

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

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

Located

At

Guwahati (Assam)

(22-4-17 to 2-5-17)

Field Strength Measurement/Reception Survey Team

R&D Report No. 942

PROPAGATION LAB

Research Department

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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 Guwahati DVB-T2 TV transmitter, operating on 538 MHz (Channel # 29) in fixed reception mode as per ITU defined field strength value.
- Identifying areas of poor reception of the transmission, in the coverage areas of Guwahati DVB-T2 transmitter.
- Determination of service area on Smartphone using DVB-T2 dongle.

Equipment Used

1. Field strength cum Spectrum Analyzer, Anritsu MS 2035B & MS 2013E.
2. UHF Log periodic antenna, Make-Rhode & Shwarz.
3. GPS Navigator, Garmin Montana 650.
4. DVB-T2 STB.
5. Sony LCD TV receiver.
6. IRD, Ericsson RX-8200
7. Promax HD Ranger DVB-T2 Analyzer
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.

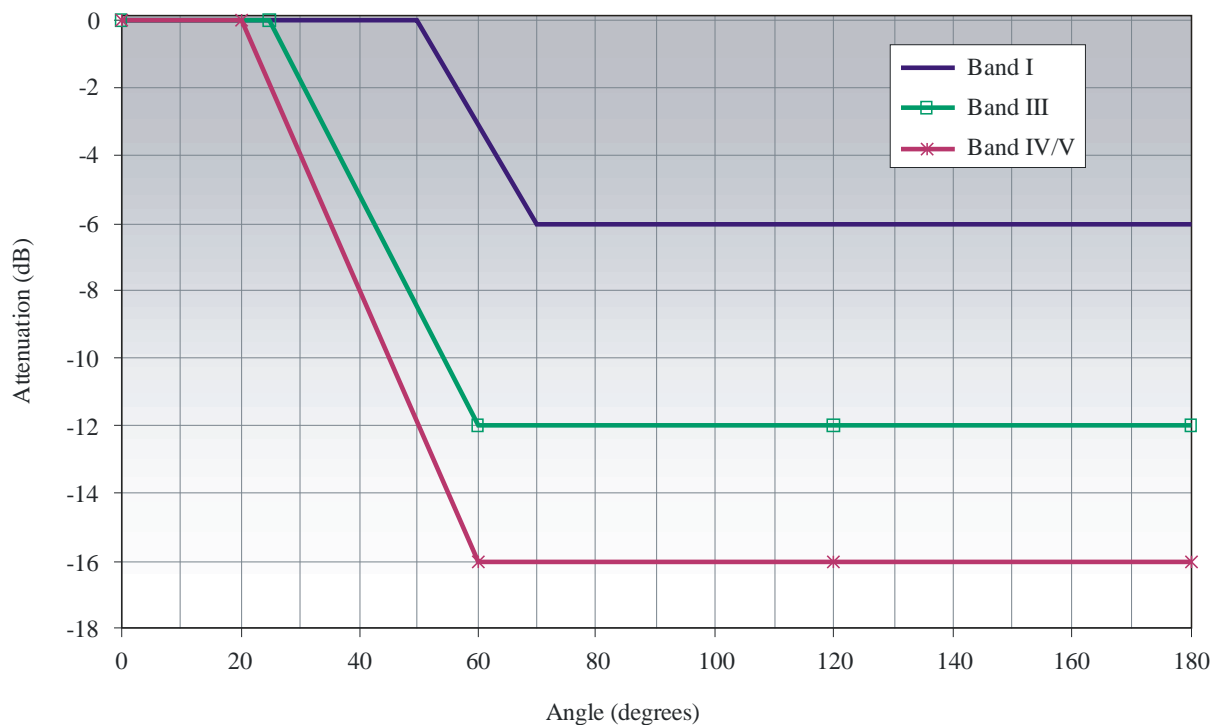


Figure-1

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).

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).

The variation of field strength with locations at a given distance and at a particular time is called the location probability, expressed in percentage. The variation of field at any given location with respect to time is called time probability.

The combined probability of location and time is called the “Service Probability”, which is defined as the probability of obtaining or providing over a given small area a desired grade of service, for a specified percentage of locations. The area of such locations is approximately 200 × 200 meters.

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).

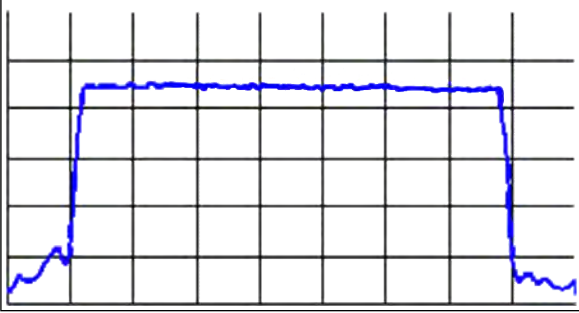
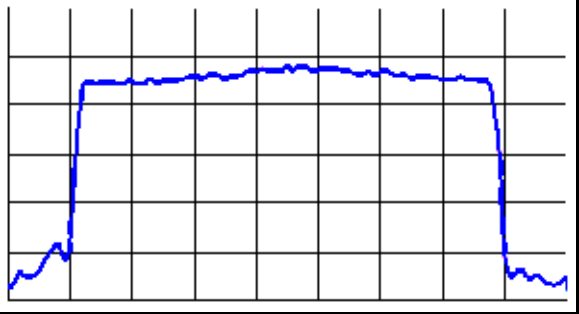
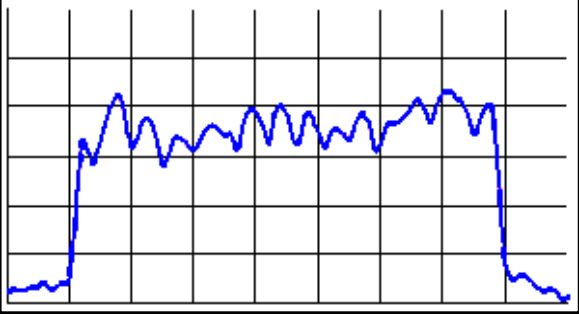
It can therefore not be assumed that DVB-T2 reception with a standard receiver is possible at every single location inside the area defined as being covered.

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.

