4. Studies and Analysis of Radio Propagation Test Result

4-1. Analysis of Receiving Field Intensity

Basic field intensity for each span has been obtained in such a manner as to read out and sum up the field intensity values recorded on the instrument's recording paper to know the instant cumulative distribution and then hourly medium value's cumulative distribution.

The process of the test is as follows;

(1) Ten minutes continuous recording of receiving field intensity was made at every hour. In the case the recording speed was 180 mm/min., the value was read out with 1dB step at every 3.3 sec., and in the case the recording speed was 60 mm/min., at every 5 sec., totalling 120 times.

(2) The values obtained by above (1) have been written down with 1dB step time rate distribution.

(3) Further the above have been rewritten in the form of cumulative distribution. This shows the hourly instant receiving field intensity cumulative distribution, an example of which is shown in Fig. 4-1. It looks similar to Rayleigh distribution.

(4) The 50% time rate value taken from the hourly receiving field intensity cumulative distribution of above (3) shows the medium value of the span at every hour. Such medium values are shown in Fig. 4-2 ~ Fig. 4-4.

(5) The medium values obtained in above (4) are expressed in time rate and further in cumulative distribution form. Refer to Fig. 4-5 ~ Fig. 4-7.

(6) The receiving levels of 50% time rate shown in Fig. 4-5 ~ Fig. 4-7 are the measured basic receiving field intensities (50% medium value).

They (Pr) are as follows;

A.	Diliman - Carmen Rosales	12dBμV
B.	Carmen Rosales - Tuguegarao	1dBμV
C.	Tanay - Naga	5dBμV

Fig. 4–1 Example of Receiving Field Intensity Cumulative Distribution

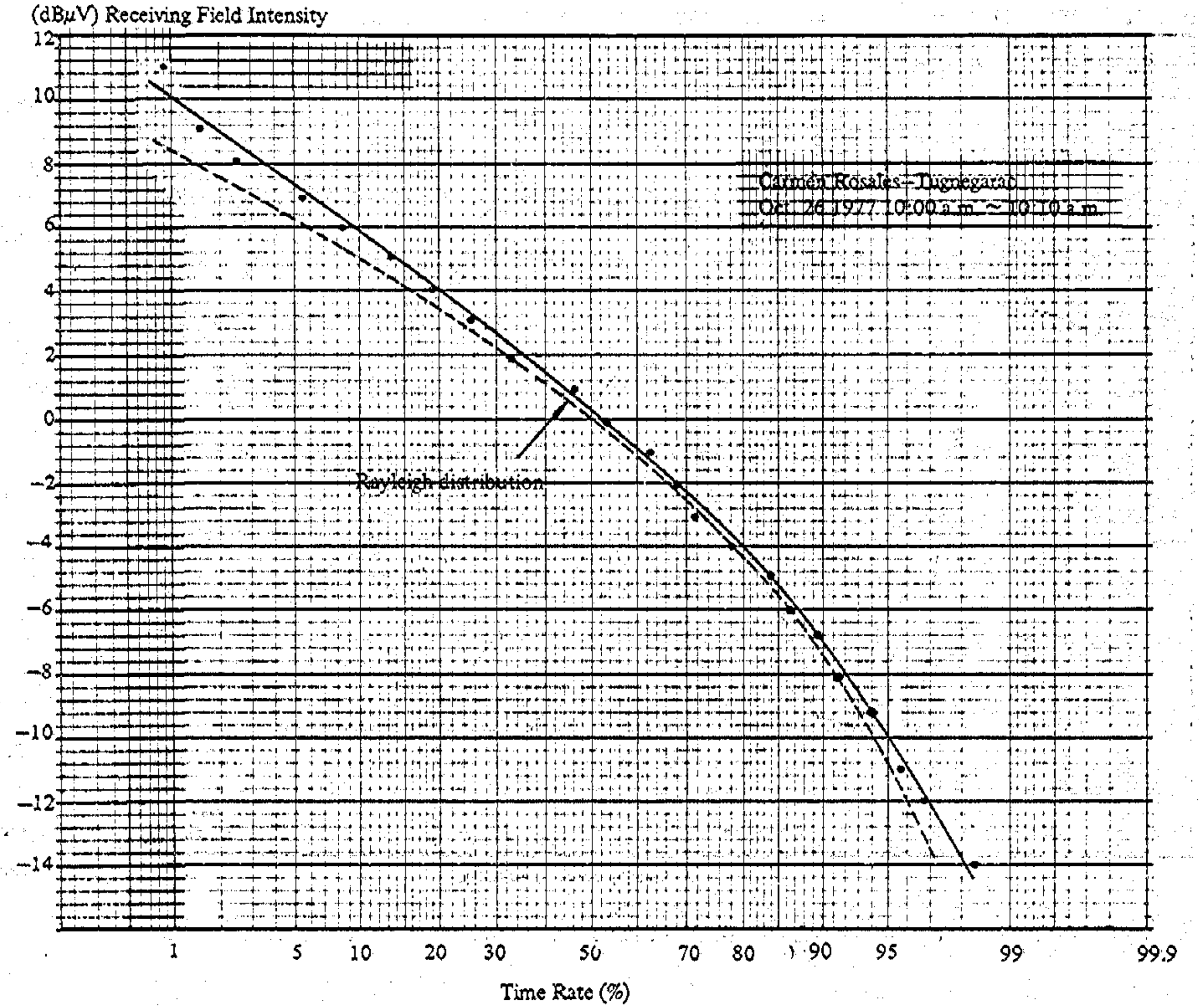


Fig. 4–2 Hourly Variation of Receiving Field Intensity and Transmission Loss (medium value)

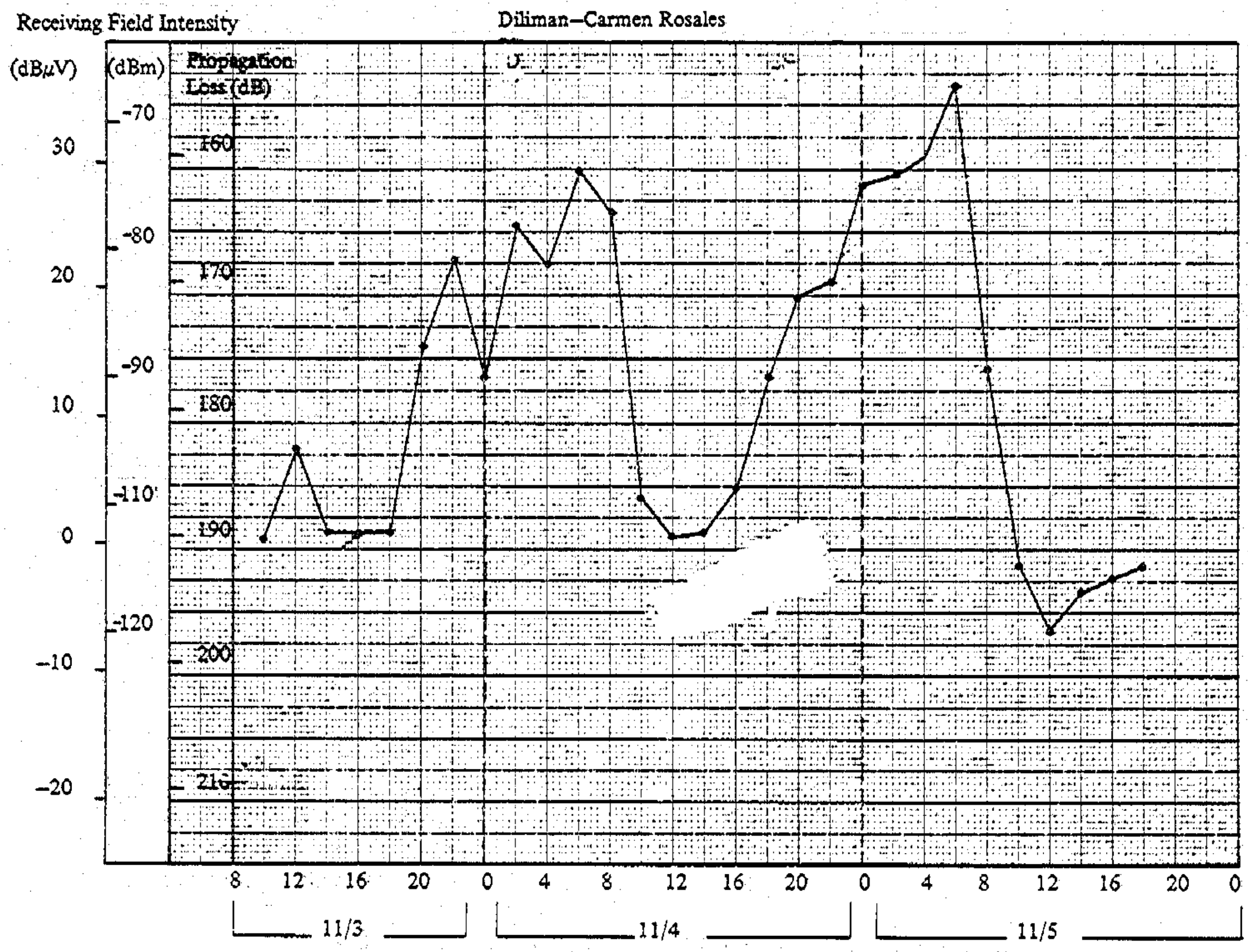


Fig. 4–3 Hourly Variation of Receiving Field Intensity Transmission Loss (medium value)

