

*Reception problem in
a narrow range at
Kolkata & 24 South Parganas
District (West Bengal)*

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Kolkata & 24 South
Parganas District
(West Bengal)***



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Dated: 18/12/2014

Section : Propagation Lab

Objective : Reception problem in a narrow range at Kolkata & 24
South Pargana District

Field Strength Measurement/Reception Survey Team

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1. Introduction:

AIR Chinsurah (near Village Mogra) is situated in north direction from Kolkata City and 24 South Parganas district of West Bengal. The approximate aerial distance of Kolkata City is 40 kilometers to 65 kilometers. One Megawatt transmitter, consisting of three numbers of 400kW modules combines together to produce 1000 kW of R.F. energy in Medium Wave band. The output of the 1000 kW Medium Wave transmitter is 60 ohms. There are 3 antenna beams. These are known as A1, A2 and A3 beam. Three separate feeder lines of 60 ohms impedance originates from the transmitter output (selectable). The A1 beam operates on two towers M1 and M2, the A2 beam operates on tower M1 with M2 reactively tuned to get the NE direction and the A3 beam operates with radiating towers M4 and M5 and reactively tuned towers M3 and M6 to get South East beam. All the six towers are of an equal height of 152 meters. The distance between M1 and M2 towers and M3, M4, M5 and M6 tower is more than 700 meters. Lumped circuit matching does not exist in the aerial field, hence there is no A.T.U. At present only A1 beam (which is near to Elliptical Pattern) operates on day time frequency 594 kHz and night time frequency of 1134 kHz.

Originally transmission line and mast were designed to operate on two frequencies viz. 590 kHz and 1130 kHz till the implementation of the 9 kHz plan in 1979. No changes were made in the matching system after changing the frequencies to 594 kHz and 1134 kHz.

2. Objective:

At present, SPT Chinsurah radiates AIR Kolkata program on 594 kHz (day) and 1134 kHz during night timings. Reception is quiet good during day timings on 594 kHz in Kolkata City area. However, reception on 1134 kHz during night timings is not up to the mark in Kolkata City as well as 24 South Parganas district which is in South direction from the transmitter. One objective was to check the field strength in affected area and to check the possible co-channel interferences on 1134 kHz during night timings and also to suggest remedial action on this matter.

3. Equipment Used

- I. F/S meter along with loop antenna and tripod.
Make: Anritsu Model: ML428B

- II. Commercial Medium Wave Portable receiver
Make: Philips Model: Bahadur

- III. GPS receiver
Make: Garmin

- IV. Spectrum Analyzer
Make: Anritsu Model: MS2713E

- V. Spectrum Analyzer
Make: Anritsu Model: VNA

4. Methodology:

For field strength measurements, locations were selected in North to South and East to West direction in Kolkata City. Similarly, locations were selected on Kolkata to Bakkhali (near Bay of Bengal) and Kolkata to Murshidabad route.

Field Strength was obtained during day timings on 594 kHz as well as 1134 kHz (Night) at the same spot along with subjective reception on commercial radio. Four readings of Field Strength were also obtained near the transmitter for power calculation purposes. Subjective listening was carried out at several spots in Kolkata as well as South Parganas district after midnight for possible co-channel interference.

Calculations were made using charts already available from I.T.U. Noise was also measured on nearly vacant channel on Medium Wave band.

5. Coverage Concept in Medium Wave Band:

At night, the received field is the vector sum of the ground and sky wave signals. Close to the transmitter, ground wave dominates while at large distances, the sky waves take over. At some moderate distance, the two waves are of approximately equal amplitudes and the resultant field obtained will depend primarily upon the phase relation of the ground and the sky wave. As a consequence, fading is observed in this zone. Possibility of occurrence of fading within the primary service area and also the probability of

interferences (if any) from other transmissions through sky-wave during night time, may lead to a shrinkage of the primary service area, even though the night time signal strength is quiet strong.

Vertical angles of Radiation: By increasing the height of the radiator (mast) up to approximately 0.625λ , the amount of signal radiated in the horizontal plane (along the ground) will increase. At the same time, radiated signal at some angles above the ground (vertical angles) will decrease. Experience has shown that an equivalent electrical height of 0.53λ (180° electrical) is about optimum for ordinary conditions. Although a height of 0.625λ gives maximum concentration of radiation along the horizontal, it is accompanied by an undesirably large lobe of radiation at high vertical angles.

