

*Reception Survey for assessment of
coverage area for satisfactory
reception of DVB-T2 transmitter
located at Kolkata*

**Reception survey for
assessment of coverage area
for satisfactory reception of
DVB-T2 Transmitter**

Located

At

Kolkata

(Survey period 05/5/17 to 13/5/17)

Field Strength Measurement/Reception Survey Team

PROPAGATION LAB
Research Department

Team Leader : Md Javed Shams, AE

Team Members:
N D DAS, SEA
Naeem Khan, Sr Technician
Sushil Kumar, Technician
J S Yadav, SCD

Supervised By : S Hyder, DDG (E)

Guided By : Mrs. Anuradha Agarwal, ADG(E)

Introduction

DVB-T2 is the second generation standard for digital terrestrial TV, offering significant benefits as compared to the older version of DVB-T.

The emergence of DVB-T2 is motivated by the higher spectral efficiency. It means that with the same amount of spectrum a larger number of programmes can be broadcast or the same number of programmes broadcast with a higher audio / video quality or coverage quality.

Like its predecessor, DVB-T2 uses OFDM (orthogonal frequency division multiplex) modulation with a large number of subcarriers, delivering a robust signal, and offers a range of different modes, making it a very flexible standard. DVB-T2 uses the same error correction coding as used in DVB-S2 and DVB-C2: LDPC (Low Density Parity Check) coding combined with BCH (Bose-Chaudhuri-Hocquengham) coding, offering a very robust signal. The number of carriers, guard interval sizes and pilot signals can be adjusted, so that the overheads can be optimised for any target transmission channel. Additional new technologies used in DVB-T2 are as follows:

- Multiple Physical Layer Pipes allow separate adjustment of the robustness of each delivered service within a channel to meet the required reception conditions (for example in-door or roof-top antenna). It also allows receivers to save power by decoding only a single service rather than the whole multiplex of services.
- Alamouti coding is a transmitter diversity method that improves coverage in small-scale single-frequency networks.
- Constellation Rotation provides additional robustness for low order constellations.
- Extended interleaving, including bit, cell, time and frequency interleaving.
- Future Extension Frames (FEF) allow the standard to be compatibly enhanced in the future.

As a result, DVB-T2 can offer a much higher data rate than DVB-T OR a much more robust signal.

Objectives of Survey

Main objectives of this survey are given below:

- Determination of service range of Kolkata DVB-T2 TV transmitter, operating on 482 MHz in QPSK (SD) (Channel # 22) in fixed reception mode (Reception antenna at a height of 10 meters).
- Determination of service range of Kolkata DVB-T2 TV transmitter, operating on 506 MHz on 64 QAM (HD) (Channel # 25) in fixed reception mode (Reception antenna at a height of 10 meters).
- Determination of service area of channel 22 on Smart phones using "TV on GO" dongle.
- Identifying areas of poor reception of the transmission, in the coverage areas of Kolkata DVB-T2 transmitter.

Equipment Used

1. Field strength cum Spectrum Analyzer, Anritsu MS 2035B & MS 2013E.
2. UHF standard Dipole Antenna, Anritsu MP663A.
3. Rhode & Schwarz make UHF log periodic antenna HL 223
3. GPS Navigator, Garmin Montana 650.
4. DVB-T2 STB.
5. Sony LCD TV receiver.
6. Promax Ranger TV analyzer
7. R&S ETL TV analyzer
7. TV on Go DVB-T2 dongle for Android phones.
7. Tata Safari Survey van equipped with 10 meter pneumatic mast and 3 KVA Honda generators.
8. Other accessories as per requirements.

Planning Criteria

Antenna diagram for fixed reception

The antenna diagram characterizes the relative output level of an antenna when the signal is received under different angles. Recommendation ITU-R BT.419 defines the directivity of a standard antenna used for fixed broadcast reception as in Fig. 1. To reproduce the actual receiving conditions of a customer installation, measurements for fixed coverage have been made with a measurement antenna having the same directivity.

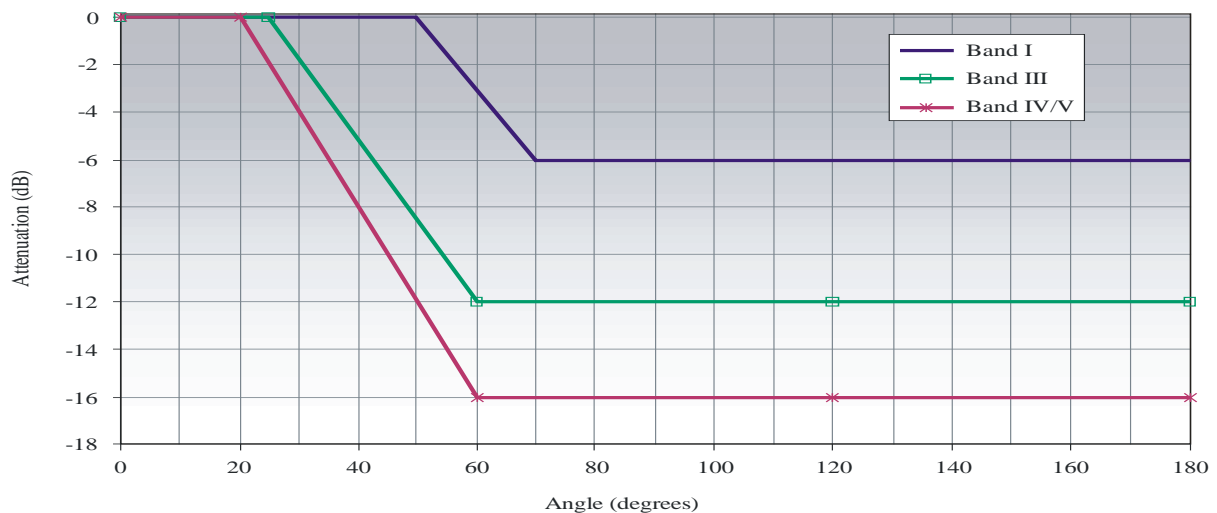


Figure-1

The term “covered”

A certain area is regarded as being “covered” by DVB-T2, when the median field strength for the particular receiving situation in a specified height above ground (often 10 m) and the protection ratio reach or exceed the values given in the relevant planning documents (e.g. ITU doc).

The fact of a certain area to be covered or not is a result of the calculation process done with a coverage survey that assumes defined conditions and/or values for:

- The receiving condition (e.g. fixed or portable reception);
- The field strength loss with distance due to topography and morphology;
- The receiver model (e.g. sensitivity and selectivity);
- The receiving antenna (height, gain and directivity);
- The reception channel (Gaussian, Rice or Rayleigh).

Attached to the attribute “covered” is also a certain probability in time and location. Using planning tools, the coverage area was calculated for this probability (e.g. 50% of the time and 50% of the locations).

It can therefore not be assumed that DVB-T2 reception with a standard receiver is possible at every single location inside the area defined as being covered.

Verification of coverage cannot be done with a standard DVB-T2 receiver by simply checking whether it works at a certain location. Instead, the technical parameters such as field strength have been measured, under the same receiving conditions as assumed in the planning tool.

