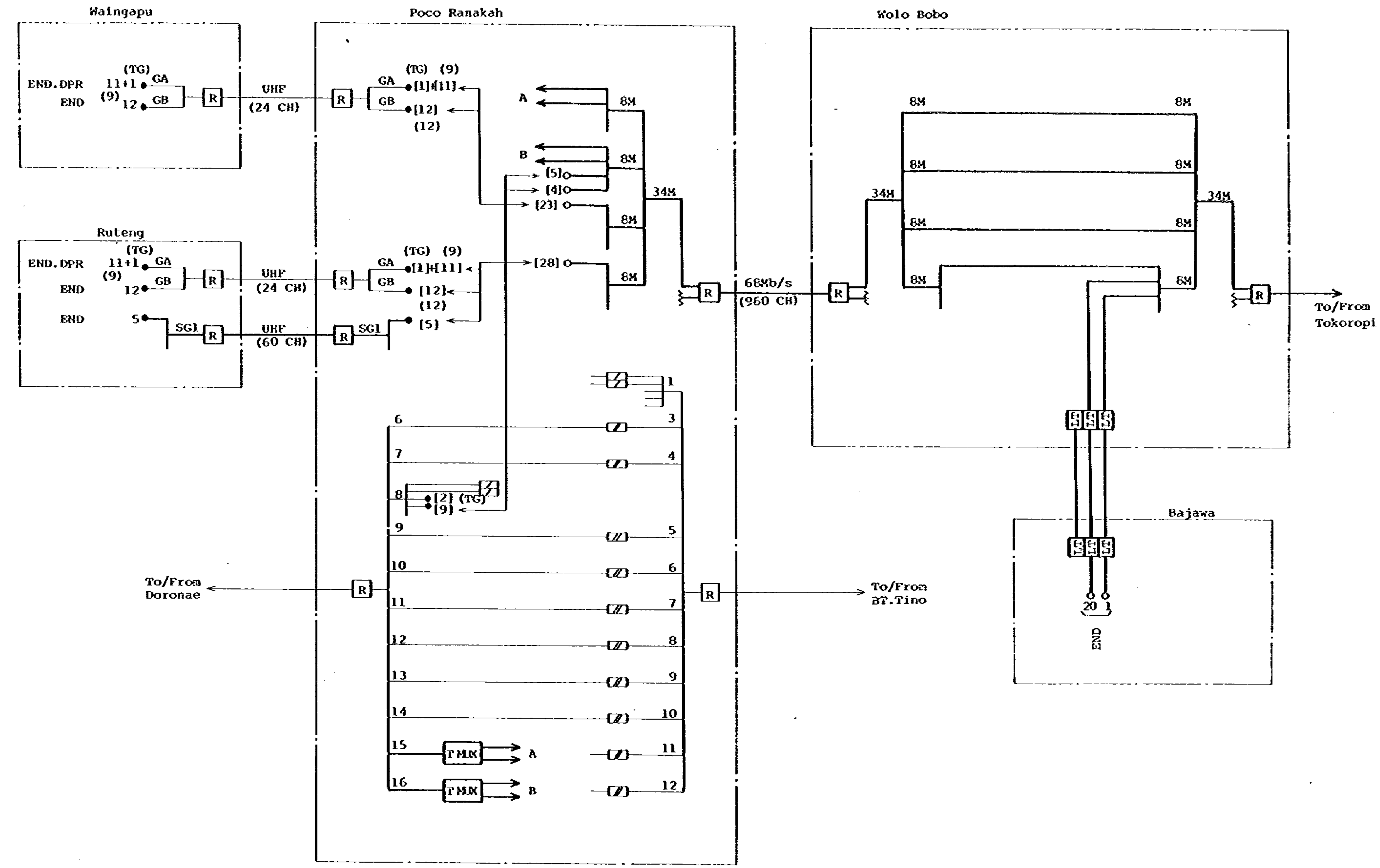


Figure AN-14-1 (1/3) Channel Accommodation Plan for Submarine Cable System (1995)

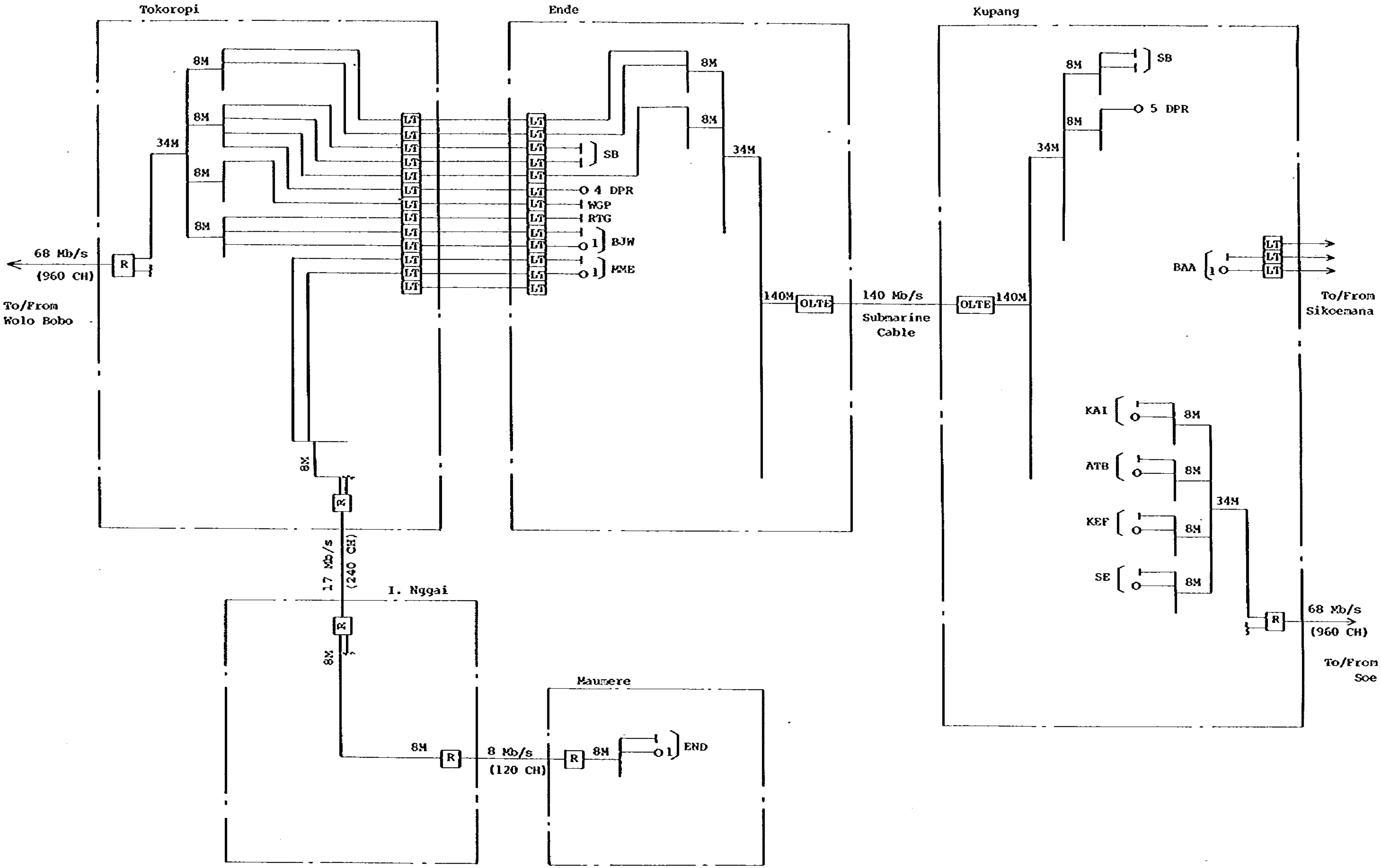


Figure AN-14-1 (2/3) Channel Accommodation Plan for Submarine Cable System (1995)

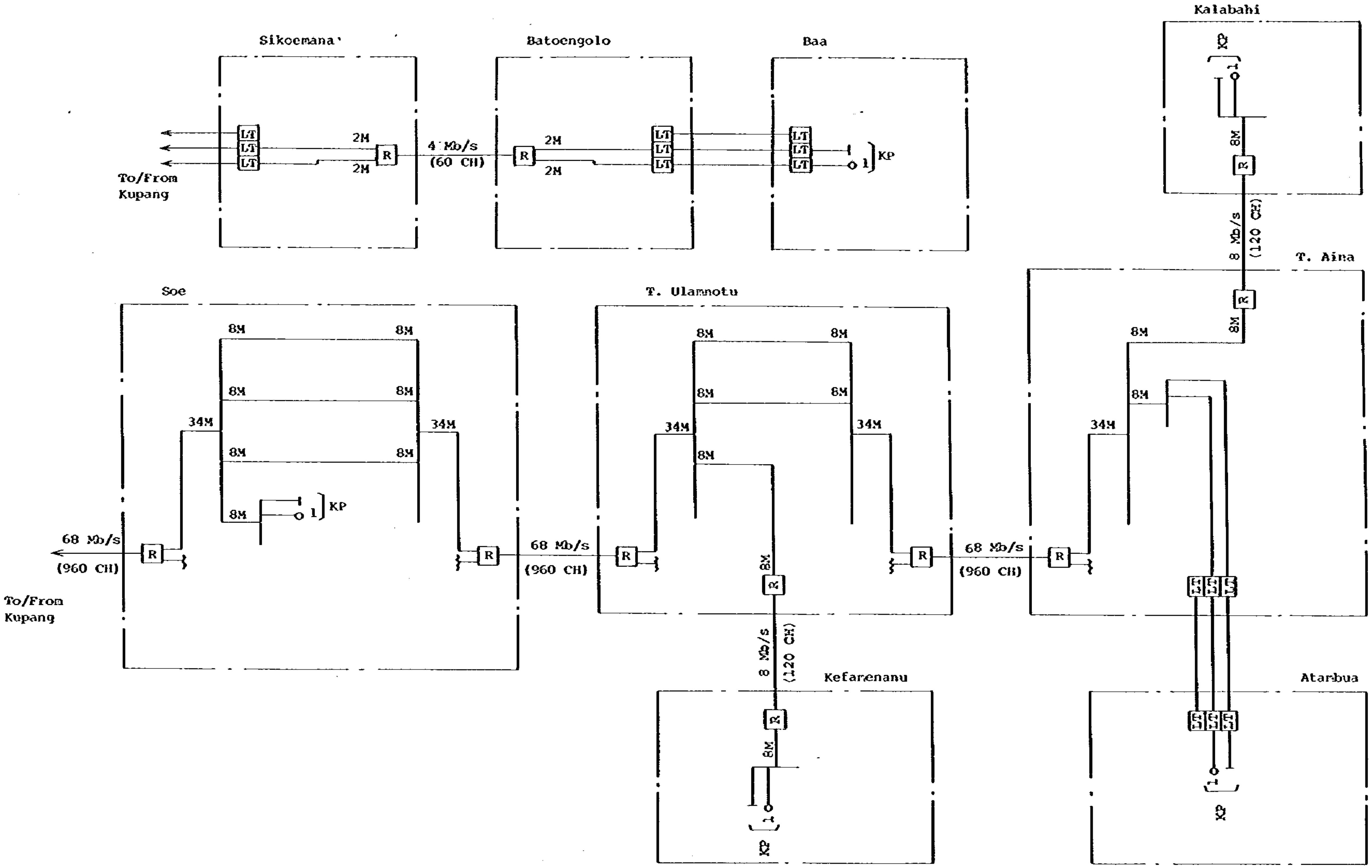


Figure AN-14-1 (3/3) Channel Accommodation Plan for Submarine Cable System (1995)

ANNEX-15 Study of Transmission Loss Distribution Plan for Telephone Network

1. Introduction of Digital System

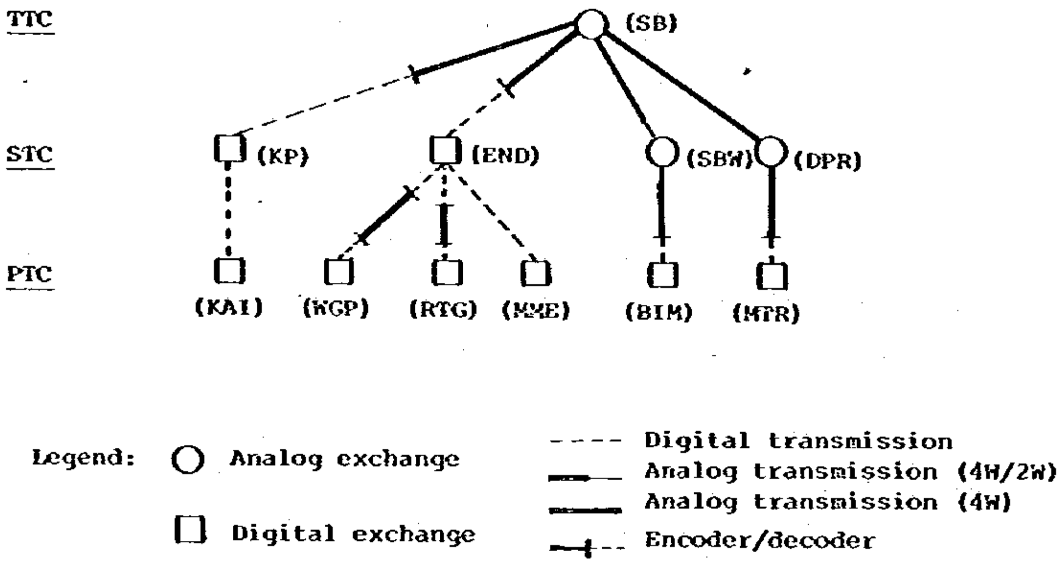
For introducing digital system in the existing analog network, two methods are available. They are "stand alone type introduction" and "integrated switching and transmission (IST) type introduction."

- "Stand alone type introduction" is to introduce digital switching equipment or digital transmission system separately in the analog network.

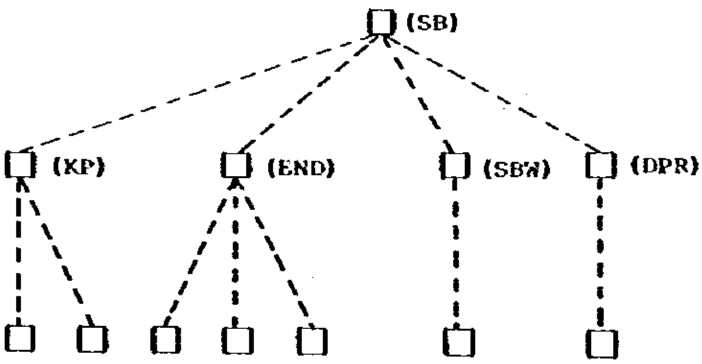
- "IST type introduction" is to introduce at the same time digital switching equipment and digital transmission system to interface with that digital switching equipment.

In this project, all Primary Trunk Centers are to be the digital type and, out of Secondary Trunk Centers, Kupang and Ende are to be the digital type. Transmission system to interconnect all these centers is mainly the digital type though in part of this transmission system the existing analog transmission system will be used. Therefore, the digital system introduction contemplated in this project is by the mixed use of "stand alone type introduction" and "IST type introduction."

The illustration below indicates part of network formation at the initial stage of this project (i.e., as of the Repelita IV termination).



Network formation in the intermediate stage of transition from analog network to digital network cannot be easily predicted. However, in the final stage, a thorough digital network can be expected. The final stage network formation is illustrated below.



2. Subscriber's Line Loop and Balance Return Loss

Minimum transmission loss depends upon 4-wire loop singing and echo. When digital switching equipment interfaces with 2-wire analog system, loop loss on 4-wire path of the switching equipment and transmission delay on the loop take place at the same time. Therefore, both must be duly considered. Following is the study of transmission loss from the viewpoints of stability and echo.

Subscriber line trunk of digital subscriber switching equipment holds 2W/4W terminating set that connects 2-wire subscriber line and 4-wire switching circuits.

Balance return loss at this terminating set exerts a serious influence on 4-wire loop loss.

Subscriber system impedance data in Indonesia is not available. Thus, for subscriber cable and telephone set to be used this time, theoretical value of balance return loss is calculated below, based on the presumed PERUMTEL specifications.

2.1 Subscriber's Line Loop Impedance

Parameters of subscriber cable and telephone set to be used are assumed as under.

a) Subscriber Cable

Cable Diameter	Loop Resistance	Mutual Capacitance
0.4 mm	300 ohms/km	50 nF/km
0.6 "	130 "	50 "

b) Telephone Set

Desk telephone (PERUMTEL Specifications: SPEC No. 01/S01/Subditpran/1/80) impedance: 600 ohms, nominal

Subscriber's line loop impedance can be expressed by the following formula:

$$Z_l = Z_o \frac{Z \cosh \gamma l + Z_o \sinh \gamma l}{Z \sinh \gamma l + Z_o \cosh \gamma l} \quad \ldots\ldots\ldots \quad (1)$$

where

Z_o : Characteristic impedance of cable pair

Z : Impedance of telephone set

γ : Propagation constant of cable pair

l : Line length

For the telephone network planning purposes, it is sufficient accuracy over the voice frequency band to calculate the impedance by neglecting the line inductance and the line conductance of non-loaded cable pairs.

Therefore, secondary constant of cable pairs can be expressed by the following formula:

$$Z_o = \left|\sqrt{\frac{r}{\omega C}}\right| \angle -\frac{\pi}{4}$$

Hence

$$R_o + j X_o = \sqrt{\frac{r}{2\omega C}} - j \sqrt{\frac{r}{2\omega C}} \quad \text{(ohms)}$$

$$\gamma = \alpha + j\beta = \sqrt{\frac{\omega C r}{2}} + j\sqrt{\frac{\omega C r}{2}} \quad \text{(Np/km; radians/km)}$$

Practical units for the above are:

$$R_o = -X_o = 8920.6\sqrt{\frac{r}{fC}} \quad \text{(ohms)} \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

$$\alpha = \beta = 5.6 \times 10^{-5}\sqrt{fCr} \quad \text{(Np/km; radians/km)} \quad \ldots\ldots \quad (3)$$

where

r : d.c. loop resistance (ohms/km)

C : Mutual capacitance (nF/km)

f : Frequency (Hz)

Z_1 calculation results by formulas (1), (2) and (3) are given in Figure AN-15-1.

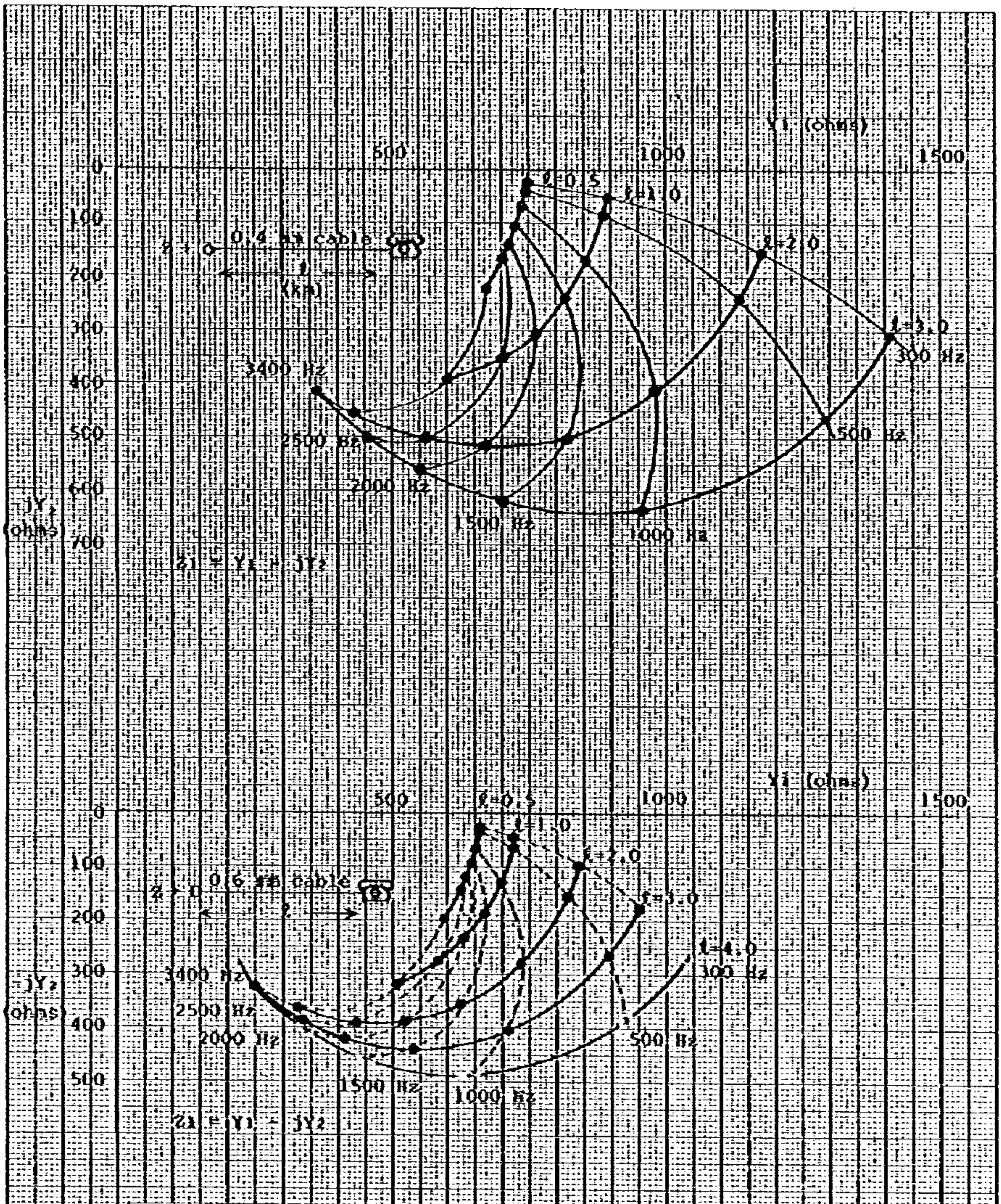
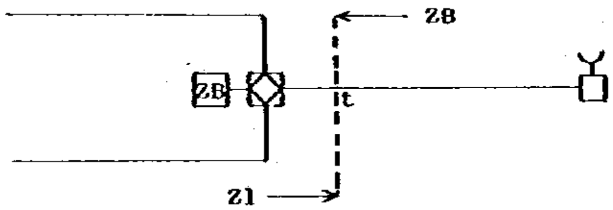


Figure AN-15-1 Impedance Characteristics of Subscriber's Loop

2.2 Balance Return Loss

Balance return loss (B.RL) at point t of 2W/4W terminating set (illustrated below) can be expressed by the following formula:

$$B.RL = 20 \log \frac{Z + Z1}{Z - Z1} \quad \text{(dB)}$$



Z_B signifies balancing network.

For balancing network circuits, two kinds of cables, i.e., 0.4 mm cable and 0.6 mm cable, are considered.
See the illustration below.