In getting the maximum coverage, both the ground wave field and the ratio of the ground wave to sky-wave field strength should have as high a value as possible. For the former, an antenna height of 0.625λ is optimum whereas for the latter, a height of 0.52λ to 0.57λ is required. The fading zone should be kept as far away as possible and the optimum height of the antenna that achieves this objective is 0.52λ to 0.57λ .

ITU Standards in Medium Wave

1. Co-channel Protection Ratio: 30 dB for stable wanted signal interfered by a stable or fluctuating signal.
2. Minimum value of Field Strength: Zone (A) (India): 60 dB μ V/m.
3. Nominal usable Field Strength:

Zone (A)	Day time	: 63 dB μ V/m
	Night (rural)	: 71 dB μ V/m
	Night (urban)	: 77 dB μ V/m

6. Data Analysis:

(A) North to South in Kolkata City (Table 1)

(Day): We started our measurements from Sadar Bazaar, Barackpur (Radial distance- 28 Km) and ended at Chitranjan Colony (Radial Distance- 60 Km). Field Strength observed was between 90 to 100 dB μ V/m, whereas power of the transmitter was 361kW. Reception on radio was excellent from 1230 hrs to 1545 hrs, on

frequency 594 kHz. Noise was between 35 dB μ V/m to 54dB μ V/m.

(Night): Similarly during night timings on 1134 kHz at transmitter power of 350kW corresponding Field Strength was from 84dB μ V/m to 69.3dB μ V/m. In fact, only at Barrackpur, Field Strength was above I.T.U. defined value of 77dB μ V/m. At all other places it was between 77dB μ V/m and 66dB μ V/m at Chitranjan Colony. At the same time noise level was from 47dB μ V/m to 51dB μ V/m. At many locations the difference between day and night timings noise level was more than 15 dB (Example Maniktala, B.T. Road).

No co-channel interference of significant level (less than 30 dB) were found all along the route.

(Refer Table 1)

(B) East to West (Table 2)

(Day): In this direction we started our survey from New Town (near Unitech building) to Writer's Building. The radial distance from transmitter was near 50 Km. Field Strength varies between 97 dB μ V/m to 102 dB μ V/m during day timings on 594 kHz with associated noise level between 34 dB μ V/m to 45 dB μ V/m. Reception quality was excellent at all places.

(Night): Except at two places, Field Strength was below 77 dB μ V/m (67 dB μ V/m to 78 dB μ V/m). Reception of

radio was clear but with large amount of noise and at some places, directivity of antenna required for clear reception. Corresponding noise level was between 42 dB μ V/m and 54 dB μ V/m. No co-channel interference was observed.

(C) Kolkata to Bakkhali (Table 3)

(Day): Observation similar to city areas was observed in this route. Day timings Field Strength was much above than the standard 63 dB μ V/m (82 dB μ V/m) at Ferry Ghat (Narayanpur Jetty) at a radial distance of 141 Km from the transmitter. Subjective audio reception on commercial radio receiver was very good.

(Night): Again subjective audio quality on commercial receiver was not up to the mark from radial distance 60 Km to the end of route near the Bay of Bengal at Bakkhali (radial distance from the transmitter- 163 Km). No significant co-channel interference was formed.

7. Conclusion

One of the major factors of weak field Strength during night timings w.r.t day is the frequency of operation. As shown in Annexure-1, ground coverage is just half of the day frequency (594 kHz), due to high losses at 1134 kHz. Figures of ground coverage are based on I.T.U. charts (Annexure 2 & 3).

Even the minimum signal requirements as per I.T.U. guidelines are based on noise measurements carried out in

1970. Noise including man-made noise has increased many times since then, as such, minimum required field strength for satisfactory reception of radio signal will also increase. The noise level measured by an expert team of University of Basque Country, Spain has given figures of 10 dB to 40 dB (city like Mexico City) increases over I.T.U. measured values of 1970.

The frequency 1134 kHz operating from AIR, Chinsurah was primarily meant for long distance coverage and physical antenna height of 152 meters selected for this purpose. This height corresponds to 0.625λ , where sky-wave radiation is very prominent along with ground wave and reception can be listened at a distance up to 2000 kilometers. This was confirmed from I.M.R.S., Todapur Delhi, where reception quality on 1134 kHz was very good from 1930 hrs to 2400 hrs.

The nominal output of Tx at 1134 kHz and 594 kHz is 350-370 kW. Even if we raise power to 700-800 kW range, then there will be hardly 6 dB gain over field strength recorded at Kolkata. This will not change this situation if nominal required field strength during night (77 dB μ V/m) is maintained. In view of the increased noise level, we may require a minimum of 85-90 dB μ V/m signal level.