<p>Gauss channel:</p> <p>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>	 <p>The graph shows a blue line representing the spectral amplitude over a grid. The line is nearly horizontal and flat across the central frequency range, indicating a rectangular spectrum with minimal variation in amplitude.</p>
<p>Rice channel:</p> <p>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>The graph shows a blue line representing the spectral amplitude over a grid. The line is mostly flat but exhibits small, irregular fluctuations in amplitude across the frequency range, characteristic of a Rice channel.</p>
<p>Rayleigh channel:</p> <p>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>	 <p>The graph shows a blue line representing the spectral amplitude over a grid. The line is highly irregular and jagged, with significant amplitude variations across the frequency range, indicating heavy distortion in a Rayleigh channel.</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 log periodic antenna with known correction factor already loaded in the analyzer for different channels. To record digital parameters, Ericson made IRD/ Promax Analyzer 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

DVB-T2 in Band IV/V			Fixed	Portable outdoor/urban	Handheld Mobile, Class H-D/Int antenna
Frequency	Freq	MHz	650	650	650
Minimum required system	C/N by	C/N dB	20.0	17.9	10.0
System variant (example)			256-QAM FEC 2/3, 32k, PP7 Extended	64-QAM FEC 2/3, 32k, PP4 Extended	64-QAM FEC 1/2, 8k, PP2 Extended
Bit rate (indicative values)		Mbit/s	35-40	26-29	11-14
Receiver noise figure	F	dB	6	6	6
Equivalent noise bandwidth	B	MHz	7.77	7.77	7.71
Receiver noise input power	P_n	dBW	-128.0	-128.3	-129.1

DVB-T2 in Band IV/V			Fixed	Portable outdoor/urban	Handheld Mobile, Class H-D/Int antenna
Min. receiver signal input power	$P_{s\ min}$	dBW	-109.1	-111.2	-1119.1
Min. equivalent receiver input voltage, 75Ω	U_{min}	dBμV	29.7	27.6	19.6
Feeder loss	L_f	dB	4	0	0
Antenna gain relative to half	G_d	dB	11	0	-9.5

dipole					
Effective antenna aperture	A_a	dBm^2	-4.6	-15.6	-25.1
Min power flux-density at receiving location	Φ_{min}	dB(W)/m^2	-100.5	-95.6	-94.0
Min equivalent field strength at receiving location	E_{min}	$\text{dB}\mu\text{V/m}$	45.3	50.2	51.8
Allowance for man-made noise	P_{mmn}	dB	0	1	0
Penetration loss (building or vehicle)	L_b, L_h	dB	0	0	8
Standard deviation of the penetration loss		dB	0	0	2
Diversity gain	Div	dB	0	0	0
Location probability		$\%$	70	70	90
Distribution factor			0.5244	0.5244	1.28
Standard deviation			5.5	5.5	5.9
Location correction factor	C_l	dB	2.8842	2.8842	7.552
Minimum median power flux-density at reception height ⁽¹⁾ ; 50% time and 50% locations	Φ_{med}	dB(W)/m^2	-97.6	-91.7	-78.5
Minimum median equivalent field strength at reception	E_{med}	$\text{dB}\mu\text{V/m}$	48.2	54.1	67.3

height ⁽¹⁾ ; 50% time and 50% locations					
Location probability		%	95	95	99
Distribution factor			1.6449	1.6449	2.3263
Standard deviation			5.5	5.5	5.9
Location correction factor	C_l	dB	9.04695	9.04695	13.72517
Minimum median power flux-density at reception height ⁽¹⁾ ; 50% time and 50% locations	Φ_{med}	dB(W)/m ²	-91.5	-85.6	-72.3
Minimum median equivalent field strength at reception height⁽¹⁾; 50% time and 50% locations	E_{med}	dBμV/m	54.3	60.2	73.5

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

For Mobile reception on Smartphone, field strength data was compiled for 99 percent location probability where as for fixed reception mode the field strength data was compiled for 95 percent location probability.

Basic Data and Transmitter details

Transmitter Details:

1. Name of the Station	: DDK Guwahati
2. GPS data of TV transmitter tower	: N 26.15389° & E 91.76828°
3. Terrain around Transmitter	: Urban, Populated, Residential
4. Rated power of the transmitter	: 6.0 KW
5. Forward radiated power	: 5.71 KW
6. Reflected Power	: 4 Watt
7. Transmission mode	: SDTV
8. Make	: HARRIS
9. Model	: ULX-6500T2
10. Frequency of operation	: 538 MHz (CH#29)
11. Date of commissioning	: 25/2/2016

Transmitting Antenna Details

1. Make	: SIRA SISTEMI RADIO
2. Type/Model/ PANEL	: UTV-01/24(6×4) UHF
3. Antenna Gain	: 12.9 db (Nominal)
4. Effective height of antenna (Midbay)	: 160 meters.
5. Polarization	: Horizontal

Transmission Parameters of DTT transmission at DDK, Guwahati

1. Constellation:	QPSK
2. PLP:	ROTATED
3. PILOT PATTERN:	PP-3
4. CODE RATE:	$\frac{1}{2}$
5. FFT:	8K
6. OFDM SYMBOL RATE:	992 SYM/SEC
7. BW:	8 MHz
8. GUARD INTERVAL:	$\frac{1}{8}$
9. SISO/MISO:	SISO
10. PLP BIT RATE:	5.5 Mbps
11. FREQUENCY:	538 MHz
12. CONTENT:	TV: FIVE SERVICES

Measurement Method

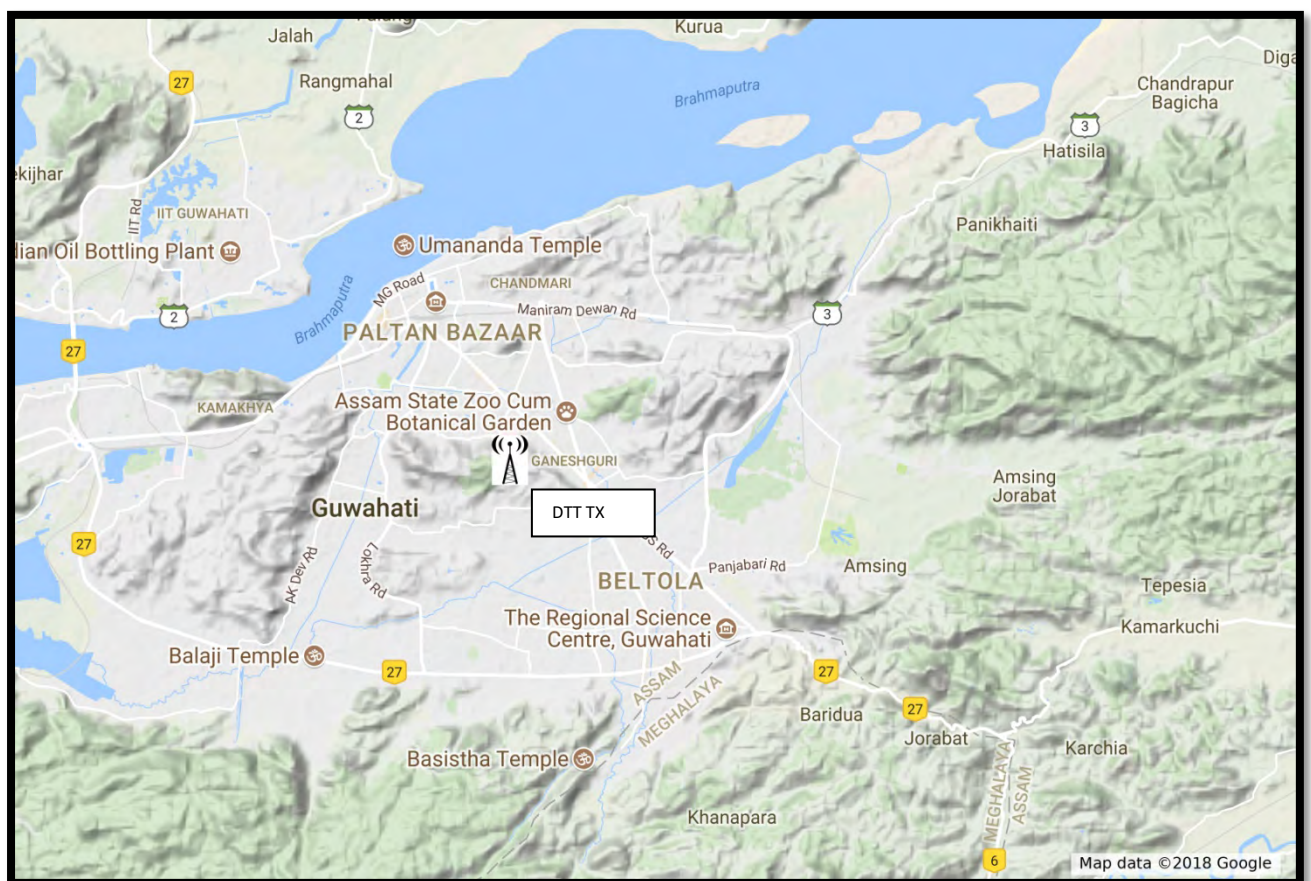
Google and Garmin maps were used throughout the survey for making different routes. Location of the transmitter tower was marked using GPS for reference purpose. Using this reference all the routes and survey points were decided keeping in consideration the type of terrain encountered. Since the purpose 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.