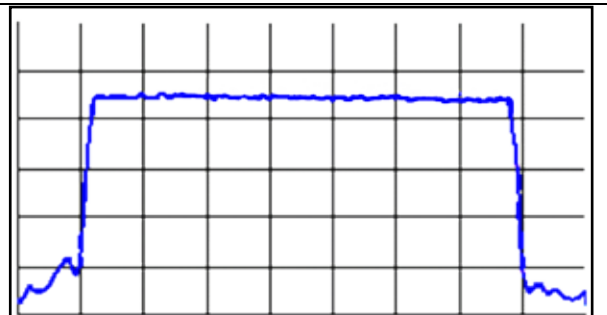
Reception Channel

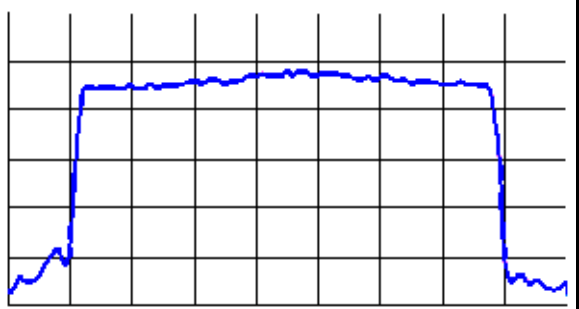
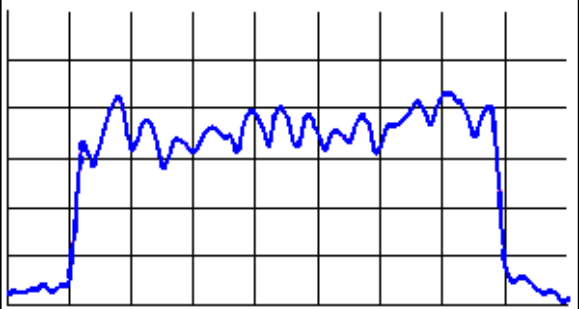
Due to reflections, shading and reception of signals from multiple transmitters of an SFN, the received spectrum can be degraded. The order of this degradation determines the reception channel

The standard deviation of the spectral amplitudes σ_{sp} has an influence on the minimum receiver input level necessary to decode the DVB-T2 signal.

Gauss channel:

Only the direct signal from a transmitter within line-of-sight is received. No reflections and co channel emissions are received. As a result, the OFDM spectrum is rectangular. The standard deviation of the spectral amplitudes over the channel bandwidth σ_{sp} is between 0 and 1 dB.



<p>Rice channel: In addition to the direct signal, several smaller co-channel signals and reflections are received. The OFDM spectrum shows slight variations in amplitude over frequency. The standard deviation of the spectral amplitudes over the channel bandwidth σ_{sp} is between 1 and 3 dB.</p>	
<p>Rayleigh channel: The received signal is composed only of reflections and components from various co-channel transmitters. No dominant direct signal is received. The OFDM spectrum shows heavy distortion. The standard deviation of the spectral amplitudes over the channel bandwidth σ_{sp} is higher than 3 dB.</p>	

Measurement Set-Up

The field trial was carried out by utilizing mobile survey van of Research department having 10 meter pneumatic telescopic mast. Field strength measurement was carried out, using Anritsu make spectrum analyzer & UHF band standard dipole antenna with known correction factor already loaded in the analyzer for different channels. To record digital parameters, R&S made ETL was used. In addition to this Garmin make GPS was used for the determination of the co-ordinates and LOS distance.

ITU Parameters for reception of DVB-T2 transmission (BT. 2254-2)

DVB-T2 in Band IV/V			Fixed	Portable outdoor/urban	Portable indoor/urban	Mobile Rural	Handheld portable outdoor	Handheld mobile Class H-D/ integrated antenna
Frequency	Freq	MHz	650	650	650	650	650	650
Minimum C/N required by system	C/N	dB	19.7	17.8	18.2	10.0	9.6	10.0
System variant (example)			256-QAM M FEC 2/3, 32k, PP7 Extended	64-QAM FEC 2/3, 32k, PP4 Extended	64-QAM FEC 2/3, 16k, PP1 Extended	16-QAM FEC 1/2, 8k, PP1 Extended	16-QAM FEC 1/2, 16k, PP3 Extended	16-QAM FEC 1/2, 8k, PP2 Extended
Bit rate (indicative values)		Mbit/s	35-40	26-29	23-28	11-14	12-15	11-14
Receiver noise figure	F	dB	6	6	6	6	6	6

DVB-T2 in Band IV/V			Fixed	Portable outdoor/urban	Portable indoor/urban	Mobile Rural	Handheld portable outdoor	Handheld mobile Class H-D/ integrated antenna
Equivalent noise bandwidth	B	MHz	7.77	7.77	7.77	7.71	7.77	7.71
Receiver noise input power	P_n	dBW	-129.1	-129.1	-129.1	-129.1	-129.1	-129.1
Min. receiver signal input power	$P_{s_{min}}$	dBW	-109.4	-111.3	-110.9	-119.1	-119.5	-119.1
Min. equivalent receiver input voltage, 75 W	U_{min}	dB μ V	29.4	27.5	27.9	19.6	19.3	19.6
Feeder loss	L_f	dB	4	0	0	0	0	0
Antenna gain relative to half dipole	G_d	dB	11	0	0	0	-9.5	-9.5
Effective antenna aperture	A_a	dBm ²	-4.6	-15.6	-15.6	-15.6	-25.1	-25.1
Min power flux-density at receiving location	θ_{min}	dB(W)/m ²	-100.8	-95.7	-94.3	-103.5	-94.4	-94.0
Min equivalent field strength at receiving location	E_{min}	dB μ V/m	45.0	50.1	50.5	42.3	51.4	51.8
Allowance for man-made noise	P_{mmn}	dB	0	1	1	0	0	0
Penetration loss (building or vehicle)	L_b, L_v	dB	0	0	11	0	0	8
Standard deviation of the penetration loss		dB	0	0	6	0	0	2
Diversity gain	Div	dB	0	0	0	0	0	0
Location probability		%	70	70	70	90	70	90
Distribution factor			0.5244	0.5244	0.5244	1.28	0.5244	1.28
Standard deviation			5.5	5.5	8.1	5.5	5.5	5.9
Location correction factor	C_l	dB	2.8842	2.8842	4.24764	7.04	2.8842	7.552
Minimum median power flux-density at reception height ¹ ; 50% time and 50% locations	θ_{med}	dB(W)/m ²	-97.9	-91.8	-79.1	-96.5	-91.5	-78.5

DVB-T2 in Band IV/V			Fixed	Portable outdoor/urban	Portable indoor/urban	Mobile Rural	Handheld portable outdoor	Handheld mobile Class H-D/integrated antenna
Minimum median equivalent field strength at reception height ¹ ; 50% time and 50% locations	E_{med}	dB μ V/m	47.9	54.0	66.7	49.3	54.0	67.3
Location probability		%	95	95	95	99	95	99
Distribution factor			1.6449	1.6449	1.6449	2.3263	1.6449	2.3263
Standard deviation			5.5	5.5	8.1	5.5	5.5	5.9
Location correction factor	C_l	dB	9.04695	9.04695	13.32369	12.79465	9.04695	13.72517
Minimum median power flux-density at reception height ¹ ; 50% time and 50% locations	θ_{med}	dB(W)/m ²	-91.8	-85.7	-72.4	-90.8	-85.4	-72.3
Minimum median equivalent field strength reception height ¹ ; 50% time and 50% locations	E_{med}	dB μ V/m	54.0	60.1	75.8	55.0	60.4	73.5

⁽¹⁾ 10 m for fixed reception and 1.5 m for the other reception modes.

