APPENDIX A: MEMBERS OF THE STUDY TEAM, SUMMARY OF ACTIVITIES AND THE LIST OF INTERVIEWED OFFICIALS

APPENDIX A.1 : Members of the Study Team

The Study Team consisted of the following members :

Name	Field	Affiliation
Yohji Baba	Hydrology and Civil Engineering	River Department Director, Public Works Research Institute, Ministry of Construction.
Yoshio Fukasawa	Telecommunications Technology	Deputy Director, Electricity and Telecommunication Section, Research and Information Division, Economic Affairs Bureau, Ministry of Construction.
Kanehiro Morishita	Hydraulics and Civil Engineering	CTI Engineering Co. Ltd.
Haruyuki Goto	System Design and Power Supply Investigation	Densetsu Engineering Co. Ltd.
Tsukasa Sato	Circuit Design and Radiowave Propagation Tests	Densetsu Engineering Co. Ltd.
Mikio Hatta	Circuit Design and Radiowave Propagation Tests	Densetsu Engineering Co. Ltd.

The Study Team was assisted by the following local consultants of Design Development Consultants Ltd.

A.K.M. Shamsuddin	Telecommunication Engineer
Md. Israil	Hydrologist
Gulam Mohammad	Structural Engineer
S.M. Khaled	Civil Engineer
Abdul Khaleque	Electrician

APPENDIX A.2 Summary of Activities

6.6.91 Thursday

The JICA team of experts associated with the Flood Forecasting & Warning Pilot Telemetry System arrived in Dhaka and made a courtesy call to Embassy of Japan and JICA office.

7.6.91 Friday

Held a meeting for confirming the site survey schedule.

8.6.91 Saturday

Held a meeting in the Office of the Chief Engineer (Hydrology) attended by representatives of EOJ, JICA, UNDP and BWDB officials. Held discussions on the Inception Report.

9.6.91 Sunday

Left Dhaka for Rajshahi.

10.6.91 Monday

Conducted site survey at Pankha.

11.6.91 Tuesday

Left Rajshahi for Rangpur.

12.6.91 Wednesday

Conducted site survey at Noonkawa.

13.6.91 Thursday

Left Rangpur for Dhaka.

14.6.91 Friday

Held a meeting with Director (SWH-2) and discussed about site survey results of Pankha and Noonkawa points.

15.6.91 Saturday

Left Dhaka for Sylhet.

16.6.91 Sunday

Conducted site survey at Amalshid.

17.6.91 Monday

Left Sylhet for Dhaka.

18.6.91 Tuesday

Made a courtesy call on Member (O&M), BTTB. Also held a meeting with BWDB officials to discuss the requirements of the study and next survey.

19.6.91 Wednesday

Made a courtesy call on Assistant Resident Representative of UNDP and discussed about the requirements of the project.

20.06.91 Thursday

Obtained permission from Bangladesh T&T Board to visit and have access to Carrier and Wireless equipment rooms, antenna towers etc. in Ramna (Dhaka), Mogh Bazar (Dhaka), Rajshahi, Nawabganj, Rangpur, Kurigram, Sylhet and Maulvi Bazar T&T Microwave stations for the following purposes :

a) Survey of Communications and other associated equipment presently in use at the above mentioned stations and collect the necessary information about the network, availability of spare channels, equipment specifications, tower, power supply conditions and availability of space for BWDB equipment.

b) Use T&T premises, towers and other facilities for temporarily placing the test equipment for conducting Radiowave Propagation Survey.

The permission was issued in the form of a Telex message addressed to JICA & BWDB, Dhaka.

Conducted site survey in Dhaka area at Tongi, Mirpur, Savar and Milbarrak.

21.06.91 Friday

Conducted site survey in Dhaka area at Narayanganj and Rikabi Bazar.

22.06.91 Saturday

Prepared the list of measurements and block diagrams of the measurement system at both master and field stations for the Radiowave Propagation Test. Also prepared a questionnaire for the collection of the required data from the T&T stations.

23.06.91- 24.06.91 Sunday and Monday

Inspected and tested the survey equipment and made the necessary adjustments.

25.06.91 Tuesday

A meeting of the Radiowave Propagation Survey team was held and the investigation items and how they would be conducted were thoroughly discussed among the team members. It was decided that the following tasks would be performed at the master and field stations.

Master Station

1. Measurement of the standard receiving input voltage level.

2. Measurement of the external noise field strength and recording it on chart recorder.

3. Measurement of signal to noise ratio (S/N).

4. Measurement of the interference from adjacent channels (1 MHz below and above the centre frequency).

5. Determination of the exact location of the master station using Global Positioning Satellite (GPS) Receiver.

6. Survey the Communications and associated equipment presently in use at the T&T Microwave stations. Collect the necessary information about the network and ascertain the availability of spare channels. Also collect the relevant equipment specifications.

7. Survey the tower, equipment room, power supply conditions and availability of space for BWDB equipment.

Field Station

1. Measurement of the standard receiving input voltage level.

2. Measurement of the external noise field strength and recording it on chart recorder.

3. Measurement of horizontal directivity pattern.

4. Measurement of antenna vertical pattern.

5. Measurement of signal to noise ratio (S/N).

6. Determination of the exact location of the field station using Global Positioning (GPS) Receiver.

7. Investigation of the site condition.

26.06.91 Wednesday

Radiowave Propagation survey team left Dhaka for Rajshahi. The other team members analyzed the collected site survey data, prepared the next survey schedule and made arrangement for it.

27.06.91 Thursday

Conducted Radiowave Propagation Test between Nawabganj and Pankha. Surveyed Nawabganj T&T Microwave station and Pankha site and collected all the necessary data.

The other team members analyzed the collected site survey data, prepared the next survey schedule and made arrangements for it.

28.06.91 Friday

Conducted Radiowave Propagation Test between Rajshahi and Pankha. Surveyed Rajshahi T&T Microwave station and collected all the necessary data.

29.06.91 Saturday

Radiowave Propagation Survey team left Rajshahi for Dhaka.

JICA expert Mr. Morishita handed over a letter describing the required hydrological data and assistance requested from BWDB for the conduction of site survey to Director (SWH-2) Mr. Alam Miah. They also discussed the survey schedule.

30.06.91 Sunday

Held a meeting with Director (SWH-2), Mr. Alam Miah. Mr. Miah handed over the previously requested hydrological data.

01.07.91 Monday

Analyzed the collected data, prepared the next survey schedule and made preparations for it.

02.07.91 Tuesday

Called on Director (International), Bangladesh T&T Board and discussed about the measurement of channel signal to noise ratio S/N of the spans which are to be leased from T&T.
Discussed with BWDB staff about site survey results and requested Mr. Miah to make arrangements for the supply of required hydrological data and topographical maps related to proposed gauge sites.

03.07.91 Wednesday

The Survey team left Dhaka for Sylhet. Inspected the existing Radio Telemetering Base station in Maulvi Bazar on the way.

Received topographical maps from BWDB.

04.07.91 Thursday

Conducted Radiowave Propagation Test between Sylhet and Amalshid. Surveyed Sylhet T&T Microwave station and collected all the necessary data.

Mr. Morishita carried out detailed site selection and river cross-section survey at Zakiganj point with the assistance of BWDB staff in Sylhet.

05.07.91 Friday

Mr. Morishita left Sylhet for Dhaka.

Radiowave Propagation Survey team conducted test between Beani Bazar and Amalshid. Surveyed Beani Bazar T&T station and collected all the necessary data.

06.07.91 Saturday

Left Sylhet for Maulvi Bazar. Tested the existing Radio Telemetering station at Maulvi Bazar.

Conducted Radiowave Propagation Test between Maulvi Bazar and Shaestaganj. Surveyed Maulvi Bazar T&T Microwave station and collected all the necessary data.

Lef: Maulvi Bazar for Dhaka.

07.07.91 Sunday

Discussed site survey results, site selection and required structural arrangement with BWDB staff Mr. Ghose and Mr. Nizam.

Analysed the results of the Radiowave Propagation Tests and other data collected during the survey.

08.07.91 Monday

Discussed with Mr. Miah, Director (SWH-2) about the meeting schedule on the following day and handed over the "Report on Site Survey Results and Proposed Gauge Sites and Telecommunication Network". Delivered the same also to Mr. Dent and BWDB staff for the following days meeting.

Continued the analysis of the results of the Radiowave Propagation Tests and other data collected during the survey.

09.07.91 Tuesday

Held a meeting in the office of the Director (SWH-2) Mr. Alam Miah to review the report on Site Survey Results of Proposed Gauge Sites and Telecommunication Network. Recommendations were noted down for taking into consideration while designing the system.

Continued the analysis of the results of the Radiowave Propagation Tests and other data collected during the survey.

10.07.91 Wednesday

Continued the analysis of the results of the Radiowave Propagation Tests and other data collected during the survey.

11.07.91 THURSDAY

The Radio Communications Team continued with the analysis of the Radiowave Propagation Tests and other data collected so far during the survey.

Mr. Morishita discussed with BWDB officials about site survey schedule and preparations to be taken for surveying Jatrapur site.

12.07.91 FRIDAY

Holiday.

13.07.91 SATURDAY

The Radio Communications Team continued with the analysis of the Radiowave Propagation Tests and other data collected so far during the survey.

Mr. Morishita continued with the design of structural arrangement for the gauging stations.

14.07.91 SUNDAY

The JICA Team left Dhaka for Rangpur.

15.07.91 MONDAY

The Radio Communications Team conducted Radiowave Propagation Test between Rangpur and Jatrapur. They also surveyed Rangpur T&T Microwave station and collected all the necessary data.

Mr. Morishita carried out detailed site selection and river cross-section survey at Jatrapur point with the assistance of BWDB staff.

16.07.91 TUESDAY

The Radio Communication Team Conducted Radiowave Propagation Test between Rangpur and Jatrapur. They also surveyed Rangpur T&T Microwave station and collected all the necessary data.

Mr. Morishita left Rangpur for Dhaka.

17.07.91 WEDNESDAY

The Radio Communications Team left Rangpur for Dhaka.

Mr. Morishita discussed with BWDB officials about the result of site survey of Jatrapur point.

18.07.91 THURSDAY

The Radio Communications Team continued with the analysis of the Radiowave Propagation Tests and other data collected so far during the survey.

Mr. Morishita continued with the analysis of hydrological data and the design of structural arrangement for the gauging stations.

19.07.91 FRIDAY

Holiday.

20.07.91 SATURDAY

The Radio Communications Team continued with the analysis of the Radiowave Propagations Tests and other data collected so far during the survey.

Mr. Morishita discussed with the Director (SWH-2), BWDB about site survey of Dhaka area.

21.07.91 SUNDAY

Continued with the analysis of the results of the Radiowave Propagation Tests and other data collected during the survey.

Held a meeting with the Chief Engineer (Hydrology). Mr. Goto gave a report on the progress of work done to date.

22.08.91 MONDAY

The Radio Communications Team conducted Radiowave Propagation Tests between Moghbazar T&T station-Savar and Mirpur sites. The Team also surveyed Moghbazar T&T Microwave station and collected the necessary data.

Mr. Morishita conducted detailed site survey at Nayarhat and Mirpur points.

23.07.91 TUESDAY

The Radio Communications Team conducted Radiowave Propagation Tests between Moghbazar-Narayanganj, Milbarrak and Rikabi Bazar sites. Also conducted measurement of interference from adjacent channels on the allocated frequency.

Mr. Morishita conducted detailed site survey at Milbarrak, Narayanganj & Rikabi Bazar points.

24.07.91 WEDNESDAY

The Radio Communications Team conducted Radiowave Propagation Test between Moghbazar T&T station and Tongi site. Also repeated the Radiowave Propagation Tests between Moghbazar-Narayanganj and Milbarrak sites with the antenna installed at 60m height.

Mr. Morishita conducted detailed site survey at Tongi point.

25.07.91 THURSDAY

The Radio Communications Team Conducted Radiowave Propagation Tests between Moghbazar T&T station-Nayarhat and Mirpur sites.

Mr. Morishita discussed with BWDB officials about the result of site survey.

26.07.91 FRIDAY

Holiday.

27.07.91 SATURDAY

The Radio Communications Team conducted mirror tests between Moghbazar-BWDB, BWDB-Ramna and Moghbazar-Ramna antenna towers.

Mr. Morishita discussed with Director (SWH-2), BWDB and Chief Technical Adviser FF&WC about Zakiganj, Nayarhat and Mirpur sites.

28.07.91 SUNDAY

The Radio Communications Team conducted survey of Ramna T&T Carrier and Microwave equipment and collected all the necessary data.

Mr. Morishita continued with the design of structural arrangement for the gauging stations.

29.07.91 MONDAY

The Radio Communications Team conducted survey of Ramna T&T station.

Mr. Morishita continued with the design of structural arrangement for the gauging stations.

30.07.91 TUESDAY

The Radio Communications Team conducted Radiowave Propagation Test between WAPDA building and Nayarhat. The received signal strength was extremely low and the interference from adjacent channels was very high. Left WAPDA building and conducted Radiowave Propagation Test between Ramna and Tongi.

Mr. Morishita started to design the components of gauging stations.

31.07.91 WEDNESDAY

The Radio Communications Team conducted Radiowave Propagation Test between Ramna-Nayarhat, Mirpur, Narayanganj & Rikabi Bazar sites.

Mr. Morishita discussed with Director (SWH-2),BWDB about the remaining issues concerning the design of structures for the gauging stations.

01.08.91 THURSDAY

The Radio Communications Team conducted Radiowave Propagation Test between Ramna T&T station and Milbarrak. Also measured radio frequency interference on the allocated frequency from adjacent channels.

Mr. Morishita conducted detailed site survey at Nayarhat site with Director (SWH-2), BWDB.

02.08.91 FRIDAY

Holiday.

03.08.91 SATURDAY

The Radio Communications Team conducted analysis of the results of the Radiowave Propagation Tests and other data collected during survey. Also commenced work on the detailed design of the Pilot Telemetry System.

Mr. Morishita conducted detailed site survey at Mirpur site.

04.08.91 SUNDAY

The Radio Communications Team continued with the detailed design of the Pilot Telemetry System.

Mr. Morishita discussed with Director (SWH-2), BWDB about the result of survey at Mirpur site.

Mr.Morishita started work on designing the gauging station structures.

05.08.91 MONDAY

The Radio Communications Team continued with the detailed design of the Pilot Telemetry System. Also visited Director (International), BTTB and followed up the request made previously by the JICA team for various information about the T&T network.

Mr.Morishita continued with the design of gauging station structures.

06.08.91 TUESDAY

The Radio Communications Team continued with the detailed design of the Pilot Telemetry System. Also visited Director (Transmission-II), BTTB at Mohakhali, Dhaka and discussed about the various options possible for establishing a Multiplex network between Mogh Bazar Terminal and FF&WC at WAPDA building. Also discussed about the measurement of Signal to Noise ratio. Visited DE (Upazila Project) in the same compound and discussed about the connection conditions of the NOKIA System.

Mr.Morishita continued with the design of gauging station structures.

07.08.91 WEDNESDAY

The Radio Communications Team continued with the design of the Pilot Telemetry System. Also visited Director (Telecom-II), DTR at Ramna T&T Building and received information about leasing fee of T&T circuits from his office. Also visited DE (MW Mtce-II) at Mogh Bazar T&T building and discussed about the measurement of S/N.

Mr.Morishita continued with the design of gauging station structures.

08.08.91 THURSDAY

The JICA Team continued with the detailed design of the Pilot Telemetry System.

09.08.91 FRIDAY

Holiday

10.08.91 SATURDAY

The JICA Team continued with the detailed design of the Pilot Telemetry System.

Held a meeting with the Chief Engineer (Hydrology) and discussed the overall progress of the work done todate.

11.8.91 Sunday

The study team commenced work on the preparation of Draft Final Report.

12.8.91 Monday

The study team continued with the preparation of Draft Final Report.

Attended a meeting held in the office of the Secretary, Ministry of Irrigation, Flood Control and Water Resources. The meeting was also attended among other by representatives of UNDP, BWDB & Planning Commission.

13.8.91 Tuesday

The study team continued with the preparation of Draft Final Report.

14.8.91 Wednesday

The study team continued with the preparation of Draft Final Report.

Also held a meeting with Director (SWH-2).

15.8.91 Thursday

The study team continued with the preparation of Draft Final Report.

16.8.91 Friday

The study team continued with the preparation of Draft Final Report.

17.8.91 Saturday

The study team continued with preparation of Draft Final Report. Also commenced work on the preparation of Draft Tender Documents.

18.8.91 Sunday

The study team attended a meeting with Chief Engineer (Hydrology) and Director (SWH-2) and discussed about the preparation of Final Report and Tender Documents.

19.8.91 Monday

The study team continued with the preparation of Draft Final Report and Tender Documents.

20.8.91 Tuesday

The study team continued with the preparation of Draft Final Report and Tender Documents.

21.8.91 Wednesday

The study team continued with the preparation of Draft Final Report and Tender Documents.

22.8.91 Thursday

The study team continued with the preparation of Draft Final Report and Tender Documents. Representative of the Ministry of Construction, Japan arrived in Dhaka.

23.8.91 Friday

The study team continued with the preparation of Draft Final Report and Tender Documents.

24.8.91 Saturday

The study team attended a meeting in the office of the Chief Engineer (Hydrology). The meeting was attended among others by representatives of JICA, BWDB and BTTB. Japanese Government representative submitted the Draft Design Report.

Elaborated discussions were held on the Report and recommendations were made for finalizing it.

25.8.91 Sunday

The study team commenced work on ammending the Draft Final Report in the light of recommendations made by BWDB. Also continued with the preparation of Draft Tender Documents.

26.8.91 Monday

The study team continued with ammending the Draft Final Report. Also continued with the preparation of Draft Tender Documents.

27.8.91 Tuesday

The study team submitted the Final Report and Draft Tender Documents to the Chief Engineer (Hydrology) for reviewing.

28.8.91 Wednesday

The Study Team reviewed the two documents for finding out discrepancies,if any.

29.8.91 Thursday

The Study Team attended a meeting in BWDB Conference Room to finalize the Draft Final Design Report and Draft Tender Documents. The meeting,presided over by Member(Planning),BWDB,was attended by BWDB officials, JICA representative, and the Study Team. The Draft Final Report was finalized. Elaborate discussions were held on the Draft Tender Documents and recommendations for amendments were made.

30.8.91 Friday

The Study Team held a meeting with Chief Technical Adviser FFWC Mr. J.E.Dent and discussed the data processing functions of the system and the proposed factory training schedule.

31.8.91 Saturday

The Study Team attended a meeting in the Office of The Chief Engineer(Hydrology). The meeting was also attended by BWDB officials & Chief Technical Adviser /FFWC. Elaborate discussions were held on the Draft Tender Documents and recommendations for amendments were made.

01.9.91 Sunday

The Study Team made all the amendments to the Draft Tender Documents as recommended in the previous meetings.

02.9.91 Monday

The Study Team made preparations for departure.

03.9.91 Tuesday

The Study Team left for Tokyo via Bangkok.

APPENDIX A.3 : List of Interviewed Offocials

Name	Organization	Designation
Syed Anwar Yusuf	BWDB	Chief Engineer, Hydrology
Md. Alam Miah	BWDB	Director, Surface Water Hydrology -2 and Project Director
Md. Musharraf Hossain	BWDB	Executive Engineer, C&I Division
Hiron C. Ghose	BWDB	Sub Divisional Engineer, Instrumentation Sub Division -1
A.K. Nizam Uddin Ahmed	BWDB	Sub Divisional Engineer, Instrumentation Sub Division -2
Khondakar A. Hafiz	UNDP	Assistant Resident Representative
James E. Dent	UNDP	Chief Technical Adviser, FF&WC
A.R. Saber	BTTB	Member, Operation & Mtce.
Md. Fazlur Rahman	BTTB	Director, International
Md. Amanat Ullah	BTTB	Director, Transmission -2
Md. Mannan Miah	BTTB	Director, Telecom -2
Md. Obaidullah	BTTB	Divisional Engineer, Upazila Project
Ashok K. Mandal	BTTB	Divisional Engineer, C&W Maintenance
Md. Shamsul Alam	BTTB	Divisional Engineer, Carrier & Wireless
Abdul Majed Sarker	BTTB	Divisional Engineer, Microwave Mtce. -1

Name	Organization	Designation
Md. Mahfuzuddin	BTTB	Divisional Engineer, Microwave Mtce. -2

APPENDIX B: MINUTES OF MEETINGS

JAPAN INTERNATIONAL COOPERATION AGENCY
THE SURVEY OF DETAILED PLAN FOR F.F.W. PILOT SYSTEM

Date : 02-07-1991

To

The Chief Engineer,
Hydrology BWDB, Dhaka

Sub : Aide-Memoire

Dear Sir,

We have the pleasure to submit herewith the above Aid-memoire, for favour of your information and kind necessary action.

Very truely yours

Haruyuki Goto 2-7-1991

(HARUYUKI GOTO)
JICA EXPERT

C.C. TO :

(1) Mr. HITOSHI BABA
First Secretary, Embassy of JAPAN, Dhaka, Bangladesh

(2) MR. KOZO YAMAKAWA
Technical Adviser, JICA

(3) Mr. J.E. DENT
Chief Technical Adviser / FF & WC. WAPDA Building, 8th Floor
Motijheel, Dhaka-1000

(4) The Director,
Surface Water Hydrology-2
BWDB, Dhaka

(5) JICA Expert's File

AIDE - MEMOIRE

June 6, 1991

JICA experts associated with the project "Flood Forecasting and Warning Telemetering Pilot System in Bangladesh" arrived in Bangladesh and made a courtesy call to the Embassy of Japan and JICA office.

June 7

JICA experts held a meeting for confirming the site survey schedule.

June 8

A meeting for discussion on the Inception report on Flood Forecasting and Warning Telemetering Pilot System in Bangladesh was held in the office of the Chief Engineer, Hydrology, BWDB at 3 p.m. The meeting was presided over by the Chief Engineer, Hydrology. The representatives from EOJ, JICA, BWDB, UNDP, T & T , Japanese experts and local consultants of DDC Limited , attended the meeting. The Japanese team of experts and the other officials were introduced to the Chief Engineer who welcomed all the participants.

A resume of discussion that took place is given below :

The Chief Engineer, Hydrology, BWDB opened the discussion. He pointed out that as per standing norms of GOB, the engagement of local consultants for any foreign assisted T.A. project is required to be cleared by the ERD. As no such approval was sought by JICA for this project, BWDB informed all concerned about this anomaly.

The EOJ representative informed that it is a Common and accepted practice in the Japanese assisted projects to appoint local Consultants.

JICA explained that as per understanding with GOB (chapter : 6 of Inception report), for conducting the field survey timely, smoothly and efficiently. BWDB was requested to cooperate with the survey team in deputing technical personnel as follows :

- Telecommunication Engineer - 3 Nos
- Hydrological Engineer - 2 "
- Electrical Technician - 4 "

As BWDB was not in a position to provide with the above personnel on full-time basis for the entire duration of the project., JICA took the decision of appointing local consultants in order to provide the required personnel and other services in the interest

of conducting the field survey smoothly and efficiently. All the related expenses are also to be borne by JICA.

BWDB, though not in a position to provide the above mentioned personnel on full-time basis, however, assured the co-operation of their Engineers and others related personnel for the whole duration of the project and especially during the gauging site selection and radio wave propagation test.

BWDB was not in a position to assign vehicles which were necessary for field survey and expressed their inability to provide office space as required for the study, however they agreed to arrange a room in the 9th floor of WAPDA Building. BWDB also assured supply of 1/50,000 scale Topographical map of the concerned area for circuit design, other maps of scale : 1/5000 for preparation of area diagrams and multiplex radio circuit survey, were found to be not available.

The JICA was also assured by BWDB full-cooperation in respect of supplying all other information as required during the survey.

June 9 to 13

The JICA team of experts executed site survey at Pankha and Noonkhawa points, which were proposed as new Construction site of telemetering stations in the UNDP report. On this site survey BWDB Counterparts, Mr Hiron Ghose, Assistant Engineer (Electrical), Mr. Moyezuddin Ahmed, Sectional Officer, and Mr. Shamsul Haque, Sectional Officer accompanied the team of experts.

June 14

The JICA experts held a meeting with the Director, surface water, Hydrology-2 and discussed about site survey results of Pankha and Noonkhawa points.

June 15 to 17

The JICA experts executed site survey of Amalshid point which was also proposed in the UNDP report. On this site survey BWDB Counter parts, Mr. Mosharraf Hossain, Executive Engineer, Construction & Instrumentation Division and Mr. Saifur Rahman , Sub-Divisional Engineer, Hydrology accompanied the experts.

June 18

The Experts made a Courtesy call to concerned T & T Board officials and discussed in respect of permission for using T & T towers.

A meeting was also held with BWDB and JICA members to discuss mainly about the requirement for future survey and study work.

June 19

The JICA experts made a Courtesy call to UNDP office and held discussion with Mr. Khondker A. Hafiz about the study work. As the pre-arranged schedule of survey was completed during the period from June 6 to 19, 1991, the Govt. staff members of Japan left Dhaka for Japan.

A List of Attendance at the meetings held on June 8 and June 18 is given below :

Name		Date of the Meeting	
		June 8	June 18
Syed Anwar Yousuf	BWDB	Present	Present
Md. Alam Miah	do	do	do
Mosharraf Hossain	do	do	do
Hiron Ghose	do	do	do
J. E. Dent	UNDP	Present	Present
Hitoshi Baba	EOJ	Present	~~Present~~
Haruo Naito	JICA	Present	Present
Kozo Yamakawa	do	do	do
Youji Baba	JICA EXPERT	Present	Present
Yoshio Fukazawa	do	do	do
Haruyuki Goto	do	do	do
Kanehiro Morishita	do	do	do
Mikio Hatta	do	do	do
Tsukasa Sato	do	do	do
A representative from	T & T	do	do

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND
WARNING TELEMETERING PILOT SYSTEM

Date : 13.07.1991

To
The Chief Engineer (Hydrology)
Bangladesh Water Development Board
Ispahani Building
Motijheel C/A
Dhaka

Sub : *Summary of Activities of the Survey & Design Team*

Dear Sir,

Enclosed please find herewith a summary of activities of the Survey and Design Team for the Flood Forecasting and Warning Telemetering Pilot System for the period of June 20, 1991 to July 10, 1991.

With best regards.

Yours sincerely,

Haruyuki Goto
13.07.1991
(HARUYUKI GOTO)
JICA Expert

cc to :

1. Mr. Hitoshi Baba
   First Secretary, Embassy of Japan, Dhaka, Bangladesh.
2. Mr. Kozo Yamakawa
   Technical Adviser, JICA
3. Mr. J.E. Dent
   Chief Technical Adviser/FF&WC, WAPDA Building, 8th floor, Dhaka.
4. The Director (SWH-2)
   BWDB, Green Road, Dhaka.
5. JICA Expert's file.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING TELEMETERING PILOT SYSTEM

SUMMARY OF ACTIVITIES OF THE JICA TEAM OF EXPERTS FOR THE PERIOD OF JUNE 20, 1991 - JULY 10, 1991

20.06.91 **Thursday**

Obtained permission from Bangladesh T&T Board to visit and have access to Carrier and Wireless equipment rooms, antenna towers etc. in Ramna (Dhaka), Mogh Bazar (Dhaka), Rajshahi, Nawabganj, Rangpur, Kurigram, Sylhet and Maulvi Bazar T&T Microwave stations for the following purposes :

a) Survey of Communications and other associated equipment presently in use at the above mentioned stations and collect the necessary information about the network, availability of spare channels, equipment specifications, tower, power supply conditions and availability of space for BWDB equipment.

b) Use T&T premises, towers and other facilities for temporarily placing the test equipment for conducting Radiowave Propagation Survey.

The permission was issued in the form of a Telex message addressed to JICA & BWDB, Dhaka.

Conducted site survey in Dhaka area at Tongi, Mirpur, Savar and Milbarrak.

21.06.91 **Friday**

Conducted site survey in Dhaka area at Narayanganj and Rikabi Bazar.

22.06.91 **Saturday**

Prepared the list of measurements and block diagrams of the measurement system at both master and field stations for the Radiowave Propagation Test. Also prepared a questionnaire for the collection of the required data from the T&T stations.

23.06.91- **Sunday and Monday**
24.06.91

Inspected and tested the survey equipment and made the necessary adjustments.

5. Measurement of signal to noise ratio (S/N).

6. Determination of the exact location of the field station using Global Positioning (GPS) Receiver.

7. Investigation of the site condition.

26.06.91 Wednesday

Radiowave Propagation survey team left Dhaka for Rajshahi. The other team members analyzed the collected site survey data, prepared the next survey schedule and made arrangement for it.

27.06.91 Thursday

Conducted Radiowave Propagation Test between Nawabganj and Pankha. Surveyed Nawabganj T&T Microwave station and Pankha site and collected all the necessary data.

The other team members analyzed the collected site survey data, prepared the next survey schedule and made arrangements for it.

28.06.91 Friday

Conducted Radiowave Propagation Test between Rajshahi and Pankha. Surveyed Rajshahi T&T Microwave station and collected all the necessary data.

29.06.91 Saturday

Radiowave Propagation Survey team left Rajshahi for Dhaka.

JICA expert Mr. Morishita handed over a letter describing the required hydrological data and assistance requested from BWDB for the conduction of site survey to Director (SWH-2) Mr. Alam Miah. They also discussed the survey schedule.

30.06.91 Sunday

Held a meeting with Director (SWH-2), Mr. Alam Miah. Mr. Miah handed over the previously requested hydrological data.

01.07.91 Monday

Analyzed the collected data, prepared the next survey schedule and made preparations for it.

02.07.91 Tuesday

Called on Director (International), Bangladesh T&T Board and discussed about the measurement of channel signal to noise ratio S/N of the spans which are to be leased from T&T.
Discussed with BWDB staff about site survey results and requested Mr. Miah to make arrangements for the supply of required hydrological data and topographical maps related to proposed gauge sites.

03.07.91 Wednesday

The Survey team left Dhaka for Sylhet. Inspected the existing Radio Telemetering Base station in Maulvi Bazar on the way.

Received topographical maps from BWDB.

04.07.91 Thursday

Conducted Radiowave Propagation Test between Sylhet and Amalshid. Surveyed Sylhet T&T Microwave station and collected all the necessary data.

Mr. Morishita carried out detailed site selection and river cross-section survey at Zakiganj point with the assistance of BWDB staff in Sylhet.

05.07.91 Friday

Mr. Morishita left Sylhet for Dhaka.

Radiowave Propagation Survey team conducted test between Beani Bazar and Amalshid. Surveyed Beani Bazar T&T station and collected all the necessary data.

06.07.91 Saturday

Left Sylhet for Maulvi Bazar. Tested the existing Radio Telemetering station at Maulvi Bazar.

Conducted Radiowave Propagation Test between Maulvi Bazar and Shaestaganj. Surveyed Maulvi Bazar T&T Microwave station and collected all the necessary data.

Left Maulvi Bazar for Dhaka.

07.07.91 Sunday

Discussed site survey results, site selection and required structural arrangement with BWDB staff Mr. Ghose and Mr. Nizam.

Analysed the results of the Radiowave Propagation Tests and other data collected during the survey.

08.07.91 Monday

Discussed with Mr. Miah, Director (SWH-2) about the meeting schedule on the following day and handed over the "Report on Site Survey Results and Proposed Gauge Sites and Telecommunication Network". Delivered the same also to Mr. Dent and BWDB staff for the following days meeting.

Continued the analysis of the results of the Radiowave Propagation Tests and other data collected during the survey.

09.07.91 Tuesday

Held a meeting in the office of the Director (SWH-2) Mr. Alam Miah to review the report on Site Survey Results of Proposed Gauge Sites and Telecommunication Network. Recommendations were noted down for taking into consideration while designing the system.

Continued the analysis of the results of the Radiowave Propagation Tests and other data collected during the survey.

10.07.91 Wednesday

Continued the analysis of the results of the Radiowave Propagation Tests and other data collected during the survey.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND
WARNING PILOT TELEMETRY SYSTEM

Date : 14.08.1991

To
The Chief Engineer (Hydrology)
Bangladesh Water Development Board
Ispahani Building
Motijheel C/A
Dhaka

Sub : *Summary of Activities of the Survey & Design Team*

Dear Sir,

Enclosed please find herewith a summary of activities of the Survey & Design Team for the Flood Forecasting and Warning Pilot Telemetry System for the period of July 11, 1991 to August 10, 1991.

With best regards.

Yours sincerely,

Haruyuki Goto
14/8/91

(HARUYUKI GOTO)
JICA EXPERT

cc to :

1. Mr. Hitoshi Baba
   First Secretary, Embassy of Japan, Dhaka, Bangladesh.
2. Mr. Kozo Yamakawa
   Technical Adviser, JICA, Dhaka.
3. Mr. J.E. Dent
   Chief Technical Adviser/FF&WC, WAPDA Bldg., 8th Floor, Motijheel C/A, Dhaka.
4. Director (SWH-2),
   BWDB, Green Road, Dhaka.
5. JICA Expert's File.

SUMMARY OF ACTIVITIES

11.07.91 THURSDAY

The Radio Communications Team continued with the analysis of the Radiowave Propagation Tests and other data collected so far during the survey.

Mr. Morishita discussed with BWDB officials about site survey schedule and preparations to be taken for surveying Jatrapur site.

12.07.91 FRIDAY

Holiday.

13.07.91 SATURDAY

The Radio Communications Team continued with the analysis of the Radiowave Propagation Tests and other data collected so far during the survey.

Mr. Morishita continued with the design of structural arrangement for the gauging stations.

14.07.91 SUNDAY

The JICA Team left Dhaka for Rangpur.

15.07.91 MONDAY

The Radio Communications Team conducted Radiowave Propagation Test between Rangpur and Jatrapur. They also surveyed Rangpur T&T Microwave station and collected all the necessary data.

Mr. Morishita carried out detailed site selection and river cross-section survey at Jatrapur point with the assistance of BWDB staff.

16.07.91 TUESDAY

The Radio Communication Team Conducted Radiowave Propagation Test between Rangpur and Jatrapur. They also surveyed Rangpur T&T Microwave station and collected all the necessary data.

Mr. Morishita left Rangpur for Dhaka.

17.07.91 WEDNESDAY

The Radio Communications Team left Rangpur for Dhaka.

Mr. Morishita discussed with BWDB officials about the result of site survey of Jatrapur point.

18.07.91 THURSDAY

The Radio Communications Team continued with the analysis of the Radiowave Propagation Tests and other data collected so far during the survey.

Mr. Morishita continued with the analysis of hydrological data and the design of structural arrangement for the gauging stations.

19.07.91 FRIDAY

Holiday.

20.07.91 SATURDAY

The Radio Communications Team continued with the analysis of the Radiowave Propagations Tests and other data collected so far during the survey.

Mr. Morishita discussed with the Director (SWH-2), BWDB about site survey of Dhaka area.

21.07.91 SUNDAY

Continued with the analysis of the results of the Radiowave Propagation Tests and other data collected during the survey.

Held a meeting with the Chief Engineer (Hydrology). Mr. Goto gave a report on the progress of work done to date.

22.08.91 MONDAY

The Radio Communications Team conducted Radiowave Propagation Tests between Moghbazar T&T station-Savar and Mirpur sites. The Team also surveyed Moghbazar T&T Microwave station and collected the necessary data.

Mr. Morishita conducted detailed site survey at Nayarhat and Mirpur points.

23.07.91 TUESDAY

The Radio Communications Team conducted Radiowave Propagation Tests between Moghbazar-Narayanganj, Milbarrak and Rikabi Bazar sites. Also conducted measurement of interference from adjacent channels on the allocated frequency.

Mr. Morishita conducted detailed site survey at Milbarrak, Narayanganj & Rikabi Bazar points.

24.07.91 WEDNESDAY

The Radio Communications Team conducted Radiowave Propagation Test between Moghbazar T&T station and Tongi site. Also repeated the Radiowave Propagation Tests between Moghbazar-Narayanganj and Milbarrak sites with the antenna installed at 60m height.

Mr. Morishita conducted detailed site survey at Tongi point.

25.07.91 THURSDAY

The Radio Communications Team Conducted Radiowave Propagation Tests between Moghbazar T&T station-Nayarhat and Mirpur sites.

Mr. Morishita discussed with BWDB officials about the result of site survey.

26.07.91 FRIDAY

Holiday.

27.07.91 SATURDAY

The Radio Communications Team conducted mirror tests between Moghbazar-BWDB, BWDB-Ramna and Moghbazar-Ramna antenna towers.

Mr. Morishita discussed with Director (SWH-2), BWDB and Chief Technical Adviser FF&WC about Zakiganj, Nayarhat and Mirpur sites.

28.07.91 SUNDAY

The Radio Communications Team conducted survey of Ramna T&T Carrier and Microwave equipment and collected all the necessary data.

Mr. Morishita continued with the design of structural arrangement for the gauging stations.

29.07.91 MONDAY

The Radio Communications Team conducted survey of Ramna T&T station.

Mr. Morishita continued with the design of structural arrangement for the gauging stations.

30.07.91 TUESDAY

The Radio Communications Team conducted Radiowave Propagation Test between WAPDA building and Nayarhat. The received signal strength was extremely low and the interference from adjacent channels was very high. Left WAPDA building and conducted Radiowave Propagation Test between Ramna and Tongi.

Mr. Morishita started to design the components of gauging stations.

31.07.91 WEDNESDAY

The Radio Communications Team conducted Radiowave Propagation Test between Ramna-Nayarhat, Mirpur, Narayanganj & Rikabi Bazar sites.

Mr. Morishita discussed with Director (SWH-2),BWDB about the remaining issues concerning the design of structures for the gauging stations.

01.08.91 THURSDAY

The Radio Communications Team conducted Radiowave Propagation Test between Ramna T&T station and Milbarrak. Also measured radio frequency interference on the allocated frequency from adjacent channels.

Mr. Morishita conducted detailed site survey at Nayarhat site with Director (SWH-2), BWDB.

02.08.91 FRIDAY

Holiday.

03.08.91 SATURDAY

The Radio Communications Team conducted analysis of the results of the Radiowave Propagation Tests and other data collected during survey. Also commenced work on the detailed design of the Pilot Telemetry System.

Mr. Morishita conducted detailed site survey at Mirpur site.

04.08.91 SUNDAY

The Radio Communications Team continued with the detailed design of the Pilot Telemetry System.

Mr. Morishita discussed with Director (SWH-2), BWDB about the result of survey at Mirpur site.

Mr.Morishita started work on designing the gauging station structures.

05.08.91 MONDAY

The Radio Communications Team continued with the detailed design of the Pilot Telemetry System. Also visited Director (International), BTTB and followed up the request made previously by the JICA team for various information about the T&T network.

Mr.Morishita continued with the design of gauging station structures.

06.08.91 TUESDAY

The Radio Communications Team continued with the detailed design of the Pilot Telemetry System. Also visited Director (Transmission-II), BTTB at Mohakhali, Dhaka and discussed about the various options possible for establishing a Multiplex network between Mogh Bazar Terminal and FF&WC at WAPDA building. Also discussed about the measurement of Signal to Noise ratio. Visited DE (Upazila Project) in the same compound and discussed about the connection conditions of the NOKIA System.

Mr.Morishita continued with the design of gauging station structures.

07.08.91 WEDNESDAY

The Radio Communications Team continued with the design of the Pilot Telemetry System. Also visited Director (Telecom-II), DTR at Ramna T&T Building and received information about leasing fee of T&T circuits from his office. Also visited DE (MW Mtce-II) at Mogh Bazar T&T building and discussed about the measurement of S/N.

Mr.Morishita continued with the design of gauging station structures.

08.08.91 THURSDAY

The JICA Team continued with the detailed design of the Pilot Telemetry System.

09.08.91 FRIDAY

Holiday

10.08.91 SATURDAY

The JICA Team continued with the detailed design of the Pilot Telemetry System.

Held a meeting with the Chief Engineer (Hydrology) and discussed the overall progress of the work done todate.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND
WARNING TELEMETERING PILOT SYSTEM

Date : 13.07.1991

To
The Chief Engineer (Hydrology)
Bangladesh Water Development Board
Ispahani Building
Motijheel C/A
Dhaka

Sub : *Report on Site Survey Results of Proposed Gauge Sites and Telecommunication Network : Resume of Review Meeting*

Dear Sir,

Enclosed please find herewith a resume of the discussion that took place in a meeting held in the Office of the Director (Surface Water Hydrology - 2), BWDB on July 9,1991 to review the above mentioned report presented by JICA expert Mr. Kanehiro Morishita.

With best regards,

Yours sincerely,

Haruyuki Goto
13/07/191

(HARUYUKI GOTO)
JICA Expert

c.c. to :

1. Mr. Hitoshi Baba
   First Secretary, Embassy of Japan, Dhaka, Bangladesh.
2. Mr. Kozo Yamakawa
   Technical Adviser, JICA, Dhaka
3. Mr. J.E.Dent
   Chief Technical Adviser/FF & WC,WAPDA, WAPDA Building, 8th floor, Dhaka.
4. The Director (SWH - 2)
   BWDB, Green Road, Dhaka.
5. JICA Expert's file.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING TELEMETERING PILOT SYSTEM

A meeting was held in the office of the Director (SWH-2), BWDB on July 9, 1991 at 10:00 for reviewing the Report on Site Survey Results of Proposed Gauge Sites and Telecommunication Network Prepared by JICA expert Mr. Kanehiro Morishita. The meeting was Presided over by the Director (SWH-2), Mr. Alam Miah and attended by BWDB officials, Chief Technical Adviser/FFWC Mr. J.E.Dent, JICA team of experts and consultants from DDC Ltd.

A resume of the discussion that took place is given below.

Director (SWH-2) Mr. Miah opened the discussion with the opinion that Pankha site should be visited again and a detailed sketch of the effluent point of the Pagla from the Ganges should be made. The site selection should be such that there is water connection present at all time of the year. Mr. Dent suggested that a sketch map of all the sites should be made. This was accepted by the JICA team.

Director (SWH-2) Mr. Miah made clear that no major bank protection work could be undertaken by BWDB in any of the proposed sites. However, it was agreed that soil compaction and sloping brick work around the gauging site might be undertaken. JICA expert Mr. Morishita agreed that it would serve the purpose.

As regards the Savar site, Director (SWH-2) Mr. Miah pointed out that it was very flat and therefore the bank type gauge would not be very suitable. The inlet pipe should be less than 20m in length. If an inlet pipe is used, there must be arrangements available for cleaning the pipe as siltation is very severe in June and September-October period. As the current in this site is generally less than 2m/sec, a pressure type gauge may be considered. Actual current meter recordings may also be checked. Mr. Miah also recommended to survey the site a little upstream and downstream. As there is a bridge a little downstream, advantage may be taken of it for the installation the gauge. Site must be selected from Hydrologist's point of view keeping in mind the purpose which is Flood Forecasting, he opined.

Director (SWH-2) Mr. Miah also suggested that as pier type gauges have several advantages, they may be given due consideration. Stilling well housing a float type gauge normally has a diameter of about 50 cm but a well with a higher diameter (about 65 cm) is acceptable. Stilling wells could be fabricated locally. JICA expert Mr. Goto observed that larger diameter stilling wells are stronger and permit the use of larger floats which operate better than the smaller ones.

Chief Technical Adviser/FFWC Mr. Dent suggested that the Rain gauge should be placed on the ground rather than on the roof of the gauging station as it is the standard practice in Bangladesh. Mr. Miah informed that in Flood Forecasting Practice, the Rain gauges are generally mounted on the roof. However, it was agreed that it the situation permitted, i.e. there was enough clearance available in the site, the Rain gauge should be installed on the ground. otherwise, it should be mounted on the roof.

Director (SWH-2) Mr. Miah was generally in agreement with the rest of the report and had no further comment to make.

JICA expert Mr. Morishita requested BWDB for providing the soil parameters of the gauging sites for foundation design purposes. Director (SWH-2) Mr. Miah informed that this data was not readily available with BWDB but it could be obtained through a soil survey, conducted by an appointed local consultant whose expenses were to be borne by JICA. The JICA experts informed that there was no budget allocation and time available for conducting this survey. Therefore, it was agreed that approximate soil parameters based on previous experience could be used for foundation design calculations.

The JICA team thanked BWDB for the supply of all other data, maps and assistances provided to them. Director (SWH-2) Mr. Miah assured the JICA team that further assistance would be provided as and when requested.

With this, Director (SWH-2) closed the meeting.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING TELEMETERING PILOT SYSTEM

To
The Chief Engineer (Hydrology)
Bangladesh Water Development Board
Ispahani Building
Motijheel C/A
Dhaka

Date : August 04, 1991

Sub : **Meeting with the Chief Engineer (Hydrology) : Progress Report**

Dear Sir,

Enclosed please find herewith a resume of the discussions that took place in a meeting held in the office of the Chief Engineer (Hydrology), BWDB on ~~August~~ July 21, 1991 to review the progress of work done till the meeting date.

With best regards,

Yours sincerely

Haruyuki Goto
4/8/91

(HARUYUKI GOTO)
JICA Expert

C.C to :

1. Mr. Hitoshi Baba
   First Secretary, Embassy of Japan, Dhaka, Bangladesh
2. Mr. Kozo Yamakawa
   Technical Adviser, JICA, Dhaka
3. Mr. J.E. Dent
   Chief Technical Adviser/FF & WC, WAPDA Building, 8th floor, Dhaka.
4. The Director (SWH-2),
   BWDB, Green Road, Dhaka
5. JICA Expert's file.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING TELEMETERING PILOT SYSTEM

A meeting was held in the Office of the Chief Engineer (Hydrology) on ~~August~~ July 21, 1991 at 15:00 to review the progress of work done till the meeting date. The meeting was attended by BWDB officials, Chief Technical Adviser/FF & WC Mr. J.E. Dent, JICA team of experts and consultant from DDC Ltd. and presided over by the Chief Engineer (Hydrology).