		For Short Haul Subscriber		For Medium/Long Haul Subscriber
0.4 mm Cable	A	60, 820, 0.04	B	225, 1200, 0.1
0.6 mm Cable	a	50, 690, 0.05	b	110, 880, 0.125

Note: Resistance in ohm
Capacitance in μF

Balancing network impedance/frequency characteristics are graphically presented in Figure AN-15-2 below.

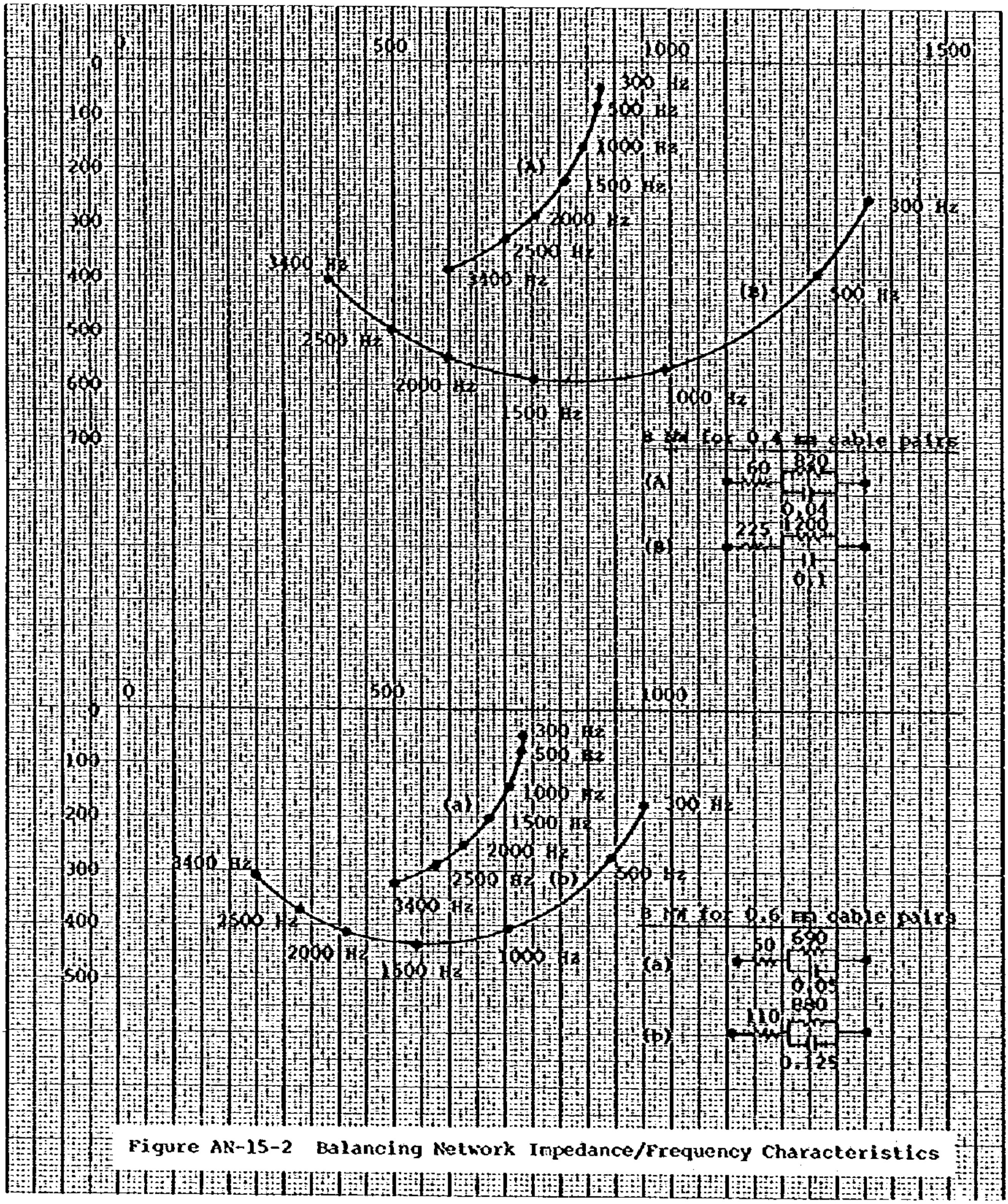


Figure AN-15-2 Balancing Network Impedance/Frequency Characteristics

Balance return loss calculation results for 0.4 mm cable and 0.6 mm cable appear in Figure AN-15-3 below.

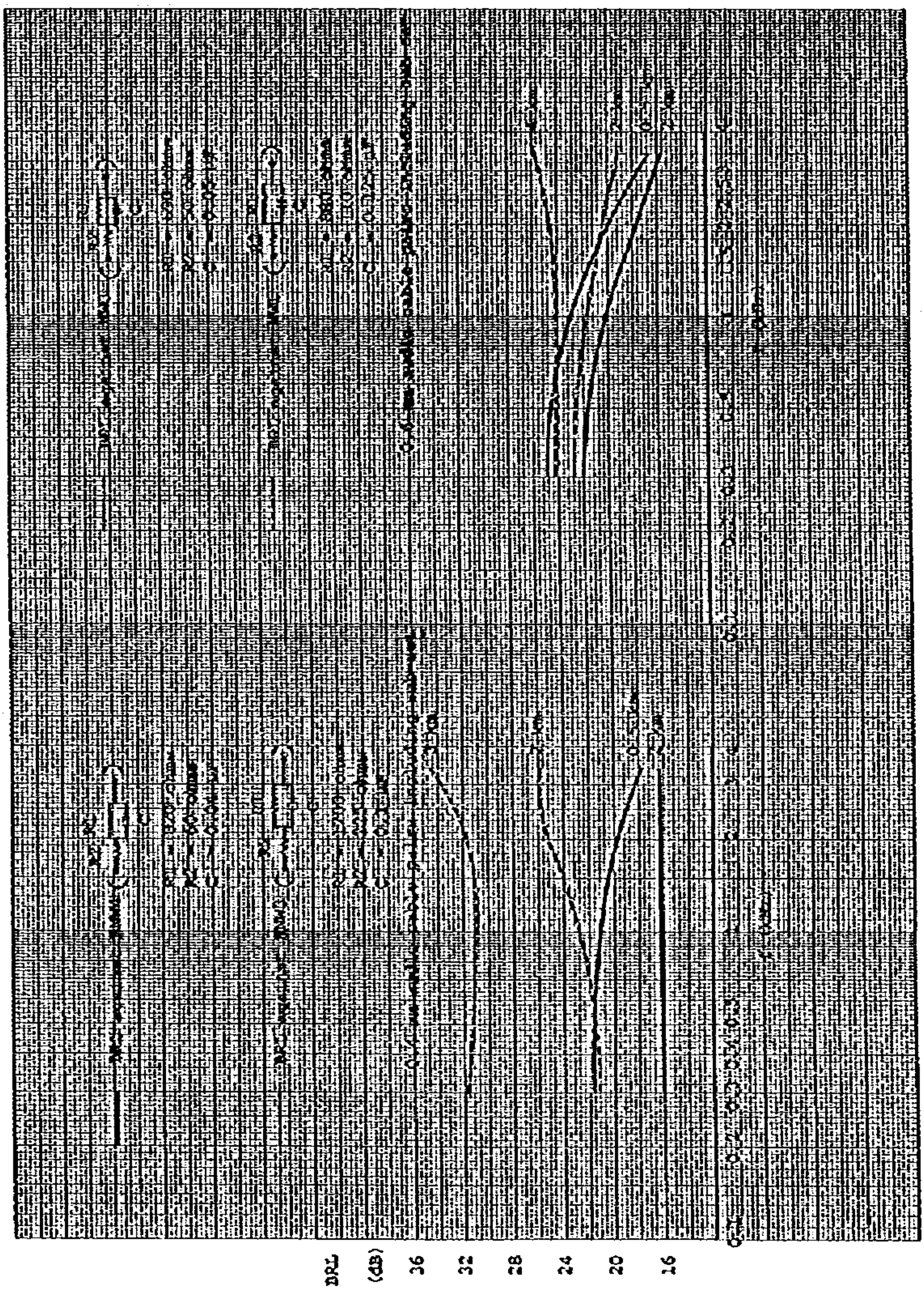


Figure AN-15-3 Balance Return Loss/Frequency Characteristics

2.3 Echo Balance Return Loss

Echo balance return loss is defined as the decibel expression of the mean power ratio over the frequency band of 500-2,500 Hz in the balance return loss/frequency characteristics calculated in the previous Section 2.2.

From balance return loss/frequency characteristics in Figure AN-15-3, echo balance return loss of 16 dB or more can be obtained in the range of 0.5 km - 3 km cable length of 0.4 mm and 0.6 mm cable pairs.

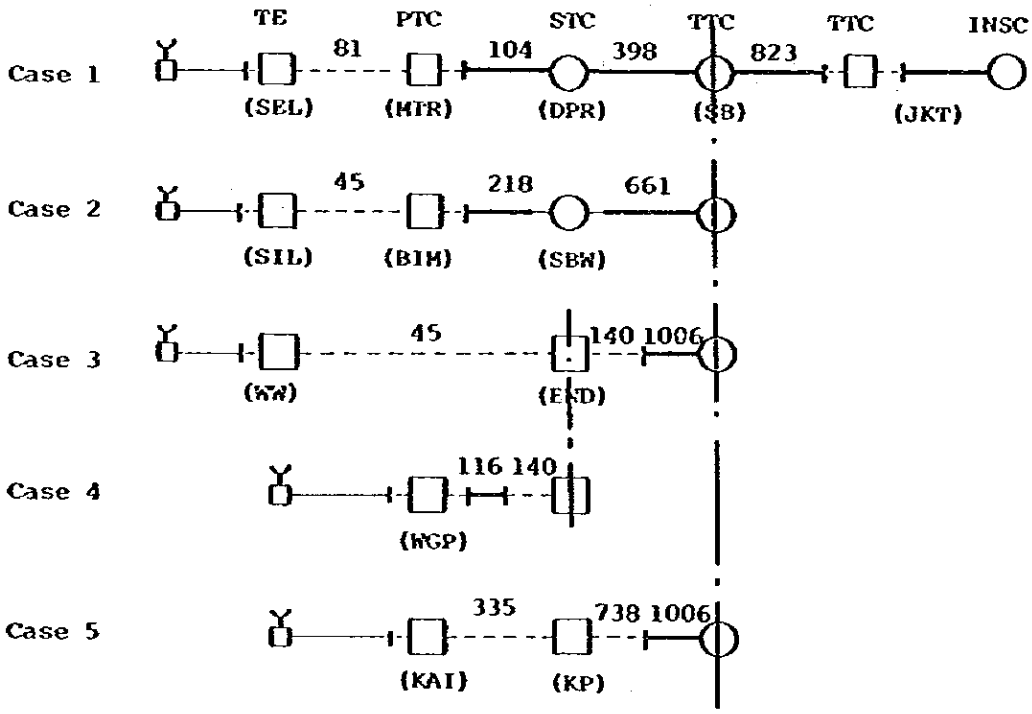
When the number of subscribers whose line length is 0.5 km - 3 km is assumed to occupy 50% or more of the total number of subscribers, mean value of echo balance return loss can be estimated at 16 dB or more.

3. Stability and Echo

In this Section, transmission loss in the initial stage of network formation is studied from the viewpoints of stability and echo.

3.1 National Circuits for International Connections

The organization of national circuits for international connections is supposed to be as under.



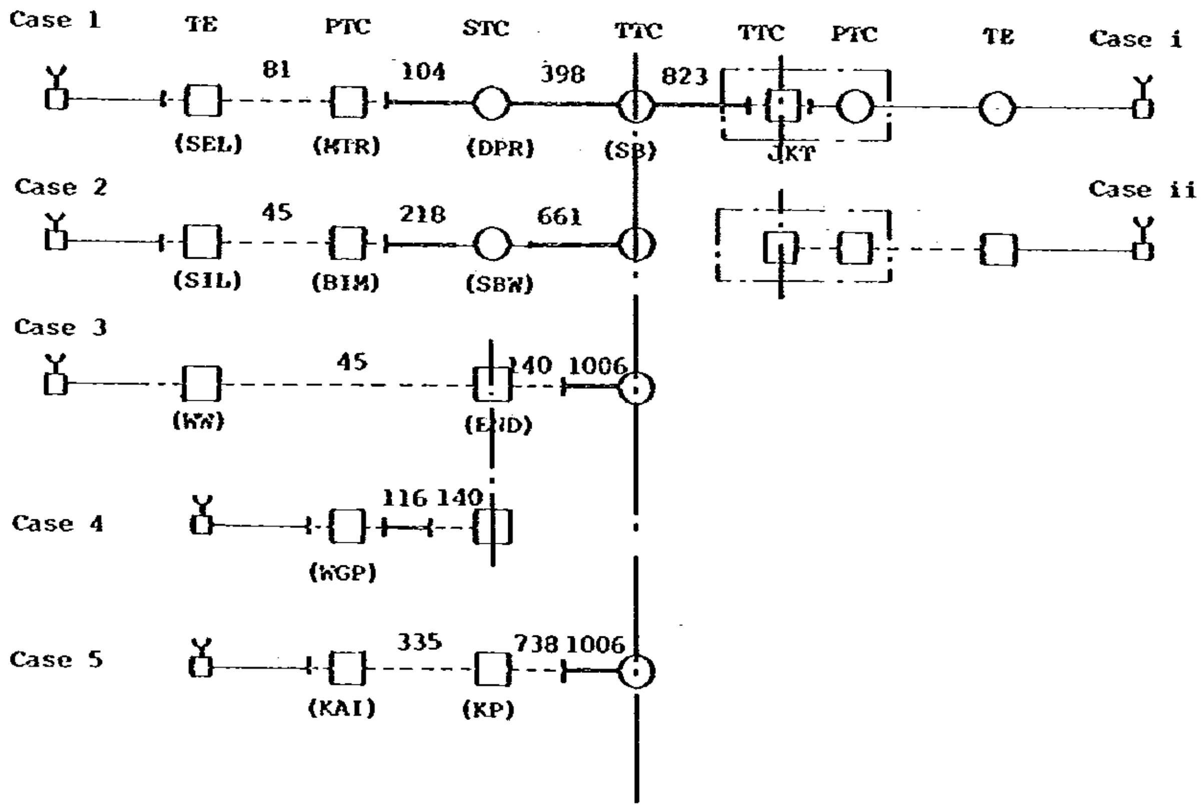
Note: Figures indicate transmission line length (km).

Legend:

- ○ Analogue switching
- □ Digital switching
- —— Analog 4-wire circuit
- —— Analog 2-wire circuit
- - - - - Digital circuit
- —+-- A/D converter (with 2W/4W terminating set)
- —+-- A/D converter (without 2W/4W terminating set)
- —— 2W/4W terminating set

3.2 Circuits for National Connections

Destinations of almost all originating/terminating long distance calls from/to this project area are Surabaya and Jakarta. Therefore, this study is made for circuits from/to Greater Jakarta Area. In this case, the following circuit configurations can be considered:



Note: Figures indicate transmission line length (km).

3.3 Stability

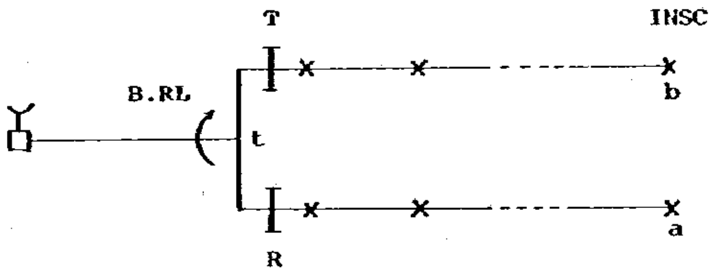
3.3.1 National Circuits for International Connections

(1) Mean Transmission Loss of the Path a-t-b

CCITT Rec. G.122, Section 1.2 provides that mean transmission loss of the path a-t-b must satisfy

$$LOSS_{a-t-b} \geqq (10 + n) \text{ dB}$$

This requirement applies to the circuit illustrated below. In the formula above, n signifies the number of analog 4-wire circuits.



Therefore, $LOSS_{a-t-b}$ can be expressed as

$$LOSS_{a-t-b} = LOSS_{a-t} + B.RL + LOSS_{t-b}$$

As for the value of pads T and R used in the above illustration, T = R = 3 dB based on CCITT Rec. G. 121 is to be used.

Requiremental formulas applicable to circuits shown in Section 3.1 are as follows:

Cases 1 and 4: $6 + B.RL \geqq 10 + 4$ (dB)

Case 2: Not to be taken up for study because STC is for analog 2-wire switching

Cases 3 and 5: $6 + B.RL \geqq 10 + 3$ (dB)

In the transmission frequency band 300 - 3,400 Hz, balance return loss is 16 dB or more, as stated in Section 2.3. This balance return loss satisfies all the above requiremental formulas.

(2) Minimum Transmission Loss of the Path a-t-b

With regard to minimum transmission loss, CCITT Rec. G.122, Section 1.1, provides

$$LOSS_{a-t-b} \geq 6 + \sum_{i=1}^{n} X_i$$

where

X_i : Sum of nominal losses in the two directions of transmission of the i-th circuit

n : Number of circuits in the national portion of 4-wire chain

Requiremental formula applicable to each case as in the preceding Paragraph (1) is:

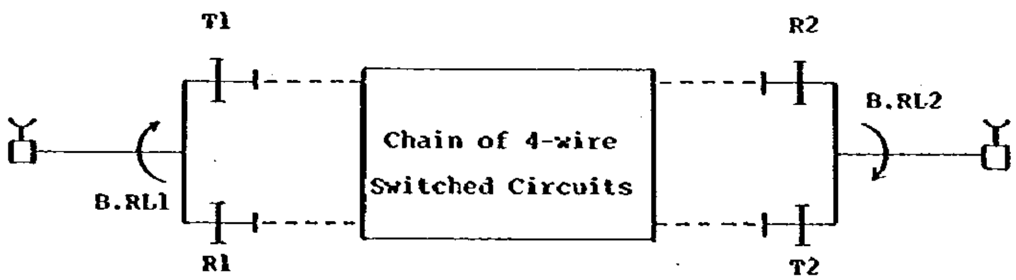
Cases 1, 3, 4 and 5: $6 + B.RL \geq 6$ (dB)

This requirement also can be satisfied.

3.3.2 Circuits for National Connections

(1) Mean 4-wire Loop Loss

Equivalent circuit for national connection is illustrated below.



For mean loop loss on 4-wire circuit for natinal connection, 2 (10 + n) dB or more should be obtained. That is to say, the requirement of

$$(R_1 + T_1 + B.RL_1) + (R_2 + T_2 + B.RL_2) \geqq 2(10 + n) \text{ dB}$$

should be satisfied.

Requirement for mean 4-wire loop loss follows:

Cases 1 and 4: $12 + (B.RL_1 + B.RL_2) \geqq 26$ dB
Cases 3 and 5: $12 + (B.RL_1 + B.RL_2) \geqq 24$ dB

For the former, requirement is satisfied when $(B.RL_1 + B.RL_2)$ is 14 dB or more. For the latter, $(B.RL_1 + B.RL_2)$ of 12 dB or more can satisfy the requirement.

As stated in Section 2.3, the mean value of $B.RL_1$ is 16 dB or more so that each foregoing requirement is satisfied.

(2) Minimum 4-Wire Loop Loss

Requirement for minimum 4-wire loop loss, based on equivalent circuit used in the preceding Paragraph (1), follows:

$$(R_1 + T_1 + B.RL_1) + (R_2 + T_2 + B.RL_2) \geqq 2[6 + \sum_{i=1}^{n} X_i] \text{ (dB)}$$

4-wire loop loss becomes minimum when 2-wire side on called subscriber side is in open-circuited state, i.e., when B.RL equals 0. Therefore, the above requiremental formula can be rewritten as

$$(R_1 + T_1 + R_2 + T_2) + B.RL_1 \geqq 2\ [6 + \sum_{i=1}^{n} Xi] \quad (dB)$$

For R = T = 3 dB, the following formula applies:

$$12 + B.RL_1 \geqq 12 \quad (dB)$$

Thus, the requirement is satisfied.

3.4 Echo

3.4.1 National Circuits for International Connections

Mean transmission loss of the path a-t-b as seen from the viewpoint of echo should satisfy the requirement of

$$ECHO\ LOSS_{a-t-b} \geqq (15 + n) \quad (dB)$$

This requirement is provided for by CCITT Rec. G.122, Section 2.

In terms of R = T = 3 dB, the above formula can be written as

$$6 + Echo\ B.RL \geqq (15 + n) \quad (dB)$$

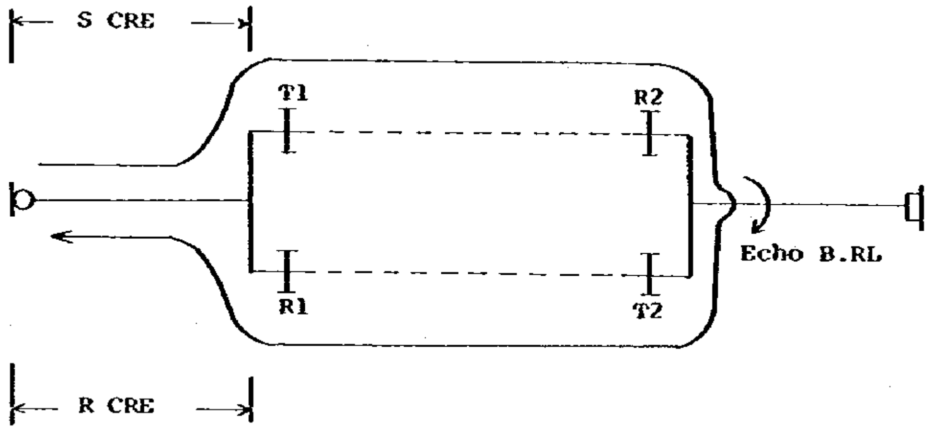
Requiremental formulas applicable to circuit shown in Section 3.1 as follows:

Cases 1 and 4: $6 + Echo\ B.RL \geqq 19$ dB
Cases 3 and 5: $6 + Echo\ B.RL \geqq 18$ dB

Since the mean value of Echo B.RL is 16 dB, the above requirements can be satisfied.

3.4.2 Circuits for National Connections

Talker's echo path and loss are as follows:



$$\text{Echo path loss} = \text{S CRE} + T_1 + R_2 + \text{Echo B.RL} + T_2 + R_2 + \text{R CRE}$$

As for relationship between echo path loss and transmission delay time, recommendation contained in CCITT Rec. G.131 is applied.