At the moment, the only solution to this problem is reducing the frequency in the lower range of Medium Wave band if transmitter distance is between 30-40 Kms from the city. Even this cannot be done at AIR Chinsurah due to the limited

technical options available. Running the frequency 594 kHz during night timings may have solved the problems, but due to the I.T.U. regulations, same cannot be made operational.

Reception survey for identification of reception problem in narrow range at Kolkata

Transmitter: SPT Mogra (Chinsurah)

Date of measurement: 22/11/2014

Radial Direction/Route: South/ Belgharia- B.T. Road-Rifel Range Road-Chitranjan Colony

Sr.No	Spot/Location	Radial Distance (Km)	Time (Hrs)	Day time measurement (594 kHz)				Time (Hrs)	Night time measurement (1134 kHz)				Remarks													
				Field Strength (dBuV/m)	Average (dBuV/m)	Q-Peak (dBuV)	Reception Quality		Professional Receiver	Commercial Receiver	Field Strength (dBuV/m)	Average (dBuV/m)		Q-Peak (dBuV)	Reception quality	Terrain										
1	Sadar Bazar Barakpur	28	1230	90.0	-	22.9	E	E	2010	84.5	47.4	29.8	G	G	Urban, Low traffic											
2	Belgharia	40	1315	100.0	35.8	45.2	E	E	2045	73.8	44.2	14.8	G	G	Urban, Heavy traffic											
3	Shanti nagar Colony (B.T. Road)	45	1345	95.2	45.0	18.0	E	E	2125	74.2	42.4	20.3	G	G	Urban, Heavy traffic											
4	Maniktala (B.T. Road)	50	1415	99.2	34.3	11.2	E	E	2150	69.8	49.2	40.2	G	G	Urban, Heavy traffic											
5	Rifle Range Road	55	1510	97.8	51.2	27.6	E	E	2230	66.2	44.8	23.2	F	F	Urban, Low traffic	Transmitter Power										
6	Chitranjan Colony	60	1545	90.2	54.2	36.8	E	E	2255	69.3	51.8	38.6	F	F	Urban, Low traffic	<table border="1"> <tr> <td>Time (Hrs)</td> <td>Power (kW)</td> </tr> <tr> <td>0730</td> <td>625</td> </tr> <tr> <td>1105</td> <td>361</td> </tr> <tr> <td>1745</td> <td>350</td> </tr> <tr> <td>2310</td> <td>354</td> </tr> </table>	Time (Hrs)	Power (kW)	0730	625	1105	361	1745	350	2310	354
Time (Hrs)	Power (kW)																									
0730	625																									
1105	361																									
1745	350																									
2310	354																									

Reception survey for identification of reception problem in narrow range at Kolkata

Transmitter: SPT Mogra (Chinsurah)

Date of measurement: 23/11/2014

Radial Direction/Route: New Town-Neentala Ghat Street-Bhootnath Ghat-Howrah Rly Station-Writer's Building

Sr.No	Spot/Location	Radial Distance (km)	Time (Hrs)	Day time measurement (594 kHz)				Time (Hrs)	Night time measurement (1134 kHz)				Remarks		
				Field Strength (dB μ V/m)	Average (dB μ V/m)	Q-Peak (dB μ V)	Reception Quality		Professional Receiver	Commercial Receiver	Field Strength (dB μ V/m)	Average (dB μ V/m)		Q-Peak (dB μ V)	Professional Receiver
1	New Town Near Unitech	52	1145	101.8	34.2	8.2	E	E	1830	77.9	42.5	10.9	VG	VG	Urban, HRB, Moderate Traffic
2	Salt Lake Central Park	49	1230	102.3	37.8	11.5	E	E	1930	70.4	42.9	16.7	VG	VG	Urban, Heavy traffic
3	Maniktala Main Rd Near Marwari Bagan	49.5	1250	102.9	45.3	19.9	E	E	1950	69.6	46.8	20.6	G/F	G/F	Urban, Moderate traffic
4	Neentala Ghat Street	48.1	1315	99.7	47.5	23.6	E	E	2030	78.5	54.2	41.9	F	F	Urban, Moderate traffic
5	Bhootnath Ghat	48.5	1320	99.2	42.8	20.1	E	E	2045	73.7	33.5	18.9	G	G	Urban, Low traffic
6	Howrah Rly Station (Rail Museum)	49.7	1345	101.5	35.6	19.2	E	E	2100	73.6	44.7	15.4	VG	VG	Urban, Moderate traffic
7	Writer's Building	49.0	1450	97.4	35.0	9.7	E	E	2130	67.8	36.9	16.7	VG	VG	Urban, Heavy traffic
												Transmitter Power			
												Time (Hrs)	Power (kW)		
												0600	642		
												1140	648		
												1700	583		
												2000	374		
												2247	611		