Basic Data and Transmitter details

Transmitter Details:

1. Name of the Station	: DDK Kolkata	
2. GPS data of TV transmitter tower	: N 22.49530° & E 88.36062°	
3. Terrain around Transmitter	: Urban, Populated Residential, High rise Buildings	
	Tx-1(482 MHz)	Tx-2(506 MHz)
4. Rated power of the transmitter	: 6.0 KW	6.0 KW
5. Forward radiated power	: 6.0 KW	5.9 KW
6. Reflected Power	: 7W	11 W
7. Transmission mode	: QPSK	64 QAM
8. Make	: HARRIS	HARRIS
9. Model	: MAXIVA ULX6500T2	MAXIVA ULX6500T2
10. Frequency of operation	: 482 MHz	506 MHz

Transmitting Antenna Details

1. Make	: SIRA SISTEMI RADIO
2. Type/Model	: UTV-01/24(6 ^a 4)
3. Antenna Gain	: 12.9 dBd (Nominal)
4. Effective height of antenna (Mid bay)	: 175 meters.
5. Polarization	: Horizontal

Transmission Parameters of DTT transmission at DDK, KOLKATA

CH # 22	CH# 25
482 MHz (SD)	506 MHz (HD)

1. Constellation:	QPSK	64QAM
2. PLP ID:	0	0
3. PILOT PATTERN:	PP3	PP5
4. CODE RATE:	1/2	3/4
5. FFT:	8K EXT	8K EXT
6. BW:	8 MHz	8 MHz
7. CONST ROTATION:	ON	ON
8. GUARD INTERVAL:	1/8	19/256
9. SISO/MISO:	SISO	SISO
10. PLP BIT RATE:	5.93 MBIT/S	30.3 MBIT/S
11. FREQUENCY:	474 MHz	522 MHz
12. CONTENT:	5 SD Channels	1 HD

Measurement Method

Google and Garmin maps were used throughout the survey for making different routes. Location of the transmitter tower was marked using GPS for reference purpose. Using this reference all the routes and survey points were decided keeping in consideration the type of terrain encountered. Since the purpose of the survey was to determine the fixed primary coverage area for satisfactory reception, the measurement was carried out in static condition along the motor able roads along particular route. ITU recommendation BT.2254-2 was used for determining coverage area on the basis of field strength at a height of 10 meters above ground using standard antenna. As per ITU recommendation the receiving antenna for subjective assessment of picture and sound quality must be checked using directional Yagi antenna having gain of 11 db (Nominal) under fixed rooftop mode. Accordingly necessary corrections were made where ever required. Digital television service coverage is characterized by a very rapid transition from near perfect reception to no reception at all and it thus becomes critical to be able to define which areas are going to be covered and which not. Accordingly coverage definition of "Excellent "has been selected as the case where 95 % of the locations within a small area are covered.

For coverage assessment of reception on Android smart phone using “TV on GO” DVB-T2 dongle, the height of smart phone is kept at 1.5 meters above normal ground level. All the available content were observed and recorded along with data. After attending all the routes, the field strength data and subjective assessment were tabulated.

Route Analysis

1. North: Table-1 and MAP-1

This route lies in the north direction from TV tower located in Golf Green area of Kolkata. The main cosmopolitan areas like Metro MG road, Bow Bazar, Barrack pore and Amoda Ghata lies in this route. The entire area consists of high rise buildings and dense population up to 40 km radial distance. The movement of vehicular traffic was very high. As more and more buildings are now using electronic ballast for lighting and other RF source for different uses including large numbers of motor vehicle, the overall man made noise was very high in this area.



MAP-1

If we check the terrain profile, it looks very normal up to the LOS distance of 60 to 70 Km. The effective range of channel 22 in this route was found up to 52.3 Km only with respect to minimum signal requirement, which is $54\text{ dB}\mu\text{V/m}$ only (ITU BT.2254-2). Similarly for Smart phone reception, excellent quality was found up to a LOS distance of 10 Km only. For channel 22 and 25, bad spots were also observed within the primary coverage at LOS distance of 30 Km. The coverage of channel 25 (HD) was observed up to the aerial distance of 40 Km

2. North-East: Table-2 and Map-2

North-East route from TV transmitter goes to VIP Nagar and New Town to Jessore road up to Indo-Bangladesh borders. Major areas in this route are full of vegetation. Both the transmitter's signal is well decoded up to the radial distance of 50 Km with field strength as low as $42\text{ dB}\mu\text{V/m}$ using Yagi antenna at a height of 10 meters. In city areas such low level signal will not decode DVB-T2 modulation properly. However due to low noise in North-East direction such possibility was present. In terms of ITU defined field strength, the coverage was up to the aerial distance of 30 Km only in both channels.

In mobile reception, the coverage was up to the aerial distance of 10 Km. Presence of thick vegetation reduces the field strength in UHF bands.

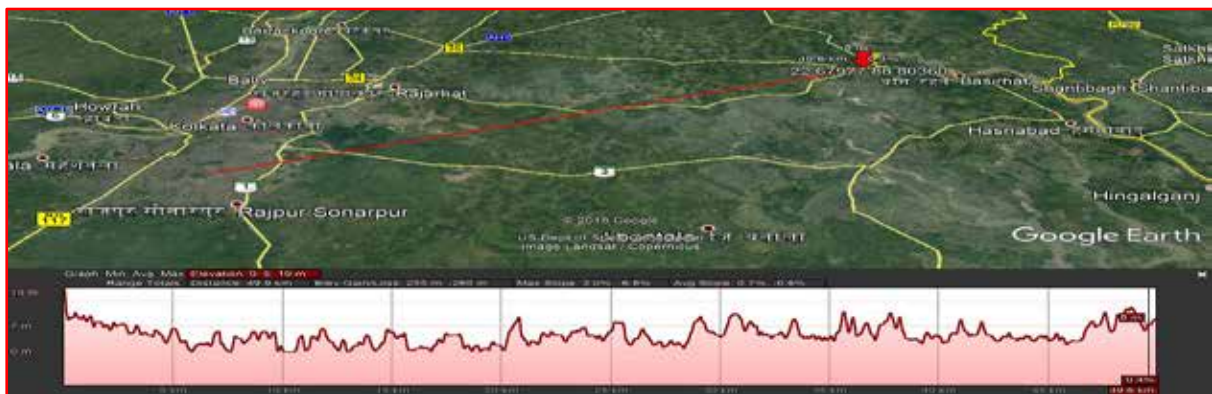
The elevation profile clearly shows small variations in height above msl in entire North-East route, which does not affect receiving antenna at a height of 10 meters above ground.



MAP-2

3. East: Table-3 and Map-3

This route goes up to Taki ghat near India-Bangladesh borders. The elevation variation is very low. The route is full of thick vegetation. The coverage in this direction was up to the aerial distance of 50 Km for fixed reception mode in both channels. In the mobile mode, the coverage goes up to 15 km. Vegetation along the route is damping factor for mobile reception.