After data collection was over the field strength figures and subjective assessment were tabulated and analyzed for final conclusion.

Analysis

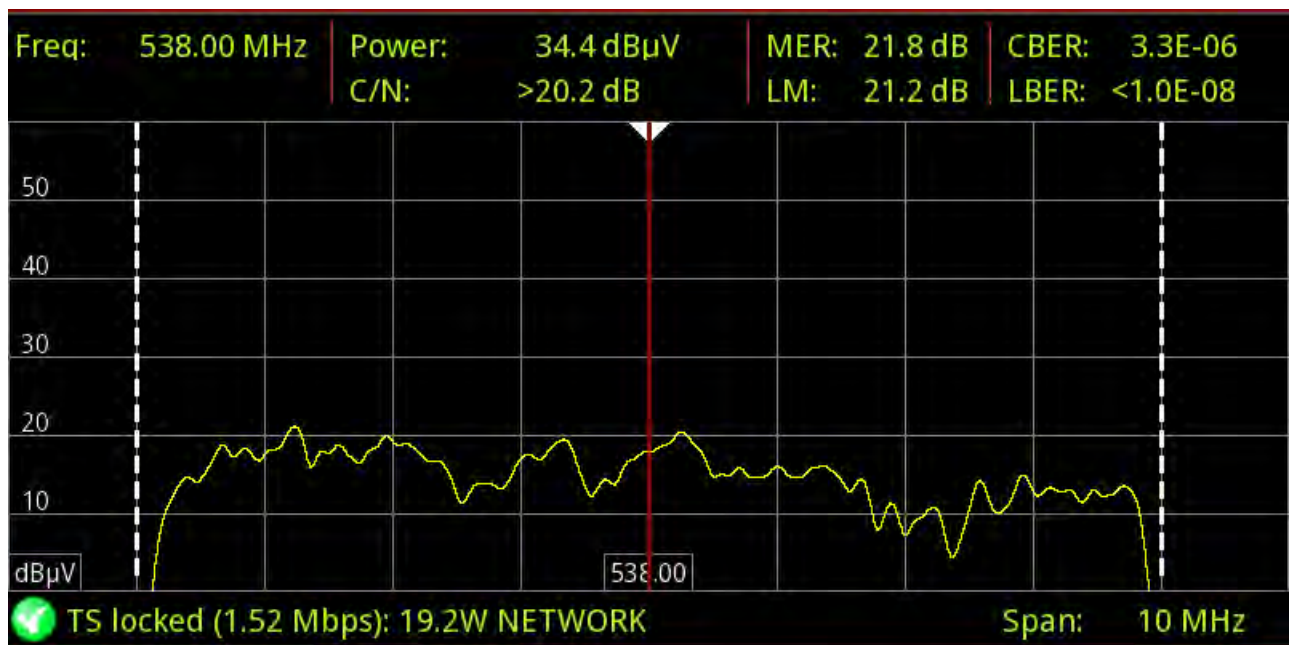
The terrain map of Guwahati (Map-1) shows very different topography when compared with other cities of India.



Map-1

Four to five hillocks are situated within the city limits with height of more than 200 meters above msl. The Doordarshan TV tower is also rest on one such hillock. The

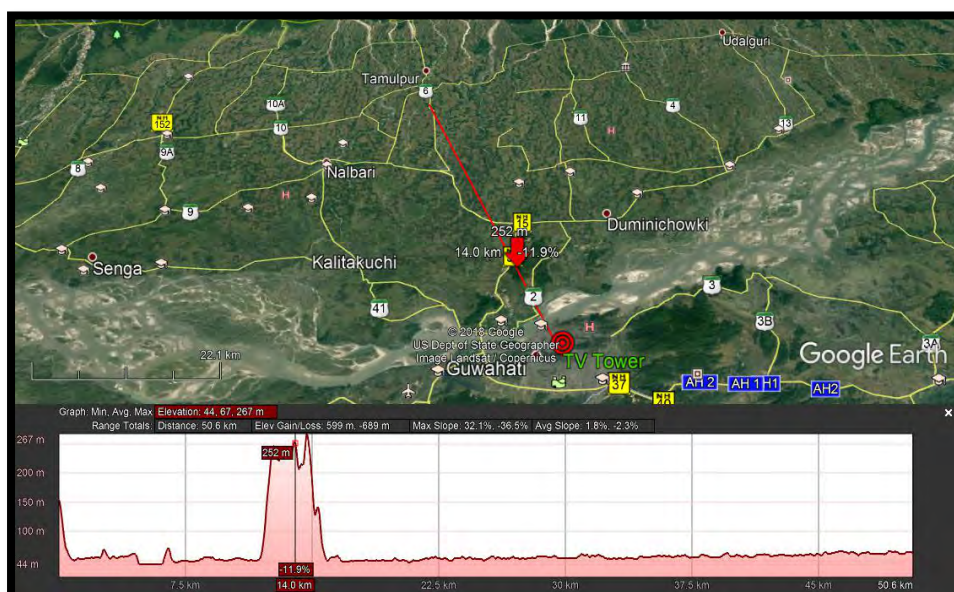
tower height is 160 meters and combined effect of height is approximately 300 meters above msl. As such availability of direct signal from TV tower to the user antenna is low. At most of the place the propagation channel was Rayleigh only. One such example is reproduced below:



The reception of DTT in the city limits of Guwahati is very poor. However in North West direction of TV tower, the coverage was good compared with other routes.