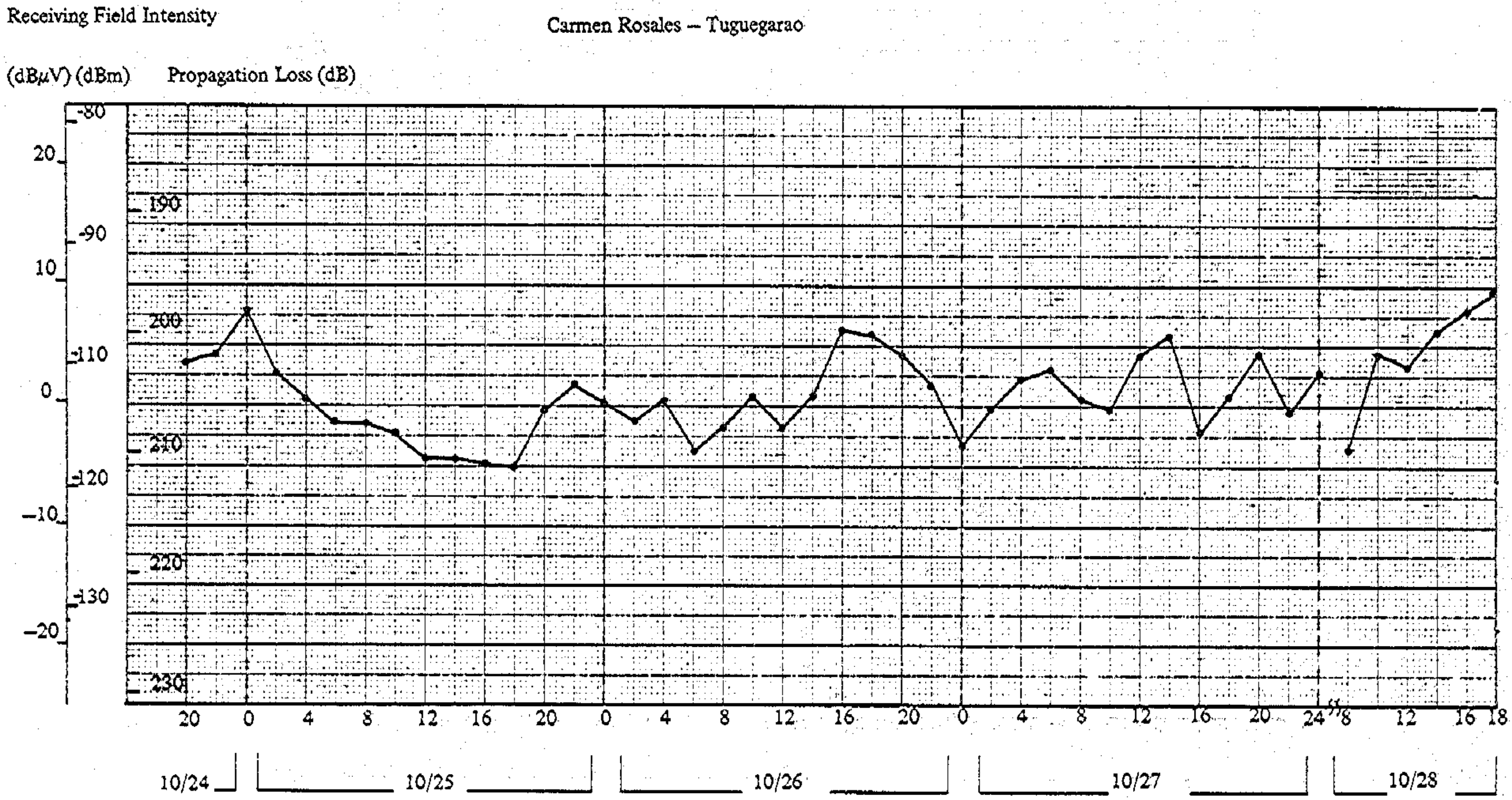


Fig. 4—4 Hourly Variation of Receiving Field Intensity Transmission Loss (medium value)

