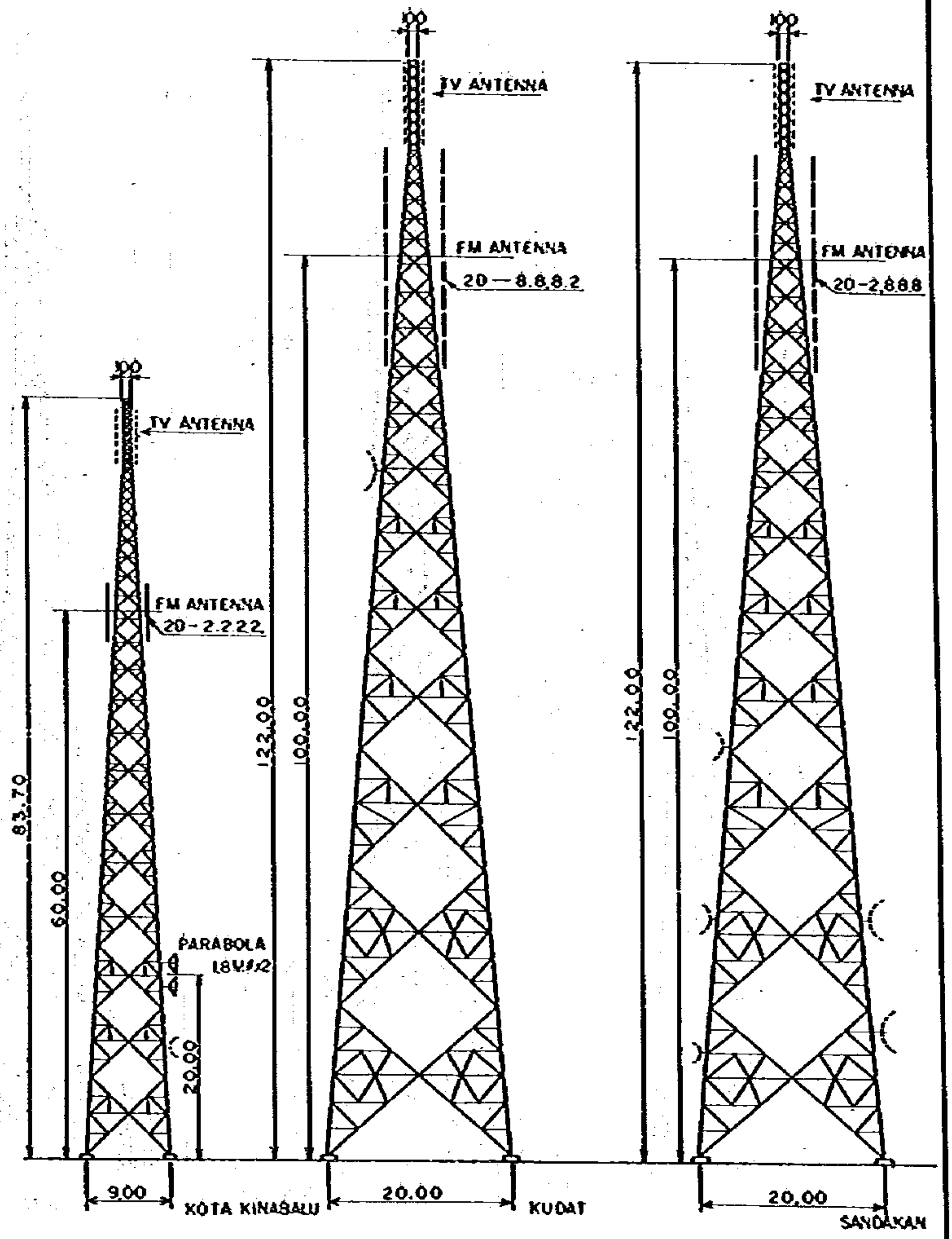


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Fig. 6-23 OUTLINE OF TV TOWER

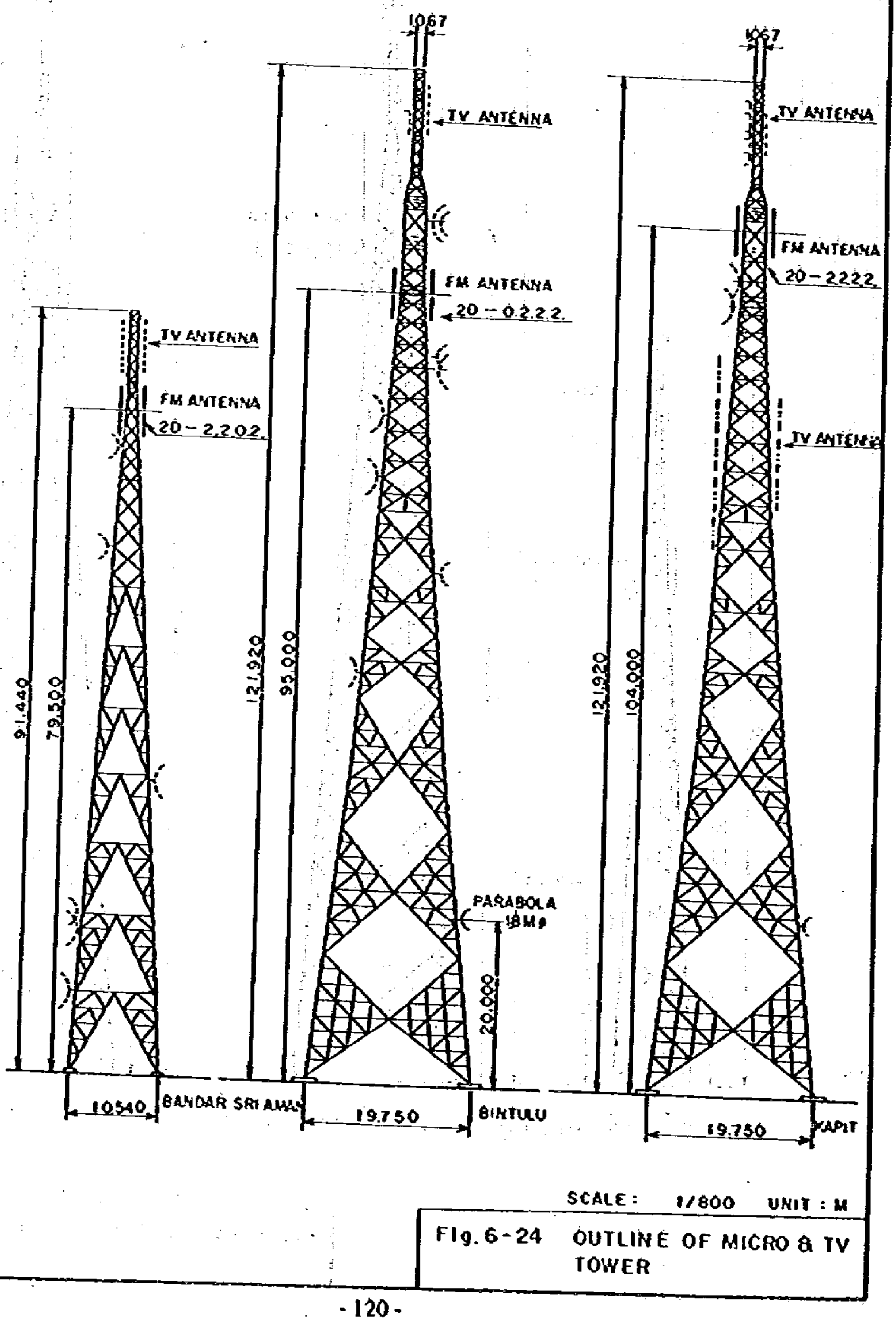
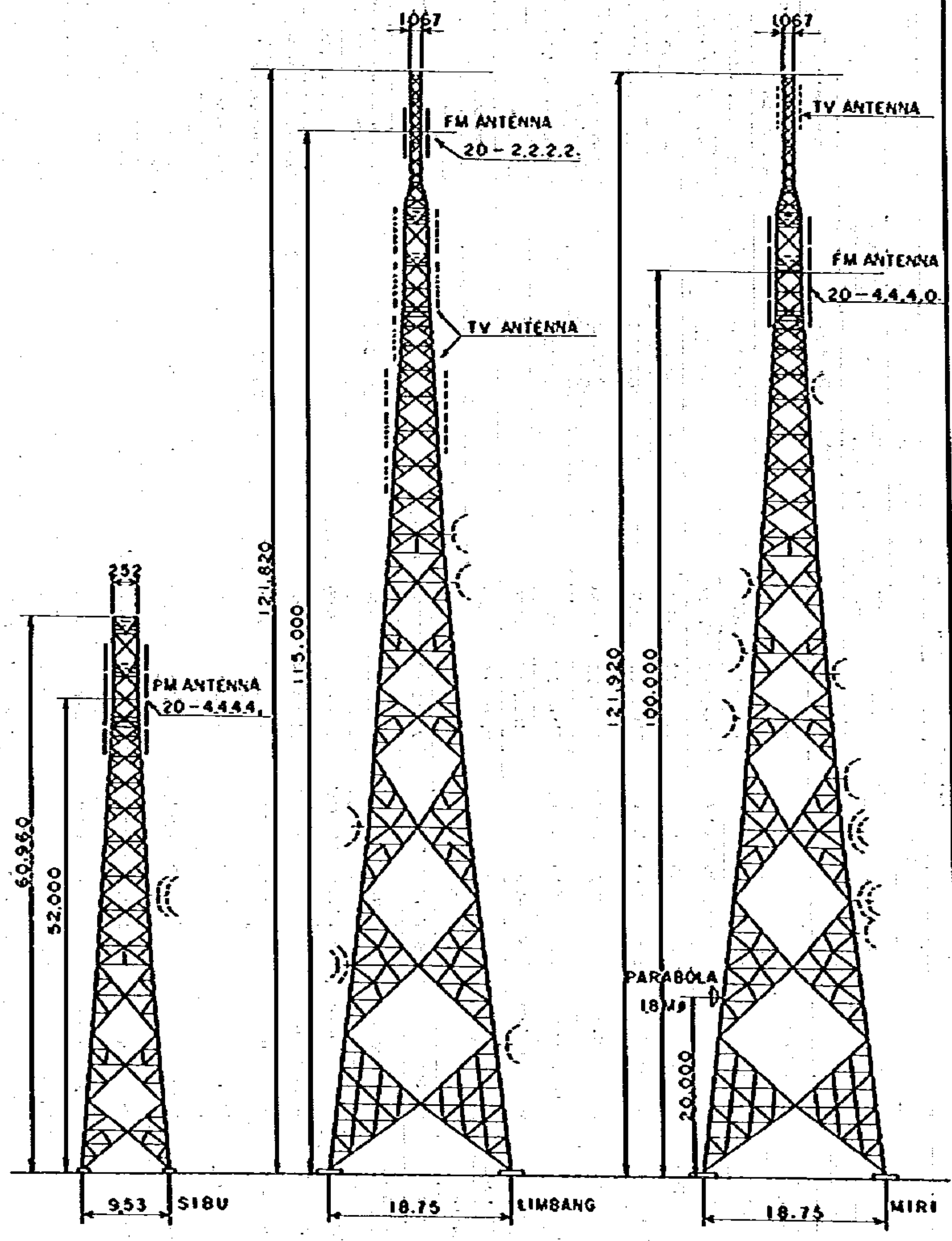


Fig. 6-24 OUTLINE OF MICRO & TV TOWER



SCALE: 1/800 UNIT: M

Fig. 6-25 OUTLINE OF MICRO & TV TOWER

Table 6-4. MF Tower List

FM Station proposed				Tower		Antennas						
State	Name	Site	Stage	Height (m)	Supplier or Type	FM	Height (m)	Parabola	Height (m)	TV	No. of other Parabolas	Remarks
Sabah	Kota Kinabalu	Bt. Lawa Mandau	1 st	83.70	N.E.C.	2D-2.2.2.2	60.00	1.8 m x 2	20.00	2D-1.4.0.4.	1	Common use with TV tower
	Tamburan /Keningau	Layang Layang	1 st			2D-0.6.6.0.						Common use with FM tower and antenna
	Sandakan	Trig Hill	1 st	122.00	N.E.C.	2D-2.8.8.8.	100.00			4D-1.2.3.3.	5	Common use with TV tower
	Kudat	Bt. Kelapa	1 st	122.00	N.E.C.	2D-8.8.8.2.	100.00			4D-3.3.3.3.	1	Common use with TV tower
	Lahad Datu	Bt. Silam	1 st	76.00	N.E.C.	2D-0.2.2.2.	60.00			2D-0.4.4.0	5	Common use with TV tower
	Tawau	Bt. Andrasi	1 st	76.00	N.E.C.	2D-0.2.2.2.	60.00	1.8 m	15.00	2D-0.4.2.2.	3	Common use with TV tower
	Sipitang	Bt. Tampulagus	1 st	76.20	E.P.T.ID	2D-2.0.2.2.	43.00			2D-3.0.1.3 2D-3.0.1.3.	6	Common use with TV tower * 2nd channel
	Ranau	Layang Layang	2 nd	30.50	N.E.C.	2D-0.2.2.0	15.00			4D-0.3.2.0		Common use with TV tower
	Tenom	Gn. Paling Paling	2 nd	65.00		2D-2.2.2.0	60.00					New tower
	Pensiangan	Gn. Antulai	2 nd	65.00		2D-0.2.2.0	60.00					New tower
	Nabawan		2 nd	65.00		2D-2.2.2.0	60.00					New tower
Sarawak	Kuching	Gn. Serapi	1 st	13.50		2D-2.2.2.2.	10.50	1.8 m x 2				New tower *on gantry
	Bandar Sri Aman	Bt. Temudok	1 st	91.44	B.I.C.C.	2D-2.2.0.2.	79.50			2D-4.2.0.2	6*	Common use with TV tower * Incl. No. under planning
	Sarikei	Bt. Kayu Malam	1 st	121.92	B.I.C.C.	2D-4.4.0.4.	100.00	1.8 m			11	Common use with Micro tower
	Sibu	Bt. Singalang	1 st	60.96	E.P.T.IC	2D-4.4.4.4.	52.00				2	Common use with Micro-tower
	Bintulu	Bt. Hyabau	1 st	121.92	E.P.T.IIB	2D-0.2.2.2.	95.00	1.8 m	20.00	2D-0.2.0.4.	8	Common use with TV tower
	Limbang	Bt. Mas	1 st	121.92	E.P.T.IIB	2D-2.2.2.2.	115.00			2D-3.1.2.1. 2D-3.1.2.1. *	6	Common use with TV tower * 2nd channel
	Kapit	Kapit	1 st	121.92	E.P.T.IIB	2D-2.2.2.2.	104.00			2D-2.3.2.5. 2D-2.3.2.5. *	3**	Common use with TV tower *2nd channel ***Incl. No. under planning
	Miri	Bt. Lambir	1 st	121.92	E.P.T.IIB	2D-4.4.4.0.	100.00	1.8 m	20.00	2D-3.3.0.3	11	Common use with TV tower *2nd channel **Incl. No. under planning
	Saratok	Bt. Kayu Malam	2 nd	121.92	B.I.C.C.	2D-0.0.0.2	80.00				11	Common use with Micro tower
	Bareo	Bareo	2 nd	65.00		2D-0.0.2.0.	60.00					New tower
	Belaga	Belaga	2 nd	65.00		2D-0.2.2.0.	60.00					New tower
	Pelamau	Pelamau	2 nd	65.00		2D-0.2.2.0.	60.00					New tower
	Batu	Bt. Batu	2 nd	65.00		2D-2.2.0.0.	60.00					New tower

6-3. Access roads

When setting up FM transmitting stations on the same sites as the existing TV transmitting stations or radio relay stations, there would be no problem about the transport of construction materials because the access roads to the existing stations have all been maintained in good order, with two exceptions; Layang-Layang and GN. Serapi. But as regards Bt. Mas, it will be necessary to ensure that the existing access road is repaired before the construction of the FM station begins, since the road has partly been damaged and vehicles cannot pass.

At Layang-Layang, no road exists that enables passage of vehicles climbing higher than the power station. However, it would not be economical to construct an access road just for the sake of transporting the materials for the construction of a new FM station. Therefore, it seems to be more advantageous to use manpower or a helicopter for the transport of such materials.

As for Gn. Serapi, too, there is no road available to enable passage of a vehicle going higher up beyond the OH transmitting/receiving station but it would be possible to transport the construction materials by manpower and by using the existing lift.

As regards the five stations at Nabawan, Bareo, Belaga, Pelamau, and Batu, construction of an access road for each is necessary. The access roads to be newly constructed will each have a width of 4 meters and must be completed before the construction of the stations starts.

SECTION 7. PROGRAMME PLANNING

SECTION 7. PROGRAMME PLANNING

7-1 FM broadcasting channels in this project

As described in Section 4 and 5, a maximum of 6 channels are available for the implementation.

These 6 channels are called FM1, FM2, ... FM6, respectively.

The use of these channels FM1 to FM6 is as follows according to the result of the meeting with RTM:

FM1 RTM national programme (N-1)
FM2 RTM national programme (N-2)
FM3 RTM national programme (N-3)
FM4 RTM regional programme (R)
FM5 RTM local programme (L)
FM6 PSP educational programme (E)

The national programmes is produced by the RTM head office in Kuala Lumpur, sent out from this head office and transmitted simultaneously throughout the country from each FM transmitting station.

According to RTM's intention, every national programme is planned to go through regional stations, so that it may be possible for regional stations to intervene in the national programme.

The regional programme is produced in KOTA KINABALU Studio and KUCHING Studio and transmitted from each broadcasting Station in the States of Sabah and Sarawak.

The local programme is produced and transmitted in 5 local stations in Sabah and 8 local stations in Sarawak.

The educational programme is produced by PSP and transmitted simultaneously from each FM transmitting station in the whole country by using the RTM's Studio facilities.

As the programme transmission path of FM6 goes through regional stations in the same path as FM1 to FM3 for the national programme, it is possible to cut in the channel, as in the case of the national programme, at the regional studio.

7-2 Relation between AM and FM programmes

FM broadcasting expected by the Government of Malaysia is stereophonic broadcasting, wider radio coverege, improvement of local broadcasting and independence of educational broadcasting.

As described in the report on peninsular Malaysia, it is appropriate to apply FM broadcasting to:

a) Entertainment programme of high-quality sound
b) Stereophonic music programme
c) Documentary programme that requires ambience

rather than to use these only for clearing poor coverage of AM stations. Even with a small number of channels at the outset, it is desirable for programming to be as above.

Since it is important to popularize FM broadcasting among the listeners in an early stage in order to clarify its positioning as a sound medium in the future, it is desirable that FM broadcasting includes all the languages.

7-3 Scheduling for FM and AM broadcasting programmes

The following points were taken into account in preparing the schedule for programming.

(1) 0 – 3 years

a) At least, 1 channel be transmitted in stereo from the outset for the purpose of giving effectively the characteristic of FM broadcasting and developing listeners.

b) National channels (FM1 to FM3) will carry the same programmes as AM.

c) The FM local channel (FM5) be transmitted in stereo from the outset, because it is a new programme.

d) As the regional channel for local stations are not constructed, the FM programming of the regional channel (FM4) is not performed.

e) The conventional programme be transmitted on AM as at present.

f) In the broadcasting time for AM local programme at the regional station, the programme of FM4 is transmitted in common.

(2) After 3 years

a) The national programme of AM, blue, green and red, is reprogrammed for the FM1, FM2 and FM3.
Programmes for the FM1, FM2 and FM3 are produced and transmitted in stereo.

b) Though the regional and local programmes have hitherto been broadcast by time division in each AM channel, they are made independent by FM4 and FM5. As the two systems include more cultural and musical programmes than educational and news programmes, most of them are broadcast by stereo.

c) The educational programme is executed by FM6. As a result, the educational programmes that was transmitted by AM will be shifted into FM6.
The educational broadcast is switched over to stereophonic in the 7th year, as effective programmes for stereophonic.
Programmes for social education and adult education are produced and also by stereophonic.
Above mentioned plan is shown in Fig. 7-1, Fig. 7-2 and Fig. 7-3.

7-4 Broadcasting hours

The provided facilities permit 24-hour broadcasting for each channel, but the following hours are established the same as in case of peninsular Malaysia.

FM1 .... 24 hours
FM2 .... 18 hours
FM3 .... 18 hours
FM4 .... 10 hours

FM5 .... 10 hours
FM6 .... 10 hours

The average daily on-air hour for educational broadcasting is 4 hours as the yearly mean.

As already mentioned, the educational broadcasting is supposed to be independent and have an on-air hour of 10 hours.

Now, in Malaysia, two-shift teaching is executed in the morning and in the afternoon in each primary school and lower secondary school.

Consequently, if the educational broadcasting schedule is restricted, and other channels will be borrowed for the purpose of educational broadcast.