North (Map-2 & Table-1)

The required minimum signal strength as per ITU standards was available up to the aerial distance of 31 to 35 KM only.



The terrain map shows the one hillock of more than 267 meter height just 14 KM away from the transmitting antenna in this direction. Reception on smart phone using DVB-T2 dongle was up to the LOS distance of 5 KM only and with regular freezing up to the 10 KM LOS distance.

North-East (Map-3 & Table-2)

The North-East route goes up to Rowta on NH-15. This route is very normal in terms of terrain with exception of one hillock (Height 200 meters above msl). The presence of this hillock reduces the coverage of DTT in fixed reception mode up to the LOS distance of 30 KM only.



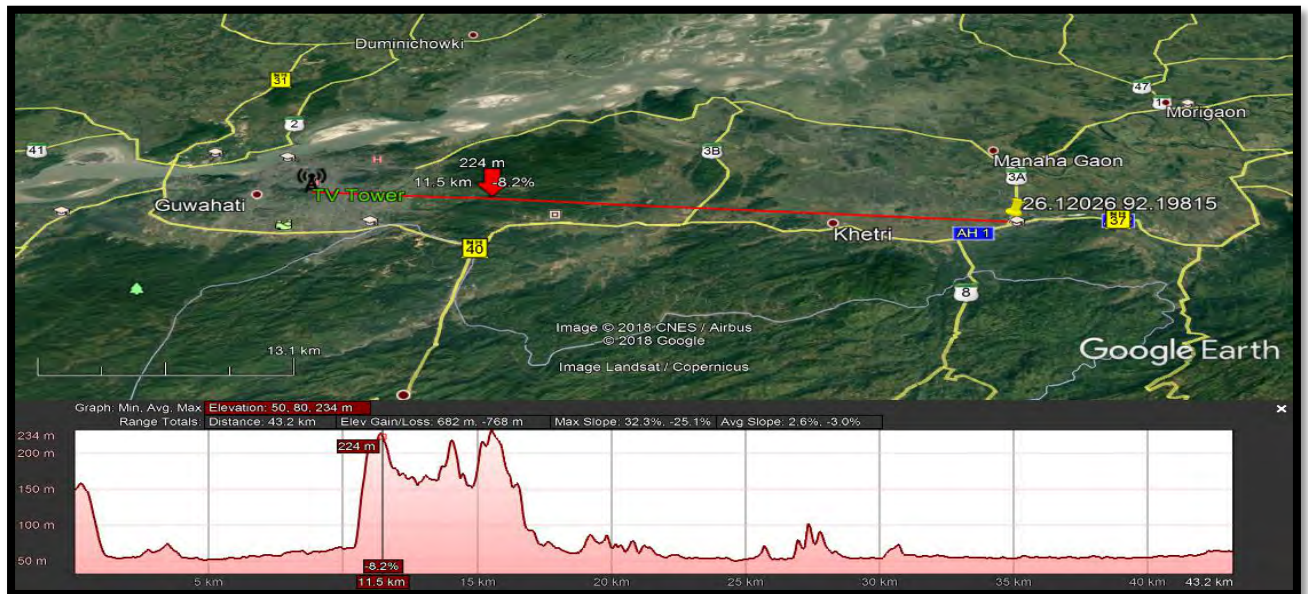
Map-3

The terrain beyond 30 KM to 40 KM is almost flat. In mobile reception for Smartphone, the minimum required f/s was available only up to the aerial distance of 5 KM. However in terms of MER, the good quality video signal was available up to the 10 KM.

East (Map-4 & Table-3)

The coverage in this direction was very poor. It may be due to the presence of steep hillock with dense vegetation over it at an aerial distance of 10 KM. The height of hillock is more than 228 meters above mean sea level. As DTT transmission is being operated in UHF band, the thick vegetation also reduces the field strength up to a great extent. The hillock extends up to the aerial distance of 10 to 17 KM. The

elevation goes down to 60-70 meters above mean sea level up to the aerial distance of 45 KM.



Map-4

South (Map-5 & Table-4)

The route in this direction goes towards Shillong City. In this route elevation rises up to 1050 meters at an aerial distance of 55 KM. At an aerial distance of 21 KM the field strength is very low (map-5A) due to the severe attenuation by long thick



Distance from Tx-21 KM (A)

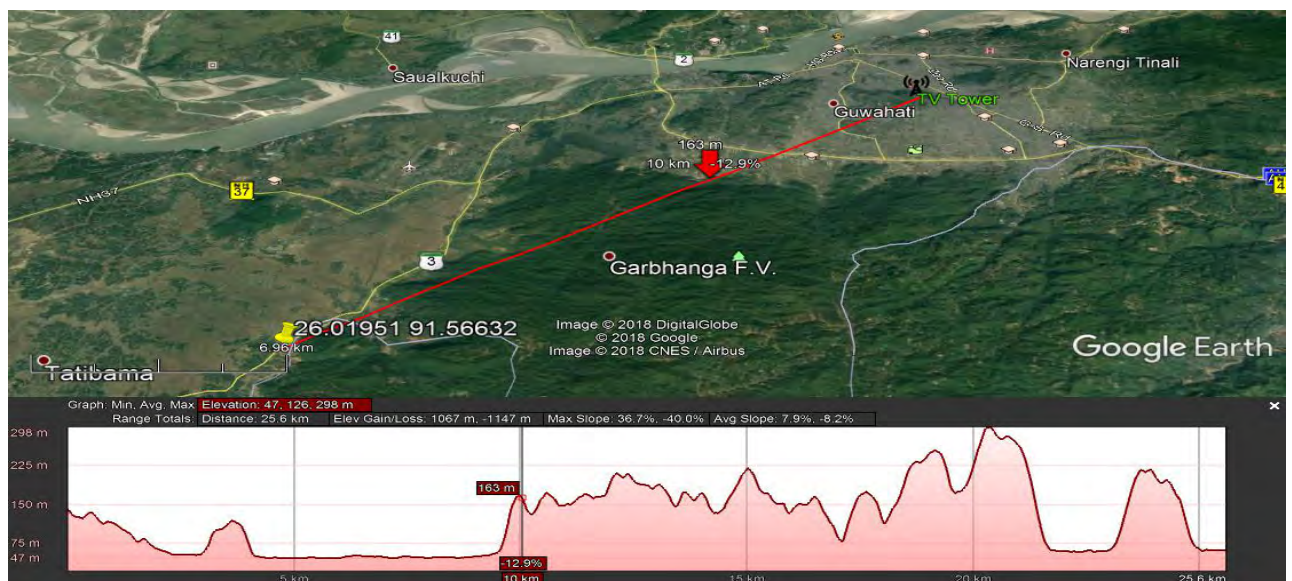
Distance from Tx-55 KM (B)

Map-5

forest over land mass. At an aerial distance of 55 Km the f/s value was 40 dB μ V/ m (Map6B) near Shillong City. The attenuation at this point was only due to the distance as high elevation is providing direct line of sight reception location. The coverage in this route was up to the 10 KM as per ITU defined standards. From 10 to 30 KM distance propagation of DTT signal is attenuated by thick forest cover as well as multipath environment.