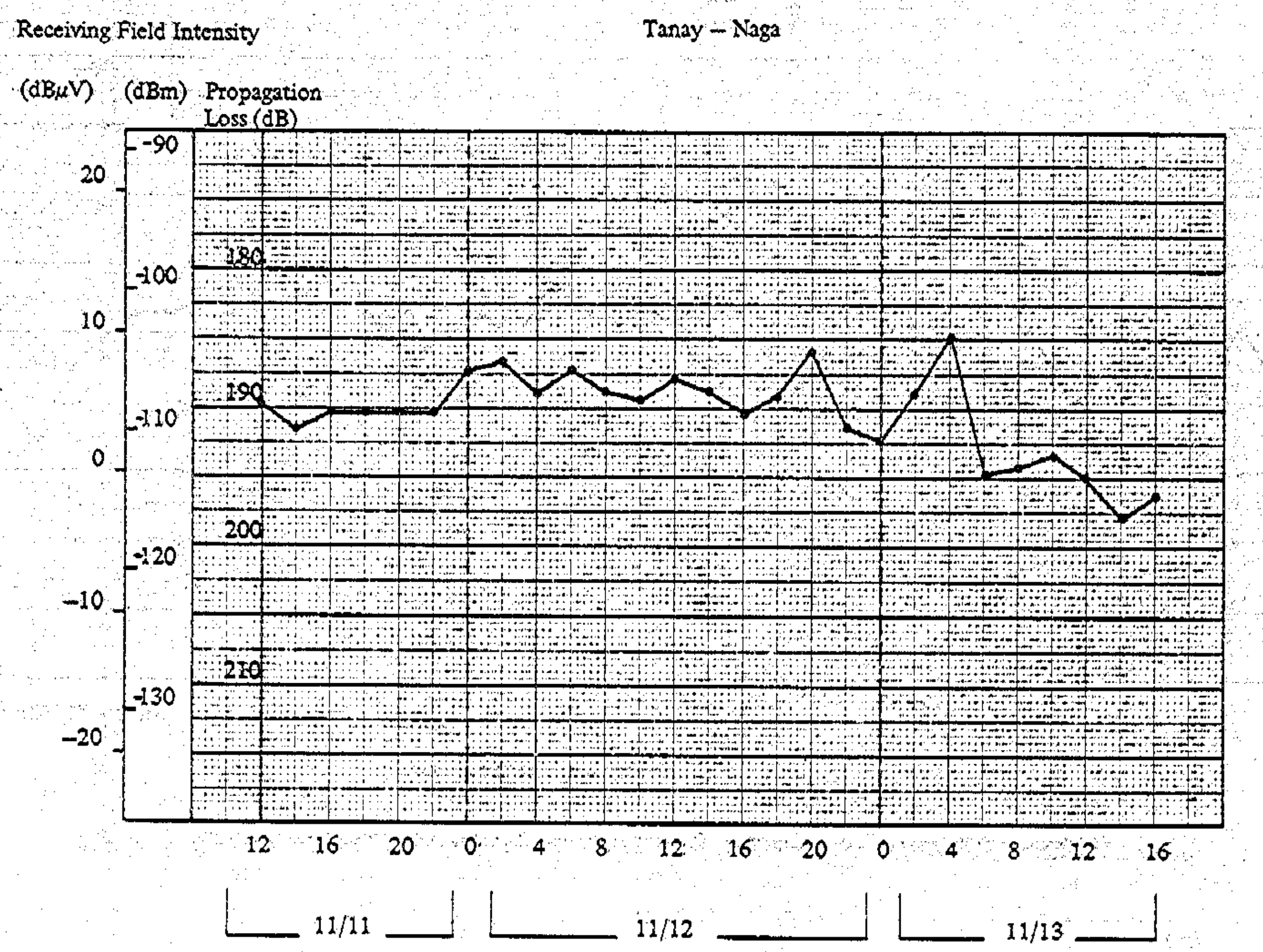


Fig. 4–5 Basic Transmission Loss Cumulative Distribution

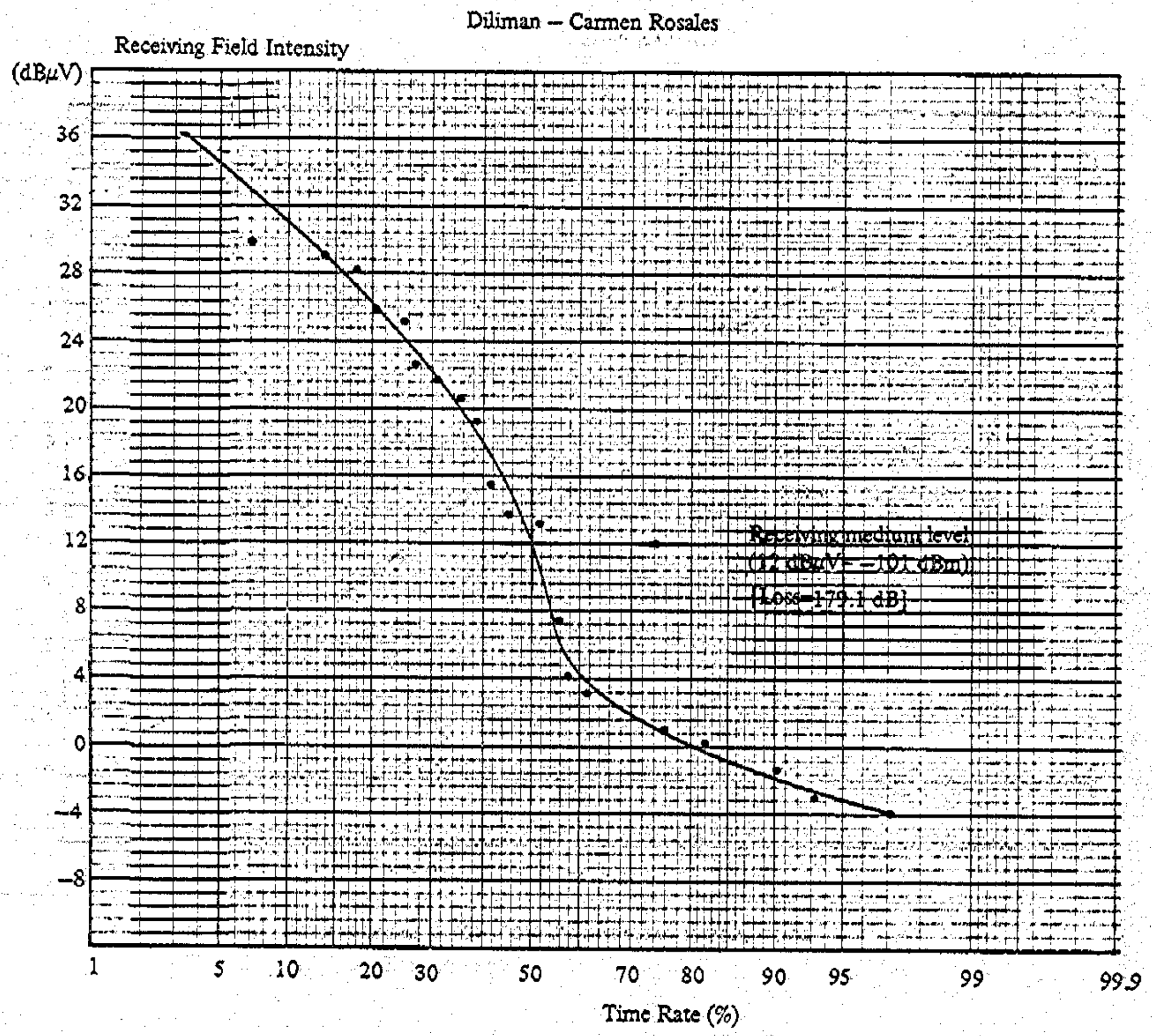


Fig. 4—6 Basic Transmission Loss Cumulative Distribution

Receiving Field Intensity Tuguegarao — Carmen Rosales

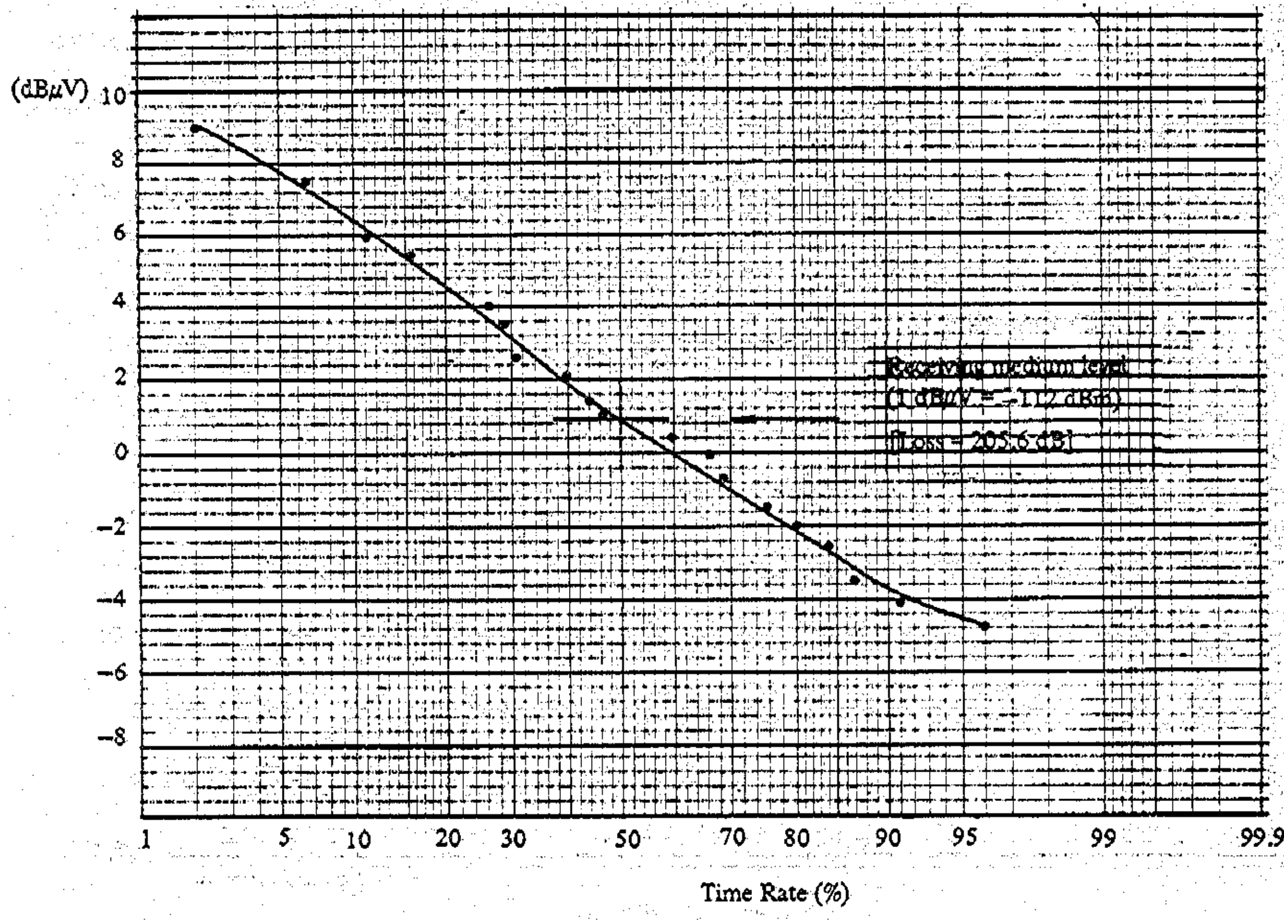
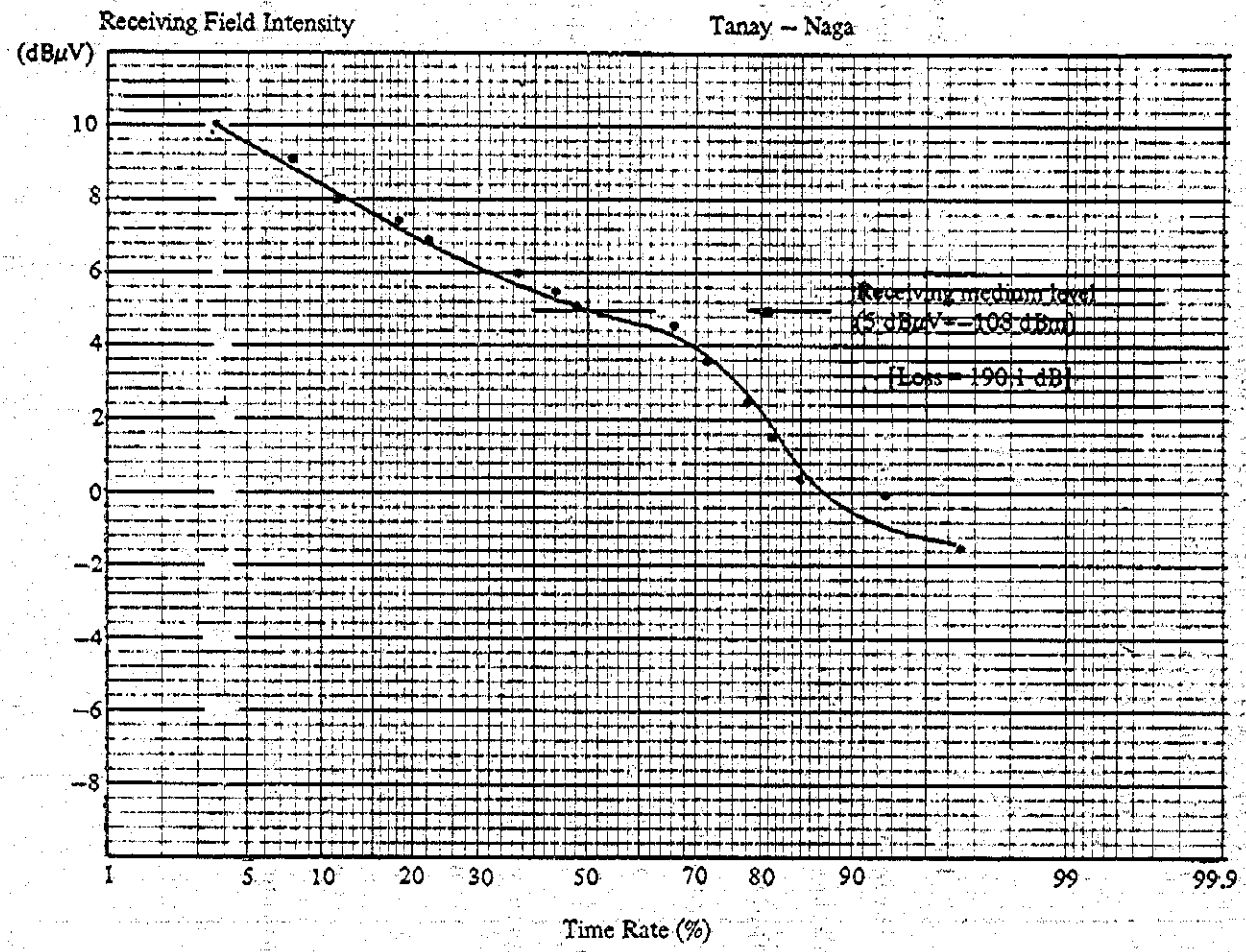