A resume of the discussions that took place in the meeting is given below.

The Chief Engineer (Hydrology) welcomed the participants to the meeting and invited JICA Expert Mr. Haruyuki Goto to report on the progress of work done till that day. Mr. Goto informed that the survey and design schedule was being strictly followed and everything was being done as planned. Mr. Goto also expressed gratitude for the cooperation extended to the JICA team by all concerned BWDB & BTTB officials at all places of work.

Mr. Goto informed that on completion of the initial site survey of the gauging stations and careful examination of the survey results followed by detailed discussions with the Director (SWH-2), the gauging station sites at Amalshid and Noonkawa were changed to Zakiganj and Jatrapur respectively.

Mr. Goto also informed that the Radiowave Propagation Test results indicated that radio communication between Pankha-Nawabganj, Zakiganj-Beani Bazar and Jatrapur-Kurigram would be very reliable but would not be at all reliable between Pankha-Rajshahi, Zakiganj-Sylhet and Jatrapur-Rangpur because of the great distances between the stations. The Chief Engineer (Hydrology) expressed the view that the main microwave links in the country were more reliable and therefore BWDB would recommend having local master stations at Rajshahi, Rangpur and Sylhet. This would also allow BWDB to add new gauging stations to the system with minimum difficulty, should the need arise in future, and the same leased T&T microwave circuit could be used for communicating with the FF & WC in Dhaka. He recommended the use of repeater stations, if required, between Pankha-Rajshahi, Zakiganj-Sylhet and Jatrapur-Rangpur sectors. Mr. Goto noted down the recommendations of the Chief Engineer (Hydrology).

Mr. Goto also informed that there was extremely high radio frequency interference at Rangpur T&T station from many sources but mainly by police communications at 149.25 MHz. As the situation existed, no reliable communication could be conducted at this frequency. Mr. Goto recommended that this matter should be taken up with relevant BTTB officials so that necessary measures are taken to make this frequency interference free.

Mr. Goto also informed that the letter from the office of the Chief Engineer (Hydrology) to BTTB requesting several information has already been handed over and it was expected that a meeting with responsible T&T officials would be held shortly to sort out all the relevant questions.

It was also decided that the next meeting with the Chief Engineer (Hydrology) would be held on August 10, 1991 at 15:00 for discussing the outcome of the meeting of the JICA team with BTTB and other matters relevant to the project before embarking on the preparation of the draft report.

With that the Chief Engineer (Hydrology) closed the meeting.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND
WARNING PILOT TELEMETRY SYSTEM

Date : 14.08.1991

To
The Chief Engineer (Hydrology)
Bangladesh Water Development Board
Ispahani Building
Motijheel C/A
Dhaka

Sub : *Report on the Radiowave Propagation Tests and the Network recommended for the FF&W Pilot Telemetry System*

Dear Sir,

Enclosed please find herewith a report on the Radiowave Propagation Tests conducted by the JICA team and the Radio Telemetry Network recommended for the Flood Forecasting and Warning Pilot Telemetry System.

Thanking you.

With best regards.

Yours sincerely,

Haruyuki Goto 14/8/91

(HARUYUKI GOTO)
JICA Expert

cc to :

1. Mr. Hitoshi Baba
   First Secretary, Embassy of Japan, Dhaka, Bangladesh.
2. Mr. Kozo Yamakawa
   Technical Adviser, JICA, Dhaka.
3. Mr. J.E. Dent
   Chief Technical Adviser/FF&WC, WAPDA Bldg., 8th Floor, Motijheel C/A, Dhaka.
4. Director (International),
   BTTB, Central Office, Dhaka
5. Director (SWH-2),
   BWDB, Green Road, Dhaka.
6. JICA Expert's File.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING PILOT TELEMETRY SYSTEM

REPORT ON THE RADIOWAVE PROPAGATION TESTS CONDUCTED BY THE JICA TEAM AND THE RADIO TELEMETRY NETWORK RECOMMENDED FOR THE FLOOD FORECASTING AND WARNING PILOT TELEMETRY SYSTEM

The following tasks were performed by the JICA team keeping in view the design requirements of the Flood Forecasting and Waring Pilot Telemetry System.

a) Radiowave Propagation Tests were conducted between the selected gauging station sites and the nearby T&T UHF & Microwave stations. The test results were analyzed in detail and the best partner T&T station for each gauging station was determined. The stability and reliability of the VHF Radio Telemetry link was the prime factor considered in determining the suitability of the partner T&T station. A summary of the Radiowave Propagation Test results is given in Table-I and II.

b) A survey of the existing T&T Multiplex network, Communications and other associated equipment currently in use, facilities, premises etc. was also conducted by the JICA team and the suitability and the possibility of their use for the Flood Forecasting and Warning Pilot Telemetry System was determined. A detailed report on this survey was given separately by the JICA team on 10.08.1991.

On the basis of the above Tests and Survey, the following Radio Telemetry Network for the Flood Forecasting and Warning Pilot Telemetry System is recommended by the JICA team.

1. Pankha - Dhaka (Mogh Bazar)

a) Install a dedicated VHF Radio Telemetry link between Pankha gauging station and Nawabganj T&T UHF station.

b) Use a leased circuit from the existing T&T FDM (Frequency Division Multiplex) UHF link operating between Nawabganj and Rajshahi and the FDM Microwave link operating between Rajshahi and Dhaka (Mogh Bazar) terminals.

2. Jatrapur - Dhaka (Mogh Bazar)

a) Install a dedicated VHF Radio Telemetry link between Jatrapur gauging station and Kurigram T&T UHF station.

b) Use a leased circuit from the existing T&T FDM UHF link operating between Kurigram and Rangpur and the FDM Microwave link operating between Rangpur and Dhaka (Mogh Bazar) terminals.

3. Zakiganj - Dhaka (Mogh Bazar)

a) Install a dedicated VHF Radio Telemetry link between Zakiganj gauging station and Beani Bazar T&T UHF station.

b) Use a leased circuit from the existing T&T PCM Multiplexed UHF Digital link operating between Beani Bazar and Sylhet and the FDM Microwave link between Sylhet and Dhaka (Mogh Bazar) terminals.

4. Moulvi Bazar Area Gauging Stations - Dhaka (Mogh Bazar)

a) Install a VHF Radio Telemetry Repeater at Moulvi Bazar Microwave station for communicating with the existing gauging stations operating in the Moulvi Bazar area.

b) Use a leased circuit from the existing T&T FDM UHF link operating between Moulvi Bazar and Sylhet and the FDM Microwave link operating between Sylhet and Dhaka (Mogh Bazar) terminals.

5. Dhaka Area Gauging Stations - Dhaka (Ramna)

a) Install a VHF Radio Telemetry network between Dhaka area gauging stations at Narayanganj, Rikabi Bazar, Milbarrak, Tongi, Mirpur, Nayarhat and Dhaka (Ramna) T&T Microwave station.

* The Ramna T&T station is recommended as the Radio Telemetry Repeater site for the Dhaka area gauging stations on the basis of the Radiowave Propagation Test results which indicate that it is the only site in Dhaka area (compared to Mogh Bazar T&T station and WAPDA building) which is relatively interference free and where the stability and reliability of the Radio Telemetry network can be ensured.

6. Multiplex link between Dhaka (Mogh Bazar) and FF&WC at WAPDA building

a) Use 4 channels from the existing Coaxial Cable link operating between Dhaka (Mogh Bazar) and Dhaka (Ramna) T&T terminals for the transmission of signals collected at the Dhaka (Mogh Bazar) terminal from the remote gauging stations at Pankha, Jatrapur, Zakiganj and Moulvi Bazar area to the Dhaka (Ramna) terminal and vice versa.

b) Install a PCM Multiplex Digital Radio system. (2 Mbit/s; 30 channels operating in the 2 GHz band) between Dhaka (Ramna) T&T station and FF&WC at WAPDA building.

This system will be used for the transmission of signals collected at Dhaka (Ramna) terminal from the remote and Dhaka area gauging stations together to FF&WC at WAPDA building and vice versa.

7. Future Expansion of the Pilot Telemetry System

If the Pilot Telemetry System is to be expanded in future, i.e. new gauging stations are to be added to the system, it can be done with relative ease by following the recommendations given below for each specific case.

a) A new gauging station is to be installed near any of the Radio Telemetry Repeater stations such as Nawabganj, Kurigram, Beani Bazar, Moulvi Bazar or Dhaka.

* Just install the new gauging station (within the range of stable and reliable communication) and link it with the nearest Radio Telemetry Repeater already operating in the respective T&T station.

b) A new gauging station is to be installed near Rajshahi, Rangpur or Sylhet.

* Install a Radio telemetry Repeater at the respective T&T Microwave station and link it with the new gauging station.

* Interface the leased T&T circuits from the UHF links (Nawabganj - Rajshahi, Kurigram - Rangpur or Beani Bazar - Sylhet as the case may be) with the respective Radio Telemetry Repeater.

* Interface the Radio Telemetry Repeater at the respective T&T Microwave station with the leased T&T Microwave circuit for signal transmission from the respective station to Dhaka (Mogh Bazar) terminal and vice versa.

c) A new gauging station is to be installed in an area not covered by the existing network.

* Install a VHF Radio Telemetry Link between the gauging station and the nearest T&T UHF or Microwave station.

* Use a leased circuit from the existing T&T Links (UHF, Microwave and Coaxial Cable Links) operating between the said T&T station and Dhaka, thereby making the signal available at Dhaka (Ramna) terminal.

* Use a new channel from the PCM Multiplex Digital Radio Link between Dhaka (Ramna) and FF&WC (WAPDA Building) for communicating with the new remote station.

8. Recommended Preparatory Work

The following preparatory work is recommended for the smooth implementation of the Pilot Telemetry Network.

a) Obtain permission from BTTB for the installation of Radio Telemetry Repeater Equipment, DC Power Supply System, Antenna etc. in each of the following T&T stations:

1. Nawabganj
2. Kurigram
3. Beani Bazar
4. Moulvi Bazar
5. Dhaka (Ramna)

b) Lease the following 4 circuits from the existing T&T Nationwide Multiplex Network.

1. Dhaka (Ramna) Carrier Terminal to Nawabganj Terminal
2. Dhaka (Ramna) Carrier Terminal to Kurigram Terminal
3. Dhaka (Ramna) Carrier Terminal to Beani Bazar Terminal
4. Dhaka (Ramna) Carrier Terminal to Moulvi Bazar Terminal

c) Obtain permission from BTTB to install a PCM Multiplex Digital Radio System (2 Mbit/s, 30 Ch) operating in the 2 GHz band between Dhaka (Ramna) T&T station and FF&WC at WAPDA building.

d) Obtain the necessary frequencies allocations from BTTB to operate the VHF Radio Telemetry Network and the PCM Multiplexed Digital Radio System.

1. 5 different frequencies in the VHF band, one each for the operation of the following Radio Telemetry links or networks.

    1. Nawabganj - Pankha Telemetry link

    2. Kurigram - Jatrapur Telemetry link

    3. Zakiganj - Beani Bazar Telemetry link

    4. Moulvi Bazar area Telemetry network (149.25 MHz is already allocated for the purpose).

    5. Dhaka area Telemetry network

2. Necessary frequencies in the 2 GHz band for the operation of the PCM Multiplex Digital Radio System between T&T Dhaka (Ramna) and FF&WC at WAPDA building.

Table 1. Summary of 150 MHz band Radiowave Propagation Tests

Test Span	Transmitting Power (W)	Distance (km)	Gauging Station antenna height (m)	Partner T&T Station antenna height (m)	Received input Voltage (dBμV)	Remarks
T & T Rajshahi - Pankha	10.0	53.0	10.0	60.0	14.0	
T & T Nawabganj - Pankha	10.0	13.0	10.0	30.0	32.5	
T & T Rangpur- Jatrapur	10.0	48.6	10.0	60.0	18.0	
T & T Kurigram - Jatrapur	10.0	17.0	10.0	30.0	50.0	
T & T Sylhet - Amalshid	10.0	61.0	10.0	30.0	5.0	
T & T Beani Bagar - Amalshid	10.0	33.7	10.0	30.0	17.0	
T & T Maulvi Bazar -BWDB Maulvi Bazar	10.0	1.0	10.0	60.0	65.5	
T & T Maulivi Bazar - Shaistaganj	10.0	38.0	10.0	60.0	25.0	Monitoring data of Existing System
T & T Ramna - Nayarhat	10.0	27.7	10.0	78.5	25.0	- do -
T & T Ramna - Mirpur	10.0	10.0	10.0	78.5	43.0	
T & T Ramna - Narayanganj	10.0	14.7	10.0	78.5	32.0	
T & T Ramna - Rikabi Bazar	10.0	20.1	10.0	78.5	33.0	
T & T Ramna - Milbarrak	10.0	2.9	10.0	78.5	58.0	
T & T Ramna - Tongi	10.0	17.4	10.0	78.5	22.0	
T & T Mogh Bazar - Nayarhat	10.0	25.6	10.0	30.0	19.0	
T & T Mogh Bazar - Mirpur	10.0	8.2	10.0	30.0	42.0	
T & T Mogh Bazar - Narayanganj	10.0	16.8	10.0	30.0	11.5	
T & T Mogh Bazar - Rikabi Bazar	10.0	22.5	10.0	30.0	5.0	
T & T Mogh Bazar - Milbarrak	10.0	5.6	10.0	30.0	14.0	
T & T Mogh Bazar - Tongi	10.0	14.7	10.0	30.0	22.0	
T & T Mogh Bazar - Nayarhat	10.0	25.6	10.0	60.0	19.0	
T & T Mogh Bazar - Mirpur	10.0	8.2	10.0	60.0	42.0	
T & T Mogh Bazar - Narayanganj	10.0	16.8	10.0	60.0	36.0	
T & T Mogh Bazar - Rikabi Bazar	10.0	22.5	10.0	60.0	—	
T & T Mogh Bazar - Milbarrak	10.0	5.6	10.0	60.0	43.0	
T & T Mogh Bazar - Tongi	10.0	14.7	10.0	60.0	22.0	
WAPDA Building - Nayarhat	10.0	28.5	10.0	30.0	0.0	

* Very high interference from Police Communications and other Sources at 149.25 MHz at Mogh Bazar T&T station. Therefore, this station is not recommended to be used as a Radio Telemetry Repeater station.

* Extreme interference from various sources in the WAPDA building site at 149.25 MHz did not allow the reception of any signal from Nayarhat. Consequently, this station is not recommended to be used as a Radio Telemetry Repeater station.

Table-1-JICA/FFWTPS

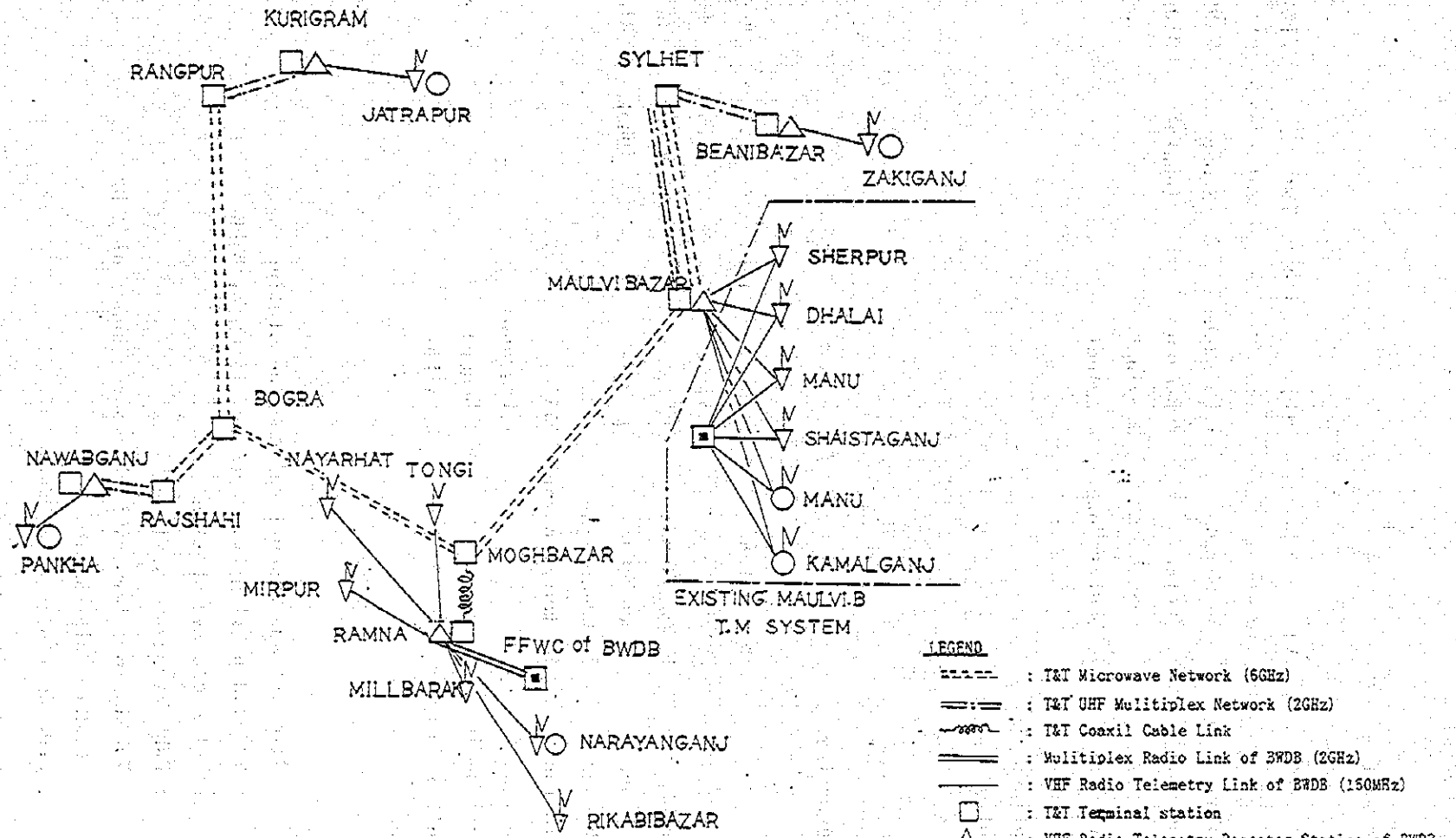
Table 2. Summary of 150 MHz Band Radiowave Propagation Tests

Gauging Station Name	Transmitting Power (W)	Antenna Used	Partner Station Name	Antenna Used	Received Input Voltage (dBμV)	Signal to Noise Ratio S/N (dB)	S/N at Fading (dB)	Judgement
Pankha	10.0	8 Element Yagi	T & T Rajishahi	3 Bay Collinear	11.2	29.2	20.8	No Good
Pankha	10.0	3 Element Yagi	T & T Nawapganj	Sleeve	36.8	Over 50.5	Over 50.5	Good
Jatrapur	10.0	8 Element Yagi	T & T Rangpur	3 Bay Collinear	12	30.0	22.1	No Good
Jatrapur	10.0	3 Element Yagi	T & T Kurigram	Sleeve	43.5	Over 50.0	Over 50.5	Good
Zakinganj	10.0	8 Element Yagi	T & T Sylhet	3 Bay Collinear	10.4	28.4	20.3	No Good
Zakinganj	10.0	3 Element Yagi	T & T Beani Bazar	5 Element Yagi	22.0	40.0	34.8	Good
Nayarhat	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	28.6	46.6	41.3	Good
Mirpur	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	43.6	Over 50.0	Over 50.5	Good
Narayanganj	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	35.8	Over 50.0	49.3	Good
Rikabi Bazar	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	33.8	Over 50.0	46.8	Good
Millbarrak	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	58.8	Over 50.0	Over 50.5	Good
Tongi	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	23.1	41.1	36.3	Good

* For a stable and reliable Radio Telemetry Link the following requirements should be met.

a) Signal to Noise Ratio (S/N) : More than 40 dB

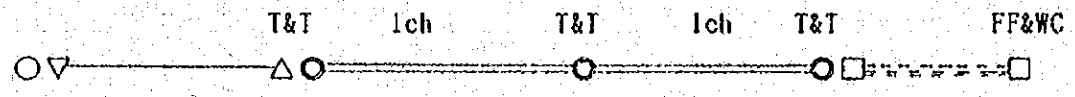
b) S/N at Fading : More than 30 dB



PILOT TELEMETRY NETWORK
OF BANGLADESH FF&WS

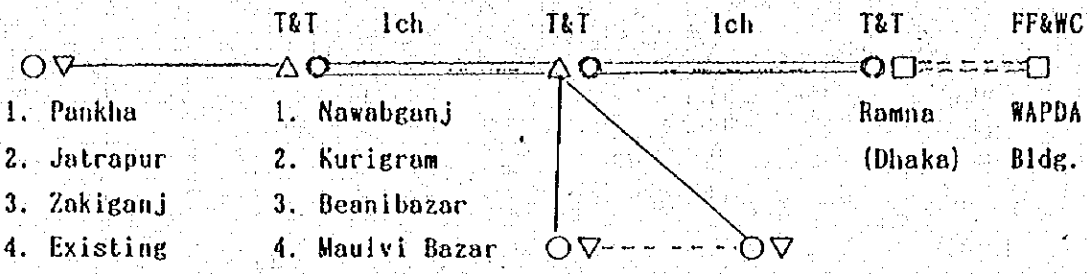
Recommended Radio Telemetry Network of the Flood Forecasting and Warning Pilot Telemetery System

1. Pilot system



1. Pankha	1. Nawabganj	1. Rajshahi	Ramna	WAPDA
2. Jatrapur	2. Kurigram	2. Rangpur	(Dhaka)	Bldg.
3. Zakiganj	3. Beanibazar	3. Sylhet		
4. Existing gauging stations in Maulivi Bazar area	4. Maulvi Bazar	4. Sylhet		

2. Future system



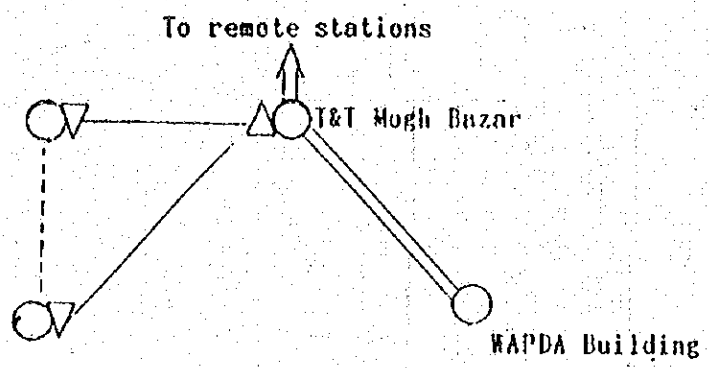
1. Pankha	1. Nawabganj		Ramna	WAPDA
2. Jatrapur	2. Kurigram		(Dhaka)	Bldg.
3. Zakiganj	3. Beanibazar			
4. Existing gauging stations in Maulivi Bazar area	4. Maulvi Bazar	1. Rajshahi 2. Rangpur 3. Sylhet		

Legend

○▽	: Rainfall and Water-level gauging station
△	: VHF Radio Telemetry Repeater staion of BWDB
○	: T&T Microwave station
□	: BWDB Microwave station
——	: VHF Radio Telemetry Link (150MHz Band) of BWDB
═══	: T&T Multiplex Radio Link
▫▫▫▫	: BWDB Multiplex Radio Link

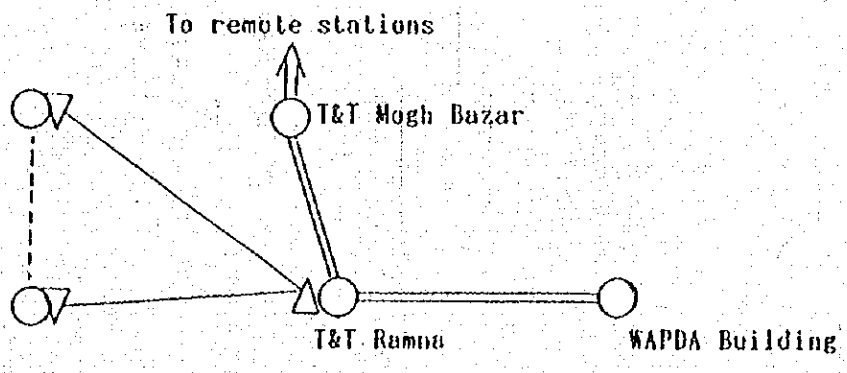
Various Plans for the Multiplex Radio Link for Dhaka Area

Plan-1



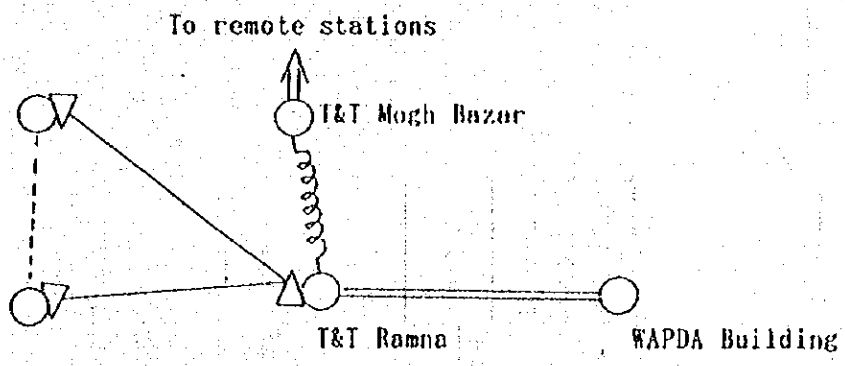
※ Not recommended

Plan-2



※ Not recommended

Plan-3



※ Recommended

Legend

: Rainfall and Water-level gauging station

: VHF Radio Telemetry Repeater staion of BWDB

: VHF Radio Telemetery Link (150MHz Band) of BWDB

: 2GHz Multiplex Radio Link of BWDB

: Co-axial Cable Link of T&T

RADIO TELEMETRY NETWORK OF FF & WS

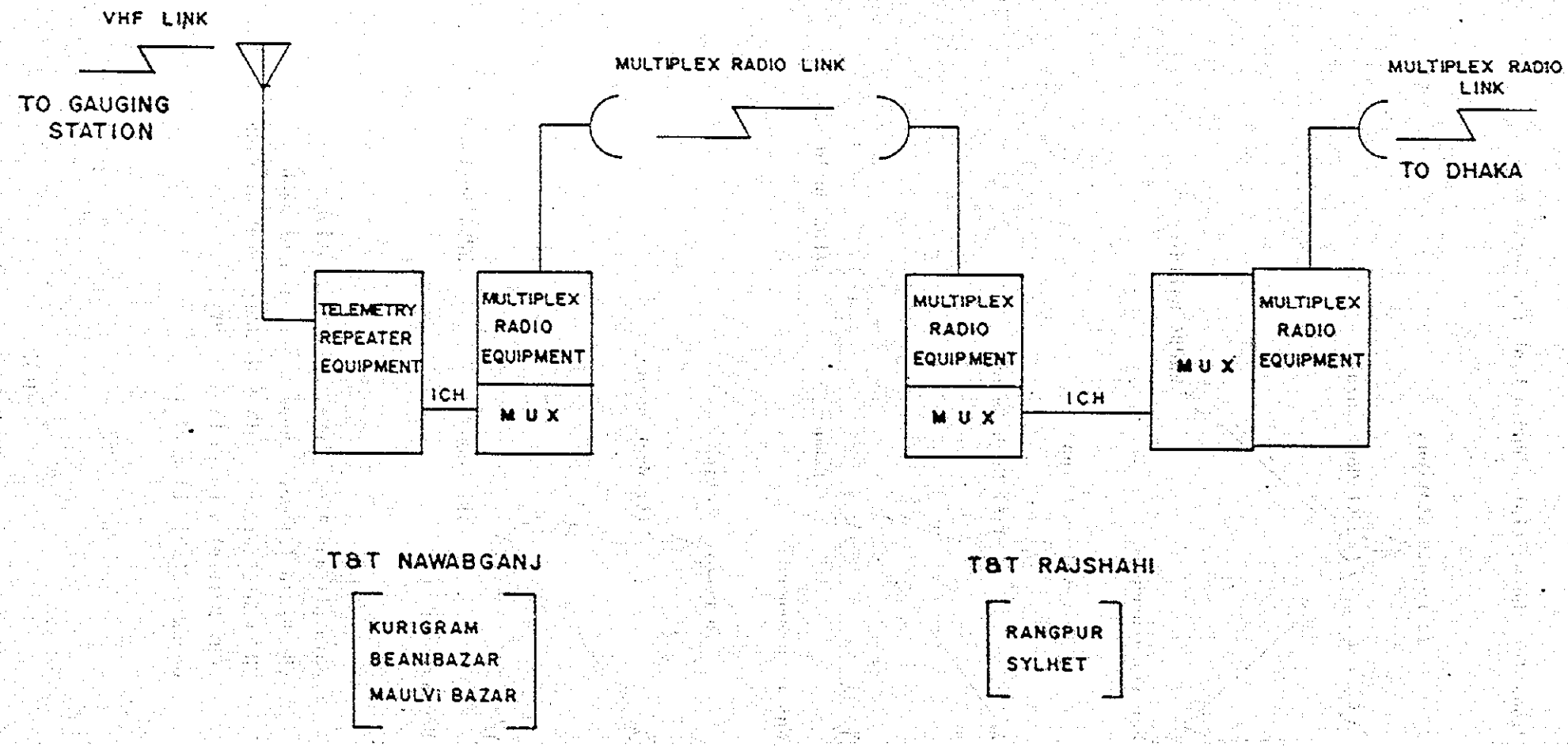


FIG.-1. PILOT SYSTEM

RADIO TELEMETRY NETWORK OF FF&WS

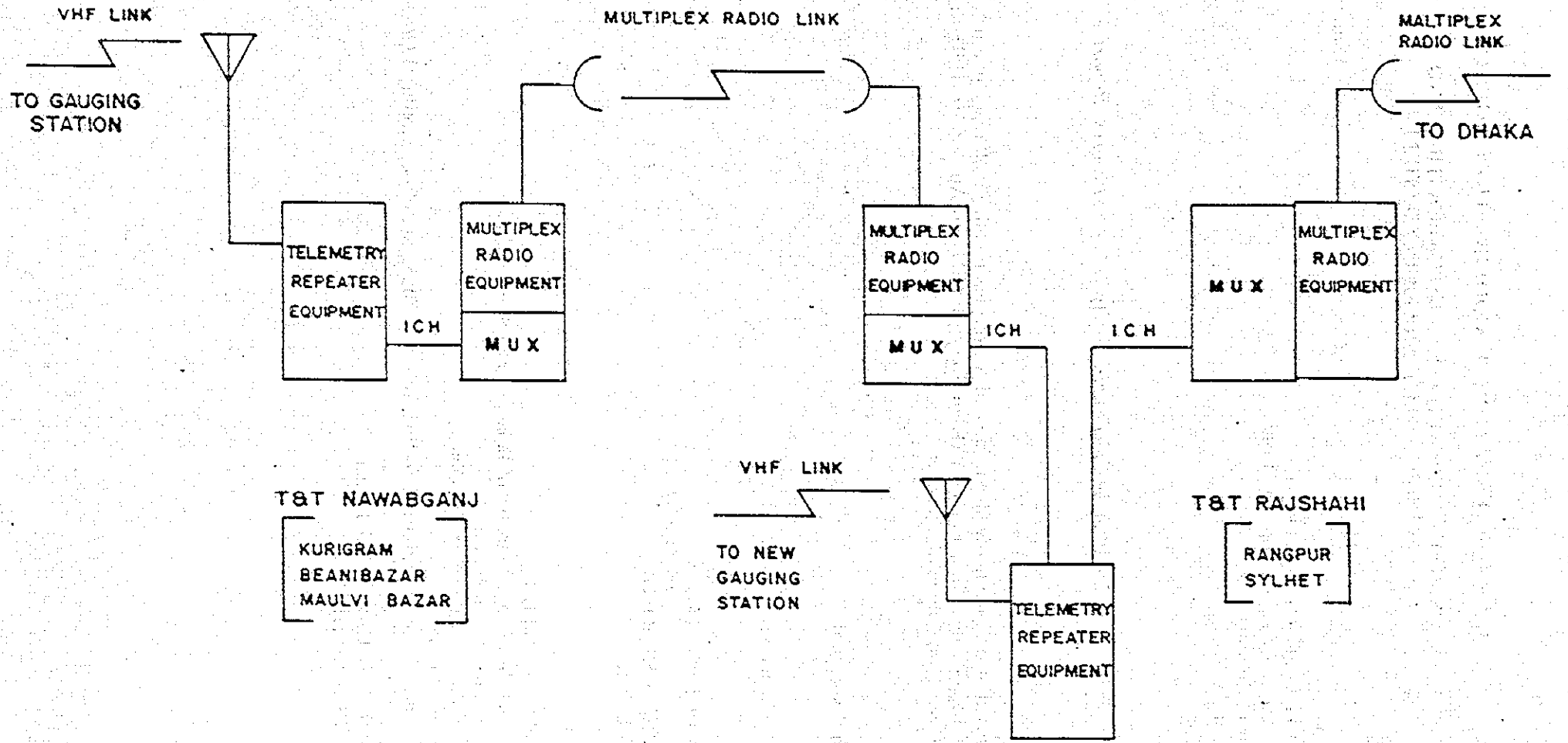


FIG.—2. FUTURE SYSTEM

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND
WARNING PILOT TELEMETRY SYSTEM

Date : 15.08.1991

To
The Chief Engineer (Hydrology)
Bangladesh Water Development Board
Ispahani Building
Motijheel C/A
Dhaka

Sub : *Meeting With the Chief Engineer (Hydrology) : Progress Report*

Dear Sir,

Enclosed please find herewith a resume of the discussions that took place in a meeting held in the Office of the Chief Engineer (Hydrology), BWDB on August 10, 1991 to review the progress of work done till that day.

With best regards.

Yours sincerely,

Haruyuki Goto 15/8/'91
(HARUYUKI GOTO)
JICA Expert

cc to :

1. Mr. Hitoshi Baba
   First Secretary, Embassy of Japan, Dhaka, Bangladesh.
2. Mr. Kozo Yamakawa
   Technical Adviser, JICA, Dhaka.
3. Mr. J.E. Dent
   Chief Technical Adviser/FF&WC, WAPDA Bldg., 8th Floor, Motijheel C/A, Dhaka.
4. Director (SWH-2),
   BWDB, Green Road, Dhaka.
5. JICA Expert's File.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING PILOT TELEMETRY SYSTEM

A meeting was held in the Office of the Chief Engineer (Hydrology) on August 10, 1991 at 15:00 to review the progress of work done till that day. The meeting, attended by BWDB officials, Chief Technical Adviser/FF&WC Mr. J.E. Dent, JICA team of experts and consultants from DDC Ltd., was presided over by the Chief Engineer (Hydrology).

A resume of the discussions that took place is given below.

The Chief Engineer (Hydrology) welcomed the participants to the meeting and invited JICA Expert Mr. Morishita to report on the final site selection for the gauging stations. Mr. Morishita explained in detail the justification for the selection of each individual site. The Chief Engineer (Hydrology), though generally agreed with the selection of most of the sites, expressed his reservations about the Pankha and Mirpur sites. The Chief Engineer (Hydrology) recommended the following in this connection.

1. Shift the proposed Pankha gauging site 100 m upstream or downstream as the bank appears to be eroded at the selected site (presumably due to rain).

2. Use a pressure type gauge in Jatrapur site, if required.

3. Install the sensor on the new bridge in Mirpur instead of the old bridge as proposed. The old bridge may be demolished at any time. If it is difficult to use a float type gauge, use a pressure type gauge.

4. As the value of land in Tongi, Narayanganj and Rikabi Bazar is very high, it is advisable to look for a site where the land is owned by the Government. Therefore, recheck the ownership of land in each site.

The Chief Engineer (Hydrology) also recommended that in the final report, the site selection should be justified by supporting statements, photos, sketches and drawings etc. for each one separately.

Then the Chief Engineer (Hydrology) examined the foundation designs of the gauging stations. He termed the designs as unusually safe, hence expensive and recommended to revise them in order to make them economic.

Then the Chief Engineer(Hydrology) also recommended that the Project should be on TURN-KEY basis and the Tender Documents should be prepared accordingly. Therefore, all civil, mechanical and other works, which constitute only a minor portion of the total project, should be shown as ancillary works for the Radio Telemetry System. The civil works, for example, should be termed as Telemetry Instrument Housing and, therefore, should be tagged with the Telemetry Equipment. The JICA team noted the recommendation of the Chief Engineer (Hydrology).

Then the Chief Engineer (Hydrology) invited Mr. Haruyuki Goto to report on the final plan for the Radio Telemetry Network. Mr. Goto explained the proposed network and showed how it could be expanded in future, if required. The Chief Engineer generally agreed with the proposed Radio Telemetry Network.

It was decided that the final meeting with the Chief Engineer (Hydrology) would be held on August 22, 1991 at 15:30. It was also suggested that if any further meeting was required by the JICA team in between it could be requested and held on a mutually agreeable date.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING
PILOT TELEMETRY SYSTEM

To
The Chief Engineer (Hydrology)
Bangladesh Water Development Board
Ispahani Building
Motijheel C/A
Dhaka

Date : August 26,1991

Sub : Meeting with the Chief Engineer (Hydrology):
(Resume of Discussions)

Dear sir,

Enclosed please find herewith a resume of discussions that took place in a meeting held in the Office of the Chief Engineer (Hydrology), BWDB on August 24,1991 at 14:30 to finalize the Draft Design Report in connection with the Flood Forecasting and Warning Pilot Telemetry System.

With best regards.

Yours sincerely,

Haruyuki Goto 26/8/91

(HARUYUKI GOTO)
JICA Expert

C.C. to :

1. Mr. Hitoshi Baba,
First Secretary, Embassy of Japan, Dhaka, Bangladesh.

2. Mr. Kozo Yamakawa,
Technical Adviser, JICA, Dhaka.

3. Mr. J.E. Dent,
Chief Technical Adviser/FF&WC, WAPDA Building,8th Floor,Dhaka.

4. Director (SWH-2), BWDB, Green Road, Dhaka.

5. Director (International), BTTB, Central Office, Dhaka.

6. JICA Expert's File.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING
PILOT TELEMETRY SYSTEM

A meeting was held in the Office of the Chief Engineer(Hydrology) on August 24,1991 at 14:30 to finalize the Draft Design Report in connection with the Flood Forecasting and Warning Pilot Telemetry System. The meeting was attended by BWDB officials, Chief Technical Adviser/FF&WC, Director(Imternational),BTTB, Technical Adviser, JICA, the Study Team and Consultants from DDC Ltd. The Chief Engineer (Hydrology) presided over the meeting.

The Chief Engineer (Hydrology) welcomed the participants to the meeting and invited Mr. Fukazawa to submit the Draft Design Report. Mr. Fukazawa while submitting the Report said that it was a matter of great pleasure for him to see that the Study was nearing completion and hoped that the Report would meet the requirements of BWDB and set the basis for introducing state-of-the-art technology of Flood Forecasting in Bangladesh.

The Chief Engineer (Hydrology) opened the discussions with the observation that a number of meetings held earlier has helped in streamlining Draft Design Report. On the contrary, no discussions were held yet on the Draft Tender Documents and it would be advisable to submit it as soon as possible and devote more time to it for discussions. Mr. Goto informed that the Draft Tender Documents were in the final phase of preparation and would be submitted soon.

The Chief Engineer (Hydrology) inquired about the justification of using five different frequencies in the VHF band. Mr. Goto explained that the use of separate VHF frequency for each Radio Telemetry link or network would enable simultaneous data collection from different regions. It was decided that a separate VHF frequency would be allocated for each major region of the country and all the present and future gauging stations of that region would operate on that frequency only.

The Chief Engineer (Hydrology) then inquired about the justification of using four different channels instead of one channel from the Coaxial Cable link operating between T&T Mogh Bazar and T&T Ramna. The Director (International), BTTB explained that if only one channel was used, it would involve the installation of switching equipment in T&T Mogh Bazar for transmitting the signals from four different channels through one channel. Moreover, there was no difference in BTTB charges for terminating the signals from remote stations at T&T Mogh Bazar or T&T Ramna. It was then decided four channels would be used now from the Coaxial Cable link but a full Group (12 channels) would be reserved by BWDB for facilitating future expansion of the Flood Forecasting and Warning System.

Chief Technical Adviser/FF&WC Mr. J.E. Dent inquired about the quality of the Coaxial Cable link between T&T Mogh Bazar and T&T Ramna. The Director (International), BTTB assured that the link was of the same standard as that of the nationwide Microwave link.

The Director (SWH-2) recommended that the locations of the gauging stations should be changeable to within 500 m of the selected points if necessary. He also recommended to make some corections in the sketches and drawings.

The Chief Engineer (Hydrology) again recommended the use of the term ancillary work instead of civil work. He also recommended that specific requirements and not detailed dimensions should be mentioned in the Tender Documents.

Then the Chief Engineer (Hydrology) examined the recommended time schedule of project implementation and observed that the commencement of Manufacturing Work was rather too early. In this connection, he observed that preparatory work such as preparation of tender documents , floating of tender, receipt of bids, tender evaluation and award of contract etc. was likely to be finished by June, 1992. Therefore, Manufacturing Work should commence in July, 1992 and end in December, 1992. As such, the training schedule should also be changed accordingly.

It was decided that the next meeting would be held on August 29, 1991 at 11:00 a.m. for submitting the Final Design Report and finalizing the Draft Tender Documents. However, it was decided that the Reports in several copies would be handed over to the Chief Engineer (Hydrology) on August 27, 1991 for prior reviewing. It was also decided that Final Tender Documents would be submitted on August 31, 1991 at a meeting scheduled at 11 a.m.

With this, the Chief Engineer (Hydrology) closed the meeting.

A list of attendance at the above meeting is given below :

1. Syed Anwar Yusuf, Chief Engineer (Hydrology), BWDB
2. J.E. Dent, Chief Technical Adviser,FF&WC,BWDB
3. Md. Alam Miah, Director (SWH-2), BWDB
4. Md. Fazlur Rahman, Director (International), BTTB
5. Md. Musharraf Hossain, Executive Engineer,C&I Division, BWDB
6. Hiron C. Ghose, SDE, Instrumentation Sub Division-1, BWDB
7. A.K. Nizam Uddin Ahmed, SDE, Instrumentation Sub Division-2 BWDB
8. Kozo Yamakawa, Technical Adviser, JICA
9. Yoshio Fukazawa, JICA Expert
10. Haruyuki Goto, JICA Expert
11. Kanehiro Morishita, JICA Expert
12. Mikio Hatta, JICA Expert
13. Tsukasa Sato, JICA Expert
14. A.K.M. Shamsuddin, DDC Consultant
15. Gulam Mohammad, DDC Consultant
16. S.M. Khaled, DDC Consultant

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING
PILOT TELEMETRY SYSTEM

To
The Chief Engineer (Hydrology)
Bangladesh Water Development Board
Ispahani Building
Motijheel C/A
Dhaka

Date : August 31,1991

Sub : Meeting for Finalising the Draft Final Design Report & Draft Tender Documents : (Resume of Discussions)

Dear sir,

Enclosed please find herewith a resume of discussions that took place in a meeting held in BWDB Conference Room on August 31,1991 at 12:00 to finalize the Draft Final Design Report and Draft Tender Documents in connection with the Flood Forecasting and Warning Pilot Telemetry System.

With best regards.

Yours sincerely,

Haruyuki Goto 31/8/'91

(HARUYUKI GOTO)
JICA Expert

C.C. to :

1. M.A. Razzak, Member (Planning), BWDB
2. Liaquat Hossain, Chief Engineer (Planning), BWDB
3. Abinash Chandra Sarker, Chief Engineer (Design-1), BWDB
4. Mohammad Alam Miah, Director (SWH-2), BWDB
5. M.A. Quayyum Rizvi, Supdt. Engineer, Design Circle-1, BWDB
6. Md. Habibur Rahman, Supdt. Engineer, FPCO, BWDB
7. Director, Purchase & Movement, BWDB
8. Mr. Hitoshi Baba, First Secretary, Embassy of Japan, Dhaka
9. Mr. Kozo Yamakawa, Technical Adviser, JICA, Dhaka
10. Mr. J.E. Dent, Chief Technical Adviser/FF&WC, BWDB
11. JICA Experts File

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING
PILOT TELEMETRY SYSTEM

A meeting was held in BWDB Conference Room on August 29,1991 at 12:00 to finalize the Draft Final Design Report and Draft Tender Documents in connection with the Flood Forecasting and Warning Pilot Telemetry System. The meeting was attended by BWDB officials, Chief Technical Adviser/FF&WC, Technical Adviser, JICA, the Study Team and a Consultant from DDC Ltd. The Member (Planning), BWDB presided over the meeting.

A resume of the discussions that took place in the meeting is given below.

The Member (Planning) welcomed the participants to the meeting and invited the Study Team leader to give a summary of the project. Mr. Goto and Mr. Shamsuddin described briefly the Pilot Telemetry System and the tasks performed by the Study Team for preparing the Final Design Report and the Draft Tender Documents.

The Member (Planning) opened the discussions for finalising the two documents. The Chief Engineer (Hydrology) made the observation that a number of meetings have been held earlier and detailed discussions were held on the Design Report. This has helped in streamlining it . On the contrary, no discussions were held on the Draft Tender Documents and, therefore, he recommended that it should be taken up immediately. The Member (Planning) agreed with the Chief Engineer (Hydrology) and invited discussions on the Draft Tender Documents. He also advised that the Draft Tender Document should be discussed itemwise.