For transmission delay time calculation, propagation time (one way) by transmission systems is used. That is to say:

Terrestrial radio transmission system:	3.5 ms/1,000 km
Analog channel modem:	1.33 ms/pair
PCM CODEC:	0.3 ms/pair
Digital switching:	0.55 ms/switching

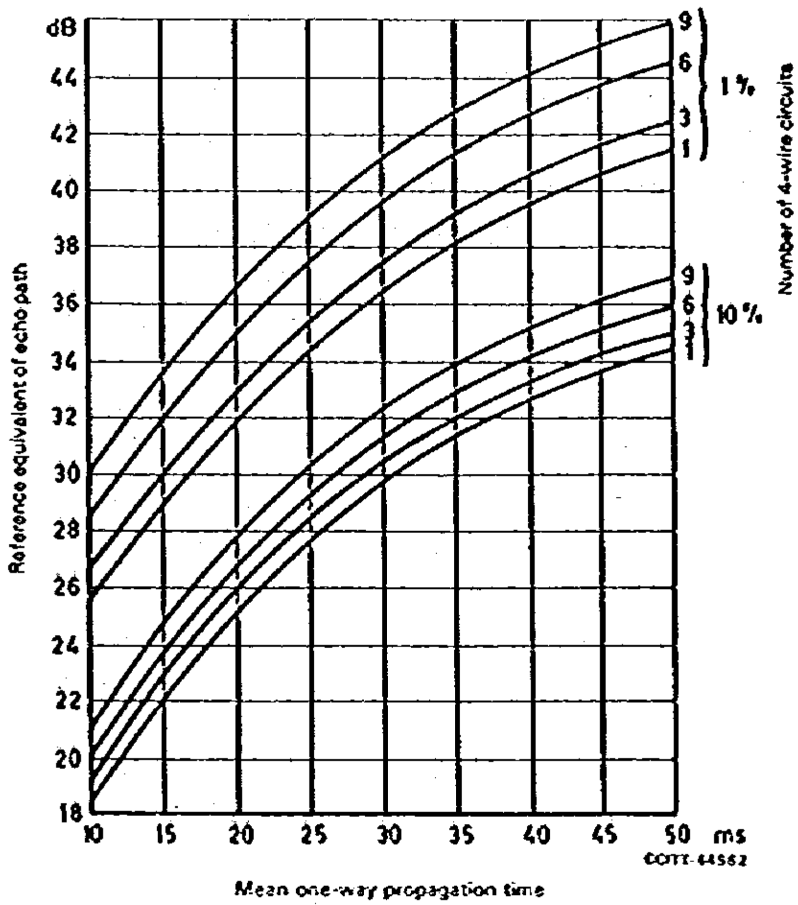
Transmission delay time and tolerable reference equivalent of echo path on circuits for national connections mentioned in Section 3.2 are tabulated below. Figures are quoted as obtained by calculation from FIGURE 2/G 131 (CCITT Rec. G 131). FIGURE 2/G 131 is introduced in Figure AN-15-4.

(a) Where Case i applies to Jakarta side

		Case 1	Case 3	Case 4	Case 5
One way propagation time (ms)		11.1	11.9	14.5	15.1
Number of analog transmission links		3	2	3	2
Tolerable reference equivalent of echo path (minimum) (dB)	10%	20.2	20.5	22.5	23.0
	1%	27.4	27.6	29.6	30.2

(b) Where Case ii applied to Jakarta side

		Case 1	Case 3	Case 4	Case 5
One way propagation time (ms)		12.3	13.1	15.5	16.2
Number of analog transmission links		3	2	3	2
Tolerable reference equivalent of echo path (minimum) (dB)	10%	21.2	21.3	23.4	23.4
	1%	28.3	28.4	30.4	30.4



Note 1 – The percentages refer to the probability of encountering objectionable echo.

Note 2 – The reference equivalent of the echo path is here defined as the sum of:

- the values of the transmission loss in the two directions of transmission between the 2-wire end of the talking subscriber's line in the terminal local exchange and the 2-wire terminals of the 4W/2W terminating set at the listener's end;
- the mean value of the echo balance return loss at the listener's end; and
- the simultaneous-minimum sending and receiving reference equivalents of subscribers' telephone sets and lines at the talker's local exchange.

FIGURE 2/G.131

Echo tolerance curves

Figure AN-15-4 Echo Tolerance Curves

With regard to the national portion of circuits in the international connection, CCITT Rec. G.121, Section 3, recommends that sending corrected reference equivalent (S CRE) down to analog switching points of international circuits be 7 dB or more. Therefore, if pad T is a pad of 4 dB, S CRE to be given to subscriber system must be

$$S\ CRE \geq 3\ dB$$

Assume that subscriber system is composed of a combination of telephone set of PERUMTEL specifications (see Figure AN-15-5) and 0.4 mm cable. When subscriber line length is about 2 km or less, additional pad insertion will be necessary in order to fulfill CCITT Rec. G 121, Section 3.
Additional pad is to be inserted in the telephone set and, in this study, the pad is assumed to be 3 dB pad.

Even in case the cable used is other than 0.4 mm cable, additional pad insertion in short haul subscriber system is to be considered so that S CRE will be 3 dB or more.

Under such conditions, relationship between echo path reference equivalent and tolerable value is

$$16.5 + \text{Echo B RL} \geq \text{Tolerable reference equivalent of echo path}$$

provided that S CRE = 3 dB, R CRE = -2.5 dB and $T_1 = R_1 = T_2 = R_2 = 4$ dB be substituted in the echo path loss formula.

Consideration is made below about that formula as applied to the aforementioned Paragraphs (a) and (b) cases.

In the case of Paragraph (b), the mean value of Echo B RL is more than 16 dB. In each connection, this value satisfies 1% of the probability of encountering objectionable echo. In other words, echo suppressor will not be necessary.

In the case of Paragraph (a), i.e., the case where called subscriber side Primary Center switching equipment and local switching equipment are analog 2-wire switching equipment, the mean value of Echo B.RL poses problem. If the balancing network commensurate with 2-wire cable pair impedance is used in 2W/4W terminating set of digital transit switching equipment, based on the philosophy described in Section 2.2 and Section 2.3, the mean value of Echo B.RL of more than 16 dB can be obtained.
Then, in each connection, 1% of the probability of encountering objectionable echo will be satisfied and echo suppressor will not be necessary.

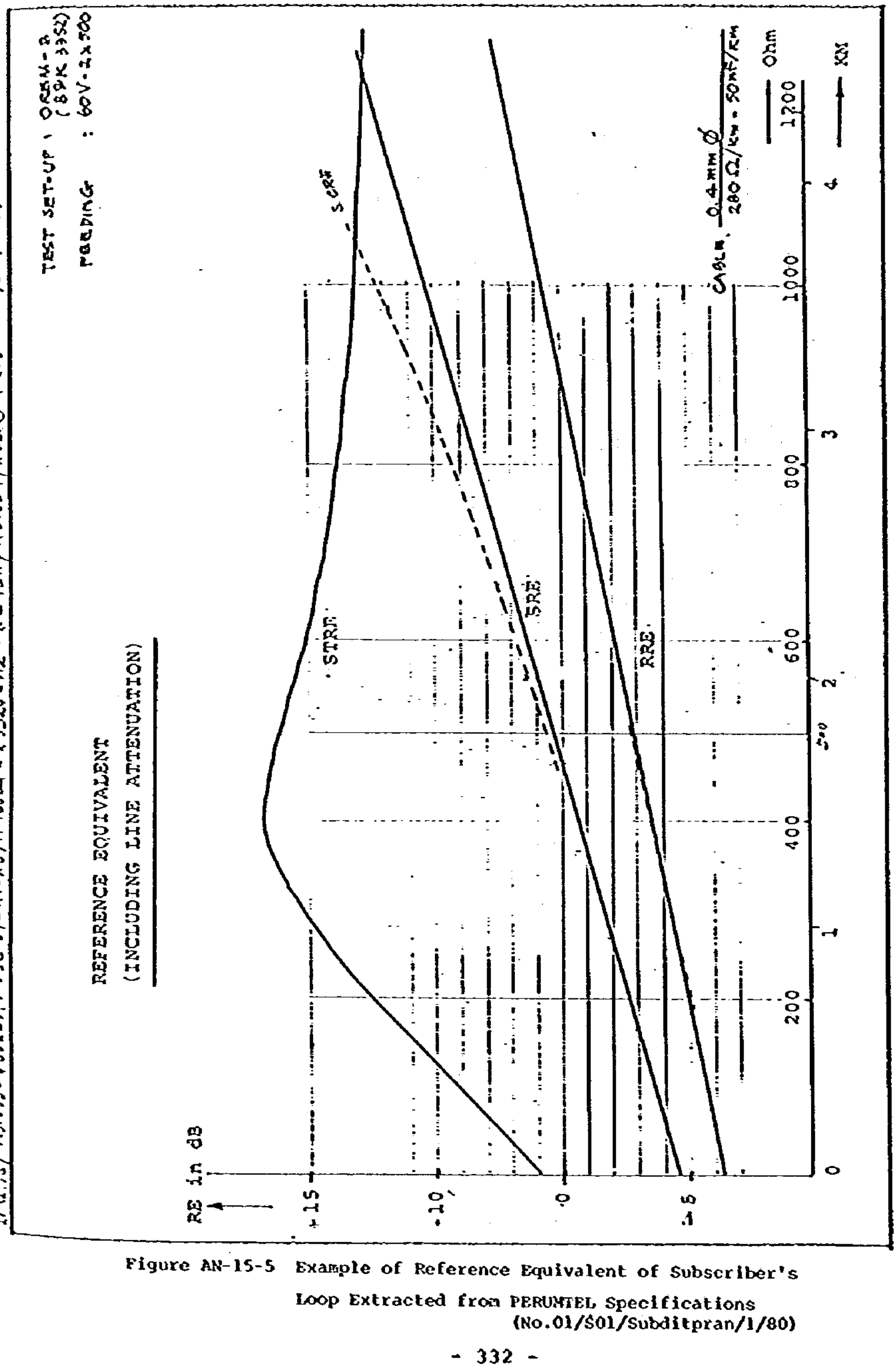
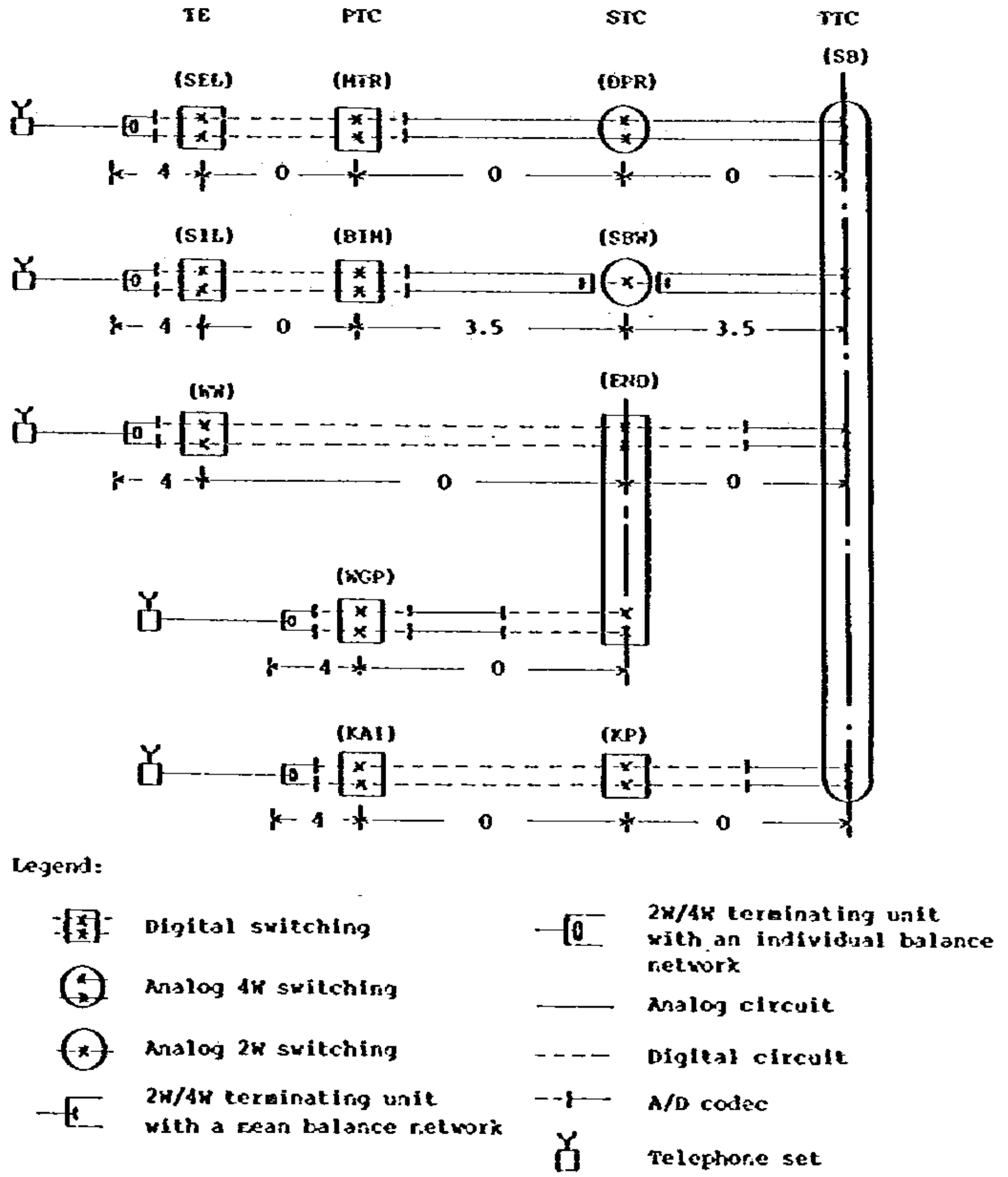


Figure AN-15-5 Example of Reference Equivalent of Subscriber's Loop Extracted from PERUMTEL Specifications (No.01/S01/Subditpran/1/80)

4. Transmission Loss Distribution Plan

Study made in all preceding sections clarifies that whatever the conditions established, echo exerts much more serious influence than stability on transmission loss of circuits.

Thus, on condition that the value of 4 dB be given to each of T and R pads, transmission loss distribution is planned as follows:



Unit: dB

5. Conclusion

This study is on the assumption that all the concepts considered are realizable. For example, the mean value of echo balance return loss is set at 16 dB, the minimum reference equivalent of subscriber's loop at 3 dB (sending side) and -2.5 dB (receiving side), and the value of T and R pads at 4 dB each. However, this study, not being based on actual subscriber's loops, is just one approach to transmission plan.

For the formulation of transmission plan in a real sense, prime requisites are, among other things, digital local exchange equipment specifications established on practical basis and fact-finding about subscriber's line impedance in all parts of the country. Such transmission plan is not of the nature that can be studied in the transmission network improvement plan contemplated by this project. Transmission plan that may establish the standard of telecommunications network should be studied and designed in an ad hoc project to serve such purpose.

ANNEX-16 Solar Battery System Application

Following are the requirements in the case of solar battery system application to the in-house power supply station:

1. Calculation of Required Solar Battery Output (Ps)

Required solar battery output (Ps) is calculated by the following formula:

$$Ps = Lw \times 1/Sv \times 1/Ch \times Cl \times Sf$$

where

Lw : Average power consumption by loads (watts)

Sv : Sunshine volume rate
(Sunshine hours rate x irradiation angle rate)
Sunshine hours rate: Annual sunshine hours ratio to gross hours/year)

Ch : Charging efficiency

C : Loss coefficient

Sf : Safety factor

Average annual sunshine hours in this project area are available in Table 16-1. In the average for the three cities, annual sunshine hours are 2,180 hours.

For reference, the number of rainy days/month at 22 sites in the project area in about 10 years in the past is given in Table 16-2.

In the case of annual sunshine hours of 2,180 hours as referred to above, the sunshine hours rate is 0.25.

The irradiation angle rate in this project area is assumed to be 1/2. In this case, the sunshine volume rate (Sv) is:

$$Sv = 0.25 \times 1/2 = 0.125$$

Therefore, in case where charging efficiency (Ch) = 0.95, loss coefficient (C) = 1/1 and safety factor (Sf) = 1.1, the required solar battery output (Ps) is about 10 times the average power consumption by loads. In other words, when the average power consumption by loads is 120 W, the required solar battery output is 1.2 kW.

2. Required Number of Solar Battery Modules (N)

Required number of solar battery modules (N) is calculated by the following formula:

$$N = Lw/Pm'$$

where

Lw : Average power consumption by loads

Pm': Average charged power by one solar battery module, $Pm' = \alpha Pm$

Pm : Rated output at the time the solar battery module is exposed to sunlight energy of 100 mW/cm in fine weather. In this study, the rated output is assumed to be 40 W.

α : Correction coefficient

α is determined in consideration of the following conditions:

- Incident angle of sunlight to solar battey varies with time in accordance with cosine curve.

- No charging is made during night time.

- Weather changes day by day. On rainy days and in cloudy weather, charged power is extremely reduced.

- According to season, as well as latitude and location, sunshine hours and solar height vary.

α is empirically determined at 0.1 and this value is commonly adopted.

In the present case, Pm' = 0.1 x 40 W = 4 W. When the average power consumption by loads is 120 W, N is 30.

Land space required for installation of solar battery system is 18 m^2. For installation, it is important to make sure that no obstacles, such as trees and buildings, exist in the direction of sunlight incidence.

3. Calculation of Secondary Storage Battery Capacity (C)

Secondary storage battery capacity (C) is calculated by the following formula:

$$C = \frac{QL \times 24\ H \times D \times d}{0.7 \times Ft}$$

where

QL : Average current consumption by loads

D : Number of non-sunshine days
(In this study, the number of non-sunshine days is assumed to be 15 consecutive days.)

d : Correction value for storage battery self-discharge
(In the case of lead storage battery: 1.06)

0.7: Correction coefficient for solar battery charge volume

(Correction is necessary because the storage battery charging current is weak so that gassing charge as in the case of short time charge is impossible.)

Ft: Correction coefficient for storage battery capacity decrease due to ambient temperature variation
(In the case of lead storage battery: 0.85)

In case where average power consumption by loads is 120 W, capacity required of 24 V storage battery, calculated by the foregoing formula, is about 3,200 AH.

4. Equipment Parameters

Following are the solar battery system equipment parameters to meet the requirements of average power consumption by loads: 120 W, annual sunshine hours: 2,180 hours, and the number of consective non-sunshine days: 15 days.

(1) Required solar battery output: 1.2 kW

(2) Required number of solar battery modules (in the case of Pm' = 4 W): 30

(3) Required land space for installation: Approx. 18 m^2

(4) Required secondary storage battery (24 V) capacity: Approx. 3,200 AH

Table AN-16-1 Mean Duration of Sunshine in Percentage

	Kupang					Maumere		Waingapu	
	1971	1972	1977	1978	1979	1978	1979	1978	1979
Jan.	-	77	43	74	52	51	71	-	63
Feb.	-	58	33	40	69	57	64	-	62
Mar.	-	47	50	51	57	73	60	-	53
April	-	91	73	57	90	74	92	-	-
May	87	-	78	57	84	84	73	88	82
June	93	-	58	93	91	81	84	59	70
July	91	-	65	54	96	79	92	65	88
Aug.	98	-	62	61	99	84	96	75	96
Sep.	96	-	57	90	96	93	93	85	92
Oct.	77	-	65	94	65	85	91	89	-
Nov.	53	-	58	77	92	-	-	73	91
Dec.	57	-	38	60	59	-	68	54	-

Remarks:

Figures of above table indicate the average sunshine volume rate per day.

For instance, sunshine hours in Jan. 1972 at Kupang are as follows:

8 hours x 30 days x 77% = 184.8 hours

Table AN-16-2 Data of Rainy Days

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total	Remarks
1. Nusa Tenggara Barat														
Ampenan	13.9	15.0	11.6	8.8	6.3	3.1	2.6	1.7	1.0	5.9	10.1	15.2	95.2	1961 - 1970
Taliwang	11.1	9.7	10.5	6.3	3.8	2.1	1.2	1.2	2.5	6.0	8.3	14.1	76.9	1962 - 1970
Alas	12.7	13.7	12.6	8.3	5.0	1.9	2.2	1.1	2.1	4.9	8.3	11.6	84.4	1961 - 1970
Utan	17.2	13.8	12.7	7.7	3.0	0.6	0.9	0.9	0.4	2.0	3.3	12.1	74.6	1961 - 1970
Lenangguar	14.3	13.7	13.0	7.0	3.7	2.6	2.0	1.2	1.8	5.4	8.4	13.9	87.0	1962 - 1970
Lunyukbesar	17.3	12.1	9.2	5.0	5.4	3.2	4.0	3.3	2.7	6.3	7.0	12.8	88.3	1964 - 1970
Sumbawabesar	14.2	15.4	12.6	6.9	2.3	1.2	0.8	0.2	0.3	3.5	6.7	14.0	78.1	1963 - 1970
Mayohilir	6.1	6.8	4.5	3.1	0.9	0.1	1.0	0.0	0.0	1.3	2.4	4.4	30.6	1961 - 1969
Lape	12.1	14.6	10.8	5.0	4.1	1.0	0.9	0.0	0.1	1.4	5.2	13.9	69.1	1961 - 1970
Plampang	14.1	16.0	13.3	4.7	3.1	1.5	0.9	0.3	1.0	2.2	6.2	11.2	74.5	1964 - 1970
Ampang	15.6	16.1	10.4	5.1	3.9	1.5	1.2	0.7	1.0	3.6	5.0	14.9	79.0	1962 - 1970
Wawo/Indria	15.2	13.6	11.7	6.8	3.0	1.8	1.8	0.6	0.2	2.2	4.4	11.5	72.8	1961 - 1970
Karumbu	13.4	11.5	7.0	2.9	3.6	2.2	2.4	0.7	0.1	1.1	2.1	8.4	55.4	1961 - 1970
2. Nusa Tenggara Timur														
Waikabubak	17.9	18.4	18.6	12.0	6.8	3.7	2.3	2.0	3.1	7.6	13.0	18.1	123.5	1961 - 1970
Waibakul	15.2	18.9	16.4	10.0	8.3	5.4	4.6	3.1	3.2	7.6	14.6	15.0	122.3	1962 - 1970
Waikelowo	19.1	17.7	18.7	14.1	7.8	4.6	2.1	3.3	4.1	9.7	15.4	18.6	135.2	1961 - 1970
Waingapu	14.8	14.8	14.0	4.3	2.5	1.3	0.9	0.3	0.2	1.1	2.9	10.2	67.2	1962 - 1970
Pacar	20.6	20.7	18.0	14.0	7.0	6.4	0.2	3.3	7.6	13.5	15.7	19.5	146.5	1961 - 1969
Lengkoajang	23.3	16.9	20.9	10.0	8.9	4.7	4.2	2.0	3.6	6.4	12.9	19.7	133.5	1961 - 1970
Larantuka	14.0	13.6	9.1	4.9	2.1	0.8	1.3	0.1	0.1	2.4	5.6	9.1	63.1	1961 - 1970
Seba	10.0	11.4	6.3	2.3	1.5	0.0	0.0	0.0	0.0	0.8	3.3	7.0	42.6	1962 - 1970
Soe	16.0	14.0	11.5	5.6	8.3	5.8	4.0	1.8	1.0	3.6	8.6	11.1	91.3	1962 - 1968