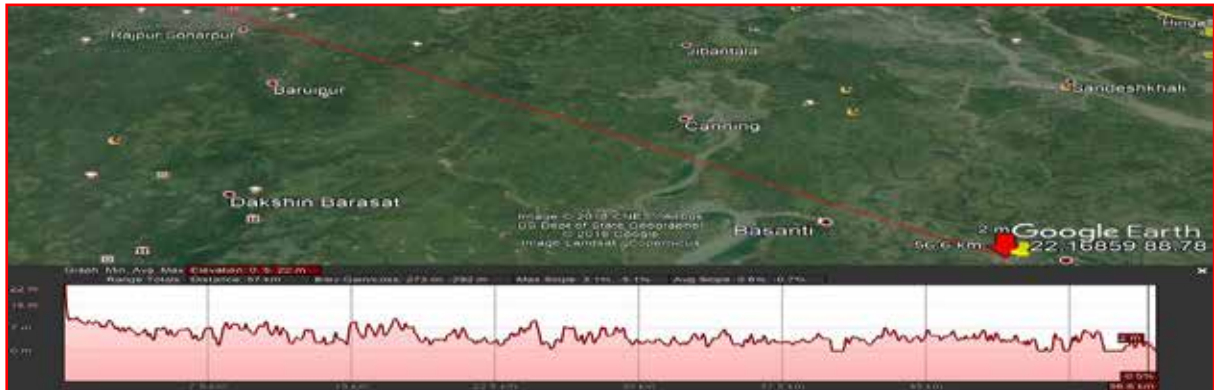


Map-3

4. South-East: Table 4 and Map-4

The Sundarbans mangrove forest lies in this direction from TV transmitter. The vegetation is very thick in those areas. Due to lack of motorable roads, survey team could not proceed beyond Gosaba. Major town in this route is Canning. Field strength of 58 dB μ V/m was available up to the aerial

distance of 56.9 Km .This value was taken as boundary of coverage for both the channels. In mobile reception mode where Smart phone with TV dongle is used, the coverage was up to an aerial distance of 20 Km.



Map-4

5. South: Table 5 and Map-5

The total available length towards South was 71 Km. The terrain profile is nearly flat with minor variations. The coverage for both SD and HD channel in fixed reception mode was 61 Km only.

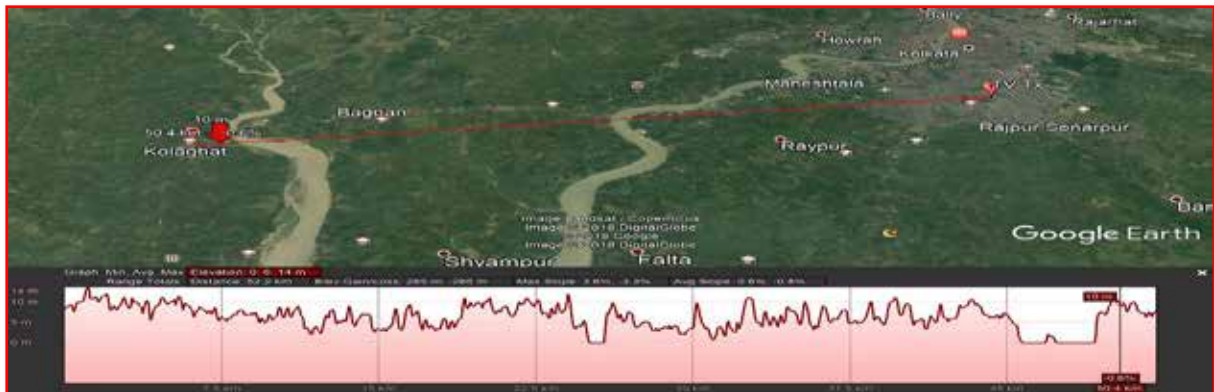


Map-5

In mobile reception the coverage was up to an aerial distance of 10.4 Km only. However satisfactory reception on Smart phone was available up to 15 Km .

6. West: Table 6 and Map-6

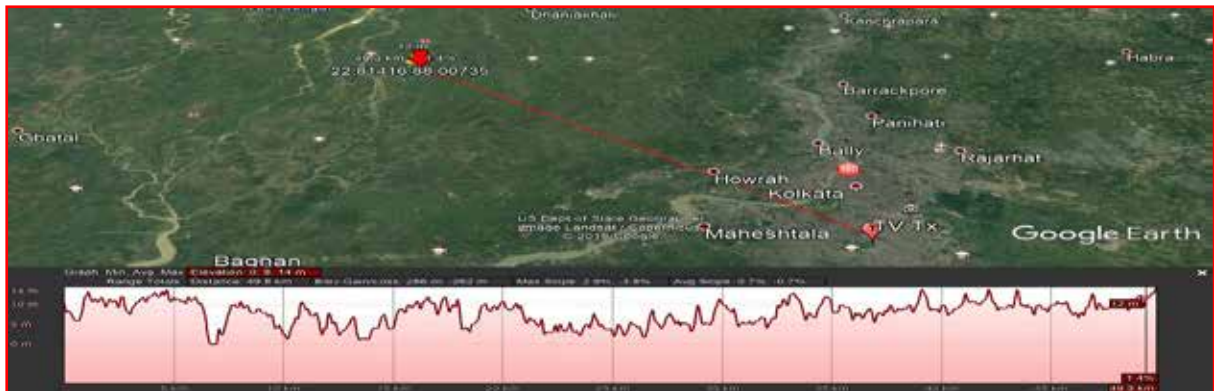
This route goes up to Sidha in West direction. The terrain profile is nearly flat except minor variations.



Map-6

The coverage in SD & HD channels was up to an aerial distance of 50 Km in fixed reception mode, and up to 15 Km in mobile reception mode using Smart phone with DVB-T2 dongle. Due to sudden drop in field strength at 1.5 meter level, coverage was interpolated for 15 Km.

7. North-West: Table 7 and Map-7



Map-7

The terrain profile is similar to earlier one with minor variation in elevation along the route. The coverage with respect to SD & HD channels in fixed reception mode was 50 Km and in mobile phone, it was up to 15.9 Km only.

Conclusion:

Based on the field strength and other related factors, the coverage in different direction are as follows (Map-8).

Direction from TV Antenna tower	Coverage in Kilometers		
	CH#22/SD As per ITU Reco. BT2245-2	CH#25/HD As per ITU Reco. BT2245-2	SMART PHONE As per good reception basis & ITU reco./ FS CH-22
NORTH	52.3	40	9.5
NORTH-EAST	30	30	15.1
EAST	50	50	15
SOUTH-EAST	56.9	56.9	20
SOUTH	60.9	60.9	19
WEST	50	50	15
NORTH-WEST	50	50	15.9

The area within coverage also includes large numbers of spots, where reception is not possible.

Recommendations:

Kolkata is a very big city surrounded by tall buildings and dense population and very high vehicular traffic. Reception of DTT on smart Mobile Phone requires street by street survey using latest software based instruments like ETL with unidirectional calibrated antennas mounted on vehicle top for full assessment.

Street by street survey of Central Kolkata having dense population but not far away from transmitter was carried out using ETL receiver in respect of channel 22 for reception on Smart phones with DVB-T2 dongle attached as receiver. The results were not much encouraging as most of the street is not getting required field strength. ITU recommends minimum signal strength of 73 dB μ V/m for receiver with integrated antenna at low heights from ground. Map-9 is the result of drive test in Central Kolkata.