The prepared comments of Director (SWH-2) on the Draft Tender Documents were distributed to the participants and the Member (Planning) invited discussions on it. The comments were taken up for discussion one by one.

1. Ref: Clause 1.6 > The suggestion that the amount of Bid Bond money should be finalised by following the set procedures of BWDB was accepted and it was agreed that the Bid Bond ($100,000) may also be given in equivalent Bangladesh Taka at the rate on that day.
2. Ref: Sub-Clause 1.11.4 > The suggesstion that the word "verified" may be omitted and "verified and endorsed" inserted was accepted.
3. Ref: Sub-Clause 1.11.9 (1) d > The suggestion that a portion of the personnel expenses of the contractor should be paid in local currency was accepted for checking with the relevant authorities and it was decided that standard procedures should be followed in this regard.
4. Ref: Clause 1.13 > The suggestion to add "Evaluation and comparison of the tender proposal will be done as per set prooc-

dures of the BWDB" to the above Clause was accepted.
5. Ref: Clause 2.25 > The suggestion in connection with tarrif, duties and taxes should be checked with the Purchase Dept. and appropriate decisions should be taken in this regard.
6. Ref: Clause 2.44 > The suggestion that the word "signally" should be corrected to the word "singly" and to delete "the JICA" was accepted.
7. Ref: Part 4 Section 1.3 > It was decided to add the word "or equivalent" in the second sentence of (1) after "All the materials shall comply with the latest Japanese Industrial Standards" and to replace the word "Engineer" with "Superintending Engineer/ Project Manager" in (2). It was, however, also decided that this para would be finalized on receipt of comments of the Director, Purchase and Movement, BWDB, Dhaka who was not present at that moment.
8. Ref: Part 4 Section 1.5 (3) > It was decided to extend the humidity range upto 100% as suggested & modify the temperature range to suit Bangladesh climate. MG

The Chief Engineer (Hydrology) insisted to rewrite Clause 1.2(1) regarding Counterpart Fund in the light of previous discussions. This was accepted by the JICA team.

It was decided that a meeting would be held in the Office of the Chief Engineer (Hydrology) on August 31,1991 at 12:00 to sort out the remaining points of the Draft Tender Documents.

With this the Member (Planning) closed the meeting.

A list of attendance at the above meeting is given below :

1. M.A. Razzak, Member (Planning), BWDB
2. Syed Anwar Yusuf, Chief Engineer (Hydrology), BWDB
3. Liaquat Hossain, Chief Engineer (Planning), BWDB
4. Abinash Chandra Sarker, Chief Engineer (Design-1), BWDB
5. J.E. Dent, Chief Technical Adviser/FFWC, BWDB
6. Mohammad Alam Miah, Director (SWH-2), BWDB
7. M.A. Quayyum Rizvi, Supdt. Engineer, Design Circle-1, BWDB
8. Md. Habibur Rahman, Supdt. Engineer, FPCO, BWDB
9. Md. Musharraf Hossain, Executive Engineer, C&I Division, BWDB
10. Hiron C. Ghose, SDE, Instr. Sub Division-1, BWDB
11. Kozo Yamakawa, Technical Adviser, JICA
12. Yoji Baba, JICA Expert
13. Yoshio Fukazawa, JICA Expert
15. Haruyuki Goto, JICA Expert
16. Kanehiro Morishita, JICA Expert
17. Mikio Hatta, JICA Expert
18. Tsukasa Sato, JICA Expert
19. A.K.M. Shamsuddin, DDC Consultant

APPENDIX C. LIST OF COLLECTED DATA DURING THE FIELD SURVEY PERIOD

APPENDIX C. LIST OF COLLECTED DATA DURING THE FIELD SURVEY PERIOD

1. Hydrological data such as annual highest WL, annual mean WL and annual lowest WL at the following sites:

   - Noonkawa
   - Amalshid
   - Tongi
   - Mirpur
   - savar
   - Nayarhat
   - Mill Barak
   - Narayanganj
   - Rekabi Bazar

2. Yearly hydrograph at the following sites:

   - Noonkawa
   - Amalshid
   - Mirpur
   - Tongi

3. Monthly and annual bright sun-shine hours(1980-1990) at the following sites:

   - Rangpur
   - Rajshahi
   - Dacca Airport
   - Sylhet city

4. Daily rainfall statistics(1979-1980) at the following sites:

   - Rajshahi
   - Dhaka
   - Rangpur
   - Sylhet

5. Daily & Monthly average of dry bulb temp.in degree Celcius and average humidity in percentage(1981-1990) at the following sites:

   - Rajshahi
   - Dhaka
   - Rangpur
   - Sylhet

6. 1:50,000 Map of relative point for site survey

APPENDIX D. SURVEY DATA OF T&T MULTIPLEX EQUIPMENT, fACILITIES ETC.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND
WARNING TELEMETERING PILOT SYSTEM

Date : 10.08.1991

To
The Chief Engineer (Hydrology)
Bangladesh Water Development Board
Ispahani Building
Motijheel C/A
Dhaka

Sub : *Report on the Survey of T&T Multiplex Network, Equipment, Facilities etc.*

Dear Sir,

Enclosed please find herewith a report on the survey conducted by the JICA team on the following items in connection with the Flood Forecasting and Warning Telemetering Pilot System Project.

a) Existing T&T Multiplex Network, Communications and Associated Equipment, Facilities, Premises etc.

b) Possibility of Establishing a Multiplex Radio Link between Mogh Bazar Terminal and FF&WC at WAPDA Building.

c) Yearly Leasing Fee of T&T microwave Circuits.

Thanking you.

With best regards.

Yours sincerely,

Haruyuki Goto
10/8/91

(HARUYUKI GOTO)
JICA Expert

cc to :

1. Mr. Hitoshi Baba
   First Secretary, Embassy of Japan, Dhaka, Bangladesh.
2. Mr. Kozo Yamakawa
   Technical Adviser, JICA, Dhaka.
3. Mr. J.E. Dent
   Chief Technical Adviser/FF&WC, WAPDA Bldg., 8th Floor, Motijheel C/A, Dhaka.
4. Director (International),
   BTTB, Central Office, Dhaka
5. Director (SWH-2),
   BWDB, Green Road, Dhaka.
6. JICA Expert's File.

JAPAN INTERNATIONAL COOPERATION AGENCY

SURVEY & DESIGN OF FLOOD FORECASTING AND WARNING TELEMETERING PILOT SYSTEM

REPORT ON THE SURVEY OF T&T MULTIPLEX NETWORK, EQUIPMENT, FACILITIES ETC. IN CONNECTION WITH THE FLOOD FORECASTING & WARNING TELEMETERING PILOT SYSTEM

With the permission of Bangladesh Telegraph and Telephone Board (BTTB), the JICA team conducted a survey in connection with the Flood forecasting and Warning Telemetering Pilot System Project of Bangladesh Water Development Board (BWDB). All the relevant BTTB offices and Microwave stations were visited by the JICA team for the purpose. In this connection, the JICA team would like to express its sincere gratitude and appreciation for the excellent cooperation extended to it by all concerned BTTB Officials without which this survey would not have been possible.

a) Survey of Multiplex Network, Equipment & Facilities

The following items were surveyed in detail in each T&T Microwave station visited by the JICA team

1. Multiplex network details and availability of spare channels from the respective T&T Microwave station to Dhaka Terminal.

2. Communications and other associated equipment currently in use and their main features.

3. Antenna tower installation and the height at which BWDB antenna may be installed.

4. Existing power supply (AC & DC) and the possibility of its use by BWDB for its equipment.

5. Availability of space in the Equipment Room and the possibility of its use by BWDB for the installation of its equipment.

A detailed report on the above survey is attached herewith. The designations of the BTTB officials with whom the JICA team coordinated their work during the survey in each T&T Microwave station is mentioned in the report. In addition to the above mentioned officials, the JICA team also visited DE (Upazila Project), Mohakhali, Dhaka for discussing the connection conditions of the NOKIA PCM Digital Radio System installed between Sylhet and Beani Bazar.

b) Possibility of Establishing Multiplex Radio Link Between Mogh Bazar (Dhaka) and WAPDA Building

The possibility of establishing a Multiplex Radio Link between Mogh Bazar and WAPDA Building was thoroughly investigated. It may be mentioned here that signals from and to the gauging stations such as Pankha (near Nawabganj), Jatrapur (near Kurigram) Zakiganj (near Beani Bazar) and the existing Maulvi Bazar Telemetering station, through dedicated VHF Radio Links and leased T&T Microwave circuits, would be made available at Dhaka (Mogh Bazar Terminal. These signals would then be required to be transmitted to FF&WC at WAPDA Building through a Multiplex Radio Link. Three possibilities were investigated thoroughly.

1. Direct Multiplex Radio Link between Mogh Bazar and WAPDA Building.

2. Multiplex Radio Link between Mogh Bazar and WAPDA Building through a passive reflector or repeater at Ramna (Dhaka).

3. Use the existing Coaxial Cable Link between Mogh Bazar and Ramna for transmitting the signals collected at Mogh Bazar Terminal to Ramna and then transmitting them to WAPDA Building by Multiplex Radio Link (2 Mbit/s PCM Digital Radio System) to be installed between Ramna and WAPDA Building.

All the three options were discussed at separate meetings with the following BTTB officials.

1. Director (International), Central Office, Dhaka.
2. Director (Transmission - II), Mohakhali, Dhaka.
3. DE (C&W) Ramna, Dhaka.
4. DE (Microwave Mtce-I), Ramna, Dhaka
5. DE (Microwave Mtce-II), Mogh Bazar, Dhaka
6. DE (C&W Maintenance), Central Office, Dhaka.

Preliminary findings indicate that options 1 & 2 are not very promising as the Mogh Bazar antenna tower is almost completely blocked in the southern side by Century Tower and direct line of sight propagation is possible only if the top portion of the antenna tower is used. But it is feared that a high-rise building may come up in the path in future and obstruct propagation. Moreover, the top portions of both Mogh Bazar and Ramna antenna towers are already filled with different types of antennas.

The third option of using the existing Coaxial Cable Link between Mogh Bazar and Ramna appears to be the best choice. Preliminary investigation has shown that a Group (12 channels) or even a Super Group (60 Channels) may now be used from this Link, if required. This has become possible due to the transfer of many circuits from the Coaxial Cable Link to the newly installed Optical Fiber Link between Mogh Bazar and Ramna in connection with the Dhaka-Khulna Digital Microwave Link.

Establishing a Muiltiplex Radio Link (2 Mbit/s PCM Digital Radio) between Ramna and WAPDA Building is relatively simple as direct line of sight propagation is possible and the possibility of a new high-rise building coming up in the propagation path in future is very remote as there is only the Bangabhavan in between and a Grid Parabolic antenna may be installed at a relatively lower height (50m) in Ramna. The antenna tower at this height in Ramna is quite free.

However, all the options need to be scrutinized further. It is understood that the final choice will be made by concerned BWDB and BTTB officials after detailed discussions.

3. Yearly Leasing Fee of T&T Circuits

A preliminary estimate of the yearly leasing Fee of T&T Microwave circuits was made. In this connection, the JICA team visited Director (Telecom-II), DTR, Ramna, Dhaka. The following information was collected from the office of the Director (Telecom-II), DTR.

CHARGES PER CHANNEL

Application Fee	: Tk.	5,00 .00	
Installation Charge	: Tk.	30,000.00	
Microwave Circuit Charge	: Tk.	1,400.00	per km per year
Minimum Circuit Charge	: Tk.	150,000.00	per year

Yearly Leasing Fee for Dhaka - Rajshahi (294.9 km)	: Tk.	412,860.00
Yearly Leasing Fee for Dhaka - Nawabganj (332.9 km)	: Tk.	466,060.00
Yearly Leasing Fee for Rajshahi - Nawabganj (38 km)	: Tk.	150,000.00
Yearly Leasing Fee for Dhaka - Sylhet (216,1 km)	: Tk.	302,540.00
Yearly Leasing Fee for Dhaka - Maulvi Bazar (264.7 km)	: Tk.	370,580.00
Yearly Leasing Fee for Dhaka - Beani Bazar (274.6 km)	: Tk.	346,640.00
Yearly Leasing Fee for Sylhet - Maulvi Bazar (48.6 km)	: Tk.	150,000.00
Yearly Leasing Fee for Sylhet - Beani Bazar (31.5 km)	: Tk.	150,000.00
Yearly Leasing Fee for Dhaka - Rangpur (302.5 km)	: Tk.	423,500.00
Yearly Leasing Fee for Dhaka - Kurigram (341.5 km)	: Tk.	478,100.00
Yearly Leasing Fee for Rangpur - Kurigram (39 km)	: Tk.	150,000.00

STATION NAME	:	NAWABGANJ	DATE : 27.06.91
COORDINATED WITH	:	AE (C&W), Rajshahi SAE (C&W), Nawabganj	
EQUIPMENT	:	MOTOROLA STARPLEX Multiplex system and STARPOINT Radio for Nawabganj-Rajshahi Link	
		Channel Capacity : 24 ch Input Level at Terminal : -16 dBm Output Level at Terminal : +8 dBm Level Deviation : ± 0.5 dB Span S/N : More than 50 dB Radio frequency : fTx=1713.5MHz, fRx=1832.5 MHz Signalling system : E&M Type Frequency : 3825 Hz Logic : Tone on when active	
AVAILABILITY OF ONE SPARE CHANNEL	:	Nawabganj-Rajshahi : Available Nawabganj-Dhaka : Available	
ANTENNA TOWER	:	Type : Guyed type Height : 60 m Height at which BWDB antenna may be installed : 30 m	
EXISTING POWER SUPPLY	:	220 VAC 50 Hz Single Phase : Available 24 VDC : Available 24 VDC may be used but it is recommended to use separate DC Power Supply for BWDB equipment	
LEASE FEE	:	Application Fee : Tk. 500.00 Installation Charge : Tk. 30,000.00 Yearly Lease Fee for Nawabganj-Rajshahi (38 km) : Tk 150,000.00 Yearly Lease Fee for Nawabganj-Dhaka (332.9 km) : Tk. 466,060.00	
AVAILABILITY OF SPACE FOR BWDB EQUIPMENT	:	Space is available for BWDB equipment	

STATION NAME : RAJSHAHI DATE : 28.06.91

COORDINATED WITH : AE (C&W), Rajshahi

EQUIPMENT : a) MOTOROLA STARPLEX Multiplex System and STARPOINT Radio for Rajshahi-Nawabganj Link

Channel Capacity	:	24 ch
Input Level at Terminal	:	-16 dBm
Output Level at Terminal	:	+8 dBm
Level Deviation	:	± 0.5 dB
Span S/N	:	More than 50 dB
Radio frequency	:	fTx= fRx=
Signalling System	:	E&M Type Frequency : 3825 Hz Logic : Tone on when active

b) NEC FDM Carrier Terminal Equipment and FUJITSU Radio for Rajshahi-Bogra-Dhaka Link

System Capacity	:	960 ch
Input Level at Terminal	:	-16 dBm
Output Level at Terminal	:	+8 dBm
Level Deviation	:	± 0.5 dB
Span S/N	:	More than 50 dB
Radio frequency	:	In the 6 GHz common carrier band (6430-7110 MHz)
Signalling system	:	Frequency : 3825 Hz Logic : Tone on when idle

AVAILABLE OF ONE SPARE CHANNEL : Rahshahi-Nawabganj : Available
Rajshahi-Dhaka : Available

ANTENNA TOWER : Type : Self-Supporting type
Tower height : 60 m
Height at which BWDB antenna may be installed : 60 m

EXISTING POWER SUPPLY :

220 VAC 50 Hz Single Phase	:	Available
380 VAC 50 Hz 3 Phase	:	Available
24 VDC	:	Available
48 VDC	:	Available

Separate DC Power Supply is recommended to be used for BWDB equipment.

LEASE FEE : Application Fee : Tk. 500.00
Installation Charge : Tk. 30,000.00
Yearly Lease Fee for Rajshahi-Nawabganj (38 km) : Tk. 150,000.00
Yearly Lease Fee for Rajshahi-Dhaka (294.9 km) : Tk. 412,860.00

AVAILABILITY OF SPACE FOR BWDB EQUIPMENT : Space is available for BWDB equipment

STATION NAME : SYLHET DATE : 04.07.91

COORDINATED WITH : AE (C&W), Sylhet

EQUIPMENT : a) NEC FDM Carrier Terminal Equipment and TOSHIBA Radio for Sylhet-Dhaka Link

System Capacity	:	960 ch
Input Level at Terminal	:	-16 dBm
Output Level at Terminal	:	+8 dBm
Level Deviation	:	± 0.5 dB
Span S/N	:	More than 50 dB
Radio frequency	:	In the 6 GHz common carrier band (5925-6425 MHz)
Signalling System	:	Frequency : 3825 Hz Logic : Tone on when idle

b) MOTOROLA STARPLEX Multiplex System and STAR POINT Radio for Sylhet-Maulvi Bazar Link

System Capacity	:	120 ch
Input Level at Terminal	:	-16 dBm
Output Level at Terminal	:	+8 dBm
Level Deviation	:	± 0.5 dB
Span S/N	:	More than 50 dB
Radio frequency	:	fTx = 1832.5 MHz, fRx=1713.5 MHz
Signalling system	:	E & M Type Frequency : 3825 Hz Logic : Tone on when active

c) NOKIA PCM Multiples Equipment + Digital Radio for Sylhet-Golapganj-Beani Bazar Link

System Capacity	:	30 ch (2 Mbit/s)
Input & Output Level	:	Conforms to CCITT Rec.
BER	:	10^{-6}
Radio frequency	:	fTx = 2496.70 MHz, fRx=2615.75 MHz
Signalling System	:	Digital signalling system

AVAILABILITY OF ONE SPARE CHANNEL : Sylhet-Dhaka : Available
Sylhet-Maulvi Bazar : Available
Sylhet-Beani Bazar : Available

ANTENNA TOWER : Type : Self-Supporting type
Tower height : 70 m
Height at which BWDB antenna may be installed : 30 m

EXISTING POWER SUPPLY : 220 VAC 50 Hz Single Phase : Available
24 VDC : Available
48 VDC : Available

		Recommended to use separate DC Power Supply for BWDB equipment
LEASE FEE	:	Application Fee : Tk. 500.00 Installation Charge : Tk. 30,000.00 Yearly Lease Fee for Sylhet-Beani Bazar (31.5 km) : Tk. 150,000.00 Yearly Lease Fee for Sylhet-Dhaka (216.1 km) : Tk. 302,540.00 Yearly Lease Fee for Sylhet-Maulvi Bazar (48.6 km) : Tk. 150,000.00
AVAILABILITY OF SPACE FOR BWDB EQUIPMENT	:	No space is available in the main Carrier + Radio room. However, enough space is available in the Equipment Room for Upazila Links for the installation of BWDB equipment.

STATION NAME	:	MOULVI BAZAR	DATE : 06.07.91
COORDINATED WITH	:	AE (C&W), Sylhet SAE (C&W), Moulvi Bazar	
EQUIPMENT	:	MOTOROLA STARPLEX Multiplex System and STARPOINT Radio for Maulvi Bazar Sylhet Link	
		Channel Capacity : 120 ch Input Level at Terminal : -16 dBm Output Level at Terminal : +8 dBm Level Deviation : ± 0.5 dB Span S/N : More than 50 dB Radio frequency : fTx=1713.5MHz, fRx=1832.5 MHz Signalling system : E&M Type Frequency : 3825 Hz Logic : Tone on when active	
AVAILABILITY OF ONE SPARE CHANNEL	:	Moulvi Bazar-Sylhet : Available Moulvi Bazar-Dhaka : Available	
ANTENNA TOWER	:	Type : Self-Supporting type Height : 129.5 m Height at which BWDB antenna may be installed : 60 m	
EXISTING POWER SUPPLY	:	220 VAC 50 Hz Single Phase : Available 48 VDC : Available 24 VDC : Available 24 VDC Power Supply may be used but it is recommended to use separate DC Power Supply for BWDB equipment	
LEASE FEE	:	Application Fee : Tk. 500.00 Installation Charge : Tk. 30,000.00 Yearly Lease Fee for Maulvi Bazar-Sylhet (48.6 km) : Tk. 150,000.00 Yearly Lease Fee for Maulvi Bazar-Dhaka (254.7 km) : Tk. 370,580.00	
AVAILABILITY OF SPACE FOR BWDB EQUIPMENT	:	Space is available for BWDB equipment	

STATION NAME	:	BEANI BAZAR DATE : 04.07.91
COORDINATED WITH	:	BANGLADESH RURAL TELECOM AUTHORITY
EQUIPMENT	:	NOKIA PCM Multiplex Equipment + Digital Radio for Beani Bazar-Sylhet Link System Capacity : 30 ch Input & Output Levels : C [illegible] Deg. Bit Error Rate : 10^{-6} Radio frequency : fTx = 2514.25 MHz, fR[illegible] Signalling System : Digital signalling system
AVAILABILITY OF ONE SPARE CHANNEL	:	Beani Bazar-Sylhet : Available Beani Bazar-Dhaka : Available
ANTENNA TOWER	:	Type : Guyed type Height : 45 m Height at which BWDB a[illegible]
EXISTING POWER SUPPLY	:	220 VAC 50 Hz Si[illegible]hase : Available 24 VDC 48 VDC may be used but it is recommended to use separate DC Power Supply for BWDB equipment
LEASE FEE	:	Application Fee : Tk. 500.00 Installation Charge : Tk. 30,000.00 Yearly Lease Fee for Beani Bazar-Sylhet (31.5 km) : Tk. 150,000.00 Yearly Lease Fee for Beani Bazar-Dhaka (247.6 km) : Tk. 346,640.00
AVAILABILITY OF SPACE FOR BWDB EQUIPMENT	:	Space is available for BWDB equipment

STATION NAME	:	KURIGRAM	DATE : 15.07.91
COORDINATED WITH	:	AE (C&W), Rangpur SAE (C&W), Kurigram	
EQUIPMENT	:	MOTOROLA STARPLEX Multiplex System and STARPOINT Radio for Kurigram-Rangpur Link	
		Channel Capacity : 60 ch Input Level at Terminal : -16 dBm Output Level at Terminal : +8 dBm Level Deviation : ± 0.5 dB Span S/N : More than 50 dB Radio frequency : fTx=1713.5MHz, fRx=1846.5 MHz Signalling system : E&M Type Frequency : 3825 Hz Logic : Tone on when active	
AVAILABILITY OF ONE SPARE CHANNEL	:	Kurigram-Rangpur : Available Kurigram-Dhaka : Available	
ANTENNA TOWER	:	Guyed type (2 Nos.) Height : 60 m Height at which BWDB antenna may be installed : 30 m	
EXISTING POWER SUPPLY	:	220 VAC 50 Hz Single Phase : Available 24 VDC : Available Power Supply earthing condition : Not proper Recommended to use separate DC Power Supply for BWDB equipment	
LEASE FEE	:	Application Fee : Tk. 500.00 Installation Charge : Tk. 30,000.00 Yearly Lease Fee for Kurigram-Rangpur (39 km) : Tk. 150,000.00 Yearly Lease Fee for Kurigram-Dhaka (341.5 km) : Tk. 478,100.00	
AVAILABILITY OF SPACE FOR BWDB EQUIPMENT	:	Space is available for BWDB equipment	

STATION NAME	:	RANGPUR	DATE : 16.07.91
COORDINATED WITH	:	AE (C&W), Rangpur	

EQUIPMENT :

a) NEC FDM Carrier Terminal equipment + FUJITSU Radio for Rangpur-Bogra-Dhaka Link

System Capacity	:	960 ch
Input Level at Terminal	:	-16 dBm
Output Level at Terminal	:	+8 dBm
Level Deviation	:	± 0.5 dB
Span S/N	:	More than 50 dB
Radio frequency	:	In the 6 GHz common carrier band
Signalling system	:	Frequency : 3825 Hz Logic : Tone on when idle

b) MOTOROLA STARPLEX Multiplex System and STARPOINT Radio for Rangpur-Kurigram Link

System Capacity	:	60 ch
Input Level at Terminal	:	-16 dBm
Output Level at Terminal	:	+8 dBm
Level Deviation	:	± 0.5 dB
Span S/N	:	More than 50 dB
Radio frequency	:	
Signalling system	:	E&M Type Frequency : 3825 Hz Logic : Tone on when active

AVAILABILITY OF ONE SPARE CHANNEL	:	Rangpur-Kurigram Rangpur-Dhaka	: Available : Available

ANTENNA TOWER :
Type : Self-supporting Type
Height : 80 m
Height at which BWDB antenna may be installed : 60 m

EXISTING POWER SUPPLY	:	220 VAC 50 Hz Single Phase	: Available
		380 VAC 50 Hz 3 Phase	: Available
		48 V DC	: Available
		24 V DC	: Available

Recommended to use separate DC Power Supply for BWDB equipment

LEASE FEE :
Application Fee : Tk. 500.00
Installation Charge : Tk. 30,000.00
Yearly Lease Fee for Rangpur-Kurigram (39 km) : Tk. 150,000.00
Yearly Lease Fee for Rangpur-Dhaka (302.5 km) : Tk. 423,500.00

AVAILABILITY OF SPACE FOR BWDB EQUIPMENT : Little space is available in the equipment room but a slight rearrangement of storage shelves will allow the installation of BWDB equipment

REMARKS : Extremely high interference at f = 149.25 MHz coming mainly from Police Communications. Steps must be taken to reduce interference if BWDB equipment is installed to operate at this frequency.

STATION NAME	:	MOGH BAZAR (DHAKA)	DATE : 22.07.91 to 25.07.91
COORDINATED WITH	:	DE (MW Mtce-II), Mogh Bazar, Dhaka).	

EQUIPMENT

a) NEC FDM Carrier Terminal Equipment and TOSHIBA Radio for Dhaka-Sylhet and Dhaka-Bogra Links

b) NEC FDM Carrier Terminal Equipment for Mogh Bazar-Ramna Coaxial Cable Link

Channel Capacity	:	960 ch
Input Level at Terminal	:	-16 dBm
Output Level at Terminal	:	+8 dBm
Level Deviation	:	± 0.5 dB
Span S/N	:	More than 50 dB
Radio frequency	:	In the 6 GHz common carrier band
Signalling system	:	Frequency : 3825 Hz Logic : Tone on when idle

AVAILABILITY OF ONE SPARE CHANNEL :

Dhaka-Rajshahi	:	Available
Dhaka-Rajshahi-Nawabganj	:	Available
Dhaka-Sylhet	:	Available
Dhaka-Sylhet-Moulvi Bazar	:	Available
Dhaka-Sylhet-Beani Bazar	:	Available
Dhaka-Rangpur	:	Available
Dhaka-Rangpur-Kurigram	:	Available

ANTENNA TOWER : Type : Self-supporting Type
Height : 85 m
Height at which BWDB antenna may be installed : 60 m

EXISTING POWER SUPPLY :

220 VAC 50 Hz Single Phase	:	Available
380 VAC 50 Hz 3 Phase	:	Available
48 V DC	:	Available
24 V DC	:	Available

Separate DC Power Supply is recommended to be used if BWDB equipment is installed here

LEASE FEE : Application Fee : Tk. 500.00
Installation Charge : Tk. 30,000.00
Yearly Lease Fee for Dhaka-Nawabganj (332.9 km) : Tk. 466,060.00

Yearly Lease Fee for Dhaka-Rajshahi (294.9 km) : Tk. 412,860.00

Yearly Lease Fee for Dhaka-Sylhet (216.1 km) : Tk. 302,540.00

Yearly Lease Fee for Dhaka-Moulvi Bazar (264.7 km) : Tk. 370,580.00

Yearly Lease Fee for Dhaka-Beani Bazar (247.6 km) : Tk. 346,640.00
Yearly Lease Fee for Dhaka-Kurigram (341.5 km)

Yearly Lease Fee for Dhaka-Kurigram (341.5 km)
: Tk. 478,100.00

Yearly Lease Fee for Dhaka-Rangpur (302.5 km)
: Tk. 423,500.00

AVAILABILITY OF SPACE FOR BWDB EQUIPMENT : No space is available in the Carrier and Radio Equipment room for the installation of BWDB equipment.

However, space is available in the ITX room but installation of BWDB equipment here is subject to approval from BTTB

REMARKS : Extremely high interference at f = 149.25 MHz coming mainly from Police Communications. Steps must be taken to reduce interference if BWDB equipment is installed here to operate at this frequency. It would be advisable not to use this station for VHF telemetry receiving station if an alternate site is available.

STATION NAME	:	RAMNA (DHAKA)	DATE : 27.07.91 to 01.08.91
COORDINATED WITH	:	DE (MW Mtce-I), Ramna, Dhaka DE (C&W), Ramna, Dhaka	
EQUIPMENT	:	NEC FDM Carrier Terminal Equipment for Ramna-Mogh Bazar Coaxial Cable Link Channel Capacity : 960 ch Input Level at Terminal : -16 dBm Output Level at Terminal : +8 dBm Level Deviation : ± 0.5 dB Span S/N : More than 50 dB Signalling system : Frequency : 3825 Hz Logic : Tone on when idle	
AVAILABILITY OF ONE SPARE CHANNEL	:	A Group or even a Super Group is available between Ramna & Mogh Bazar in the Coaxial cable Link	
ANTENNA TOWER	:	Type : Self-supporting type Height : 78.5m Height at which BWDB antenna may be installed a) VHF omnidirectional antenna at h = 78.5 m b) Grid Parabolic antenna at h = 50 m	
EXISTING POWER SUPPLY	:	In the UHF & MW Radio Room 220 VAC 50 Hz Single Phase : Available 48 VDC : Available Separate DC Power Supply is recommended to be used for BWDB equipment.	
AVAILABILITY OF SPACE FOR BWDB EQUIPMENT	:	Space is available for the installation of Telemetry and 2 Mbit/s PCM Radio Equipment in the UHF &.MW Radio Room	

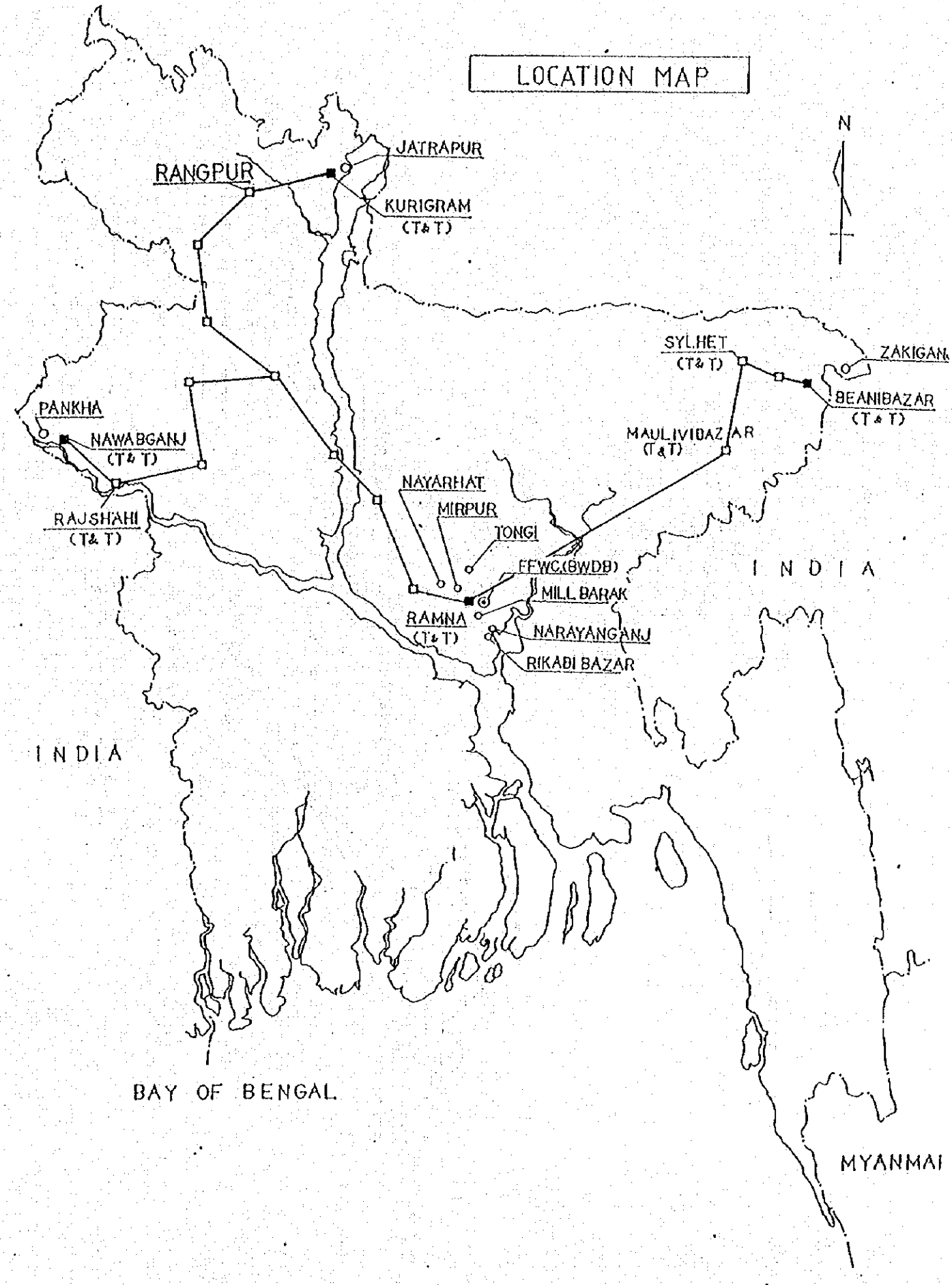
APPENDIX-E : RADIOWAVE PROPAGATION TEST DATA, LOCATION MAP AND SITE DRAWING OF EACH STATION

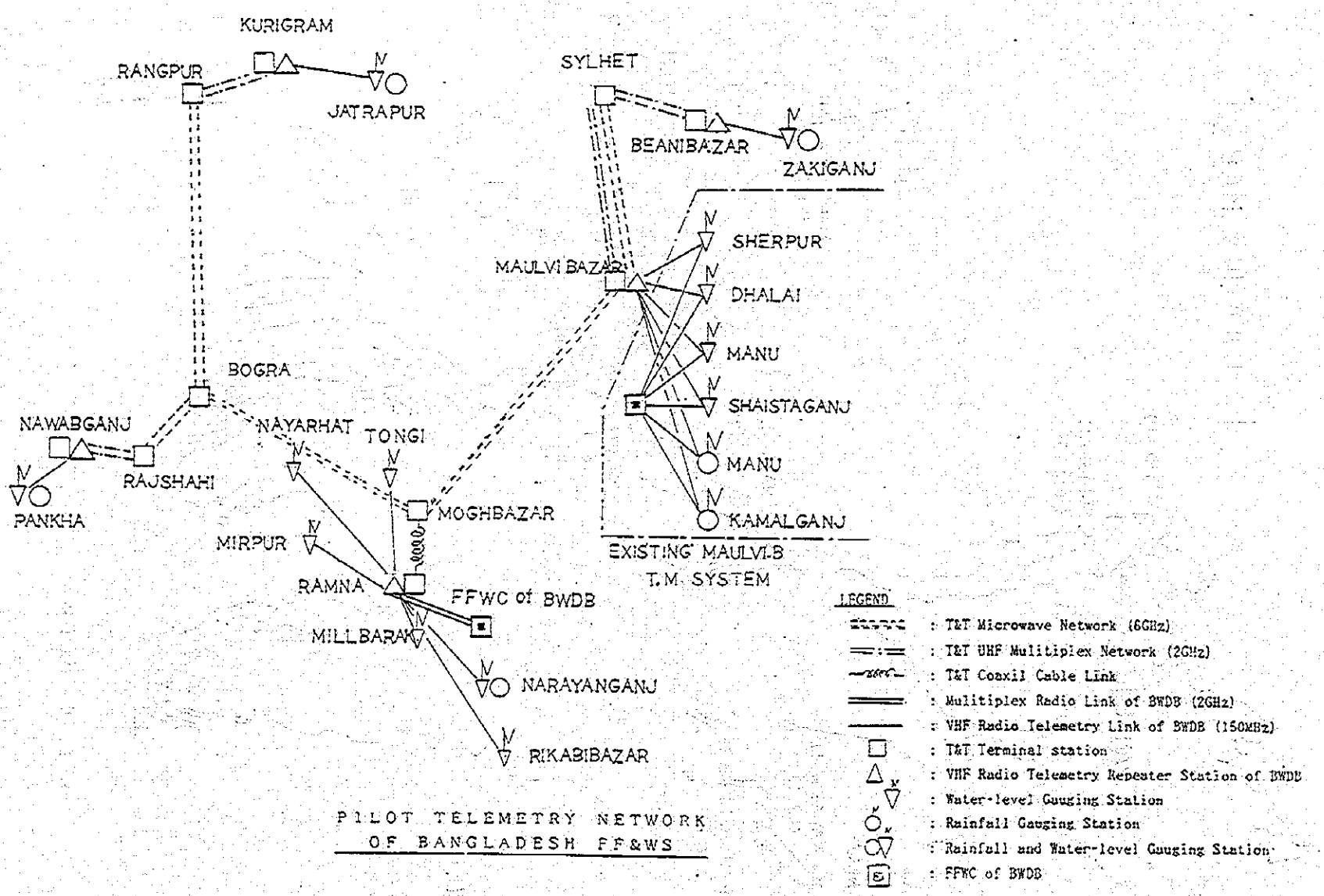
E - 1 : LOCATION MAP

E - 2 : PILOT TELEMETERING NETWORK OF BANGLADESH FF&WS

E - 3 : LOCATION MAP AND MIRROR TEST DATA FOR MICRO WAVE RADIO LINK

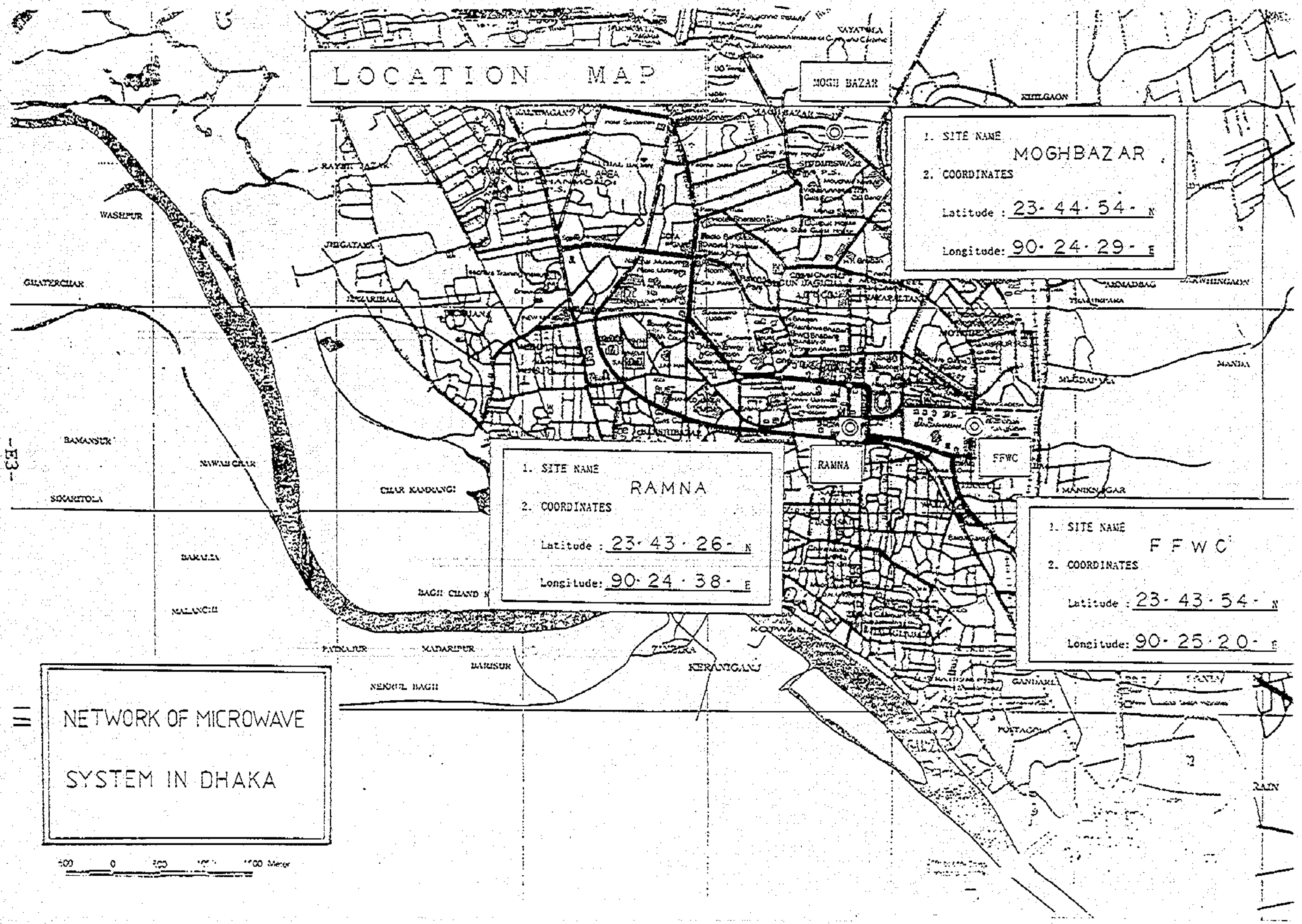
E - 4 : AZIMUTH & DISTANCE, LOCATION MAP OF SURVEYED SITE AND VHF RADIO WAVE PROPAGATION TEST DATA FOR TELEMETERING PILOT SYSTEM


LOCATION MAP
N
JATRAPUR
RANGPUR
KURIGRAM
(T&T)
SYLHET
(T&T)
ZAKIGANJ
BEANIBAZAR
(T&T)
PANKHA
NAWABGANJ
(T&T)
MAULVIBAZAR
(T&T)
NAYARHAT
MIRPUR
TONGI
RAJSHAHI
(T&T)
FFWC.(BWDB)
MILL BARAK
RAMNA
(T&T)
NARAYANGANJ
RIKABI BAZAR
INDIA
INDIA
BAY OF BENGAL
MYANMAI



PILOT TELEMETRY NETWORK
OF BANGLADESH FF&WS

MIRROR TEST FOR MICROWAVE RADIO LINK


LOCATION MAP
MOGH BAZAR
1. SITE NAME MOGHBAZAR
2. COORDINATES
Latitude : 23·44·54· N
Longitude: 90·24·29· E
1. SITE NAME RAMNA
2. COORDINATES
Latitude : 23·43·26· N
Longitude: 90·24·38· E
RAMNA
FFWC
1. SITE NAME F F W C
2. COORDINATES
Latitude : 23·43·54· N
Longitude: 90·25·20· E
KHILGAON
WASHPUR
GHATERCHAR
BAMANSUR
NAWABCHAR
SIKARITOLA
BARALIA
MALANCHI
CHAR KAMRANGI
BAGH CHAND
MADARIPUR
BARISUR
KERANIGANJ
GANDARIA
MANDA
MANIKNAGAR
NETWORK OF MICROWAVE
SYSTEM IN DHAKA
1000 Meter