ANNEX-17 Path profiles

1. Main Route

Poco Ranakah	- Wolo Bobo
Wolo Bobo	- K.Ndora
K.Ndora	- Tokoropi
Tokoropi	- Lepe Mbusu
Lepe Mbusu	- I.Nggai
I.Nggai	- I.Wengot
I.Wengot	- I.Pasengdaeng
I.Pasengdaeng	- Hanga Wite
Hanga Wite	- Batang Lol
Batang Lol	- Regiar
Regiar	- T.Aina
Bikoun	- T.Aina
T.Ulamnotu	- Bikoun
Soe	- T.Ulamnotu
Upuba	- Soe
Kupang	- Upuba

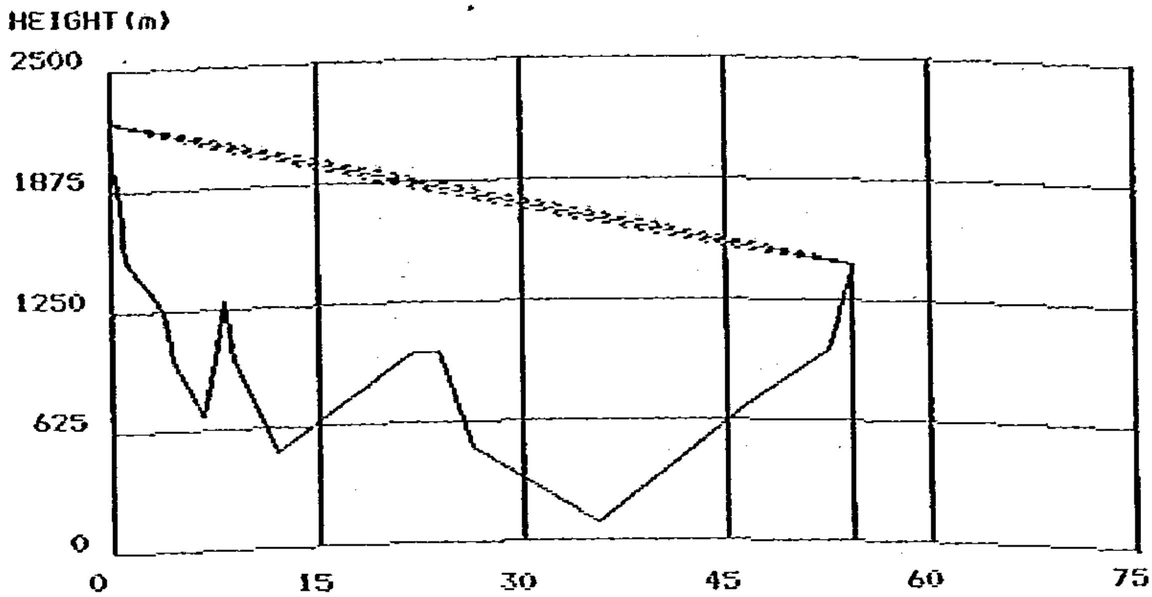
2. Spur Route

I.Nggai	- Maumere
I.Pasengdaeng	- Larantuka
Regiar	- Laling
Laling	- Kalabahi
T.Ulamnotu	- Kefamenanu
Sikoemana	- D.Oesai
D.Oesai	- Batoengolo
Prainghoar	- Pilautamanu
Pilautamanu	- Paraingmahara
Paraingmahara	- Wailiang

3. Nusa Tenggara Barat

Doronae	- Monggo
Monggo	- Dompu
BT.Jorongkoak	- Lab-barat

POCBOB (1.33 RADIUS)



DISTANCE : 54.3 km

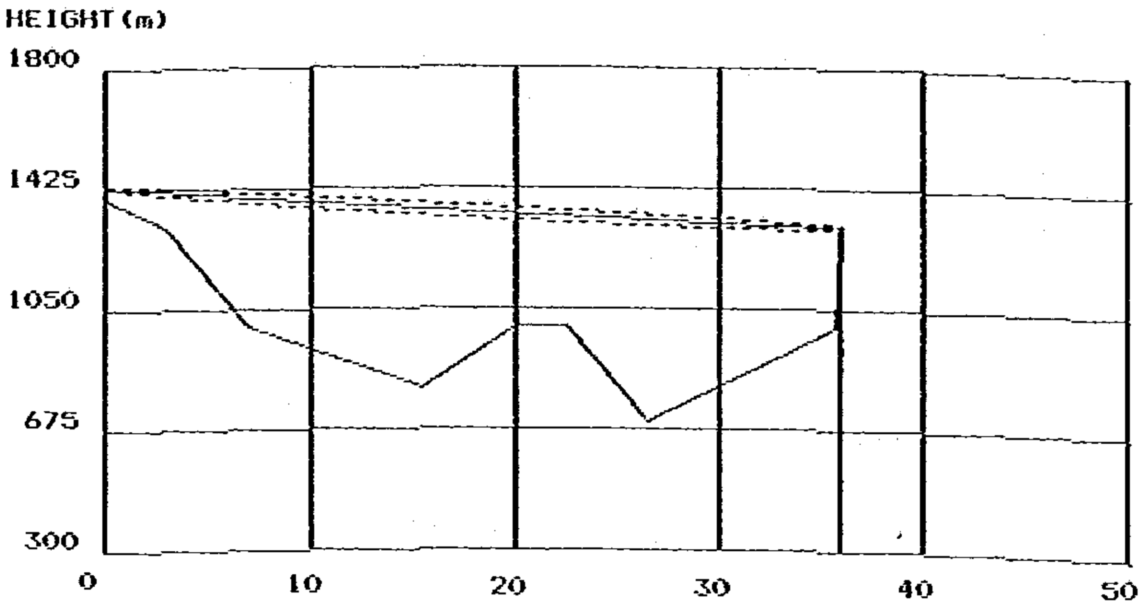
SITE NAME : Poco Ranakah
GROUND LEVEL : 2200 m

SITE NAME : Wolo Bobo
GROUND LEVEL : 1400 m

T. Roughness	:	531.8 m
Ant. Height(1)	:	30.0 m
Critical Point	:	24.0 km
Tree Height	:	20.0 m
Clearance	:	813.5 m
Free Space Loss	:	143.8 dB
Total Loss	:	143.8 dB

Frequency	:	6770 MHz
Ant. Height(2)	:	30.0 m
Ridge Height	:	1000.0 m
Fresnel Dip	:	24.4 m
Clearance Fac.	:	33.4
Ridge Loss	:	0.0 dB

BOBNDR (1.33 RADIUS)



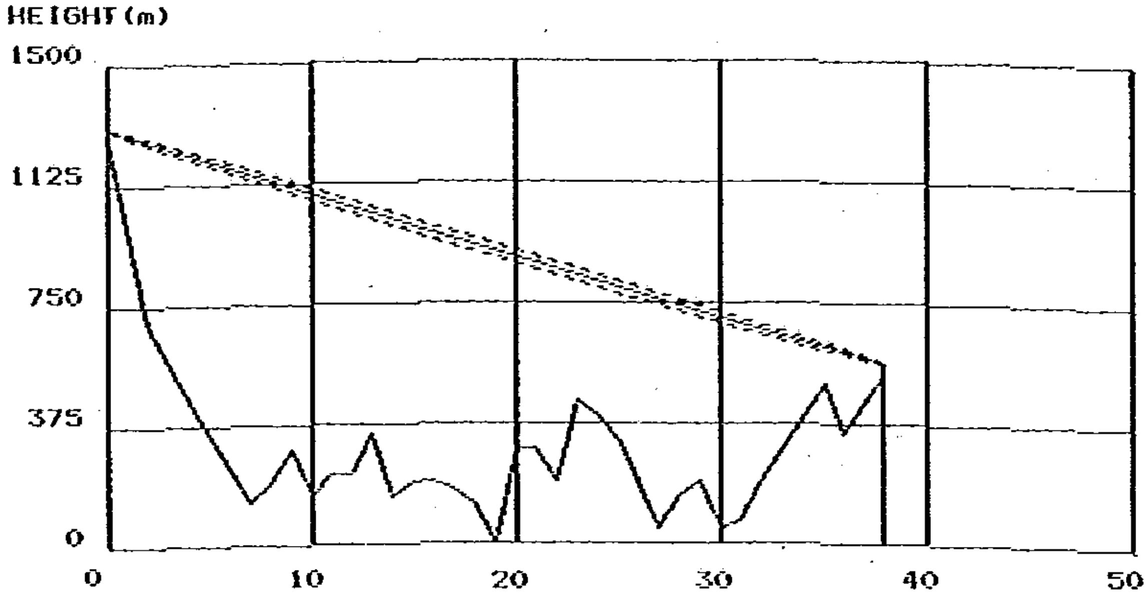
DISTANCE : 36 km

SITE NAME : Wolo Bobo
GROUND LEVEL : 1400 m

SITE NAME : K.Ndora
GROUND LEVEL : 1270 m

T. Roughness	:	216.5 m	Frequency	:	6770 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	30.0 m
Critical Point	:	3.0 km	Ridge Height	:	1300.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	11.0 m
Clearance	:	93.3 m	Clearance Fac.	:	8.5
Free Space Loss	:	140.2 dB	Ridge Loss	:	0.0 dB
Total Loss	:	140.2 dB			

NDRTOK (1.33 RADIUS)

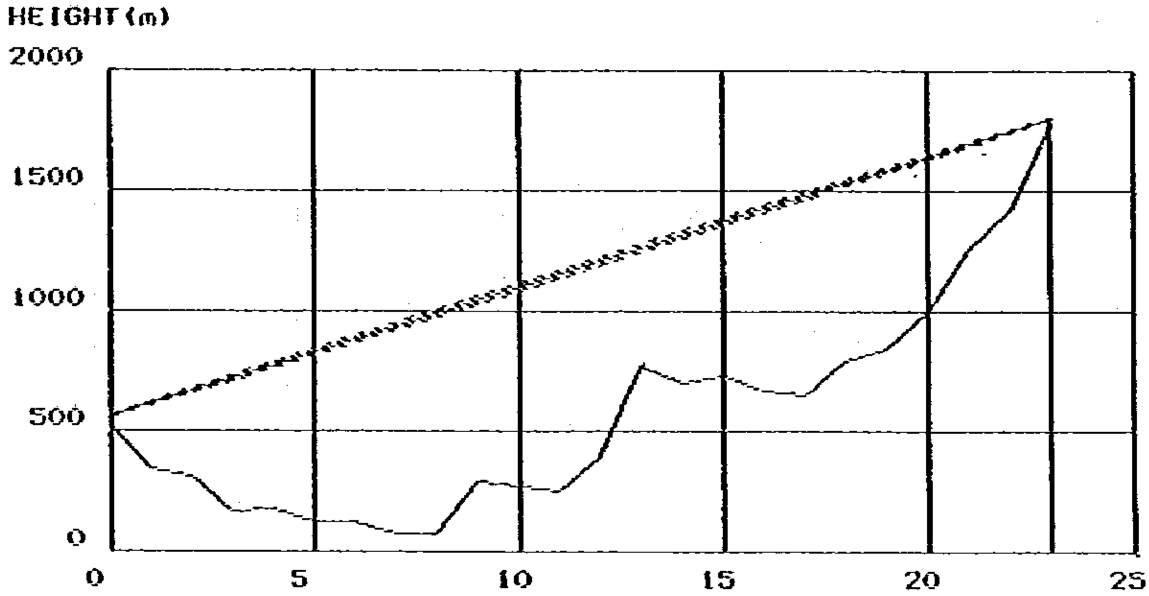


DISTANCE : 37.9 km

SITE NAME : K.Ndora		SITE NAME : Tokoropi	
GROUND LEVEL : 1270 m		GROUND LEVEL : 530 m	

T. Roughness	:	225.1 m	Frequency	:	6770 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	30.0 m
Critical Point	:	35.0 km	Ridge Height	:	500.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	10.9 m
Clearance	:	90.6 m	Clearance Fac.	:	8.3
Free Space Loss	:	140.6 dB	Ridge Loss	:	0.0 dB
Total Loss	:	140.6 dB			

TOKLEP (1.33 RADIUS)



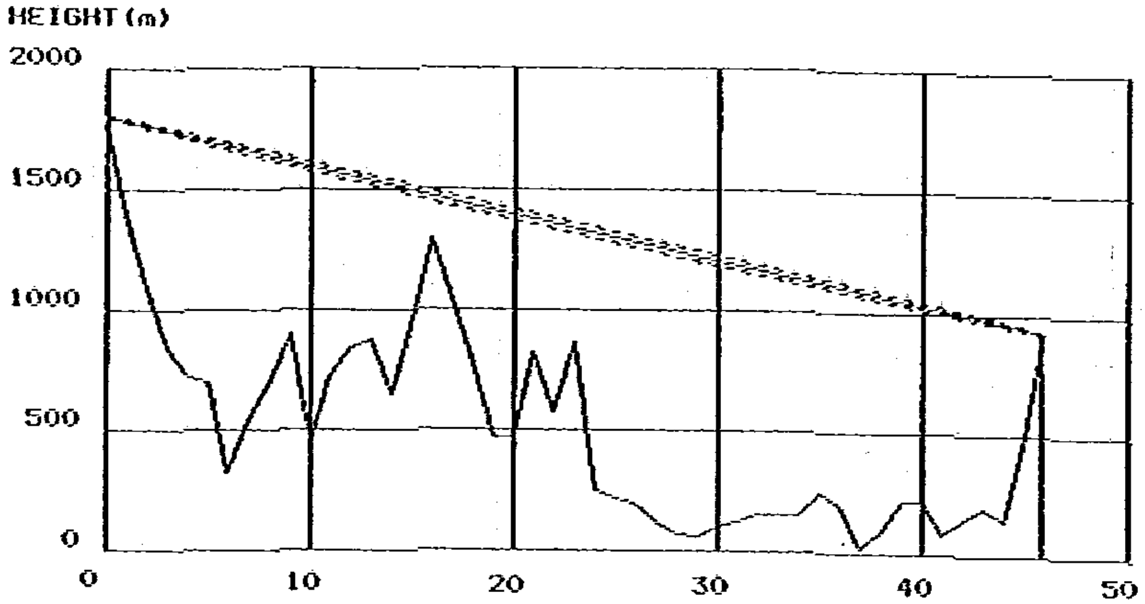
DISTANCE : 23 km

SITE NAME : Tokoropi
GROUND LEVEL : 530 m

SITE NAME : Lepe Mbusu
GROUND LEVEL : 1770 m

T. Roughness	: 368.5 m	Frequency	: 6770 MHz
Ant. Height(1)	: 30.0 m	Ant. Height(2)	: 30.0 m
Critical Point	: 13.0 km	Ridge Height	: 775.0 m
Tree Height	: 20.0 m	Fresnel Dip	: 15.8 m
Clearance	: 458.2 m	Clearance Fac.	: 29.0
Free Space Loss	: 136.3 dB	Ridge Loss	: 0.0 dB
Total Loss	: 136.3 dB		

LEPNGG (1.33 RADIUS)



DISTANCE : 45.8 km

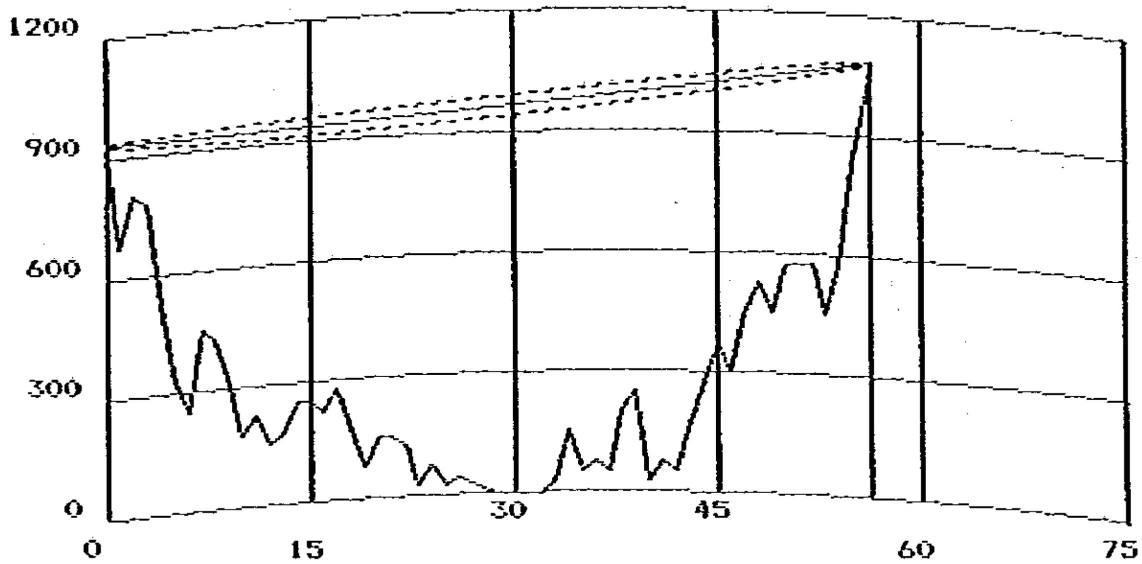
SITE NAME : Lepe Mbusu
GROUND LEVEL : 1770 m

SITE NAME : I.Nggai
GROUND LEVEL : 900 m

T. Roughness	:	406.7 m
Ant. Height(1)	:	30.0 m
Critical Point	:	16.0 km
Tree Height	:	20.0 m
Clearance	:	147.9 m
Free Space Loss	:	142.3 dB
Total Loss	:	142.3 dB

Frequency	:	6770 MHz
Ant. Height(2)	:	30.0 m
Ridge Height	:	1300.0 m
Fresnel Dip	:	21.5 m
Clearance Fac.	:	6.9
Ridge Loss	:	0.0 dB

NGGWEN (1.33 RADIUS)

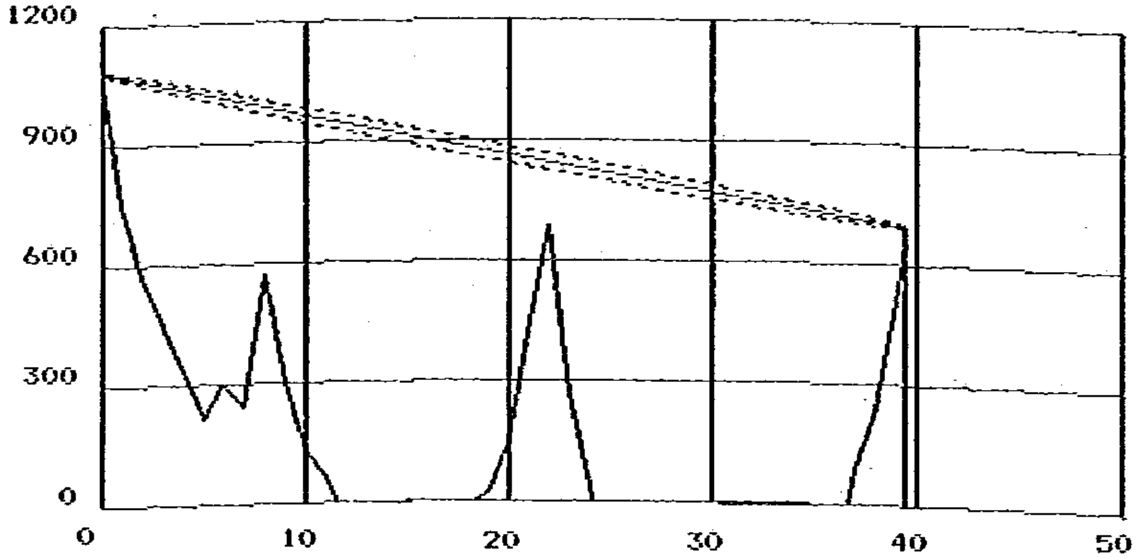


DISTANCE : 56.3 km

SITE NAME	:	I.Nggai	SITE NAME	:	I.Wengot
GROUND LEVEL	:	900 m	GROUND LEVEL	:	1050 m

T. Roughness	:	236.2 m	Frequency	:	6770 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	30.0 m
Critical Point	:	2.0 km	Ridge Height	:	800.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	9.2 m
Clearance	:	108.9 m	Clearance Fac.	:	11.8
Free Space Loss	:	144.1 dB	Ridge Loss	:	0.0 dB
Total Loss	:	144.1 dB			

WENPAS (1.33 RADIUS)



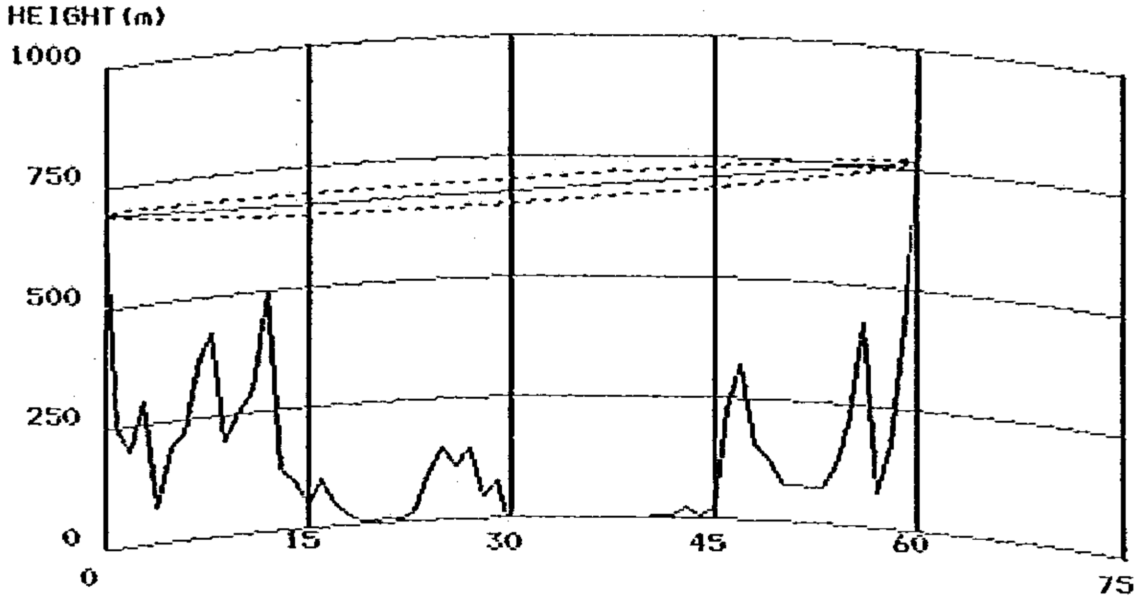
DISTANCE : 39.5 km

SITE NAME : I.Wengot
GROUND LEVEL : 1050 m

SITE NAME : I.Pasengdaeng
GROUND LEVEL : 660 m

T. Roughness	:	270.0 m	Frequency	:	6770 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	30.0 m
Critical Point	:	22.0 km	Ridge Height	:	690.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	20.8 m
Clearance	:	130.1 m	Clearance Fac.	:	6.3
Free Space Loss	:	141.0 dB	Ridge Loss	:	0.0 dB
Total Loss	:	141.0 dB			

PASWIT (1.33 RADIUS)