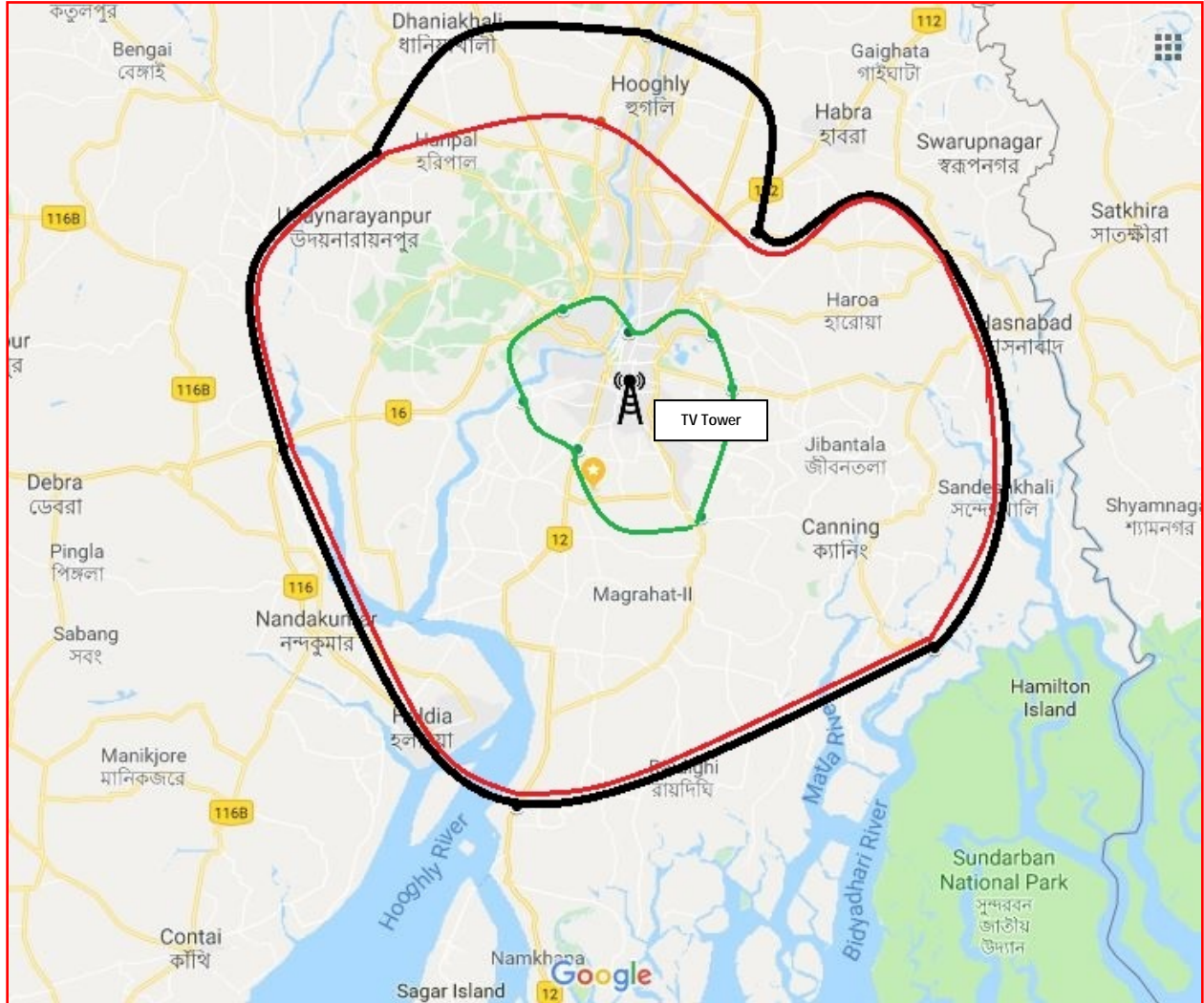
It is recommended to install DVB-T2 gap fillers of low wattage to overcome those problems. Other option is to use two or more transmitters in SFN mode, if city area is large and gap fillers are not able to provide required field strength in effected areas.

Acknowledgement:

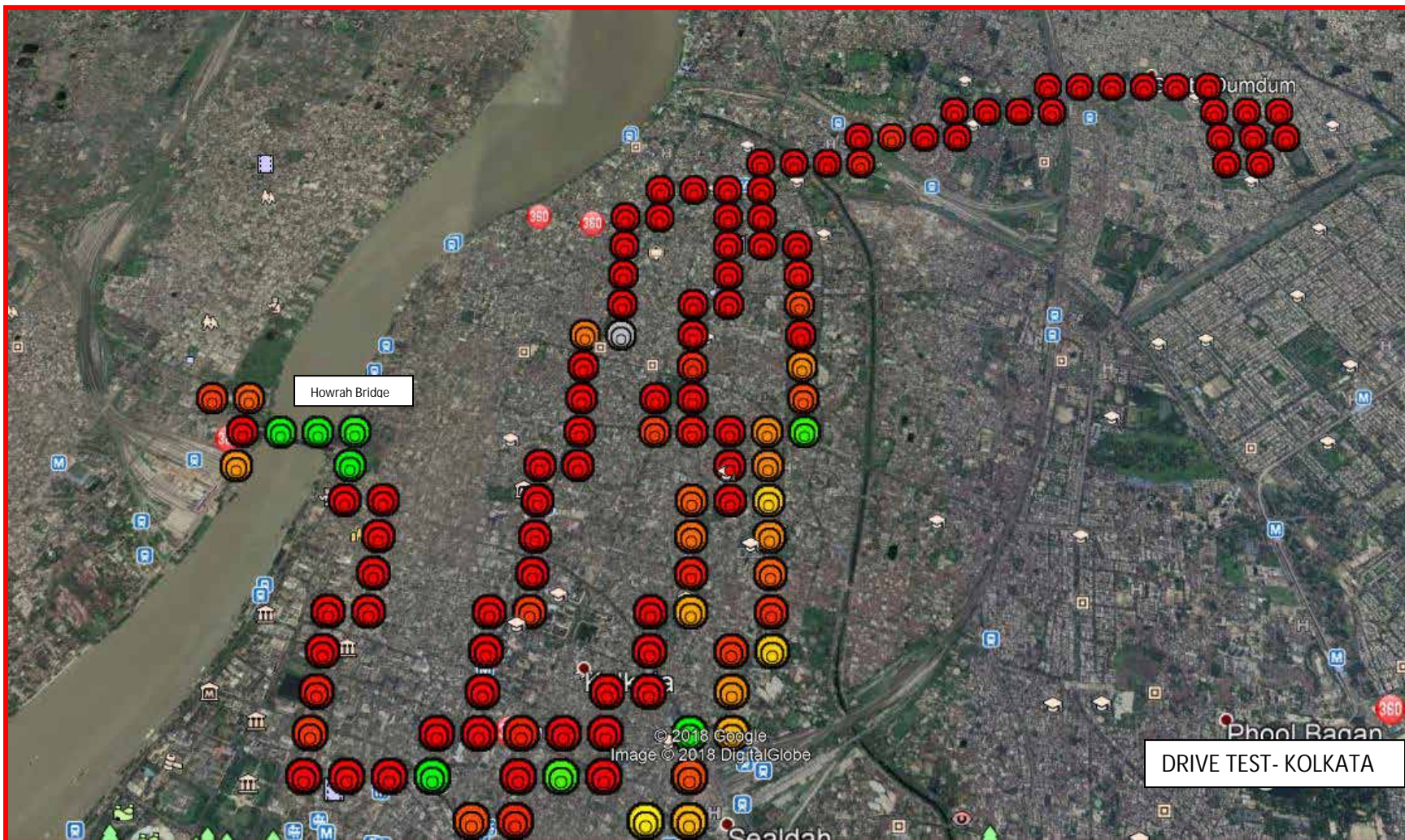
The DTT coverage survey of DDK, Kolkata was carried out by the Propagation labs of The Research department of AIR & DD, New Delhi. The field trial was successfully done with the sincere support of Engineers of DDK, Kolkata. The survey team also extends their gratitude to Mr. A K Sarkar- DDG (E) of O/o ADG (E) TV Projects, Mr. Rajat Bose-DDG (E) and Mr.Sudip Chaudhary- DE, of DDK Kolkata for necessary support.