LOCATION MAP OF SURVEYED SITE

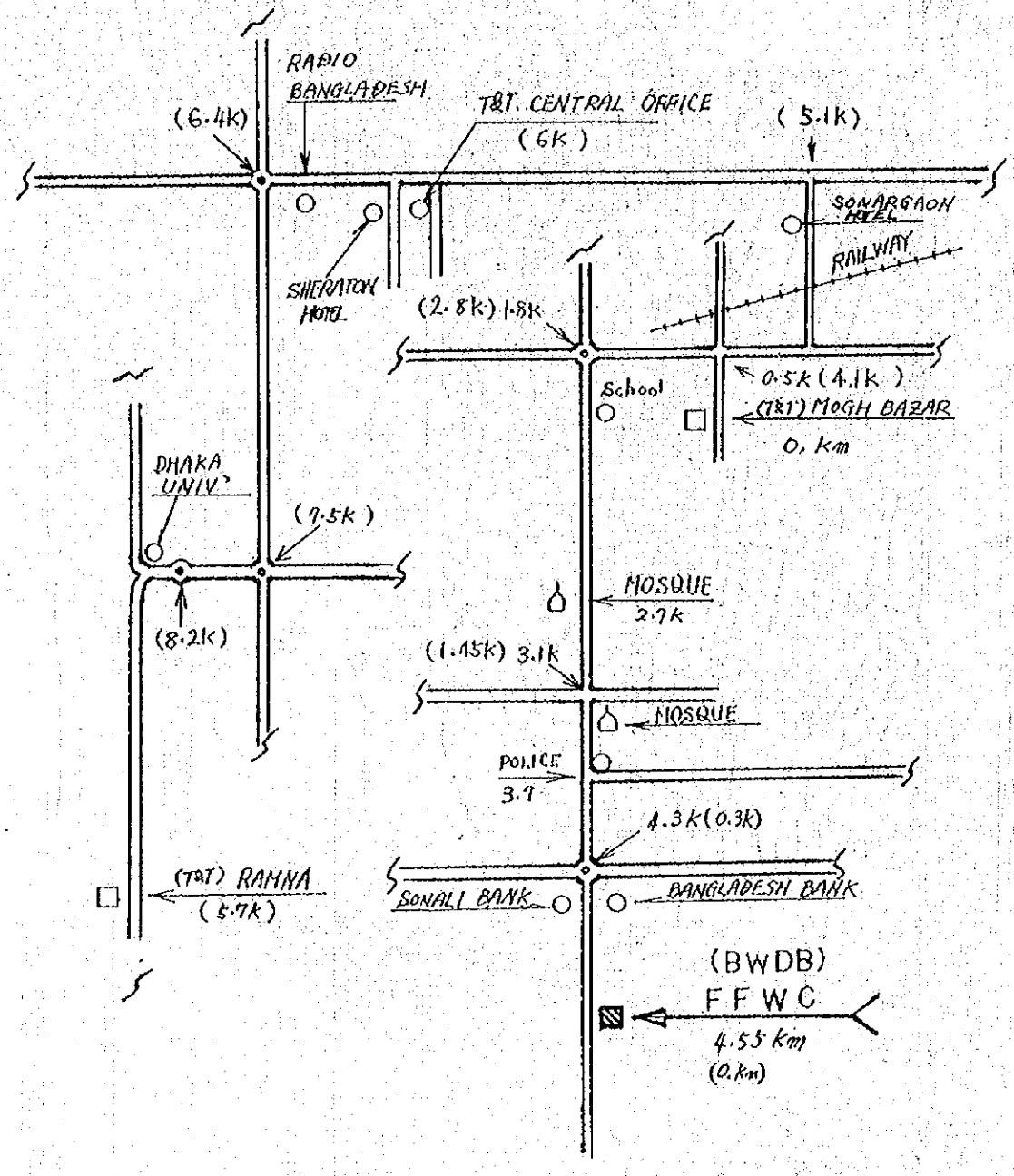
1. SITE NAME

2. COORDINATES F F W C

Latitude : 23° 43 ' 25 " N

Longitude: 90° 25 ' 20 " E

3. LOCATION MAP



LOCATION MAP OF SURVEYED SITE

1. SITE NAME

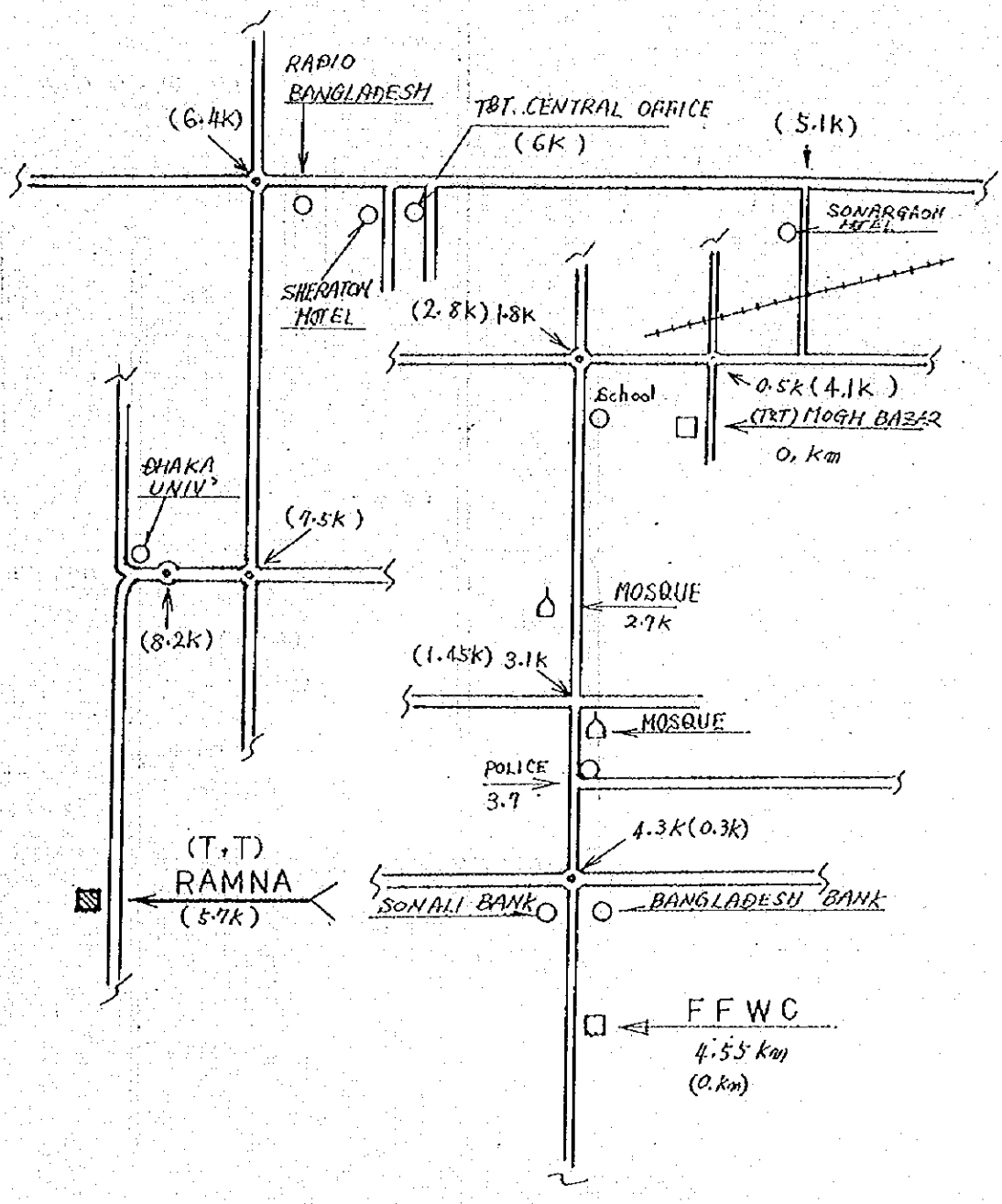
(T&T)

2. COORDINATES RAMNA

Latitude : 23° 43 ' 26 " N

Longitude: 90° 24 ' 38 " E

3. LOCATION MAP



LOCATION MAP OF SURVEYED SITE

1. SITE NAME

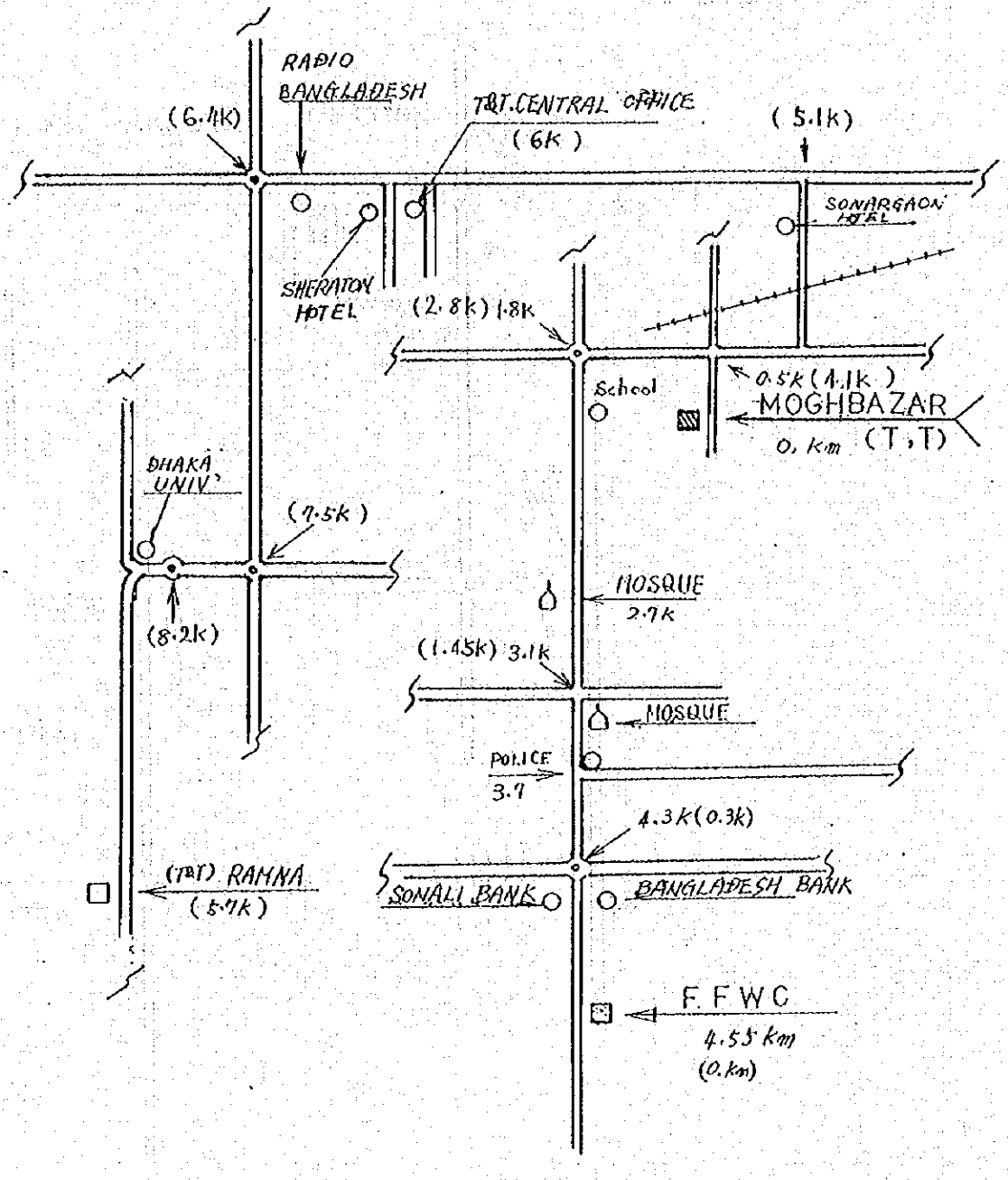
(T& T)

2. COORDINATES MOGHBAZAR

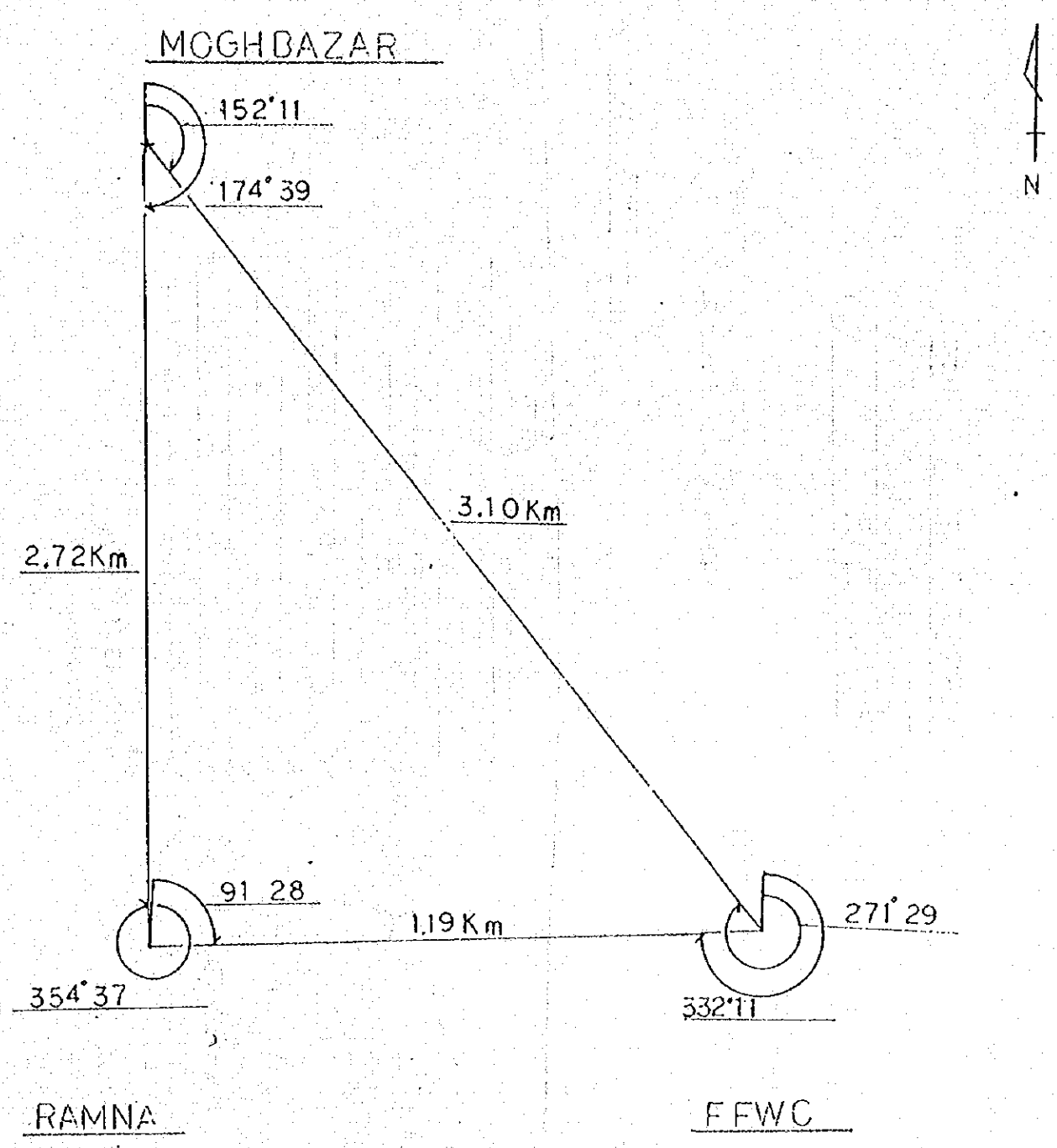
Latitude : 23° 44' 54" N

Longitude: 90° 24' 29" E

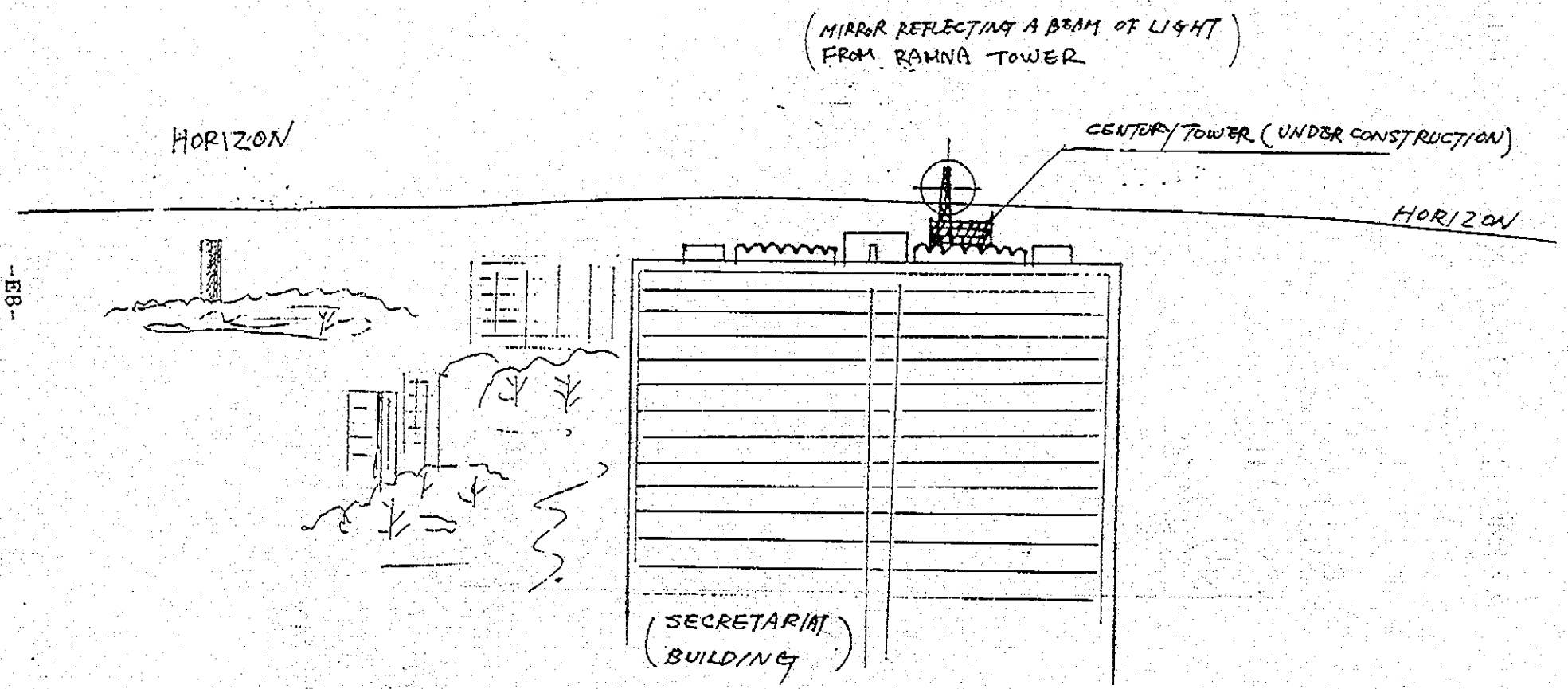
3. LOCATION MAP



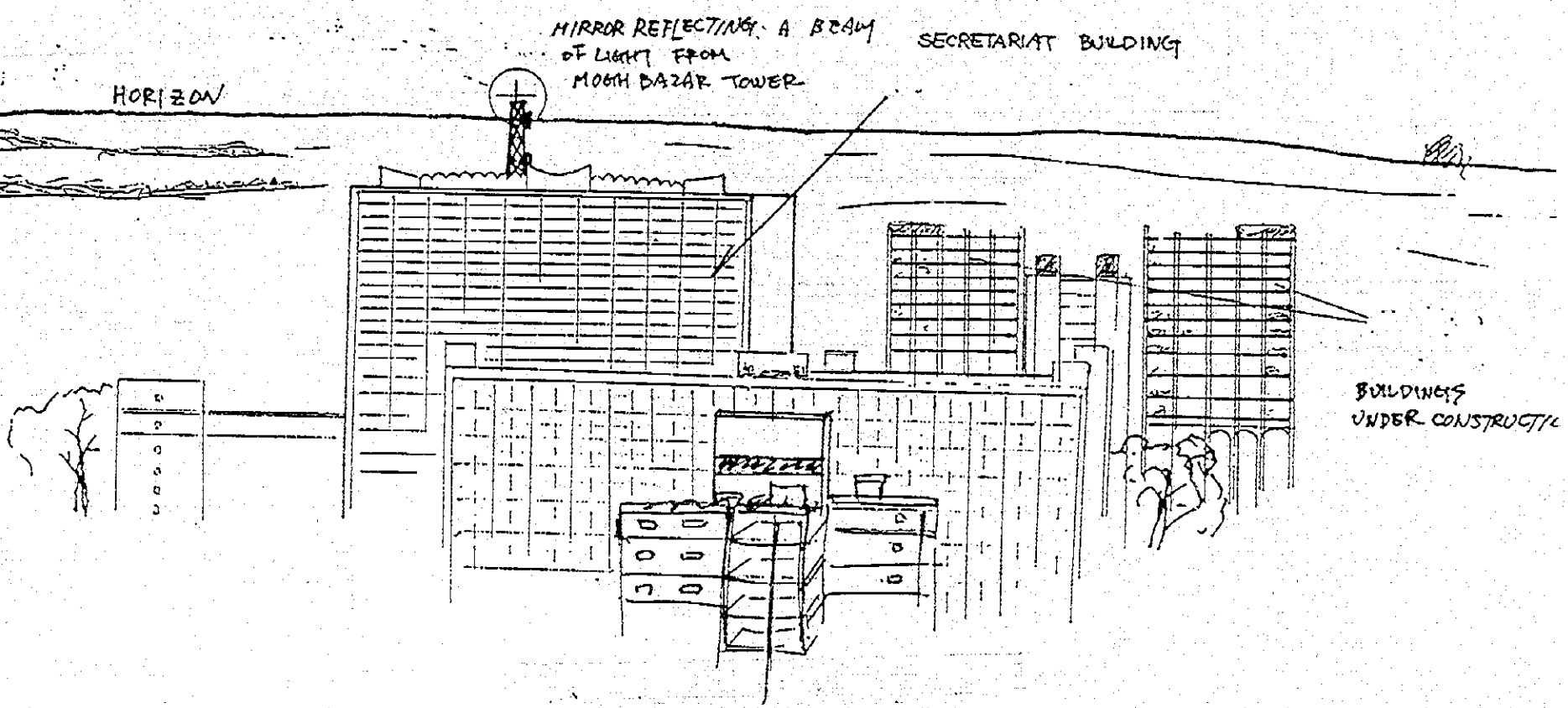
AZIMUTH DISTANCE FOR MICROWAVE (UHF) RADIO LINK



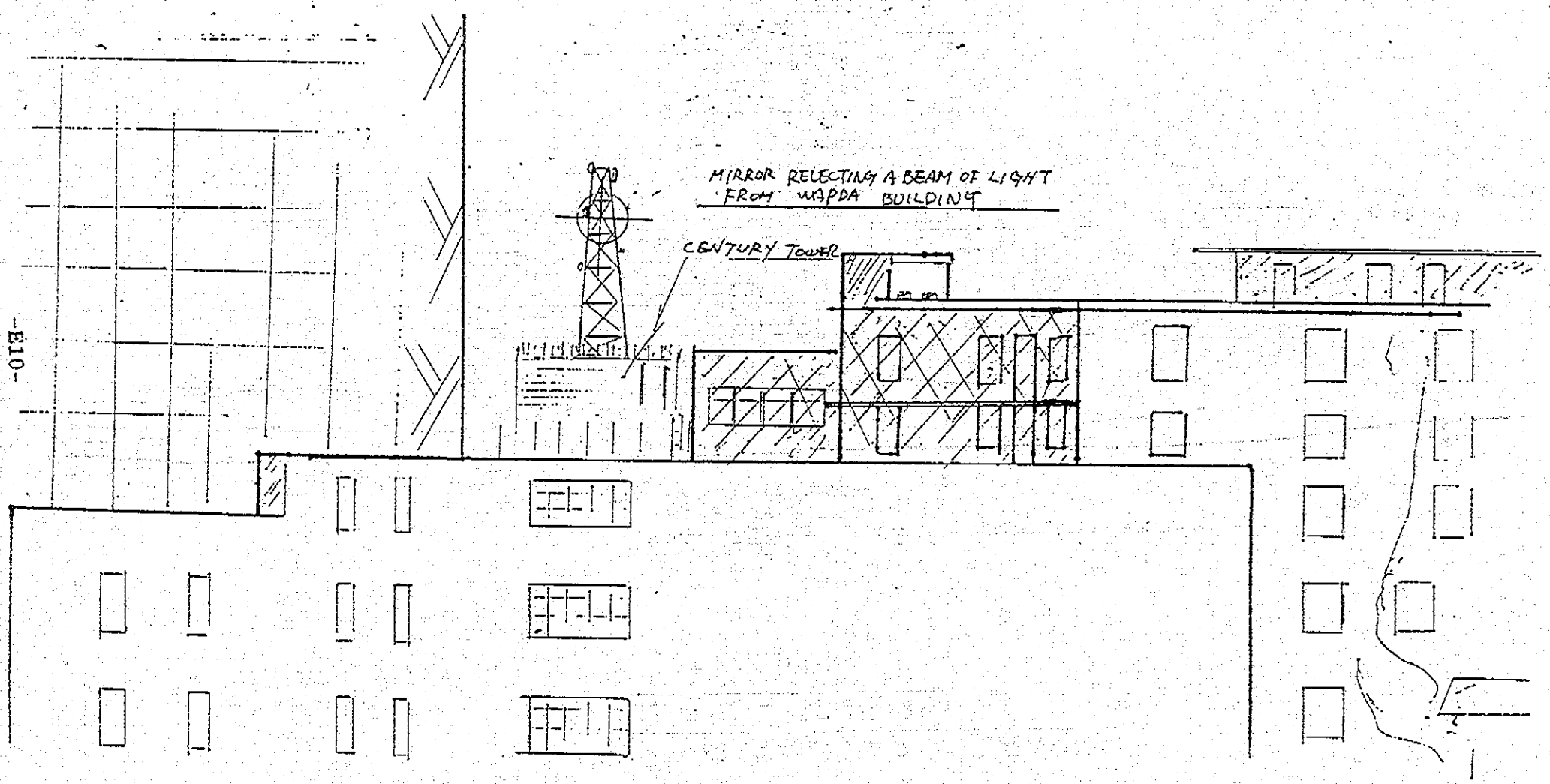
MIRROR TEST BETWEEN TdT RAMNA AND TαT MOGHBAZAR



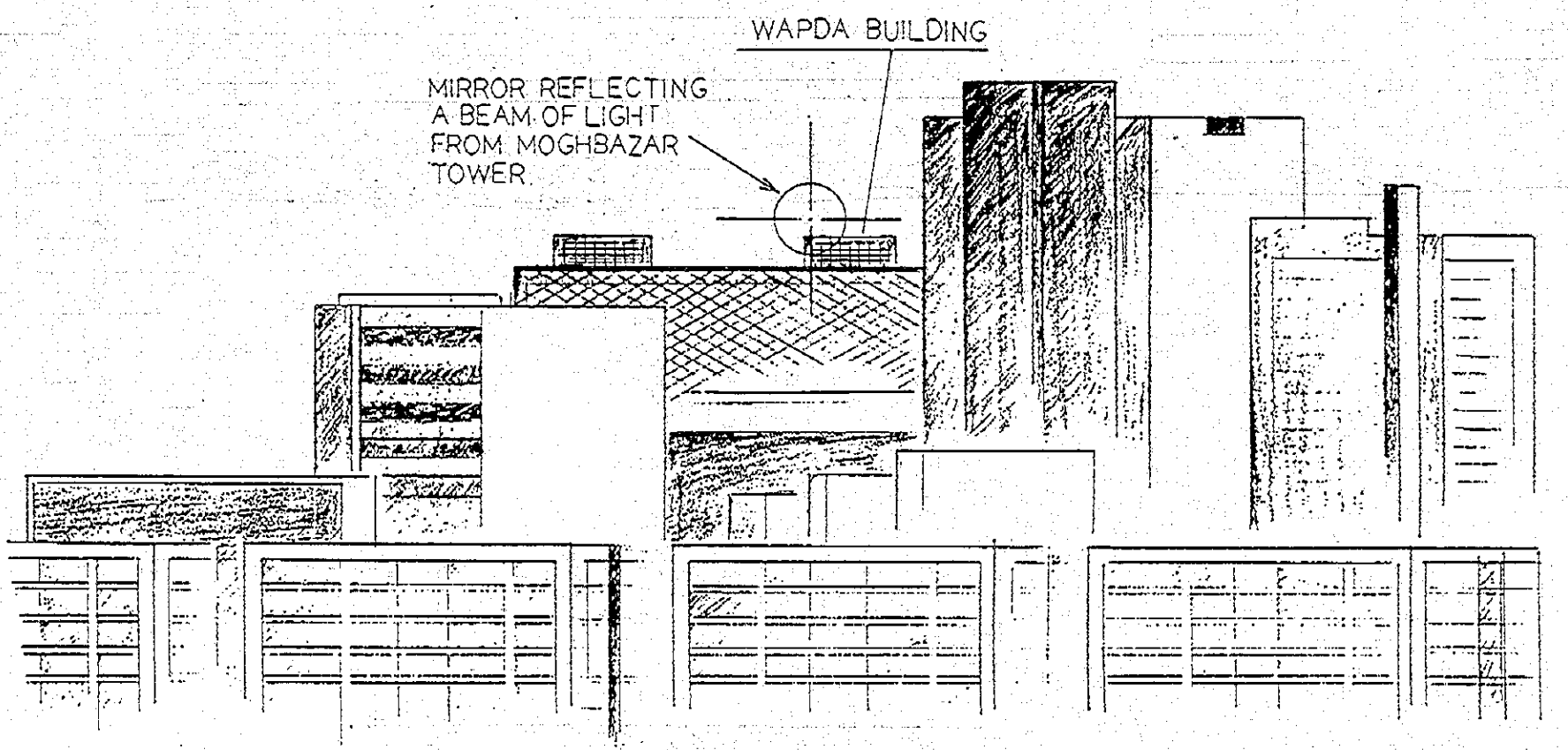
MIRROR TEST BETWEEN T&T MOGHBAZAR AND RAMNA ANTENNA TOWERS



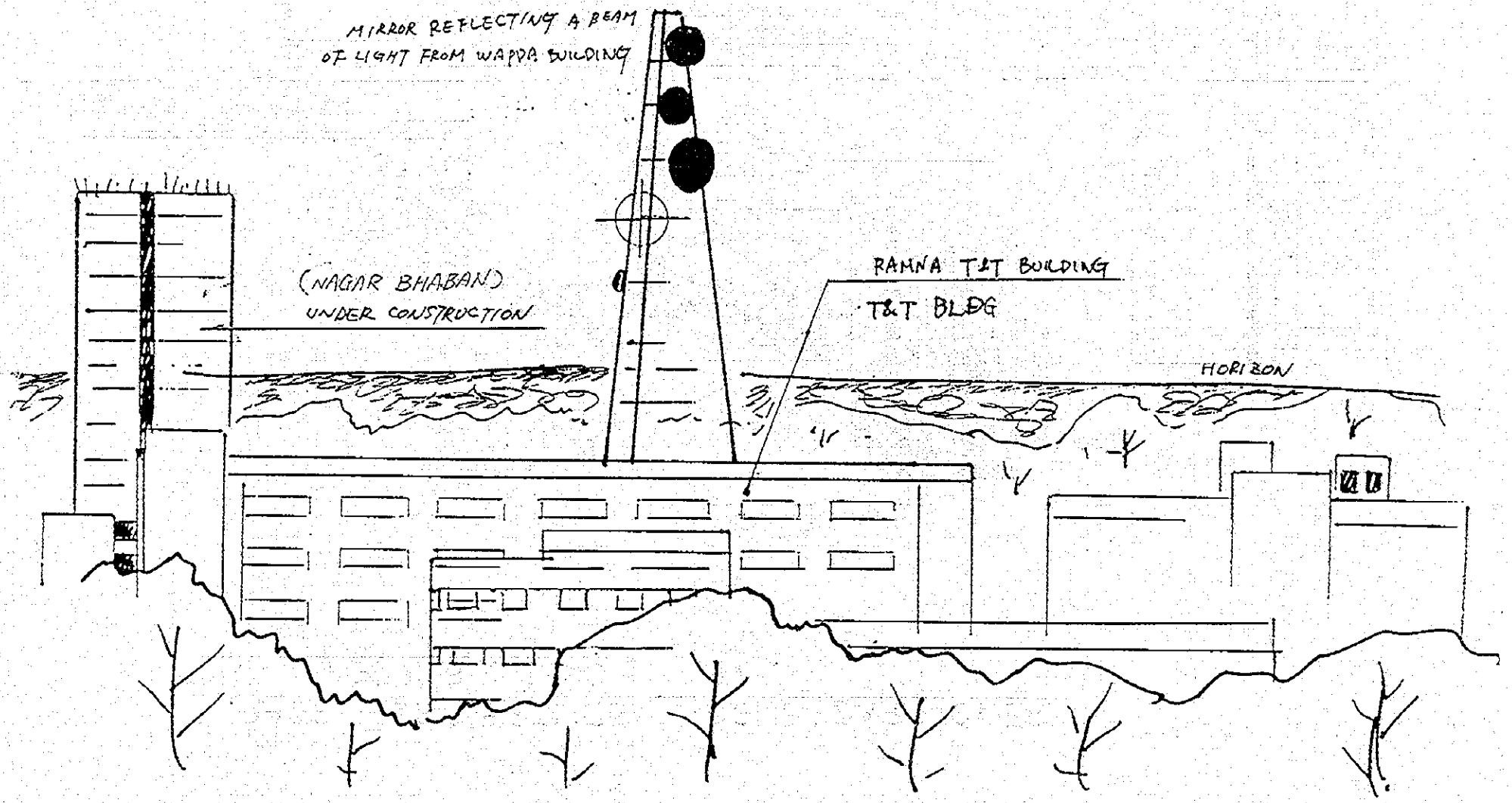
MIRROR TEST BETWEEN WAPDA BUILDING AND MOGHBAZAR ANTENNA TOWER



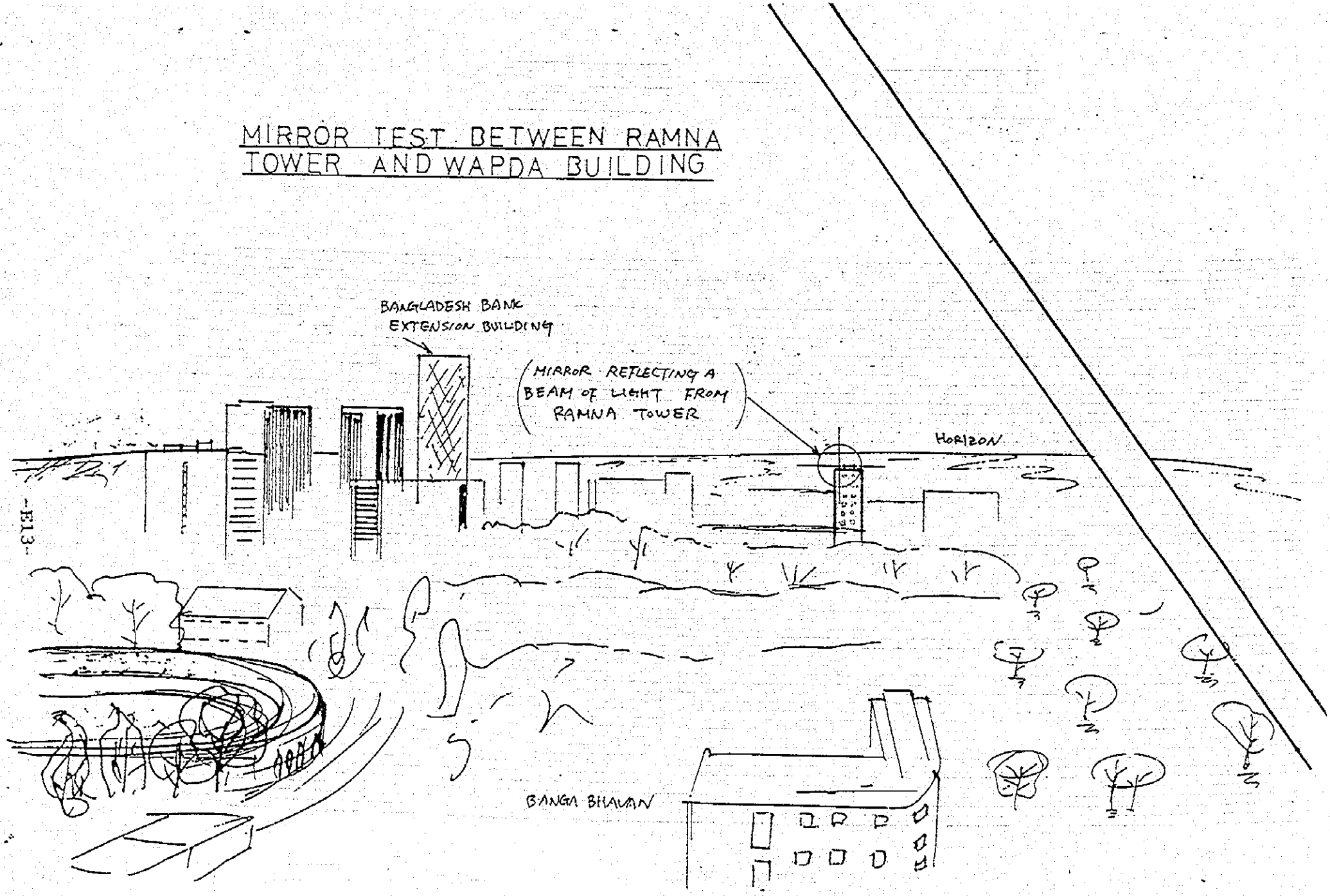
MIRROR TEST BETWEEN MOGHBAZAR TOWER AND WAPDA BUILDING



MIRROR TEST BETWEEN WAPDA BUILDING AND RAMNA TOWER



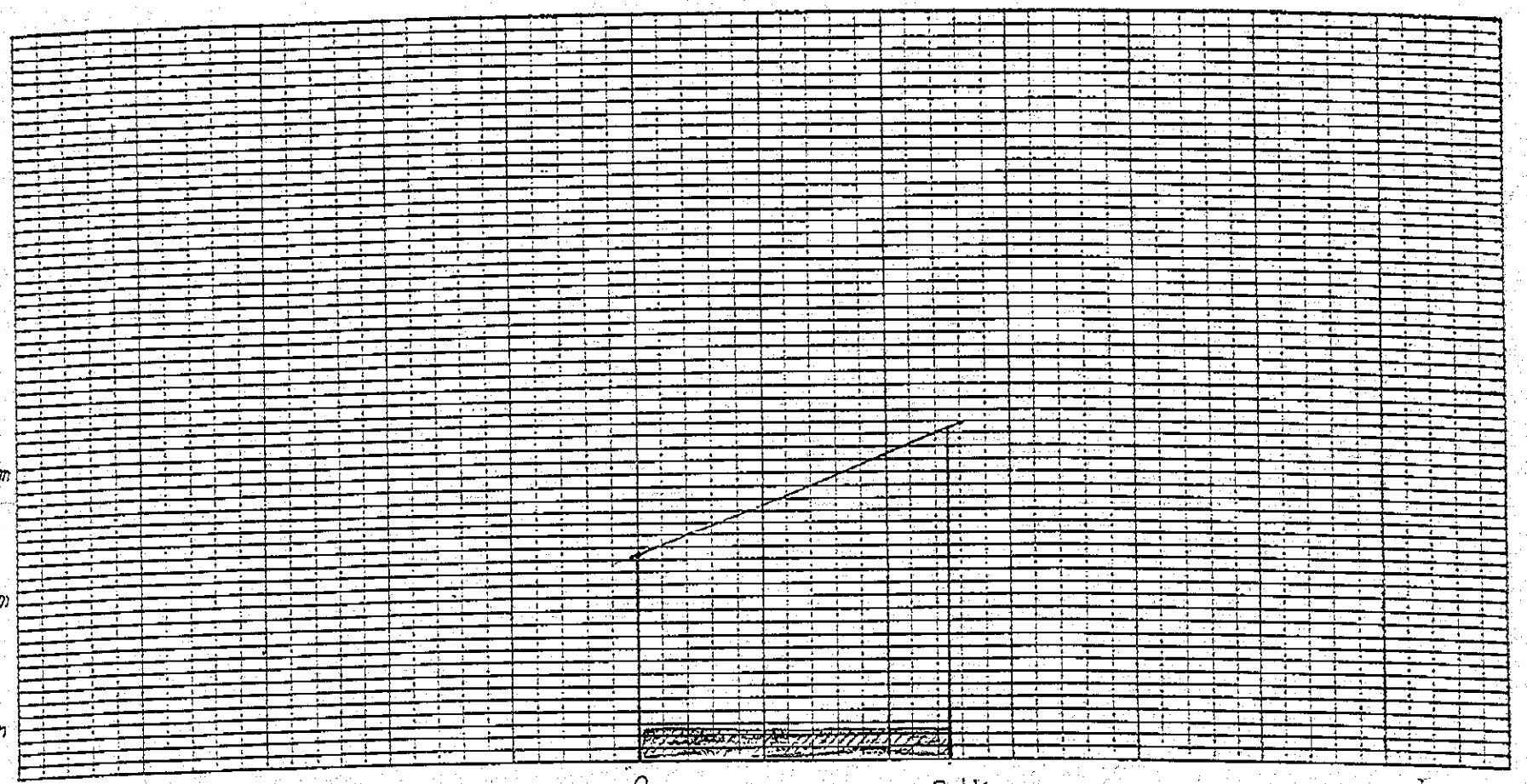
MIRROR TEST BETWEEN RAMNA TOWER AND WAPDA BUILDING



Scale; C Type 30km/600m

(15km/150m; 60km/2400m)

TERRAIN PROFILE



MAP: 79 I/6

W.A.P.D.A

ALTITUDE 6 m

ANTENNA HEIGHT 35m

3.1 km

MOGHBAZAR

ALTITUDE 6 m

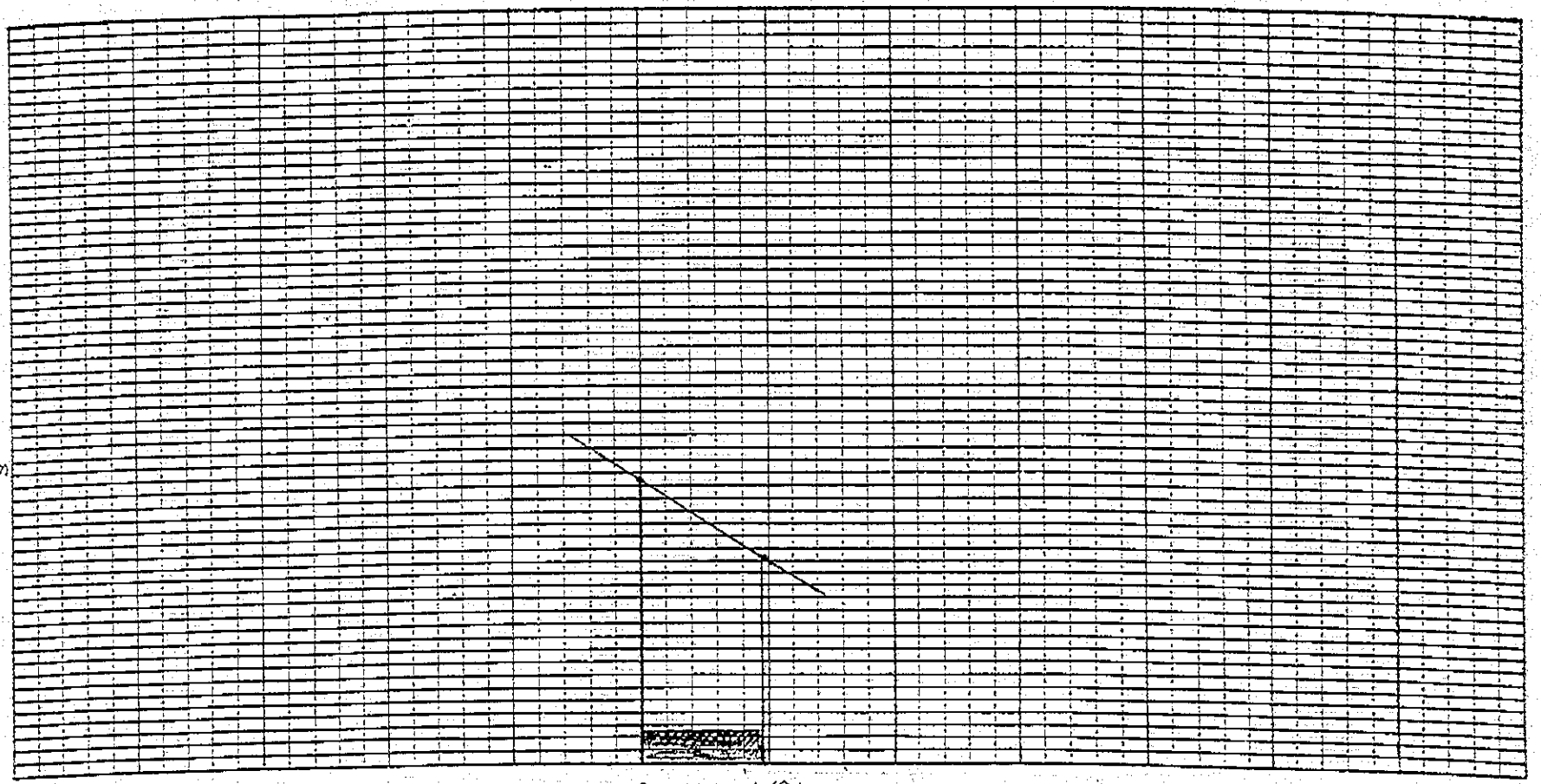
ANTENNA HEIGHT 60m

K=4/3

Scale ; C Type 30km/600m

(15km/150m ; 60km/2400m)

TERRAIN PROFILE



RAMNA
ALTITUDE 6 m
ANTENNA HEIGHT 50m

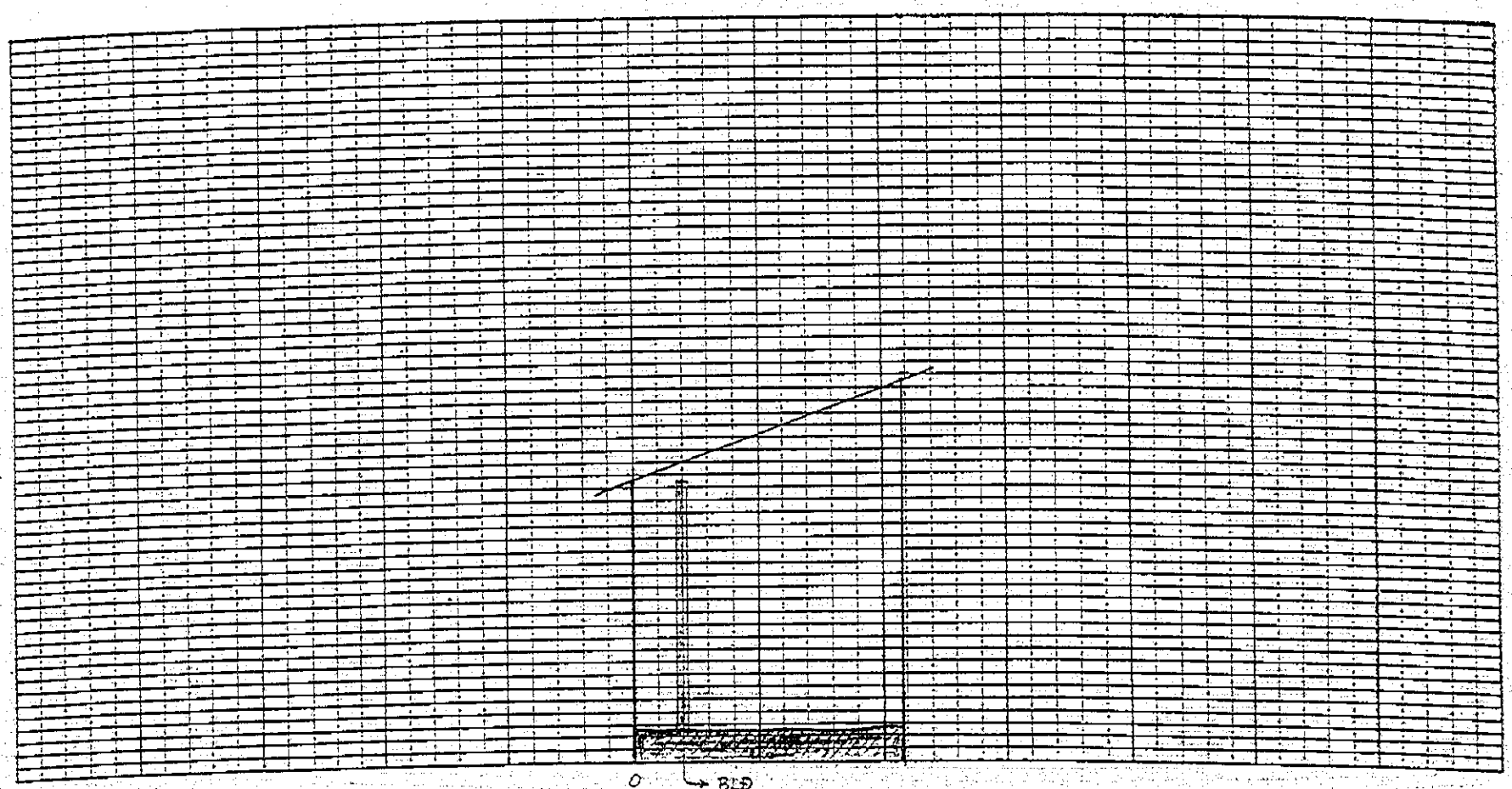
1.2 km

W.A.P.D.A
ALTITUDE 6 m
ANTENNA HEIGHT 35 m

K = 4/3

Scale; C Type 30km/600m
(15km/150m; 60km/2400m)