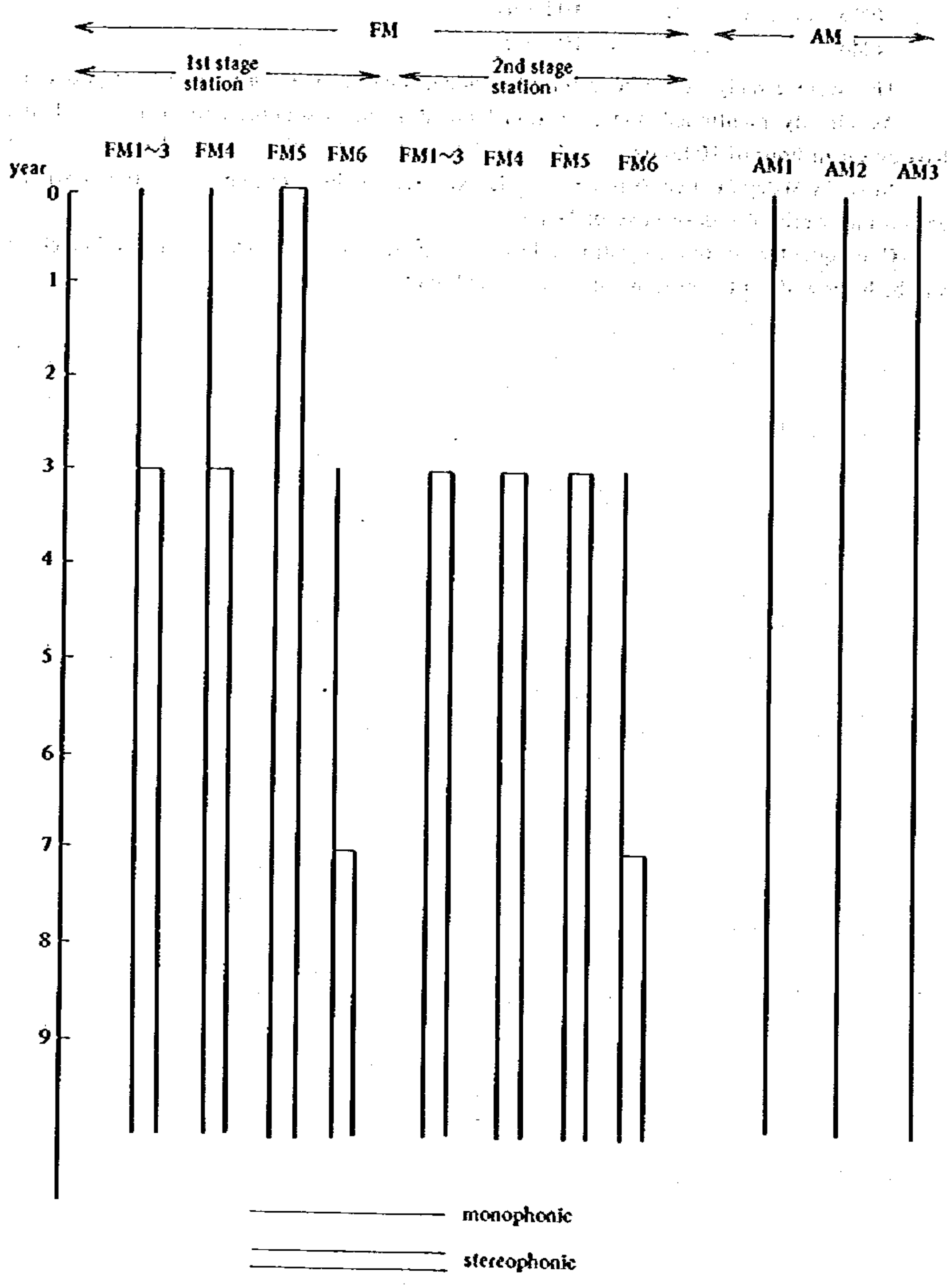


Fig. 7-1 Transmission Schedule

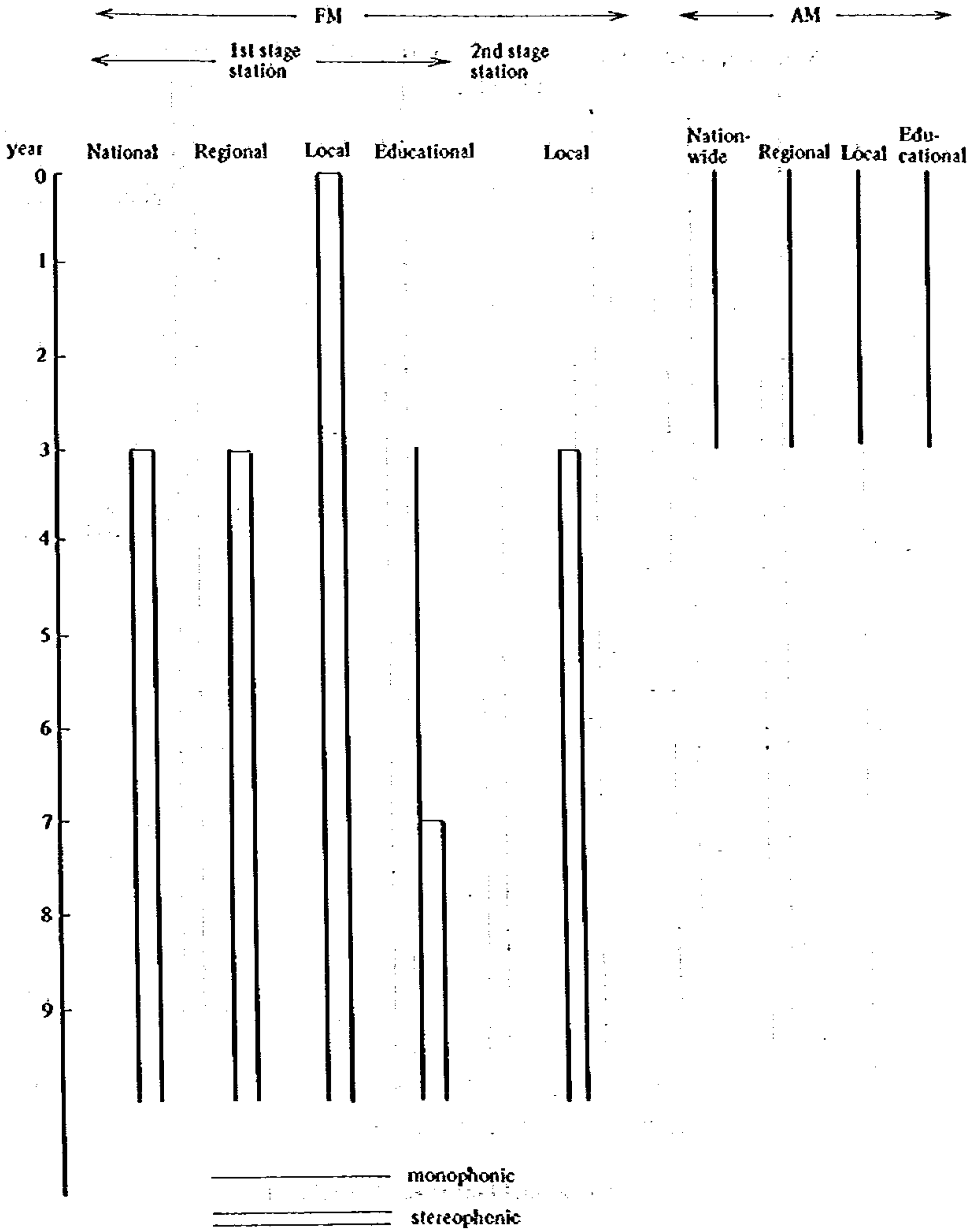


Fig. 7-2 Program Production Schedule

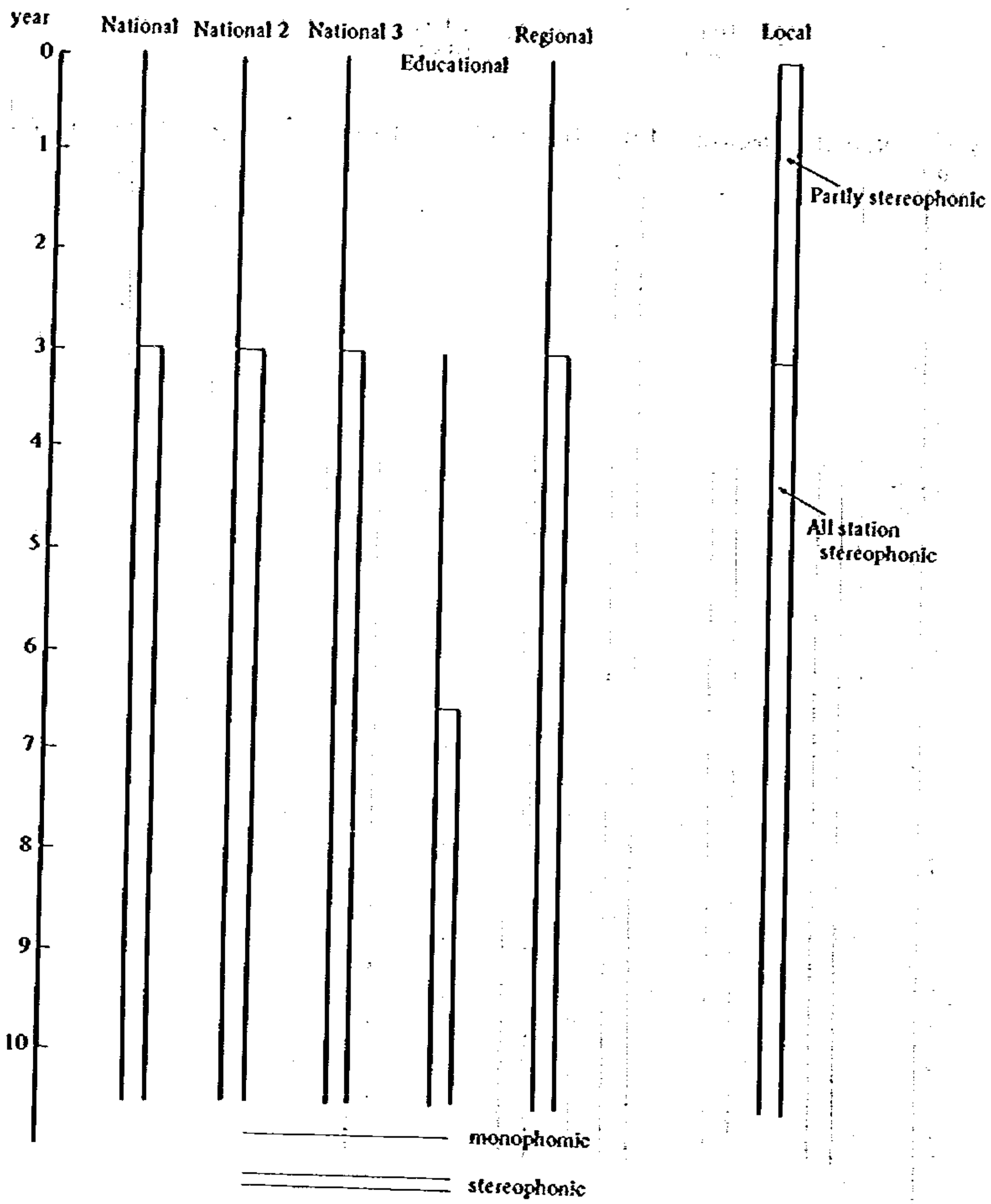


Fig. 7-3 Rental Line Operation Schedule

SECTION 8. PROGRAMME TRANSMISSION PLAN

SECTION 8. PROGRAMME TRANSMISSION PLAN

8-1 Basic way of thinking about the design of programme transmission system

The design of programme transmission system is based on the following basic concept.

(1) The national programme is sent from peninsular Malaysia, and its transmission is by submarine cable and the communications satellite (PALAPA Which has beeing leased from Indonesia).

As the transmission by submarine cable is analog and its link length is more than 700 km, a phase difference will be caused by relay amplifier in both L/R independent transmission and sum/difference transmission, so that stereophonic transmission is considered to be impossible.

On the other hand, 1 TV channel, 72 telephone channels and 2 telegraph channels are actually secured for the satellite.

One channel for FM stereophonic programme corresponds to the capacity of 10 telephone channels, and a 4-channel FM stereophonic programme needs 40 telephone channels. Accordingly, it is thought that the exisiting telephone lines will suffice for the purpose. Furthermore, with regard to the PALAPA-B, a demand for 1 1/2 transponder has been submitted, and it is desired that the PALAPA-B's transmitting/receiving terminal equipment is prearranged for FM stereophonic.

As for the national programme, it goes through KOTA KINABALU Studio and KUCHING Studio that are regional programme originating stations, and so the earth stations of Kinarut and Sematan are used.

(2) In the national/regional programme line, the section using Off-Air relay for TV programme transmission adopts Off-Air relay and the other sections adopt the Telecom line.

(3) As for the transmission line from a Studio to a transmitting station, if the transmission distance is between 10 km and 50 km, a 2 GHz STL is proposed. This STL directly connects the RTM studio and the transmitting station. For the others, the Telecom line will be rented.

8-2 Composition of programme transmission line

Figs. 8-2-1 and 8-2-2 show the composition of programme transmission line for each section, and Table 8-2-1 shows the programme transmission network, including the exisiting TV links, between the studio and each transmitting station.

8-3 Design of Off-Air relay (for the technical standard, refer to 2-5-2)

The relaying by Off-Air relay is used for transmitting the national/regional programme from Lawa Mandau to Layang-Layang in Sabah where TV is actually used for Off-Air relay.

Table 8-3-2 shows the list of specifications for the FM relay in BAREO and BELAGA.

8-4 Design of STL lines (for the technical standard, refer to 2-5-2)

Table 8-4 shows the design of STL lines.

Table 8-2-1 Programme Transmission Network between the Studio and Each Transmitting Station

Station	Distance between studio and trans-mitting point (km)	Transmission means	Network	Present situation of TV link Studio → Telecom → Transmitting Point
1 KOTAKINABALU (Bt. Lawa Mandau)	16.6	2 GHz STL	N.R.L.E.	Microwave line
2 KUDAT (Bt. Kelapa)	2.8	Telecom line	N.R.L.E.	Line Microwave line
3 SANDAKAN (Trig Hill)	2.5	Telecom line	N.R.L.E.	Line Microwave line
4 TAWAU (Mt. Andrassy)	9.6	2 GHz STL	N.R.L.E.	Line Microwave line
5 TANBUNAN/KENINGAU (Layang-Layang)	59.0	Off-Air Relay Li Telecom line	N.R.L.E.	– Off-Air Relay
6 KUCHING (G. Serapi)	16.8	2 GHz STL	N.R.L.E.	Line Microwave line
7 BANDAR SRI AMAN (Bt. Temudok)	5.5	Telecom line	N.R.L.E.	Line Microwave line
8 SIBU (Bt. Singalang)	40.0	Telecom line	N.R.L.E.	Line Microwave line
9 MIRI (Bt. Lambir)	21.0	2 GHz STL	N.R.L.E.	Line Microwave line
10 BINTULU (Bt. Nyabau)	6.0	2 GHz STL	N.R.L.E.	– Microwave line
11 LIMBANG (Bt. Mas)	3.0	Telecom line	N.R.L.E.	Line Line
12 SARIKEI (Bt. Kayu Malam)	23.0	2 GHz STL	N.R.L.E.	– Microwave line
13. KAPIT (Kapit)	0.5	Telecom line	N.R.L.E.	– Line

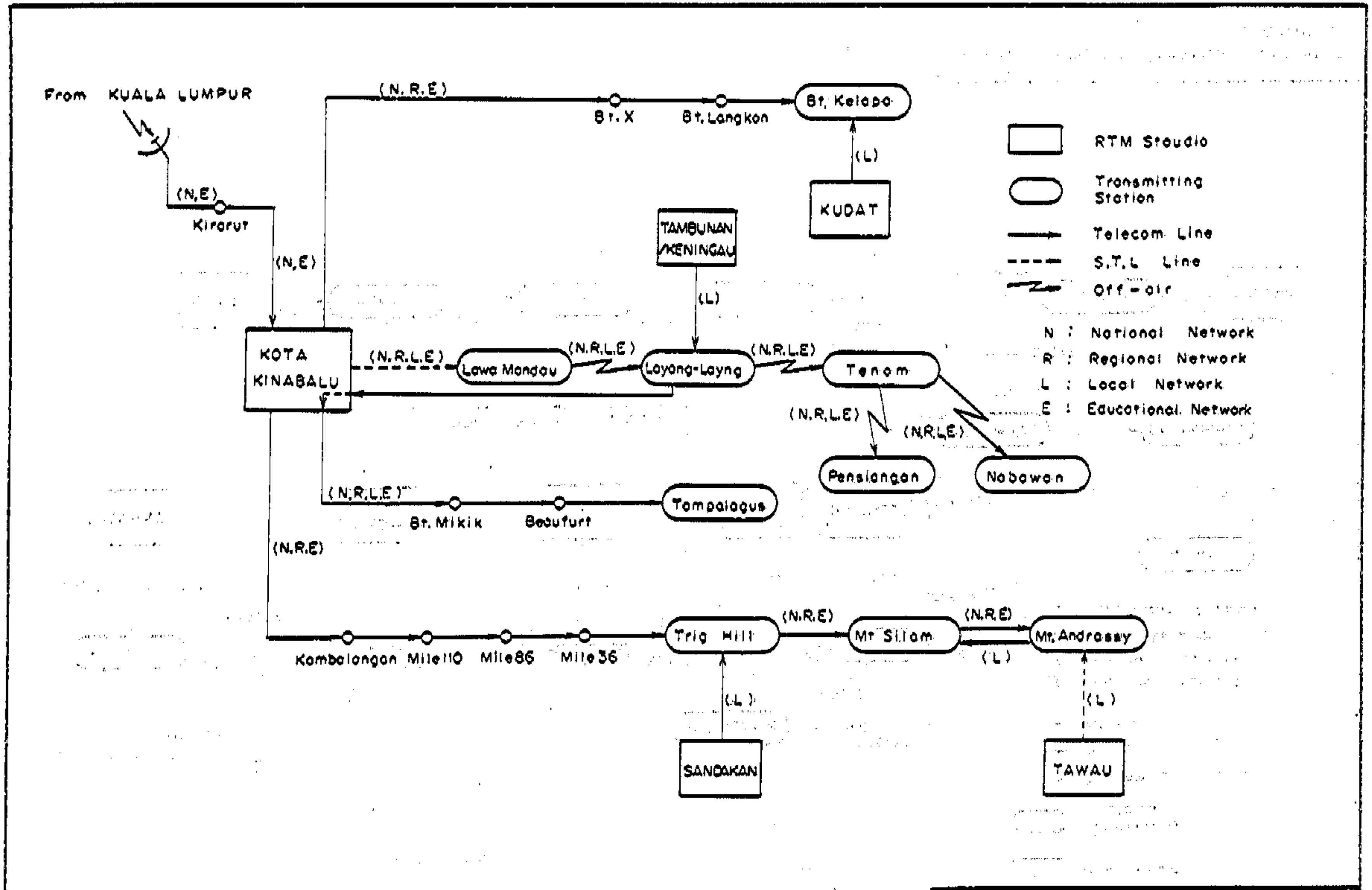


Fig. 8-2-1 PROGRAMME TRANSMISSION LINE SYSTEM (SABAH)

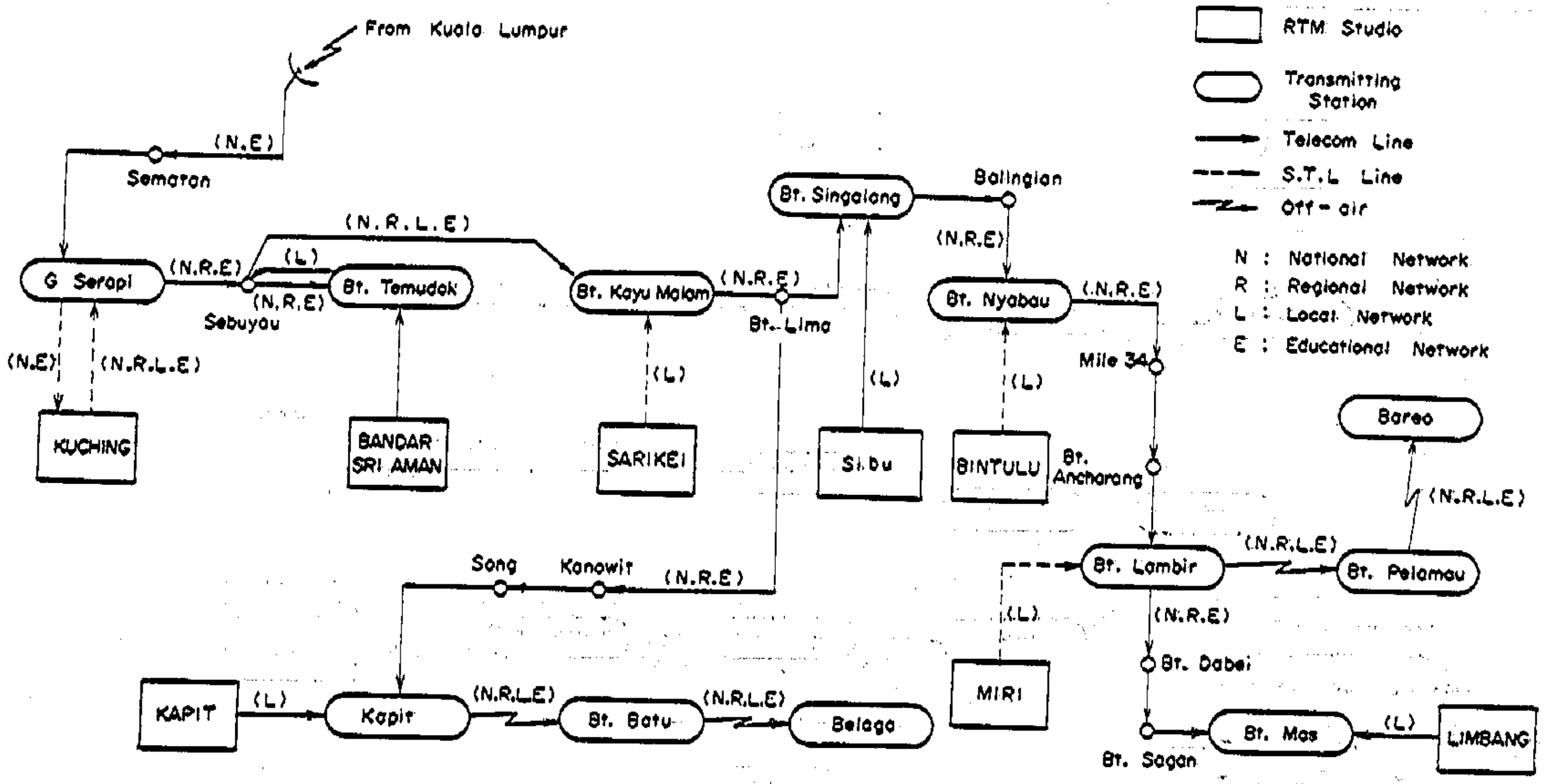


Fig. 8-2-2 Programme Transmission Line System (SARAWAK)

Table 8-3-2 Design of Off-Air Relay

	KOTA KINABALU → TAMBUNAN/ KENINGAU & RANAU	TANBUNAN/ KENINGAU → TENOM	TENOM → PENSIANGAN	MIRI → Bt. Pelamau	Bt. Pelamau → BAREO	KAPIT → Bt. BATU	Bt. BATU → BELAGA
Transmission distance (km)	38.5	118	59	95	67	90	57
Master station ERP (kW)	1.5	9.3	0.26	6	0.19	2.8	0.3
Master station receiving field strength (μv/m)	106	75	66	68	63	72	67
Fading (dB)	− 8	− 24	−12	−19	−13	−18	−11
Receiving antenna gain (dB)	11	11	11	11	11	11	11
Effective antenna length (dB)	0	0	0	0	0	0	0
Feeder loss (dB)	− 1	− 1	− 1	− 1	− 1	− 1	− 1
Distributor loss, etc. (dB)	− 16	− 16	−16	−16	−16	−16	−16
Minimum receiver capacity (dBl)	92	45	48	43	44	48	50

Table 8-3-3 Specifications of Bt. PELAMAU Station and Bt. BATU Station

Specification \ Transmitting station	Bt. PELAMAU Miri → Bareo						Bt. BATU Kapit → Belaga					
Class	N_1	N_2	N_3	R	L	E	N_1	N_2	N_3	R	L	E
Frequency f (MHz)	100.7	106.5	105.5	107.3	104.7	99.7	98.3	101.3	103.1	102.1	100.1	103.9
Channel CH	65	94	89	98	85	60	53	68	77	72	62	81
Position												
East longitude	114°51'02"						113°42'53"					
North latitude	3°56'48"						2°15'05"					
Altitude (m)	1322						2088					
Transmitter output (W)	100						100					
Receiving antenna	5Y x 2						5Y x 2					
Transmitting antenna												
Composition	2 dipoles, 2 stages, 2 Face						2 dipoles, 2 stages, 2 Face					
Open angle	Face A: 110°, Face B: 210°						Face A: 40°, Face B: 110°					
Power distribution ratio	Face A : Face B = 1 : 1						Face A : Face B = 1 : 4					
Gain (dB)	5.7						7.2					
ERP (W)	370						520					
AVR (KVA)	10						10					
ENG (KVA)	15						15					

Table 8-4 Design of STL Lines

	KOTA KINABALU → Bt. Lawa Mandau	TAWAU → Mt. Andrassy	KUCHING → G. Serapi	MIRI → Bt. Lambir	BINTULU → Bt. Nyabau	SARIKEI → Bt Kayu Malam
Transmission distance	16.6 km	9.6 km	16.8 km	21 km	6 km	23 km
Transmitter output	27 dBm (0.5W)	20 dBm (0.1W)	27 dBm (0.5W)	27 dBm (0.5W)	20 dBm (0.1W)	27 dBm (0.5W)
Transmitting antenna gain	29 (1.8mϕ)	29 (1.8mϕ)	29 (1.8mϕ)	29 (1.8mϕ)	29 (1.8mϕ)	29 (1.8mϕ)
Free space gain	−122 dB	−118 dB	−123 dB	−125 dB	−114 dB	−126 dB
Receiving antenna gain	29 (1.8mϕ)	29 (1.8mϕ)	29 (1.8mϕ)	29 (1.8mϕ)	29 (1.8mϕ)	29 (1.8mϕ)
Feeder loss	− 8 dB	− 8 dB	− 8 dB	− 8 dB	− 8 dB	− 8 dB
Distributor loss, etc.	− 6.5 dB	− 6.5 dB	− 6.5 dB	− 6.5 dB	− 6.5 dB	− 6.5 dB
Fading margin	− 3 dB	− 2 dB	− 3 dB	− 4 dB	− 1 dB	− 5 dB
Minimum receiver input power	−55 dBm	−57 dBm	−55 dBm	−59 dBm	−52 dBm	−61 dBm

SECTION 9. STAFF PLANNING

SECTION 9. STAFF PLANNING

9-1. Introduction

Now, in Malaysia, the broadcasting production, operation and transmission are performed in the form shown in Table 9-1-1. For studying the staff planning, it is necessary to assume an operating form. The assumption in Table 9-1-2 was made as an operation system for this project.