Coverage Map of DTT Kolkata

Map-8



- Legends:
1. Area within green lines is the coverage of DTT reception on Smart-Phone using T2 dongle.
 2. Area within Red lines is the coverage of DTT reception in HD mode (CH#25) in fixed reception mode.
 3. Area within Black lines is the coverage of DTT reception in SD mode (CH#22) in fixed reception mode.



Legends: Red Circle-Field Strength ≤ 60 dB μ V/m, Orange Circle- ≤ 63 dB μ V/m, Yellow Circle-65 dB μ V/m, Green Circle- ≥ 67 dB μ V/m.
Minimum Required Field Strength for Smart-phone reception is 73 dB μ V/m

Reception Survey for satisfactory coverage of DTT Transmitter [CH 22-SD (482 MHz) & CH 25-HD (506 MHz)] of DD, Kolkata

Direction from DTT Antenna: North

Table No. 1

Date & Time	Location	Line of Sight Distance in Km	Height above Mean Sea Level in Meters	F/S in dBμV/m				COFDM(10m) Parameters			Subjective viewing@10 m Ant Height on TV		COFDM(3m) Parameters			Subjective viewing@ 3/1.5 m level		Terrain
				10 meters		3 meters		MER	CBER	LBER	CH 22	CH 25	MER	CBER	LBER	CH 22 Mobile SAMSUNG NOTE3	CH 25 Promax T2Analyzer	
				CH 22	CH 25	CH 22	CH 25	CH 22 CH 25	CH 22 CH25	CH 22 CH 25			CH 22 CH 25	CH 22 CH 25	CH 22 CH 25			
1110	SARAT BOSE ROAD	5	17	65	65	61	58	26.4 26.9	3.5 E-2 5.1 E-02	1.0E-07 1.0E-08	OK	OK	19.6 18.0	5.2 E-05 3.8 E-04	1.0 E-08 1.0 E-07	OK	OK	HRB/MT/LWR/POP
1204	METRO MG ROAD (MAHAJATI SADAN)	9.5	23	71	65	62	63	27.4 28.3	1.0 e-06 3.0 e-04	1.0 e-07 1.0 e-08	OK	OK	27.2 15.2	1.0 E-06 1.6 E-02	1.0 E-06 1.0 E-08	OK	OK	HRB/MT/LWR/POP
1248	BARANAGAR BAZAR COSSIPORE	15	16	75	73	60	58	37 37	1.0E-0E 1.0E-06	1.0E-07 1.0E-08	OK	OK	24.1 22.6	2.9E-06 7.4E-04	1.0 E-07 1.0 E-08	OK	OK	HRB/LRW POP/MT
1320	KAMARHATI BT ROAD	20.4	15	62	63	51	---	28.9 30.2	1.0E-07 1.3E-04	1.0E-07 1.0E-08	OK	OK	13.8 ---	2.6 E-03 ---	1.0 E-07 ---	F	OK	HT/LRB
1750	HASTINGS JUTE MILL G T ROAD	25.1	21	59	57	---	---	26.5 24.8	1.0E-06 2.4E-03	1.0E-07 1.0E-08	OK	OK	---	---	---	NT	---	MRB/HT/LWR
1410	DAS BARI BARRACKPORE	29.83	13	47	42	---	---	14.8 ---	3.3 E-03 ---	1.0E-07 ---	OK	NT	---	---	---	---	---	MRB/HT/LWR
1834	CHATRA BOW BAZAR SERAM PORE	30.4	15	57	61	47		30.4 30.6	1.0E-06 2.1.0E-04	1.0E-07 1.0E-07	OK	OK	21.5 ---	1.0E-06 ---	1.0E-07 ---	NT	OK	VEG/MT/LRB
1917	NAWA PARA SH-13	40	18	60	59	---	NA	34.7 36.1	1.0E-06 6.9E-06	1.0E-07 1.0E-07	OK	OK	NA	NA	NA	NA	NA	HT/LRB/OPEN AREA
1900 08/05	NEAR AMODGHATA SH-6	52.3	7	52	49	52	NA	28.3 24.7	<1.0E-06 1.3E-03	<1.0 E-07 <1.0 E-08	OK	OK	NA	NA	NA	NA	NA	VEG/HT SHW
1927	DUMURLAHARLY STN.	60.1	6	48	48	NA	NA	25.9 25.5	<1.0E-05 6.5E-08	<1.0 E-07 <1.0 E-08	OK	OK	NA	NA	NA	NA	NA	VEG/HT SHW
1800	BALAGARHARLY STN.	70.3	4	37	37	NOISE ONLY	NOISE ONLY	14.5	6.5E-05	<1.0E-07	OK	NT	NA	NA	NA	NA	NA	HT/SHW

Reception Survey for satisfactory coverage of DTT Transmitter [CH 22-SD (482 MHz) & CH 25-HD (506 MHz)] of DD, Kolkata
 Direction from DTT Antenna: North-EAST

Table No. 2

Date & Time	Location	L.O.S Distance Km	Height above Mean Sea Level in Meters	F/S in dBμV/m				COFDM(10m) Parameters			Subjective viewing@10 m Ant Height on TV		COFDM(3m) Parameters			Subjective viewing@ 3/1.5 m level		Terrain
				10 meters		3 meters		MER	CBER	LBER	CH 22	CH 25	MER	CBER	LBER	CH 22 Mobile SAMSUNG NOTE3	CH 25 Promax	
				CH 22	CH 25	CH 22	CH 25	CH 22 CH 25	CH 22 CH25	CH 22 CH 25			CH 22 CH 25	CH 22 CH 25	CH 22 CH 25			
10:45 08/05/17	VIP NAGAR E. M. BYPASS	5	6	85	84	72	64	37 37	1.0E-06 1.0E-06	1.0E-07 1.0E-08	OK	OK	32.7 23.7	1.0E-06 2.3E-03	1.0E-07 1.0E-07	OK	OK	LT/MRB/ POP
1500 06/05/17	BIDHANNAG AR OFF NH- 12	10.5	9	61	57	60	---	29.1 26.9	1.0E-06 7.0E-05	1.0E-07 1.0E-07	OK	OK	31.9 ---	4.0E-04 ---	1.0E-08 ---	OK	OK	VEG/MT/ MRB
11:56 08/05/17	B C BLOCK NEW TOWN	15.1	10	79	80	73	70	36.5 37.0	1.0E-06 1.0E-06	1.0E-07 1.0E-08	OK	OK	30.8 35.7	1.0E-06 2.7E-06	1.0E-07 1.0E-08	OK	OK	Open area/ Medium Traffic
13.03 08/05/17	LAUHATI SH-3	20.15	9	70	68	58	63	37.0 37.0	1.0E-06 4.2.0E-05	1.0E-07 1.0E-08	OK	OK	35.6 35.6	1.0E-06 1.2.0E- 06	1.0E-07 1.0E-08	OK	OK	MT/VEG/ LRB
15:20 08/05/17	PURBBA ISHAPORE SH-2	30	13	52	51	---	---	30.1 30.4	<1.0E-06 2.6.0E-05	<1.0E-07 2.6.0E-08	OK	OK	---	---	---	NT	NT	VEG/LRB/LT
16:20 08/05/17	LAKSMIPUL POST OFFICE JESSORE RD	40.67	16	49	49	---	---	25.6 27.3	<1.0E-06 <1.1.0E- 04	<1.0E-07 <1.0E-08	OK	OK	---	---	---	NA	NA	HT/VEG/LRB
1705 08/05/17	HABRA JESSORE RD	50.7	11	41	42	---	---	16.8 16.9	1.2E-4 >5.1E-02	<1.0E-07 <1.0E-08	OK	OK/F	---	---	---	NA	NA	HT/VEG/LRB