Reception survey for identification of reception problem in narrow range at Kolkata

Transmitter: SPT Mogra (Chinsurah)

Date of measurement: 24/11/2014

Radial Direction/Route: South/Diamond Harbour Road-Kakdwip-Ferry Ghat-Bakkhali

Sr.No	Spot/Location	Radial Distance (Km)	Time (hrs)	Day time measurement (594 kHz)				Time (hrs)	Night time measurement (1134 kHz)				Terrain	Remarks	
				Field Strength (dB μ V/m)	Average (dB μ V/m)	Q-Peak (dB μ V)	Reception Quality		Professional Receiver	Commercial Receiver	Field Strength (dB μ V/m)	Average (dB μ V/m)			Q-Peak (dB μ V)
1	Chaurasia Diamond harbour-Behla Road	60.5	1140	93.4	38.9	23.4	E	E	2300	70.5	39.7	19.8	G	G	Urban, Moderate Traffic, Metro Flyover
2	Hashim Nagar Diamond Harbour Road	80	1245	88.9	64.5	43.6	F	F	2215	72.2	46.1	19.6	P	P	Urban, Heavy Moderate traffic
3	Diamond Harbour	95	1345	89.9	45.7	19.6	E	E	2140	65.9	44.8	33.6	G	G	Open area, River side, Low Traffic
4	Anando Nagar	120	1430	86.1	38.6	23.0	E	E	2050	64.2	40.5	16.8	P	P	Open Vegetation, Low Traffic
5	Kakdwip	130	1459	78.2	52.3	25.7	VG	VG	2030	55.6	49.6	24.9	NT	NT	Sub Urban, Moderate traffic, HT Line
6	Ferry Ghat	141	1515	82.2	35.6	9.2	E	E	1915	61.4	41.7	16.6	G	P	Urban, Moderate traffic
7	Bakkhali	163	1740	-	-	-	-	-	1750	60.4	32.6	6.2	P	P	Sea Shore, Open area

Time (Hrs)	Power (kW)
0730	647
1340	656
1719	654
2300	351

Weak Co-Channel Interference

Transmitter Power

Reception survey for identification of reception problem in narrow range at Kolkata

Transmitter: SPT Mogra (Chinsurah)

Date of measurement: 25/11/2014

Radial Direction/Route: Murshidabad-Rafinagar(NH-4)-Krishnanagar(NH-4)

Sr.No	Spot/Location	Radial Distance (km)	Time (Hrs)	Day time measurement (594 kHz)				Time (Hrs)	Night time measurement (1134 kHz)				Remarks									
				Field Strength (dB μ V/m)	Average (dB μ V/m)	Q-Peak (dB μ V)	Reception Quality		Reception Quality	Field Strength (dB μ V/m)	Average (dB μ V/m)	Q-Peak (dB μ V)		Reception quality	Terrain							
1	Before Murshidabad	120																				
2	NH-34, Near Rafi Nagar	95						1950	78.0	31.5	11.5	G	G	G	Rural, Low Traffic,							
3	NH-34 Near Krishna Nagar	55						2105	79.2	39.5	24.5	G	G	G	Rural, Low Traffic							
								2230	86.4	44.5	14.5	VG	VG	VG	Rural, Low Traffic							
															Transmitter Power Time (Hrs) Power (kW) 0600 357 0902 351 1410 342 1953 645							

Annexure-1

AIR (SPT)-Chinsurah Antenna

1. Height of Self Radiating Mast : 152 Meter each(Two Tower Operation)
2. Radiation Pattern : Elliptical (A1 Beam)

Frequency	λ	0.25λ	0.55λ	0.625λ
594kHz (Day time)	506.75 Meters	126.68 Meters	278 Meters	316.7 Meters
1134kHz(Night time)	264 Meters	66 Meters	145 Meters	165 Meters

Day Time Coverage (As per ITU Chart)