Fig. 4–7 Basic Transmission Loss Cumulative Distribution



4-2. Calculation of Basic Propagation Loss

From the foregoing 3-2-1(3) and 4-1-(6), the basic propagation (transmission) loss (Lp) can be obtained.

A. Diliman - Carmen Rosales

$Lp = 191.1 - 12.0 = 179.1$ (dB)

B. Carmen Rosales - Tuguegarao

$Lp = 206.6 - 1.0 = 205.6$ (dB)

C. Tanay - Naga

$Lp = 195.1 - 5.0 = 190.1$ (dB)

In the span, Diliman - Carmen Rosales, the basic propagation (transmission) loss differs greatly at daytime and night time. Therefore, the values of basic measured propagation loss obtained in Fig. 4-5 cannot be applied to the system circuit design, which will cause low reliability of transmission at daytime.

In designing the system circuit, it is reasonable to take up the basic propagation (transmission) loss obtained in Fig. 4-8 which has the data measured from 8:00 a.m. to 6:00 p.m.

D. Diliman - Carmen Rosales (daytime)

$Lp = 191.1 - 2 = 189.1$ (dB)

Reference is made to Table 4-1 ~ Table 4-3 which compare the desk planned values and the measured values for correction purposes.

Fig. 4–8 Basic Transmission Loss Cumulative Distribution

Diliman – Carmen Rosales (8:00 a.m. ~ 6:00 p.m.)

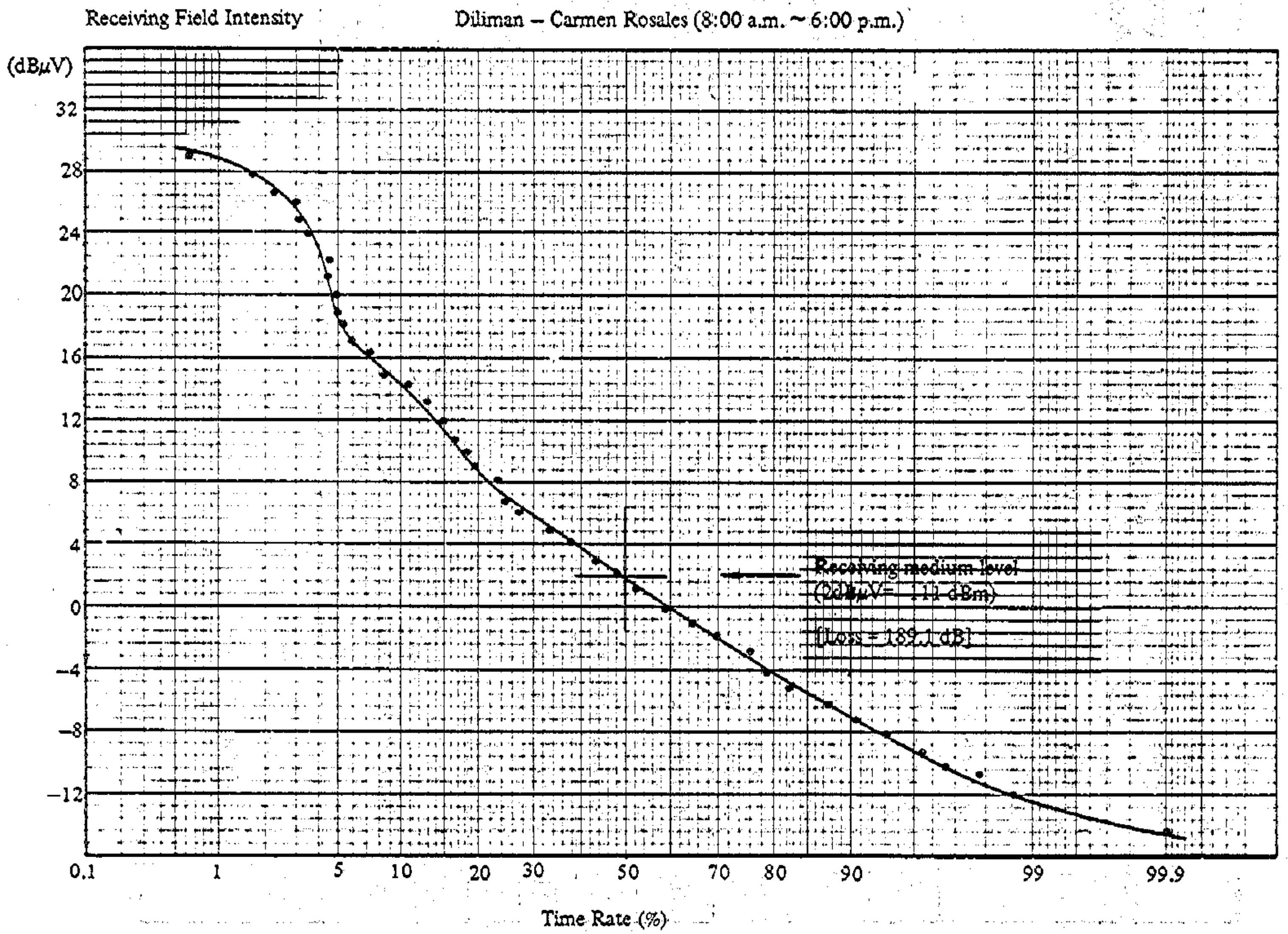


Table 4-1. DILIMAN - CARMEN ROSALES
PROPAGATION TEST DATA SHEET

		Calculation		Measurement	
	Span	DILIMAN -	CARMEN ROSALES	DILIMAN -	CARMEN ROSALES
	Altitude	60m	15m	60m	15m
	Antenna Height	29m	19m	29m	19m
	Distance	144.9km		144.9km	
①	Transmitting Feeder Loss	-3.2dB	RG-17/U, 40m	-3.2dB	RG-17/U, 40m
②	Receiving Feeder Loss	-7.2dB	RG-17/U, 40m 8D-2W, 25m	-7.2dB	RG-17/U, 40m 8D-2W, 25m
③	Transmitting Antenna Gain	+25.5dB	6mø G.P.	+25.5dB	6mø G.P.
④	Receiving Antenna Gain	+14dB	12 ELE YAGI	+14dB	12 ELE YAGI
⑤	Propagation Loss	-177.2dB		-189.1dB	(⑥-①-②-③-④)
5.1	Corrective Value	-		-11.9dB	
⑥	Span Loss	-148.1dB	(①+②+③+④+⑤)	-160dB	(⑧-⑦)
⑦	Transmitting Power	+49dBm	80W	+49dBm	80W
⑧	Receiving Power	-99.1dBm (13.9dBμV)	(⑥+⑦)	-111dBm (2dBuV)	Measured Value
	Note				