South-West (Map-6 & Table-5)

Again the terrain profile in this direction is not suitable for propagation in UHF band

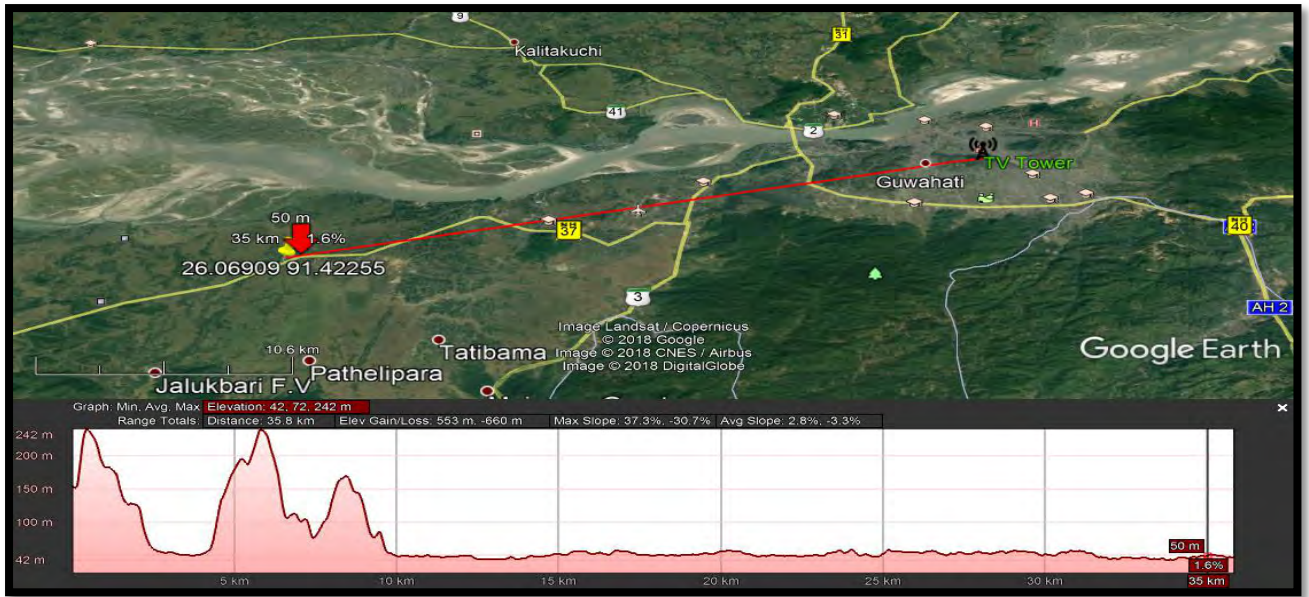


Map-6

due the presence of long stretch of multiple hillocks with thick vegetation over it. The coverage in fixed reception mode was only up to the aerial distance of 5.3 KM. Our team could not take measurements at 10 KM due to the non availability of motorable road. At an aerial distance of 20 KM, the field strength was below 39 dB μ V/ m (Threshold of equipment). The severe attenuation by thick vegetation and multipath environment was responsible for this worst reception condition.

West (Map-7 & Table-6)

This route goes towards Goalpara, and except two hillocks of similar height the rest of elevation is flat. The first hillock is the location of TV tower and second hillock is located at the distance of 6 KM in west direction.

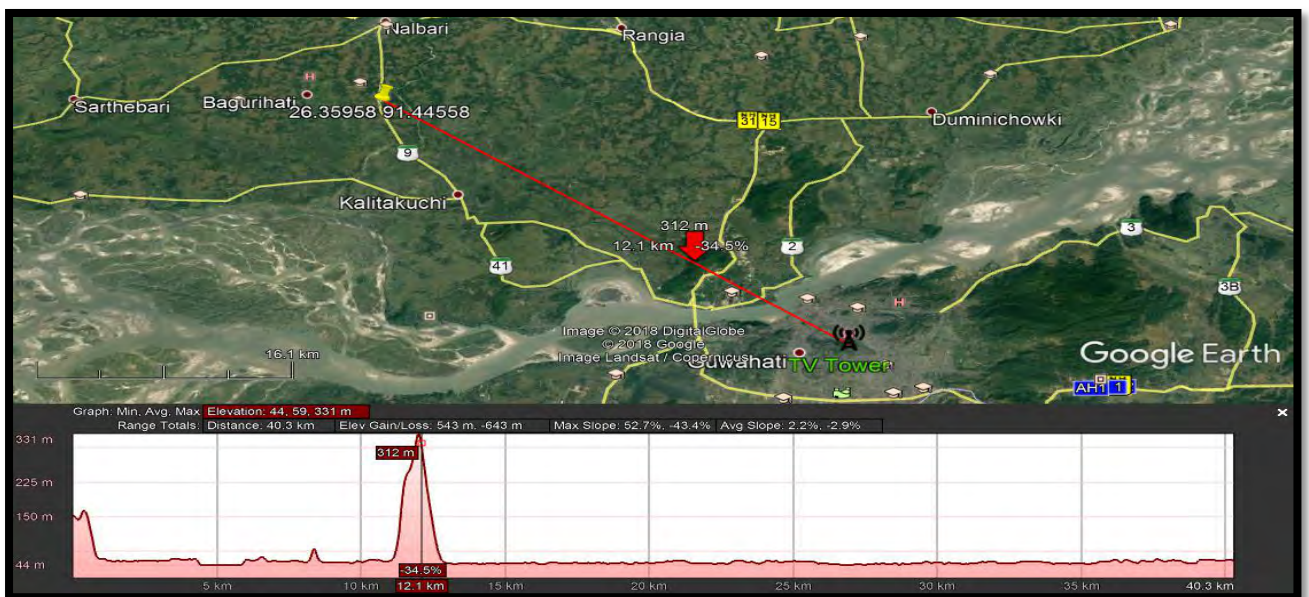


Map-7

The DTT coverage in this direction as per ITU standards was up to the distance of 30 KM. The field strength at the receiver antenna height between 1.5 to 3 meters (For Smartphone) was less than the required ITU defined value at an aerial distance of just 5 KM.