Table 9-9-1. Present Operation System

	Production	Operation	Transmission
AM broadcasting	RTM	RTM	RTM
Overseas	RTM	RTM	RTM
Educational AM broadcasting	PSP	RTM	RTM
TV broadcasting	RTM	RTM	Telecom*
Educational TV broadcasting	PSP	RTM	Telecom*

*(Note):- Lawa Mandau and Layang-Layang are operated by RTM.

Table 9-1-2. FM Broadcasting Operation System After Completion of This Project

	Studio		Transmission in maintenance
	Production	Operation	
FM national broadcasting (FM-1)	RTM	RTM	TELECOM
" (FM-2)	RTM	RTM	TELECOM
" (FM-3)	RTM	RTM	TELECOM
FM regional broadcasting (FM-4)	RTM	RTM	TELECOM
FM local broadcasting (FM-5)	RTM	RTM	TELECOM
FM educational broadcasting (FM-6)	PSP	RTM	TELECOM

(Note): Lawa Mandau and Layang-Layang are operated by RTM.

9-2. Personnel plan for the transmitting stations

At present, 10–20 technicians are assigned to each of the TELECOM's transmitting stations. But this does not mean that the above-mentioned number of technicians are regularly working at those transmitting stations; they are working on shifts.

In installing the FM transmitters, if the following points were taken into consideration, it would not be necessary to increase the number of staff members when the FM transmitters are installed in the existing TV tansmitting stations. However, an increase of one staff member on one shift per station is proposed for two reasons; the FM transmitter is a little different from TV transmitter in that the former is in stereo and on-the-job training will be necessary for the staff in charge.

Points Considered in the Estimation of the Required Number of Staff Members for a FM Transmitting Station

(1) FM transmitters are similar to TV transmitters and the FM transmitters is simpler than TV.
(2) New FM transmitters will became more stabilized.
(3) FM transmitters are installed in the same place as TV.
(4) In Japan, FM transmitting stations are unattendedly operated.

Nevertheless, it will slightly differ in respect of stereophonic broadcasting from the present TV facilities. In this respect, 4 technicians for 4 shifts per station (3 shifts + 1 person for holiday) and 2 indirect personnels will be added. In an unattended station and a new station, 6 persons will permanently be stationed at the nearest Telecom Substation as maintenance staff. Consequently, with regard to Telecom, the number of persons will be referred to table 9-2.

Table 9-2 Plan for Personnel Increase Following the Construction of FM Transmitting Stations

	Sabah	Sarawak	Total
(1) Existing attended TV transmitting stations	5 sites-TELECOM 2 sites-RTM	(6 sites)	(13 sites)
Technicians	28	24	52
Indirect personnel	14	12	26
(2) Existing unattended microwave relay stations	–	(2 site)	(2 site)
Technicians	–	8	8
Indirect personnel	–	4	4
(3) Newly-built transmitting stations	(3 sites)	(4 sites)	(7 sites)
Technicians	12	16	28
Indirect personnel	6	8	14
Total	60	72	132

9-3. Staff for regional studios

For the consideration of the number of operating persons, the same way of thinking as that for peninsular Malaysia is adopted as follows:

(1) A manual operation system is totally applied without adopting any automatic operation system.

(2) All educational broadcasting programmes are broadcasted by package. As for regional and local broadcasting, 70 %of the programmes are broadcasted by Package and the remaining 30 %are broadcasted direct from Programme Continuity Room with live programmes. As the job in the Programme Continuity Room consists mainly of the Continuity and quality check of broadcasting programmes, a minimum of 1 producer and 1 technician should be fixed during the On-Air time, and 1 announcer will be provided at need.

9-3-1. Operating staffs

The regional station has 3 Programme Continuity Rooms for regional broadcasting (FM4), local broadcasting (FM5) and educational broadcasting (FM6). Supposing that broadcasting of 10 hours is carried out every day, 2-shift is adopted for the operating staff. Its result is as follows:

(1) Staff for regional programme continuity room
    Producer : 2 shifts x 1 = 2 persons
    Technician : 2 shifts x 1 = 2 persons
(2) Staff for local programme continuity room
    Producer : 2 shifts x 1 = 2 persons
    Technician: 2 shifts x 1 = 2 persons
(3) Staff for educational programme continuity room
    Producer : 2 shifts x 1 = 2 persons
    Technician : 2 shifts x 1 = 2 persons
        Total Producer............. 6 persons
               Technician .... 6 persons

The above (6 persons + 6 persons) is the number of actual working persons without considering holidays.

Announcers do not need to continuously work in the Programme Continuity Room, but are required upon occasion only for a certain period of time. The holidays and announcers will be described together afterwards.

9-3-2. Staff for programme production studio

70 %of broadcasting programmes will be produced at regional stations and the possesive hour of a production studio for a programme production is needed 3.5 times of a programme broadcasting hour, therefore, the total hour for programme production at regional studio is estimated 50 hours as follows:

regional programmes (10 hours) + local programmes (10 hours) x 0.7 x 3.5 = 50 hours

Accordingly, the staff for programmes will be fixed in 5 studios. The programme producer has such work as programme planning, study on materials, collection of materials, etc. in addition to the studio work. Therefore, in the staff planning, it is supposed that three times as much time as the actual working time in the studio is required.

(1) Technicial
    chief: 2 shifts x 1 person x 5 rooms = 10 persons
    Assistant : 2 shifts x 1 person x 5 rooms = 10 persons
(2) Producer

Supposing that the On-Air time of a programme is 30 minutes, the time a producer stays in the studio is 30 minutes x 3.5 = 1 hour and 45 minutes.

If the actual daily working time of a person is supposed to be 7 hours, 5 hours and 15 minutes, excluding the time spent for the daily production of a programme, are assigned as the working time out of the studio.

It follows that the producer takes charge of a programme a day If 70% of daily broadcasting hours comprises 30 minute programmes, 28 programmes can be produced every day. As a result, a total of 28 producers is required. The number does not take holidays and announcers into account, as in the case of the staff for Programme Continuity Room.

9-3-3. Announcer

The announcer does not need to continuously work in the Programme Continuity Rooms or production studios, but is fixed in the relative studio only for the period of time that needs the announcer. Therefore, the number of announcers corresponding to half the number of studios will be on duty by 2 shifts.

Accordingly, the necessary number of persons is (Programme Continuity Room (3) + production studio (5)) x 1/2 x 2 shifts = 8 persons.

Table 9-3-4. Personnel-increase Plan for Regional Broadcasting Stations after Completion of this Project

	Actual work force	Additional personnel required if holiday is taken into account	Total
(1) Producers	34	34/7	39
(2) Technicians	26	26/7	30
(3) Announcers	8	8/7	9
Total	68	10	78

9-4. Staff for local studio

The local studio, unlike the regional station, only executes the braodcasting and production of local programmes. The calculation of number of persons has been made in the same way of thinking as in the case of regional studio referred as table 9-4.

Table 9-4. Personnel Plan for Local Broadcasting Stations after Completion of This Project

	Actual work force	Additional personnel if holiday is taken into account	Total
(1) Producer	16	16/7	18
(2) Technicians	10	10/7	12
(3) Announcers	3	3/7	4
Total	29	5	34

Furthermore, at the newly-build local stations, the following personnel would become necessary for the management of the stations.

The following types of fields are required as administrative staff for new FM broadcasting station.

(1) Station Manager: 1 person
(2) Technical department chief: 1 person
(3) Broadcasting department chief: 1 person
(4) General affairs department chief: 1 person

(5) Secretary: 5 persons
(6) General affairs department staff: 10 persons

9-5. Other supporting staff

Addition to the Staffs mentioned above, some supporting personnels for direct jobs of the programme production and transmitting, i.e., personnel for Administration, Training and Monitor, are needed. The 50 % of total number of the personnel as mentioned chapter 9-2 to 9-4 in this SECTION will be taken into account and it is calculated as 75 %, 20 % and 5 % of the 50 % of total number who are assigned for the direct jobs, as same thinking as in case of Peninsular Malaysia.

Table 9-5. Personnel Plan for Supporting Staffs

	Regional Stations	Existing Local Stations	New Local Stations
(1) Administration	156 persons x 50% x 75% = 59	170 persons x 50% x 75% = 64	318 persons x 50% x 75% = 119
(2) Training	156 persons x 50% x 20% = 16	170 persons x 50% x 20% = 17	318 persons x 50% x 20% = 32
(3) Monitor	156 persons x 50% x 5% = 4	170 persons x 50% x 5% = 4	318 persons x 50% x 5% = 8
Total	323 persons		

9-6. Total number of personnels including supporting staffs

The increasing of personnels after completion of this project is 1145 persons and Table 9-6 shows the Personnel-increase Plan by each department.

Table 9-6. Summary of Personnel-Increase Plans by Department

	Regional Stations (Kota Kinabalu; Kuching)	Existing Local Stations (Note 1)	New Local Stations (Note 2)	Sub Total
(1) Transmitting station personnel	TELECOM (20 stations) RTM (2 stations)		120 persons 12 persons	132 persons
(2) Broadcasting studio personnel				
a) Producers	39 persons x 2 stations = 78	18 x 5 = 90	18 x 6 = 108	
b) Announcers	9 x 2 = 18	4 x 5 = 20	4 x 6 = 24	644 persons
c) Technicians	30 x 2 = 60	12 x 5 = 60	12 x 6 = 72	
d) Administrative personnel	–	–	19 x 6 = 114	
(Sub total)	(156 persons)	(170 persons)	(318 persons)	
(3) Administration	156 persons x 75% = 59 persons	170 x 50% x 75% = 64	318 x 50% x 75% = 119	
(4) Training	156 x 50% x 20% = 16	170 x 50% x 20% = 17	318 x 50% x 20% = 32	323 persons
(5) Monitor	156 x 50% x 5% = 4	170 x 50% x 5% = 4	318 x 50% x 5% = 8	
TOTAL	1,099 persons			

Note 1. Bandar Sri Aman, Kapit, Sibu, Miri, Limbang.
Note 2. Kudat, Sandakan, Tawau, Keningau, Bintulu, Sarikei.

SECTION 10. CONSTRUCTION SCHEDULE

SECTION 10. CONSTRUCTION SCHEDULE

10-1. Enforcement schedule for the project

Both from financial and physical points of view, it would not be a practical idea to construct all the stations at a time. Hence, a plan is proposed to construct the 24 stations under Plan A in two phases. In Phase 1, the plan calls for construction of 15 stations on the same sites where either TV transmitting stations or TELECOM microwave relay stations stand. For those 15 stations, there is no need to construct the roads, which already exist. In Phase 2, nine stations under the 2nd Stage of Plan A will be added; of these nine, seven will have to be newly constructed, the remaining two being RANAU (Layang-Layang) and SARATOK (Bt. Kayu Malam). Therefore, as for the seven stations to be newly built, it will be necessary to start with the purchasing of the access roads and the grounds and then the construction of the roads and the leveling of the grounds.

As regards the construction periods, a total of seven years have been considered; 3 years for the Phase 1 and 4 years for the Phase 2, the latter being longer to give time to take care of the problem of the land on which the stations are to be built. This construction schedule is shown in Table 10-1. One of the reason it is set the construction period at seven years was that consideration had been given to the time required in giving training to the staff to be in charge of the operation of the FM stations, as well as the time to get the program transmission lines.

Before starting the construction of the stations, the preceding one year will have to be devoted to more detailed surveys and studies regarding each station by capable consultants and, needless to say, to the preparation of detailed blueprints and tender documents. Such work is extremely important in ensuring efficient progress of the entire project.

10-2. Consultant

The consultants will participate in the project from the 1st to the 2nd stages of the project and will assist TELECOM and RTM in the construction work.

The consultants' duties in each stage will be as follows:

1st stage: The consultants will conduct detailed on-site surveys and, according to the results of such surveys, will prepare tender-specifications.
After the tender is over, they will evaluate the tender documents submitted and will assist TELECOM AND RTM in their negotiations on and signing of contracts.

2nd stage: The consultants will examine the detailed blueprints submitted by the contractors.

3rd stage: Jointly with TELECOM and RTM, the consultants will conduct inspections of shipments from the contractors' factories.

4th stage: They will administer the progress of construction work, adjust the progress with that of the construction work in other sectors (e.g. construction of station buildings, service entrance wiring, etc.) and conduct inspections in the final stage of delivery.

Table 10 - 1 CONSTRUCTION SCHEDULE

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
1st stage							
1. Preparation 1) Consultant Contract 2) Detailed Survey and Detailed Design 3) Preparation of Tender Documents							
2. Tender							
3. Tender Evaluation							
4. Supplyer's Contract							
5. Approval for Drawings							
6. Building Construction							
7. Manufacturing the Equipment and Towers							
8. Transportation							
9. Installation							
10. Starting the Operation							
2nd Stage							
1. Preparation 1) Consultant Contract 2) Detailed Survey and Detailed Design 3) Preparation of Tender Documents							
2. Tender							
3. Tender Evaluation							
4. Supplyer's Contract							
5. Approval for Drawing							
6. Building Construction							
7. Manufacturing the Equipment and Towers							
8. Transportation							
9. Installation							
10. Starting the Operation							
A. Detailed Survey and Detailed Design for Access Road Construction		Land Acquisition					
B. Construction of the Access Road and Land Leveling for Transmitter Sites							

SECTION 11. CONSTRUCTION COST

SECTION 11. CONSTRUCTION COST

The construction cost for this project is approximately M$ 143,638,000.
This cost has been calculated under the following conditions:

(1) The prices used for this calculation are as of October, 1982, and those for equipment and construction materials are CIF MALAYSIAN PORT BY SEA.

(2) At the start time of this project, the value estimated in this report will be readjusted by economic fluctuation factors such as the rate of price increase, etc.

(3) The internal transportation cost in Malaysia (including warehouse charges) and the construction cost for access roads are not included in the estimate.

(4) Exchange rate: 1M$ = ¥100

The approximate total construction cost is as shown in Table 11-1.

Table 11-1 Estimated Construction Cost

CIF BY SEA, M$1000. (1M$ = ¥100)

	Cost of imported facilities	Installation Cost	Construction cost by Malaysian	Sub-total
Transmitting facilities	23,533.	3,336.		26,869.
Programme Transmission facilities	8,591.	897.		9,488.
Antenna & Feeder	2,609.	2,038.		4,647.
Control & Supervisary facilities	12,696.	974.		13,670.
Engine-Generator Unit	3,347.	4,670.		8,017.
Studio Facilities	14,645.	3,636.		18,281.
a) Regional Studio	(5,738.)	(1,023.)		(6,761.)
b) Local Studio	(8,907.)	(2,613.)		(11,520.)
Transmitter's Building			33,741.	33,741.
Steel Tower	1,894.		3,189.	5,083.
Consultancy Fee	4,200.			4,200.
Spare Parts	6,542.			6,542.
Contingency	13,100.			13,100.
Total				143,638.

SECTION 12. OPERATION COST

SECTION 12. OPERATION COST

12-1. Operation cost for transmitting stations

The operation cost for transmitting stations will be calculated by the ODM (Other Departments Maintenance) system in which RTM entrusts the service to Telecom in the same way as in peninsular Malaysia, and the following conditions are established.

(1) As described in SECTION 9, this project will bring about an increment of 4 persons per station and its rate of increase is about 20 %. However, as the FM broadcasting hours become 24 hours in the case of the national programme, unlike the existing TV, the personnel expenses are expected to be about 30 % of TV.

(2) For maintenance expenses, each TV station comprises 2 channels or 8 transmitters in total for video, audio and each standby system. On the other hand, in the case of FM, a total of 7 transmitters including the common standby unit, is used. Consequently, the maintenance cost of FM transmitter facilities are almost the same as that of TV transmitter facilities.

(3) As for fuel and miscellaneous expenses, there are kept 20 % proportional to the personnel expenses and 100 % proportional to the cost of facilities for TV, and so those for FM will be reduced to half.

By considering an average yearly economic growth rate of 7.6 % on the operation cost for peninsular Malaysia calculated under these conditions, the following figures per station can be obtained as the ODM budget of FM stations.

Personnel expeses	M$ 35,000.
Maintenance cost	M$ 80,000.
Fuel and miscellaneous expenses	M$ 25,000.
Total	M$140,000./year/station

The expenses for all FM transmitter station are as follows:

(a) Personnel expenses: 132 persons should be assigned for new FM transmitter stations to be established, as mentioned in SECTION 9 in this Report. The number of working site for them are 22, therefore,

M$ 35,000./site x 22 sites = M$ 770,000.

(b) Maintenance cost

b-1. Maintenance cost

M$ 80,000./station x 24 stations = M$ 1,920,000.

b-2. Fuel and miscellaneous expenses

M$ 25,000./station x 24 stations = M$ 600,000.

Total expenses for the Maintenance of all FM transmitter stations can be obtained as follows:

b-1 + b-2 = M$ 2,520,000./year

12-2. Line rental expenses

For calculating the line rental expenses, the following conditions are established for each line.

(1) All lines permit stereophonic transmission in the band of 15 kHz.

(2) The unit price for line rental is three times that in monophonic transmission at 10 kHz and ten times that in telephone line at 3 kHz, for both charging by distance and charging by terminal. This is because the frequency band is enlarged 1.5 times and the L/R 2 signal is transmitted.

(3) The connection with peninsular Malaysia is made by the PALAPA, and the expenses per 15 kHz stereophonic line is as follows:

KL → Kota kinabalu: M$ 2,820,000/year

Though there is no integration of satellite rental expenses between KL and Kuching, the satellite line between KL and Kota Kinabalu will be received in Sematan without establishing any specific rental expenses.

M$ 2,820,000.- of rental expenses is included with terminal rental expenses. One terminal expense is M$ 7,000.-.

Therefore,

(a) Rental expense per a line

M$ 2,820,000. − M$ 7,000. = M$ 2,813,000.

M$ 2,813,000. x 4 lines = M$ 11,252,000.

(b) Terminal expenses

M$ 7,000. x 4 lines x 2 ground stations = M$ 56,000.0

Total line rental expenses can be obtained as follows:

M$ 11,252,000. + M$ 56,000. = M$ 11,308,000.

(4) The yearly rental expenses for a 3 kHz telephone line in the States of Sabah and Sarawak are M$ 70,000.0 with a terminal, therefore, the rental expenses for a 15 kHz stereophonic line with a terminal are M$ 700,000./years.

Therefore,

(a) For National Programmes

M$ 700,000. x 3 lines = M$ 2,100,000.

(b) For Regional Programmes

M$ 700,000. x 1/2 x 2 lines = M$ 700,000.

(c) For Educational Programmes

M$ 700,000. x 1 line = M$ 700,000.

Total rental line expenses in the States of Sabah and Sarawak can be obtained as follows:

(a) + (b) + (c) = M$ 3,500,000./year.

(5) The rental expenses for a 15 kHz stereophonic Local line and a terminal are M$ 600. and M$ 7,000./year.

The 8 stations without using STL should prepared the programme transmission lines for FM

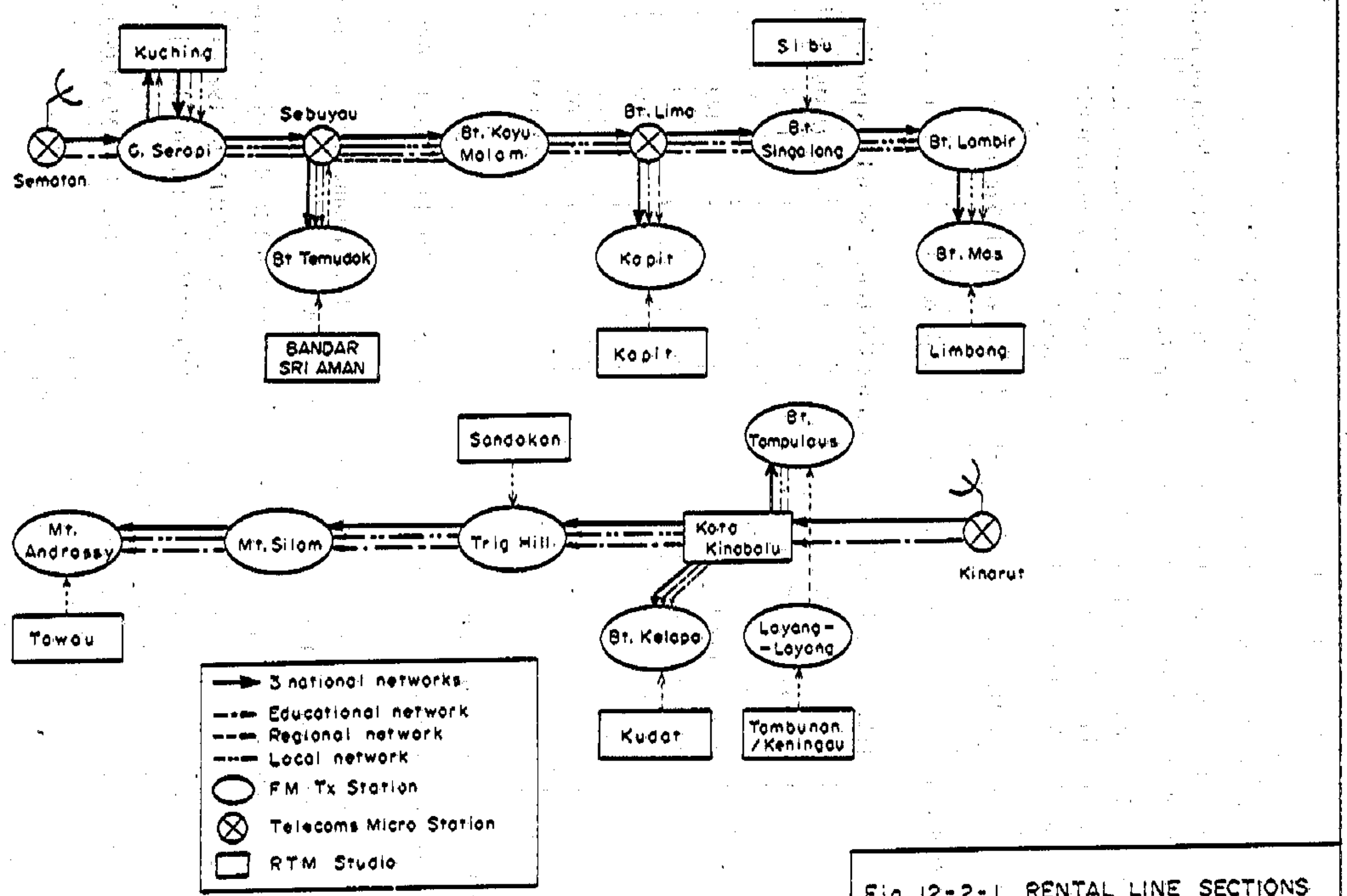


Fig. 12-2-1 RENTAL LINE SECTIONS

transmitter station from studio.