Table 4-2. CARMEN ROSALES - TUGUEGARAO
PROPAGATION TEST DATA SHEET

		Calculation		Measurement	
	Span	CARMEN ROSALES	TUGUEGARAO	CARMEN ROSALES	TUGUEGARAO
	Altitude	15m	15m	15m	15m
	Antenna Height	19m	16m	19m	19m
	Distance	224.5km		224.5km	
①	Transmitting Feeder Loss	-3.2dB	RG-17/U, 40m	-3.2dB	RG-17/U, 40m
②	Receiving Feeder Loss	-3.2dB	RG-17/U, 40m	-3.2dB	RG-17/U, 40m
③	Transmitting Antenna Gain	+25.5dB	6mϕ G.P.	+25.5dB	6mϕ G.P.
④	Receiving Antenna Gain	+25.5dB	6mϕ G.P.	+25.5dB	6mϕ G.P.
⑤	Propagation Loss	-199.5dB		-205.6dB	(⑥-①-②-③-④)
⑤.1	Corrective Value	-		-6.1dB	
⑥	Span Loss	-154.9dB	(①+②+③+④+⑤)	-161dB	(⑧-⑦)
⑦	Transmitting Power	+49dBm	80W	+49dBm	80W
⑧	Receiving Power	-105.9dBm (7.1dBμV)	(⑥+⑦)	-112dBm (1dBμV)	Measured Value
	Note				

Table 4-3. TANAY - NAGA
PROPAGATION TEST DATA SHEET

		Calculation		Measurement	
	Span	TANAY - NAGA		TANAY - NAGA	
	Altitude	530m	5m	530m	5m
	Antenna Height	10m	19m	10m	19m
	Distance	222km		222km	
①	Transmitting Feeder Loss	-3.2dB	RG-17/U, 40m	-3.2dB	RG-17/U, 40m
②	Receiving Feeder Loss	-3.2dB	RG-17/U, 40m	-3.2dB	RG-17/U, 40m
③	Transmitting Antenna Gain	+14dB	12 ELE YAGI	+14dB	12 ELE YAGI
④	Receiving Antenna Gain	+25.5dB	6mø G.P.	+25.5dB	6mø G.P.
⑤	Propagation Loss	-186.1dB		-190.1dB	(⑥-①-②-③-④)
(5-1)	Corrective Value	-		-4dB	
⑥	Span Loss	-153 dB	(①+②+③+④+⑤)	-157dB	(⑧-⑦)
⑦	Transmitting Power	+49dBm	80W	+49dBm	80W
⑧	Receiving Power	-104dBm (9dBµV)	(⑥+⑦)	-108dBm (5dBµV)	Measured Value
	Note				

5. Multiplex Telecommunication Network

5-1. General

After the survey, it has become necessary to give some modifications to the previously submitted report in regard to the multiplex telecommunication network covering the routes from all the subcenters to New FFC and BPW via relay stations in its routes, radio frequencies, transmitting powers, antenna characteristics, type of diversity system and etc.

With this requirement for modifications, it has also become necessary to increase the budget for equipment, installation, adjustment and etc.

5-2. Multiplex Telecommunication System Routes

The multiplex telecommunication system routes running from the subcenters in basins to New FFC, BPW and PAGASA have been planned as shown in Fig. 5-1. Out of the above routes, Diliman - Carmen Rosales, Carmen Rosales - Tuguegarao and Tannay - Naga are planned to have troposcatter telecommunication systems because of their out of line-of-sight conditions and the other spans to have line-of-sight telecommunication systems.

In planning the above system routes, the following points have been taken into account;

(1) The multiplex telecommunication station (subcenter) for Tuguegarao is planned to be located at its BPW office. It is to be noted, however, that PAGASA weather station is located at better point in view of propagation of troposcatter waves. This fact deserves studies.

(2) The center of the systems is to be located at the new building of PAGASA (tentatively called New FFC) due to the information that the originally planned FFC in present PAGASA building will be changed to its new building. For this reason, small capacity multiplex telecommunication system is added to link present PAGASA and its new building as it is required until the present PAGASA facilities are completely

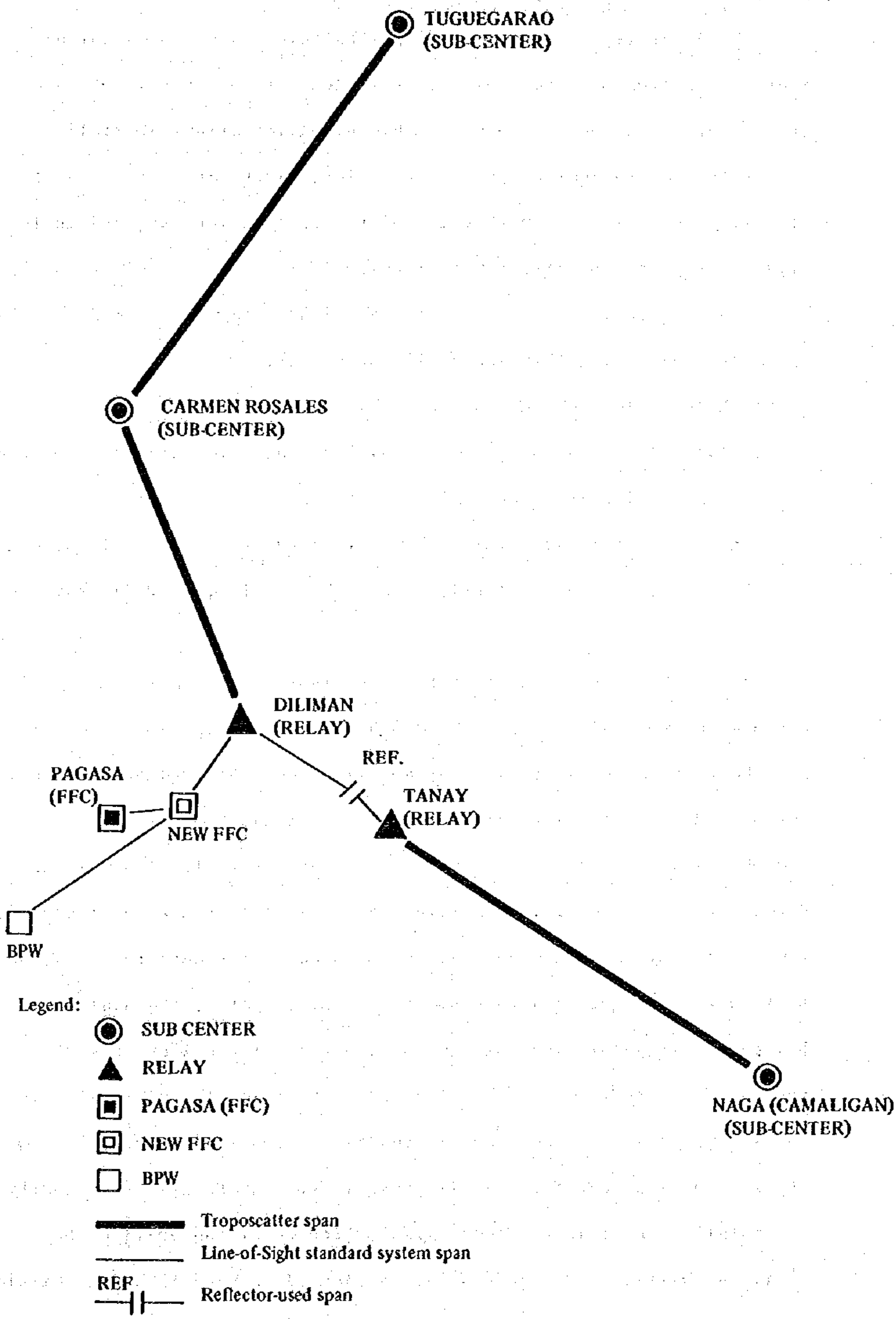
moved to the new building.

(3) In the route from Naga to New FFC through Tanay, it is considered more advantageous to connect Tanay directly to New FFC in view of communication quality, servicing at the time of faults, and etc. than to connect Tanay, Diliman and then to New FFC.

However, in order to have direct connection between Tanay and New FFC by 7000 MHz band multiplex system, a big type antenna tower is required to be built at New FFC site.

In view of this difficulty, the present plan has been made to have a relay station at Diliman tentatively with the consideration that in future the route may be changed by installing a suitable tower at the roof of the new PAGASA building.

Fig. 5—1 Multiplex Telecommunication System Route



5-3. Studies on Diversity System

The diversity system is generally believed to be an essential factor in designing a communications system for the span which is out of line of sight because such span has great variations in field intensity and propagation phase distortion. There are two types of diversity system; space diversity and frequency diversity, and in the previous report, the latter was proposed.

The frequency diversity system has disadvantages compared with the space diversity system in the following points;

a) Many radio frequencies are required.

b) Two sets of radio equipment being operated in parallel, the power consumption is bigger and the maintenance costs more.

The space diversity system, however, needs two arrays of antenna, and their construction is costlier than that of frequency diversity's antenna.

After the present radio propagation test and the site survey, it has been known that the span, Carmen Rosales - Tuguegarao is very long and the propagation loss is great and also that the frequency allocation for 400 MHz band is difficult. Therefore, it has been planned to use 800 MHz band space diversity system although originally 400 MHz band frequency diversity multiplex telecommunication system which needs high power and many radio frequencies was planned. It should be noted, however, that in the case of employing space diversity system, the distance between the transmitting antenna and the receiving antenna must be more than 80 m. Both in Carmen Rosales and Tuguegarao, the BPW's site is not so spacious as to accommodate the two antennas with more than 80 m's separation, and therefore, it is possible that there arises necessity to install an auxiliary antenna system (for receiving only) at both stations. Diliman - Carmen Rosales is planned to have 100W transmission power, and Tanay - Naga, 50W transmission power. The radio equipment for these two spans are of all solid-state, and therefore easy in servicing and maintenance. Also there is almost no restriction for frequency allocation of 800 MHz.