DISTANCE : 59.9 km

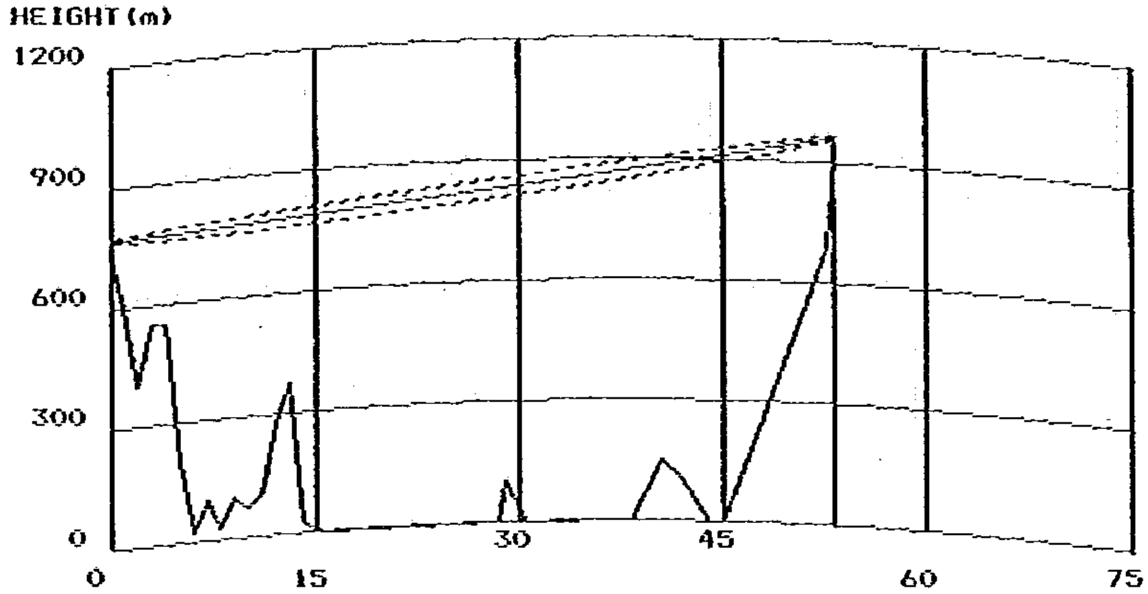
SITE NAME : I.Pasengdaeng
GROUND LEVEL : 660 m

SITE NAME : Hanga Wite
GROUND LEVEL : 735 m

T. Roughness	:	149.4 m
Ant. Height(1)	:	30.0 m
Critical Point	:	12.0 km
Tree Height	:	20.0 m
Clearance	:	151.1 m
Free Space Loss	:	144.6 dB
Total Loss	:	144.6 dB

Frequency	:	6770 MHz
Ant. Height(2)	:	30.0 m
Ridge Height	:	500.0 m
Fresnel Dip	:	20.6 m
Clearance Fac.	:	7.3
Ridge Loss	:	0.0 dB

WITBAT (1.33 RADIUS)



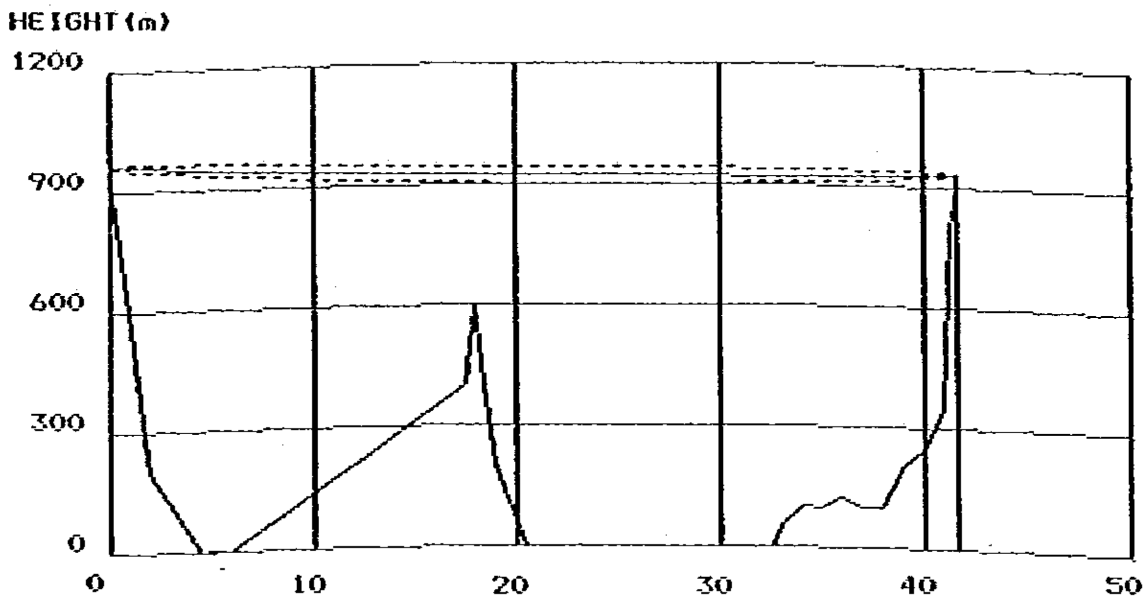
DISTANCE : 53.3 km

SITE NAME : Hanga Wite
GROUND LEVEL : 735 m

SITE NAME : Batang Lol
GROUND LEVEL : 930 m

T. Roughness	:	235.6 m	Frequency	:	6770 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	30.0 m
Critical Point	:	4.0 km	Ridge Height	:	550.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	12.8 m
Clearance	:	198.0 m	Clearance Fac.	:	15.5
Free Space Loss	:	143.6 dB	Ridge Loss	:	0.0 dB
Total Loss	:	143.6 dB			

BATREG (1.33 RADIUS)



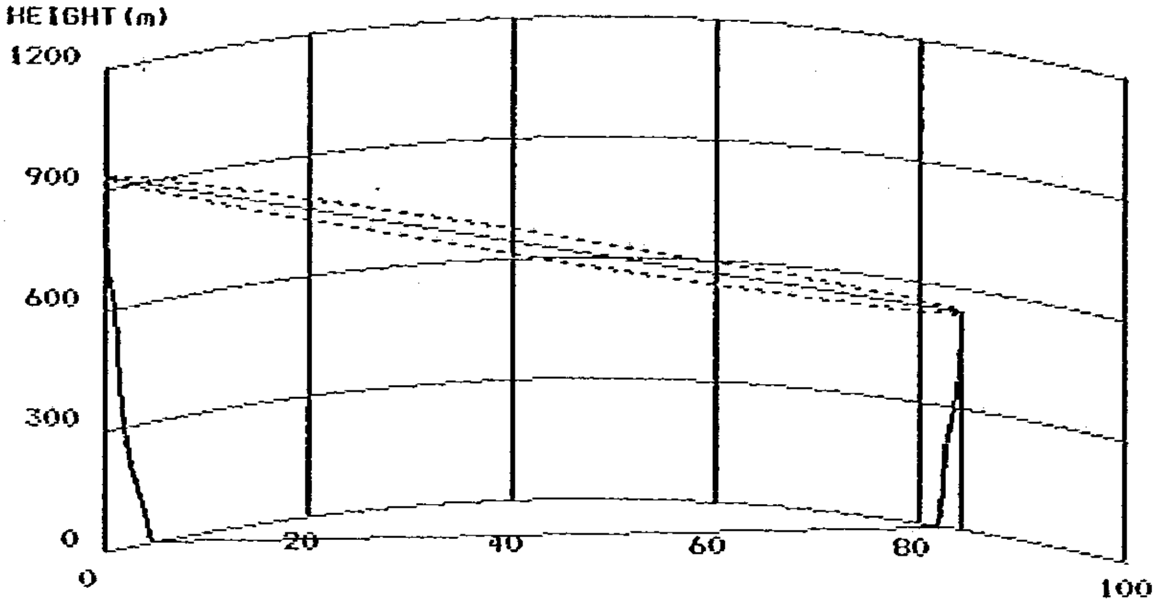
DISTANCE : 41.6 km

SITE NAME : Batang Lol
GROUND LEVEL : 930 m

SITE NAME : Regiar
GROUND LEVEL : 900 m

T. Roughness	:	264.0 m	Frequency	:	6770 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	30.0 m
Critical Point	:	18.0 km	Ridge Height	:	600.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	21.3 m
Clearance	:	301.9 m	Clearance Fac.	:	14.2
Free Space Loss	:	141.5 dB	Ridge Loss	:	0.0 dB
Total Loss	:	141.5 dB			

REGAIN (1.33 RADIUS)

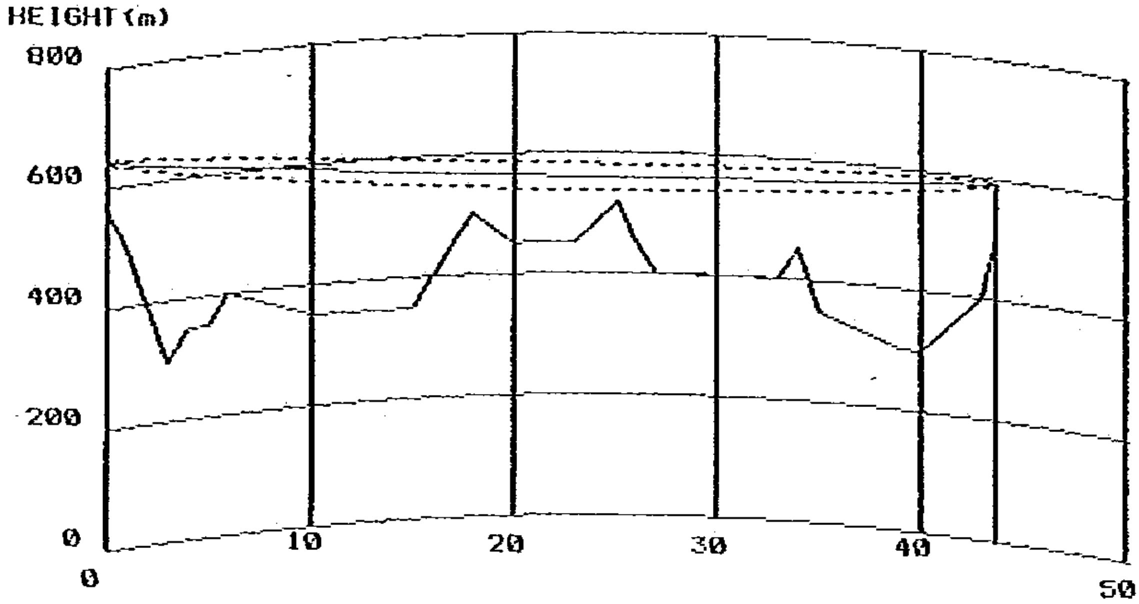


DISTANCE : 84.2 km

SITE NAME : Regiar		SITE NAME : T.Aina	
GROUND LEVEL : 900 m		GROUND LEVEL : 510 m	

T. Roughness	: 274.9 m	Frequency	: 6770 MHz
Ant. Height(1)	: 30.0 m	Ant. Height(2)	: 30.0 m
Critical Point	: 0.2 km	Ridge Height	: 800.0 m
Tree Height	: 20.0 m	Fresnel Dip	: 3.0 m
Clearance	: 108.1 m	Clearance Fac.	: 36.3
Free Space Loss	: 147.6 dB	Ridge Loss	: 0.0 dB
Total Loss	: 147.6 dB		

BIKAIN (.67 RADIUS)



DISTANCE : 43.7 km

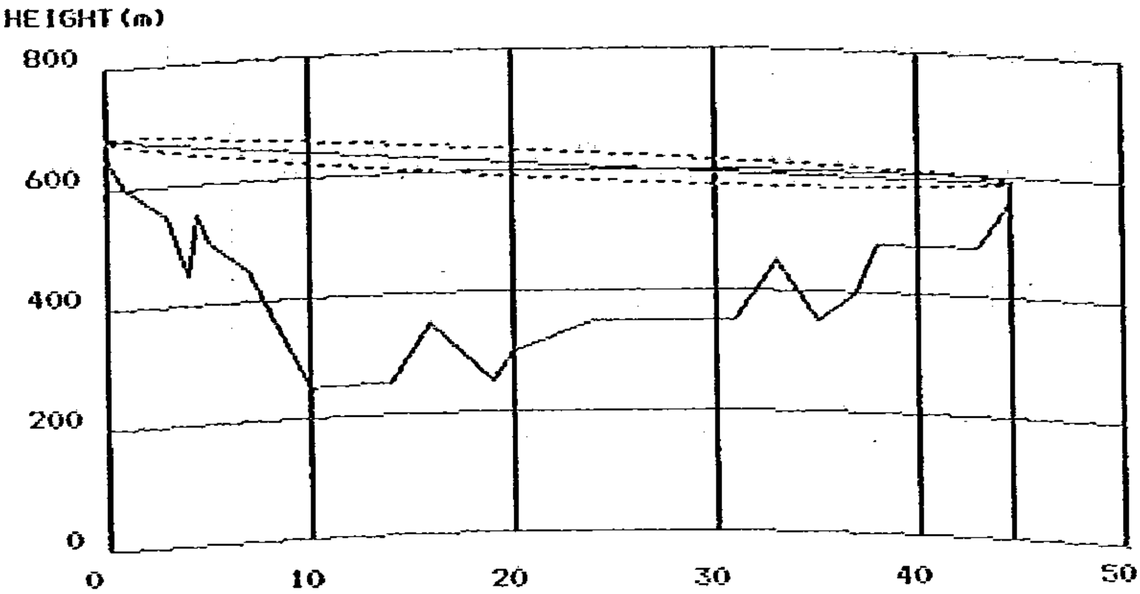
SITE NAME : Bikoun
GROUND LEVEL : 560 m

SITE NAME : T.Aina
GROUND LEVEL : 510 m

T. Roughness	:	69.3 m
Ant. Height(1)	:	80.0 m
Critical Point	:	25.0 km
Tree Height	:	20.0 m
Clearance	:	16.6 m
Free Space Loss	:	141.9 dB
Total Loss	:	141.9 dB

Frequency	:	6770 MHz
Ant. Height(2)	:	80.0 m
Ridge Height	:	520.0 m
Fresnel Dip	:	21.8 m
Clearance Fac.	:	0.8
Ridge Loss	:	0.0 dB

ULABIK (1.33 RADIUS)

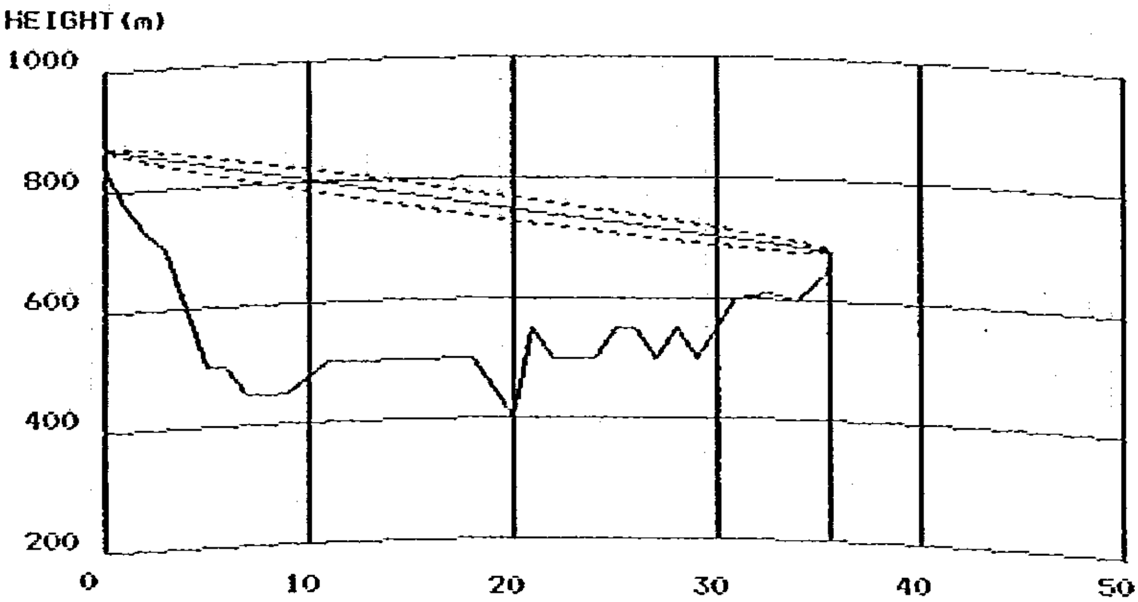


DISTANCE : 44.6 km

SITE NAME : T.Ulamnotu		SITE NAME : Bikoun	
GROUND LEVEL : 650 m		GROUND LEVEL : 560 m	

T. Roughness	:	112.9 m	Frequency	:	6770 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	30.0 m
Critical Point	:	38.0 km	Ridge Height	:	480.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	15.8 m
Clearance	:	88.5 m	Clearance Fac.	:	5.6
Free Space Loss	:	142.1 dB	Ridge Loss	:	0.0 dB
Total Loss	:	142.1 dB			

SOEULA (1.33 RADIUS)



DISTANCE : 35.6 km

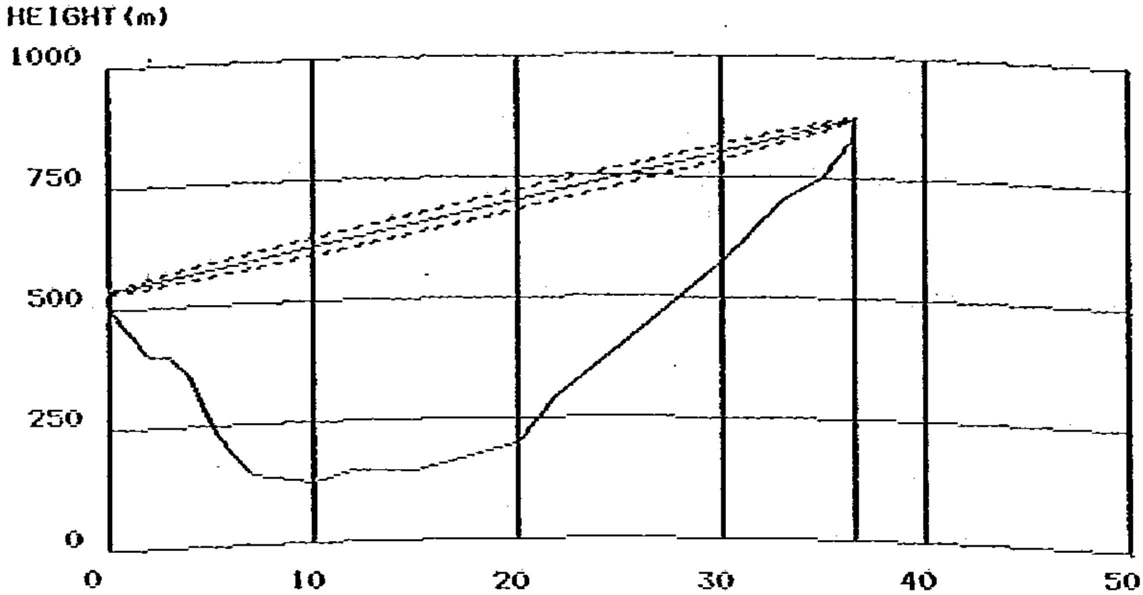
SITE NAME : Soe
GROUND LEVEL : 840 m

SITE NAME : T.Ulamnotu
GROUND LEVEL : 650 m

T. Roughness	:	105.2 m
Ant. Height(1)	:	30.0 m
Critical Point	:	32.5 km
Tree Height	:	20.0 m
Clearance	:	60.6 m
Free Space Loss	:	140.1 dB
Total Loss	:	140.1 dB

Frequency	:	6770 MHz
Ant. Height(2)	:	30.0 m
Ridge Height	:	610.0 m
Fresnel Dip	:	11.2 m
Clearance Fac.	:	5.4
Ridge Loss	:	0.0 dB

UPUSOE (1.33 RADIUS)



DISTANCE : 36.6 km

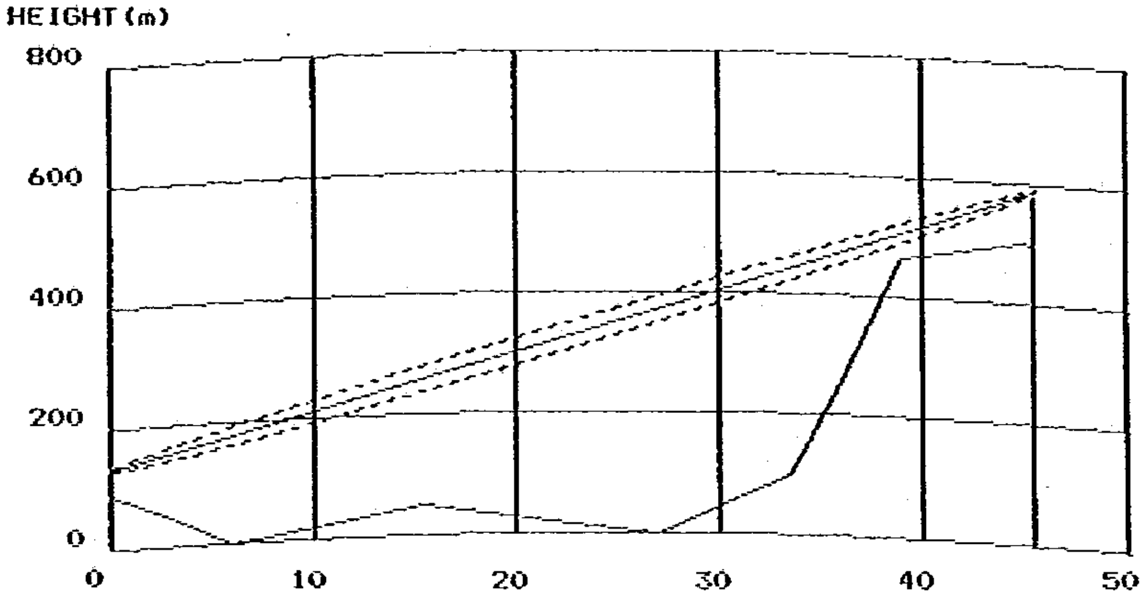
SITE NAME : Upuba
GROUND LEVEL : 504 m

SITE NAME : Soe
GROUND LEVEL : 840 m

T. Roughness	:	221.1 m
Ant. Height(1)	:	30.0 m
Critical Point	:	36.0 km
Tree Height	:	20.0 m
Clearance	:	43.2 m
Free Space Loss	:	140.3 dB
Total Loss	:	140.3 dB

Frequency	:	6770 MHz
Ant. Height(2)	:	30.0 m
Ridge Height	:	800.0 m
Fresnel Dip	:	5.1 m
Clearance Fac.	:	8.5
Ridge Loss	:	0.0 dB