Reception Survey for satisfactory coverage of DTT Transmitter [CH 22-SD (482 MHz) & CH 25-HD (506 MHz)] of DD, Kolkata
 Direction from DTT Antenna: East Table No. 3

Date & Time	Location	L.O.S Distance Km	Height above Mean Sea Level in Meters	F/S in dBμV/m				COFDM(10m) Parameters			Subjective viewing@10 m Ant Height on TV		COFDM(3m) Parameters			Subjective viewing@ 3/1.5 m level		Terrain
				10 meters		3 meters		MER	CBER	LBER	CH 22	CH 25	MER	CBER	LBER	CH 22 Mobile SAMSUNG NOTE3	CH 25 Promax	
				CH 22	CH 25	CH 22	CH 25	CH 22 CH 25	CH 22 CH 25	CH 22 CH 25			CH 22 CH 25	CH 22 CH 25	CH 22 CH 25			
1300 06/05/17	PURBALOK off. NH-12	5	46	96	95	76	---	37 37	1.0E-06 1.0E-06	1.0E-08 1.0E-08	OK	OK	3.6	1.0E-06	1.0E-07	OK	OK	LRB/LT
1610 06/05/17	BASANTI HIGH WAY	10.7	07	84	78	80	---	36.9 37	1.0E-06 1.2E-04	1.0E-06 1.0E-08	OK	OK	39.6 ---	1.0E-06 ---	1.0E-07 ---	OK	OK	HT/LRB/VEG
1630 6/5/17	BASANTI HWY	15.0	06	68	66	63	---	33 32	1.0E-06 1.2E-04	1.0E-06 1.0E-08	OK	OK	28	---	---	OK	OK	HT/VEG
1650 06/05/17	BASANTI HWY BHOJARHAT	20.0	07	77	75	61	---	37 37	1.0E-06 8.4E-06	1.0E-06 1.0E-07	OK	OK	33.2 ---	1.0E-06 ---	1.0E-06 ---	OK	OK	LT/LRB/VEG
1740 06/05/17	BASANTI HWY BALI HATI	40.8	0	72	70	62	---	37 37	1.0E-06 1.0E-06	1.0E-07 1.0E-08	OK	OK	36.5 ---	1.0E-06 ---	1.0E-06 ---	OK	OK	OA
2057 06/05/17	KHOLA POTA BASIR HAT RD	49.9	05	52	52	---	---	27.5 30.3	1.0E-07 1.1E-05	1.0E-07 1.0E-08	OK	OK	---	---	---	---	---	HT/VEG/LRB
2020 06/05/17	BASIRHAT SH-2	55.5	02	48	49	--	---	21.2 26.9	1.0E-06 1.9E-04	1.0E-07 1.0E-07	OK	OK	---	---	---	---	---	HT/LRV/VEG
1925 06/05/17	TAKI GHAT ROAD	58.9	07	58.9	38	NOI SE	NOISE	---	---	---	NT	NT	---	---	---	NT	NT	VEG/LRB/LT

Reception Survey for satisfactory coverage of DTT Transmitter [CH 22-SD (482 MHz) & CH 25-HD (506 MHz)] of DD, Kolkata
 Direction from DTT Antenna: South-East Table No. 4

Date & Time	Location	L.O.S Distance Km	Height above Mean Sea Level in Meters	F/S in dBμV/m				COFDM(10m) Parametrs			Subjective viewing@10 m Ant Height on TV		COFDM(3m) Parameters			Subjective viewing@ 3/1.5 m level		Terrain
				10 meters		3 meters		MER	CBER	LBER	CH 22	CH 25	MER	CBER	LBER	CH 22 Mobile SAMSUNG NOTE3	CH 25 Promax	
				CH 22	CH 25	CH 22	CH 25	CH 22 CH 25	CH 22 CH25	CH 22 CH 25			CH 22 CH 25	CH 22 CH 25	CH 22 CH 25			
1240 10/05/17	NETAJI SUBHASH CHANDRA BOSE ROAD MAHMAYA TOLA	5	11	HT LINE		71	64	HT LINE PROBLEM			OK	OK	21.4 16.9	1.8 E-04 8.8 E-03	<1.0 E-07 <1.0 E-07	Mobile OK		HT/MRB/ LWR/VEG
1315 10/05/17	PHOOL TALA CANNING ROAD	20	8	77	75	63	61	30 37	1.0 E-06 4.4 E-05	1.0 E-07 <1.0 E-08	OK	OK	13.7 34.9	8.9 9E- 041.4 E- 04	<1.0 E-07 <1.0 E-08	OK	OK	LRB/MT/VEG
1942 09/05/17	RAJAPUR CANNING RD	30	05	69	65	60	57	36.9 37	<1.0 E-06 1.1 E-06	<1.0 E-07 <1.0 E-08	OK	OK	34.9 35.4	1.0 E-06 1.6 E-04	1.0 E-07 1.0 E-08	OK/F	OK	MT/LRB/VEG
2122 09/05/17	GOSABA SUNDERBA N	56.9	5	58	57	---	----	33.6 33.8	<1.0 E-06 1.2 E-04	<1.0 E-07 <1.0 E-08	OK	OK	---	---	---	NT	NT	VEG/OPEN SEA

Due to non-availability of road from Gosaba (Sunder Ban), measurements could not be taken from 56.9 Km onwards.

Reception Survey for satisfactory coverage of DTT Transmitter [CH 22-SD (482 MHz) & CH 25-HD (506 MHz)] of DD, Kolkata
 Direction from DTT Antenna: South

Table No. 5

Date & Time	Location	L.O.S Distance Km	Height above Mean Sea Level in Meters	F/S in dBμV/m				COFDM(10m) Parameters			Subjective viewing@10 m Ant Height on TV		COFDM(3m) Parameters			Subjective viewing@ 3/1.5 m level		Terrain
				10 meters		3 meters		MER	CBER	LBER	CH 22	CH 25	MER	CBER	LBER	CH 22 Mobile SAMSUNG NOTE3	CH 25 Promax	
				CH 22	CH 25	CH 22	CH 25	CH 22 CH 25	CH 22 CH25	CH 22 CH 25			CH 22 CH 25	CH 22 CH 25	CH 22 CH 25			
1207 09/05	BAKUL BITHI M G ROAD	5.6	27	98	96	83	79	37 37	<1.0 E-06 <1.0 E-06	<1.0 E-07 <1.0 E-05	OK	OK	36.8 37	<1.0 E-06 <1.0 E-06	<1.0 E-07 <1.0 E-08	OK	OK	LRB/LWR
1240 09/05	CHOWK RAJU MOLLA D H ROAD NH-12	10.4	19	89	87	68	71	37 37	<1.0 E-06 <1.0 E-06	<1.0 E-07 <1.0 E-08	OK	OK	34 36.9	<1.0 E-06 <1.0 E-06	<1.0 E-07 <1.0 E-07	OK	OK	HT/LRB/ VEG/HWY
1305 09/05	BISHNUPUR NH-12	15.3	14	---	---	63	59	---	---	---	---	---	33.2 30.6	<1.0 E-06 4.7 E-04	<1.0 E-07 <1.0 E-08	OK	OK	HT/LRB/ VEG/HWY
1328 09/05	NEAR RAJARHAT	20.2	12	72	72	51	46	37 37	<1.0 E-06 2.9 E-06	<1.0 E-07 <1.0 E-07	OK	OK	23.1 17.4	<1.0 E-06 <1.5 E-02	<1.0 E-07 <1.0 E-08	NT	NT	VEG/MT/ LRB
1457 09/05	HATBARIA BEFORE KULPI NH-12	40.35	5	64	62	---	---	36.5 36.8	<1.0 E-06 2.5 E-05	<1.0 E-07 <1.0 E-08	OK	OK	---	-----	--	NT	NA	OA/LT/ LRB
1536 09/05	NISCHANDA PUR NH-12	60.9	10	52	51	---	---	29.7 28.4	<1.0 E-06 9.8 E-05	<1.0 E-07 <1.0 E-08	OK	OK	---	--	--	NT	NA	OA/VEG/ LT
1604 09/05	KAKDEEP NH-12	70.82	10	40	39	---	---	14.6 ---	2.7 E-04	<1.0 E-07	OK	OK	14.6	2.7 E-04	1.0 E-07	NT	NT	LRB/MT HWY