TERRAIN PROFILE



MAP : 79 I/6

RAMNA
ALTITUDE 6 m
ANTENNA HEIGHT 50m

2.7 km

MOGHBAZAR
ALTITUDE 6 m
ANTENNA HEIGHT 70m

K=4/3

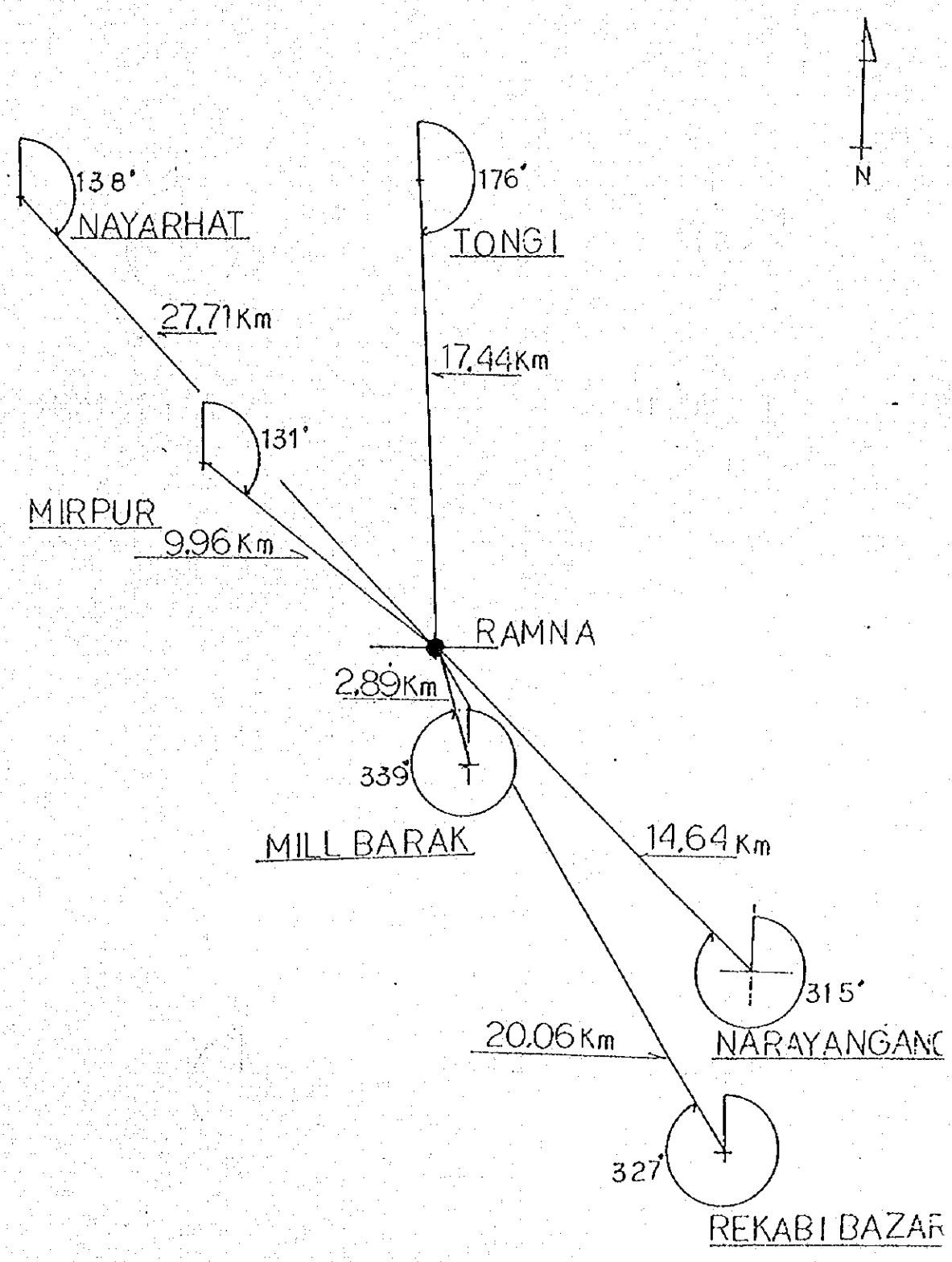
Radio Path Calculation for
2000 MHz Band PCM-QPSK Digital Radio Link

Span				a WAPDA	b T&T RAMNA	a WAPDA	b T&T RAMNA
Altitude				m	m	m	m
Antenna height				32 m	55 m	32 m	55 m
Radio path length				1.19 Km		1.19 Km	
Path type				Plain C= 1.0		Plain C= 1.0	
Feeder Type				WF-H50-7 50 m	WF-H50-7 85 m	WF-H50-7 50 m	WF-H50-7 85 m
Sub Coaxial Cable				8D-2W 1.0 m	8D-2W 1.0 m	8D-2W 1.0 m	8D-2W 1.0 m
Antenna Type				1.2mφ GPA	1.2mφ GPA	1.2mφ GPA	1.2mφ GPA
Model of Equipment				DR (2 Mb/s) 0.2 W (ATT 6 dB)		DR (2 Mb/s) 0.2 W (ATT 6 dB)	
1	Feeder Loss	a	dB	-3.9		-3.9	
		b	dB	-6.2		-6.2	
2	Duplexer Loss	T	dB	-3.0		-3.0	
		R	dB	-3.5		-3.5	
3	RF Hybrid Loss		dB	0.0		0.0	
4	Antenna Gain	a	dB	26.0		26.0	
		b	dB	26.0		26.0	
5	Reflector Gain	A	dB				
		B	dB				
6	Free Space Loss	A	dB	-100.0	d1= 1.19 Km	-100.0	d1= 1.19 Km
		B	dB		d2= Km		d2= Km
		C	dB		d3= Km		d3= Km
7	Azimuth Loss of Reflector	A	dB				
		B	dB				
8	Azimuth Loss of Antenna		dB				
9	Loss of Splitting Power		dB				
10	Shadow Loss	A	dB		d1= h1=		d1= h1=
		B	dB		d2= h2=		d2= h2=
11	Additional Loss	A	dB				
		B	dB				
		C	dB				
12	Span Loss	Loss	dB	-116.6		-116.6	
		Gain	dB	52.0		52.0	
		Total	dB	-64.6		-64.6	
13	Transmitting Power		dBm	17.0	0.2 W (ATT 6 dB)	17.0	0.2 W (ATT 6 dB)
14	Receiving Power		dBm	-47.6		-47.6	
15	Receiver Noise		dBm	-110.5	F= 3.0 dB B= 1.1 MHz	-110.9	F= 3.0 dB B= 1.1 MHz
16	C/N in median		dB	62.9		62.9	
17	Interference		dB	60.0	Presumed	60.0	Presumed
18	City Noise		dB	58.1	Presumed	58.1	Presumed
19	Others		dB	60.0		60.0	
20	Variable Factor Total		dB	53.9		53.9	
21	C/N for Variable Factor		dB	14.4	BER = 1 E-3	14.4	BER = 1 E-3
22	Fading Margin		dB	39.5		39.5	
23	Pr				Pr= 4.2E-09		Pr= 4.2E-09
24	Pre Considering Reflection				Pre= 4.2E-09		Pre= 4.2E-09
25	Diversity Improvement				Isd= 1.0E+00		Isd= 1.0E+00
26	Outage Time Due to Fading		%		Pm= 4.7E-11		Pm= 4.7E-11
27	Outage Margin		dB	---	57.4		57.4

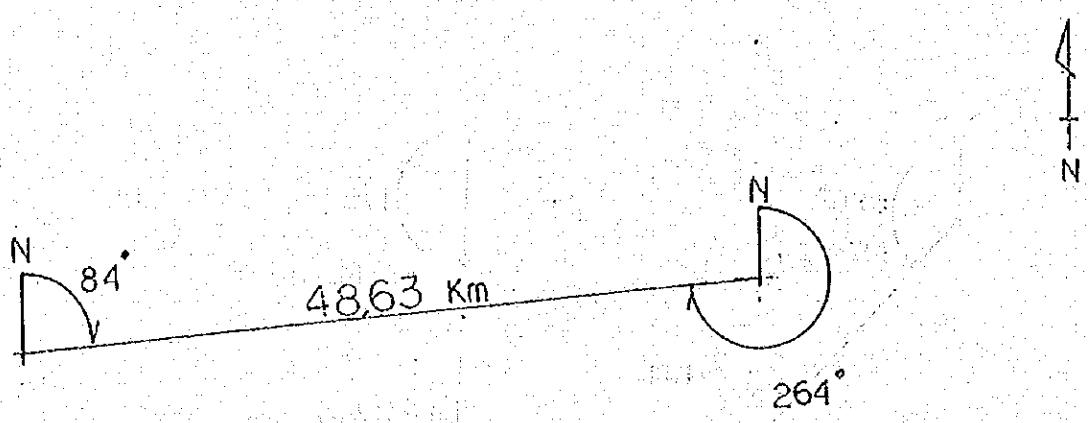
Radio Path Calculation for
2000 MHz Band PCM-QPSK Digital Radio Link

Span				a WAPDA (CENTER)		b T&T RAMNA	a T&T RAMNA		b T&T MOGBAZAR
Altitude				m		m	m		m
Antenna height				32 m		55 m	70 m		75 m
Radio path length				1.19 Km			2.72 Km		
Path type				Plain C= 1.0			Plain C= 1.0		
Feeder Type				WF-H50-13 50 m		WF-H50-7 15 m	WF-H50-7 15 m		WF-H50-13 110 m
Sub Coaxial Cable				8D-2W 1.0 m		8D-2W 0.0 m	8D-2W 0.0 m		8D-2W 1.0 m
Antenna Type				4.2m¢ GPA		3.0m¢ GPA	3.0m¢ GPA		4.2m¢ GPA
Model of Equipment				DR (2 Mb/s) 0.2 W (ATT 0 dB)			DR (2 Mb/s) W (ATT 0 dB)		
1	Feeder Loss	a	dB	-2.9			-1.0		
		b	dB	-1.0			-5.7		
2	Duplexer Loss	T	dB	-3.0					
		R	dB				-3.5		
3	RF Hybrid Loss		dB	0.0			0.0		
4	Antenna Gain	a	dB	36.3			33.3		
		b	dB	33.3			36.3		
5	Reflector Gain	A	dB						
		B	dB						
6	Free Space Loss	A	dB	-100.0	d1= 1.19 Km		-107.2	d1= 2.72 Km	
		B	dB		d2= Km			d2= Km	
		C	dB		d3= Km			d3= Km	
7	Azimuth Loss of Reflector	A	dB						
		B	dB						
8	Azimuth Loss of Antenna		dB						
9	Loss of Splitting Power		dB						
10	Shadow Loss	A	dB		d1=			d1=	
		B	dB		d2= h1=			d2= h1=	
11	Additional Loss	A	dB						
		B	dB						
		C	dB						
12	Span Loss	Loss	dB	-106.9			-117.3		
		Gain	dB	69.6			69.6		
		Total	dB	-37.3			-47.7		
13	Transmitting Power		dBm	23.0	0.2 W (ATT 0 dB)		-14.3	W (ATT 0 dB)	
14	Receiving Power		dBm	-14.3			-62.0		
15	Receiver Noise		dBm				-110.5	F= 3.0 dB B= 1.1 MHz	
16	C/N in median		dB				48.5		
17	Interference		dB				29.3		
18	City Noise		dB				43.2	Presumed	
19	Others		dB				60.0		
20	Variable Factor Total		dB				29.1		
21	C/N for Variable Factor		dB				14.4	BER = 1 E-3	
22	Fading Margin		dB				14.7		
23	Pr							Pr= 8.0E-08	
24	Pre Considering Reflection							Pre= 8.0E-08	
25	Diversity Improvement							Isd= 1.0E+00	
26	Outage Time Due to Fading		%					Pm= 2.7E-01	
27	Outage Margin		dB	----				23.3	

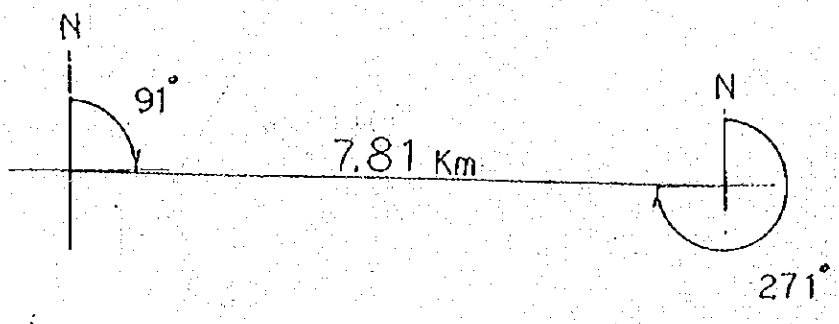
AZIMUTH AND DISTANCE



AZIMUTH AND DISTANCE

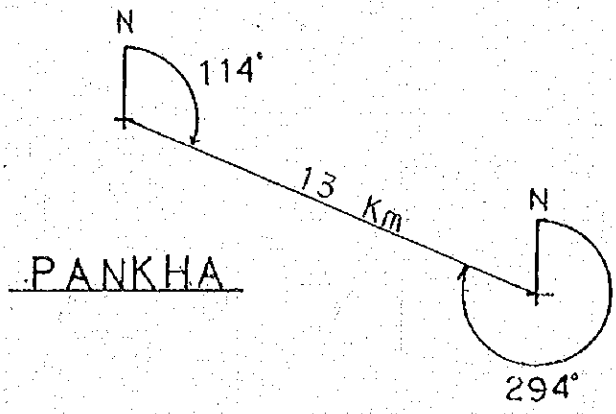


RANGPUR — JATRAPUR



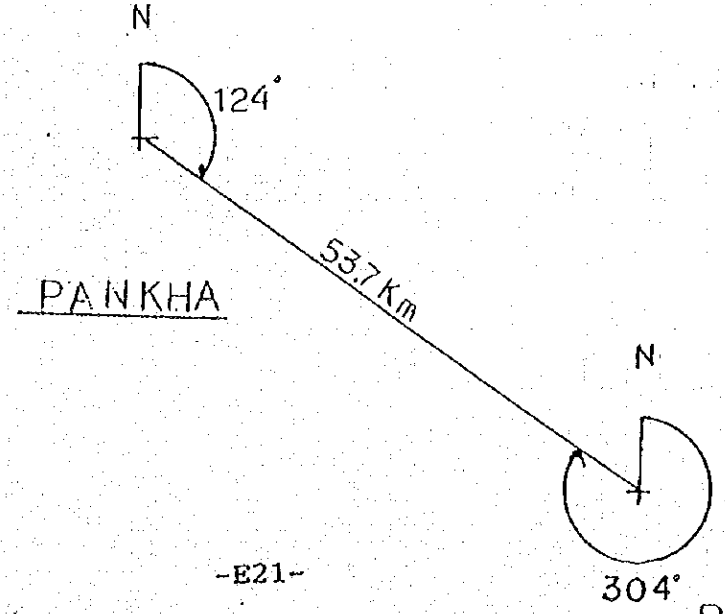
KURIGRAM — JATRAPUR

AZIMUTH AND DISTANCE



PANKHA

NAWABGANG

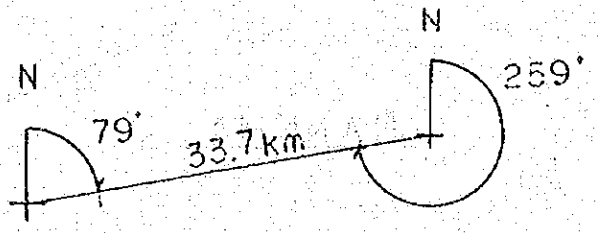


PANKHA

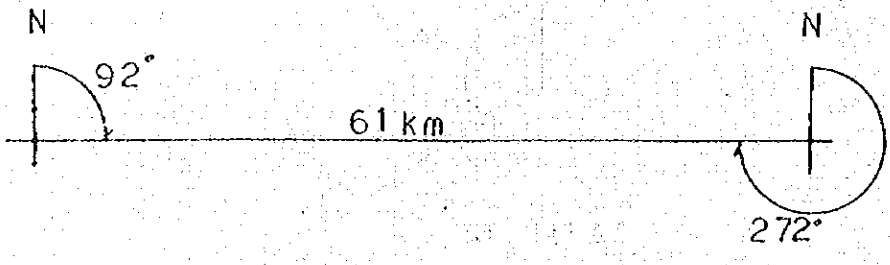
RAJSHAHI

10
21

AZIMUTH AND DISTANCE

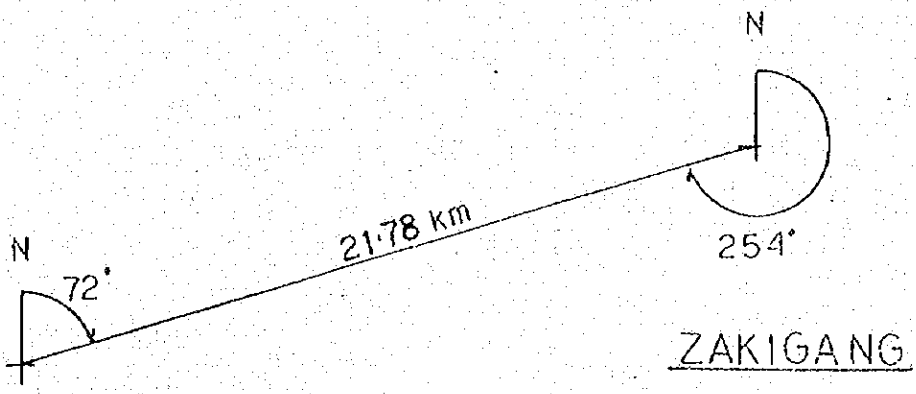


BEANIBAZAR — AMALSHID



SYLHET — AMALSHID

AZIMUTH AND DISTANCE



BENI BAZAR

Table 1. Summary of 150 MHz band Radiowave Propagation Tests

Test Span	Transmitting Power (W)	Distance (km)	Gauging Station antenna height (m)	Partner T&T Station antenna height (m)	Received input Voltage (dBμV)	Remarks
T & T Rajshahi - Pankha	10.0	53.0	10.0	60.0	14.0	
T & T Nawabganj - Pankha	10.0	13.0	10.0	30.0	32.5	
T & T Rangpur- Jatrapur	10.0	48.6	10.0	60.0	18.0	
T & T Kurigram - Jatrapur	10.0	17.0	10.0	30.0	50.0	
T & T Sylhet - Amalshid	10.0	61.0	10.0	30.0	5.0	
T & T Beani Bagar - Amalshid	10.0	33.7	10.0	30.0	17.0	
T & T Maulvi Bazar -BWDB Maulvi Bazar	10.0	1.0	10.0	60.0	65.5	
T & T Maulivi Bazar - Shaistaganj	10.0	38.0	10.0	60.0	25.0	Monitoring data of Existing System
T & T Ramna - Nayarhat	10.0	27.7	10.0	78.5	25.0	- do -
T & T Ramna - Mirpur	10.0	10.0	10.0	78.5	43.0	
T & T Ramna - Narayanganj	10.0	14.7	10.0	78.5	32.0	
T & T Ramna - Rikabi Bazar	10.0	20.1	10.0	78.5	33.0	
T & T Ramna - Milbarrak	10.0	2.9	10.0	78.5	58.0	
T & T Ramna - Tongi	10.0	17.4	10.0	78.5	22.0	
T & T Mogh Bazar - Nayarhat	10.0	25.6	10.0	30.0	19.0	
T & T Mogh Bazar - Mirpur	10.0	8.2	10.0	30.0	42.0	
T & T Mogh Bazar - Narayanganj	10.0	16.8	10.0	30.0	11.5	
T & T Mogh Bazar - Rikabi Bazar	10.0	22.5	10.0	30.0	5.0	
T & T Mogh Bazar - Milbarrak	10.0	5.6	10.0	30.0	14.0	
T & T Mogh Bazar - Tongi	10.0	14.7	10.0	30.0	22.0	
T & T Mogh Bazar - Nayarhat	10.0	25.6	10.0	60.0	19.0	
T & T Mogh Bazar - Mirpur	10.0	8.2	10.0	60.0	42.0	
T & T Mogh Bazar - Narayanganj	10.0	16.8	10.0	60.0	36.0	
T & T Mogh Bazar - Rikabi Bazar	10.0	22.5	10.0	60.0	—	
T & T Mogh Bazar - Milbarrak	10.0	5.6	10.0	60.0	43.0	
T & T Mogh Bazar - Tongi	10.0	14.7	10.0	60.0	22.0	
WAPDA Building - Nayarhat	10.0	28.5	10.0	30.0	0.0	

* Very high interference from Police Communications and other Sources at 149.25 MHz at Mogh Bazar T&T station. Therefore, this station is not recommended to be used as a Radio Telemetry Repeater station.

* Extreme interference from various sources in the WAPDA building site at 149.25 MHz did not allow the reception of any signal from Nayarhat. Consequently, this station is not recommended to be used as a Radio Telemetry Repeater station.

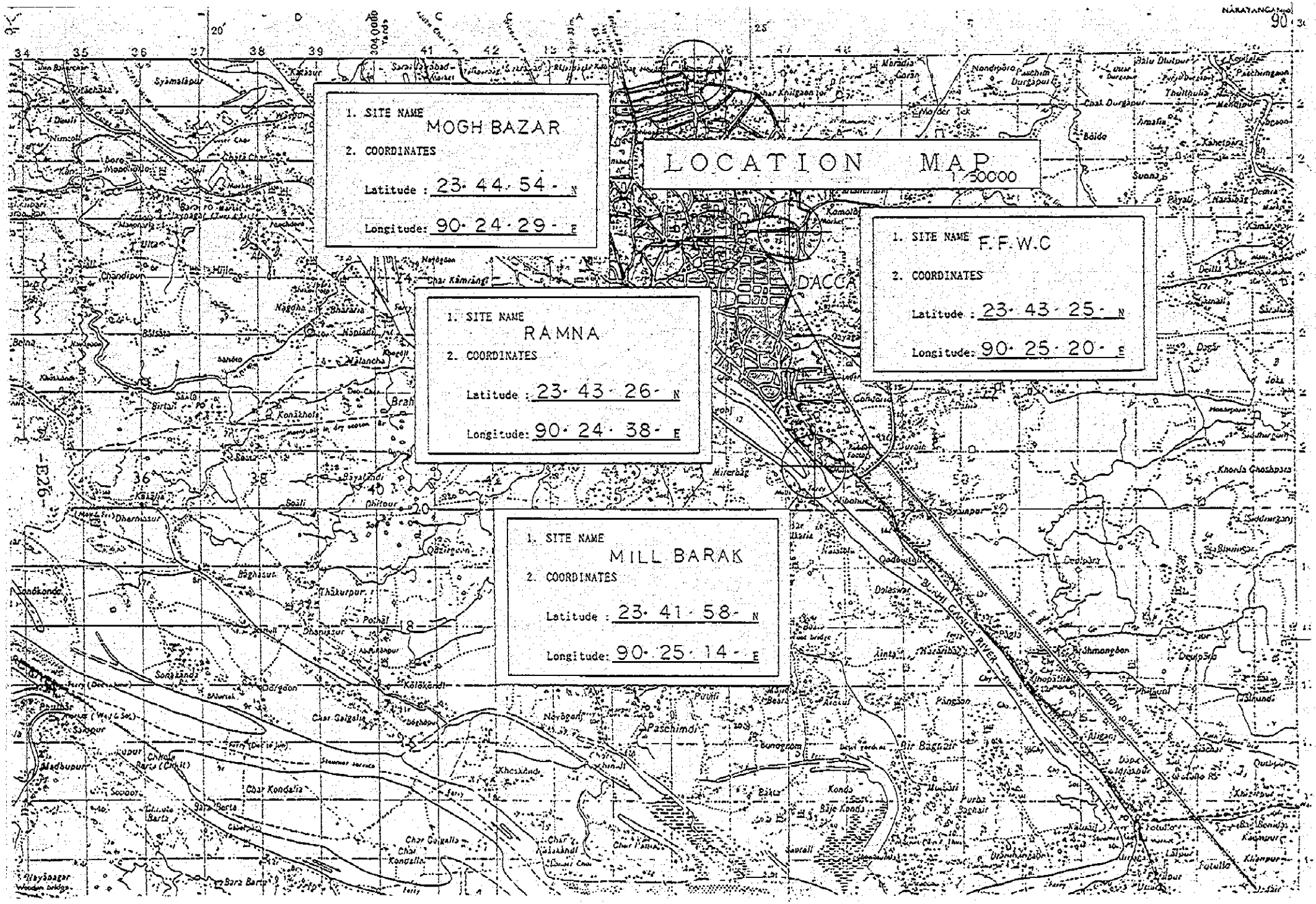
Table 2. Summary of 150 MHz Band Radiowave Propagation Tests

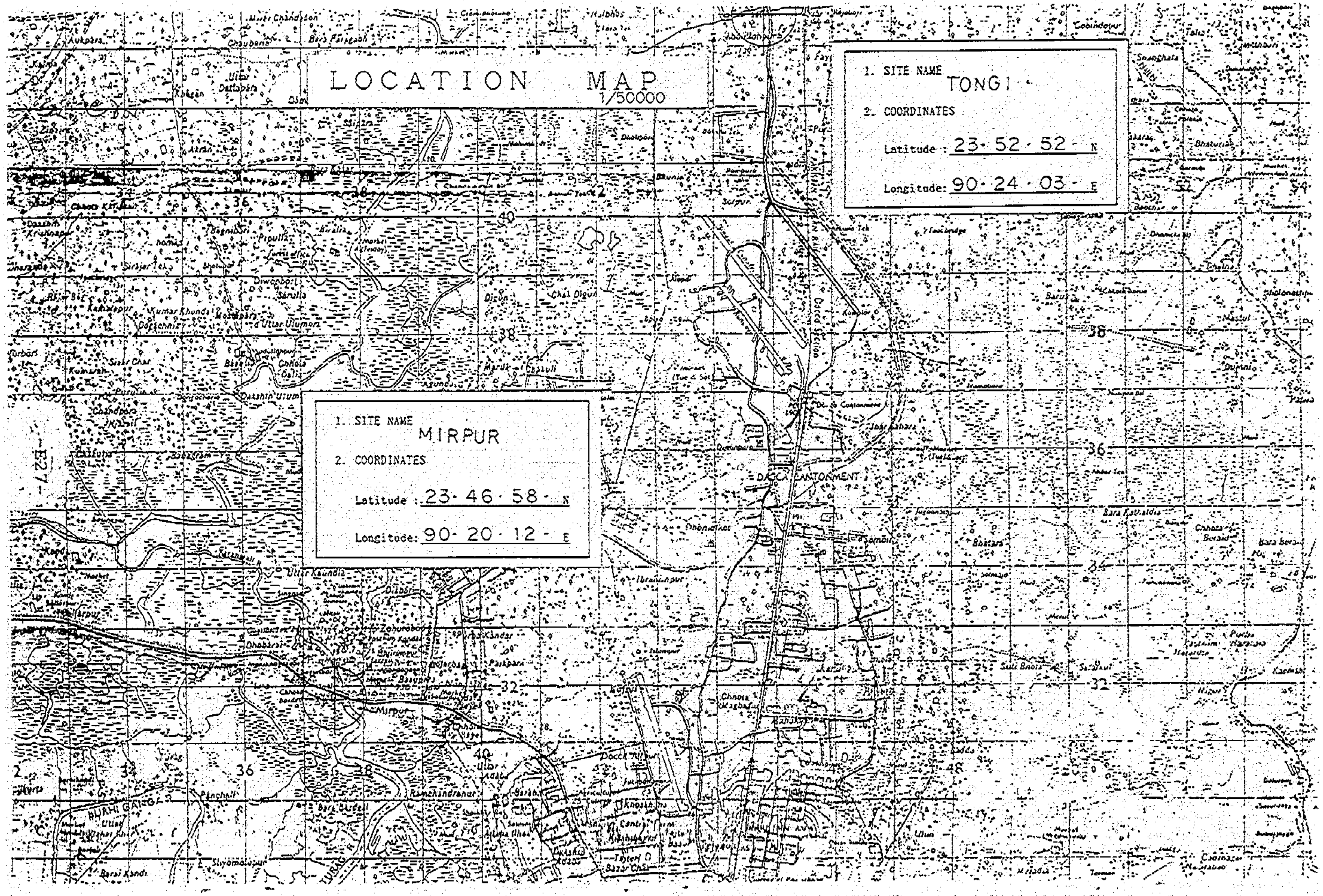
Gauging Station Name	Transmitting Power (W)	Antenna Used	Partner Station Name	Antenna Used	Received Input Voltage (dBμV)	Signal to Noise Ratio S/N (dB)	S/N at Fading (dB)	Judgement
Pankha	10.0	8 Element Yagi	T & T Rajishahi	3 Bay Collinear	11.2	29.2	20.8	No Good
Pankha	10.0	3 Element Yagi	T & T Nawapganj	Sleeve	36.8	Over 50.5	Over 50.5	Good
Jatrapur	10.0	8 Element Yagi	T & T Rangpur	3 Bay Collinear	12	30.0	22.1	No Good
Jatrapur	10.0	3 Element Yagi	T & T Kurigram	Sleeve	43.5	Over 50.0	Over 50.5	Good
Zakinganj	10.0	8 Element Yagi	T & T Sylhet	3 Bay Collinear	10.4	28.4	20.3	No Good
Zakinganj	10.0	3 Element Yagi	T & T Beani Bazar	5 Element Yagi	22.0	40.0	34.8	Good
Nayarhat	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	28.6	46.6	41.3	Good
Mirpur	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	43.6	Over 50.0	Over 50.5	Good
Narayanganj	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	35.8	Over 50.0	49.3	Good
Rikabi Bazar	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	33.8	Over 50.0	46.8	Good
Millbarrak	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	58.8	Over 50.0	Over 50.5	Good
Tongi	10.0	3 Element Yagi	T & T Ramna	3 Bay Collinear	23.1	41.1	36.3	Good

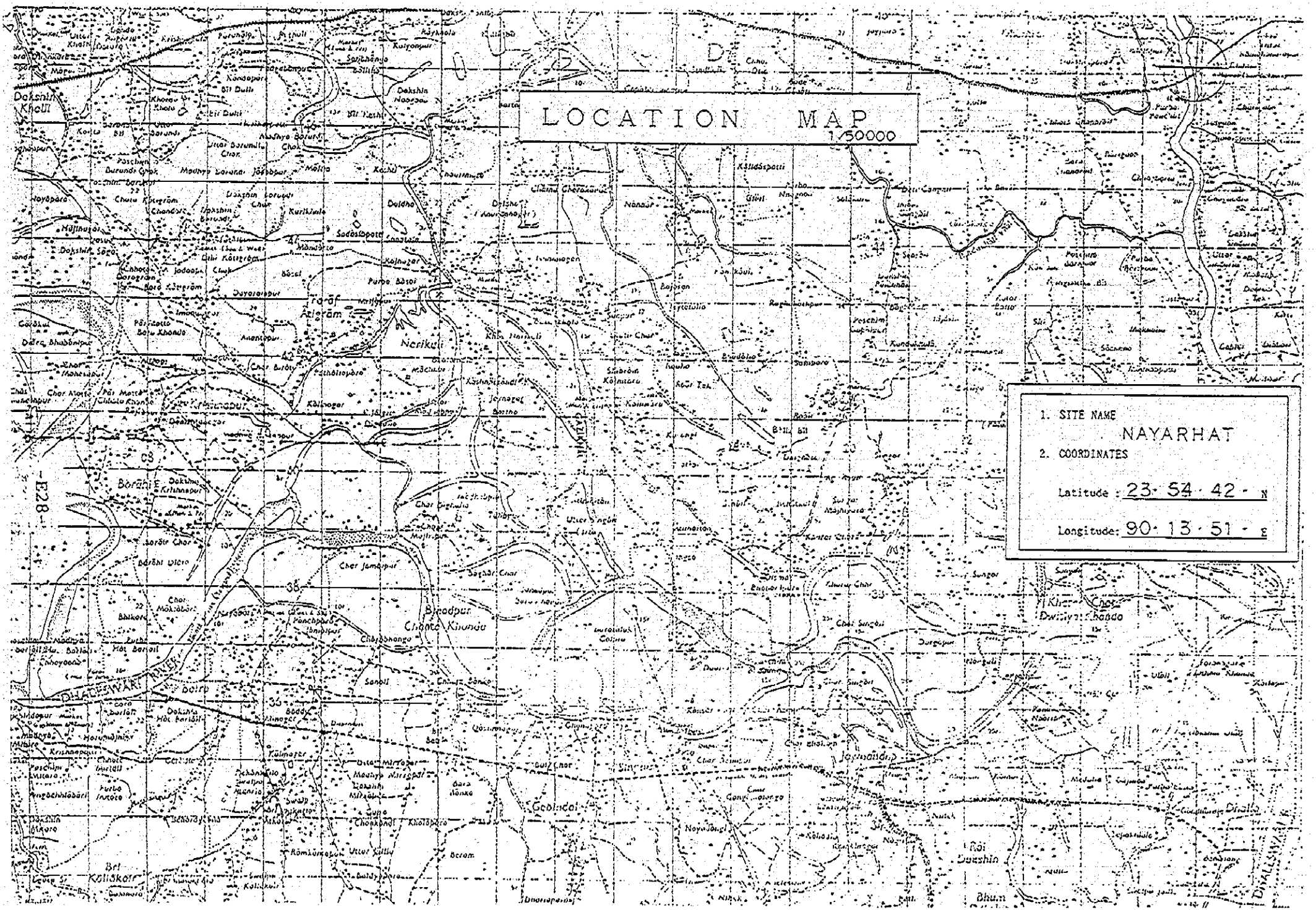
* For a stable and reliable Radio Telemetry Link the following requirements should be met.

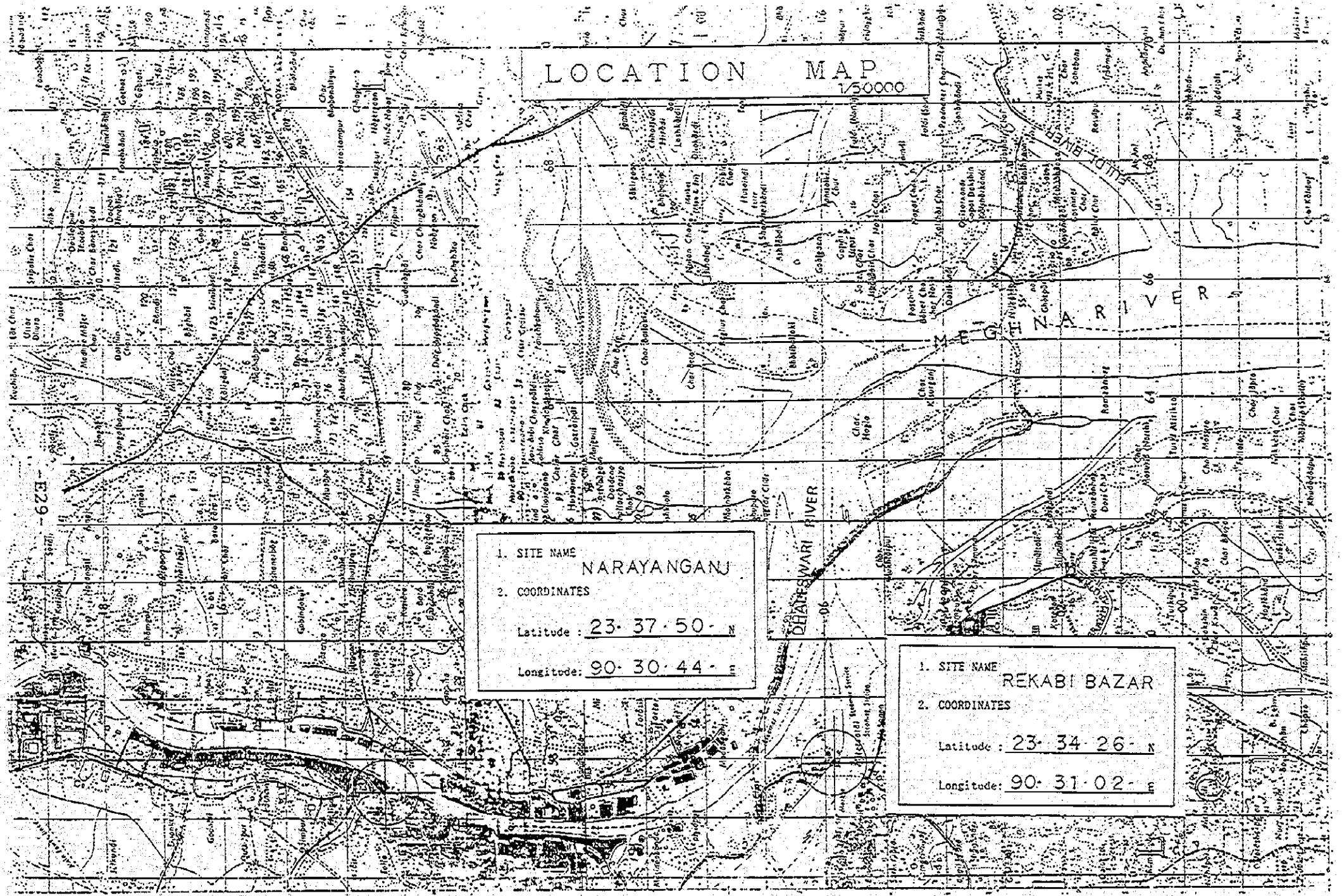
a) Signal to Noise Ratio (S/N) : More than 40 dB

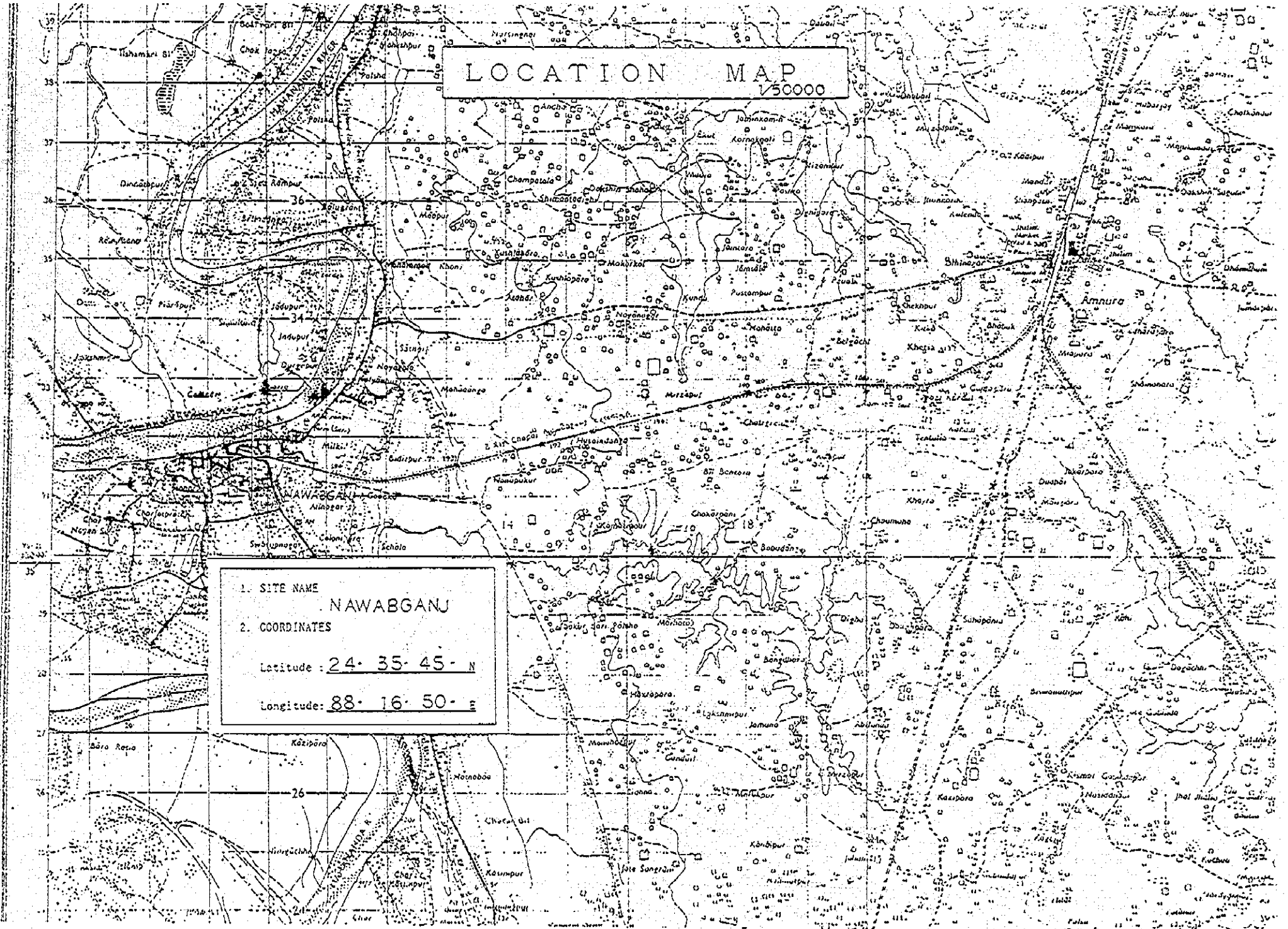
b) S/N at Fading : More than 30 dB

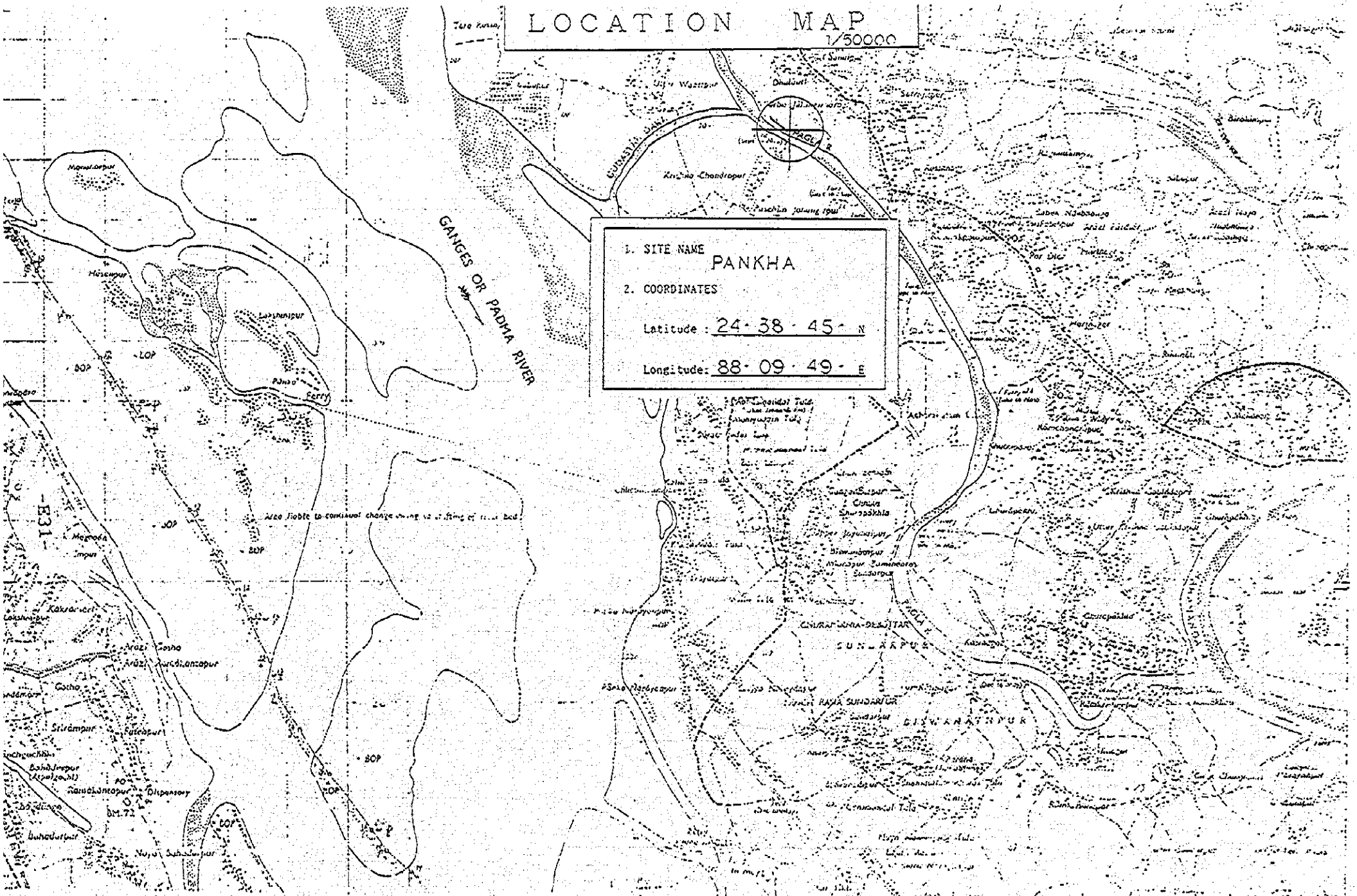

1. SITE NAME
MOGH BAZAR
2. COORDINATES
Latitude : 23· 44· 54· N
Longitude: 90· 24· 29· E
LOCATION MAP
1/50000
1. SITE NAME
F.F.W.C
2. COORDINATES
Latitude : 23· 43· 25· N
Longitude: 90· 25· 20· E
1. SITE NAME
RAMNA
2. COORDINATES
Latitude : 23· 43· 26· N
Longitude: 90· 24· 38· E
1. SITE NAME
MILL BARAK
2. COORDINATES
Latitude : 23· 41· 58· N
Longitude: 90· 25· 14· E
DACCA
BURIGANGA RIVER
CROSS SECTION