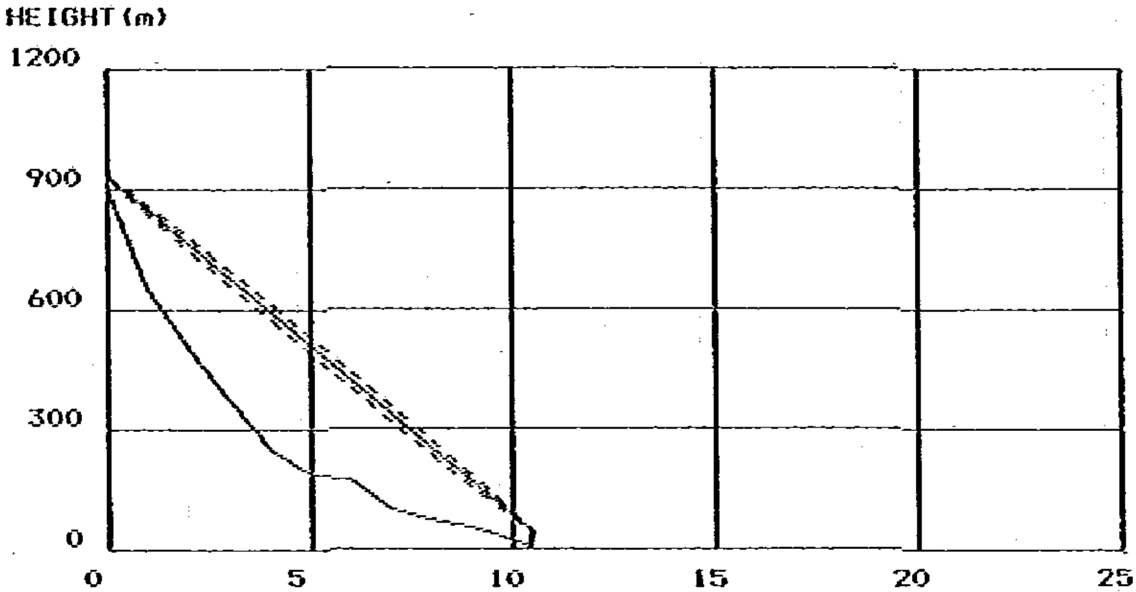
KUPUPU (1.33 RADIUS)



DISTANCE : 45.5 km

SITE NAME : Kupang			SITE NAME : Upuba		
GROUND LEVEL : 90 m			GROUND LEVEL : 504 m		
T. Roughness	:	182.3 m	Frequency	:	6770 MHz
Ant. Height(1)	:	40.0 m	Ant. Height(2)	:	80.0 m
Critical Point	:	39.0 km	Ridge Height	:	463.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	15.7 m
Clearance	:	21.2 m	Clearance Fac.	:	1.3
Free Space Loss	:	142.2 dB	Ridge Loss	:	0.0 dB
Total Loss	:	142.2 dB			

NGGMAU (1.33 RADIUS)

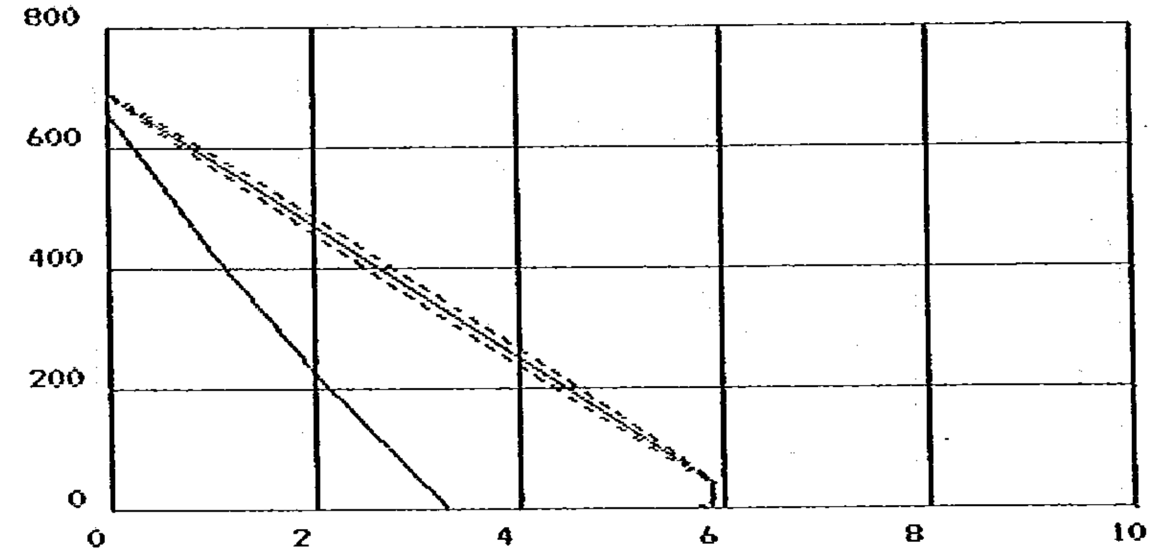


DISTANCE : 10.5 km

SITE NAME	:	I.Nggai	SITE NAME	:	Maumere
GROUND LEVEL	:	900 m	GROUND LEVEL	:	10 m

T. Roughness	:	264.4 m	Frequency	:	2000 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	30.0 m
Critical Point	:	9.0 km	Ridge Height	:	60.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	13.9 m
Clearance	:	86.3 m	Clearance Fac.	:	6.2
Free Space Loss	:	118.9 dB	Ridge Loss	:	0.0 dB
Total Loss	:	118.9 dB			

PASLAR (1.33 RADIUS)



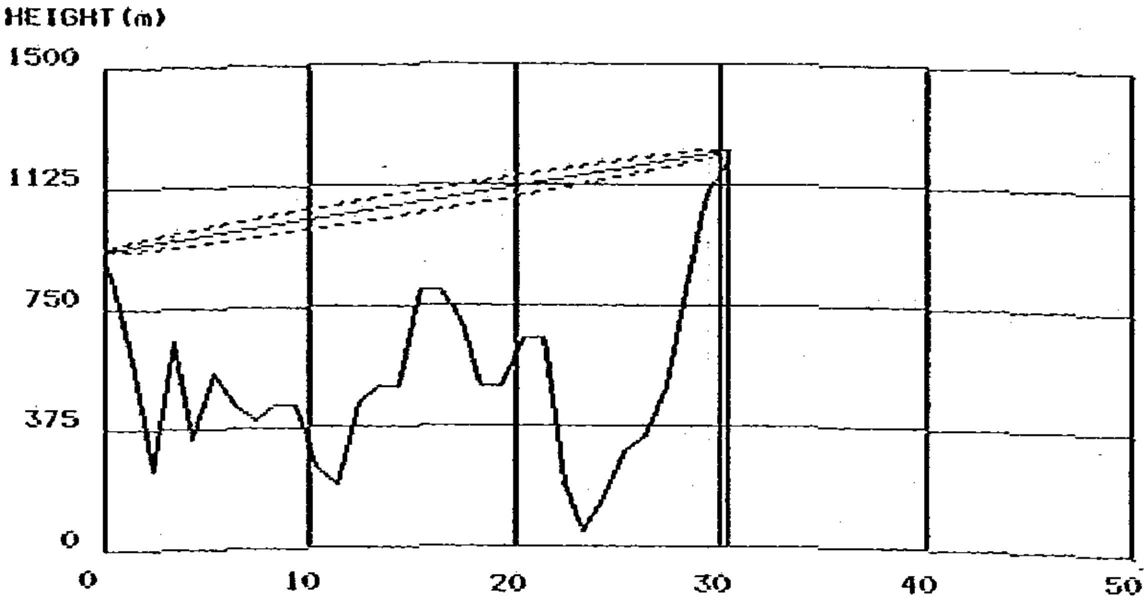
DISTANCE : 5.9 km

SITE NAME : I.Pasengdaeng
GROUND LEVEL : 660 m

SITE NAME : Larantuka
GROUND LEVEL : 10 m

T. Roughness	:	254.4 m	Frequency	:	2000 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	30.0 m
Critical Point	:	5.7 km	Ridge Height	:	0.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	5.4 m
Clearance	:	42.0 m	Clearance Fac.	:	7.8
Free Space Loss	:	113.9 dB	Ridge Loss	:	0.0 dB
Total Loss	:	113.9 dB			

REGLAL (1.33 RADIUS)



DISTANCE : 30.4 km

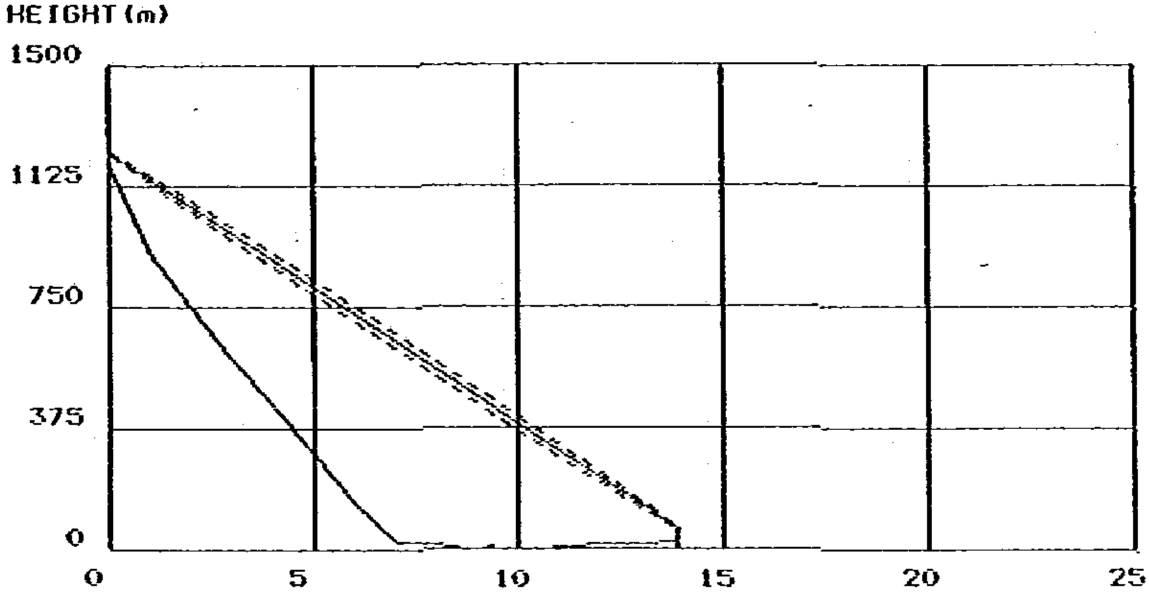
SITE NAME : Regiar
GROUND LEVEL : 900 m

SITE NAME : Laling
GROUND LEVEL : 1200 m

T. Roughness	:	238.5 m
Ant. Height(1)	:	30.0 m
Critical Point	:	15.4 km
Tree Height	:	20.0 m
Clearance	:	248.3 m
Free Space Loss	:	128.1 dB
Total Loss	:	128.1 dB

Frequency	:	2000 MHz
Ant. Height(2)	:	30.0 m
Ridge Height	:	800.0 m
Fresnel Dip	:	33.8 m
Clearance Fac.	:	7.4
Ridge Loss	:	0.0 dB

LALKAR (1.33 RADIUS)



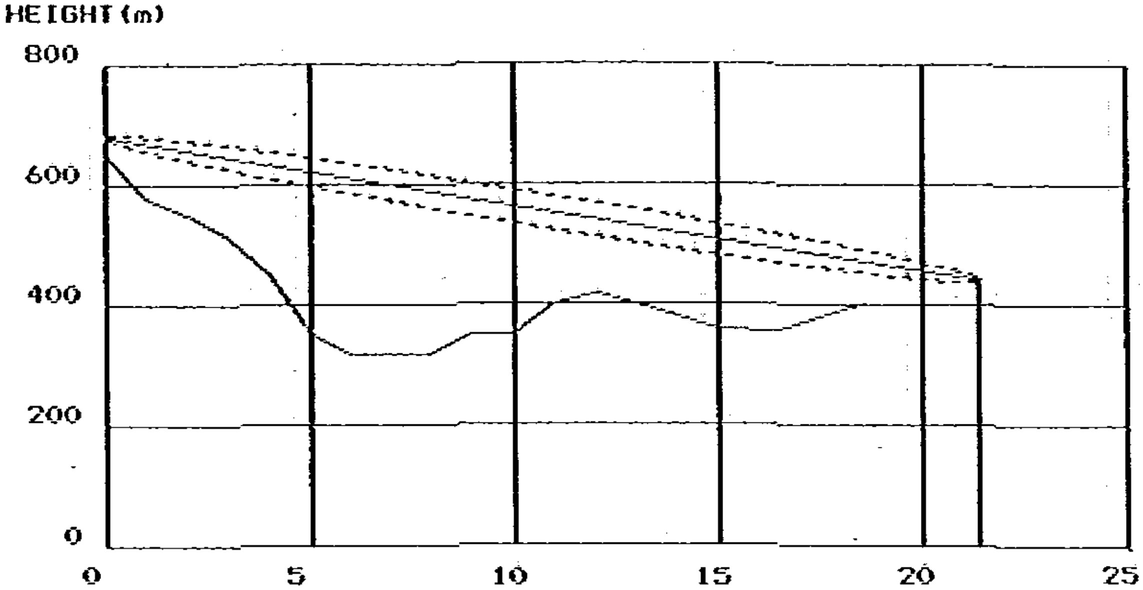
DISTANCE : 13.9 km

SITE NAME : Laling
GROUND LEVEL : 1200 m

SITE NAME : Karabahi
GROUND LEVEL : 30 m

T. Roughness	:	377.8 m	Frequency	:	2000 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	30.0 m
Critical Point	:	13.0 km	Ridge Height	:	20.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	11.2 m
Clearance	:	95.1 m	Clearance Fac.	:	8.5
Free Space Loss	:	121.3 dB	Ridge Loss	:	0.0 dB
Total Loss	:	121.3 dB			

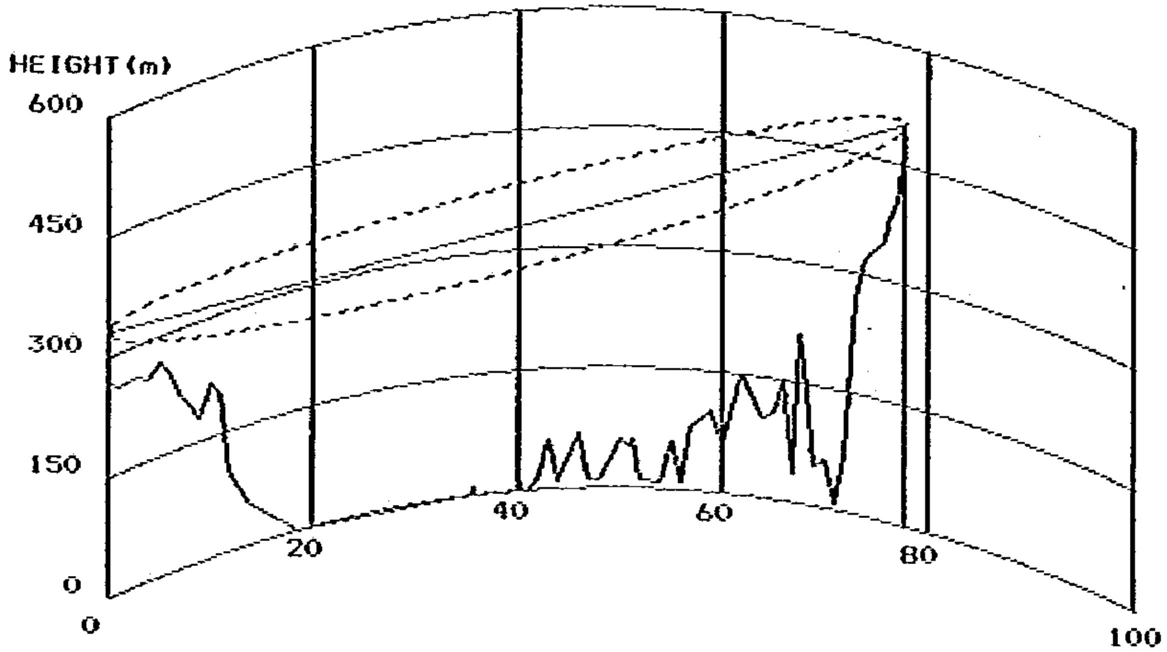
ULAKEF (1.33 RADIUS)



DISTANCE : 21.4 km

SITE NAME : T.Ulamnotu		SITE NAME : Kefamenanu	
GROUND LEVEL : 650 m		GROUND LEVEL : 400 m	
T. Roughness	: 91.7 m	Frequency	: 2000 MHz
Ant. Height(1)	: 30.0 m	Ant. Height(2)	: 40.0 m
Critical Point	: 20.0 km	Ridge Height	: 400.0 m
Tree Height	: 20.0 m	Fresnel Dip	: 14.0 m
Clearance	: 34.0 m	Clearance Fac.	: 2.4
Free Space Loss	: 125.1 dB	Ridge Loss	: 0.0 dB
Total Loss	: 125.1 dB		

SIKOES (1.33 RADIUS)

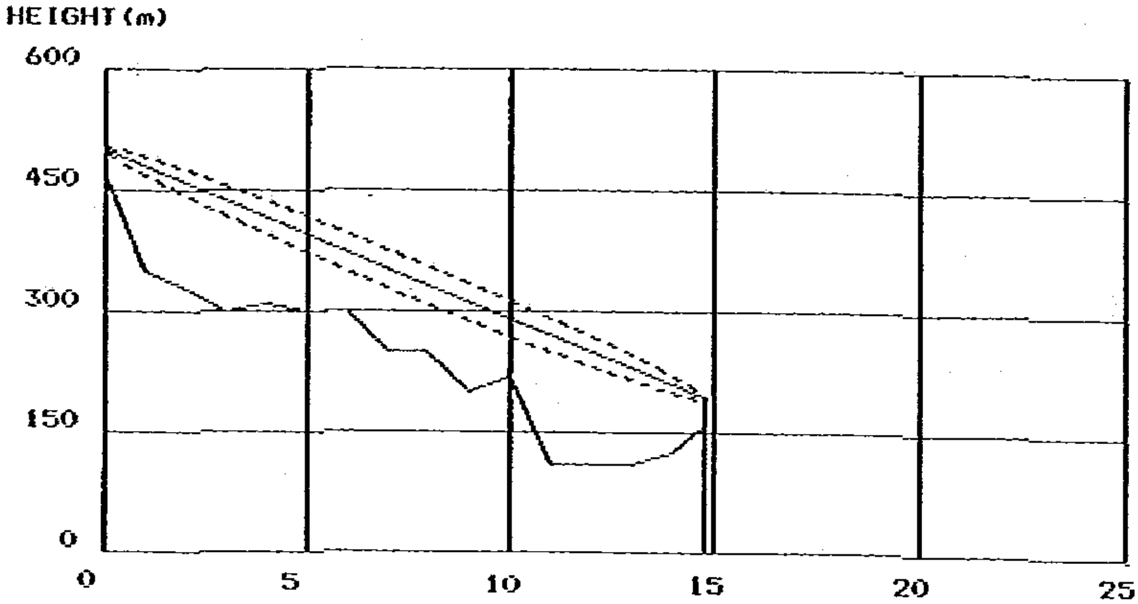


DISTANCE : 77.9 km

SITE NAME : Sikoemana		SITE NAME : D.Oesai	
GROUND LEVEL : 270 m		GROUND LEVEL : 470 m	

T. Roughness	: 118.5 m	Frequency	: 2000 MHz
Ant. Height(1)	: 60.0 m	Ant. Height(2)	: 30.0 m
Critical Point	: 5.0 km	Ridge Height	: 270.0 m
Tree Height	: 20.0 m	Fresnel Dip	: 26.5 m
Clearance	: 29.4 m	Clearance Fac.	: 1.1
Free Space Loss	: 136.3 dB	Ridge Loss	: 0.0 dB
Total Loss	: 136.3 dB		

OESBAT (1.33 RADIUS)



DISTANCE : 14.8 km

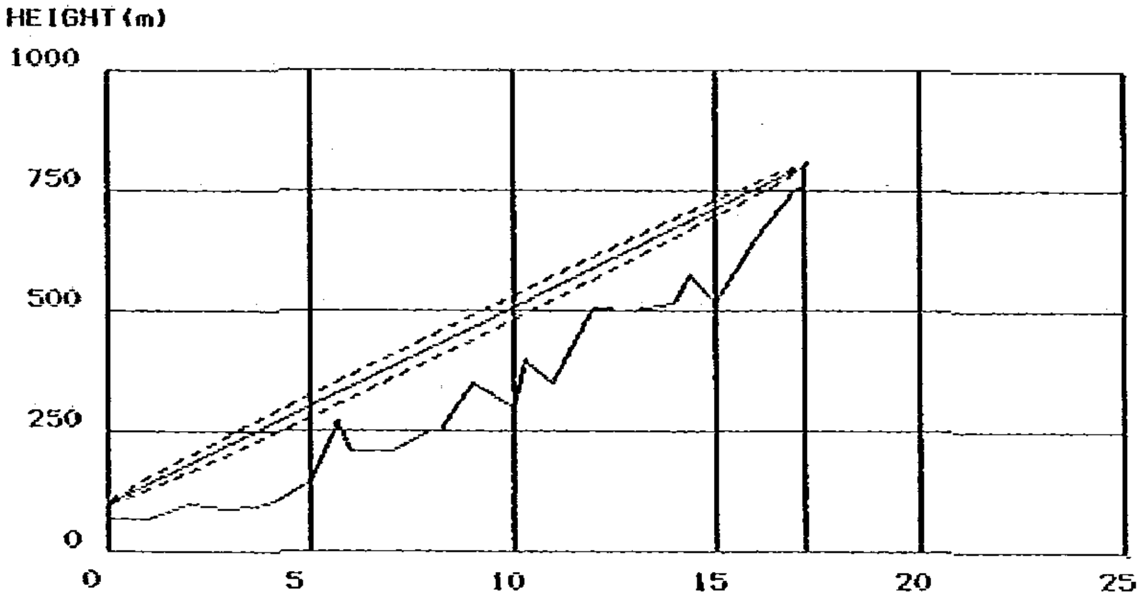
SITE NAME : D.Oesai
GROUND LEVEL : 470 m

SITE NAME : Batoengolo
GROUND LEVEL : 160 m

T. Roughness	:	97.5 m
Ant. Height(1)	:	30.0 m
Critical Point	:	10.0 km
Tree Height	:	25.0 m
Clearance	:	42.7 m
Free Space Loss	:	121.9 dB
Total Loss	:	121.9 dB

Frequency	:	2000 MHz
Ant. Height(2)	:	30.0 m
Ridge Height	:	220.0 m
Fresnel Dip	:	22.1 m
Clearance Fac.	:	1.9
Ridge Loss	:	0.0 dB

PRAPIL (1.33 RADIUS)