Reception Survey for satisfactory coverage of DTT Transmitter [CH 22-SD (482 MHz) & CH 25-HD (506 MHz)] of DD, Kolkata
 Direction from DTT Antenna: West Table No. 6

Date & Time	Location	L.O.S Distance Km	Height above Mean Sea Level in Meters	F/S in dBμV/m				COFDM(10m) Parameters			Subjective viewing@10 m Ant Height on TV		COFDM(3m) Parameters			Subjective viewing@ 3/1.5 m level		Terrain
				10 meters		3 meters		MER	CBER	LBER	CH 22	CH 25	MER	CBER	LBER	CH 22 Mobile SAMSUNG NOTE3	CH 25 Promax	
				CH 22	CH 25	CH 22	CH 25	CH 22 CH 25	CH 22 CH25	CH 22 CH 25			CH 22 CH 25	CH 22 CH 25	CH 22 CH 25			
1500 10/05	BANAMALI NASKAR NASKARPUR	05	15	84	85	77	73	37 37	1.0E-06 <1.0E-06	<1.0E-07 1.0E-07	OK	OK	>37 37	1.0 E-06 <1.0E-06	1.0 E-07 <1.0 E-08	OK	NT	MRB/LHR/ MT/POP
1335 11/05	DEFENCE PARK BIRAN ROY RD	10	12	79	77	60	57	37 37	<1.0 E-06 2.5 E-06	<1.0 E-07 1.0 E-08	OK	OK	31 25	<1.0 E-06 7.6 E-03	<1.0 E-07 <1.0 E-08	OK	OK	VEG/LT/MRB /POP
1420 11/05	BUDGE BUDGE	15	17	65	69	60	59	31.6 35.7	<1.0 E-07 4.0 E-05	<1.0 E-07 <1.0 E-08	OK	OK	31.6 32.2	<1.0 E-06 5.8 E-05	<1.0 E-07 1.0 E-08	OK	OK	MRB/LRB LT/VEG
1700 10/5/17	NH-16 RAGHUDEB PUR	22.7	7	68	67	57	59	36 37	<1.0 E-6 3.8 E -05	<1.0 E-7 1.0 E-7	OK	OK	30.8 33	<1.0 E-06 5.0 E-05	1.0 E-07 <1.0 E-07	OK	OK	OA/HT /HWY
1810 10/05	KOLAGHAT	50	2	54	52	---	---	27 29	1.0 E-06 6.7 E-05	<1.0 E-06 <1.0 E-07	OK	OK	---	---	---	NA	NA	OA/HT /HWY/LRB
1835 10/5/17	SIDHA NH-16	60	1	47	48	---	---	23 24	1.0 E-06 9.3 E-04	<1.0 E-06 <1.0 E-07	OK	OK	---	---	---	NA	NA	OA/HT /HWY/VEG

Reception Survey for satisfactory coverage of DTT Transmitter [CH 22-SD (482 MHz) & CH 25-HD (506 MHz)] of DD, Kolkata
 Direction from DTT Antenna: North West Table No. 7

Date & Time	Location	L.O.S Distance Km	Height above Mean Sea Level in Meters	F/S in dB/m				COFDM(10m) Parameters			Subjective viewing@10 m Ant Height on TV		COFDM(3m) Parameters			Subjective viewing@ 3/1.5 m level		Terrain
				10 meters		3 meters		MER	CBER	LBER	CH 22	CH 25	MER	CBER	LBER	CH 22 Mobile SAMSUNG NOTE3	CH 25 Promax	
				CH 22	CH 25	CH 22	CH 25	CH 22 CH 25	CH 22 CH25	CH 22 CH 25			CH 22 CH 25	CH 22 CH 25	CH 22 CH 25			
1310 11/05/17	LOYLA HIGH SCH, DIAMOND HARBOUR ROAD	5.2	11	82	80	73	----	35 37	<1.0 E-06 <1.0 E-06	<1.0 E-06 <1.0 E-08	OK	OK	28.8 34.0	<1.0 E-06 <1.5 E-05	<1.0 E-07 <1.0 E-08	OK	OK	HT/HWY/HRB & MRB/POP
1127 12/05/17	GARDEN REACH	10	7	64	61	62	67	26 24	2.5 E-05 1.5 E-03	<1.0 E-05 1.0 E-08	OK	OK	26 34	<1.0 E-06 1.9 E-04	<1.0 E-07 <1.0 E-08	OK	OK -	MRB/LWR /POP
0015 11/05/17	SALAP BRIDGE X-ING NH-16	15.9	7	77	75	66		36 36.2	<1.0 E-06 <1.0 E-06	<1.0 E-07 <1.0 E-07	OK	OK	27	<1.0 E-06 4.1 E-03	<1.0 E-07 <1.0 E-07	OK	- OK	HT/HWY/LRB
2345 10/05/17	DANKUNI OUTSKIRTS	20	9	70	70	57	56	>37 >37	<1.0 E-06 <1.0 E-06	<1.0 E-07 <1.0 E-08	OK	OK	22.3 20	<1.0 E-06 1.2 E-02	<1.0 E-07 <1.0 E-08	NT	OK	VEG/LT/LRB
2303 10/05/17	JANGALPARA DANKUNI	30	7	#	#	56	56	NOT LOCKING DUE TO THICK VEGITATION					26 26.3	<1.0 E-6 1.6 E-04	<1.0 E-07 <1.0 E-08	NT	NT	LRB/MT/SHW/VEG/VILL
2200 10/05/17	SIPAI GACHHI SH-15	40	3	74	74	66	65	36.9 >37.0	<1.0 E-06 <1.0 E-06	<1.0 E-07 <1.0 E-08	OK	OK	36 37	1.0 E-06 1.0 E-06	<1.0 E-07 <1.0 E-08	OK/F	OK/F	OA/MT SHW OA/MT/SHW
2130 10/05/17	BEFORE CHAMPADANGA	50	14	54	54	48	NA	28 29	--DO--	--DO--	OK	OK	15 14	----	----	NT	OK/F	MT/SH/VEG
2115 10/05/17	NEAR SAIDPUR SH-2	60	17	50	48	---	---	27.2 26.5	5.9 E-05 1.5 E-04	<1.0 E-07 <1.0 E-08	OK	OK	---	-----	-----	NT	NT	VEG/LRB /MT