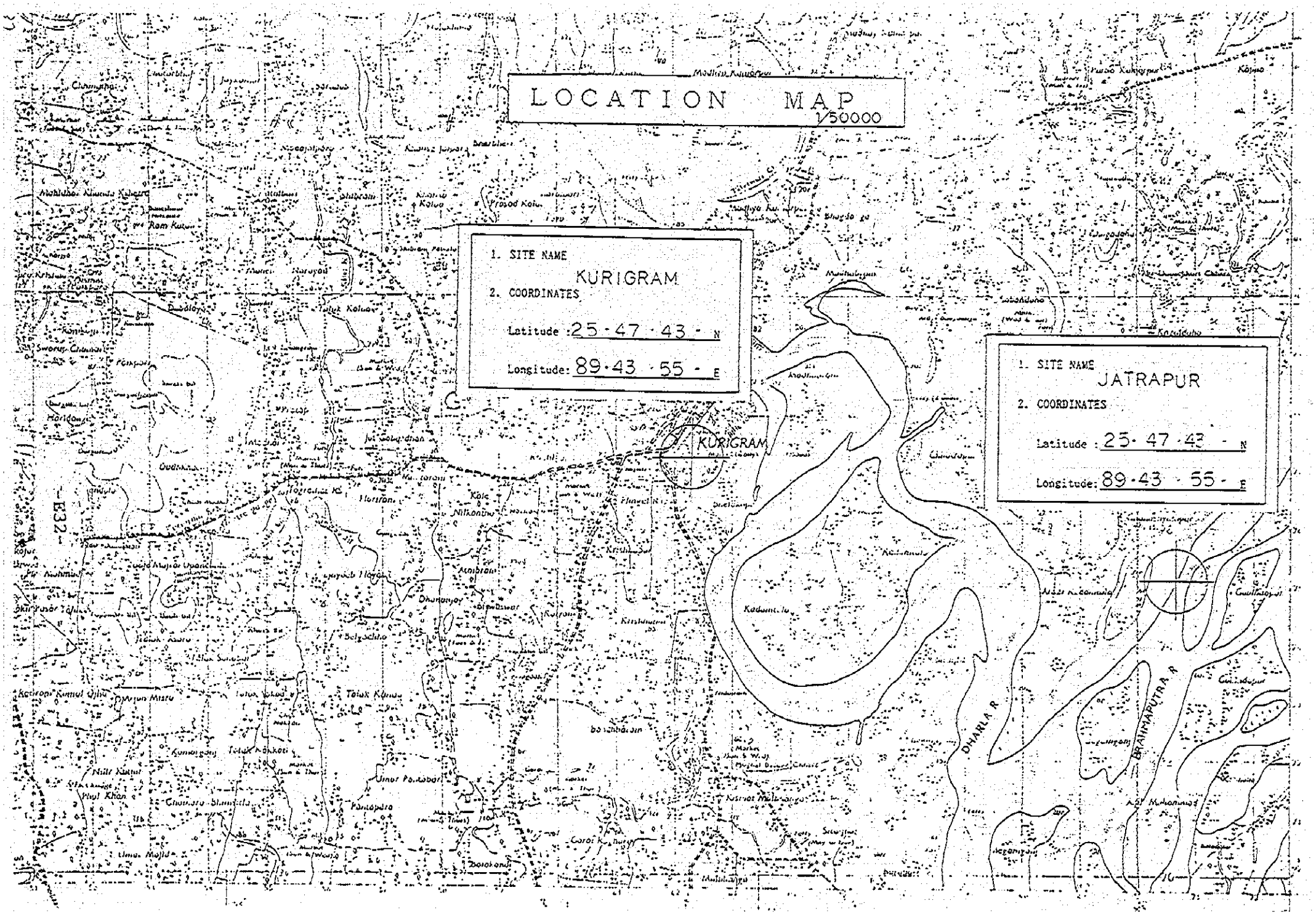

LOCATION MAP
1/50000
1. SITE NAME TONGI
2. COORDINATES
Latitude : 23·52·52·N
Longitude: 90·24·03·E
1. SITE NAME MIRPUR
2. COORDINATES
Latitude : 23·46·58·N
Longitude: 90·20·12·E
DACCA CANTONMENT
Mirpur

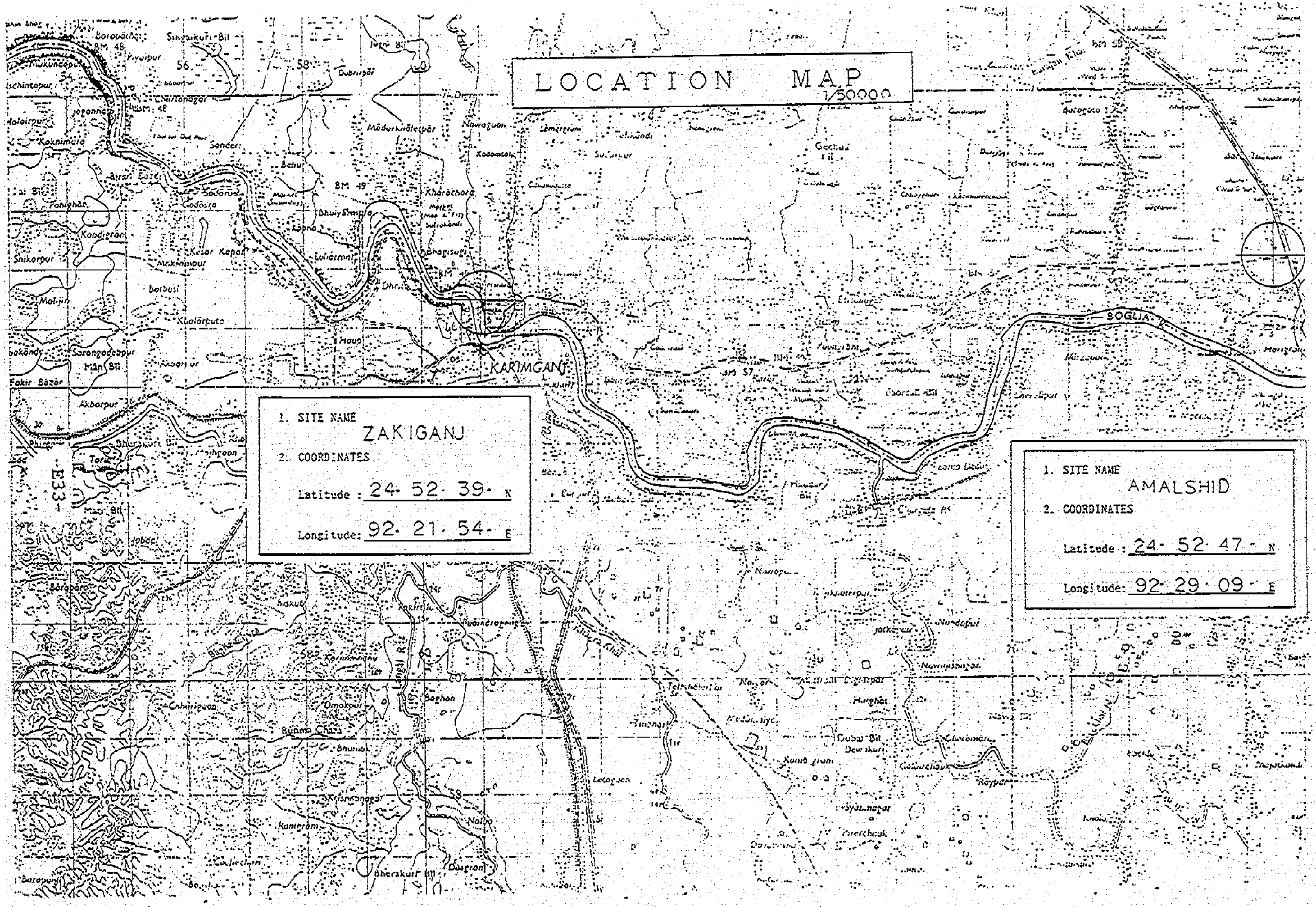

LOCATION MAP
1/50000
1. SITE NAME
NAYARHAT
2. COORDINATES
Latitude : 23 · 54 · 42 - N
Longitude: 90 · 13 · 51 - E


LOCATION MAP
1/50000
1. SITE NAME
NARAYANGANJ
2. COORDINATES
Latitude : 23· 37· 50· N
Longitude: 90· 30· 44· E
1. SITE NAME
REKABI BAZAR
2. COORDINATES
Latitude : 23· 34· 26· N
Longitude: 90· 31· 02· E
M E G H N A R I V E R
DHALESWARI RIVER
E29-


LOCATION MAP
1/50000
1. SITE NAME
NAWABGANJ
2. COORDINATES
Latitude : 24· 35· 45· N
Longitude: 88· 16· 50· E
NAWABGANJ
HARINKHOLA RIVER
Amnura


LOCATION MAP
1/50000
1. SITE NAME
PANKHA
2. COORDINATES
Latitude : 24 · 38 · 45 · N
Longitude: 88 · 09 · 49 · E
GANGES OR PADMA RIVER
Area liable to continuous change owing to shifting of river bed
-E31-


LOCATION MAP
1/50000
1. SITE NAME
KURIGRAM
2. COORDINATES
Latitude : 25 · 47 · 43 - N
Longitude: 89 · 43 · 55 - E
KURIGRAM
1. SITE NAME
JATRAPUR
2. COORDINATES
Latitude : 25 · 47 · 43 - N
Longitude: 89 · 43 · 55 - E
DHARLA R
BRAHMAPUTRA R
E32


LOCATION MAP
1/50000
1. SITE NAME
ZAKIGANJ
2. COORDINATES
Latitude : 24 52 39 N
Longitude: 92 21 54 E
1. SITE NAME
AMALSHID
2. COORDINATES
Latitude : 24 52 47 N
Longitude: 92 29 09 E
KARIMGANJ
BOGLIA R.

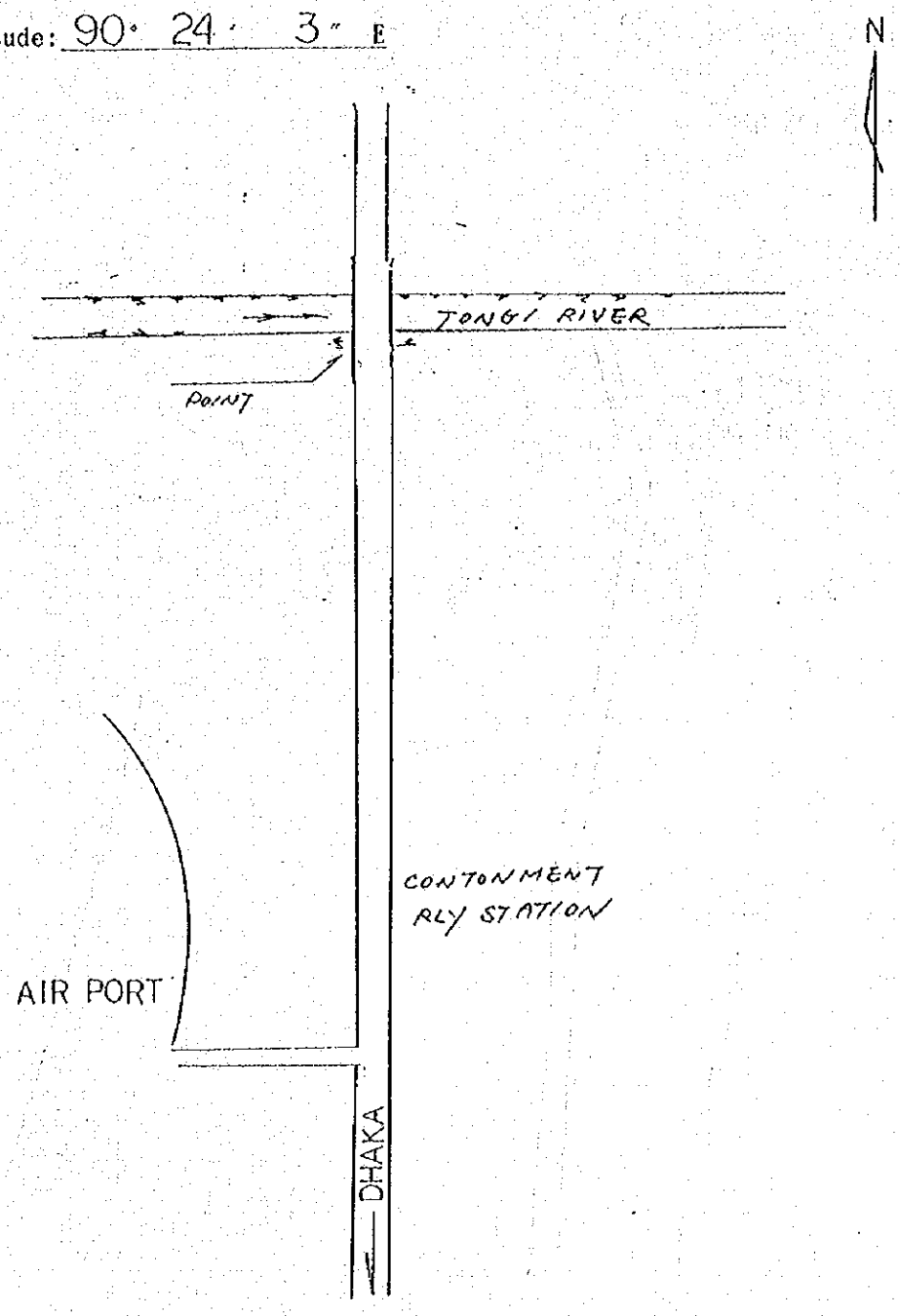
LOCATION MAP OF SURVEYED SITE

1. SITE NAME TONGI

2. COORDINATES

Latitude : 23° 52' 52" N

Longitude: 90° 24' 3" E



LOCATION MAP OF SURVEYED SITE

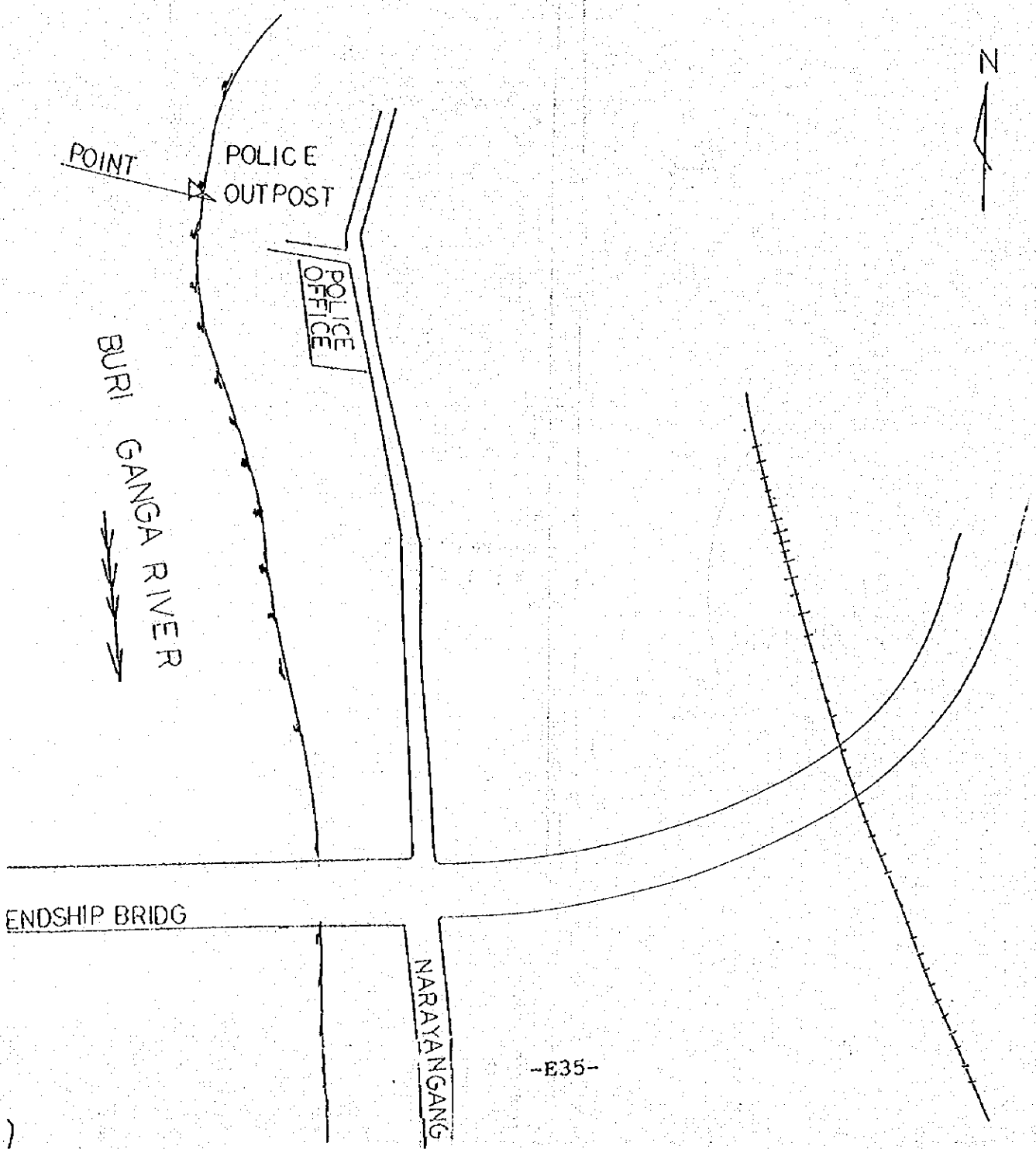
1. SITE NAME MIL BARRAK

2. COORDINATES

Latitude : 23° 41' 58" N

Longitude: 90° 25' 14" E

3. LOCATION MAP



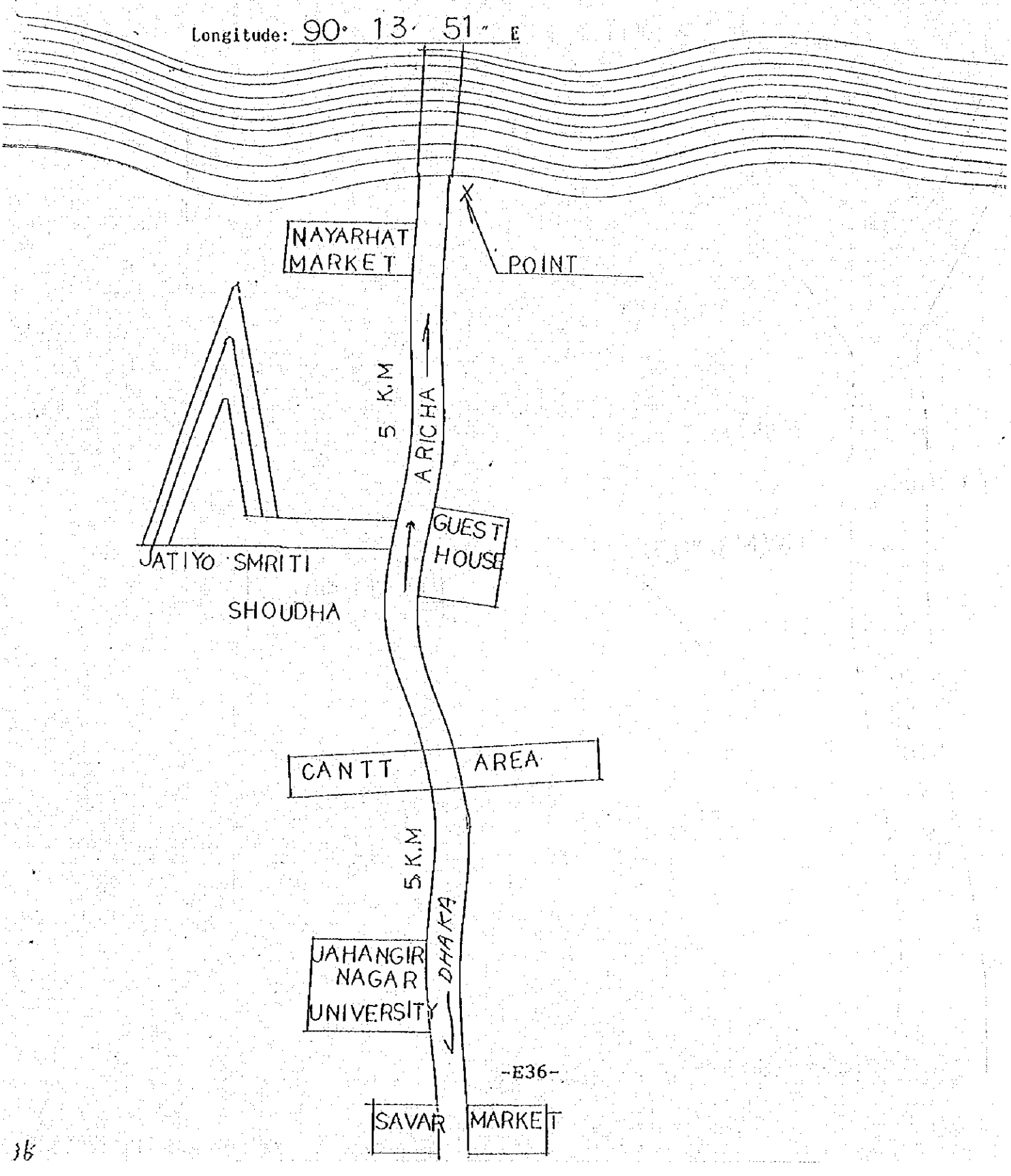
LOCATION MAP OF SURVEYED SITE

1. SITE NAME NAYARHAT

2. COORDINATES

Latitude : 23° 54' 42" N

Longitude: 90° 13' 51" E



LOCATION MAP OF SURVEYED SITE

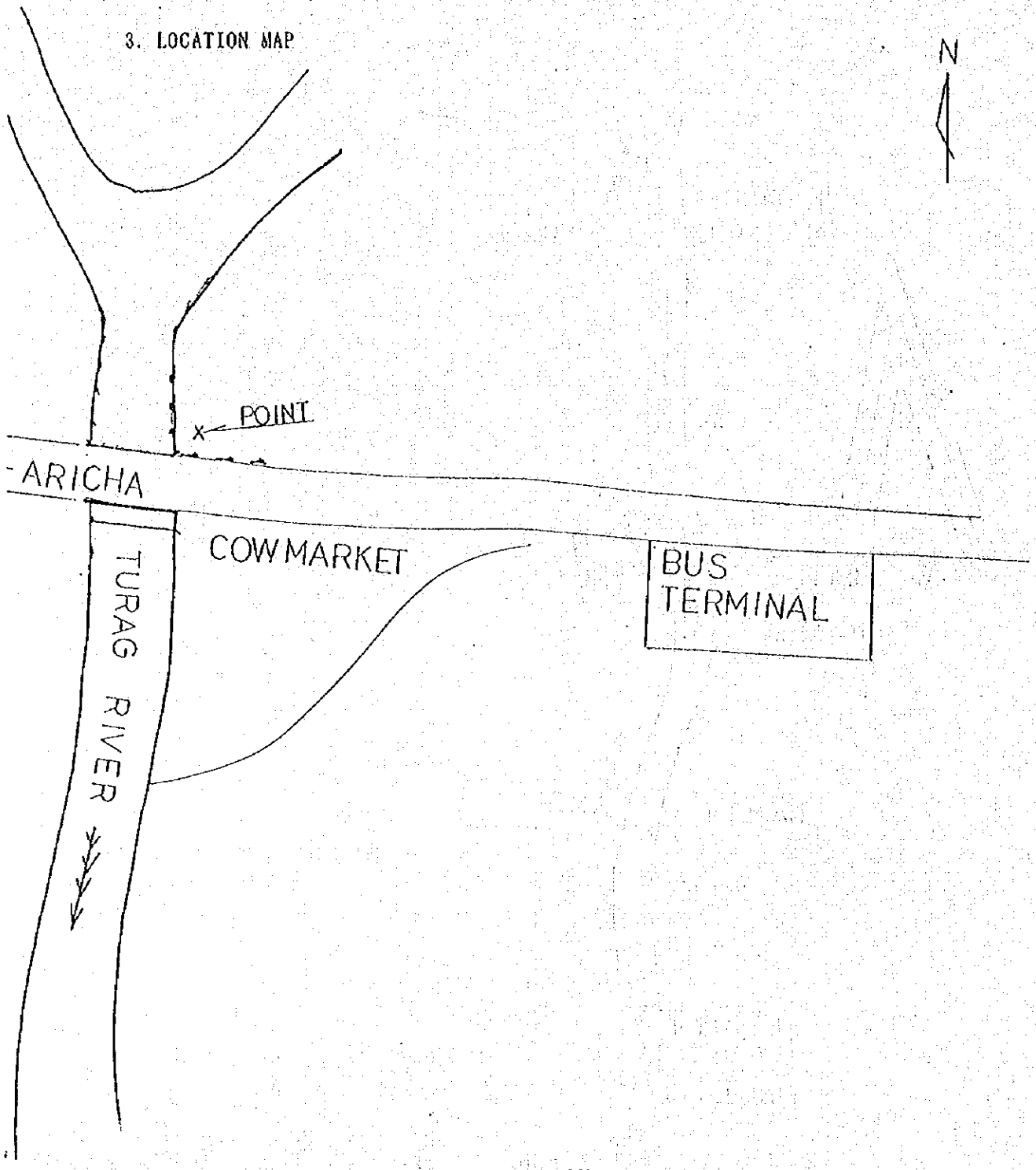
1. SITE NAME MIRPUR

2. COORDINATES

Latitude : 23° 46' 58" N

Longitude: 90° 20' 12" E

3. LOCATION MAP



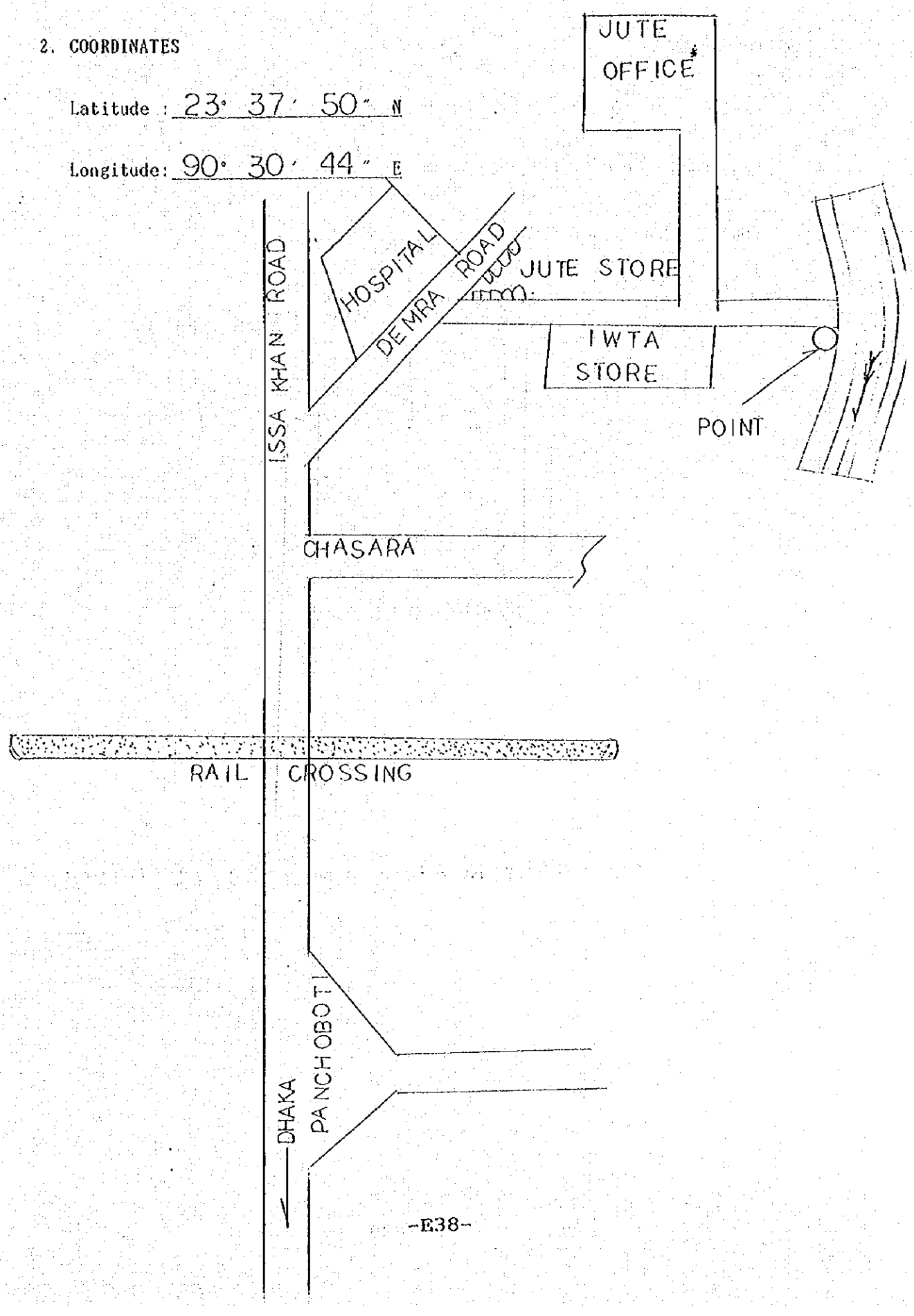
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Narayanganj

2. COORDINATES

Latitude : 23° 37' 50" N

Longitude: 90° 30' 44" E



33

LOCATION MAP OF SURVEYED SITE

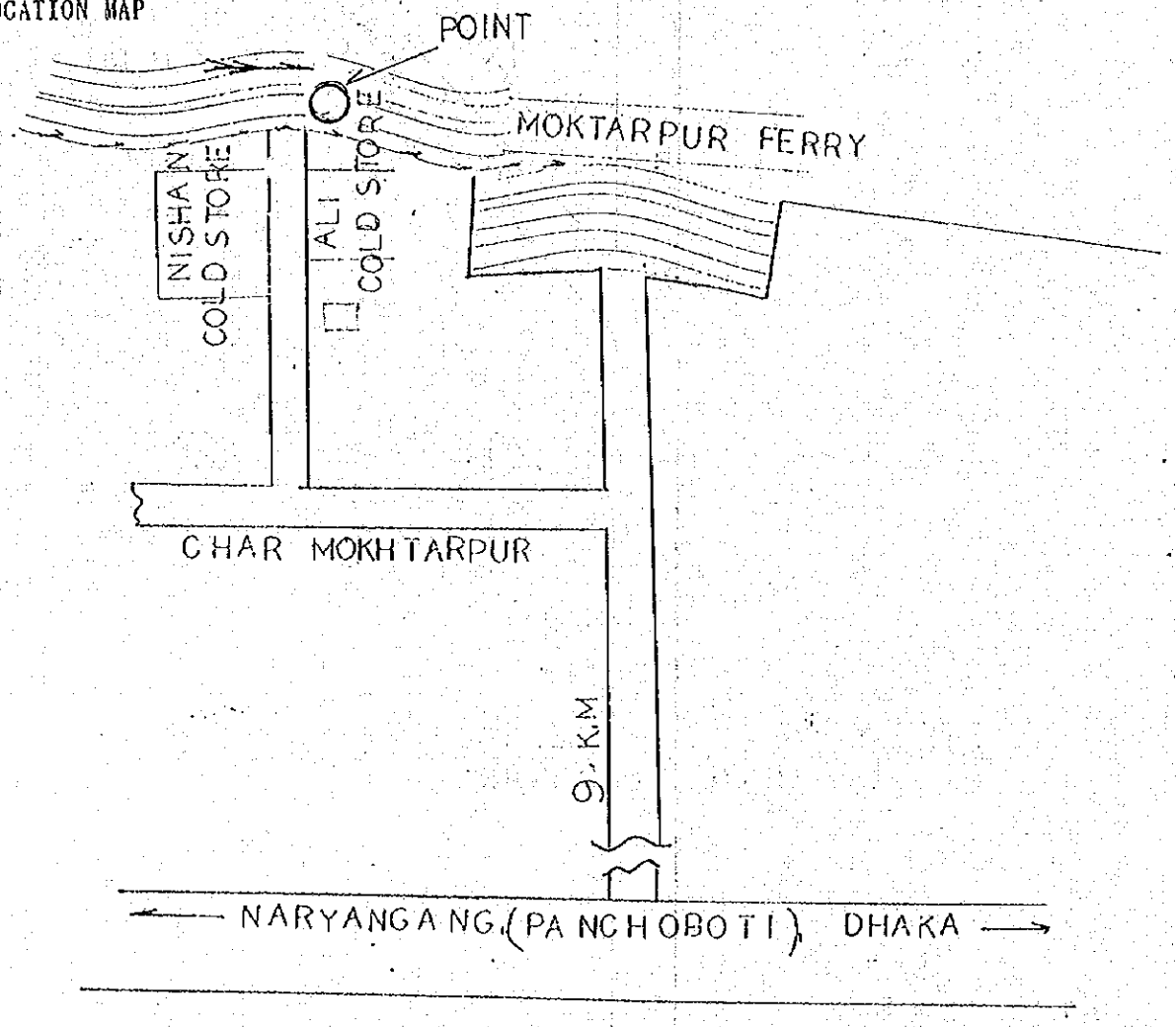
1. SITE NAME REKABIBAZAR

2. COORDINATES

Latitude : 23° 34' 18" N

Longitude: 90° 31' 2" E

3. LOCATION MAP



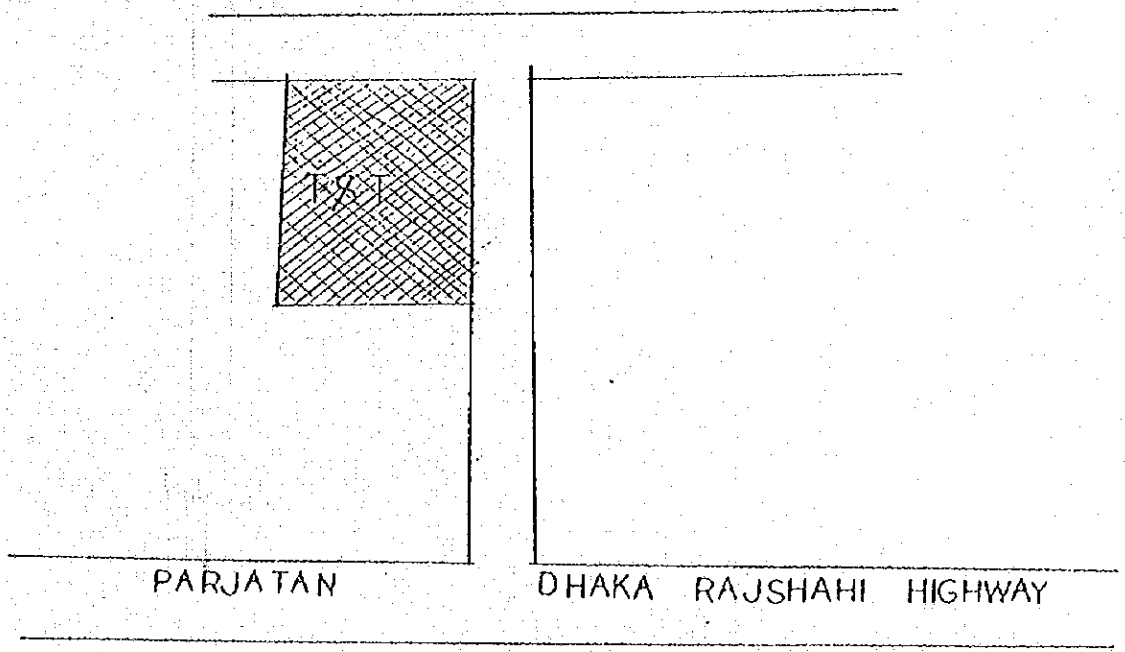
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Rajshahi T&T station

2. COORDINATES

Latitude : 24° 22' 26" N

Longitude: 88° 36' 10" E



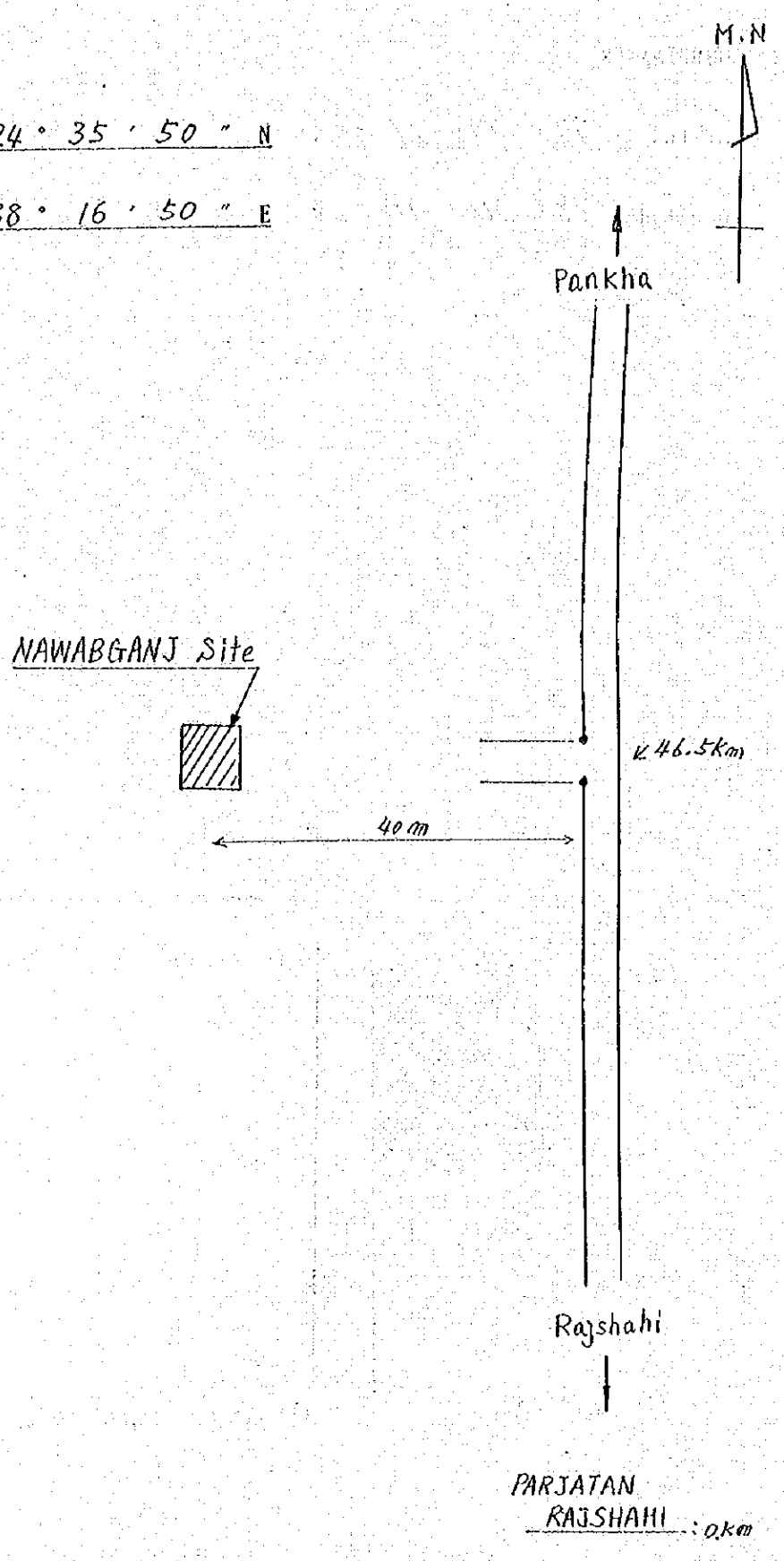
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Nawabganj T&T station

2. COORDINATES

Latitude : 24 ° 35 ' 50 " N

Longitude: 88 ° 16 ' 50 " E



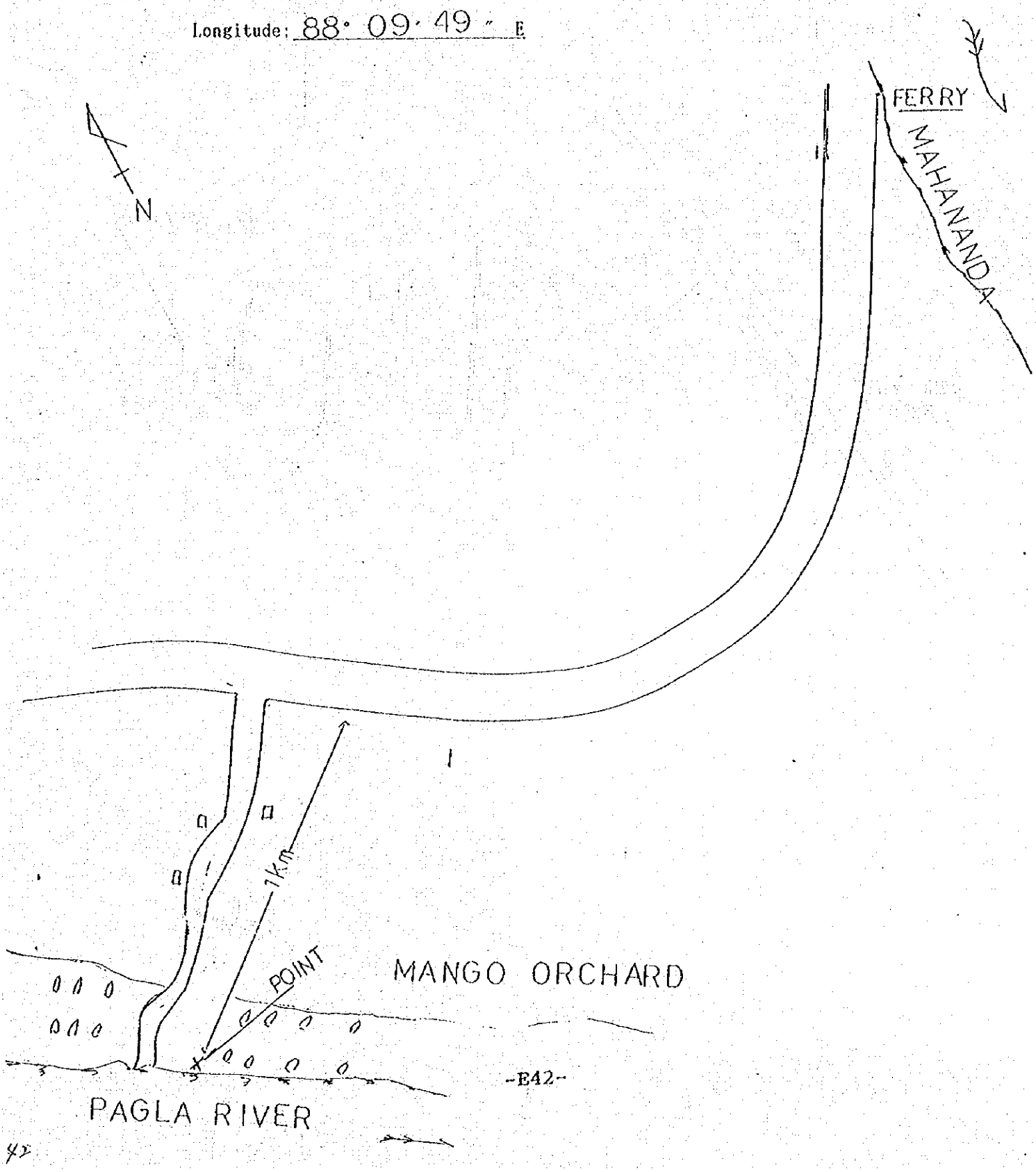
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Pankha