Therefore,

M$ 7,600. x 1 line x 8 stations = M$ 60,800./year

(6) The calculation of rental line expenses as mentioned above are based on route diagram of the programme transmission line as shown Fig. 12-2-1.

(7) Besides, the 3 lines of 10 kHz band will not be used after the completion of FM networks if existing broadcasting stations will broadcast as same programme as FM.

Therefore, M$ 700,000.- will be able to be cancelled.

$$3 \text{ lines} \times \text{M\$ } 700{,}000, \times \left(\frac{10 \text{ kHz}}{15 \text{ kHz} \times 2 \text{ lines}}\right) = \text{M\$ } 700{,}000./\text{year}$$

Under these above mentioned conditions, the yearly rental expenses are calculated as follows:

Table 12-2. Rental Expenses for the FM Transmission Lines per Year

Section	Lines	Cost (M$1000.)
K.L to East Malaysia	4	11,308.
Microwave lines in East Malaysia		
a) For National Programmes	3	2,100.
b) For Regional Programmes	2	700.
c) For Educational Programme	1	700.
City Lines for Local Programmes	8	60.8
3 lines for Programmes	3	-700.
TOTAL		14,168.8

12-3. Cost of programme production

The yearly expenses for programme production are calculated based on the following conditions:

(1) The production cost for the national and educational programmes are not necessary because of no production at the Studio in Sabah and Sarawak.

(2) Therefore, here, the production cost for the regional and local programmes is estimated.

(3) The production cost for radio programmes in the budget of RTM for 1981 is M$4,884,000 and the radio broadcasting hours per day of all the RTM network, excluding the educational broadcasting, are 138 hours and 25 minutes.

Consequently, the yearly budget per 1-hour programme will be about M$35,000.

According to SECTION 9, the broadcasting hours are:

(1) 2 regional programmes x 20 hours = 40 hours

(2) 13 local programmes x 10 hours = 130 hours

Total : 170 hours

Therefore, the increment caused by this project will be M$35,000 x 170 hours = M$6,000,000./year.

12-4. Personnel expenses

The yearly personnel expenses can be calculated on the basis of the number of persons in SECTION 9 and the budget of RTM for 1980. Table 12-4-1 shows the personnel expenses.

Table 12-4. Personnel Expenses for Persons Increased in this Project

(Unit: M$ 1000.)

	Budget for 1980	Number of 1980	Unit cost	Number of persons increased	Personnel expenses
Transmitter Stations	Telecoms & RTM			132*	770.
Administration	1,700.	675	2.5	338	840.
Programming	12,965.	1,496	8.7	356	3,100.
Engining	8,500.	1,214	7.0	192	1,340.
Training	1,220.	164	7.4	65	480.
Monitoring	250.	58	4.3	16	70.
TOTAL	—			1,099	6,600.

Note: This is an additional increment of 120 persons for TELECOMS and 12 persons for RTM.

12-5. Maintenance cost for studio facilities and others.

The estimation of maintenance costs for Studios concerned is very difficult because they have much unknown factors, but, it is enough to prepare approximately 5 % of total cost of equipment, (for yearly with average of the period to be kept equipment life).

The M$14,645,000. is estimated for the purchasing cost of studio equipment in the SECTION 11 hereinbefore. Therefore,

M$ 14,645,000. x 0.05 = M$ 732,250.

And maintenance cost for STL and Control & Supervisory equipment are estimated 10 % and 5 % of their purchasing cost. That is

(a) STL equipment

M$ 8,591,000. x 0.1 = M$ 859,100./year

(b) Control & supervisory equipment

M$ 12,696,000. x 0.05 = M$ 634,800./year

Therefore, M$ 732,250. + M$ 859,100. + M$ 634,800. = M$ 2,226,150./year.

12-6. The yearly maintenance and operation costs

Table 12-6 shows the yearly maintenance and operation costs to be compiled under these above mentioned calculation.

Table 12-6. Yearly Maintenance and Operation Costs

Items	Cost
Personnel Expenses	M$ 6,600,000.
(a) Transmitter station	(770,000.)
(b) Studio	(5,830,000.)
Programme Production	M$ 6,000,000.
Rental Expenses for Programme Transmission Lines	M$14,169,000.
Maintenance Cost	M$ 4,746,150.
(a) Transmitter station	(2,520,000.)
(b) Studio and Others	(2,226,150.)
TOTAL	M$31,515,150.

SECTION 13. BASIC STUDY FOR THE PLAN B

SECTION 13. BASIC STUDY FOR THE PLAN B

13-1 Site planning

The following has been taken into account in studying the Site Planning such as selection of transmitting points and transmitting conditions, so that Plan B can cover all the States of Sabah and Sarawak.

(1) Transmitting stations are effectively distributed by taking it into account that the existing TV transmitting stations are utilized as much as technically possible to raise the economical efficiency.

(2) Radio wave spill over to areas other than the specified is suppressed to the utmost, in order to secure many frequencies assignable to each transmitting station.

(3) Transmitting points are selected on the mountains in the neighborhood of towns as far as possible to facilitate the construction.

(4) As there are many towns along rivers, the radiational direction is set along the rivers.

Table 13-1 shows the results of the study on the Site Planning based on the above.

As a result, a total of 46 stations was selected as the necessary transmitting points; 13 stations to be established together in the existing broadcasting stations, 2 stations to be established together in the microwave relay stations and 31 new stations.

The coverage after the implementation of Plan B will become approximately 100% .

Table 13-1 List of Transmitting Stations for Plan B

District	Conditions / Stations	Position (East longitude North latitude)	Altitude (m)	Transmitter Power	Antenna (2-dipoles) Face x Stage	Direction	Power distribution Ratio	Gain (dB)	ERP
Pantai Barat	Kota Kinabalu (Bt. Lawa Mandau)	116°12'36" 6°02'42"	910	500W	4 x 2	35°, 90° 215°, 305°	4:1:4:1	4.7	1.5kW
	Ranau (Layang-Layang)	116°34'40" 6°03'37"	2758	100W	2 x 2	80°, 140°	1:1	5.7	370W
Kudat	Kudat (Bt. Kelapa)	116°50'14" 6°55'22"	138	1kW	3 x 8 1 x 2	10°, 100° 190°, 280°	4:4:4:1	9.1	8.1kW
	New Banggi Peak	117°05'18" 7°17'28"	520	10W	2 x 2	70°, 140°	1:4	7.8	60W
Sandakan	Sandakan (Trig Hill)	118°02'10" 5°48'50"	356	1kW	3 x 8 1 x 2	30°, 120° 210°, 300°	1:4:4:4	9.1	8.1kW
	S. Linkabau *1	117°01'12" 6°20'52"	960	50W	2 x 2	70°, 140°	4:1	7.8	300W
	Masasau	117°15'35" 5°59'30"	824	5W	4 x 2	50°, 140° 230°, 320°	1:1:1:1	2.8	10W
	Bt. Tangkunan	117°11'33" 5°38'31"	450	5W	3 x 2	0°, 90° 270°	1:1:1	4.0	13W

District	Conditions / Stations	Position (East longitude North latitude)	Altitude (m)	Transmitter Power	Antenna (2-dipoles)				ERP
					Face x Stage	Direction	Power distribution Ratio	Gain (dB)	
	S. Sinoa *1	117°12'14" 5°04'15"	1470	10W	3 x 2	60°, 180° 330°	1:1:1	4.0	25W
	S. Melikop *1	116°41'40" 5°01'02"	1205	10W	3 x 2	0°, 100° 200°	4:1:1	7.0	50W
	Mount Hatton	118°41'59" 5°14'47"	562	50W	2 x 2	20°, 90°	1:4	7.8	300W
Tawau	Tawau (Mt. Andrassy)	117°58'32" 4°20'00"	669	500W	3 x 2	100°, 190° 280°	1:1:4	6.9	2.4kW
	Lahad Datu (Mt. Silam)	118°09'34" 4°57'23"	944	500W	3 x 2	80°, 170° 260°	4:1:1	6.9	2.4kW
Pedalaman	Tambunan/Keningau (Layang-Layang)	116°34'40" 6°03'37"	2978	1kW	2 x 3	90°, 200°	1:4	9.7	9.3kW
	Sipitang (Bt. Tampulagus)	115°38'30" 5°08'54"	348	500W	3 x 2	30°, 210° 300°	4:1:4	5.3	1.7kW
	Pensiangan (G. Antulai)	116°20'42" 4°40'36"	1662	100W	2 x 2	100°, 190°	4:1	6.6	460W
	Tenom (G. Paling-Paling)	116°01'50" 5°06'26"	945	100W	3 x 2	130°, 210° 330°	4:4:1	4.1	260W
	Nabawan	116°23'19" 5°05'11"	995	100W	3 x 2	0°, 90° 160°	1:1:1	4.0	250W
	S. Saburan *1	116°51'16" 4°43'19"	1209	5W	2 x 2	60°, 180°	1:4	7.8	30W
	S. Slakutan *1	115°44'07" 5°03'06"	801	10W	4 x 2	60°, 180° 240°, 330°	1:4:1:1	6.4	44W
First Division	Kuching (G. Serapi)	110°08' 1°34'	928	1kW	4 x 2	15°, 105° 195°, 285°	1:4:4:4	4.5	2.8kW
Second Division	Bandar Sri Aman (Bt. Temudok)	111°27'08" 1°12'20"	292	1kW	3 x 2	80°, 260° 350°	1:1:1	4.3	2.7kW
	Saratok (Bt. Kayu Malam)	111°25'34" 1°56'28"	272	500W	1 x 2	230°	1	10.6	5.7kW
Third Division	Sibu (Bt. Singalang)	112°12'39" 2°27'11"	265	1kW	4 x 4	30°, 120° 210°, 300°	1:1:1:1	5.8	3.8kW
Fourth Division	Miri (Bt. Lambir)	114°02'40" 4°13'00"	298	1kW	3 x 4	110°, 200° 350°	4:4:1	7.8	6.0kW
	Bintulu (Bt. Nyabau)	113°04'47" 3°13'12"	259	5kW	3 x 2	50°, 140° 230°	1:1:1	5.0	16kW
	Bareo (Bareo)	115°25'55" 3°46'59"	1355	100W	1 x 2	180°	1	8.1	650W
	Bt. Pelamau	114°51'02" 3°56'48"	1322	100W	2 x 2	110°, 210°	1:1	5.7	370W

District	Conditions / Stations	Position (East longitude North latitude)	Altitude (m)	Transmitter Power	Antenna (2-dipoles)				ERP
					Face x Stage	Direction	Power distribution Ratio	Gain (dB)	
Fourth Division	Bt. Marigong	115°05'38" 3°31'12"	1440	5W	2 x 2	70°, 140°	1:1	5.8	19W
	Bt. Teh	114°54'54" 3°24'08"	940	5W	3 x 2	50°, 140° 230°	1:1:1	4.0	13W
	Bt. Liting	114°22'24" 3°31'05"	570	50W	3 x 2	10°, 130° 290°	1:4:4	5.3	170W
	Bt. Selikan	114°03'56" 3°30'33"	790	50W	3 x 2	140°, 210° 280°	1:4:4	5.3	170W
	Bt. Kanawang West 7km	114°43'43" 2°58'16"	1226	50W	3 x 2	30°, 120° 300°	1:1:1	4.0	130W
Fifth Division	Limbang (Bt. Mas)	115°00'27" 4°44'44"	297	500W	4 x 2	70°, 160° 250°, 340°	4:1:1:1	6.0	2.0kW
	Bt. Tiong	115°23'49" 4°51'52"	45	10W	2 x 2	60°, 150°	1:1	5.8	38W
	Bt. Pagon	115°19'09" 4°17'38"	1821	50W	3 x 2	30°, 150° 280°	1:1:1	4.0	130W
Sixth Division	Sarikei (Bt. Kayu Malan)	111°25'34" 1°56'28"	292	1kW	3 x 4	0°, 100° 230°	1:1:1	7.0	5.0kW
	K. Matu	111°28'40" 2°42'32"	5	500W	3 x 2	50°, 70° 290°	4:1:4	5.3	1.7kW
Seventh Division	Kapit (Kapit)	112°56'45" 2°00'50"	154	1kW	4 x 2	0°, 90° 180°, 270°	1:4:4:1	4.4	2.8kW
	Belaga (Belaga)	113°48'45" 2°44'54"	425	100W	2 x 2	90°, 220°	1:4	6.6	500W
	Song *2	112°33'08" 2°00'31"	149	500W	3 x 2	0°, 140° 200°	1:4:4	5.3	1.7kW
	Bt. Batu	113°42'53" 2°15'05"	2088	100W	2 x 2	40°, 110°	1:4	7.2	520W
	S. Semobong *1	113°49'05" 2°51'49"	840	10W	2 x 2	60°, 220°	4:1	7.8	60W
	Bt. Talang	114°07'10" 2°40'10"	837	50W	2 x 2	70°, 140°	1:1	5.8	190W
	Bt. Wong	113°02'44" 2°12'03"	318	100W	2 x 2	50°, 120°	1:1	5.8	380W
	Bt. Majau	113°27'02" 1°54'15"	618	100W	2 x 2	100°, 220°	1:1	5.8	380W

Note: *1 – upper stream
*2 – (will be established in the same site of microwave relay station)

13-2 Frequency assignment

As a result of the frequency assignment under the same conditions described in SECTION 3, the number of frequencies assignable to each station has been 3 in the major cities, and 2 in the other local areas, Table 13-2-1 shows the frequency assignment.

13-3 Transmitting facilities and antenna

The study on the transmitting facilities was made under th same conditions described in SECTION 5.

Table 13-3 shows the composition of transmitting equipment for stations other than those listed in Plan A (SECTION 5), and Fig. 13-3 shows the system diagram.

13-4 Programme transmission line

For the programme signal to be supplied, the 22 stations from within these the 46 stations, i.e., other than 24 stations, which have been studied for the Plan A in the SECTION 3, will receive the programme signal from the higher rank transmitter station (mother station) by means of Off-Air relay as well as direct receiving of the communication Satellite.

Fig. 13-5 shows the programme relaying system for them.

Table 13-2-1 Frequency Assignment for Plan B

Station \ Frequency (CH)	f1	f2	f3
KOTA KINABALU (Bt. Lawa Mandau)	88.1 MHz	88.9 MHz	89.9 MHz
RANAU (Layang-Layang)	104.5		
KUDAT (Bt. Kelapa)	94.1	94.9	89.5
New Banggi Peak	98.1	98.9	
SANDAKAN (Trig Hill)	91.1	92.1	102.1
S. Linkabau *	95.9	96.7	
Masasau	92.9	94.3	
Bt. Tangkunan	95.1	96.1	
S. Sinoa *	106.3	89.7	
S. Melikop *	95.7	97.1	
Mt. Hatton	87.9	88.7	
TAWAU (Mt. Andrassy)	93.9	94.7	89.1
LAHAD DATU (Mt. Silam)	90.5	91.7	92.5

Note: * – Upper Stream

Frequency (CH) / Station	f1	f2	f3
TAMBUNAN/KENNINGAU (Layang-Layang)	99.5 MHz	100.3 MHz	98.5 MHz
SIPITANG (Bt. Tampalagus)	95.5	96.5	97.9
PENSIANGAN (G. Antulai)	102.7	103.5	104.9
TENOM (G. Paling-Paling)	88.5	89.3	92.3
NABAWAN (Sikatin)	101.1	101.9	103.1
S. Saburan *	106.7	105.7	
S. Slakutan *	90.3	91.1	
KUCHING (G. Serapi)	92.7	88.1	88.9
BANDAR SRI AMAN (Bt. Temudok)	107.1	99.5	100.3
SARATOK (Bt. Kayu Malam)	89.5		
SIBU (Bt. Singalang)	93.3	94.1	95.1
MIRI (Bt. Lambir)	91.9	92.7	88.1
BINTULU (Bt. Nyabau)	94.7	96.7	97.5
BAREO (Bareo)	92.5	87.9	88.7
Bt. Pelamau	100.7	105.5	106.5
Bt. Mengong	89.7	90.5	
Bt. Teh	107.3	104.7	
Bt. Liting	90.7	99.7	
Bt. Selikan	88.9	89.9	
Bt. Kanawang 7km to the West	91.7	97.7	
LIMBANG (Bt. Mas)	97.1	98.5	101.5
Bt. Tiong	102.3	103.3	
Bt. Pagon	99.1	99.9	
SARIKEI (Bt. Kayu Malam)	91.5	92.3	93.7
K. Matu	95.9	97.1	

Note: * – Upper Stream

Station \ Frequency (CH)	f1	f2	f3
KAPIT (Kapit)	90.7 MHz	91.9 MHz	92.7 MHz
BELAGA (Belaga)	93.1	88.5	89.3
Song	89.9	97.7	
Bt. Batu	98.3	101.3	103.1
S. Semobong *	90.3	92.3	
Bt. Talang	91.1	98.9	
Bt. Wong	99.3	100.5	
Bt. Majau	88.1	88.9	

Note: * – Upper Stream

Table 13-3 (1) Composition of Transmitting Equipment

Composition \ Station		KUDAT	SANDAKAN					
		New Banggi Peak	S. Linkabau *	Masasau	Bt. Tangkunan	S. Sinoa *	S. Melikop *	Mount Hatton
Network		2	2	2	2	2	2	2
Trans-mitter	Composition	10W x2(1)	50W x 2(1)	5W x 2 (1)	5W x 2 (1)	10W x 2(1)	10W x 2(1)	50W x 2(1)
	Type	C	C	C	C	C	C	C
Antenna	Feeder	20D, 40m x 2	20D, 40m x 2	20D, 40m x 2	20D, 40m x 2	20D, 40m x 2	20D, 40m x 2	20D, 40m x 2
	Composition of Antenna	2.2D x 2	2.2D x 2	2.2D x 4	2.2D x 3	2.2D x 3	2.2D x 3	2.2D x 2
Power Supply		5 KVA	10 KVA	5 KVA	5 KVA	5 KVA	5 KVA	10 KVA

Note: * – Upper Stream

Table 13-3 (2) Composition of Transmitting Equipment

Composition \ Station		PEDALAMAN		4th				
		S. Saburan *	S. Slakutan *	Bt. Merigong	Bt. Teh	Bt. Liting	Bt. Selikan	Bt. Kanawang 7km to the West
Network		2	2	2	2	2	2	2
Transmitter	Composition	5W x 2 (1)	10W x 2(1)	5W x 2 (1)	5W x 2 (1)	50W x 2(1)	50W x 2(1)	50W x 2(1)
	Type	D	D	D	D	D	D	D
Antenna	Feeder	20D, 40m x 2	20D, 40m x 2	20D, 40m x 2	20D, 40m x 2	20D, 40m x 2	20D, 40m x 2	20D, 40m x 2
	Composition of Antenna	2.2D x 2	2.2D x 2	2.2D x 2	2.2D x 3	2.2D x 3	2.2D x 3	2.2D x 3
Power Supply		5 KVA	5 KVA	5 KVA	5 KVA	10 KVA	10 KVA	10 KVA

Note: * – Upper Stream

Table 13-3 (3) Composition of Transmitting Equipment

Composition \ Station		5th		6th	7th				
		Bt. Tiong	Bt. Pagon	K. Matu	Song	S. Semobong *	Bt. Talang	Bt. Wong	Bt. Majau
Network		2	2	2	2	2	2	2	2
Transmitter	Composition	10Wx2(1)	10Wx2(1)	500Wx2 (1)	500Wx2 (1)	10Wx2(1)	50Wx2(1)	100Wx2 (1)	100Wx2 (1)
	Type	D	D	D	D	D	D	D	D
Antenna	Feeder	20D, 40mx2	20D, 40mx2	39D, 40mx2	39D, 40mx2	20D, 40mx2	20D, 40mx2	20D, 40mx2	20D, 40mx2
	Composition of Antenna	2.2Dx2	2.2Dx3	2.2Dx3	2.2Dx3	2.2Dx2	2.2Dx2	2.2Dx2	2.2Dx2
Power Supply		5 KVA	5 KVA	35 KVA	35 KVA	15 KVA	20 KVA	20 KVA	20 KVA

Note: * – Upper Stream

13-5 Transmitter Building and Steel Towers

As for the technical standard, structure and finish for the buildings and towers, the same conditions described in SECTION 2 and 6 were adopted.

The station building is one-storied and is provided with a transmitter room, a generator room, etc.

The tower is of self-supporting type and 30 m high as shown in Fig. 13-4. An area of about 500 m^2 is needed for the site.