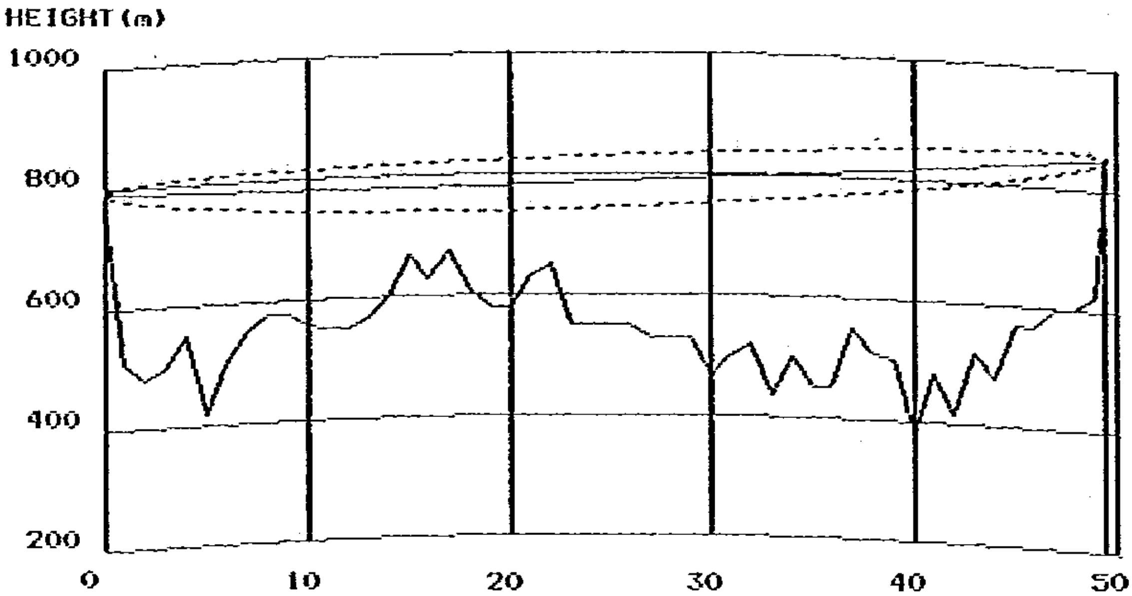
DISTANCE : 17.2 km

SITE NAME : Prainghoar
GROUND LEVEL : 70 m

SITE NAME : Pilautamanu
GROUND LEVEL : 760 m

T. Roughness	:	198.1 m	Frequency	:	2000 MHz
Ant. Height(1)	:	30.0 m	Ant. Height(2)	:	40.0 m
Critical Point	:	5.7 km	Ridge Height	:	270.0 m
Tree Height	:	20.0 m	Fresnel Dip	:	23.9 m
Clearance	:	38.1 m	Clearance Fac.	:	1.6
Free Space Loss	:	123.2 dB	Ridge Loss	:	0.0 dB
Total Loss	:	123.2 dB			

PILPAR (1.33 RADIUS)

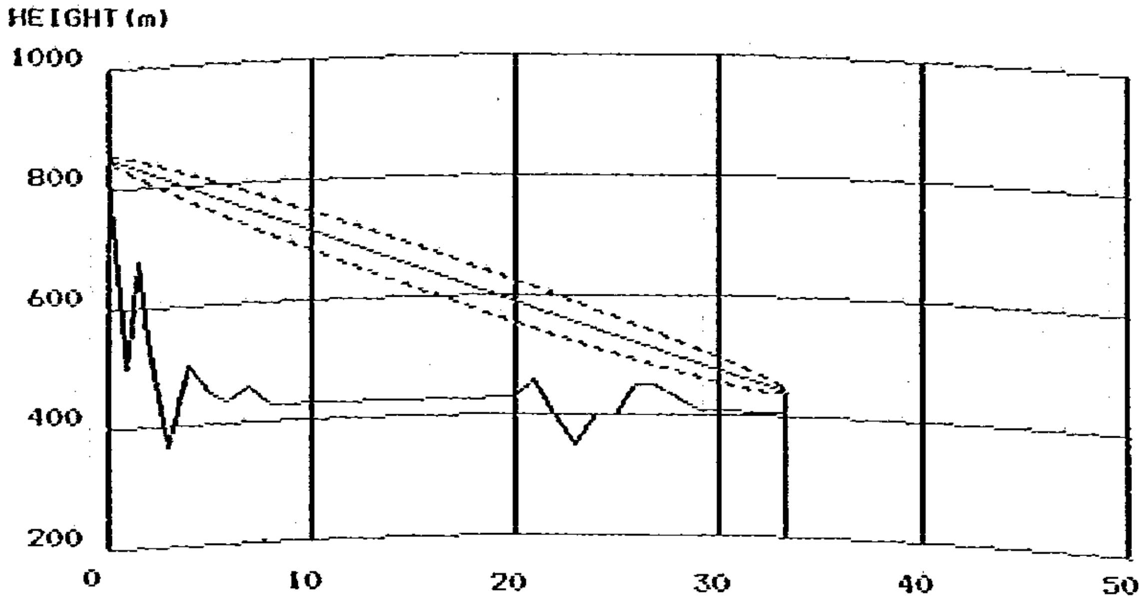


DISTANCE : 49.5 km

SITE NAME : Pilautamanu		SITE NAME : Paraingmahara	
GROUND LEVEL : 760 m		GROUND LEVEL : 820 m	

T. Roughness	: 72.3 m	Frequency	: 2000 MHz
Ant. Height(1)	: 30.0 m	Ant. Height(2)	: 30.0 m
Critical Point	: 17.0 km	Ridge Height	: 675.0 m
Tree Height	: 20.0 m	Fresnel Dip	: 40.9 m
Clearance	: 83.0 m	Clearance Fac.	: 2.0
Free Space Loss	: 132.4 dB	Ridge Loss	: 0.0 dB
Total Loss	: 132.4 dB		

PARWAI (1.33 RADIUS)



DISTANCE : 33.2 km

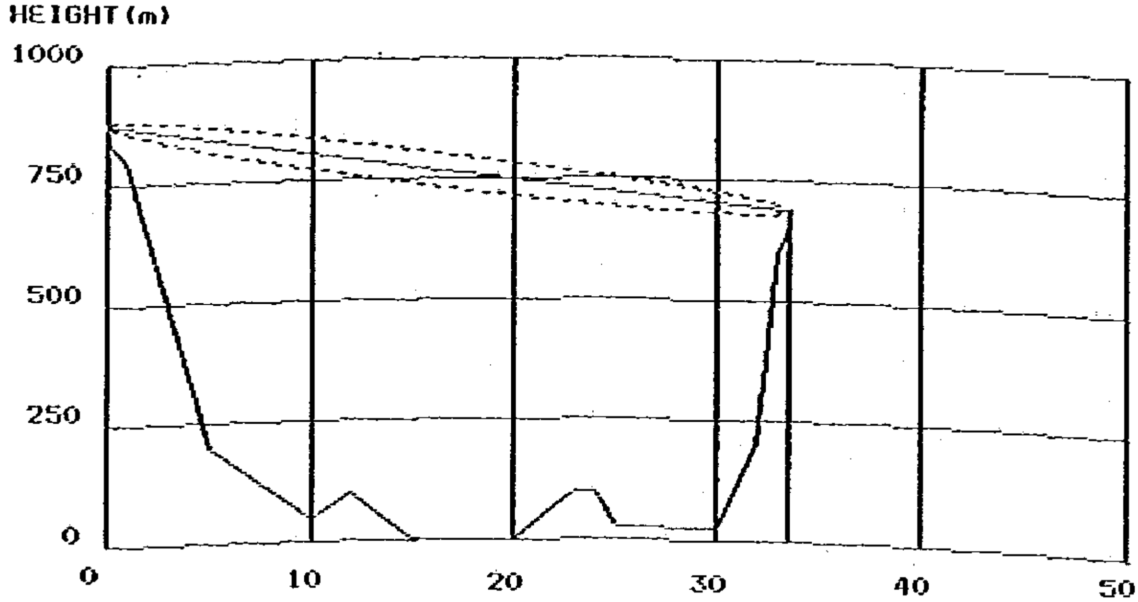
SITE NAME : Paraingmahala
GROUND LEVEL : 820 m

SITE NAME : Wailiang
GROUND LEVEL : 410 m

T. Roughness	:	105.5 m
Ant. Height(1)	:	30.0 m
Critical Point	:	27.0 km
Tree Height	:	20.0 m
Clearance	:	36.7 m
Free Space Loss	:	128.9 dB
Total Loss	:	128.9 dB

Frequency	:	2000 MHz
Ant. Height(2)	:	30.0 m
Ridge Height	:	450.0 m
Fresnel Dip	:	27.5 m
Clearance Fac.	:	1.3
Ridge Loss	:	0.0 dB

DORMON (1.33 RADIUS)



DISTANCE : 33.6 km

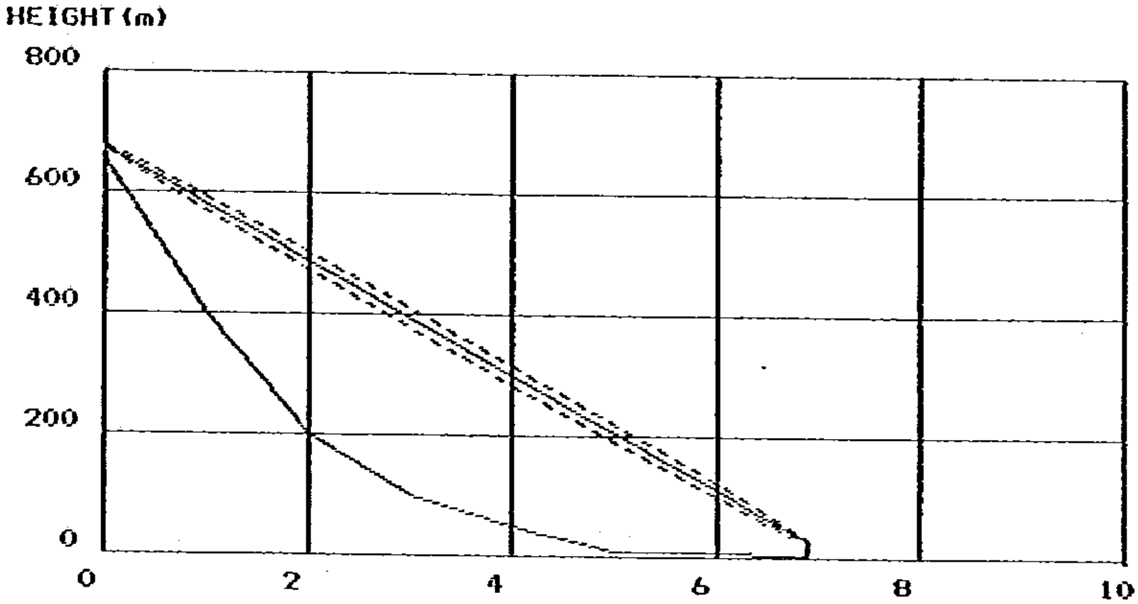
SITE NAME : Doronae
GROUND LEVEL : 843 m

SITE NAME : Monggo
GROUND LEVEL : 655 m

T. Roughness	:	291.0 m
Ant. Height(1)	:	30.0 m
Critical Point	:	1.0 km
Tree Height	:	20.0 m
Clearance	:	45.5 m
Free Space Loss	:	129.0 dB
Total Loss	:	129.0 dB

Frequency	:	2000 MHz
Ant. Height(2)	:	30.0 m
Ridge Height	:	800.0 m
Fresnel Dip	:	12.1 m
Clearance Fac.	:	3.8
Ridge Loss	:	0.0 dB

MONDOM (1.33 RADIUS)



DISTANCE : 6.9 km

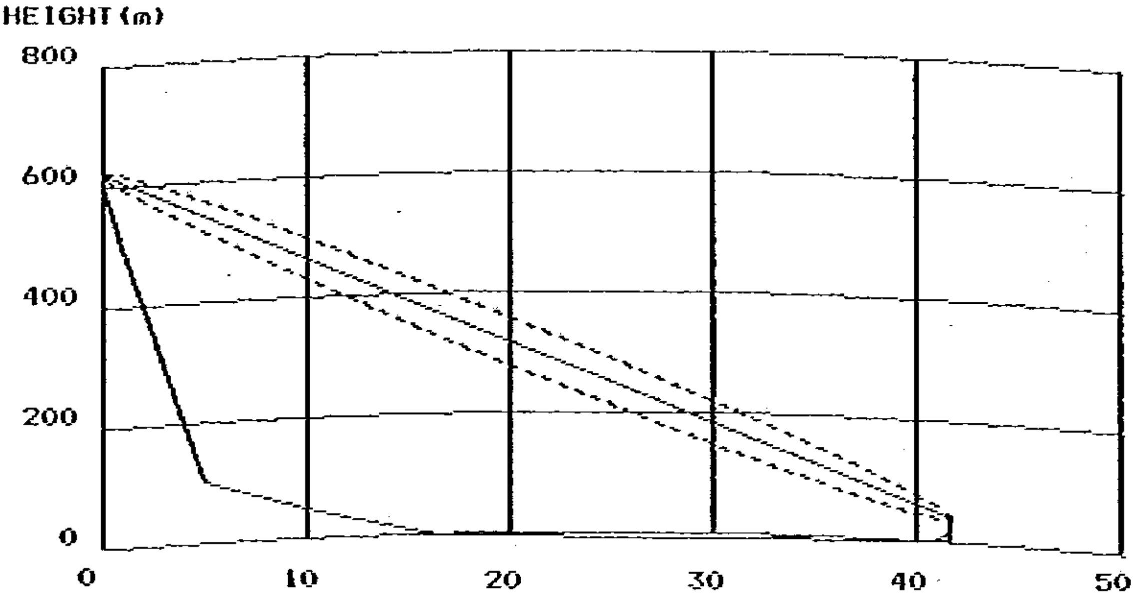
SITE NAME : Monggo
GROUND LEVEL : 655 m

SITE NAME : Dompu
GROUND LEVEL : 5 m

T. Roughness	:	219.7 m
Ant. Height(1)	:	20.0 m
Critical Point	:	6.7 km
Tree Height	:	20.0 m
Clearance	:	18.8 m
Free Space Loss	:	115.3 dB
Total Loss	:	115.3 dB

Frequency	:	2000 MHz
Ant. Height(2)	:	20.0 m
Ridge Height	:	5.0 m
Fresnel Dip	:	5.4 m
Clearance Fac.	:	3.5
Ridge Loss	:	0.0 dB

JORLAB (1.33 RADIUS)



DISTANCE : 41.6 km

SITE NAME : BT.Jorongkoak
GROUND LEVEL : 600 m

SITE NAME : Lab-Balat
GROUND LEVEL : 20 m

T. Roughness	:	222.8 m
Ant. Height(1)	:	20.0 m
Critical Point	:	41.0 km
Tree Height	:	20.0 m
Clearance	:	26.9 m
Free Space Loss	:	130.9 dB
Total Loss	:	130.9 dB

Frequency	:	2000 MHz
Ant. Height(2)	:	20.0 m
Ridge Height	:	0.0 m
Fresnel Dip	:	9.4 m
Clearance Fac.	:	2.9
Ridge Loss	:	0.0 dB

ANNEX-18 Scope of Work

SCOPE OF WORK
FOR
THE FEASIBILITY STUDY
ON
TERRESTRIAL TRANSMISSION NETWORK DEVELOPMENT
IN
THE NUSA TENGGARA AREA
OF
THE REPUBLIC OF INDONESIA

Agreed upon between

DIRECTORATE GENERAL OF POSTS AND TELECOMMUNICATIONS,

The Government of Indonesia

and

JAPAN INTERNATIONAL COOPERATION AGENCY

April , 1983

IR. ROLLIN	TATSUO KAWANO
Deputy Director General	Leader
Directorate General of Posts and Telecommunications.	JICA Preliminary Study Team

I. INTRODUCTION

In response to the request of the Government of Indonesia, the Government of Japan has decided to conduct a feasibility study on the terrestrial transmission system in the Nusa Tenggara area of the Republic of Indonesia (hereinafter referred to as "the Study") as a part of its technical cooperation programmes to foreign countries.

The Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical cooperation programmes of the Government of Japan, will carry out the Study in close cooperation with the Government of the Republic of Indonesia and the authorities concerned.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to verify the technical and economic feasibility of developing a terrestrial transmission system in the Study area as the target year of 2005, with due consideration of the coexistence with the satellite transmission system.

III. SCOPE OF THE STUDY

1. Study Area

   Nusa Tenggara Barat and Nusa Tenggara Timur

2. Outline of the Study

   1). Collection and review of existing data/information, including those of the satellite system, relevant to the Study

   2). Field survey for terrestrial transmission network

   3). Interview and discussion with relevant Government departments and agencies

   4). Technical and economic evaluation of various alternatives including a submarine cable system between Ende and Kupang

   5). Preparation of a basic system design on the optimum terrestrial transmission network and its implementation program

6). Estimation of the project cost

7). Financial and economic analysis of the project

IV. STUDY SCHEDULE

The whole work will be conducted in accordance with the attached tentative study schedule.

V. REPORTS

JICA will prepare and submit the following reports in English to the Government of Indonesia.

1) Inception Report
   - 20 copies
   - at the beginning of the field survey

2) Progress Report
   - 20 copies
   - at the end of the field survey

3) Draft Final Report
   - 20 copies
   - within three months after the submission of the Progress Report
   - by the end of the stay of the Study Team in Indonesia, the Government of Indonesia will provide JICA with its comments on the Draft Final Report

4) Final Report
   - 50 copies
   - within two months after the explanation of the Draft Final Report.

VI. UNDERTAKING OF THE GOVERNMENT OF INDONESIA

1) to provide the Study Team with available data and information relevant to the Study

2) to provide suitable office space with necessary equipment and services

3) to ensure the transportation to carry out the field survey

4) to assign official counterparts during the field survey

5) to allow the Study Team to take all data and documents related to the Study including photographs out of Indonesia to Japan in accordance to the security regulation of the Government of Indonesia.

6) to exempt the Study Team from income tax and charges on allowances aid to the members of the Japanese Study Team for their services in connection with the implementation of the study

7) to provide necessary facilities to the Study Team for the remittances as well as utilization of funds introduced into Indonesia from Japan in connection with the implementation of the Study

8) to bear claims, if any arises, against the members of the Study Team resulting from occuring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members

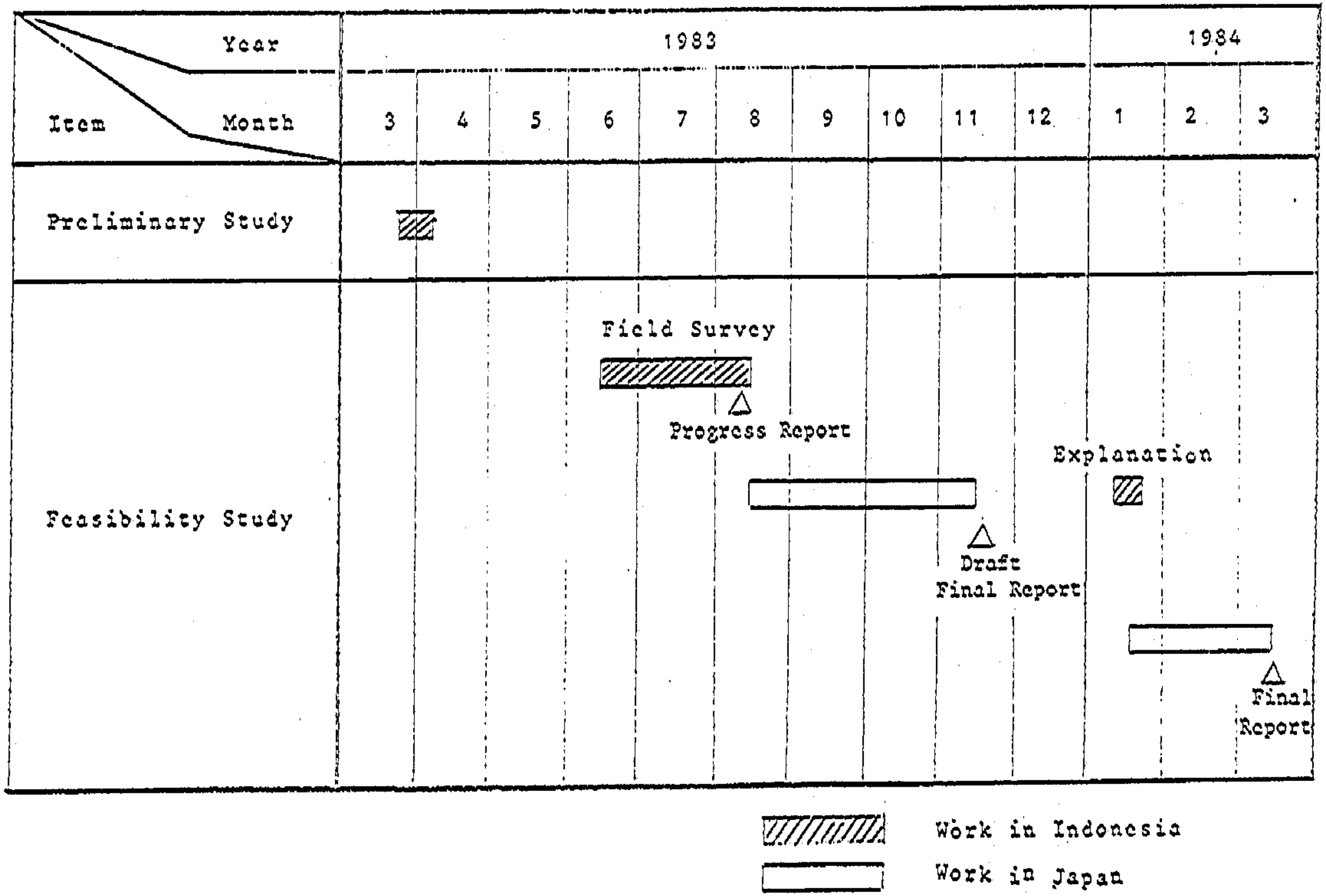
9) to take necessary measures regarding the security of the Study Team

VII. UNDERTAKING OF THE GOVERNMENT OF JAPAN

1) to send, at its own expense, Japanese Study Team to the Republic of Indonesia

2) to perform technology transfer to the Indonesian counterpart personnel in the course of the field survey and relevant work.

STUDY SCHEDULE (Tentative)



ANNEX-19 Minutes of Meeting

MINUTES OF MEETING

CONCERNING

THE DRAFT FINAL REPORT ON FEASIBILITY STUDY

FOR

THE NUSA TENGGARA AREA TERRESTRIAL TRANSMISSION NETWORK PROJECT

The JICA Study Team headed by Mr. Akira AIKEI and the Team of DITJEN POSTEL and PERUMTEL headed by Mr. Agus DARMAN/Mr. H.V.R. SARAGIH held the meetings concerning the captioned report on January 19 and 25, 1984, at the conference room of DITJEN POSTEL. A list of attendants is in ANNEX.

Main items discussed are as follows:

1. In the meeting held on January 19, 1984, the JICA Study Team briefed DITJEN POSTEL on the Draft Final Report.

   It was mutually agreed that detailed explanation and discussion on the report would be made between the JICA Study Team and the Team of PERUMTEL at PERUMTEL Offices, Bandung.