2. COORDINATES

Latitude : 24° 38' 45" N

Longitude: 88° 09' 49" E



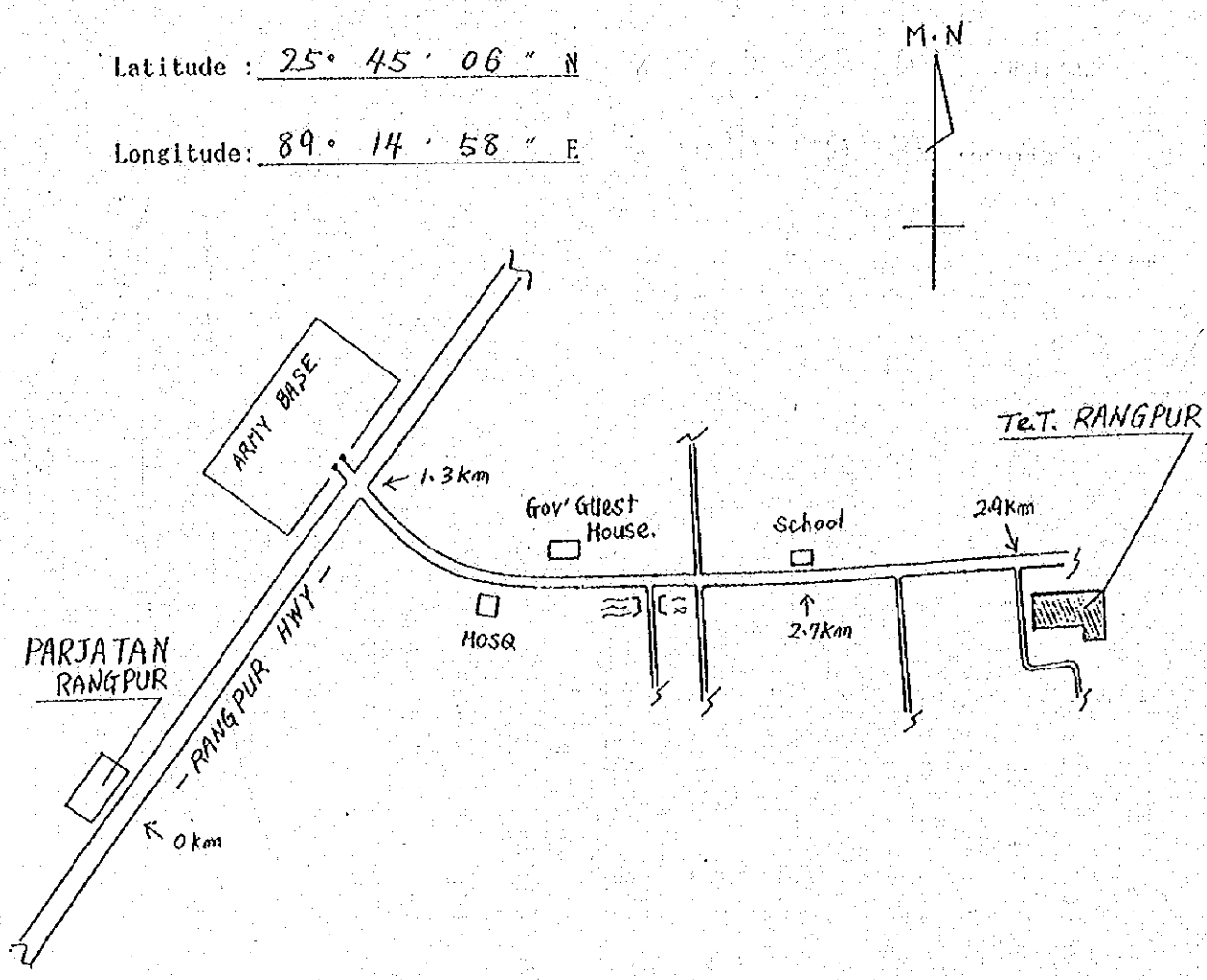
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Rangpur T&T station

2. COORDINATES

Latitude : 25° 45' 06" N

Longitude: 89° 14' 58" E



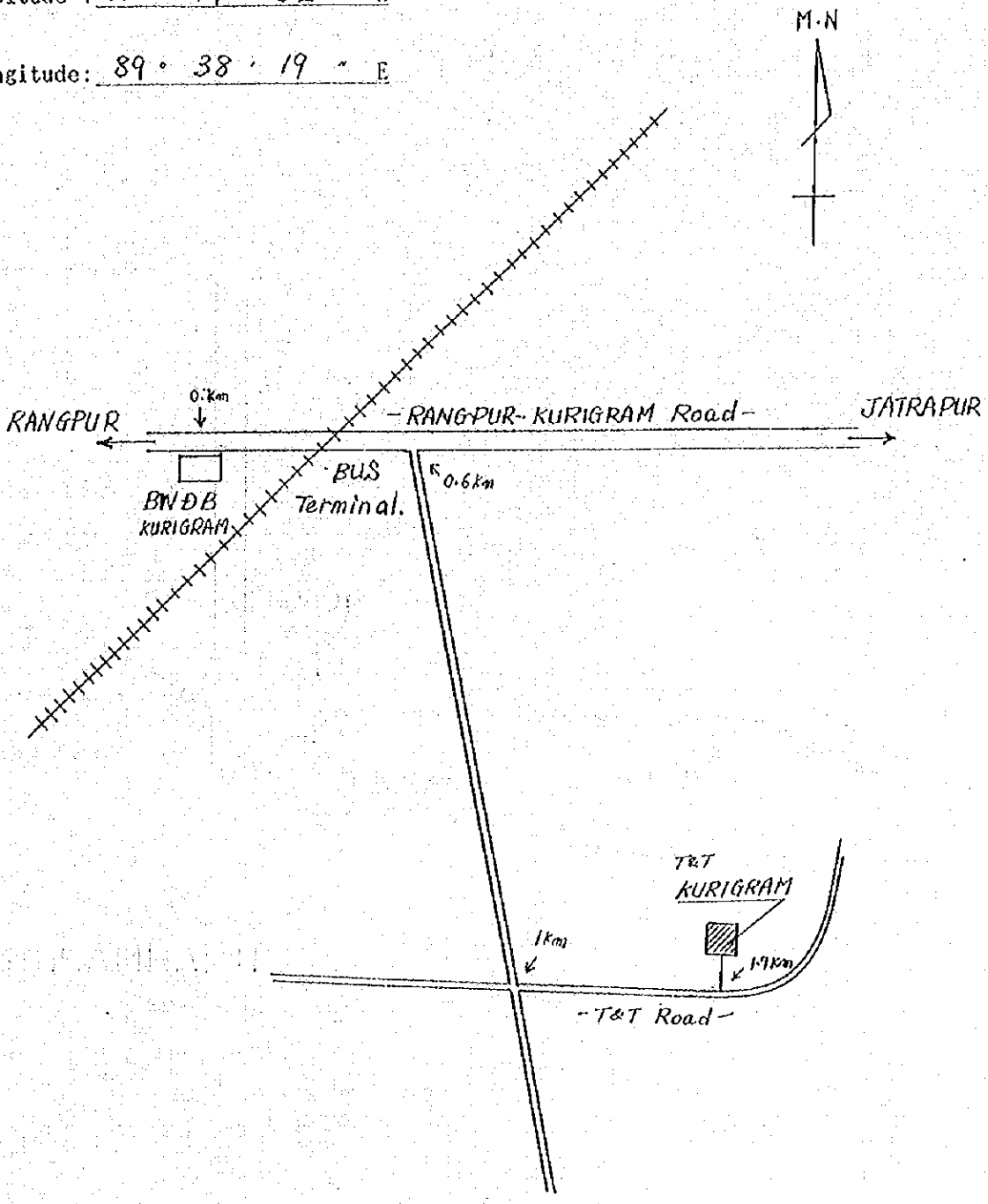
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Kurigram T&T station

2. COORDINATES

Latitude : 25° 47' 52" N

Longitude: 89° 38' 19" E



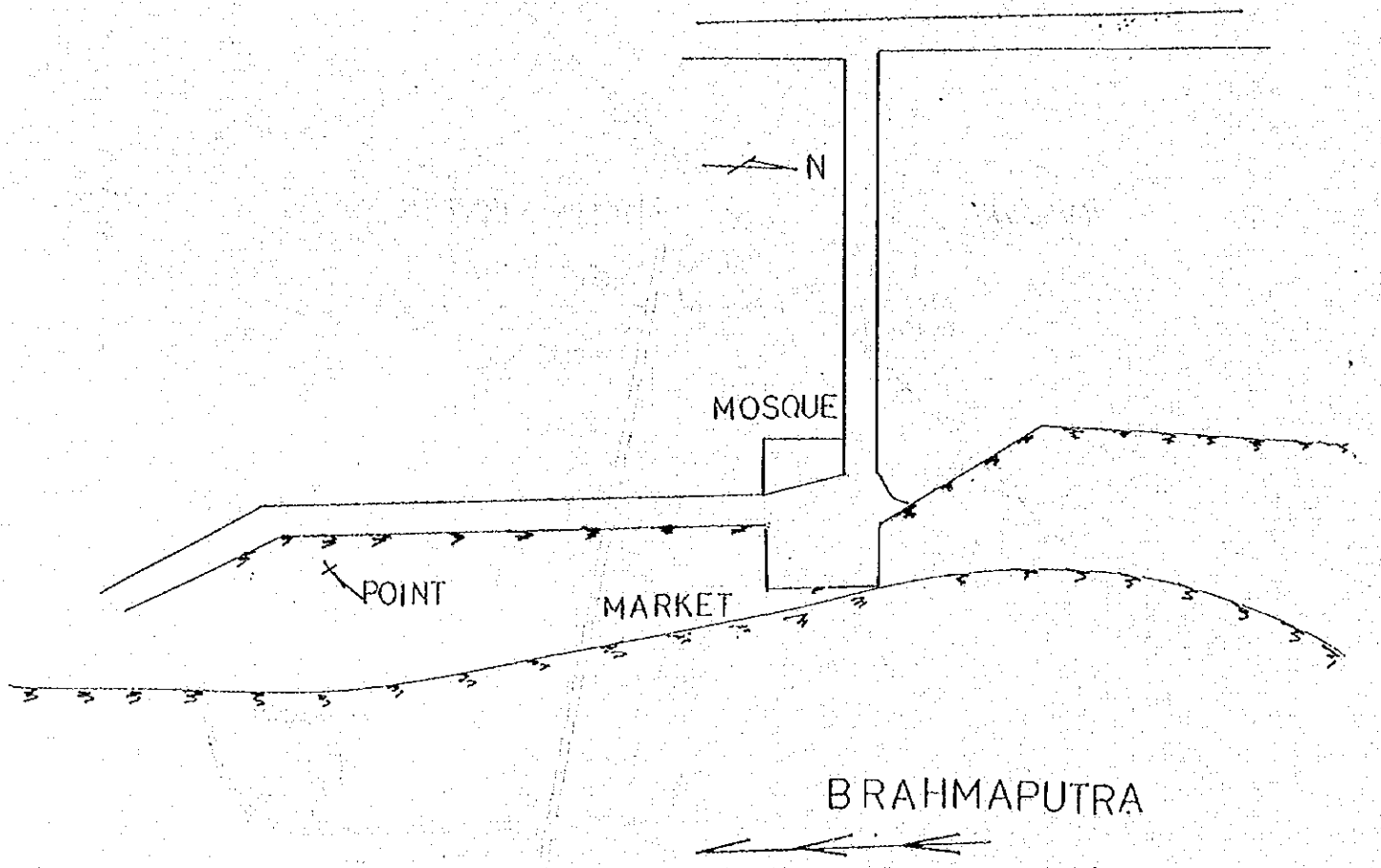
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Jatrapur

2. COORDINATES

Latitude : 25° 45' 6" N

Longitude: 89° 14' 58" E



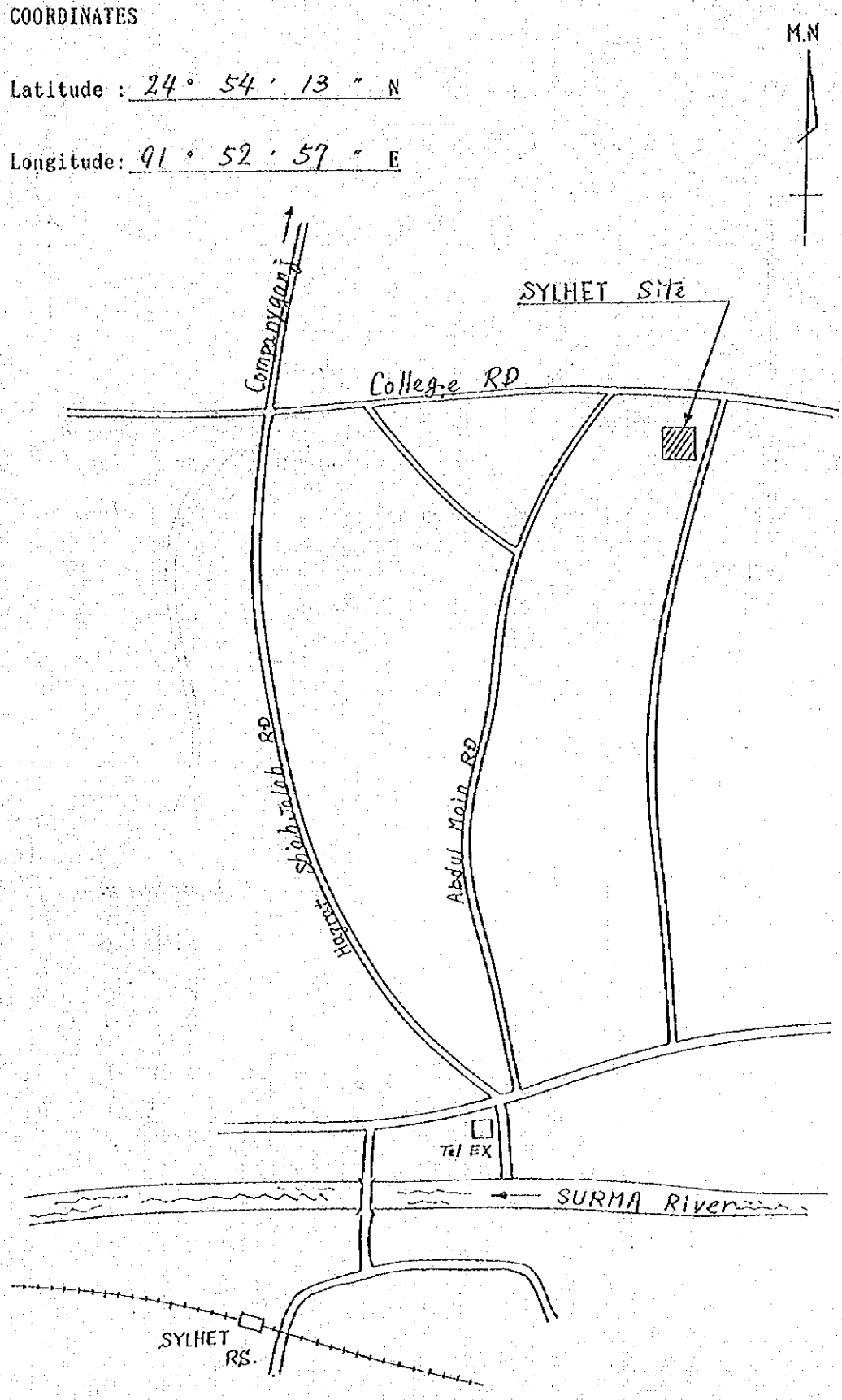
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Sylhet T&T station

2. COORDINATES

Latitude : 24° 54' 13" N

Longitude: 91° 52' 57" E



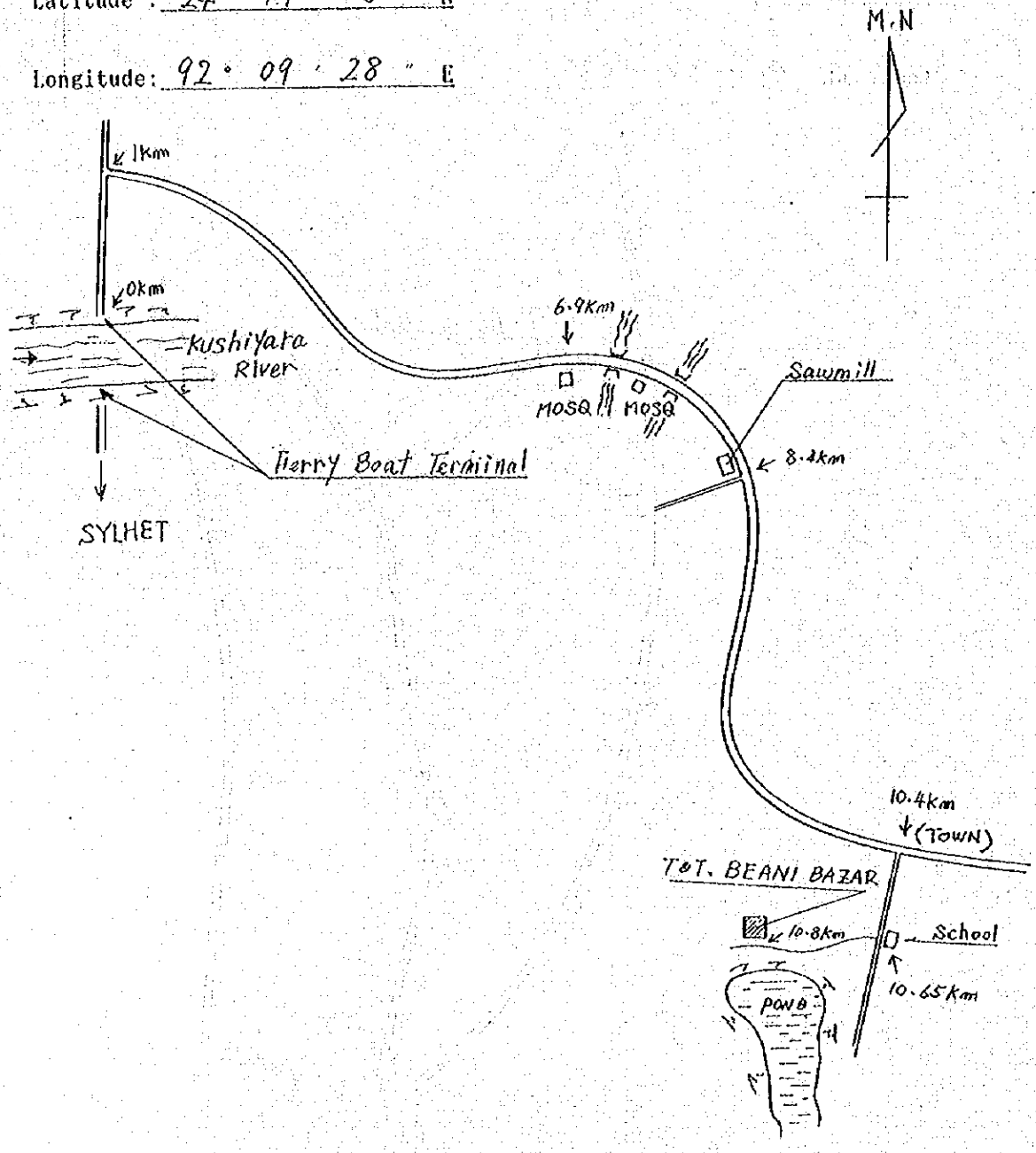
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Beani Bazar T&T station

2. COORDINATES

Latitude : 24° 49 · 25 " N

Longitude: 92° 09 · 28 " E



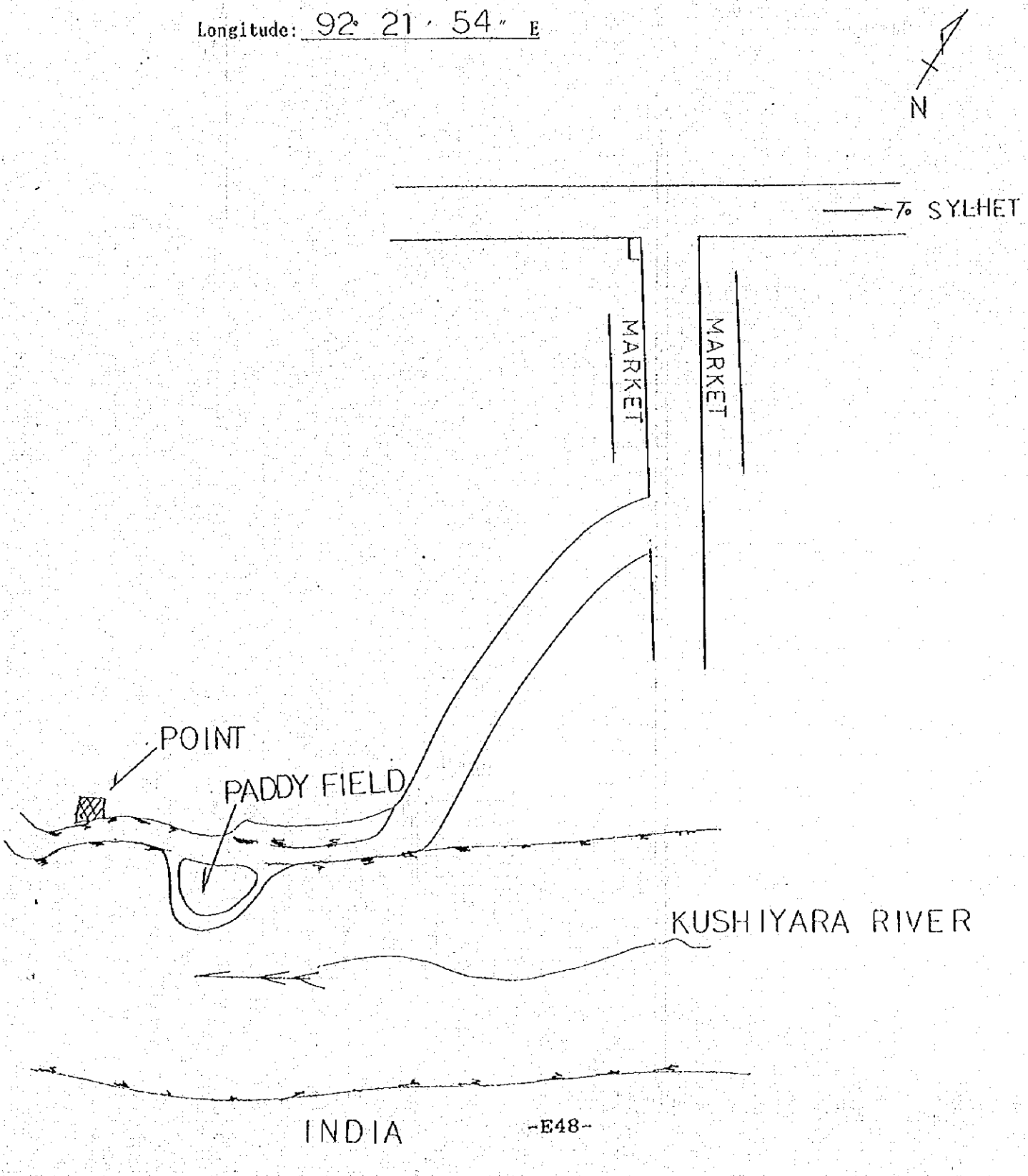
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Z a k i g a n j

2. COORDINATES

Latitude : 24° 52' 39" N

Longitude: 92° 21' 54" E



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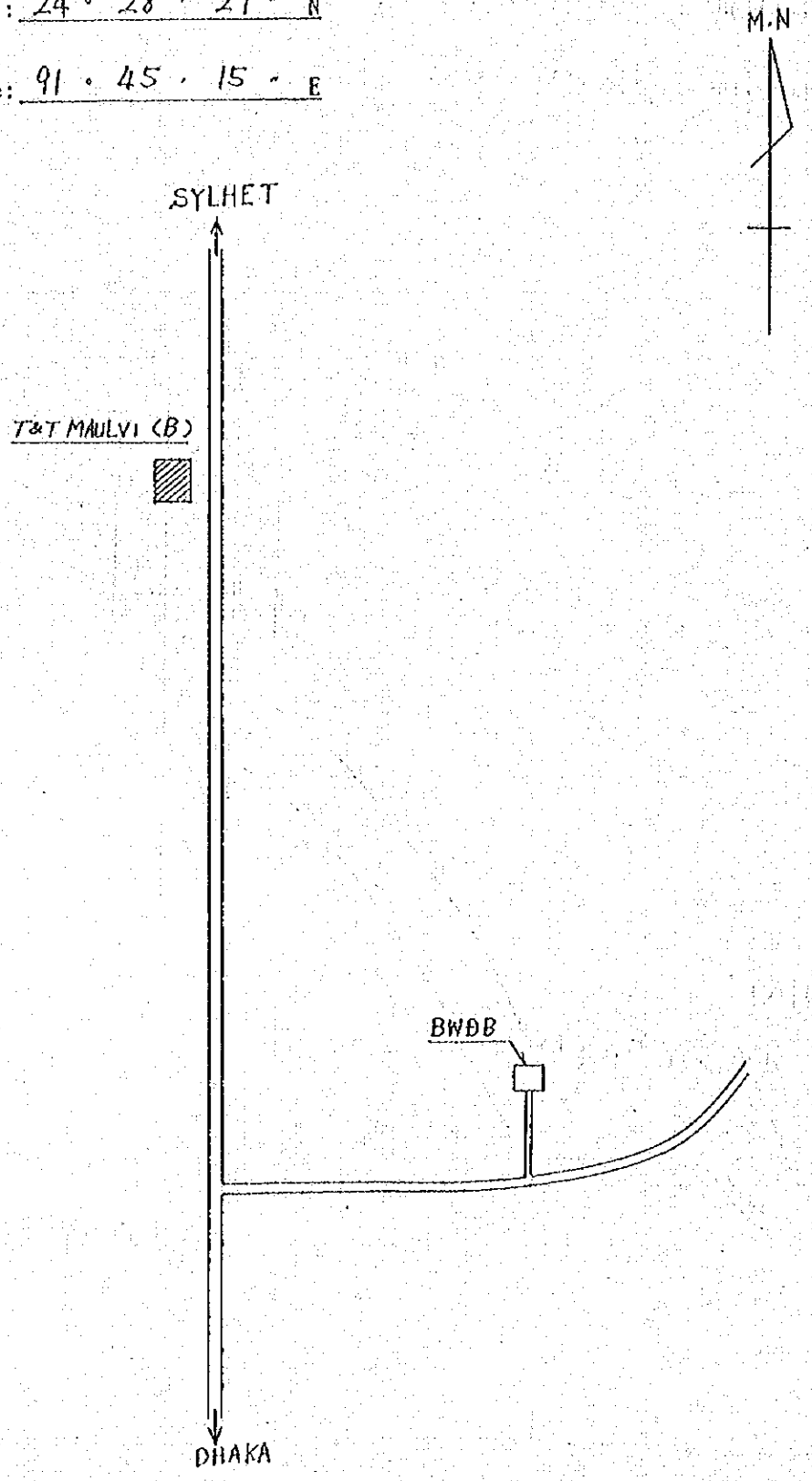
LOCATION MAP OF SURVEYED SITE

1. SITE NAME Maulvi Bazar T&T station

2. COORDINATES

Latitude : 24 · 28 · 27 · N

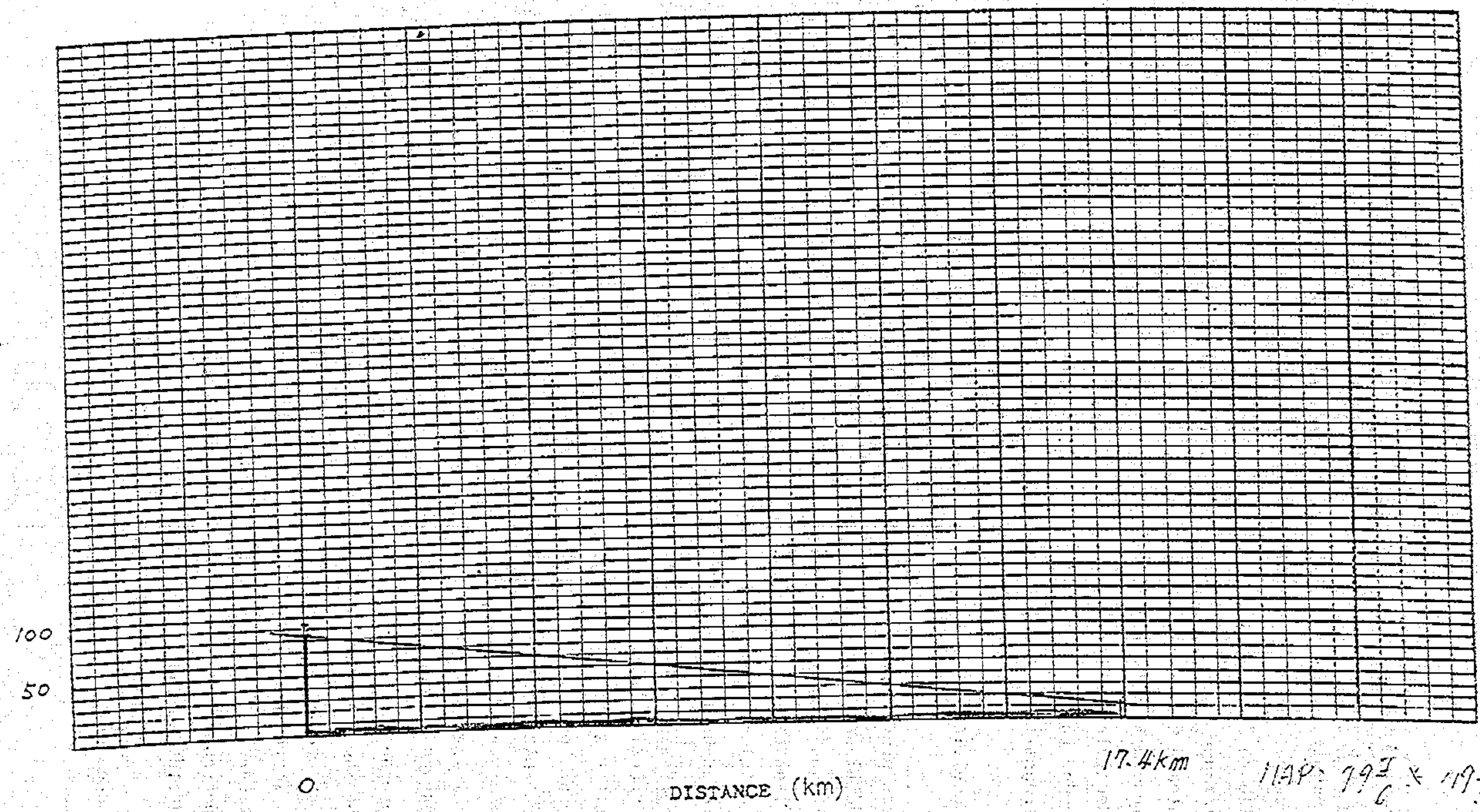
Longitude: 91 · 45 · 15 · E



Ramna TdT — Tongi 150Mz Band Radio Path Design Table				
	I t e m	Desk Plan	Actual Test	Design Value
	Transmit. Height (Ht) Receive. Height (Hr) *(Above Sea Level)	85.0 (m) 13.0 (m)	85.0 (m) 13.0 (m)	85.0 (m) 18.0 (m)
	Distance (D)	17.4 (Km)	17.4 (Km)	17.4 (Km)
1	Antenna Gain (Ga) (Transmitting Side) (Receiving Side)	10.0 dB Sleeve 3E Yagi	10.0 dB Sleeve 3E Yagi	14.0 dB 3B Collinear 3E Yagi
2	Feeder Loss (Lf1) (Transmitting Side) (Receiving Side)	-6.5 dB 10D-2V (100.0 m) 10D-2V (20.0 m)	-6.5 dB 10D-2V (100.0 m) 10D-2V (20.0 m)	-3.7 dB AFZE50-7 (80.0 m) 10D-2V (30.0 m)
3	Free space Loss (Lpf)	-100.8 dB	dB	-100.8 dB
4	Additional Loss Shadow Loss -1 (Lps) Plane earth Loss (Lpp) Additional Loss (As) for spherical earth	 — dB — dB -10.8 dB	 dB dB dB	 — dB — dB -10.8 dB
	Divider. Fil. etc. Loss (Lf2)	— dB	dB	-6.0 dB
5	Correction Value After Actual Test (Lpc)	dB	dB	-22.6 dB
6	Span Loss (Ls)	-108.4 dB	dB	-129.9 dB
7	Transmitting Power (Pt)	10W. 40dBm	10W. 40dBm	10W. 40dBm
8	Receiving Power (Pr)	-68.4 dBm	dBm	-89.9 dBm
9	Receiving input Voltage (0dBμV=-113dBm) (Er)	44.6 dBμV/m	22.0 dBμV/m	23.1 dBμV/m
10	Threshold Level (Pth)	-110.0 dBm	dBm	-110.0 dBm
11	Threshold Margin (Mth)	41.6 dB	dB	20.1 dB
12	Crest Factor (Cf)	9 dB	9 dB	9 dB
13	S/N Improvement Factor (I)	12 dB	12 dB	12 dB
14	Standard S/N (S/N)	62.6 dB	dB	41.1 dB
15	Expected Fading Value (Lf) (0.1dB/Km+3dB)	-4.8 dB	dB	-4.8 dB
16	S/N at Fading (S/Nf)	57.8 dB	dB	36.3 dB
17	Judgement			Good
18	Remarks			

Scale; O Type 30km/600m
(15km/150m; 60km/2400m)

TERRAIN PROFILE



RAMNA
ALTITUDE 6 m
ANTENNA HEIGHT 79 m

17.4 km

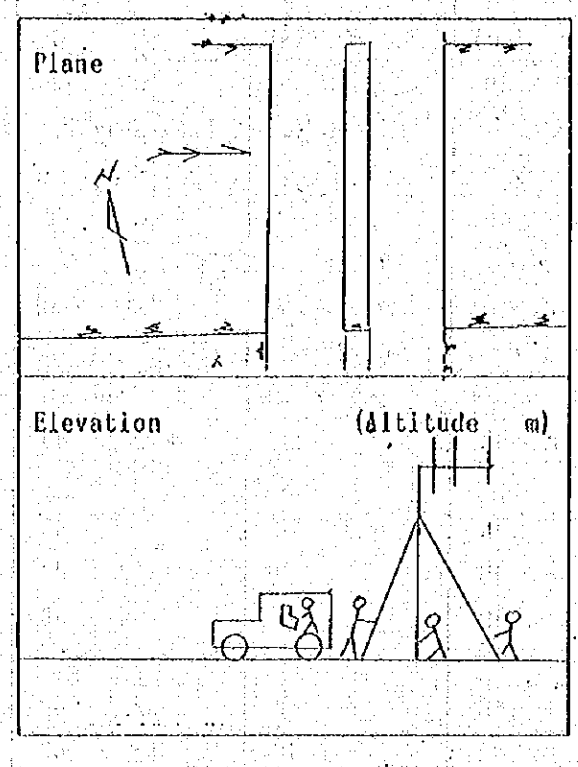
TONGI
ALTITUDE 3 m
ANTENNA HEIGHT 10 m

K=4/3

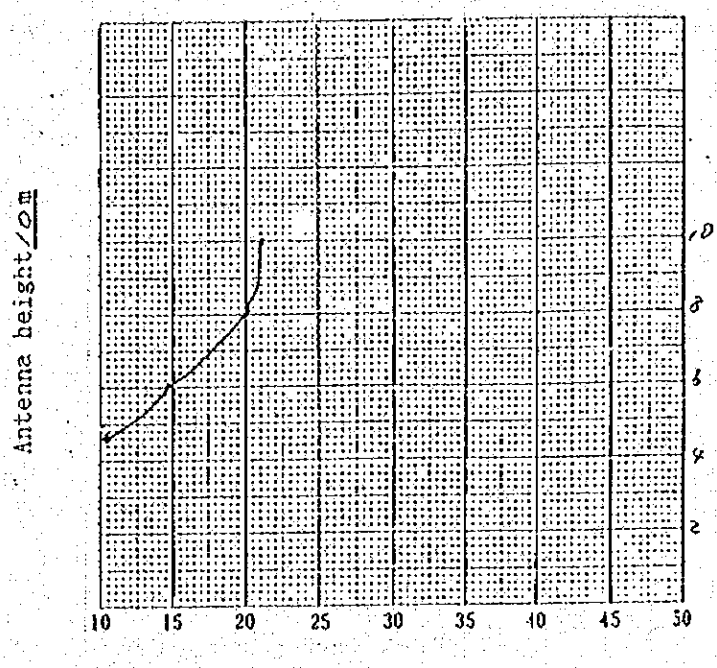
Transmitting station → Measuring Station

RAMNA → TONGI

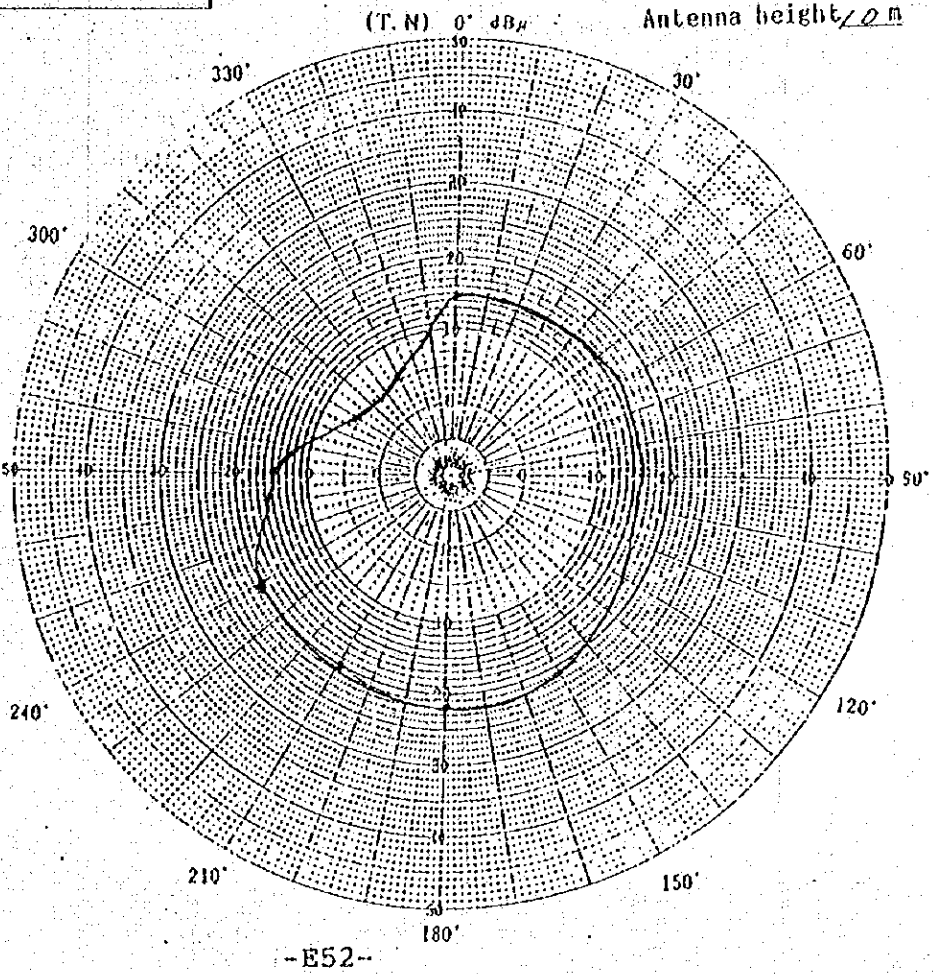
Roughly Drawing of Surveyed Point



Antenna Vertical pattern



Antenna Horizontal directivity pattern



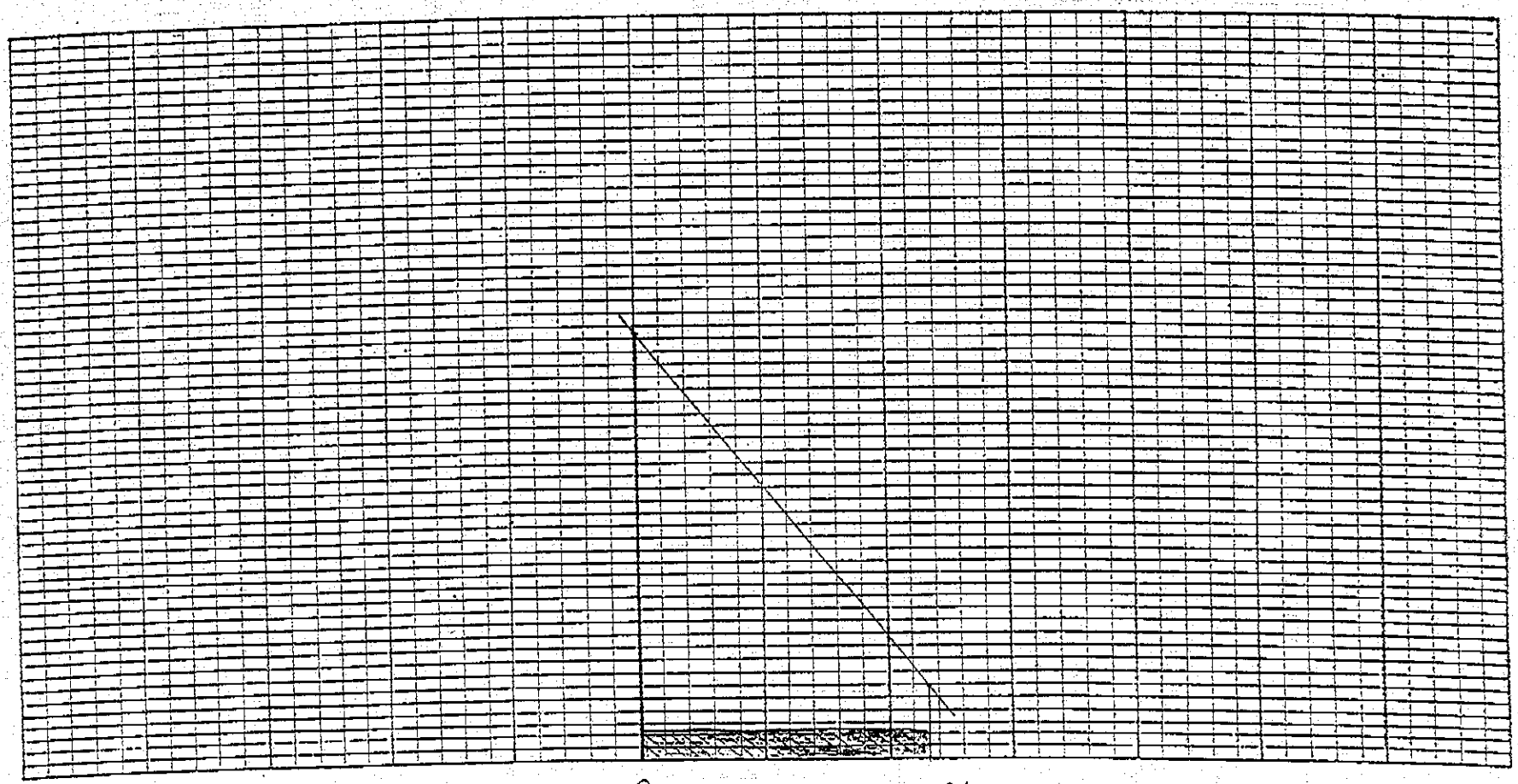
Station Base / Item	Transmitting station	Measuring station
Transmitting Power	10 (W) 40 (dBm)	
Frequency	149.34 (MHz)	
Type of Antenna	SLEEVE	3E YAGI
Polarization	Ⓥ. H.	Ⓥ H
Feeder	10D-2V 100 m	10D-2V 90 m
Antenna height	78.4 m	10 m
Field strength Meter	Band with 12 KHz	

Ramna 727 — Millbarrak 150Mz Band Radio Path Design Table				
.	Item	Desk Plan	Actual Test	Design Value
	Transmit. Height (Ht) Receive. Height (Hr) *(Above Sea Level)	85.0 (m) 15.0 (m)	85.0 (m) 15.0 (m)	85.0 (m) 20.0 (m)
	Distance (D)	2.9 (Km)	2.9 (Km)	2.9 (Km)
1	Antenna Gain (Ga) (Transmitting Side) (Receiving Side)	10.0 dB Sleeve 3EYagi	10.0 dB Sleeve 3EYagi	14.0 dB 3B Collinear 3EYagi
2	Feeder Loss (Lf1) (Transmitting Side) (Receiving Side)	-6.5 dB 10D-2V (100.0 m) 10D-2V (20.0 m)	-6.5 dB 10D-2V (100.0 m) 10D-2V (20.0 m)	-3.7 dB AFZE50-7 (80.0 m) 10D-2V (30 m)
3	Free space Loss (Lpf)	-85.2 dB	dB	-85.2 dB
4	Additional Loss Shadow Loss -1 (Lps) Plane earth Loss (Lpp) Additional Loss (As) for spherical earth	— — dB — dB — dB	dB dB dB dB	— — dB — dB — dB
	Divider. Fil. etc. Loss (Lf2)	— dB	dB	-6.0 dB
5	Correction Value After Actual Test (Lpc)	dB	dB	-13.3 dB
6	Span Loss (Ls)	-81.7 dB	dB	-94.2 dB
7	Transmitting Power (Pt)	10W. 40dBm	10W. 40dBm	10W. 40dBm
8	Receiving Power (Pr)	-41.7 dBm	dBm	-54.2 dBm
9	Receiving input Voltage (0dBμV=-113dBm) (Er)	71.3 dBμV/m	58.0 dBμV/m	58.8 dBμV/m
10	Threshold Level (Pth)	-110.0 dBm	dBm	-110.0 dBm
11	Threshold Margin (Mth)	68.3 dB	dB	55.8 dB
12	Crest Factor (Cf)	9 dB	9 dB	9 dB
13	S/N Improvement Factor (I)	12 dB	12 dB	12 dB
14	Standard S/N (S/N)	89.3 dB	dB	76.8 dB
15	Expected Fading Value (Lf) (0.1dB/Km+3dB)	-3.3 dB	dB	-3.3 dB
16	S/N at Fading (S/Nf)	86.0 dB	dB	73.5 dB
17	Judgement			Good
18	Remarks			