Due to above reasons, the frequency diversity system, low in construction cost, has been planned.

5-4. Studies on Radio Frequency

The results of studies on radio frequencies to be used for the multiplex telecommunication network are as follows;

5-4-1. Spans out of Line of Sight

(1) Diliman - Carmen Rosales and Tanay - Naga, as described in the foregoing chapters, will use 800 MHz band radio frequencies due to difficulty in obtaining frequency allocation for 400 MHz band in Manila and nearby areas.

Carmen Rosales - Tuguegarao, however, will use 400 MHz band (400 MHz - 470 MHz) because this span is far away from Manila enough to be less subject to cross-talk or interference and also because it has great propagation loss, requiring a high transmission power.

(2) The radio frequencies required for the spans which are out of line of sight are as follows;

Span \ Item	Frequency Band	Number of Frequency	Remarks
Diliman - Carmen Rosales	800 MHz	4 (2 pairs)	Frequency diversity
Carmen Rosales - Tuguegarao	400 MHz	2 (1 pair)	Space diversity
Tanay - Naga	800 MHz	4 (2 pairs)	Frequency diversity
Total	800 MHz	8 (4 pairs)	
	400 MHz	2 (1 pair)	

5-4-2. Spans within Line of Sight

(1) After the radio propagation test and the radio path survey, it has been known that either 400 MHz or 800 MHz band can be applied to New FFC - Diliman and Diliman - Tanay
However, 400 MHz band frequencies are so congested in Manila and nearby areas that a new allocation for that frequency band is difficult. Also 800 MHz band is not recommendable due to the fact that high power troposcatter multiplex system expected to be installed at both Diliman and Tanay for communications with other directions will cause mutual interferences.
In view of the requirements as the trunk line for excellent circuit quality, sufficient capacity and future expansions, 7000 MHz band multiplex telecommunication system has been planned for these two spans.

(2) It has been confirmed after the line of sight survey and the site survey that high quality circuit can be secured by 800 MHz band.
It is not recommendable to use 7000 MHz band which needs a high antenna tower due to the tall buildings existing on the radio path.
Therefore, these two spans have been planned to use 800 MHz band.
The radio frequencies to be used for the line-of-sight spans are as follows;

Span \ Item	Frequency	Number of Frequency	Remarks
New FFC - Diliman	7000 MHz	2 (1 pair)	
Diliman - Tanay	7000 MHz	2 (1 pair)	
New FFC - BPW	800 MHz	2 (1 pair)	
New FFC - PAGASA	800 MHz	2 (1 pair)	
Total	7000 MHz	4 (2 pairs)	
	800 MHz	4 (2 pairs)	

5-5. Circuit Design

5-5-1. Spans out of Line of Sight

(1) The span, Carmen Rosales - Tuguegarao which will use 400 MHz band has been designed by utilizing the basic propagation loss obtained by the test. The spans, Diliman - Carmen Rosales and Tanay - Naga which will use 800 MHz have been designed by calculating the basic propagation loss for 800 MHz band based on the values obtained by the test for 400 MHz band plus the data in position. The calculation has revealed the increase of the basic propagation loss by 9 dB for both spans compared with 400 MHz band.

(2) The target values for the system circuit design have been placed on about 40 dB S/N (50% value) and about 99.0% reliability in consideration of necessary circuit quality and maintenance procedures as private communications links and also from economical view point.

(3) The safety factor of 3 dB has been taken into account in anticipation of variations of propagation loss which may occur in a long period of time in a year because the test of propagation loss for each span was conducted only for 52 to 88 hours.

(4) Reference is made to Table 5-1 for the system circuit design for the spans out of line of sight.

5-5-2. Spans within Line of Sight

(1) For the spans within line of sight, the turget values for the system circuit design have been put on about 50 dB S/N and about 99.9% reliability.

(2) The designed values are shown in Table 5-2.

Table 5-1 Network System Calculation Chart (Multiplex Telecommunication Network)

System Design Data Sheet

Name of span / Item	Unit	Diliman - Carmen Rosales (144.9Km)		Carmen Rosales - Tuguegarao (224.5Km)		Tanay - Naga (222Km)	
Antenna Power	dBm	+50	100W	+60	1 KW	+47	50W
Basic Propagation loss	dB	-198.1	f:800MHz scatter loss	-205.6	f:400MHz scatter loss	-199.1	f:800MHz scatter loss
Additional loss	dB						
Safety factor	dB	-3		-3		-3	
Feeder loss	dB	-1.8	SFZE50-13W 90W	-2.0	SFZE50-13W 100m	-1.8	SFZE50-13W 90m
Antenna gain (T)	dB	+35.5	10m∅ G.P.B.R.	+28.5	10m∅ G.P.B.R	+35.5	10m∅ G.P.B.R
Antenna gain (R)	dB	+35.5	10m∅ G.P.B.R.	+28.5	10m∅ G.P.B.R	+35.5	10m∅ G.P.B.R
		-4	Antenna-to-medium coupling loss			-4	Antenna-to-medium coupling loss
Duplex system loss	dB	-2.5		-2.5		-2.5	
Receiving Power	dBm	-88.4		-96.1		-92.4	
Threshold level	dBm	-105	B=460kHz, NF=3dB	-113	B=80kHz, NF=3dB	-113	B=80kHz, NF=34B
Margin against threshold level	dB	16.6		16.9		20.6	
S/N improvement factor	dB	29	20+9 (Crest factor)	21	12 + 9 (Crest factor)	21	12 + 9 (Crest factor)
Diversity improvement	dB	4.0	Frequency diversity	2.5	Unequal medium	4.0	Frequency diversity
Combined gain	dB	—		—		—	
S/N in standard state	dB	49.6		40.4		45.6	
Fading value presumed	dB	-16.6		-16.9		-20.6	
S/N exceeded	dB	33.0	S/N exceeded	23.5	S/N exceeded	25.0	S/N exceeded
____%			99.2%		99.5%		99.8%
Remarks		Troposcatter System (Frequency Diversity)		Troposcatter System (Space Diversity)		Troposcatter System (Frequency Diversity)	

Table 5-2 Network System Calculation Chart (Multiplex Telecommunication Network)

System Design Data Sheet

Item \ Name of span	Unit	New FFC - Diliman (4Km)		Diliman - Tanay (28.4Km-Ref Point-3.2Km)		New FFC - B.P.W (9.9Km)	
Antenna Power	dBm	+30	1W	+30	1W	+37	5W
Free space loss	dB	-121.0	f: 7000MHz	-257.2	f: 7000MHz	-110.4	f: 800MHz
Additional loss	dB	-20	ATT at FFC	+98.9	Reflector Gain	-18.2	Shadow loss
		-6	Experimental correction	-6	Experimental correction	-6	Experimental correction
Feeder loss	dB	-4.5	FR-6H 90m	-3.5	FR-6H 70m	-5.4	AFZE50-7 90m
Antenna gain (T)	dB	+35.5	1.2mø P.B.R	+43.5	3mø P.B.R	+20.0	1.8mø G.P
Antenna gain (R)	dB	+35.5	1.2mø P.B.R	+43.5	3mø P.B.R	+20.0	1.8mø G.P
Duplex system loss	dB	-6.2	T:-2.0 R:-4.2	-6.2	T:-2.0 R:-4.2	-7.0	Included HYB loss
Receiving Power	dBm	-56.7		-57.0		-70.0	
Threshold level	dBm	-89	B=8MHz, NF=7dB	-89	B=8MHz, NF=7dB	-101	V=460kHz, NF=7dB
Margin against threshold level	dB	32.3		32.0		31.0	
S/N improvement factor	dB	39.6	30.6+9 (Crest factor)	39.6	30.6+9 (Crest factor)		
Diversity improvement	dB	–		–		–	
Combined gain	dB	3		3		3	
S/N in standard state	dB	74.9		74.6		51.0	
Fading value presumed	dB	-7.2	0.3dB/Km+6dB	-15.5	0.3dB/Km+6dB	-8.0	0.2dB/Km+6dB
S/N exceeded 99.9%	dB	67.7		59.1		43.0	
Remarks							

5-5-3. Characteristics of Multiplex Telecommunication Network

(1) The Characteristics for the multiplex telecommunication network, both for out-of-line-of-sight spans and within-line-of-sight spans, are as follows;

	Span	Frequency	Output Power	Antenna	Description
Out-of-Line-of-Sight Communications	Diliman-Carmen Rosales	800 MHz	100W	10mø grid parabola	Frequency diversity
	Carmen Rosales-Tuguegarao	400 MHz	1KW	10mø, 6mø grid parabola	Space diversity *
	Tanay-Naga	800 MHz	50W	10mø grid parabola	Frequency diversity
Within-Line-of-Sight Communications	New FFC-Diliman	7000 MHz	1W	1.2mø parabola	10dB ATT to be inserted
	Diliman-Tanay	7000 MHz	1W	3mø parabola	2 Reflectors of 6mx4m to be used
	New FFC-BPW	800 MHz	5W	1.8mø grid parabola	
	New FFC-PAGASA	800 MHz	5W	60° Corner Ref. Ant.	