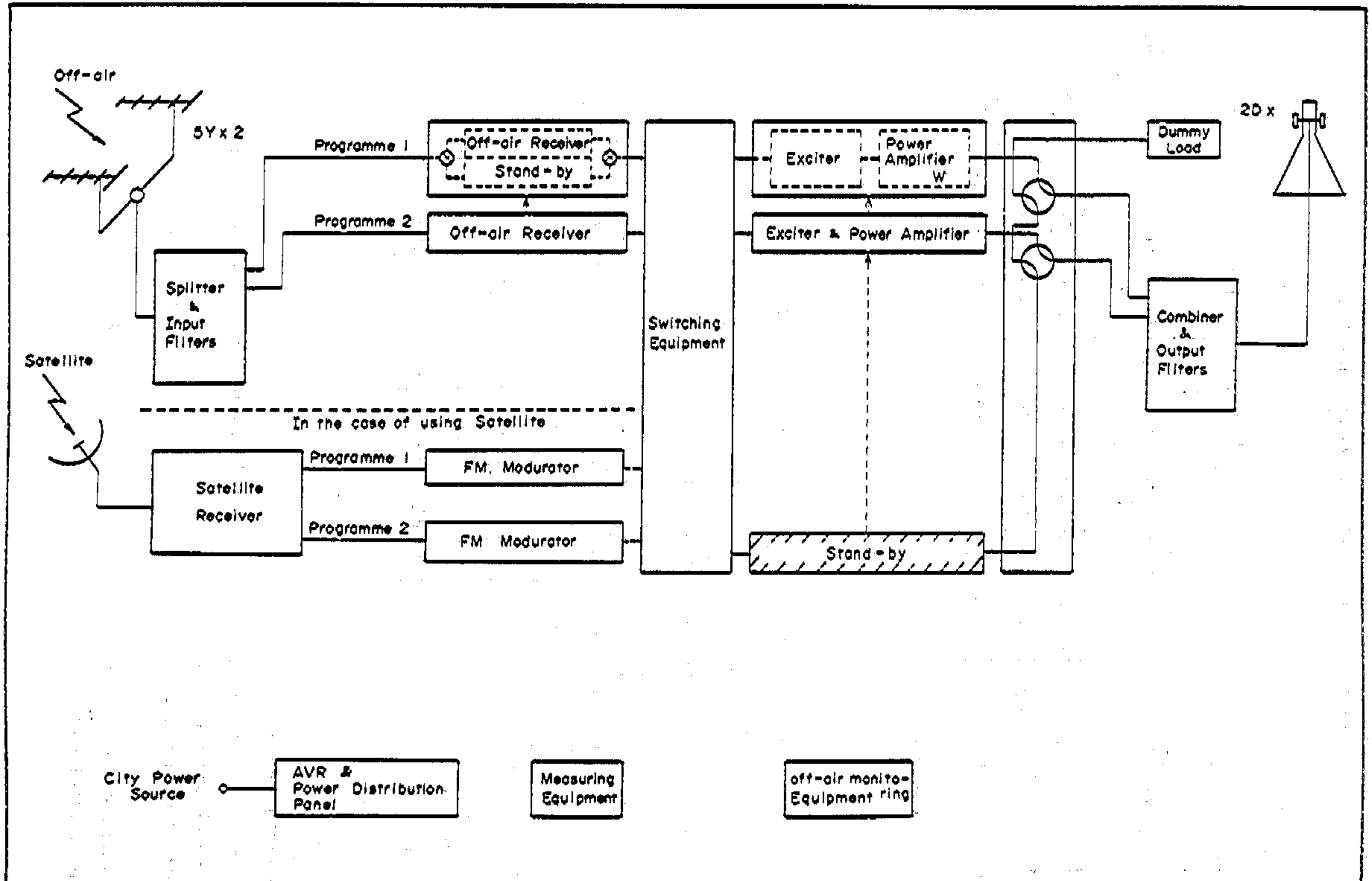


Fig. 13-3 Schematic Diagram of PLA Station

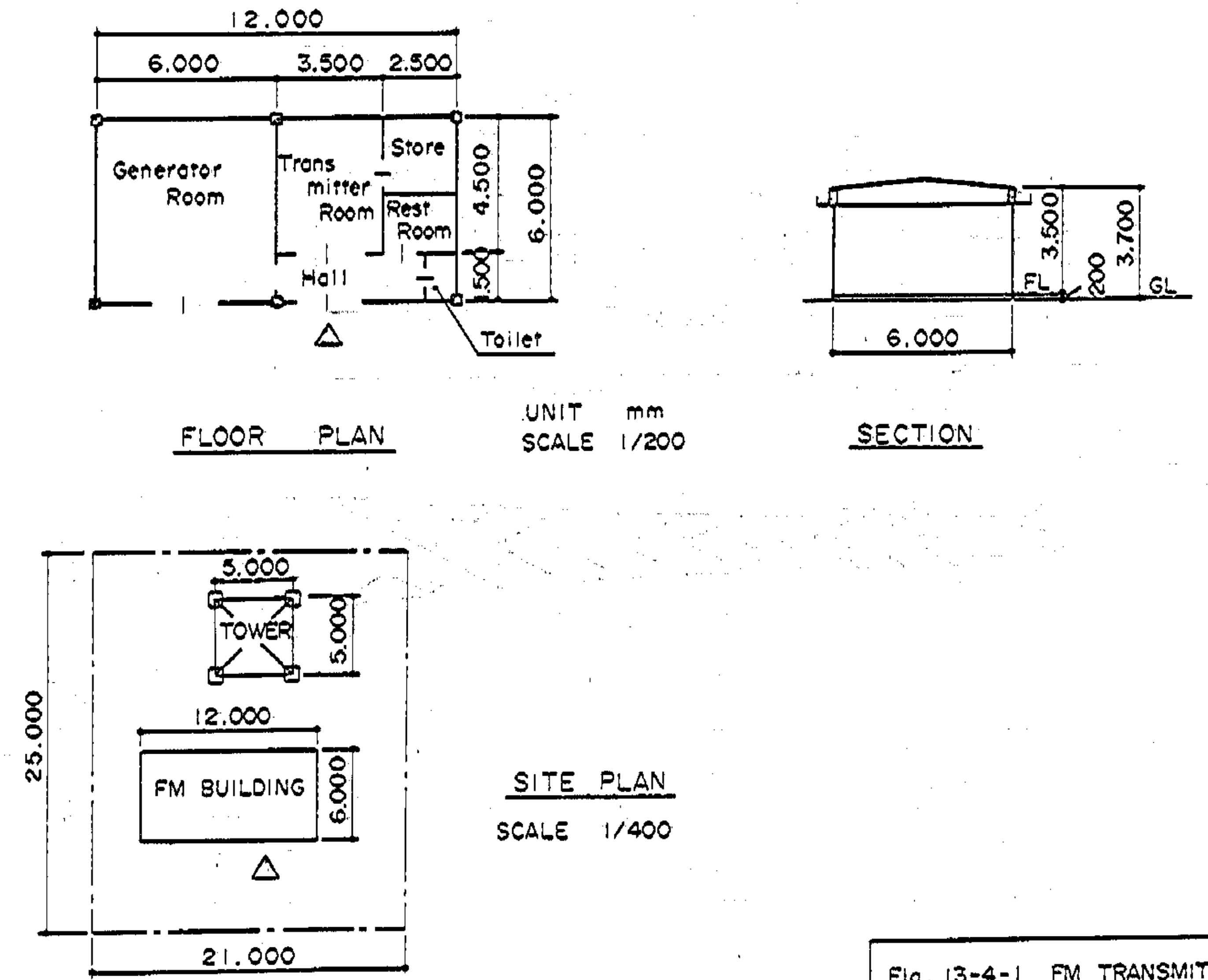
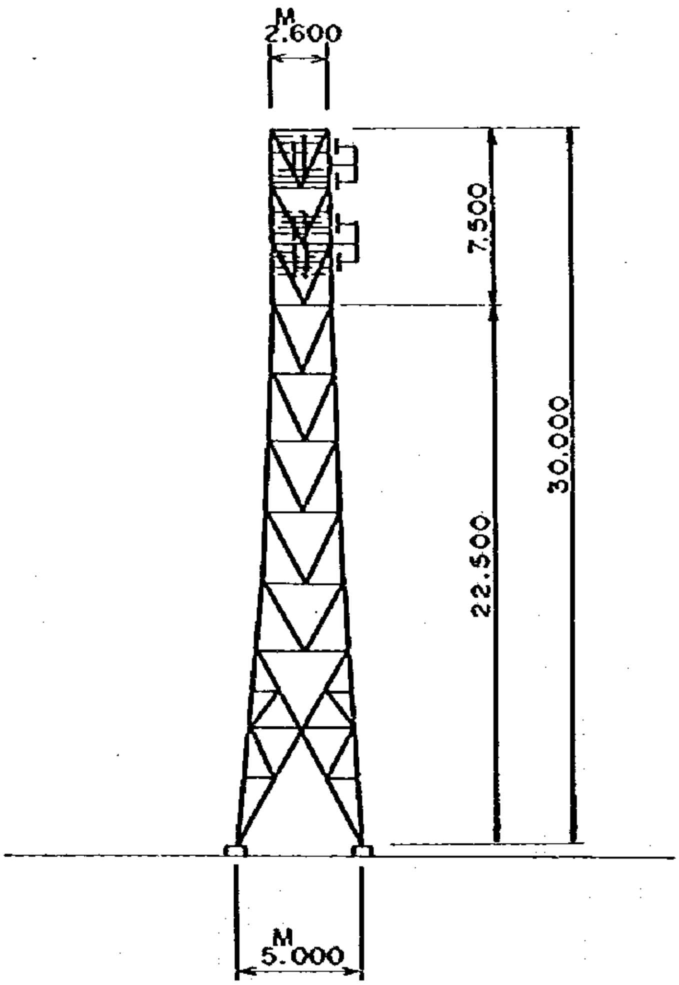


Fig. 13-4-1 FM TRANSMITTING STATION (PLAN B)



30M TOWER

Fig. 13-4-2 FLOOR PLAN, SITE PLAN & OUTLINE OF TOWER (BT. SEMBILAN)

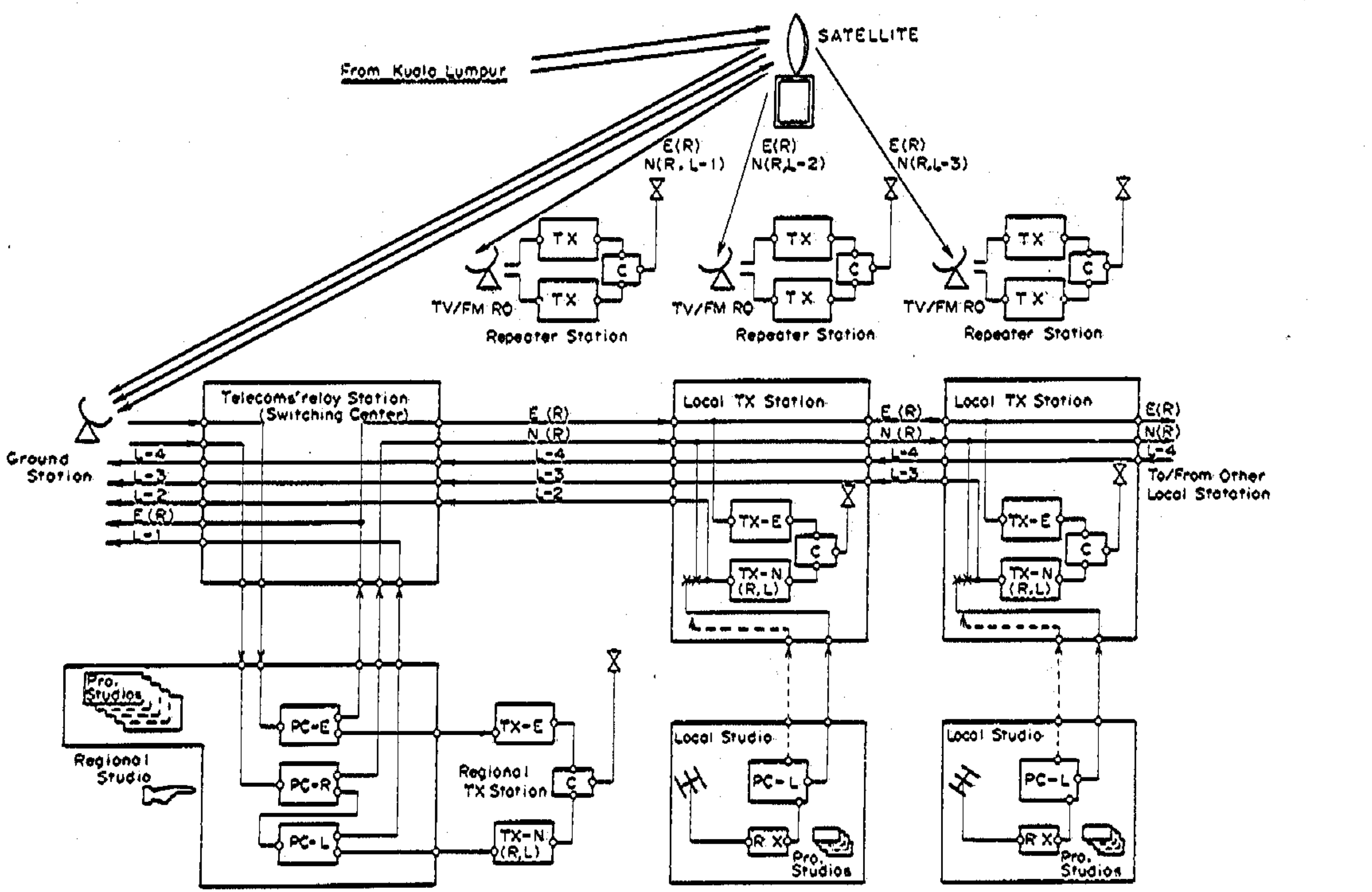


Fig 13-5 SECHEMATIC DIAGRAM FOR BROADCASTING SYSTEM CASE OF PLAN-B

SECTION 14. PROJECT EVALUATION

SECTION 14. PROJECT EVALUATION

In the States of Sabah and Sarawak, Malaysia, the sound broadcasting today does not yet cover the entire regions. While such measures as raising the output or building more stations in the existing mediumwave broadcasting service can be considered as one way of expanding the service area, the realization of such measures has been made extremely difficult by the international condition of frequency availability. Moreover, because of its innate characteristics, the medium-wave broadcasting has a number of shortcomings in its being used to provide adequate local services and, in view of the Malaysian Government's plan being to reinforce regional and local sound broadcasting services, it is quite difficult to place expectations on medium-wave broadcasting. Furthermore, from the listeners' side, hopes are raised increasingly for higher quality in sound broadcasting service.

In view of such circumstances as outlined above, it have come to believe that it would be a wise measure to take if we were to promote the plans to establish an FM broadcasting network by introducing the latest technologies, especially at the present stage in the world where the technological developments in various aspects of FM broadcasting, such as, the studio equipment, transmitter and program transmission system, have already reached a level high enough to be able to meet the expectations of the radio listeners in this country.

As a result of the survey conducted for this project, a conclusion has been reached that, under the station-establishment plan which is based mainly on the distribution of population (Plan A), a VHF/FM broadcasting system with six channels would be feasible. This conclusion coincides with the Frequency Plan given in the "Report on the Feasibility Study for the Plan to Establish an FM Broadcasting Network in Malaysia", the report which was prepared in March 1981 under the Japanese Government's technical assistance program. And from the point of view of broadcast programing plans, it will be feasible to promote this project as a part of Malaysia's national development plans.

Also, in the station-establishment plan to cover the entire regions in the States of Sabah and Sarawak (Plan B), too, it has been confirmed that it will be possible to secure frequencies for VHF/FM broadcasts on 2–3 channels at 44 sites (46 stations). When we consider the program transmission route under Plan B, the need will arise of constructing new microwave routes for some of the sites, but when the demand from telephone service is not so large, the programme transmission route using communication satellite and TV/FM-RO can be considered.

In either case – whether it was to promote the project under Plan A or Plan B – a huge amount of construction expenses will be required, as explained in the previous SECTION in this Report. Besides, careful thought will have to be given to the operational expenses and personnel costs required after the construction. For those reasons, it will be desirable to carry out this construction plan over a period of a number of fiscal years and in stages.

As mentioned above, the social benefits that can be secured as a result of the execution of this FM project are expected. Thus, it can be concluded that this FM network project will be an extremely significant one in various ways; in terms of economic or cultural effects, or as the basis on which to carry on social development.

ANNEX - 1

ANNEX - 2

CONTENTS OF ANNEX - 1

CONTENTS OF ANNEX - 2

ANNEX - 1

RECOMMENDATION 412-2*

STANDARDS FOR FM SOUND BROADCASTING AT VHF

(1956–1959–1963–1974–1978)

The CCIR

UNANIMOUSLY RECOMMENDS

that for frequency-modulation sound broadcasting in band 8 (VHF):

1. the maximum frequency deviation should be either ±75 kHz or ±50 kHz;

2. the pre-emphasis characteristic should be defined as a curve rising with frequency in conformity with the admittance of a parallel combination of a capacitance and a resistance having at time constant of either 50 or 75 μs;

3. in the absence of interference from industrial and domestic equipment:

3.1 a field strength (measured 10 m above ground level) of at least 50 μV/m can be considered to give an acceptable monophonic service;

3.2 a field strength of at least 250 μV/m (measured 10 m above ground level) can be considered to give an acceptable stereophonic (pilot-tone system, as defined in Recommendation 450) service if a directional antenna with appreciable gain is used;

4. in the presence of interference from industrial and domestic equipment**, a satisfactory service requires a median field strength (measured 10 m above ground level) of at least:

4.1 for the monophonic service
- 0.25 mV/m in rural areas,
- 1 mV/m in urban areas,
- 3 mV/m in large cities;

---

* 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 §5.3 which sets out the problems which will arise if the required design characteristics of such receivers are not met.

** For the limits of radiation from such equipments refer to the relevant CISPR Recommendations.

4.2 for the stereophonic service

- 0.5 mV/m in rural areas,
- 2 mV/m in urban areas,
- 5 mV/m in large cities;

5. the radio-frequency protection ratios required:

5.1 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.

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

The protection ratios at important values of the frequency spacing are also given in Table 1.

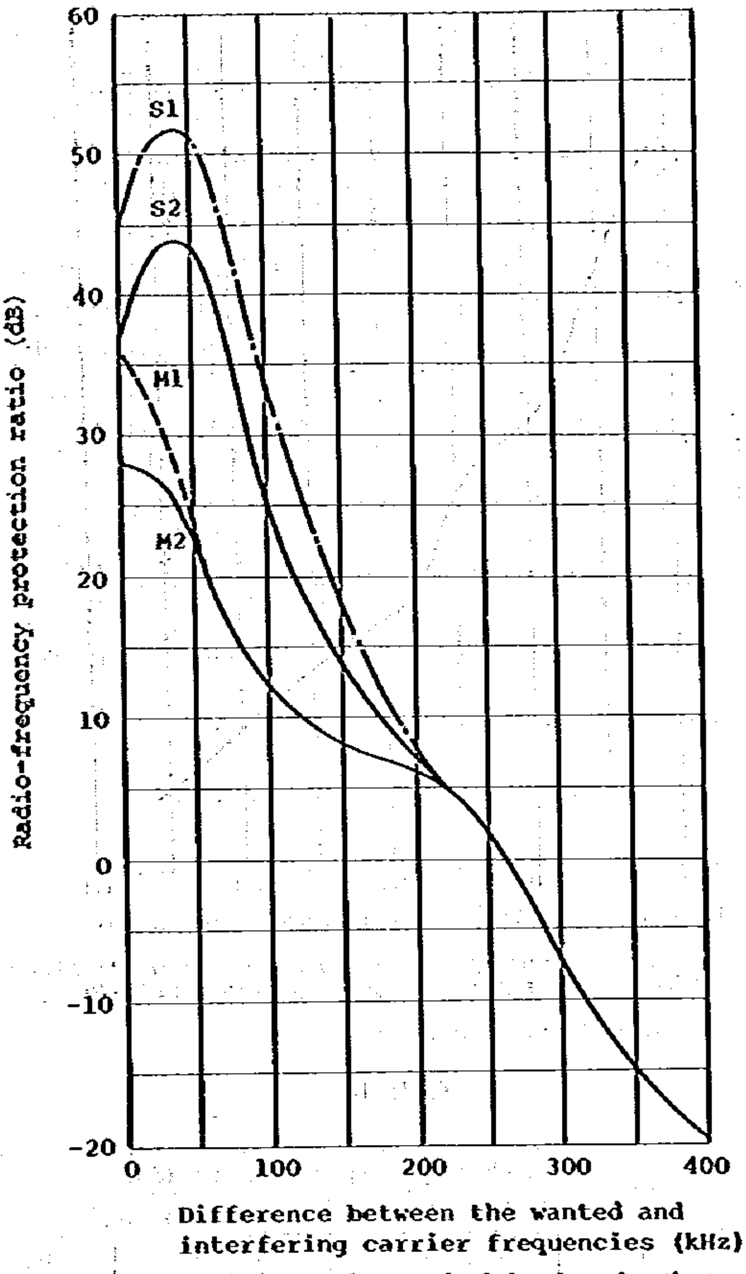


Fig. 1. Radio-frequency protection ratio required by broadcasting services in bands 8 (VHF) at frequencies between 87.5 MHz and 108 MHz using a maximum frequency deviation of ± 75 kHz

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)

(CCIR Rec. 412-2)

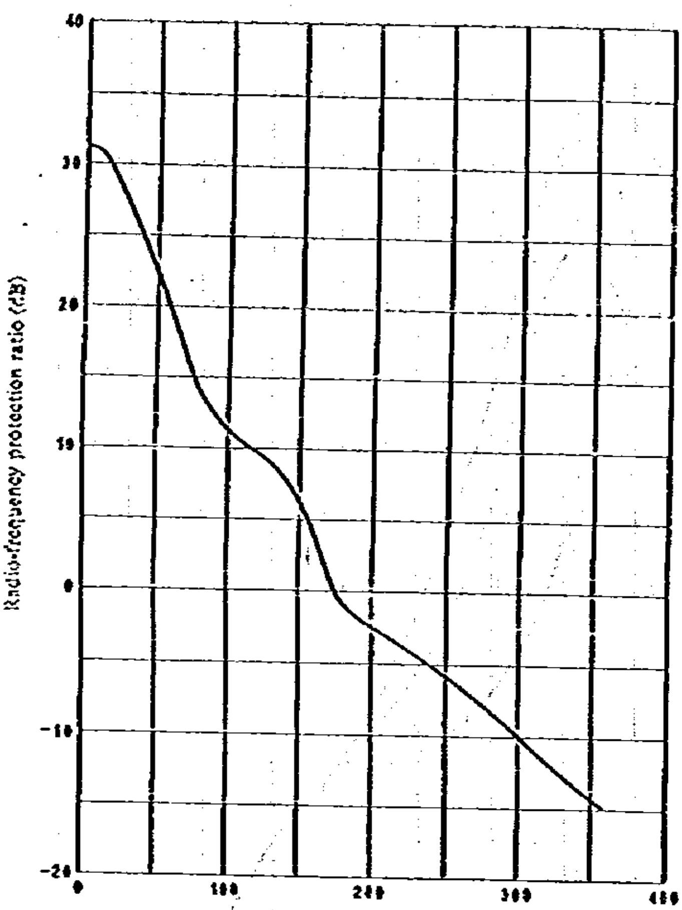


Fig. 2. – *Radio-frequency protection ratios for monophonic sound broadcasting in band 8 (VHF) at frequencies below 87.5 MHz using a maximum frequency deviation of ± 50 kHz*

Tropospheric interference (protection for 99% of the time)

Table 1

Frequency spacing, (kHz)	Radio-frequency protection ration (dB)			
	Monophonic		Stereophonic	
	Steady interference	Troposheric 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

5.2 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 ratios at important values of the frequency spacing are also given in Table 1.