North-West-1 (Map-8 & Table-7)

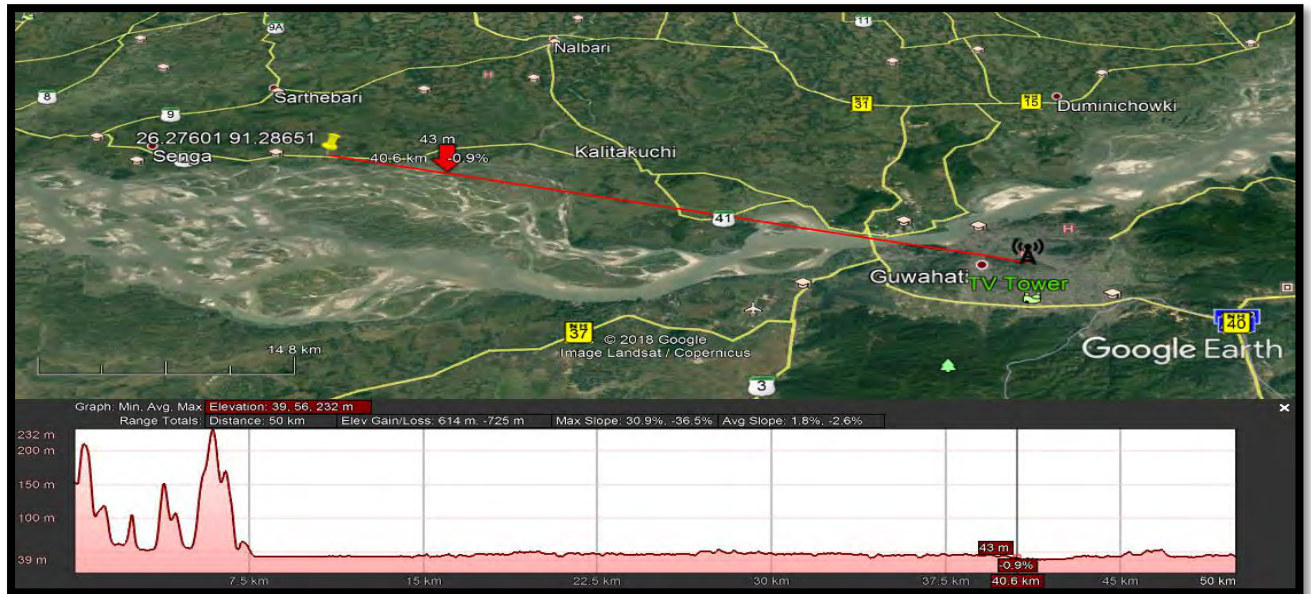
This route goes towards Nalbari in North Assam. The elevation profile is very flat except one hillock of 330 meter height above mean sea level.



Map-8

The presence of this hillock is reducing the coverage in this direction. In the fixed reception mode, the coverage was up to the aerial distance of 30 KM, where as in the mobile reception mode it was up to 8.7 KM.

North-West (Map-9 & Table-8)



Map-9

This road goes towards Barpeta town. Small hillocks of height 230 meters is scattered within 6 KM from TV tower. Rest of the route is flat with average height of 50 meters above mean sea level. The coverage in fixed reception mode was 40 KM only, where as coverage in respect of Smartphone was 10 KM.

Conclusion:

Based on the field survey, the coverage in fixed reception mode as well as in Smartphone mode is as follows:

- Very large numbers of bad spots are scattered throughout the city of Guwahati due to the presence of many hillocks in the city areas.
- Reception in Smartphone is very difficult due to the severe multipath environment, where as reception is slightly better in fixed reception mode, still it was not up to the mark.
- The effect of hillocks can be clearly seen in drive test (Map-10) results. All the red dots in the map are the indicator of low field strength points.

Coverage based upon the ITU defined standards is as follows:

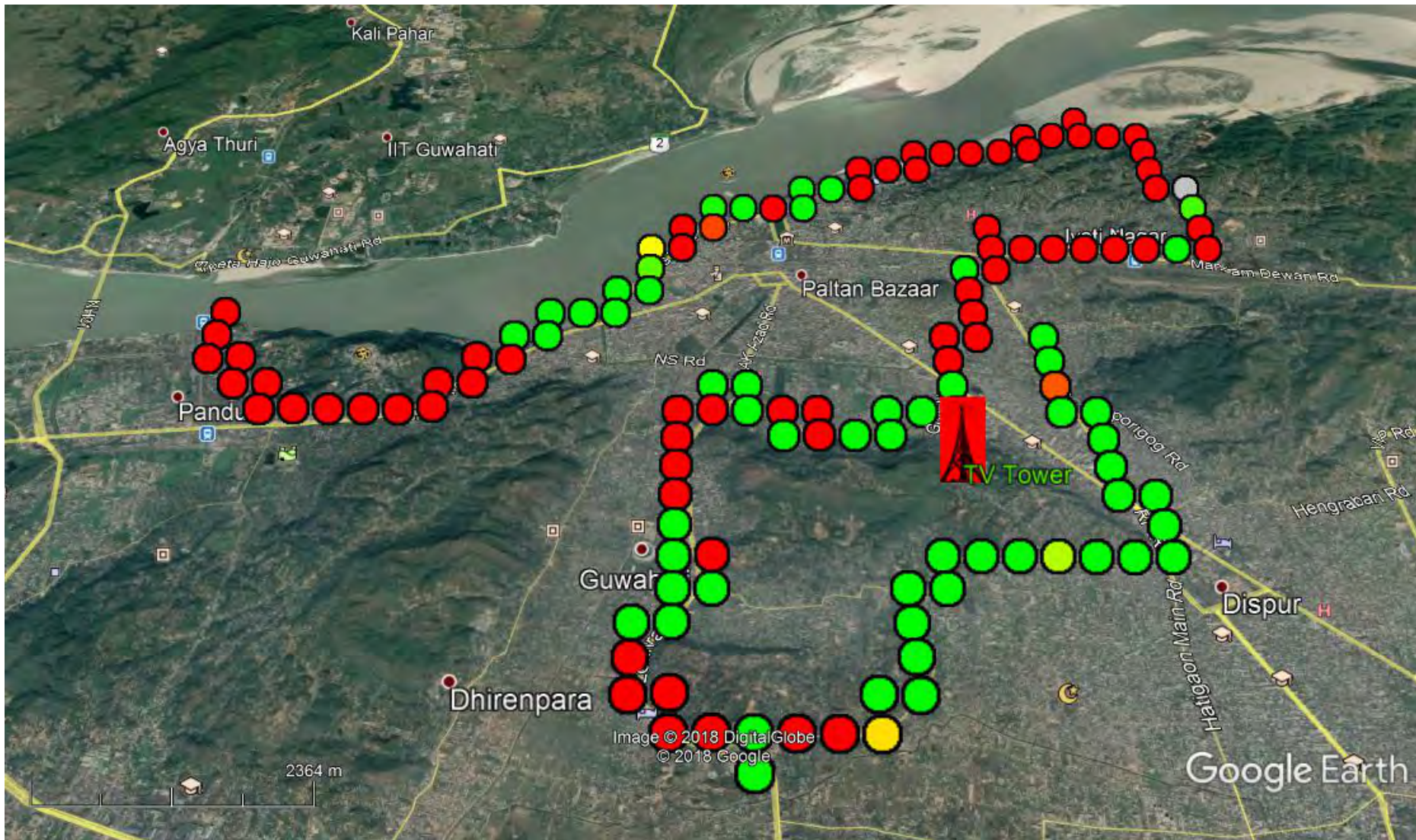
Direction from TV Tower	Coverage in fixed reception mode at receiver antenna height @10 meters.	Coverage in Smartphone mode at receiver antenna height of 1.5 meters
NORTH	31 KM	10 KM
NORTH-EAST	30 KM	5 KM
EAST	11 KM	5 KM
SOUTH	10 KM	5 KM
SOUTH-WEST	5.3 KM	5.3 KM
WEST	30 KM	5 KM
NORTH-WEST 1	30 KM	8.7 KM
NORTH-WEST 2	40 KM	10 KM

Recommendation:

DG-Doordarshan is requested to check the possibility of installing additional low power DTT transmitters in SFN mode to ward of multipath and low field strength problem in city areas.