Note: * The main antenna for the space diversity system will be 10m in diameter and the auxiliary antenna (receiving only), 6m in diameter.

5-5-4. Overall S/N and Circuit Reliability

The overall S/N and the system circuit reliability for the multiplex links from New FFC to the subcenters in the basins, BPW and PAGASA are as follows;

Item / Span	Overall S/N and Reliability		
	S/N(50% value) at standard conditions	S/N at 99.0% reliability	S/N at 99.9% reliability
New FFC - Carmen Rosales	49.2 dB	33.2 dB	-
New FFC - Tuguegarao	39.9 dB	25.6 dB	-
New FFC - Naga	45.4 dB	29.4 dB	-
New FFC - Diliman	59.7 dB	-	59.1 dB
New FFC - Tanay	58.9 dB	-	55.8 dB
New FFC - BPW	50.2 dB	-	42.9 dB
New FFC - PAGASA	57.1 dB	-	54.7 dB
Remarks			

5-6. Proposed Composition of Equipment and Materials and their Cost

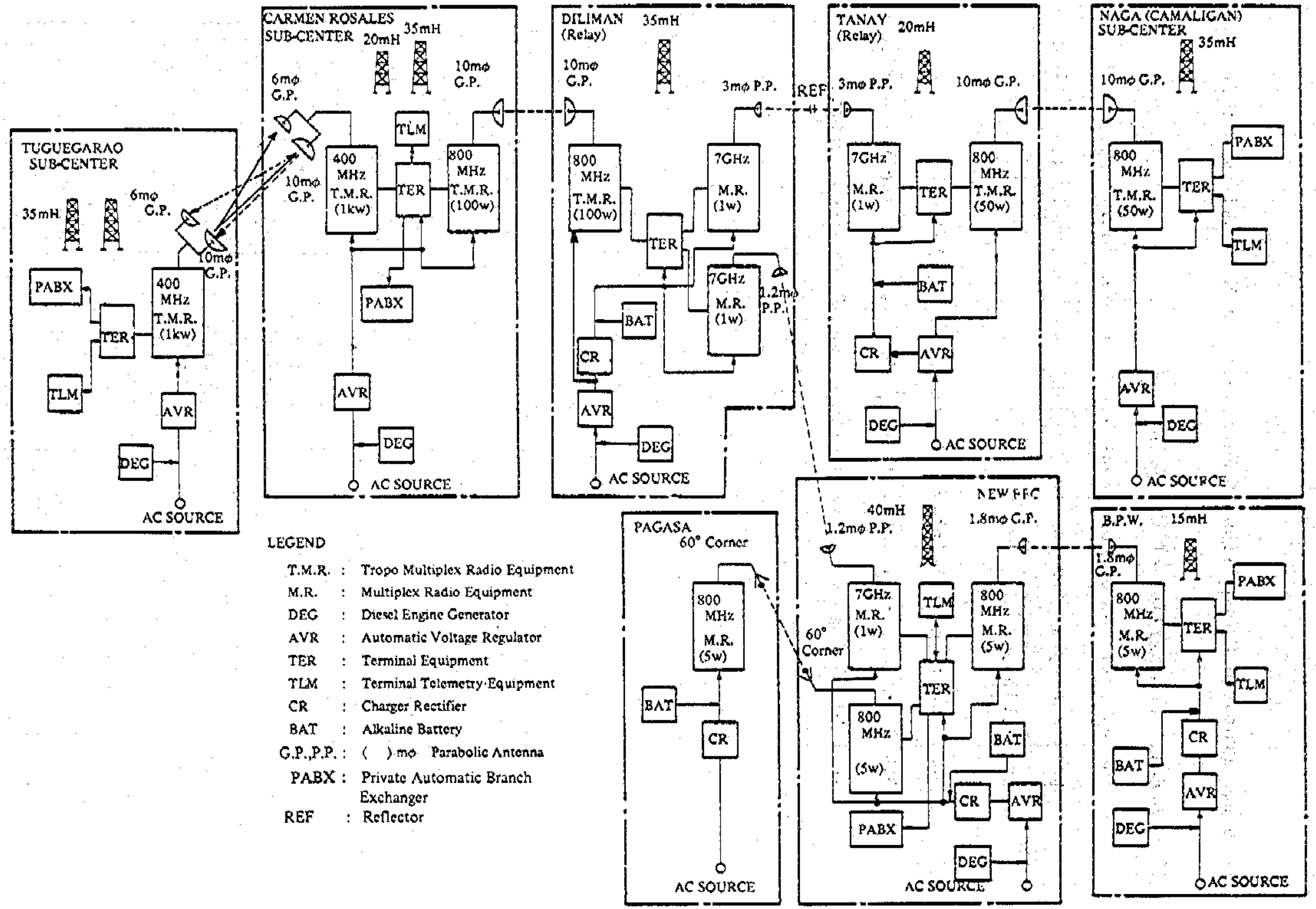
5-6-1. Composition of Equipment and Materials

The composition of equipment which are considered necessary by the preliminary design for the present systems are listed up in Fig. 5-2 and Table 5-3.

5-6-2. Cost for Multiplex Telecommunication Network

Based on the preliminary design, the costs for the network are shown in Table 5-4 in comparison with those of previous report.

Fig. 5—2 Schematic Multiplex Telecommunication



LEGEND

T.M.R.	:	Tropo Multiplex Radio Equipment
M.R.	:	Multiplex Radio Equipment
DEG	:	Diesel Engine Generator
AVR	:	Automatic Voltage Regulator
TER	:	Terminal Equipment
TLM	:	Terminal Telemetry Equipment
CR	:	Charger Rectifier
BAT	:	Alkaline Battery
G.P.,P.P.	:	( ) mφ Parabolic Antenna
PABX	:	Private Automatic Branch Exchanger
REF	:	Reflector

Table 5-3 Equipment Composition List

ITEM	APPLICATIONS / NAME OF STATION (FUNCTION)	BPW (MONITOR)	NFPC (PAGASA)	PAGASA	DILIMAN (RELAY)	CARMEN ROSALES (SUB)	TANAY (RELAY)	NAGA (SUB)	TUGUEGARAO (SUB)	TOTAL
Multiplex Radio Equipment 400 MHz	Troposcator, 1kW 6ch FM No.1/No.2	-	-	-	-	1	-	-	1	2
" " " 800 MHz	" 50W 6ch FM "	-	-	-	-	-	1	1	-	2
" " " 800 MHz	" 100W 12ch FM "	-	-	-	1	1	-	-	-	2
" " " 7 GHz	1W 60ch FM No.1/No.2	-	1	-	2	-	1	-	-	4
" " " 800 MHz	5W 24ch FM No.1/No.2	1	1	-	-	-	-	-	-	2
" " " 800 MHz	5W 6ch FM No.1/No.2	-	1	1	-	-	-	-	-	2
Dividing Circuit	For SS-FM Multiplex	-	2	-	1	2	1	-	-	6
" "	For SS-FM Multiplex	-	1	-	2	-	1	-	-	4
Antenna	400 MHz G.P.B.R. 10mø	-	-	-	-	1	-	-	1	2
"	400 MHz G.P.B.R. 6mø	-	-	-	-	1	-	-	1	2
"	800 MHz G.P.B.R. 10mø	-	-	-	1	1	1	1	-	4
"	800 MHz G.P.B.R. 1.8mø	1	1	-	-	-	-	-	-	2
"	800 MHz 60° Corner Reflector	-	1	1	-	-	-	-	-	2
"	7 GHz P.B.R. 3mø	-	-	-	1	-	1	-	-	2
"	7 GHz P.B.R. 1.2mø	-	1	-	1	-	-	-	-	2
Radome	7 GHz P.B.R. for 1.2m	-	1	-	-	-	-	-	-	1
Coaxial Cable	Equality as SFZE-50-13W	-	-	-	60	250	45	60	220	635
" "	" AFZE-50-7	60	115	50	-	-	-	-	-	225
Wave Guide	" FR-6H	-	100	-	200	-	40	-	-	340
" "	WRJ-7-(D)	-	8	-	16	-	-	-	-	28
Coaxial Connector	For SF Cable	-	-	-	1	3	1	1	2	8
" "	For AF Cable	1	2	1	-	-	-	-	-	4