5.3 The protection ratios for stereophonic broadcasting assume the use of a low-pass filter following the frequency-modulation demodulator designed to reduce interference and noise at frequencies greater than 53 kHz. 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.

Note: 1. 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 293-4, particularly Table 1 and Figs. 2, 3 and 4.

2. The protection ratios for steady interference provide approximately 50 dB signal-to-noise ratio (r.m.s. weighted, reference signal at maximum frequency deviation).

3. It should be noted that a modulation compression of the interfering signal of, for example, 6 dB may require an increase in the protection ratio of about 6 dB, when the frequency spacing is of the order of 100 kHz. In consequence, the use of modulation compression would increase the effect of interference to other stations, especially at a separation of 100 kHz.

RECOMMENDATION 450-1

SYSTEMS FOR FREQUENCY-MODULATION STEREOPHONIC BROADCASTING IN BAND 8 (VHF)

(1966)

The CCIR,

CONSIDERING

(a) that it is technically possible to transmit stereophonic programmes by a single frequency-modulation transmitter;

(b) that, as far as possible, the introduction of these transmissions should not impair any aspects of existing monophonic reception.

(c) that such transmissions should be capable of rendering a high quality of stereophonic reproduction;

(d) that several systems exist that fulfil these requirements and are compatible within the definition contained in Question 15/10;

(e) that theoretical studies as well as experiments have been carried out with a number of these systems;

(f) that favourable operational results have been obtained with only two of the systesm (see Report 300-4);

(g) that intercontinental standardization would enhance the development of stereophonic broadcasting,

UNANIMOUSLY RECOMMENDS

That stereophonic transmissions in band 8 (VHF) should be made, using one of the two systems defined by the following specifications which concern components of the signal used to frequency-modulate the transmitter;

1. Polar-modulation System
(maximum frequency deviation: ±50 kHz or ±75 kHz).

1.1 a compatible signal, M, equal to one half of the sum of the left-hand signal, A, and the right-hand signal, B, produces deviation of the main carrier by not more than 80% of the maximum frequency deviation for monophonic transmission;

1.2 a signal, S, equal to one half the difference between the left-hand and right-hand signals is used to obtain the sidebands of an amplitude-modulated partly suppressed sub-carrier;

1.3 the frequency of the sub-carrier is 31 · 250±2 Hz;

1.4 the maximum modulation depth of the sub-carrier, before its suppression, is 80%;

1.5 the suppression ratio of the sub-carrier is −14 dB, the suppression is effected by a resonant circuit having a *Q*-factor of 100;

1.6 the residual sub-carrier produces a deviation of the main carrier which is 20% of the maximum frequency deviation for the monophonic transmission;

2. Pilot-tone System
(maximum frequency deviation: ±75 kHz or ±50 kHz).

2.1 a compatible signal M, equal to one half of the sum of the left-hand signal A, and the right-hand signal, B, produces a deviation of the main carrier of not more than 90% of the maximum frequency deviation for monophonic transmission;

2.2 a signal, S, equal to one half the difference between the left-hand and right-hand signals is used to obtain the sidebands of an amplitude-modulated suppressed sub-carrier. The sum of these sidebands produces a peak deviation of the main carrier of the same amount as the signal S would give if applied to the channel, M. The peak deviation is not more than 90% of the maximum frequency deviation for monophonic transmission;

2.3 the frequency of the sub-carrier is 38 000 ±4 Hz;

2.4 the residual sub-carrier produces a deviation of the main carrier of not more than 1% of the maximum frequency deviation for monophonic transmission;

2.5 a pilot signal having frequency equal to one half of that of the sub-carrier produces a deviation of the main carrier between 8% and 10% of the maximum frequency deviation for monophonic transmission;

2.6 the pre-emphasis of the signal S is identical with that of the compatible signal M;

2.7 the phase relationship between the pilot signal and the sub-carrier is such that when modulating the transmitter with a multiplex signal for which A is positive and B equals − 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;

2.8 if it is desired to transmit a supplementary monophonic programme simultaneously with a stereophonic programme and the maximum frequency deviation is ±75 kHz, the following additional specification applies:

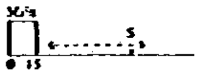
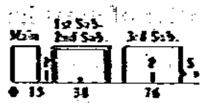
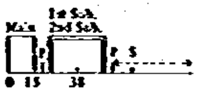
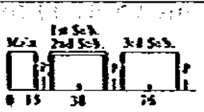
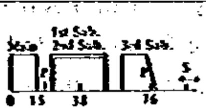
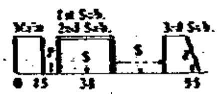
2.8.1 the stereophonic multiplex signal deviates the main carrier by not more than 90% of the maximum frequency deviation for monophonic transmission;

2.8.2 the instantaneous frequency of the frequency-modulated supplementary sub-carrier is within the range of 53 to 75 kHz;

2.8.3 the modulation of the main carrier by the supplementary sub-carrier is not more than 10%.

Note: (Added at the request of the Administration of Sweden). Countries which find it essential to use a stereophonic system capable of transmitting two separate monophonic programmes when the equipment is not used for stereophony (see Report 300-4, §2.1.8), may also take into consideration the FM/FM compressor/expander system described in §3.3 of the same Report.

The 4-channel Stereophonic System and SCA System as Examined by NQRC

System	Composite Signal	Sound Signal	Pilot Signal	SCA
Current (Φ_M) Mono		Master : M"	————	67kHz, 30%
Current (Φ_B) 2-channel STEREP		Master : M' Sub : Y" (36kHz, sin, DSSC)	19kHz, sin, 10%	67kHz, 10%
QSI (1A)		Master : M 1st sub : Y(38kHz, sin, DSSC) 2nd sub : X (38kHz, COS, DSSC) 3rd sub : U (76kHz, sin, DSSC)	1st : 19kHz, sin, 10% 2nd : 76kHz, cos, 5%	95kHz, 10%
RCA (1B1)		Master : M 1st sub : Y(38kHz, sin, DSSC) 2nd sub : X(38kHz, cos, DSSC)	1st : 19kHz, sin, 10%	67kHz, 10% 95kHz, 5%
RCA (1B2)		Master : M 1st sub : Y(38kHz, sin, DSSC) 2nd sub : X(38kHz, cos, DSSC) 3rd sub : U(76kHz, sin, DSSC)	1st : 19kHz, sin, 10% 2nd : 76kHz, cos, 5%	95kHz, 5%
Cooper-UMX (1D1)		Master : M 1st sub : y (38kHz, sin, DSSC) 2nd sub : x (38kHz, cos, DSSC)	1st : 19kHz, sin, 10% 2nd : 57kHz, sin, 3.33%	67kHz, 8%
Cooper-UMX (1D2)		Master : M 1st sub : y (38kHz, sin, DSSC) 2nd sub : x (38kHz, cos, DSSC) 3rd sub : U(76kHz, sin, DSSC)	1st : 19kHz, sin, 10% 2nd : 57kHz, sin, 3.33% 3rd : 95kHz, sin, 2%	——
GE (3A)		Master : M 1st sub : Y(38kHz, sin, DSSC) 2nd sub : U(38kHz, -cos, DSSC) 3rd sub : X(76kHz, sin, LVSB)	1st : 19kHz, sin, 10% 2nd : 76kHz, sin, 5%	95kHz, 10%
Zenith (3C1)		Master : M 1st sub : Y(38kHz, sin, DSSC) 2nd sub : X(38kHz, -cos, DSSC) 3rd sub : U(95kHz, -sin, LVSB)	1st : 19kHz, sin, 10% 2nd : 95kHz, -sin, 5%	67kHz, 10%
Zenith (3C2)		Master : M 1st sub : Y(38kHz, sin, DSSC) 2nd sub : X(38kHz, -cos, DSSC) 3rd sub : U(95kHz, -sin, LVSB)	1st : 19kHz, sin, 10% 2nd : 57kHz, sin/cos, 5% 3rd : 95kHz, -sin, 5%	67kHz 10%

M" = Master channel signal (MONO)
M' = L + R (2-channel stereo, sum signal)
Y' = L – R (2-channel stereo, difference signal)
M = LF + LB + RB + RF (Sum signal)
Y = LF + LB – RB – RF (L and R difference signal)
X = LF – LB – RB + RF (F and B difference signal)
U = LF – LB + RB – RF (Diagonal difference signal)
y = LF∠45 + LB∠–45 – RB∠45 – RF∠–45
x = LF∠45 – LB∠–45 – RB∠45 + RF∠–45

P = Pilot (Pilot signal)
S = SCA
sin = sine
cos = cosine
DSSC = Double Sideband Suppressed Carrier
LVSB = Lower Vestigial Sideband

RECOMMENDATION 370-4*

VHF AND UHF PROPAGATION CURVES FOR THE FREQUENCY RANGE FROM 30 MHz TO 1,000 MHz**

Broadcasting services
(Study Programme 7D/5)
(1951–1953–1956–1959–1963–1966–1974–1978)

The CCIR,

CONSIDERING

(a) that there is a need to give guidance to engineers in the planning of broadcast services in the VHF and UHF bands;

(b) that, for stations working in the same or adjacent frequency channels, the determination of the minimum geographical distance of separation required to avoid intolerable interference due to long-distance tropospheric transmission is a matter of great importance;

(c) that the annexed curves are based on the statistical analysis of a considerable amount of experimental data (see Report 239-4),

UNANIMOUSLY RECOMMENDS

1. that the curves given in Annex I be adopted for provisional use (Note 1) for the following conditions:

1.1 The filed strengths have been adjusted to corresponds to a power of 1 KW radiated from a half-wave dipole. If field strength values are to be referred to the free space field radiated by a hypothetical isotropic radiator, these can be obtained from values on the curves by subtracting 2.15 dB.

1.2 The height of the transmitting antenna is defined as its height over the average level of the ground between distances of 3 and 15 km from the transmitter in the direction of the receiver.

1.3 The height of the receiving antenna is defined as the height above local terrain.

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* This Recommendation is brought to the attention of Study Groups 10 and 11.

** It must be emphasized that the curves of this Recommendation are intended for use in the planning of broadcasting services for the solution of interference problems over a wide area: they should not be used for point-to-point communication links, for which systems the actual terrain profile may be determined and more accurate methods of field strength prediction may be used.

1.4 A parameter Δh is used to define the degree of terrain irregularity: it is the difference in heights exceeded by 10% and 90% of the terrain in the range 10 km to 50 km from the transmitter (see Fig. 6 of Annex I and § 4.1 of Report 239-4).

1.5 Methods for determining field strengths over mixed land and sea paths are described in Report 239-4.

1.6 The effect of changing the receiving antenna height is given in § 2.3, § 3.3 and Fig. 17 of Annex I. It is also referred to in Report 239-4 and Report 567-1.

1.7 Account should be taken of the attenuation through forest and vegetation (see Fig. 2, Report 236-4).

1.8 Improved accuracy of predicted field strengths can be obtained by taking into account terrain local to the receiving location by means of a terrain clearance angle. The method is described in Report 239-4.

Note: It must be emphasized that the curves are based on data obtained mainly for temperate climates and should be used with caution for other climates.
Propagation curves for broadcasting in the African Continent are given on pages 343-379 of the Final Acts of the African VHF/UHF Broadcasting Conference, Geneva, 1963.

ANNEX I

1. Introduction

1.1 The propagation curves represent field strength values in VHF and UHF as a function of various parameters; some curves refer to land paths, others refer to sea paths. The land path curves were prepared from data obtained mainly from temperate climates as encountered in Europe and North America. The sea path curves were prepared from data obtained mainly from the Mediterranean and the North Sea regions.

1.2 The propagation curves represent the field strength values exceeded at 50% of the locations for different percentages of time. They correspond to different transmitting antenna heights and a receiving antenna height of 10 metres. The land path curves refer to a value of $\Delta h = 50$ m which generally apply to rolling terrain commonly found in Europe and North America.

1.3 For locations other than 50%, probability distribution curves are also presented in this Annex.

1.4 Estimates of mixed-path field strengths should be made in accordance with the methods described in Report 239-4.

1.5 Since most of the measurements relate to distances less than 500 km, the results given by these curves are less reliable above this distance. The sections of the curves in dashed lines, obtained by extrapolation, should be used with even greater caution.

1.6 All these curves are based on long-term values (several years) and may be regarded as representative of the mean climatic conditions prevailing in all the temperate regions. It should be noted, however, that for brief periods of time (e.g. for some hours or even days), field strengths may be obtained which are much higher than those shown by these curves, particularly over relatively flat terrain.

1.7 It is known that the median field strength varies in different climatic regions, and data for a wide range of such conditions in North America and Western Europe show that it is possible to correlate the observed values of median field strength with the refractive index gradient in the first kilometre of the atmosphere above ground level. If n_s and n_1 are the refractive indices at the surface and at a height of 1 km respectively, and if ΔN is defined as $(n_1 - n_s) \times 10^6$, then in a standard atmosphere, $\Delta N \approx -40$, the 50% curves of Fig. 1 refer to this case. If the mean value of ΔN, in a given region, differs appreciably from -40, the appropriate median field strengths for all distances beyond the horizon are obtained by applying a correction factor of $-0.5\ (\Delta N + 40)$dB to the curves. If ΔN is not known, but information concerning the mean value of N_s is available, where $N_s = (n_s - 1) \times 10^6$, an alternative correction factor of $0.2\ (N_s -$

310) dB may be used, at least for temperate climates. Whilst those corrections have so far only been established for the geographical areas referred to above, they may serve as a guide to the corrections which may be necessary in other geographical areas. The extent to which it is reliable to apply similar corrections to the curves for field strengths exceeded 1% and 10% of the time is not known. It is expected, however, that a large correction will be required for the 1% and 10% values, in regions where super-refraction is prevalent for an appreciable part of the time.

2. VHF

2.1 The curves in Figs. 1, 2a, 3c and 4a represent field strength values exceeded at 50% of the locations and for 50%, 10%, 5% and 1% of the time for land paths where Δh of 50 m is considered representative. For a different value of Δh, a correction should be applied to the curves as shown in Fig. 7. (See § 4.1 of Report 239-4). For locations other than 50% corrections may be obtained from the distribution curves in Fig. 5.

2.2 The curves in Figs. 1, 2a, 2b, 3a, 3b, 4b and 4c represent field strength values exceeded at 50% of the locations for 50%, 10%, 5% and 1% of the time for sea paths for the Mediterranean and North Sea regions. Generally, the Δh for the sea path curves is less than 10 m. It is assumed however that the curves in Figs. 1 and 2a refer to the same values of Δh (Note 2).

2.3 The following reduction in the median field strength values may be expected by changing the receiving antenna height from 10 to 3 m above ground: in Bands I and II, 9 dB in hilly or flat terrain for both urban and rural areas; in Band III, 7 dB for flat terrain in rural areas and 11 dB for urban or hilly terrain. These values apply for distances up to 50 km. For distances in excess of 10 km the values should be halved, with linear interpolation for intermediate distances. Refer also to § 4.4 of Report 239-4.

2.4 The ionosphere, primarily through the effects of sporatic-E ionization, can influence propagation in the power part of the VHF band, particularly at frequencies below about 90 MHz. In some circumstances this mode of propagation may influence the field strength exceeded from small percentages of the time at distances beyond some 500 km, and near the magnetic equator and in the auroral zone higher percentages of the time may be involved. However these ionospheric effects can usually be ignored in most applications covered by this Recommendation and the propagation curves of this Annex have been prepared on this assumption. Report 259-4 and Recommendation 534 of Volume VI should be consulted to determine whether the assumption is reasonable.

Note: In the absence of separate sea and land curves, it is provisionally recommended that for Figs. 1 and 2a the same method used for Δh correction for land paths is applied to sea paths.

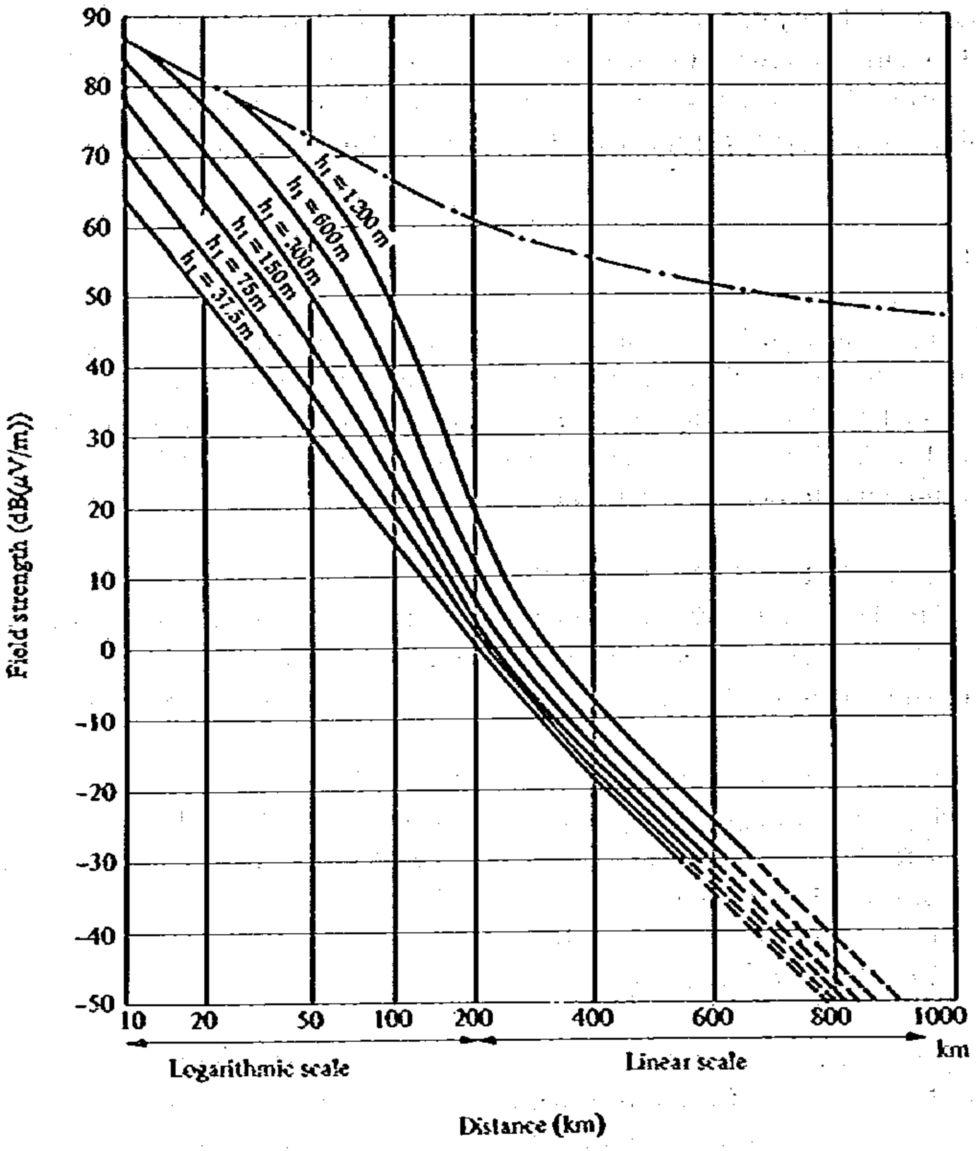


Fig. 1 Field Strength (dB (μv/m)) for 1 kW ERP

Frequency: 30 to 250 MHz (Bands I, II and III); Land, North Sea and Mediterranean Sea; 50% of the time; 50% of the locations; h_2 = 10 m

—— · —— · —— Free space

CCIR REC, 370-3

Annex B-1 Calculated and Measured Values in the Survey

The State of Sarawak

Station	No.	Date	Place	Time	d (Km)	h2	Eo (dB)	Sinθ	S	φH	E (dBf)	Evaluation					
												N	B	G	P	TL	SQ
Kuching	1	6/25	RTM	–	16.8	4	105.8 (88)	0	0	0	105.8 (104)	4	4	4	4	4	5
	2	6/26	Semarian	–	15.0	4	106.8 (86+1)	0	0	1.5	105.3 (103)	(4)	(4)	(4)	(4)	(4)	(5)
	3	6/28	Bau	10:00	18.5	8	105.0 (81+1.5)	0	0	10.0	101.0 (98.5)	3^+	4	3^+	4	3^+	4
	4	6/28	Lundu	11:15	38.5	4	96.6 (66+1.5)	0	0	10.0	86.6 (83.5)	3^-	3^-	3^-	4	3^-	4
	5	6/28	Sematan	15:35	54.5	4	90.3 (60+1.5)	0	0	10.0	80.3 (77.5)	4	5	4	5	4	5
	6	6/29	Sibran	10:25	34.0	7	99.7 (81+1)	+3.3	0	2.5	100.5 (98)	4	5	4	5	4	5
	7	6/30	Serian	10:20	60.0	4	94.8 (67+0.5)	6.5	0	2.5	86.0 (83.5)	4	5	4	5	4	5
	8	6/30	Pantu	13:30	37.6	4	96.2 (52+1)	12.8	6	6.5	70.9 (69)	3	4	4	5	3	5
Bandar Sri Aman	9	7/ 1	Betong	11:45	27.0	4	99.1 (63.5+0.9)	6.7	8.8	0.5	83.1 (80.4)	3^+	5	4	5	3^+	5
	10	7/ 1	Engkilili	14:00	23.5	4	100.3 (58+0.9)	8.0	11.0	7.0	74.3 (74.9)	4	5	4	5	4	5
	11	7/ 2	Simanggang	8:20	5.5	4	112.9 (95.5+0.7)	0	0	0	112.9 (112.2)	4	5	5	5	4	5
Sibu	12	7/ 6	Sarikei	14:00	40.5	4	94.8 (52+0.2)	23.4	0	6	71.3 (67.2)	3	5	4	5	3	5
	13	7/ 6	Julau	18:00	25.0	4	98.9 (60+0.2)	16.9	0	1.0	81.0 (75.2)	4	5	4	5	4	5
	14	7/ 7	Sibintek	10:00	27.0	20	98.3 (77+0.2)	3.8	0	1.0	93.5 (92.2)	4	5	4	5	4	5
	15	7/ 7	Sibu	14:00	6.0	4	111.3 (88+0.5)	3.5	0	0	107.8 (103.5)	4	5	4	5	4	5