Acknowledgement:

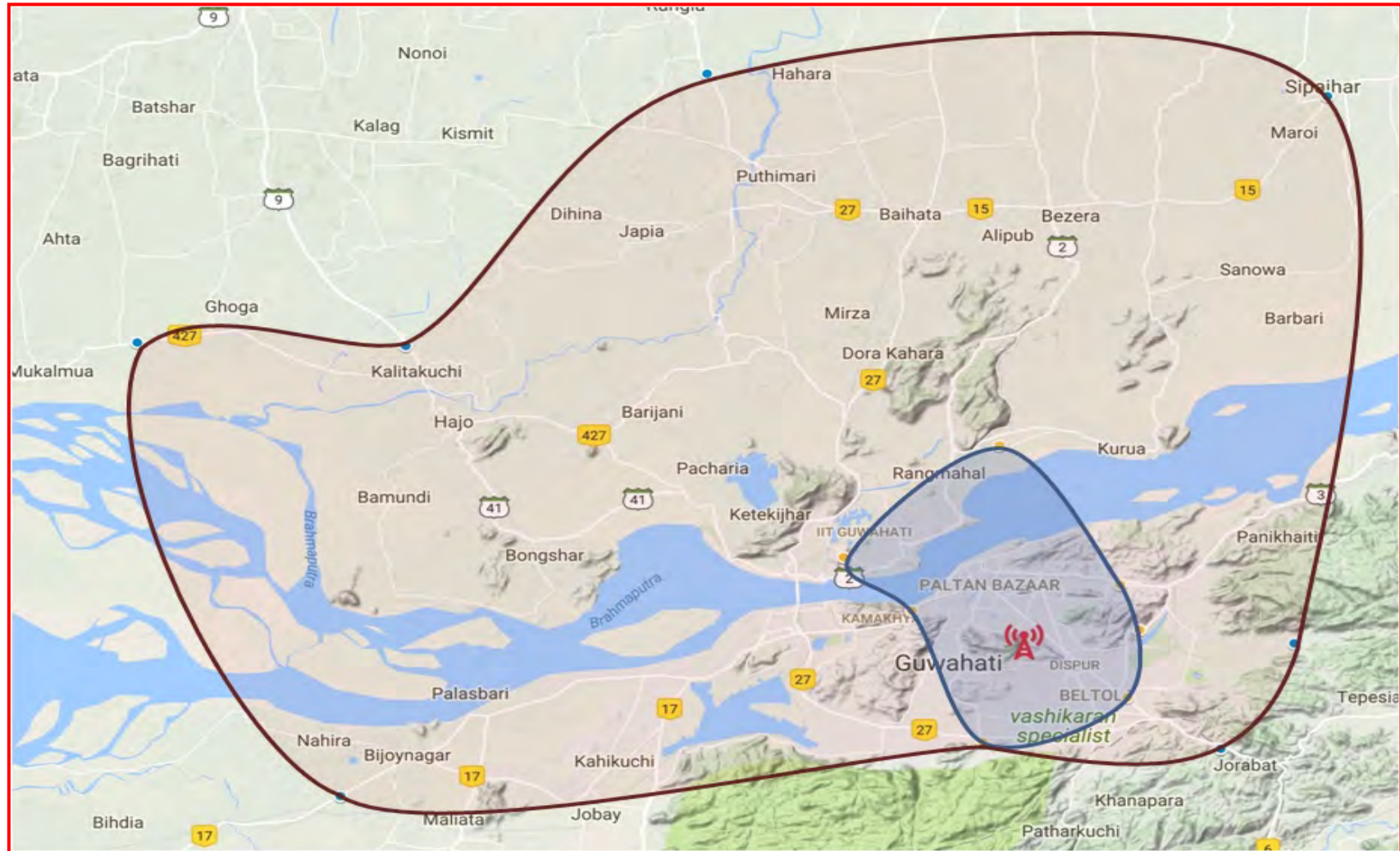
The DTT coverage survey of DDK, Guwahati was carried out by the Propagation labs of The Research department of AIR & DD, New Delhi. The field trial was successfully done with the sincere support of the Engineers of DDK, Guwahati. The survey team also extends their gratitude to Ms. Shipra Manaswita, DDG (E) for providing all logistic support.



Red Circles indicates NO reception area to receive the DTT on Smart Phones at 1.5 to 3.0 meters of height from ground
Green Circles indicates OK reception of the DTT on Smart Phones at 1.5 to 3.0 meters of height from ground.

Combined Coverage Map of DTT Guwahati

(Map-11)



The outer lines are the coverage boundary of DTT in fixed reception mode; where as inner boundary is for Smartphone reception

Reception Survey for satisfactory coverage of DVB - T2 Transmitter (538 Mhz, Ch # 29) Guwahati.

Direction :- NORTH

Table no :- 1

Route :- Tx → Guwahati Refinery→ Rangiya

Date :- 25-27-28/04/2017

Time (Hrs)	Spot / Location	Location Co-ordinates	MSL (Mtrs)	Radial Distanse (KM)	Field Strength (dB μ V/m)		COFDM (Promax) Parameter @ 10Mtrs			Subjective Assessment on TV PROMAX	Subjective Assessment on Mobile	Terrain	Remarks
					10Mtrs	1.5Mtrs	MER (dB)	BER (Pre)					
								LDPC	BCH				
1640 25/04/17	Nunmati Refinery Road	26.19021 91.79955	74	5	78	74	37	2.3, E-06	1.0, E-08	OK	OK	LT/LRB/ Veg.	C/N 38dB. C/N 38dB.
1725 25/04/17	Kharghurli Hills	26.19731 91.76889	53	4.8	52	52	13	1.8, E-03	1.0, E-07	OK	OK / F	MT/LRB Hillock	C/N 18dB. C/N 13dB.
1350 27/04/17	Near Fulung - SH	26.24123 91.73788	51	10.2	85	82	37	8.9, E-05	1.0, E-07	OK	OK / F	LRB/Veg.	C/N 39dB. C/N 46dB.
1440 27/04/17	Block Resource Center Bezera - SH	26.33827 91.78169	50	20.4	49	55	22	4.4, E-06	1.0, E-07	OK	NT	LRB/Veg.	C/N 23dB. C/N 15dB.
1140 28/04/17	Before Rangea Bazar- NH-27	26.40659 91.63352	44	31	56	54	28	2.1, E-06	1.0, E-07	OK	NT	HT/LRB/ Veg.	C/N 17dB.
1340 28/04/17	Rangea-Bhutan NH 127D Tamulpur Road	26.48812 91.59824	53	40.7	42	41	7.5	2.2, E-02	1.0, E-07	OK	NT	LT/LRB/ Veg.	C/N 2.6dB
1415 28/04/17	Near Namati NH-127D	26.57658 91.58513	64	50	40	0	0	1.0, E-01	1.0, E-01	NT	NT	LT/LRB/ Veg.	C/N 04dB

LEGENDS :- **LT** = Low Traffic , **HT** = High Traffic , **MT** = Moderate Traffic, **HW** = High Ways , **HRB** = High Rise Buildings , **LRB** = Low Rise Buildings .
MRB = Medium Rise Building , **Veg** = Vegetation , **OA** = Open Area , **IA** = Industrial Area , **HDP** = High Density Population.