Scale ; C Type 30km/600m

(15km/150m ; 60km/2400m)

TERRAIN PROFILE



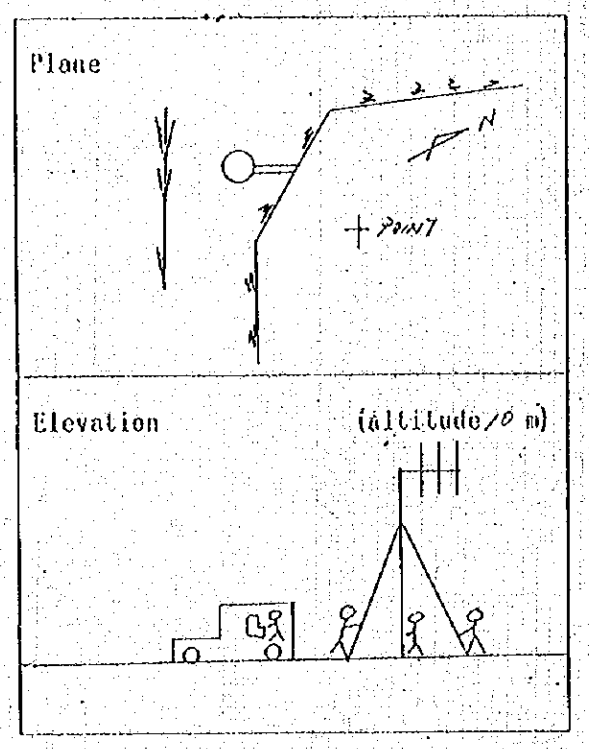
RAMNA		MILBARAK
ALTITUDE 6 m	2.9km	ALTITUDE 5 m
ANTENNA HEIGHT 79m		ANTENNA HEIGHT 10 m

K=4/3

Transmitting station → Measuring Station

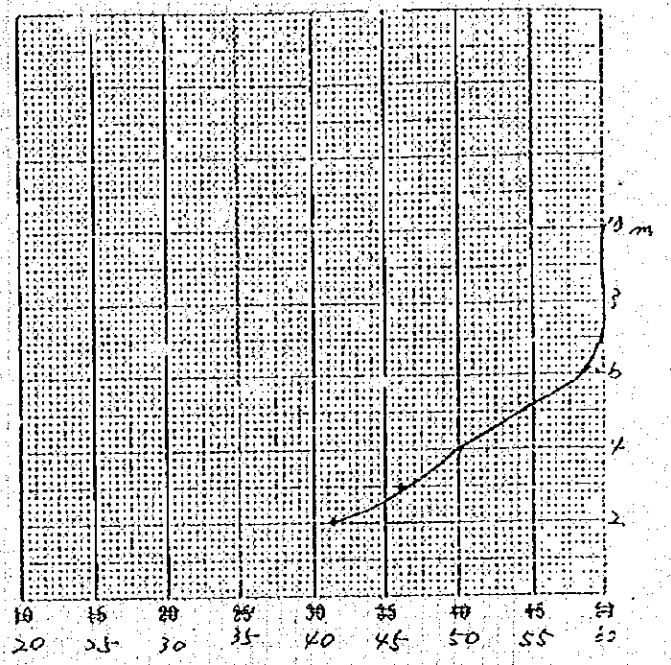
RAMNA → MILL BARAK

Roughly Drawing of Surveyed Point

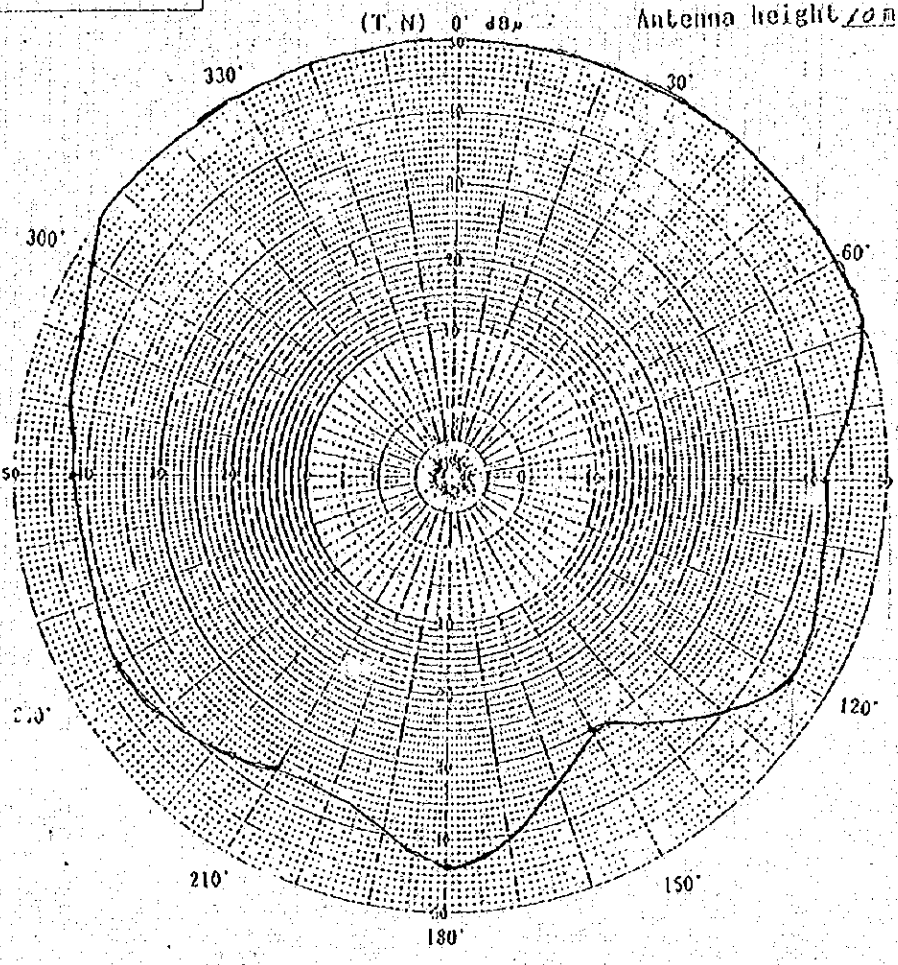


Station Name / Item	Transmitting station	Measuring station
Transmitting Power	10 (W) 40 (dBm)	
Frequency	149.5 (MHz)	149.5
Type of Antenna	SLEEVE	3E YAGI
Polarization	V H	V H
Feeder	100-2V 100 m	100-2V 20 m
Antenna height	28.5 m	10 m
Field strength Meter	Band with	12 KHz

Antenna Vertical pattern



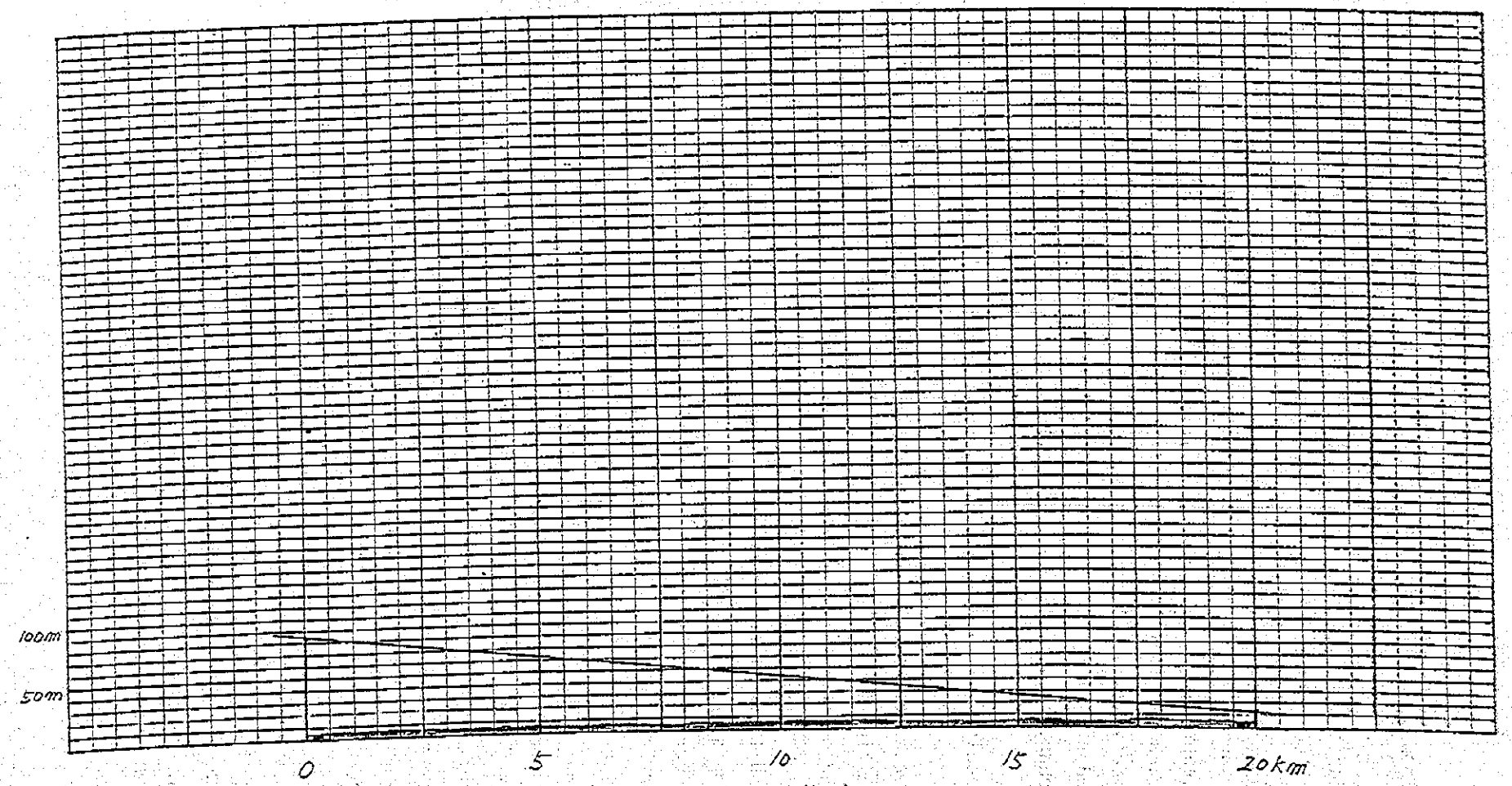
Antenna Horizontal directivity pattern



	Ramna TIT — Rikazi Bazar 150Mz Band Radio Path Design Table			
	I t e m	Desk Plan	Actual Test	Design Value
	Transmit. Height (Ht) Receive. Height (Hr) *(Above Sea Level)	85.0 (m) 15.0 (m)	85.0 (m) 15.0 (m)	85.0 (m) 20.0 (m)
	Distance (D)	20.0 (Km)	20.0 (Km)	20.0 (Km)
1	Antenna Gain (Ga) (Transmitting Side) (Receiving Side)	10.0 dB Sleeve 3EYagi	10.0 dB Sleeve 3EYagi	14.0 dB 3.8 Collinear 3EYagi
2	Feeder Loss (Lf1) (Transmitting Side) (Receiving Side)	-6.5 dB 10D-2V (100.0 m) 10D-2V (20.0 m)	-6.5 dB 10D-2V (100.0 m) 10D-2V (20.0 m)	-3.7 dB AFZ50-7 (80.0 m) 10D-2V (30.0 m)
3	Free space Loss (Lpf)	-102.0 dB	dB	-102.0 dB
4	Additional Loss Shadow Loss -1 (Lps) Plane earth Loss (Lpp) Additional Loss (As) for spherical earth	 — dB — dB -11.2 dB	 dB dB dB	 — dB — dB -11.2 dB
	Divider.Fil.etc.Loss (Lf2)	— dB	dB	-6.0 dB
5	Correction Value After Actual Test (Lpc)	dB	dB	-10.3 dB
6	Span Loss (Ls)	-109.7 dB	dB	-119.2 dB
7	Transmitting Power (Pt)	10W, 40dBm	10W, 40dBm	10W, 40dBm
8	Receiving Power (Pr)	-69.7 dBm	dBm	-79.2 dBm
9	Receiving input Voltage (0dBμV=-113dBm) (Er)	43.3 dBμV/m	33.0 dBμV/m	33.8 dBμV/m
10	Threshold Level (Pth)	-110.0 dBm	dBm	-110.0 dBm
11	Threshold Margin (Mth)	40.3 dB	dB	30.8 dB
12	Crest Factor (Cf)	9 dB	9 dB	9 dB
13	S/N Improvement Factor(I)	12 dB	12 dB	12 dB
14	Standard S/N (S/N)	61.3 dB	dB	51.8 dB
15	Expected Fading Value (Lf) (0.1dB/Km+3dB)	-5.0 dB	dB	-5.0 dB
16	S/N at Fading (S/Nf)	56.3 dB	dB	46.8 dB
17	Judgement			Good
18	Remarks			

Scale; C Type 30km/600m
(15km/150m; 60km/2400m)

TERRAIN PROFILE



MAY '79 $\frac{5}{6}$ & '79 $\frac{7}{10}$

RAMNA
ALTITUDE 6 m
ANTENNA HEIGHT 79m

20 km

RIKABI (B)
ALTITUDE 4.5m
ANTENNA HEIGHT 10 m

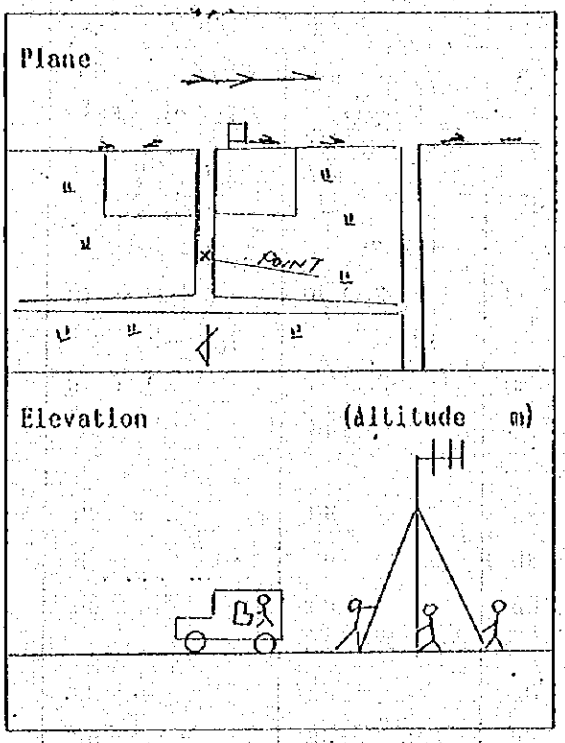
K=4/3

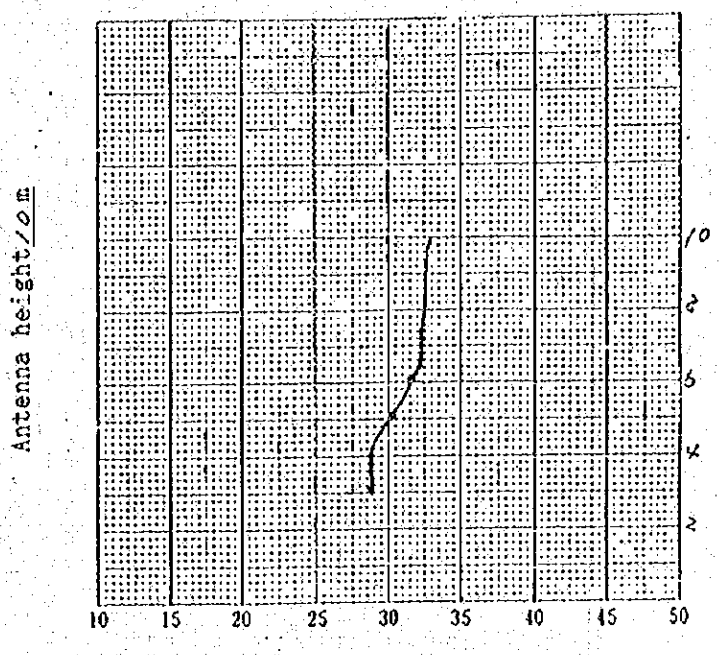
Transmitting station → Measuring Station

RAMNA — REKABI BAZAR

Antenna Vertical pattern

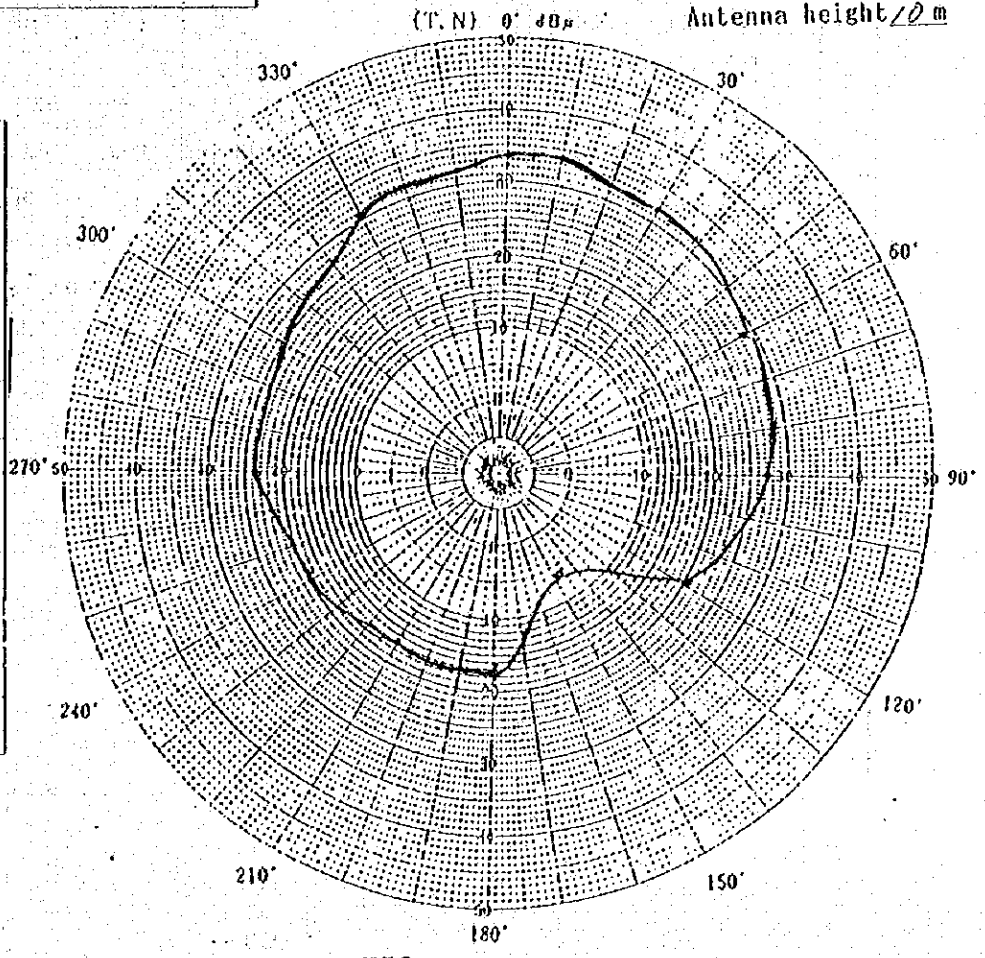
Roughly Drawing of Surveyed Point





Receiving input voltage

Antenna Horizontal directivity pattern



Station Name / Item	Transmitting station	Measuring station
Transmitting Power	10 (W) 40 (dBm)	
Frequency	149.35 (MHz)	
Type of Antenna	SLEEVE	3E YAGI
Polarization	V . H	(V) H
Feeder	10D-2V 100 m	10D-2V 20 m
Antenna height	28.5 m	10 m
Field strength Meter	Band with 12 KHz	

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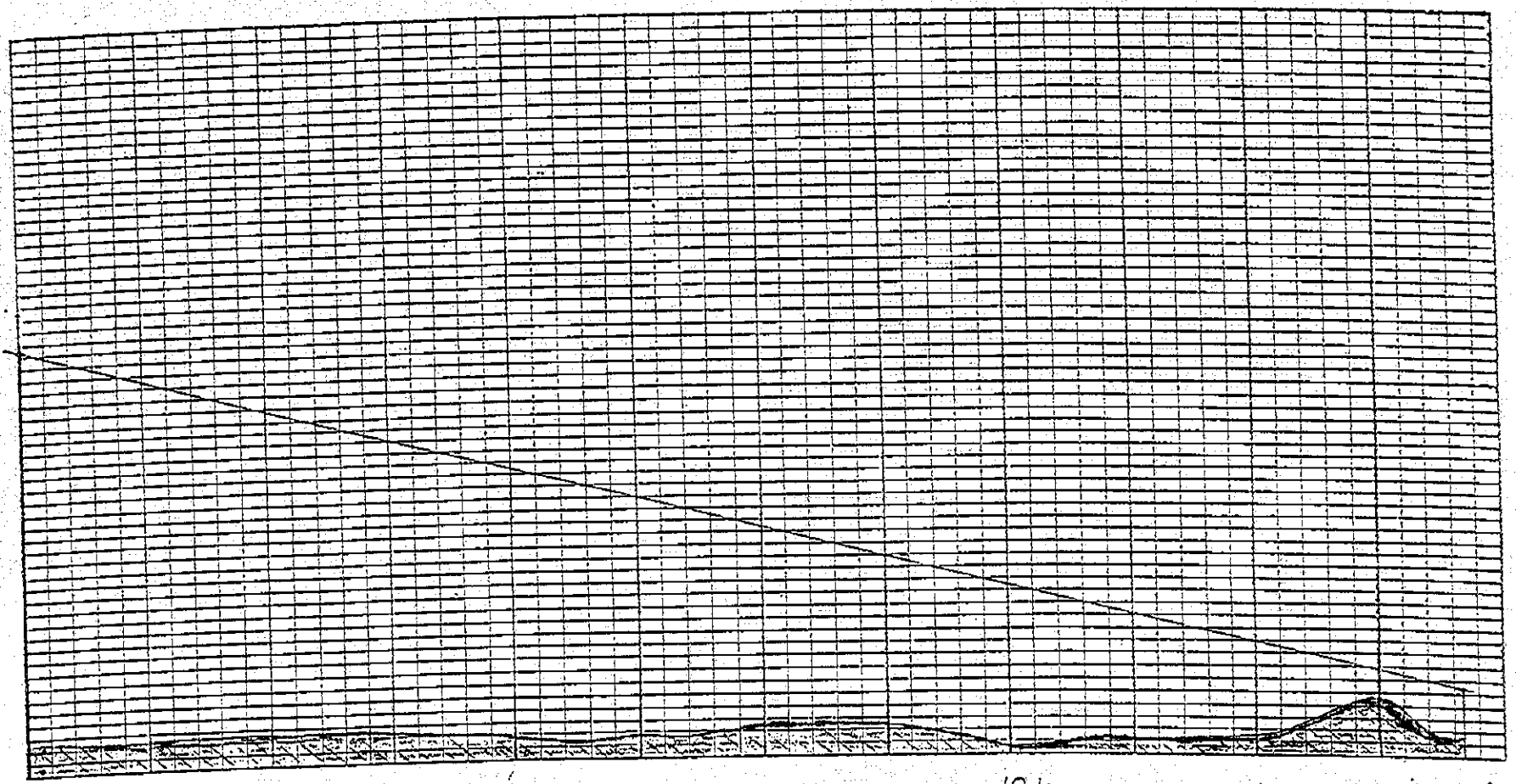
	Ranna — Narayangarj 150Mz Band Radio Path Design Table			
	Item	Desk Plan	Actual Test	Design Value
	Transmit. Height (Ht) Receive. Height (Hr) *(Above Sea Level)	85.0 (m) 14.0 (m)	85.0 (m) 14.0 (m)	85.0 (m) 14.0 (m)
	Distance (D)	14.6 (Km)	14.6 (Km)	14.6 (Km)
1	Antenna Gain (Ga) (Transmitting Side) (Receiving Side)	10.0 dB Sleeve 3E Yagi	10.0 dB Sleeve 3E Yagi	14.0 dB 3B Collinear 3E Yagi
2	Feeder Loss (Lf1) (Transmitting Side) (Receiving Side)	-6.5 dB 10D-2V (100.0 m) 10D-2V (20.0 m)	-6.5 dB 10D-2V (100.0 m) 10D-2V (20.0 m)	-3.7 dB AFZE50-7 (80.0 m) 10D-2V (30.0 m)
3	Free space Loss (Lpf)	-99.2 dB	dB	-99.2 dB
4	Additional Loss Shadow Loss -1 (Lps) Plane earth Loss (Lpp) Additional Loss (As) for spherical earth	 — dB — dB -8.2 dB	 dB dB dB	 — dB — dB -8.2 dB
	Divider. Fil. etc. Loss (Lf2)	— dB	dB	-3.0 dB
5	Correction Value After Actual Test (Lpc)	dB	dB	-17.1 dB
6	Span Loss (Ls)	-103.9 dB	dB	-117.2 dB
7	Transmitting Power (Pt)	10W. 40dBm	10W. 40dBm	10W. 40dBm
8	Receiving Power (Pr)	-63.9 dBm	dBm	-77.2 dBm
9	Receiving input Voltage (0dBμV=-113dBm) (Er)	49.1 dBμV/m	32.0 dBμV/m	35.8 dBμV/m
10	Threshold Level (Pth)	-110.0 dBm	dBm	-110.0 dBm
11	Threshold Margin (Mth)	46.1 dB	dB	32.8 dB
12	Crest Factor (Cf)	9 dB	9 dB	9 dB
13	S/N Improvement Factor (I)	12 dB	12 dB	12 dB
14	Standard S/N (S/N)	67.1 dB	dB	53.8 dB
15	Expected Fading Value (Lf) (0.1dB/Km+3dB)	-4.5 dB	dB	-4.5 dB
16	S/N at Fading (S/Nf)	62.6 dB	dB	49.3 dB
17	Judgement			Good.
18	Remarks			

Scale; C Type 30km/600m

(15km/150m; 60km/2400m)

TERRAIN PROFILE



RAMNA

ALTITUDE 6 m

ANTENNA HEIGHT 79 m

14.6 km

NARAYAN (G)

ALTITUDE 4 m

ANTENNA HEIGHT 10 m

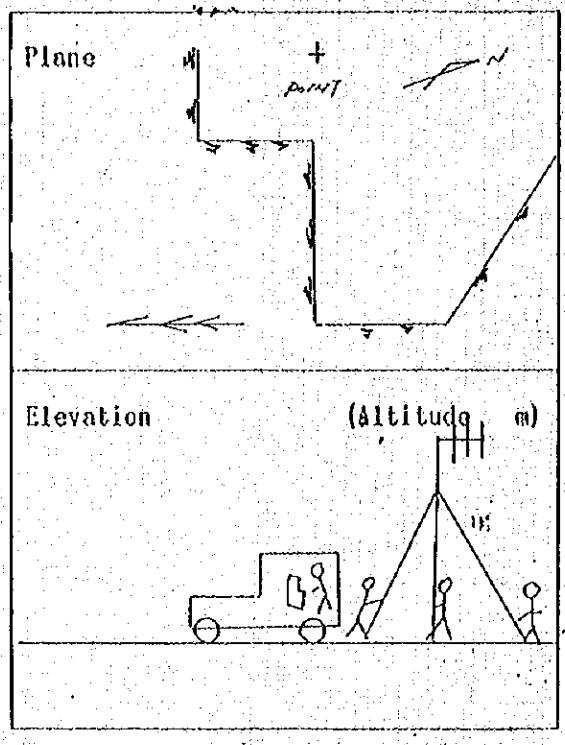
K=4/3

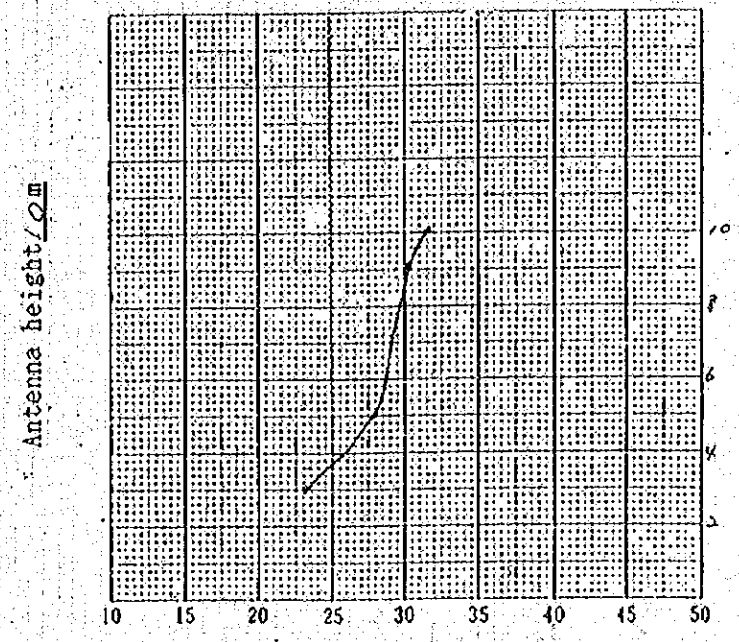
Transmitting station → Measuring Station

RAMNA → NARAYANGANJ

Antenna Vertical pattern

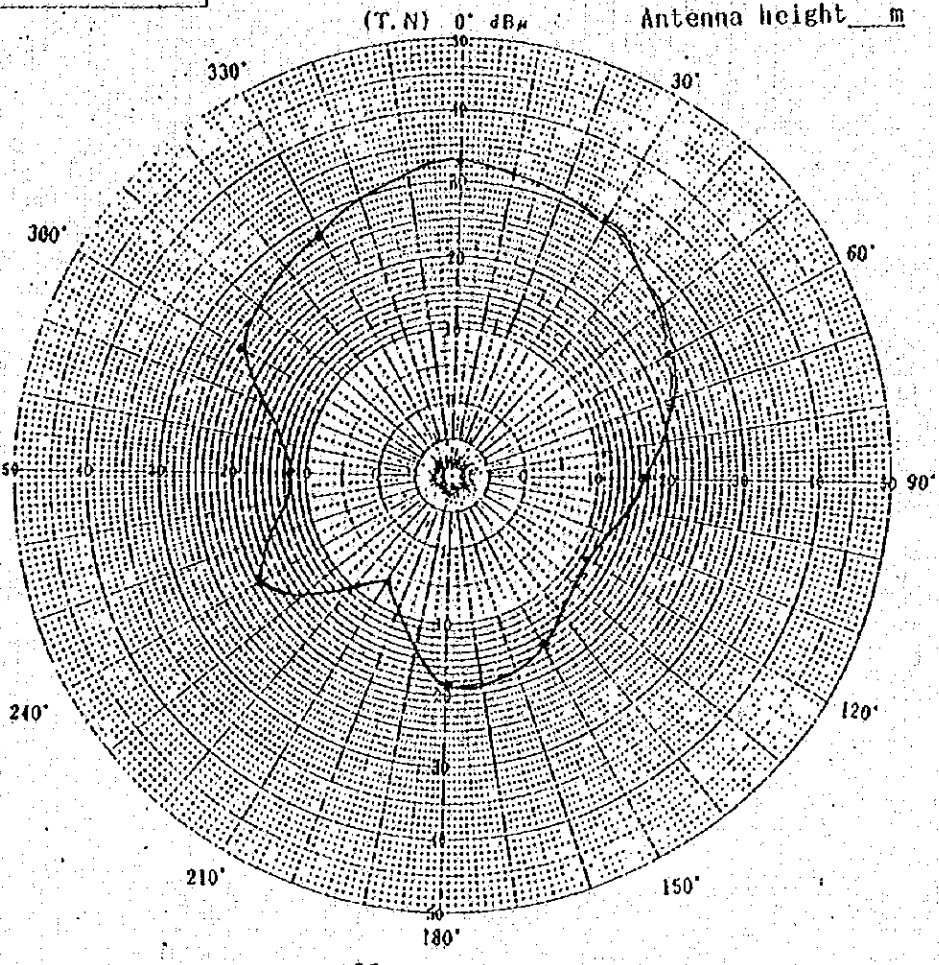
Roughly Drawing of Surveyed Point





Receiving input voltage

Antenna Horizontal directivity pattern



Station Name / Item	Transmitting station	Measuring station
Transmitting Power	10 (kW) 40 (dBm)	
Frequency	149.25 (MHz)	
Type of Antenna	SLEEVE	3EYAGI
Polarization	(V) H	(V) H
Feeder	10D-2V 100 m	10D-2V 20 m
Antenna height	28.5 m	10 m
Field strength Meter	Band with 12 KHz	

Ramna T&T —— Mirpur	150Mz Band Radio Path Design Table		
Item	Desk Plan	Actual Test	Design Value
Transmit. Height (Ht) Receive. Height (Hr) *(Above Sea Level)	85.0 (m) 12.0 (m)	85.0 (m) 12.0 (m)	85.0 (m) 18.0 (m)
Distance (D)	17.4 (Km)	17.4 (Km)	17.4 (Km)
1 Antenna Gain (Ga) (Transmitting Side) (Receiving Side)	-10.0 dB Sleeve 3EYagi	10.0 dB Sleeve 3EYagi	14.0 dB 3B.Collinear 3EYagi
2 Feeder Loss (Lf1) (Transmitting Side) (Receiving Side)	-6.5 dB 10D-2V (100.0 m) 10D-2V (20.0 m)	-6.5 dB 10D-2V (100.0 m) 10D-2V (20.0 m)	-3.7 dB AFZE50-7 (80.0 m) 10D-2V (30.0 m)
3 Free space Loss (Lpf)	-96.0 dB	dB	-96.0 dB
4 Additional Loss Shadow Loss -1 (Lps) Plane earth Loss (Lpp) Additional Loss (As) for spherical earth	 — dB — dB -5.4 dB	 dB dB dB	 — dB — dB -5.4 dB
Divider.Fil.etc.Loss (Lf2)	— dB	dB	-6.0 dB
5 Correction Value After Actual Test (Lpc)	dB	dB	-12.3 dB
6 Span Loss (Ls)	-97.7 dB	dB	-109.4 dB
7 Transmitting Power (Pt)	10W. 40dBm	10W. 40dBm	10W. 40dBm
8 Receiving Power (Pr)	-57.7 dBm	dBm	-69.4 dBm
9 Receiving input Voltage (0dBμV=-113dBm) (Er)	55.3 dBμV/m	43.0 dBμV/m	43.6 dBμV/m
10 Threshold Level (Pth)	-110.0 dBm	dBm	-110.0 dBm
11 Threshold Margin (Mth)	52.3 dB	dB	40.6 dB
12 Crest Factor (Cf)	9 dB	9 dB	9 dB
13 S/N Improvement Factor (I)	12 dB	12 dB	12 dB
14 Standard S/N (S/N)	73.3 dB	dB	61.6 dB
15 Expected Fading Value (Lf) (0.1dB/Km+3dB)	-4.8 dB	dB	-4.8 dB
16 S/N at Fading (S/Nf)	68.5 dB	dB	56.8 dB
17 Judgement			Good.
18 Remarks			

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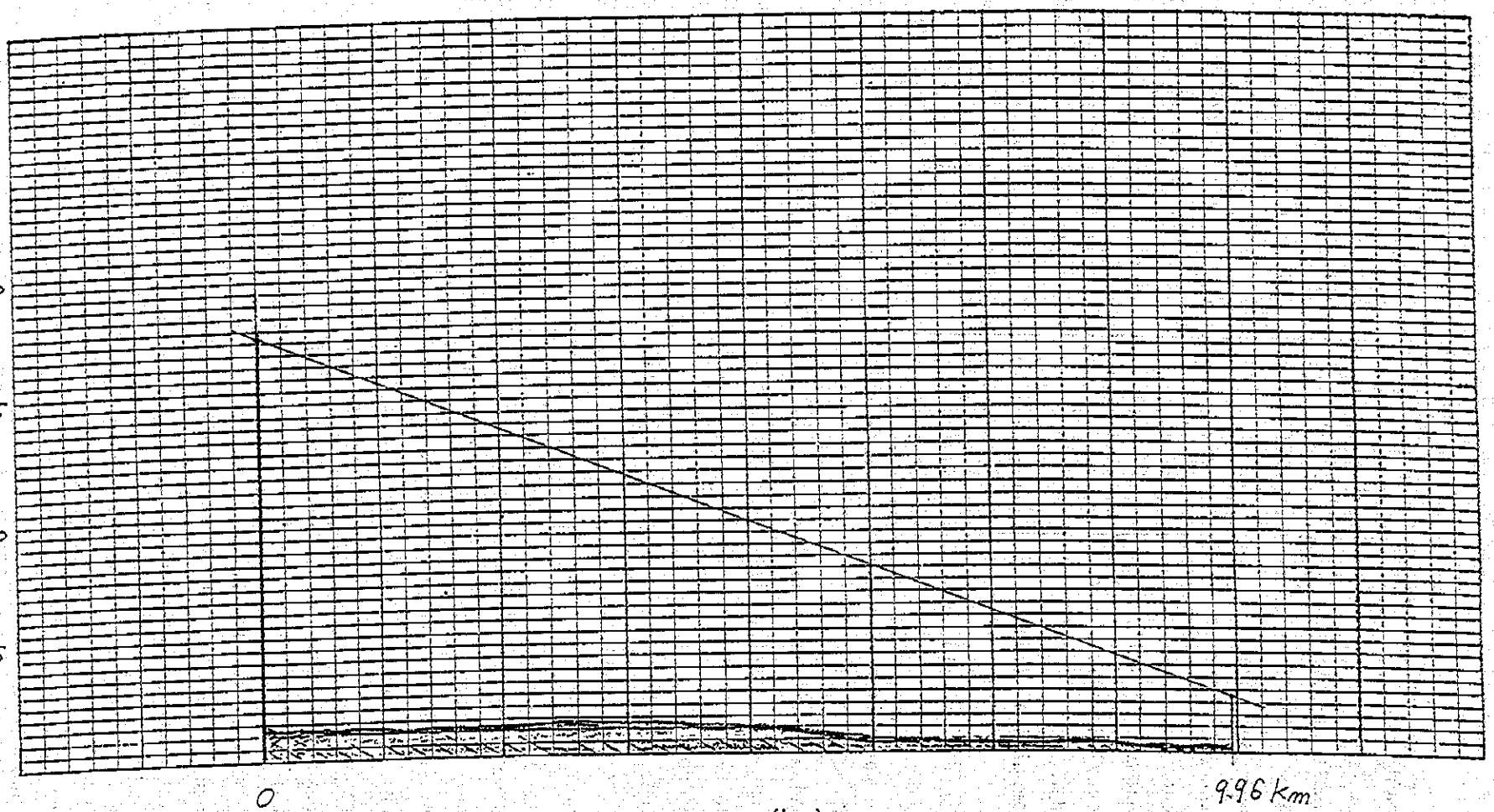
Scale ; C Type 30km/600m
(15km/150m ; 60km/2400m)

TERRAIN PROFILE



RAMNA
ALTITUDE 6 m
ANTENNA HEIGHT 79 m

9.96 km

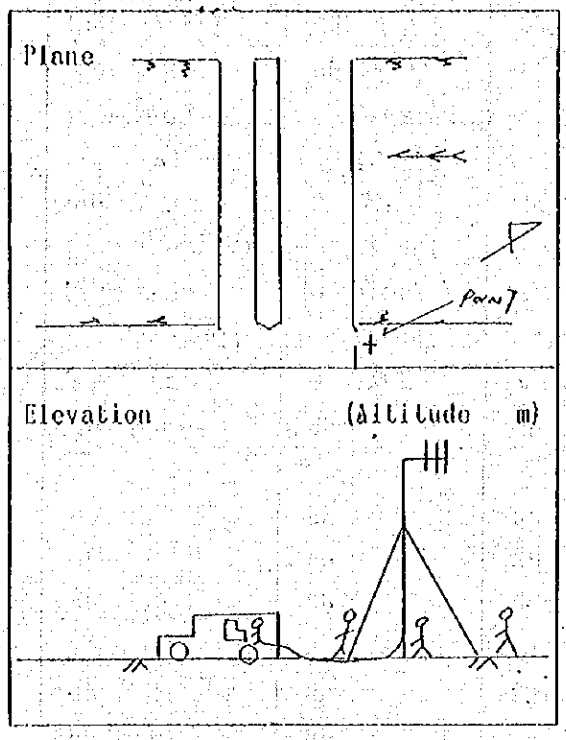
MIRPUR
ALTITUDE 2 m
ANTENNA HEIGHT 10 m

K = 4/3

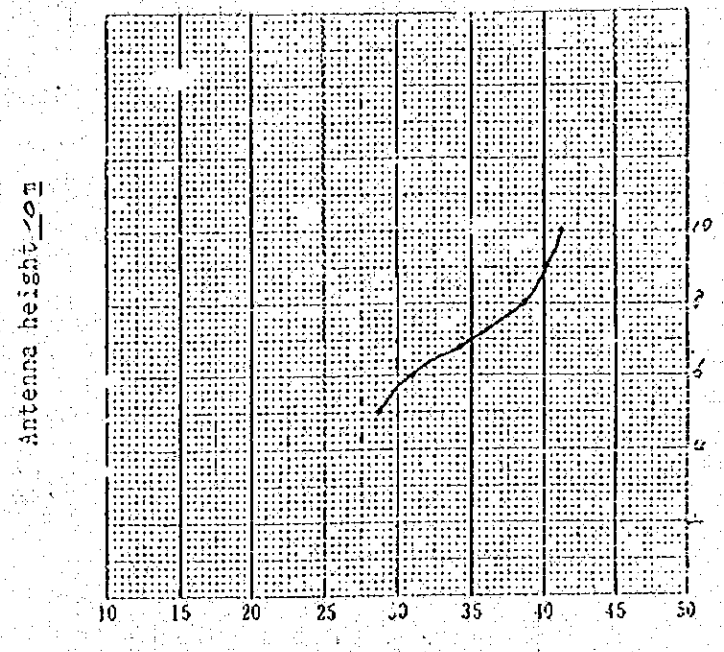
Transmitting station → Measuring Station

RAMNA – MIRPUR

Roughly Drawing of Surveyed Point



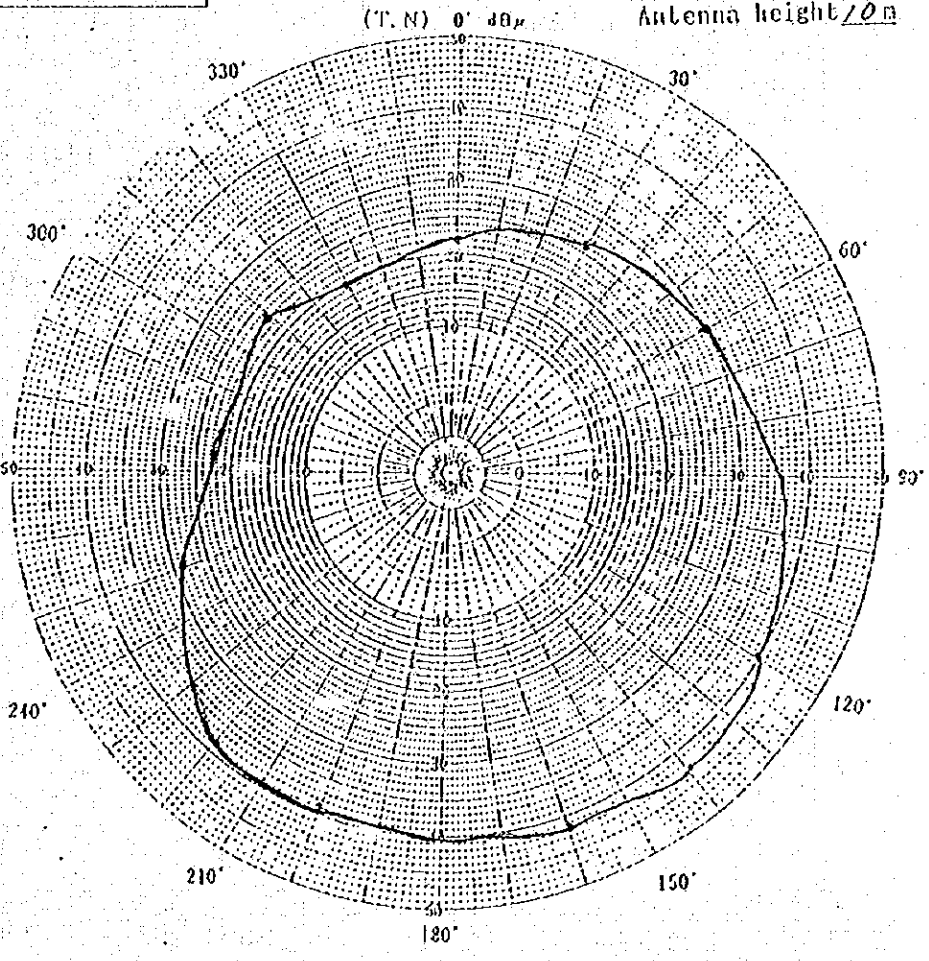
Antenna Vertical pattern



Receiving input voltage

Antenna Horizontal directivity pattern

Antenna height 10 m



Station Name / Item	Transmitting station	Measuring station
Transmitting Power	10 (kW) 40 (dBW)	
Frequency	149.35 (MHz)	149.35
Type of Antenna	SLEEVE	3E YAGI
Polarization	V H	V H
Feeder	100-2V 100 m	100-2V 20 m
Antenna height	78.5 m	10 m
Field strength Meter	Band with 12 KHz	