No. 2

Station	No.	Date	Place	Time	d (Km)	h2	Eo (dB)	Sinθ	S	φH	E (dBf)	Evaluation					
												N	B	G	P	TL	SQ
Kapit	16	7/ 8	Song	11:00	42.5	4	87.3 (53)	25.2	0	0	62.1 (57.6)	4	5	4	5	4	5
	17	7/ 8	Kapit	16:30	1.9	10	114.3 (110)	+3.7	0	4.5	113.5 (114.6)	4	5	4	5	4	5
	18	7/ 9	School	9:00	10.5	4	99.5 (68)	18.2	9.4	4.0	67.9 (72.6)	4	5	4	5	4	5
Bintulu	19	7/12	Bintulu	16:05	3.0	4	110.4 (71+0.2)	+6.0	0	20.0	96.4 (97.2)	4	5	4	5	4	5
	20	7/13	Bintulu	9:00	10.0	4	99.9 (69+0.2)	1.1	0	8.0	90.8 (85.2)	4	5	4	5	4	5
	21	7/13	Bintulu	10:05	6.5	4	103.7 (88)	0	0	0	103.7 (104)	4	5	4	5	4	5
Miri	22	7/14	Niah	1:20	53	4	89.8 (36)	16.5	20.4	0.5	52.4 (52)	3⁻	5	3⁻	5	3⁻	3⁺
	23	7/15	Miri	11:45	23	4	97.1 (61)	7.2	0	0	89.8 (77)	4	5	4	5	4	5
	24	7/15	Kuala Baram	15:40	40.5	4	92.2 (61)	13.1	0	0	79.1 (77)	4	5	4	5	4	5
	25	7/17	Murudi	9:25	31.0	4	94.5 (67+0.4)	10.2	0	0	84.3 (83.4)	4	5	4	5	4	5
Limbang	26	7/17	Lawas	10:55	46.0	4	83.6 (39+0.5)	0	31.5	0.5	51.6 (42)	3⁻	5	3	5	3⁻	4
	27	7/19	Buang Siol	9:30	4.0	4	104.9 (85.5+1)	4.7	0	9.5	90.7 (89)	4	5	5	5	4	5
	28	7/19	Kpg. Bakol	12:00	11.5	8	95.7 (75.5+1)	7.9	0	6.0	81.8 (79)	4	5	4	5	4	5

The State of Sabah

No.3

Station	No.	Date	Place	Time	d (Km)	h2	Eo (dB)	Sinθ	S	φH	E (dBf)	Evaluation					
												N	B	G	P	TL	SQ
Layang-Layang	1	6/25	Ranau	11:00	16.0	3	97.6 (80.0)	+5.7	0	-3.5	99.8 (95.7)	4	5	4	5	4	4
	2	6/26	Tambunan town	13:00	43.0	4	89.0 (59.0)	0	-9.1	-4.0	75.9 (74.7)	4	5	3+	5	3+	4
	3	6/26	Keningau	15:30	89.5	3	82.6 (56)	-4.0	0	-4.0	74.6 (71.7)	4	5	4	5	4	4
	4	7/ 4	Nabawan	12:50	112.0	4	80.7 (30)	-4.7	-23.8	-5.0	47.2 (45.7)	2	–	–	–	–	3
Sipitang	5	6/29	Sipitang town	17:00	11.0	15	97.4 (81.0+0.8)	0	0	-11.5	85.9 (85.4)	4	5	5	5	4	5
	6	6/29	Weston Hospital	11:40	8.3	4	99.9 (83.0+0.8)	-8	0	-0.3	91.6 (87.4)	4	5	4	5	4	4
	7	6/29	Beaufort	15:40	25.0	4	90.3 (41.0+0.8)	-17.9	-7.2	0	65.2 (45.4)	4	5	4	5	4	5
Kota Kinabalu	8	6/30	Papaar	14:50	49.0	4	93.1 (73+0.5)	-4.3	0	-0.2	88.6 (89.5)	4	3+	4	5	3+	5
	9	6/30	Kota Kinabalu	18:00	22.5	4	99.9 (84+0.5)	+2.3	0	-0.7	101.5 (100.5)	4	5	4	5	4	5
	10	7/ 1	Kota Belud (1)	13:50	42.0	4	94.4 (52+0.5)	-2.9	-22.3	0	69.2 (68.5)	4	5	3+	5	3+	5
	11	7/ 1	Kota Belud (2)	–	43.0	4	94.2 (35.5+0.5)	-3.1	-34.6	0	56.5 (52.0)	2	–	–	–	–	4
Kudat	12	7/ 2	Kpg. Rosob	14:30	27.0	6	98.3 (68+2.8)	-11.6	0	-3.5	83.2 (86.5)	4	5	3+	5	3+	5
	13	7/ 2	Bandau	16:00	45.0	4	93.8 (43+2.8)	-22.0	-10.4	-0.7	60.7 (61.5)	3	5	4	5	3	3
	14	7/ 2	Kudat	18:00	3.3	4	116.5 (101.5+2.8)	0	2.9	0	119.4 (120.0)	4	5	3+	5	3+	5
	15	7/ 3	S. Pinawan-tai	10:00	21.0	4	100.5 (42+2.8)	-18.3	-10	-2.5	69.6 (60.5)	4	5	5	5	4	5

No.4

Station	No.	Date	Place	Time	d (Km)	h2	Eo (dB)	Sinθ	S	φH	E (dBf)	Evaluation					
												N	B	G	P	TL	SQ
Sandakan	16	7/ 7	Sandakan (1)	10:10	3.8	4	115.3 (96+2.2)	0	0	-1.0	114.3 (113.6)	4	5	3^+	5	3^+	5
	17	7/ 7	Sandakan (2)	12:00	4.0	4	114.9 (68+2.2)	0	0	-7.0	107.9 (85.6)	4	5	3^+	5	3^+	4
	18	7/ 7	Sungai Manila	14:30	18.0	3	101.8 (74+2.2)	-6.4	0	0	95.4 (91.6)	4	5	3^+	5	3^+	5
	19	7/ 8	Bt. Garam	11:00	48.0	6	93.3 (60+2.2)	-11.7	0	0	81.6 (77.6)	4	5	3^+	5	3^+	4
	20	7/ 8	Beluran	14:00	60.0	4	91.3 (46+2.2)	-16.1	-6	-1.5	67.7 (63.6)	3^+	5	3^+	5	3^+	4
	21	7/ 9	Telupid	12:00	109.0	4	86.2 (33+2.2)	-39.4	0	-1.5	45.2 (50.6)	3^-	4	3^+	5	3^-	4
Lahad Datu	22	7/12	Sungai Sabahan	15:00	20.0	4	96.9 (72+0.1)	0	-6	-1.5	89.4 (87.1)	4	5	4	5	4	5
	23	7/12	Madai Caves	16:20	27.0	6	94.3 (80+0.1)	+3.4	0	0	97.6 (95.1)	4	5	5	5	4	4
	24	7/13	Tungku	11:00	78.0	4	85.1 (43+0.1)	0	-27	0	58.1 (58.1)	4	5	5	5	4	4
	25	7/13	Silibukan	13:15	40.0	4	90.9 (70.0+0.1)	-3.0	0	0	87.9 (85.1)	4	5	5	5	4	5
	26	7/13	Airport	15:10	19.0	4	97.3 (84.5+0.1)	+3.1	0	-1.0	99.4 (99.6)	4	5	5	5	4	5
	27	7/16	Lahad Datu Kunak	12:00	32.0	3	92.8 (65+0.1)	-3.4	6	-2.0	81.5 (80.1)	3^-	5	4	5	3^-	4
Tawau	28	7/15	Kalabakan	12:20	54.0	10	87.0 (60.5+1.9)	-0.8	0	-6.0	80.3 (78.1)	4	5	3^+	5	3^+	5
	29	7/15	Merutai	15:00	26.0	4	93.4 (66+1.9)	-1.9	0	-6.0	85.5 (83.6)	4	5	4	5	4	5
	30	7/16	Semporna	15:20	73.0	4	84.4 (40.5+1.8)	-12	-8	-1.5	62.9 (58.1)	4	3^+	5	5	3^+	4

No. 5

Station	No.	Date	Place	Time	d (Km)	h2	Eo (dB)	Sinθ	S	φH	E (dBf)	Evaluation					
												N	B	G	P	TL	SQ
Tawau	31	7/17	Kpg. Tanjung Batu	9:40	13.5	4	99.1 (69+1.9)	0	0	−8	91.0 (86.6)	4	4	3*	5	3*	5
	32	7/17	Airport	11:20	13.0	6	99.4 (80+1.9)	+5.8	0	−7.5	97.7 (97.6)	4	5	4	5	4	5

Note:
Eo : Free Space Field Strength
S : Diffraction Loss
φH : Horizontal Directivity
E : Calculated Field Strength
( ) : Measured Value
N : Noise
B : Beat
G : Ghost
P : Pulse
TL : Total Evaluation
SQ : Sound Quarity

Calculation of Diffraction Loss

In the States of Sabah and Sarawak which are quite mountaineous, screen diffraction of electromagnetic waves caused by these mountains becomes a serious problem. This study team has decided to apply calculation of numerical values to the analysis of the survey so as to ensure accuracy.

Calculation of diffraction loss by mountains and the like requires advanced mathematics such as Fresnel's integral and, therefore, the analysis of its numerical value is usually very difficult.

Furthermore, the numerical values largely depend on the shape of the summit, whether it is sharp like a knife-edge or round, and much more on the extent of growth of trees or plants on it.

The following calculation formula of diffraction loss is in a simplified form suited for the analysis of numerical values and it has been prove to be effective in estimating diffractions in this survey.

$$X = \sqrt{\frac{2}{\lambda} \cdot \frac{d_1 + d_2}{d_1 \quad d_2}} \quad H$$

$$E = 6 + 6 \times X \qquad : -1 \leqq X \leqq 2$$

$$= 11 + 20 \times \log X \qquad : \qquad X > 2$$

Provided that d_1 : the distance between a trasmitting point and a shielding object ($>> \lambda, H$)

d_2 : the distance between a shielding object and a receiving point ($>> \lambda, H$)

λ : the wave length

H : Height of the shielding object as it appears on the profile paper

Results of Calculations on Diffraction Loss

1. The State of Sabah

Observed at:	d_1 (km)	d_2 (km)	Height of shielding on the profile (m)	Diffraction loss (dB)
Beaufort	12.0	13.0	20	7.2
Tambunan	34.0	9.0	30	23.8
Nabawan	54.0	58.0	500	23.8
Kota Belud – 1	34.0	8.0	200	22.3
Kota Belud – 2	34.0	9.0	270	24.5
	8.5	0.5	10	10.1
S. Pinawantai	15.0	6.0	30	10.0
Bandau	15.0	30.0	50	10.4
Beluran	58.0	7.0	0	6.0
Sungai Sabahan	18.0	3.0	0	6.0
Tungku	65.0	13.0	460	27.0
Kunak	2.0	30.0	0	6.0
Semporna	43.0	30.0	30	8.0

2. The State of Sarawak

Observed at:	d_1 (km)	d_2 (km)	Hight of shielding on the profile (m)	Diffraction loss (dB)
Pantu	37.4	0.2	0	6.0
Betong	26.0	1.0	10	8.8
Engkilili	11.0	12.5	0	6.0
	12.3	0.2	-1	5.4
Kapit School	4.0	6.5	35	9.4
Niah	50.0	3.0	50	14.4
	1.5	1.5	0	6.0
Lawas	39.5	5.5	155	15.5
	3.0	2.5	35	10.0
	1.3	1.2	0	6.0

REPORT 293-4*

AUDIO-FREQUENCY PARAMETERS FOR THE STEREOPHONIC TRANSMISSION AND REPRODUCTION OF SOUND

Principal audio-frequency characteristics

(1963–1966–1970–1974–1978)

3. Table of Quality Tolerances in Stereophony

Table 1 summarizes the tolerances applicable to the quality parameters of stereophonic reproduction.

The diagrams following the Table show some of these tolerances in graphical form.

Table 1

Characteristics and signals (1)	Frequencies (kHz)	Broadcast signal (2)	Overall tolerances
Bandwidth *A*, *B*, *M* and *S*		0.04 to 15 kHz	0.04 to 15 kHz
Amplitude/frequency response profile (Fig. 1) *A* and *B* (dB)	0.04 to 0.125 0.125 to 0.630 0.630 to 1.25 1.25 to 10 10 to 14 14 to 15	+0.7 to −2.5 +0.7 to −0.7 +0.5 to −0.5 +0.7 to −0.7 +1 to −2.5 +1 to −3	+2 to −3 +1 to −1 +0.5 to −0.5 +1 to −1 +2 to −3 +2 to −3
Gain difference (3) (Fig. 2) *A* and *B* (dB)	1 0.04 to 0.125 0.125 to 10 10 to 14 14 to 15	1 2 1 2 3	1 3 1.5 3 3
Phase difference (3) (Fig. 3) *A* and *B* (degrees)	0.04 0.04 to 0.2 0.2 to 4 4 to 15 15	40° oblique segment 20° oblique segment 45°	90° oblique segment 45° oblique segment 90°
Linear crosstalk (3) (Fig. 4) (dB)	0.04 to 0.3 0.3 to 4 4 to 15	−36 −36 oblique segment 6 dB per octave	oblique segment 6 dB per octave −30 oblique segment 6 dB per octave
Weighted signal-to-noise ratio *A*, *B* and *M* (dB)		54 (5)	50 (4)(5)
Non-linearity distortion *A*, *B* and *M* (dB) Total harmonic distortion Non-harmonic products	0.04 to 0.125 0.125 to 7.5 7.5 to 15	−37 −43 −40	−34 −40 −30

(1) *A* is the signal on the left and *B* the signal on the right. $M = \frac{1}{2}(A + B)$ and $S = \frac{1}{2}(A - B)$.

(2) The broadcast signal tolerances apply to the chain circuit + encoder + transmitter. The circuit taken is the reference circuit defined in Recommendation 502.

(3) This concerns only differences of gain, differences of phase or linear crosstalk, which are introduced unintentionally between the *A* and *B* channels owing to imperfections in the transmission chain.

(4) The value of 50 dB is adequate in most cases. However, for some types of programme (e.g. piano music) it would be desirable to increase this value by about 10 dB.

(5) The indicated values result from r.m.s. noise measurements when a weighting network is used in accordance with Recommendation 468-2.

SECTION 2 PERFORMANCE CHARACTERISTICS OF SOUND-PROGRAMME CIRCUITS

Recommendation J. 21

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

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

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

1) This Recommendation corresponds to CCIR Recommendation 505-1 [1].

output impedances of a strephonic 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 bandwith: 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.

2) See the definition of zero-relative level in Recommendation J.14.

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.

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

2. If the weighting network defined in the Recommendation cited in [2] is used, the measured value will be about 4 dB less. More details are given in [3].

3. Suitable values for unweighted noise cannot be recommended with precision because such values depend upon characteristics of the circuit noise. However, if an unweighted noise measurement is performed upon a sound-programme circuit just complying with the requirements of § 3.1.5 and § 3.1.6 then the worst values expected to be found are –41 dBm0s and/or –36 dBq0s, and in most cases the values obtained will be several decibels better.

CCIR Report 493-2 [4] indicates that if a compandor is used, then with some programme material an improved signal-to-noise ratio is necessary to avoid objectionable effects.

When using radio-relay systems, the values given for both the weighted and unweighted noise should not be exceeded for more than 20% of any month. For 1% and 0.1% of any month, limits 4 dB higher and 12 dB, respectively, seem to be acceptable.

3.1.6 The single-tone interference, measured selectively, should not exceed (–73 – Δps) dBm0s, in which Δps is the correction for the frequency being measured, given by the weighting characteristics in CCIR Recommendation 468-2 (which is reproduced at the end of Recommendation J.16).

For sound-programme transmissions over carrier systems, occurrence of carrier leaks can be expected. For this reason, stop filters may be provided in the carrier frequency path which can be switched in, if required, to suppress the tones otherwise audible in the upper frequency range from 8 to 15 kHz. For a hypothetical reference circuit, a 3-dB bandwidth of less then 3% for stop filters, referred to the mid-frequency, is recommended. The use of stop filters influencing frequencies below 8 kHz should be avoided.

3.1.7 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[5]). The value for higher frequencies has to be determined (see CCIR Study Programme 17F/CMTT[6]).

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 1/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

The duration for which a single tone is to be transmitted at this level should be restricted in accordance with the appropriate Series N Recommendations.

3.1.8.2 The difference-tone factors[3)] selectively measured with double-tone send signals each at +3 dBm0 should not exceed the following limits:

3.1.8.2.1 Frequencies 0.8 and 1.42 kHz corresponding to those prescribed in Recommendation O.31 [9], for a 3rd-order difference-tone measured at 0.18 kHz: 0.5%.

3.1.8 2.2 Frequencies 5.6 and 7.2kHz for a 2nd-order difference-tone measured at 1.6kHz: 0.5%

3.1.8.2.3 Frequencies 4.2 and 6.8kHz for a 3rd-order difference-tone measured at 1.6kHz: 0.5%

The measurements of § 3.1.8.2.2 and § 3.1.8.2.3 are intended for baseband transmissions on physical circuits only and on modulation equipment in the local loops.

3.1.9 Error in reconstituted frequency

Note to be greater 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 broadcasts 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.

3.1.10 Intelligible crosstalk radio

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 straightl-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.

Notes to § 3.1.10

Note: 1. It is understood that these values are defined between the relative levels applicable to telephony. An explanation for the relation between the relative levels for sound-programme circuits and telephone circuits is given in the Annex to Recommendation J.22.

2. The CCITT draws the attention of Administrations to the fact that it is in some cases difficult or impossible to meet these limits. This may occur when unscreened pairs are used for a long audio-frequency circuit (e.g. about 1000 km or longer), or in certain carrier systems on symmetric pair cables, or in the low frequency range (e.g. below about 100 kHz) in certain carrier systems on coaxial cables. When such difficulties arise, such systems or parts of systems should be avoided, if possible, for setting up programme channels.

3. When a minimum noise level of at least 4000 pW0p is always present in the telephone channel (this may be the case in satellite systems, for example) a reduced crosstalk ratio of 58 dB between a sound-programme circuit and a telephone circuit is acceptable.

4. The CCITT draws the attention of Administrations to the fact that, because of crosstalk which may occur in terminal modulating and line equipment, special precautions may have to be taken to meet the above crosstalk limits between two sound-programme circuits, simultaneously occupying the go and return channels respectively of a carrier system (the most economical arrangement), because in those circumstances they occupy the same position in the line-frequency band (see Recommendation J.18).

5. The value indicated is based on the assumption that sine-wave test signals are used. The use of the test signal as described in Recommendation J.19 is under study.

6. The effect of crosstalk from a sound-programme circuit into a telephone circuit is not a question of secrecy, but rather of subjective disturbance by an interfering signal whose character is noticeably different from random noise or babble.

The frequency offset adopted for some sound-programme equipment allows a reduction of crosstalk from a telephone circuit into a sound-programme circuit. However in the reverse direction, this reduction of crosstalk remains only for speech material, but is practically ineffective

3) Attention is drawn to the fact that in transmission systems using compandors, a 3rd-order difference-tone may occur which exceeds the specified limit of 0.5%. This may occur when the difference between the two fundamental frequencies is less than 200 Hz. Thus, the components due to 3rd-order distortion will have frequencies which correspond to the difference between the two test frequencies. However, in these cases the subjective masking is such that a distortion up to 2% is acceptable.

for music material.

3.1.11 Error in amplitude/amplitude response

When the level of a 0.8 or 1-kHz test signal is changed from +6 to –6 dBm0s or vice versa, the level difference at the receiving end should not lie outside the range 12 ±0.5 dB. This level change of the test signal corresponds to that prescribed in Recommendation O.31 [9].

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] to 15 kHz: 60 dB.

4. Transmission Performance of the Hypothetical Reference Circuit for 15 kHz-type Sound-programme Circuits with Particular Reference to Digital Methods of Transmission

This section will deal with special additional parameters for digital systems. CCIR Report 649 [10] and Study Programme 14A/CMTT [11] refer.

Note: The CCIR has issued Recommendation 572 [12] which deals with the transmission of one sound-programme associated with an analogue television signal by means of time-division multiplex in the line synchronizing pulse. The system recommended is a digital one, using pulse code modulation. A sound-programme bandwidth of 14 kHz provided.

4) The CMTT is requested to produce a definition for this expression.

5. **Estimation of Transmission Performance of Circuits Shorter or Longer than the Hypothetical Reference Circuit**

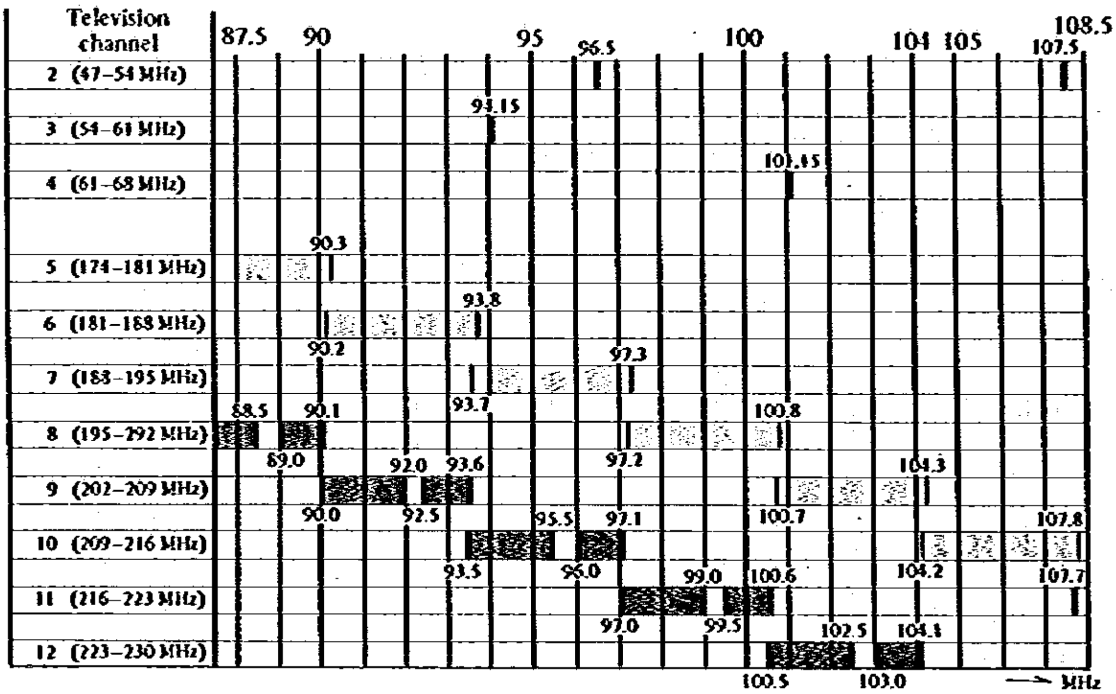
CCIR Study Programme 17D/CMTT [13] refers.

Note: For further work, CCIR Report 496-2 [14] may be consulted. This Reports also draws attention to cartain differences between the above Recommendation and one drawn up by the OIRT.

"A Consideration of local interference problems in VHF/FM broadcasting"

By K. N. Stokke

EBU REVIEW – TECHNICAL, 1981 DECEMBER



Second harmonics of channel-2 sound and vision carriers interfering with Band II

Second harmonic of VHF/FM carrier interfering with Band III

Local oscillator of television receiver tuned to channels 3 or 4 interfering with Band II

Second harmonic of VHF/FM local oscillator interfering with Band III

Fig. 3 Diagram showing potential sources of interference between VHF/FM transmissions and television transmission in Bands I and III (system B).