At 350 kW XTr Power	Frequency	Night Time Field Strength (77dB μ V/m)	Day Time Field Strength (63dB μ V/m)
	594kHz	260 Kms	280 Kms
	1134kHz	130 Kms	160 Kms

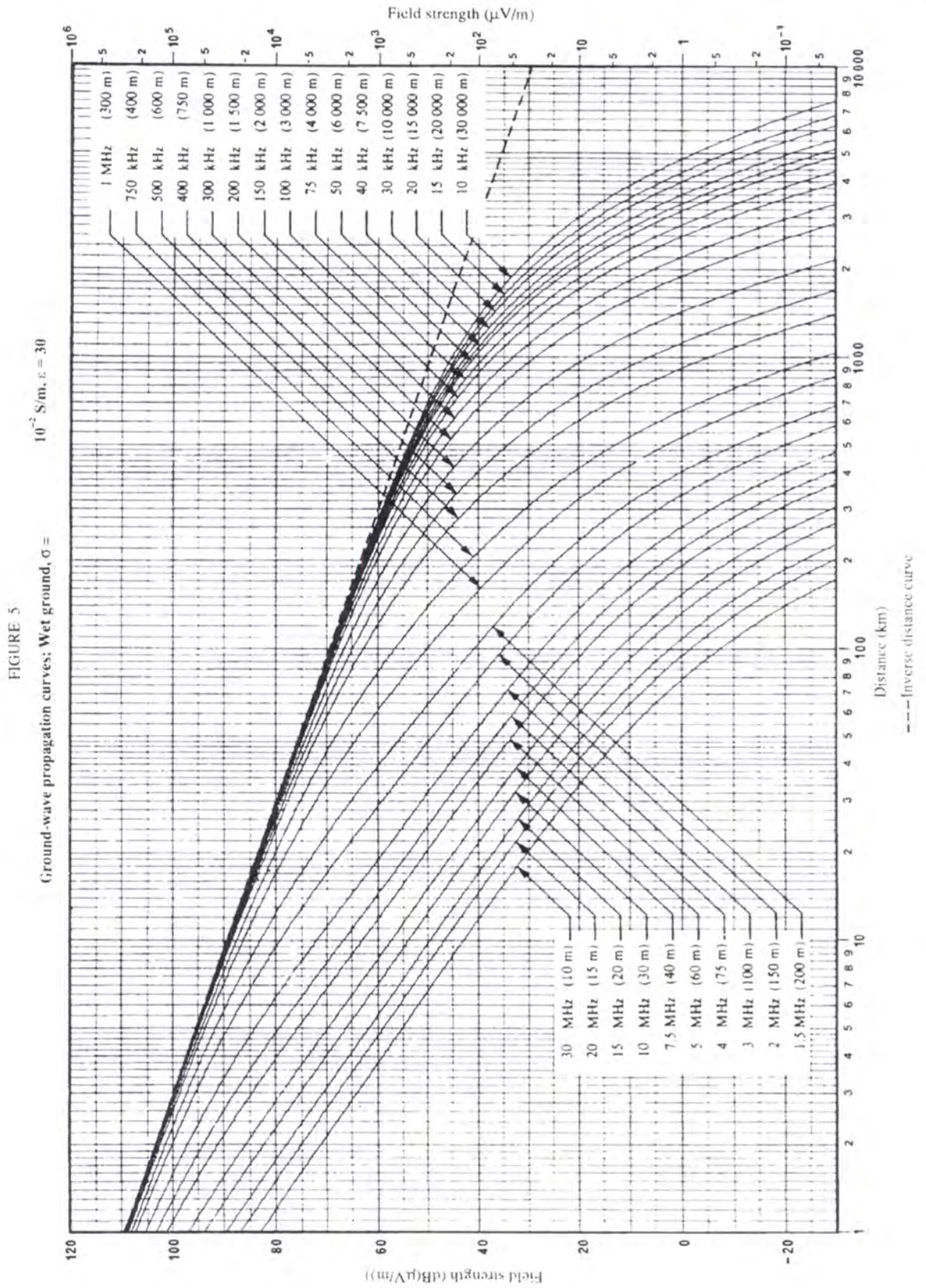
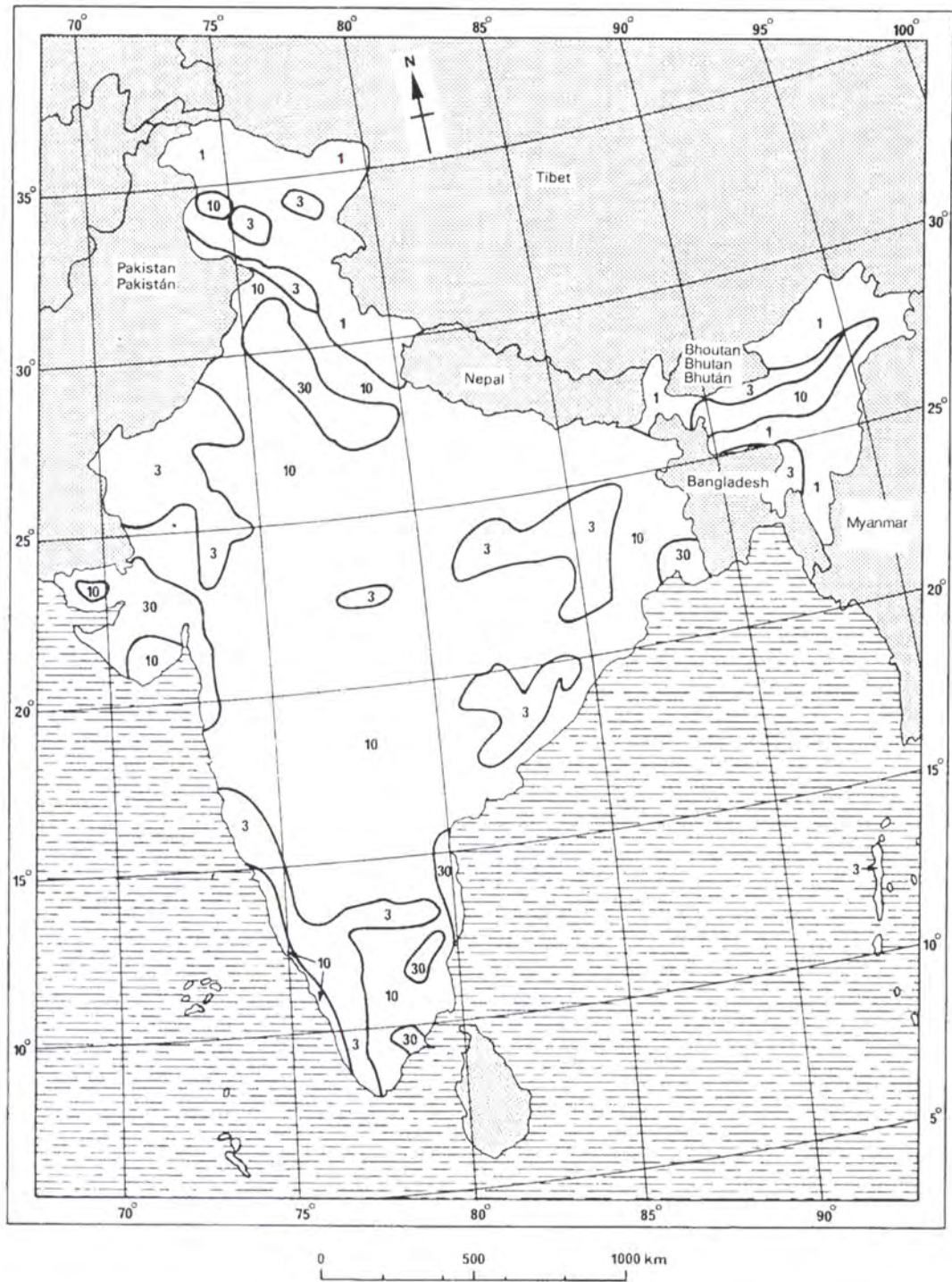


FIGURE 26
India (Republic of)



Ground Conductivity Map of India

Basic Data and Transmitter details

Transmitters Details:

1. Name of Station : SPT,AIR,Chinsurah(West Bengal)
2. Location of the Transmitters : LAT- N 88° 21' 15"
(In 6 figure coordinates) LON- E 23° 01' 28"
3. Description of terrain around the : Rural/Vegetation
Site of Transmitters
4. Classification(Large city/urban/rural) : Rural
5. Rated power of the Transmitter : 1000kW
6. Make : Thomcast(Thomson)
7. Model No. : S7HP MW Transmitter
8. Frequency of operation : 594 kHz(Day Time)
1134 kHz (Night Time)
9. Date of Commissioning : 05/03/2014

:

Transmitting Antenna Details:

1. Type of Antenna : Self Radiating Vertical Mast
2. Height of Tower : 152 Meter
3. Radiation Pattern : Elliptical