Table 5-3 Equipment Composition List

ITEM	APPLICATION / NAME OF STATION (FUNCTION)	BPW (MONITOR)	NPPC (PAGASA)	PAGASA	DILIMAN (RELAY)	CARMEN ROSALES (SUB)	TANAY (RELAY)	NAGA (SUB)	TUGUEGARAO (SUB)	TOTAL
Dehydrator		-	1	-	1	1	1	1	1	6
Carrier Terminal Equipment	6/12 ch 2PG Repeater	-	-	-	1	-	1	-	-	2
" " "	12/12 ch	-	1	-	-	-	-	-	-	1
" " "	24/24 ch	1	1	-	-	-	-	-	-	2
" " "	9/24 ch 1PG	-	-	-	-	1	-	-	-	1
" " "	5/6 ch	-	-	-	-	-	-	1	1	2
Automatic Voltage Regulator	220V 1ϕ 5KVA	1	-	-	1	1	1	1	-	5
" " "	220V 1ϕ 15KVA	-	-	-	-	1	-	-	1	2
" " "	220V 3ϕ 40KVA	-	1	-	-	-	-	-	-	1
DC Power Supply Equipment	DC 24V 1ϕ 15A 100AH	1	1	-	1	1	1	1	1	7
Diesel Engine Generator	AC 100V, 10KVA with starter	1	-	-	1	1	1	1	-	5
" " "	AC 100V, 20KVA, main and stand-by	-	-	-	-	-	-	-	2	2
" " "	AC 100V, 50KVA "	-	1	-	-	-	-	-	-	1
Remote Control Equipment	Master Station, Cyclic	-	1	-	-	-	-	-	-	1
" " "	Terminal Station, Cyclic	1	-	-	1	1	1	1	1	6
Automatic Telephone Exchange	XB 60 extension line	-	1	-	-	-	-	-	-	1
" " "	XB 40 " "	1	-	-	-	-	-	-	-	1
Telephone Exchange	With 10 telephone sets	-	-	-	-	1	-	1	1	3
Converter Cabinet	6/6 ch with FS ringer	-	1	-	-	1	-	1	1	4
Repeater Rack	3/6 ch includ. Signal Power	1	1	-	-	1	-	1	1	6
Reflecter	4 M x 6 M	-	-	-	-	-	2	-	-	2
Test Equipment		1	1	1	1	1	1	1	1	8
Accessories and Spare Parts		1	1	1	1	1	1	1	1	8

Table 5-4-(1) Cost Comparison for Multiplex Radio Communication Facilities

(Unit: x10^3 Yen)

ITEM	NAME OF STATION	BPW (MONITOR)	NFFC (PAGASA)	PAGASA	DILIMAN (RELAY)	CARMEN ROSALES (SUB)	TANAY (RELAY)	NAGA (SUB)	TUGUEGARAO (SUB)	TOTAL
Equipment cost	Revised amount	32,360	62,172	12,465	70,768	103,690	67,218	51,258	73,736	473,667
	Original amount	30,642	47,483	0	48,312	70,605	33,683	34,085	58,200	323,010
	Increase/Decrease	1,718	14,689	12,465	22,456	33,085	33,535	17,173	15,536	150,657
Installation and Adjustment Cost	Revised amount	26,568	33,553	1,000	19,793	25,735	13,973	14,119	13,804	148,545
	Original amount	26,568	33,553	0	19,293	24,735	13,473	13,619	12,804	144,045
	Increase/Decrease	0	0	1,000	500	1,000	500	500	1,000	4,500
Total	Revised amount	58,928	95,725	13,465	90,561	129,425	81,191	65,377	87,540	622,212
	Original amount	57,210	81,036	0	67,605	95,340	47,156	47,704	71,004	467,055
	Increase/Decrease	1,718	14,689	13,465	22,956	34,085	34,035	17,673	16,536	155,157

Note: Original cost of the installation and adjustment for the New FFC is quoted based on the amount of PAGASA's survey report issued on August 1977.

Table 5-4-(2) Revised Cost for Multiplex Radio Communications Facilities

(Unit: x10^3 Yen)

ITEM	NAME OF STATION (FUNCTION) / APPLICATIONS	BPW (MONITOR)		NPFC (PAGASA)		PAGASA		DILIMAN (RELAY)		CARMEN ROSALES (SUB)		TANAY (RELAY)		NAGA (SUB)		TUGUEGARAO (SUB)		TOTAL	
		Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount
Multiplex Radio Equipment 400 MHz	Troposcator, 1kW 6ch PM No.1/No.2									1	20,850					1	20,850	2	41,700
" " " 800 MHz	" 50W 6ch PM "											1	10,000	1	10,000			2	20,000
" " " 800 MHz	" 100W 12ch PM "							1	17,300	1	17,300							2	34,600
" " " 7 GHz	1W 60ch PM No.1/No.2			1	7,000			2	14,000			1	7,000					4	28,000
" " " 800 MHz	5W 24ch PM No.1/No.2	1	3,300	1	3,300													2	6,600
" " " 800 MHz	5W 6ch PM No.1/No.2			1	5,000	1	4,850											2	9,850
Dividing Circuit	For SS-PM Multiplex			2	216			1	108	2	216	1	108					6	648
" "	For SS-FM Multiplex			1	180			2	360			1	180					4	720
Antenna	400 MHz G.P.B.R. 10mø									1	14,000					1	14,000	2	28,000
"	400 MHz G.P.B.R. 6mø									1	2,650					1	2,650	2	5,300
"	800 MHz G.P.B.R. 10mø							1	16,000	1	16,000	1	16,000	1	16,000			4	64,000
"	800 MHz G.P.B.R. 1.8mø	1	460	1	460													2	920
"	800 MHz 60° Corner Reflector			1	270	1	270											2	540
"	7 GHz P.B.R. 3mø							1	900			1	900					2	1,800
"	7 GHz P.B.R. 1.2mø			1	480			1	480									2	960
Radome	7 GHz P.B.R. 1.2mø use			1	160													1	160
Coaxial Cable	Equality as SFZE-50-13W							60	480	250	2,000	45	360	60	480	220	1,760	635	5,080
" "	" AFZE-50-7	60	126	115	242	50	110											225	478
Wave Guide	" FR-6H			100	610			200	1,220			40	244					340	2,074
" "	WRJ-7-(D)			8	96			16	192			4	48					28	336
Coaxial Connector	For SP Cable							1	198	3	594	1	198	1	198	2	396	8	1,584
" "	For AF Cable	1	24	2	48	1	24											4	96

Table 5-4-(2) Revised Cost for Multiplex Radio Communications Facilities

(Unit: $\times 10^3$ Yen)

ITEM	APPLICATIONS	BPW (MONITOR)		NFFC (PAGASA)		PAGASA		DILIMAN (RELAY)		CARMEN ROSALES (SUB)		TANAY (RELAY)		NAGA (SUB)		TUGUEGARAO (SUB)		TOTAL	
		Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount
Dehydrator				1	230			1	230	1	230	1	230	1	230	1	230	6	1,380
Carrier Terminal Equipment	6/12ch 2PG Repeater							1	3,300			1	3,300					2	6,600
" " "	12/12ch			1	3,700													1	3,700
" " "	24/24ch	1	5,250	1	5,250													2	11,100
" " "	9/24ch 1PG									1	3,700							1	3,700
" " "	5/6 ch													1	3,000	1	3,000	2	6,000
Automatic Voltage Regulator	220V 1φ 5KVA	1	500					1	500	1	500	1	500	1	500			5	2,500
" " "	220V 1φ 15KVA									1	2,500					1	2,500	2	5,000
" " "	220V 3φ 40KVA			1	3,000													1	3,000
DC Power Supply Equipment	DC 24V 1φ 15A 100AH	1	1,400	1	3,130			1	1,400	1	1,400	1	1,400	1	1,400	1	1,400	7	11,530
Diesel Engine Generator	AC 100V, 10KVA with Starter	1	7,700					1	7,700	1	7,700	1	7,700	1	7,700			5	38,511
" " "	AC 100V, 20KVA, main and stand-by															2	15,200	2	15,200
" " "	AC 100V, 50KVA " "			1	8,000													1	8,000
Remote Control Equipment	Master Station, Cyclic			1	2,700													1	2,700
" " "	Terminal Station, Cyclic	1	1,800					1	1,800	1	1,800	1	1,800	1	1,800	1	1,800	6	10,800
Automatic Telephone Exchange	XB 60 extension line			1	7,500													1	7,500
" " "	XB 40 " "	1	7,500															1	7,500
Telephone Exchange	With 10 telephone sets									1	1,200			1	1,200	1	1,200	3	3,600
Converter Cabinet	6/6ch with FS ringer			1	1,500					1	1,500			1	1,500	1	1,500	4	6,000
Repeater Rack	3/6ch includ. Signal Power	1	1,500	1	1,500					1	450	1	450	1	450	1	450	6	4,800
Reflector	4 M x 6 M											2	10,000					2	10,000
Test Equipment		1	1,500	1	5,000	1	5,911	1	2,000	1	6,500	1	5,500	1	5,500	1	5,500	8	37,411
Accessories and Spare Parts		1	1,300	1	2,000	1	1,300	1	2,600	1	2,600	1	1,300	1	1,300	1	1,300	8	137,760
Total:			32,360		62,172		12,465		70,768		103,690		67,218		51,258		73,736		473,667