Specifications of a Radio Receiver for Use in Preparing a Channel Plan

The Tables C-4-1 and C-4-2 below show, respectively, the specifications of the receiver which is used in Japan in drawing up a channel plan and the reference performances that take into account the characteristics of FM broadcasts.

Table C-4-1 Specifications of the Receiver

Items	Specifications
1) Intermediate frequency	10.7 MHz
2) Intermediate frequency interference ratio	Over 50 dB
3) Local oscillation frequency	(–) side
4) Drifting of local oscillation frequency	Less than 10 kHz
5) Maximum sensitivity	Less than 20 μV, the sensitivity required in obtaining the output of 50 mW
6) Difference in sensitivity	Less than 3 dB
7) Image interference ratio	Over 30 dB
8) Selectivity	±200 kHz: –14 dB ±400 kHz: –34 dB
9) Minimum input required when S/N ratio is set	S/N ratio 30 dB: less than 30 μV 45 dB: less than 100 μV
10) LR Separation	Over 20 dB in the range from 100 Hz to 10 kHz

Source: Report of the Radio Technical Council of the Ministry of Posts and Telecommunication of Japan, 1961, excepting item (10) which is from the 1963 report of the same Council

Table C-4-2 Reference Performances of Receiver

Items	Specifications
1) Bandwidth of intermediate frequencies	200 kHz as reference value
2) High frequency input impedance	300Ω balance form (should be convertible into unbalanced form by attaching an intermediary tap)
3) Unnecessary radiation	Less than 50μV/m as a tentative value, for a distance of 30 m
4) AM suppression	Over 30 dB at an input level of 1mV
5) De-emphasis characteristics	50 μS
6) Electric fidelity	Deviation from the de-emphasis curve should be ±2 dB within the range of 50 Hz – 15 kHz
7) Distortion ratio	In case of 400 Hz 100%-modulated signal with input level of 1 mV, the content ratio of high harmonics should be less than 2%
8) Maximum output	More than 2W with harmonic distortions 10%
9) Residual hum	Hum level for 50 mW output should be less than -30 dB in the case of 400 Hz 30%-modulation signal with input level of 1 mV.
10) Noise index	8–9 dB as a recommended value
11) Electric fidelity of stereophonic channel	Deviation from de-emphasis curve should be less than ±2 dB within the range of 50 Hz – 15 kHz
12) LR level difference	Difference in level between the de-emphasis characteristics of the left and right channels should be less than 1.5 dB within the range of 100 Hz – 10 kHz
13) Distortion ratio of stereophonic channel	In case of 400 Hz 45%-modulation signal with input level of 1 mV, the content ratio of high harmonics at the output of 50 mW should be below 2%
14) Intermodulation	Less than -30 dB within the range of 400 Hz – 10 kHz

Source: Report of the Radio Technical Council of the Ministry of Posts and Telecommunications of Japan, 1961 excepting the items (11) to (14) which are from the 1963 report of the same Council.

Annex D

Observed Data on Potential Field Strength in FM Broadcast Wave Band

Field Strength; dB (μV/m) = dBo − $20\log\frac{\lambda}{\pi}$ + 3

1. The State of Sabah

Station	Observed at:	Frequency	Polarization plane	Azimuth degree	Observed value (dBo)	Remarks
LAYANG – LAYANG	Ranau	91.5	H	295	29.0	Lawa Mandau/Kudat
		93.5	H	310	81.0	Layang-Layang
		97.5	H	310	81.5	Layang-Layang
	Tambunan	88.5	H	28	37.0	Carrier
		91.5	H	340	23.0	Lawa Mandau/Kudat
		93.5	H	28	74.0	Layang-Layang
		97.5	H	28	75.0	Layang-Layang
	Keningau	88.5	H	20	30.0	Carrier
		91.5	H	0	16.0	Lawa Mandau/Kudat
		92.3	H	230	22.0	Brunei
		93.5	H	30	68.0	Layang-Layang
		95.9	H	230	20.0	Brunei
		97.5	H	30	68.0	Layang-Layang
		107.5	H	40	39.5	Carrier
SIPITANG	Sipitang	88.5	H	50	11.0	Carrier
		92.3	H	250	55.0	Brunei
		93.5	H	45	54.0	Layang-Layang
		93.8	H	250	30.0	Brunei
		95.9	H	250	52.0	Brunei
		96.9	H	250	25.5	Brunei
		97.5	H	45	48.0	Layang-Layang
	Weston Hospital	92.3	H	240	37.0	Brunei
		93.5	H	50	32.0	Layang-Layang
		95.9	H	240	33.0	Brunei
		97.5	H	50	36.0	Layang-Layang
	Beaufort	92.3	H	240	33.0	Brunei
		93.5	H	50	39.0	Layang-Layang
		97.5	H	50	45.0	Layang-Layang
LAYANG-LAYANG	Nabawan	93.5	H	10	48.0	Layang-Layang
		97.5	H	10	45.0	Layang-Layang

Station	Observed at:	Frequency	Polarization plane	Azimuth degree	Observed value (dBo)	Remarks
KOTA KINABALU	Paper	88.5	H	45	41.0	Carrier
		91.5	H	45	33.0	Lawa Mandau/Kudat
		92.3	H	230	47.5	Brunei
		92.9	H	45	30.0	Lawa Mandau/Kudat
		93.5	H	60	71.0	Layang-Layang
		93.8	H	230	46.0	Brunei
		95.9	H	230	43.5	Brunei
		96.9	H	230	42.0	Brunei
		97.5	H	60	70.0	Layang-Layang
	Kota Kinabalu	88.5	H	65	37.0	Carrier
		91.5	H	55	43.0	Lawa Mandau/Kudat
		92.3	H	230	42.0	Brunei
		92.9	H	55	44.0	Lawa Mandau/Kudat
		93.5	H	65	72.0	Layang-Layang
		93.8	H	230	30.0	Brunei
		94.7	H	25	31.0	K.K/Tuaran
		95.9	H	230	45.5	Brunei
		96.9	H	230	33.0	Brunei
		97.5	H	65	70.5	Layang-Layang
		100.2	H	25	23.0	K.K/Layang-Layang
		103.7	H	25	26.0	K.K/Layang-Layang
	Kota Belud–1	91.5	H	215	31.0	Lawa Mandau/Kudat
		92.9	H	215	27.0	Lawa Mandau/Kudat
		93.5	H	165	24.5	Layang-Layang
		97.5	H	165	25.0	Layang-Layang
	Kota Belud–2	93.5	H	165	27.0	Layang-Layang
		97.5	H	165	26.0	Layang-Layang
SANDAKAN	Sandakan–1	93.5	H	280	49.0	Layang-Layang
		97.5	H	280	49.0	Layang-Layang
	Sungai Manila	93.5	H	275	54.0	Layang-Layang
		97.5	H	275	53.0	Layang-Layang
	Bt. Garam	93.5	H	295	53.0	Layang-Layang
		97.5	H	295	51.0	Layang-Layang
	Sandakan–2	93.5	H	280	44.5	Layang-Layang
		97.5	H	280	45.0	Layang-Layang
	Beluran	93.5	H	280	61.0	Layang-Layang
		97.5	H	280	61.0	Layang-Layang
	Telupid	93.5	H	310	46.0	Layang-Layang
		97.5	H	310	41.0	Layang-Layang

Station	Observed at:	Frequency	Polarization plane	Azimuth degree	Observed value (dBo)	Remarks
LAHAD DATU	Sungai Sabahan	93.5	H	310	23.0	Layang-Layang
		97.5	H	310	24.5	Layang-Layang
	Madai Caves	93.5	H	310	21.0	Layang-Layang
		97.5	H	310	21.0	Layang-Layang
	Tungku	93.0	H	260	28.0	Carrier
		93.5	H	290	15.0	Layang-Layang
		97.5	H	290	17.0	Layang-Layang
	Silibukan	93.5	H	290	27.0	Layang-Layang
		97.5	H	290	29.0	Layang-Layang
	Airport	93.5	H	300	31.0	Layang-Layang
		97.5	H	300	32.0	Layang-Layang
TAWAU	Kalabakan	93.5	H	330	27.0	Layang-Layang
		97.5	H	330	25.0	Layang-Layang
	Kunak	93.5	H	310	19.0	Layang-Layang
		97.5	H	310	17.0	Layang-Layang
	Merutai	93.5	H	320	24.0	Layang-Layang
		97.5	H	320	27.0	Layang-Layang
	Semporna	93.5	H	300	22.0	Layang-Layang
		97.5	H	300	22.0	Layang-Layang
	KPG Tanjung Batu	93.5	H	315	28.0	Layang-Layang
		97.5	H	315	28.0	Layang-Layang
	Tawau Air port	93.5	H	320	38.0	Layang-Layang
		97.5	H	320	37.0	Layang-Layang

2. The State of Sarawak

Station	Observed at:	Frequency	Polarization plane	Azimuth degree	Observed value (dBo)	Remarks
6th	Sarikei	88.0	V	200	65.0	–
3rd	Sibintek	87.8	H	240	14.0	Talk
		96.9	H	60	7.0	Brunei
4th	Bintulu	96.9	V	45	4.0	Brunei
	Niah	92.3	H	45	5.0	Brunei
		93.8	H	60	15.0	Brunei
		95.5	V	315	7.5	Brunei (s)
		97.5	H	45	17.0	Layang-Layang
	Miri	89.5	V	270	2.0	Indian music
		92.3	H	45	12.0	Brunei
		93.5	H	45	19.0	Layang-Layang
		93.8	H	90	36.0	Brunei
		95.9	H	45	13.0	Brunei
		96.9	H	90	34.0	Brunei
		97.5	H	90	17.0	Layang-Layang
	Kuala Balam	89.5	V	90	7.0	English Music
		92.3	H	90	26.0	Brunei
		93.5	H	45	18.5	Layang-Layang
		93.8	H	45	39.0	Brunei
		95.9	H	45	22.5	Brunei
		96.9	H	45	41.0	Brunei
	Murdi	90.8	H	20	Minimal	Music
		92.3	H	45	31.0	Brunei
		93.5	H	45	24.0	Layang-Layang
		93.8	H	40	43.0	Brunei
		95.9	H	45	30.0	Brunei
		96.9	H	20	42.0	Brunei
		97.5	H	45	21.0	Layang-Layang
5th	Lawas	90.8	H	30	3.0	Music
		92.3	H	225	47.0	Brunei
		93.5	H	45	28.0	Layang-Layang
		93.8	H	0	23.0	Brunei
		95.9	H	270	45.0	Brunei
		96.9	H	255	25.0	Brunei
		97.5	H	90	24.0	Layang-Layang

Division	Observed at:	Frequency	Polarization plane	Azimuth degree	Observed value (dBo)	Remarks
5th	Buang Soil	90.5	H	45	21.0	Brunei (s)
		91.8	V	0	17.0	Brunei (s)
		92.3	H	135	74.9	Brunei
		92.9	V	315	12.0	Lawa Mandau/Kudat
		93.5	H	45	23.0	Layang-Layang
		93.8	H	150	43.0	Brunei
		94.0	V	0	24.0	Cinese
		94.4	V	0	4.0	Music
		95.2	V	0	6.0	Brunei (s)
		95.5	V	0	16.0	Brunei (s)
		95.9	H	135	73.0	Brunei
		96.9	H	215	36.5	Brunei
		97.5	H	225	24.5	Layang-Layang
	Kpg. Bakol	90.5	H	45	22.0	Brunei (s)
		91.8	H	0	13.0	Brunei (s)
		92.3	H	45	73.0	Brunei
		93.5	H	0	44.0	Layang-Layang
		93.8	H	315	40.0	Brunei
		93.9	H	315	19.0	Brunei (s)
		95.5	H	45	12.0	Brunei (s)
		95.9	H	45	74.0	Brunei
		96.9	H	45	38.0	Brunei
		97.5	H	315	41.0	Layang-Layang

Note: (s) Spurious emission

List of Additional Usable FM Frequencies for Plan A

In actually using these frequencies, further examination will be required concerning the designing of devices including antennas and conbiners, etc.

Station \ ch	ch7 (MHz)	ch8 (MHz)
KOTA KINABALU	100.9	101.7
KUDAT	89.5	107.7
SANDAKAN	102.1	
TAWAU	89.1	
LAHAD DATU	100.7	104.1
TAMBUNAN/KENINGAU (Layang-layang)		
SIPITANG	107.7	
RANAU		
PENSIANGAN		
TENOM		
NABAWAN		
KUCHING	98.1	99.9
BANDAR SRI AMAN	88.5	94.9
SIBU		
MIRI		
BINTULU	104.9	105.7
LIMBANG		
SARIKEI	103.3	
KAPIT	97.7	
SARATOK	104.9	
BAREO	97.7	
BELAGA	98.9	

Annex F

List of Frequencies of Existing VHF Radio Stations

1. The State of Sabah

Station	KOTA KINABALU (Bt. Lawa Mandau)	KUDAT (Bt. Kelapa)	SANDAKAN (Mt. Trig)	TAWAU (Mt. Andrasi)	LAHAD DATU (Mt. Silam)	TANBUNAN/ EKNINGAU (Layang-Layang)	SIPITANG (Bt. Tampalagus)
Receiving Frequencies (MHz)	100.2	70.075	75.55	75.6	75.525	100.2	75.6
	103.7	91.5	75.775	75.825	75.750	103.7	75.825
	153.25	92.9		154.775	155.350		76.225
				157.3	155.500		
				157.35	157.25		
					157.3		

2. The State of Sarawak

Station	KUCHING (Gn. Serapi)	BANDAR SRI AMAN (Bt. Temudok)	SIBU (Bt. Singalang)	MIRI (Bt. Lambir)	BINTULU (Bt. Nyabau)	LIMBANG (Bt. Mas)	SARIKEI (Bt. Kayu Malam)	KAPIT (Kapit)
Receiving Frequencies (MHz)	72.15	154.1		71.55	72.25	86.9	156.8	82.75
	72.20	157.0		71.6	72.3	87.5	157.0	155.025
	155.025	158.5		71.65	82.0	87.55	157.25	155.150
	155.350			71.825	82.2	126.1	157.35	155.9
	160.0			72.2	82.5	152.3		
	162.3			72.3	82.8	155.025		
	162.35			141.7	155.075	155.35		
	162.4			142.3	155.35	156.8		
	162.5			142.9	156.9	157.0		
	166.0			162.0	157.0	157.25		
					157.1			
					157.25			
					157.35			
					162.4			
					162.5			
					165.9			

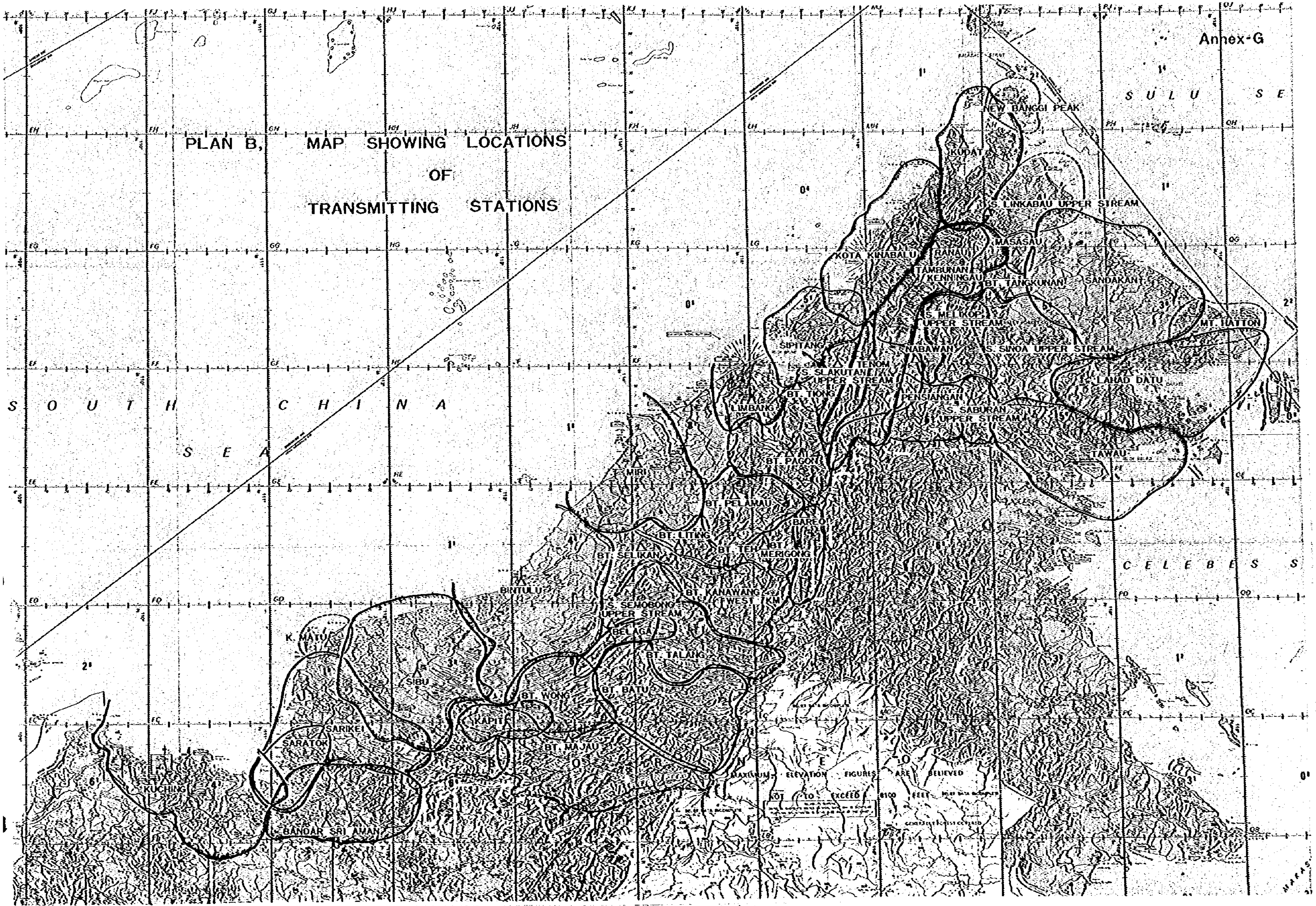
1. The State of Sabah

Station	KOTA KINABALU (Bt. Lawa Mandau)	KUDAT (Bt. Kelapa)	SANDAKAN (Mt. Trig)		TAWAU (Mt. Andrassy)	LAHAD DATU (Mt. Silam)	TAMBUNAN/ KENINGAU/ RANAU (Layang-Layang)	SIPITANG (Bt. Tampalagus)
Transmitting Frequencies (MHz)	W	W	W	W	W	W	W	W
	153.275(100)	82.600(60)	70.075(25)	159.975(10)	70.125(50)	70.050(50)	70.100 (50)	82.600(60)
	153.375(100)	153.525(10)	72.775(25)	160.275(25)	82.600(60)	82.525(60)	82.575(60)	82.825(60)
	154.30 (10)	153.775(10)	82.550(60)	160.700(25)	82.825(60)	82.750(60)	82.800(60)	160.425(25)
	160.275(25)	153.975(10)	82.775(60)	161.800(25)	160.550(25)	133.305(250)	125.100(50)	
		160.225(50)	84.025(10)	161.900(25)	161.900(60)	153.425(10)	126.100(250)	
			84.200(10)	162.225(10)	161.950(60)	160.7 (25)	133.295(250)	
			84.475(10)	162.275(10)		161.850(60)	153.540(10)	
			148.325(10)	162.450(10)		161.9 (60)	160.450(25)	
			148.525(10)	162.675(10)		171.0 (20)	160.550(25)	
			148.825(10)	162.900(10)			161.800(50)	
			148.875(10)	163.125(10)			161.900(50)	
			148.925(10)	163.800(10)			164.400(140)	
			148.975(10)	164.025(10)			165.400(140)	
			155.375(10)	164.250(10)			165.900(20)	
			158.675(10)	165.925(10)			167.700(20)	
			159.225(10)	166.600(10)			169.200(20)	

2. The State of Sarawak

Station	KUCHING (G. Serapi)	BANDAL SRI AMAN (Bt. Temudok)	SIBU (Bt. Singalang)	MIRI (Bt. Lambir)	BINTULU (Bt. Nyabau)	LIMBANG (Bt. Mas)	SARIKEI/ SARATOK (Bt. Kayu Malam)	KAPIT (Kapit)
Transmitting Frequencies (MHz)	W	W	W	W	W	W	W	W
	50.0	99.533(50)	86.4 (10)	76.55 (10)	77.45 (100)	81.9 (10)	156.80(40)	87.25 (10)
	77.35 (100)	99.616(50)	86.6 (10)	76.6 (10)	77.50	82.25 (10)	161.60(40)	160.225(5)
	77.40 (100)	161.6 (50)	86.85(10)	76.65 (10)	87.0 (100)	82.55 (10)	161.85(40)	160.350(5)
	121.5 (51)	166.5 (18)	87.05(10)	76.825(10)	87.2 (100)	121.3 (50)	161.95(40)	167.4 (2)
	134.5 (51)	170.0 (18)	87.15(10)	77.40 (50)	87.5 (100)	156.8 (50)		
	150.0 (21)		87.20(10)	77.5 (50)	87.8 (100)	160.225(20)		
	157.70 (100)		87.30(10)	148.0 (25)	154.4 (20)	160.550(20)		
	157.75 (100)		87.50(10)	155.2 (50)	156.8 (100)	161.6 (50)		
	157.8		87.70(10)	155.3 (50)	157.8 (50)	161.85 (50)		
	157.95		87.75(10)	155.5 (50)	157.95 (50)	163.8 (20)		
	160.225		87.80(10)		160.55 (100)			
	160.550		87.85(10)		160.275(100)			
			88.0 (10)		161.5 (100)			
					161.6 (100)			
					161.7 (100)			
					161.85 (100)			
					161.95 (100)			

Annex-G


PLAN B, MAP SHOWING LOCATIONS OF TRANSMITTING STATIONS
SOUTH CHINA SEA
SULU SE
CELEBES S
NEW BANGGI PEAK
KUDAT
S. LINKABAU UPPER STREAM
KOTA KINABALU
RANAU
MASASAU
TAMBUNAN
KENINGAU
BT. TANGKUNAN
SANDAKAN
S. MELIKOP UPPER STREAM
MT. HATTON
SIPITANG
TENOM
NABAWAN
S. SUNOA UPPER STREAM
S. SLAKUTAN UPPER STREAM
LAHAD DATU
BT. TIONG
LIMBANG
PENSIANGAN
S. SABURAN UPPER STREAM
TAWAU
BT. PAGO
MIRI
BT. PELAMAU
BAREO
BT. LITING
BT. TEH
MERIGONG
BT. SELIKAN
BINTULU
BT. KANAWANG
WEST KM
S. SEMOBONG UPPER STREAM
BELAGA
K. MATU
BT. TALANG
SIBU
BT. WONG
BT. BATU
KAPIT
SARIKEI
SARATOK
SONG
BT. MAJAU
KUCHING
BANDAR SRI AMAN
MAXIMUM ELEVATION FIGURES ARE BELIEVED NOT TO EXCEED 8100 FEET