2. In the meeting held on January 25, 1984, the JICA Study Team reported to DITJEN POSTEL the result of meetings held by the JICA Study Team and the Team of PERUMTEL on January 21 and 23, 1984, at PERUMTEL Offices, Bandung.

DITJEN POSTEL approved the minutes of the meeting, which were mutually agreed between the JICA Study Team and the Team of PERUMTEL. The said minutes are attached hereto.

Jakarta, January 25, 1984

Confirmed and signed by:

R.I. SOEMARDI
Director of Planning
DITJEN POSTEL

愛敬 彬

AKIRA AIKEI
Leader,
JICA Study Team

ANNEX ATTENDANTS TO THE MEETING (1/2)

January 19, 1984, at the conference room of DITJEN POSTEL, Jakarta.

DITJEN POSTEL

Ir. Agus Darman	- Director of Planning
Mr. R.I. Soemardi Bc.T.T.	- Staff of Planning Division
Mr. H.V.R. Saragih Bc.T.T.	- "
Mr. Sutarto	- "
Mr. M. Malano	- "

DEPARPOSTEL

Mr. Rai Sardjana Bc.T.T.	- Staff
Drs. Soetomo	- Staff of Bureau I

PERUMTEL

Mr. Roesmijanto Bc.T.T.	- Chief, Terrestrial Transmission Planning Division C
Ir. Tjahjono D.H.	- Chief, Terrestrial Transmission Planning Division B
Mr. Azwar Mohamad Bc.T.T.	- Chief, Terrestrial Transmission Planning Division E
Ir. Budiwasisto	- Staff of Coordination Planning Division
Mr. Yasin Rivai Bc.T.T.	- Staff of Terrestrial Transmission Planning Division C
Mr. Jajat Suprijatna Bc.T.T.	- Staff of Terrestrial Transmission Planning Division E

JICA Study Team

Mr. Akira AIKEI	- Leader
Mr. Takashi SUZUKI	
Mr. Junichi KOMADA	
Mr. Mikio DANNO	
Mr. Minoru TATEMATSU	- Coordinator

Mr. Yasuo SUZUKI	- First Secretary, Embassy of Japan
Mr. Tatsuichi HIDAKA	- Resident Representative, NTT Jakarta Office
Mr. Ken INOMATA	- Assistant Resident Representative, JICA Jakarta Office

ANNEX. ATTENDANTS TO THE MEETING (2/2)

January 25, 1984, at the conference room of DITJEN POSTEL, Jakarta.

DITJEN POSTEL

Mr. H.V.R. Saragih Bc.T.T.	- Staff of Planning Division
Mr. Sutarto	- Staff of Planning Division
Mr. M. Malano	- Staff of Planning Division

PERUMTEL

Mr. Azwar Mohamad Bc.T.T.	- Chief, Terrestrial Transmission Planning Division E
Mr. Budiwasisto	- Staff of Coordination Planning Division
Mr. Jajat Suprijatna Bc.T.T.	- Staff of Terrestrial Transmission Planning Division E

JICA Study Team

Mr. Akira AIKEI	- Leader
Mr. Takashi SUZUKI	
Mr. Junichi KOMADA	
Mr. Mikio DANNO	
Mr. Minoru TATEMATSU	- Coordinator
Mr. Tatsuichi HIOAKA	- Resident Representative, NTT Jakarta Office

MINUTES OF MEETING
CONCERNING
THE DRAFT FINAL REPORT ON FEASIBILITY STUDY
FOR
THE NUSA TENGGARA AREA
TERRESTRIAL TRANSMISSION NETWORK PROJECT

The JICA Study Team headed by Mr. Akira Aikei and the Team of PERUMTEL headed by Mr. Roesmijanto made discussion on the Draft Final Report of the captioned Feasibility Study on January 21 and 23, 1984, at PERUMTEL Offices located at Jl. Hassanudin No.7, Jl. Cendana No. 16 and Jl. Supratman No. 48, Bandung.

A list of attendants is in ANNEX.

The JICA Team made explanation on the Feasibility Study Report and made discussion with the PERUMTEL Team.

As the result , concerning the formulation of the Final Report, both parties have agreed and confirmed the following :

1. The presented Draft Final Report has been approved as the Final Report by both parties.
2. For the finalization of the report, necessary editorial modifications will be made.

Bandung, January 23, 1984

Confirmed and signed by :

Roesmijanto
Chief
Terrestrial Transmission
Planning Division C

Akira AIKEI
Leader
JICA Study Team

ANNEX **ATTENDANTS TO THE MEETING (1/3)**

January 21, 1984, at the conference room of PERUMTEL, Bandung.

PERUMTEL:

Mr. Roesmijanto Bc.TT	- Chief, Terrestrial Transmission Planning Division C
Ir. Tjahjono D.H.	- Chief, Terrestrial Transmission Planning Division B
Mr. Azwar Mohamad Bc.TT	- Chief, Terrestrial Transmission Planning Division E
Ir. Budiwasisto	- Staff of Coordination Planning Division
Mr. Yasin Rivai Bc.TT	- Staff of Terrestrial Transmission Planning Division C
Mr. Jajat Suprijatna Bc.TT	- Staff of Terrestrial Transmission Planning Division E
Ir. Gadang R.	- Staff of Cable Planning Division
Mr. Soewito Bc.TT	- Staff of Cable Planning Division
Drs. Endang Rachmat	- Staff of Financial Division

JICA Study Team:

Mr. Akira AIKEI	- Leader
Mr. Takashi SUZUKI	
Mr. Junichi KOMADA	
Mr. Mikio DANNO	
Mr. Minoru TATEMATSU	- Coordinator

JTM:

Mr. Takao IWASHIMIZU	- Leader of JTM

ANNEX ATTENDANTS TO THE MEETING (2/3)

January 23, 1984, at the conference room of PERUMTEL, Bandung

PERUMTEL

Drs. Sutjito Bc.A.T.	- Chief, Capital Management Division
Drs. I. Nangah Seroma	- Staff of Capital Management Division
Drs. Endang Rachmat	- Staff of Financial Division

JICA Study Team

Mr. Mikio DANNO

ANNEX ATTENDANTS TO THE MEETING (3/3)

January 23, 1984, at the conference room of PERUMTEL, Bandung

PERUMTEL

Mr. Roesmijanto Bc.T.T.	- Chief, Terrestrial Transmission Planning Division C
Ir. Tjahjono D.H.	- Chief, Terrestrial Transmission Planning Division B
Ir. Budiwasisto	- Staff of Coordination Planning Division
Mr. Yasin Rivai Bc.T.T.	- Staff of Terrestrial Transmission Planning Division C
Ir. Dewi Arumi	- Staff of Switching Planning Division

JICA Study Team

Mr. Akira AIKEI	- Leader
Mr. Takashi SUZUKI	
Mr. Junichi KOMADA	
Mr. Mikio DANNO	
Mr. Minoru TATEMATSU	- Coordinator

JTM

Mr. Takao IWASHIMIZU	- Leader of JTM

MINUTES OF MEETING

CONCERNING

THE PROGRESS REPORT ON FEASIBILITY STUDY

FOR

THE NUSA TENGGARA TERRESTRIAL TRANSMISSION NETWORK PROJECT

IN

THE REPUBLIC OF INDONESIA

The JICA Study Team headed by Mr. Akira AIKEI and DITJEN. POSTEL and PERUMTEL personnel headed by Ir. Agus Darman held the meeting concerning the captioned report on September 21, 1983 at the conference room of DITJEN. POSTEL.

Attendants to this meeting are shown in Attachment-1.

Team Leader of JICA expressed his sincere thanks for the DITJEN. POSTEL's and PERUMTEL's kind cooperation during the study work.

JICA Study Team explained the outlines of Progress Report.
During the meeting, the report was discussed and mutually agreed.

JICA Study Team reported the result of meeting held on September 16, 1983 at PERUMTEL Headquarters, Bandung, and DITJEN. POSTEL approved the minutes of the meeting. The above-mentioned minutes are attached as Attachment-2.

POSTEL requested JICA Study Team to study the application of Solar Cell System and this study will be included in Draft Final Report.

Jakarta, September 22, 1983

Confirmed and signed by:

Ir. AGUS DARMAN	AKIRA AIKEI
Director of Planning	Leader
DITJEN. POSTEL	JICA Study Team

ATTENDANTS TO THE MEETING

September 21, 1983 at the conference room of DITJEN. POSTEL, Jakarta.

POSTEL:

Ir. Agus Darman	- Director, Planning Division
Mr. Moher Malano	- Staff of Planning Division
Mr. Sutarto	- Staff of Planning Division

PERUMTEL:

Ir. Abdul Muhaimin	- Chief, Terrestrial Transmission Planning Division
Mr. Azwar Mohammad Bc.T.T.	- Staff of Terrestrial Transmission Planning Division
Ir. Mulia Tambunan	- Staff of Terrestrial Transmission Planning Division
Mr. Yayat Suprijatna Bc.T.T.	- Staff of Terrestrial Transmission Planning Division
Ir. Budiwasisto	- Staff of Coordination Planning Division
Ir. Andreas Peranginangin	- Staff of Satellite Transmission Planning Division
Ir. Iwan Krisnadi	- Staff of Satellite Transmission Planning Division
Ir. Suradji	- Staff of Satellite Transmission Planning Division
Ir. Mas'ud Bc.T.T.	- Staff of Production Planning Division
Mr. Loeshir Arif JEC	- Staff of Telegraph and Telephone Exchange Planning Division
Ir. Dewi Arumi	- Staff of Telegraph and Telephone Exchange Planning Division

JICA STUDY TEAM:

Mr. Akira AIKEI	- Leader
Mr. Kazutomo OSAWA	- Sub-Leader
Mr. Takashi SUZUKI	- Survey Leader
Mr. Kazuo MORITA	
Mr. Kinya SUZUKI	
Mr. Satoru KUSHIDA	
Mr. Junichi KOMADA	

Mr. Yoshihide HIRATA

Mr. Mikio DANNO

Mr. Katsuhiko KAKEI - Coordinator

NTTPC

Mr. Tatsuichi HIDAKA - Resident Representative in Jakarta.

MINUTES OF MEETING CONCERNING THE PROGRESS REPORT ON FEASIBILITY STUDY FOR THE NUSA TENGGARA TERRESTRIAL TRANSMISSION NETWORK PROJECT IN THE REPUBLIC OF INDONESIA

The JICA Study Team headed by Mr. Akira AIKEI and PERUMTEL personnel concerning this Project headed by Ir. Abdul Muhaimin made discussion on Progress Report of the captioned Feasibility Study on 15 th September, 1983, at the conference room of PERUMTEL Headquarters in Bandung.

Attendants to this meeting are shown in Attachment-1.

Team Leader of JICA expressed his sincere thanks for the PERUMTEL's kind cooperation during the study work.

JICA Study Team explained the outlines of Progress Report.

During the meeting, following points were discussed and mutually agreed.

1. In the meeting at WITEL VIII on 2nd August, 1983, WITEL VIII requested to establish the terrestrial transmission link for the Alas exchange in this Project. After the discussion, however, the terrestrial transmission link to Alas is not to be included in this Project because Alas is not classified as primary centre.

2. As for the Traffic distribution between terrestrial and satellite links, the distribution ratio which is mentioned in ANNEX VI of Progress Report is applied (attached as Attachment - 2).

   In the case of direct routes between secondary centres, the same ratio as the above is applied

3. Terrestrial transmission link for Seba, which is located in Sawu island, is not applied from the technical and economical points of view.
   Establishment of satellite link is to be planned by PRANSAT.

4. Transmission links for Waikabubak and Larantuka are not included in initial construction of this Project since the digital automatic switching system will not be installed before 1995.

5. Transmission link will be established by analogue system in following sections from the economical viewpoint, because these links are branched from existing analogue system.

   i) Corcorae - Dompu
   ii) ST. Jorongkoak - Taliwang
   iii) Poco Ranakah - Waingapu
   iv) Poco Ranakah - Ruteng

Bandung, September 19, 1983

Confirmed and signed by :

ABDUL MUHAIMIN	AKIRA AIKEI,
DRANTRA	LEADER
PERUMTEL	JICA STUDY TEAM

ATTENDANTS TO THE MEETING

September 16, 1983 at the conference room of PERUMTEL Headquarter, Bandung.

PERUMTEL

Ir. Abdul Muhaimin	-	Chief, Terrestrial Transmission Planning Division.
Ir. Azwar Mohammad Bc.TT	-	Staff of Terrestrial Transmission Planning Division.
Ir. Mulia Tambunan	-	Staff of Terrestrial Transmission Planning Division.
Ir. K.Andreas Peranginangin	-	Staff of Satellite Transmission Planning Division.
Ir. Iwan Krisnadi	-	Staff of Satellite Transmission Planning Division.
Ir. Suradji	-	Staff of Satellite Transmission Planning Division.
Mr. Loeshir Arif. JEC	-	Staff of Telegraph and Telephone Exchange Planning Division.
Mr. Chumaidi Bc.TT	-	Staff of Production Planning Division.
Mr. A.Djunaedi	-	Staff of Production Planning Division.
Ir. Budi Wasisto	-	Staff of Coordination Planning Division.
Mr. Soewito	-	Staff of Cable Planning Division.
Mr. Nelson	-	Staff of Building Planning Division.
Mr. Muhammad Iljas	-	Staff of Data Analysis and Evaluation Division.

JICA STUDY TEAM

Akira AIKEI	-	Leader
Kazutomo OSAWA	-	Sub-Leader
Takashi SUZUKI	-	Survey Leader
Kazuo MORITA		

Kinya SUZUKI

Satoru KUSHIDA

Junichi KOMADA

Yoshihide HIRATA

Mikio DANNO

Katsuhiko KAKEI - Coordinator

JTM (Japan Telecommunications Mission)

Takao IWASHIMIZU - Leader of JTM

ANNEX-VI

TRAFFIC DISTRIBUTION TO SATELLITE/TERRESTRIAL SYSTEM

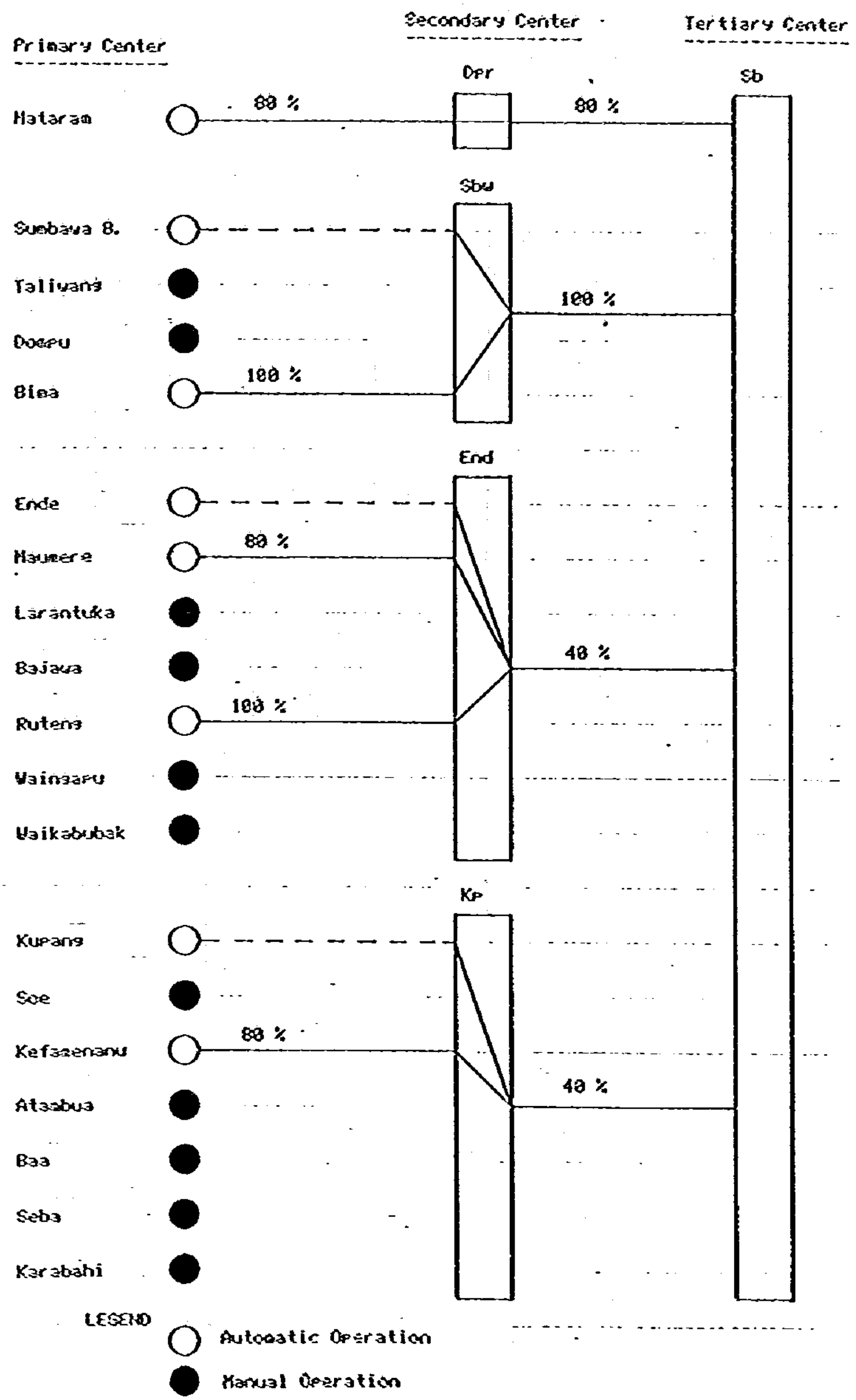
Trunk Exchanges in NTB and NTT

Area Code	Exchange Name	Existing Switching Sys. Auto	Existing Switching Sys. Man.	Existing SBS/SBK	Repelita IV Switching Sys. Auto	Repelita IV Switching Sys. Man.	Repelita IV SBS/SBK	Remarks
364	Mataram	○		SBS	○		SBS	
371	Sumbawa B.	○			○			
372	Taliwang		○			○		
373	Dompu		○			○	SBK	
374	Bima		○		○			
381	Ende		○	SBK	○		SBK	
382	Maumere		○	SBK	○		SBK	
383	Larantuka		○	SBK		○	SBK	
384	Bajawa					○		
385	Ruteng		○		○			
386	Waingapu		○	SBS		○	SBS	
387	Waikabubak		○	SBK		○	SBK	
391	Kupang	○		SBS	○		SBS	
392	Soe		○			○	SBK	
393	Kefamenanu		○		○		SBK	
394	Atambua		○	SBK		○	SBK	
395	Baa		○			○		
396	Seba					○	SBK*	
397	Kalabahi		○	SBK		○	SBK	

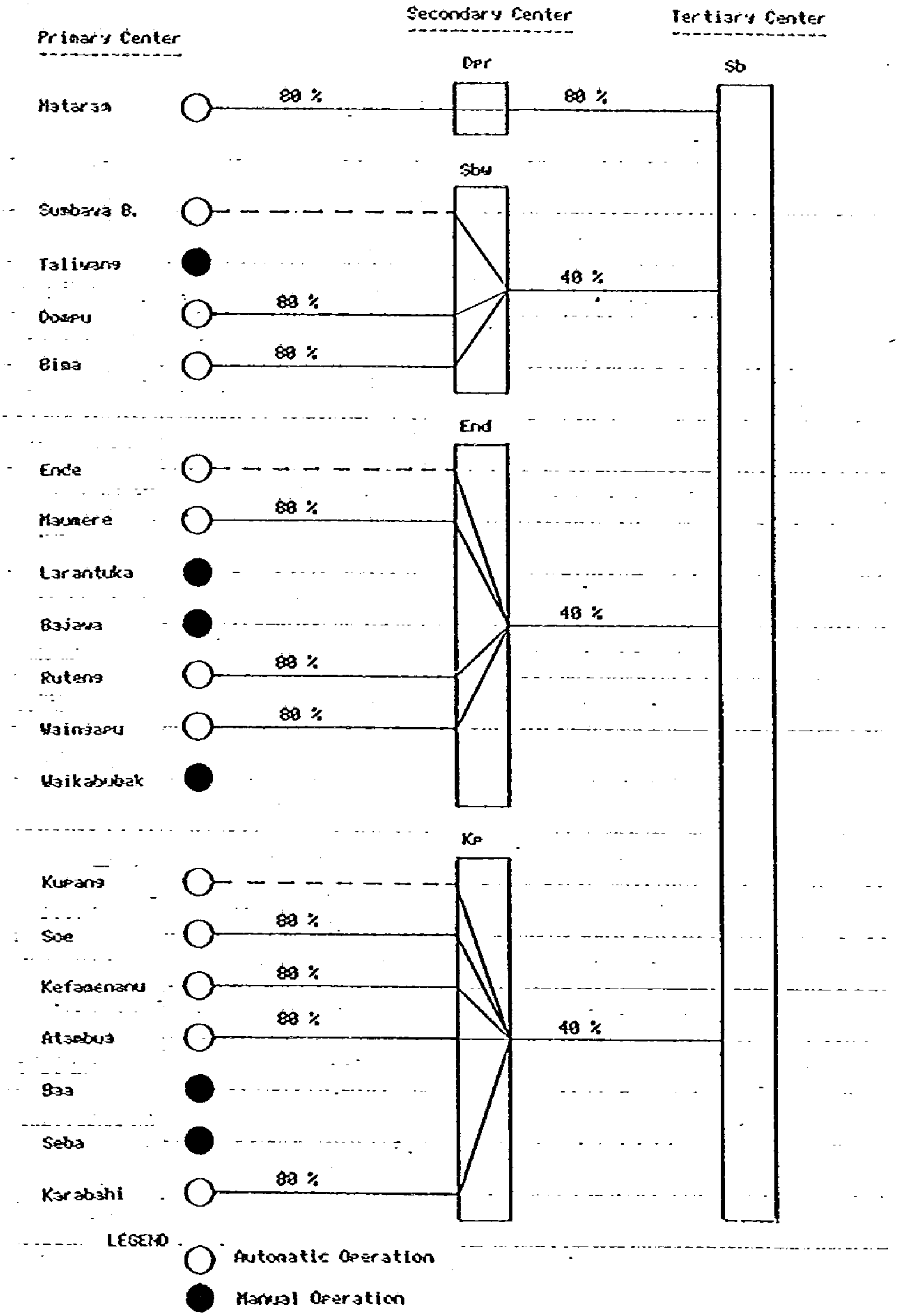
Traffic Distribution between Satellite Link and Terrestrial Link

Crow-flight Distance	Satellite	Terrestrial
less than 500 km	20 %	80 %
more than 500 km	60 %	40 %

Traffic Distribution to Terrestrial Links for SLDD Calls (Year: 1990)



Traffic Distribution to Terrestrial Links for SLDD Calls (Year: 1995)



Traffic Distribution to Terrestrial Links for SLDO Calls (Year: After 2000)