Reception Survey for satisfactory coverage of DVB - T2 Transmitter (538 Mhz, Ch # 29) Guwahati.

Direction :- NORTH EAST

Table no :- 2

Route :- Tx- Mother Teresa Road → Sipajhar → Menapara NH#15

Date :- 27-30/04/2017

Time (Hrs)	Spot / Location	Location Co-ordinates	MSL (Mtrs)	Radial Distance (KM)	Field Strength (dB μ V/m)		COFDM (Promax) Parameter @ 10Mtrs			Subjective Assessment on TV PROMAX	Subjective Assessment on Mobile	Terrain	Remarks
					10Mtrs	1.5Mtrs	MER (dB)	BER (Pre)					
								LDPC	BCH				
1240 30/04/17	Mother Teresa Road Geeta Road	26.1793 91.80912	59	4.95	82	64	37	3.2, E-05	1.0, E-07	OK	OK	Ind Area CRB/LT	C/N 50dB. C/N 34dB.
1315 30/04/17	Khankar Gaon SH-3	26.20483 91.8578	45	10.6	61	49	34	2.1,E-06	1.0, E-07	OK	OK	OA/Veg.	C/N 34dB. C/N 21dB.
1340 30/04/17	Chandrapur Bagicha SH-3	26.22426 91.89863	49	15.2	47	44	17.7	2.5, E-03	1.0, E-07	OK	NT	LT/OA/ Veg.	C/N 16dB. C/N 17dB.
1415 30/04/17	Digaru SH-3	26.23971 91.94675	53	20.2	40	<i>Noise Floor</i>			NT	NT	DVEG		
1655 27/04/17	Sipajhar SH-15	26.39657 91.89713	53	29.8	53	46	24	1.2, E-05	1.0, E-08	OK	OK / F	MT/LRB Veg.	C/N 18dB. C/N 3.7dB.
1800 27/04/17	Mangaldoi PS NH-15	26.43415 92.02184	48	40	47	42	21.5	1.9, E-06	1.0, E-07	OK	NT	MT/LRB Veg.	C/N 16dB. C/N 7.8dB.
1840 27/04/17	Menapara NH-15	26.46819 92.05817	46	45.3	40	<i>Noise Floor</i>			NT	NT	MT/LRB Veg.		

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MRB = Medium Rise Building , **Veg** = Vegetation , **OA** = Open Area, **IA** = Industrial Area , **HDP** = High Density Population.

Reception Survey for satisfactory coverage of DVB - T2 Transmitter (538 Mhz, Ch # 29) Guwahati.

Direction :- EAST

Table no :- 3

Route :-VIP Road → Jagi Road.

Date :- 23/04/2017

Time (Hrs)	Spot / Location	Location Co-ordinates	MSL (Mtrs)	Radial Distance (KM)	Field Strength (dB μ V/m)		COFDM (Promax) Parameter @ 10Mtrs			Subjective Assessment on TV PROMAX	Subjective Assessment on Mobile	Terrain	Remarks
					10Mtrs	3Mtrs	MER (dB)	BER (Pre)					
								LDPC	BCH				
1235	VIP Road Kamakhya Motors	26.15911 91.81743	71	5	67	67	30.6	2.0, E-06	1.0, E-07	OK	OK	MT/LRB/ Veg.	Bit rate 5.9 mbps
1500	Thimmaya Road Satsang Ashram	26.15318 91.88313	75	11.4	72	60	37	2.0, E-06	1.0, E-08	OK	OK / F	LRB/Veg. Hillock	
1620	Digaru Amchong PWD Road	26.15186 91.96909	59	20	33.5	44 (Noise)	0	7.7, E-02	1.0, E-07	OK	NT	OA/ Hillock	C/N 2.4dB.
1700	Nawgaon NH Khaloibari village	26.11387 92.06921	64	30	Noise Floor	Noise Floor	0	-	-	NT	NT	HT/LRB/ Veg.	
1800	Jagi Road Police Station- NH	26.12026 92.19815	63	42	Noise Floor	Noise Floor	0	-	-	NT	NT	HT/LRB	

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Reception Survey for satisfactory coverage of DVB - T2 Transmitter (538 Mhz, Ch # 29) Guwahati.

Direction :- SOUTH

Table no :- 4

Route :-Tx- Khanapara → NH-6, GS Road → Umiam Lake

Date :- 26/04/2017

Time (Hrs)	Spot / Location	Location Co-ordinates	MSL (Mtrs)	Radial Distanse (KM)	Field Strength (dB μ V/m)		COFDM (Promax) Parameter @ 10Mtrs			Subjective Assessment on TV PROMAX	Subjective Assessment on Mobile	Terrain	Remarks
					10Mtrs	1.5Mtrs	MER (dB)	BER (Pre)					
								LDPC	BCH				
900	Khanapara Agri Dept. G.S.Road.	26.12901 91.81229	51	5	72	84	25	4.0, E-05	1.0, E-07	OK	OK	HT/HRB/ Veg.	C/N 43dB. C/N 38dB.
955	Before Jorbat G.S.Road.	26.10612 91.85484	120	10	61	56	31	2.1, E-06	1.0, E-07	OK	OK	HT/LRB/ Veg.	C/N 35dB. C/N 21dB.
1025	Barnihat G.S.Road.	26.0539 91.86991	66	15	40	noise	0	0	0	NT	NT	Near Hill Veg.	Noise floor Noise floor
1050	Umling Check gate NH-6, G.S.Road	25.98069 91.86151	282	21	noise	noise	0	0	0	NT	NT	Surrounded by Hills	Noise floor Noise floor
1130	Nongpoh Bethani Hospital, G.s.Road	25.90005 91.87765	523	30	41	noise	15	3.3, E-03	1.0, E-07	OK	NT	HT/Veg./ Hillock	C/N 13.5dB. C/N 8.6dB.
1200	Vill- Umsamlem G.S.Road.	25.80631 91.87579	568	40	noise	noise	0	0	0	NT	NT	HT/Veg./ Hillock	Noise floor
1230	NH-6, G.S.Road	25.70947 91.89507	841	50.8	noise	noise	0	0	0	NT	NT	HT/Veg./ Hillock	Noise floor
1300	Lake Umiam	25.67219 91.90183	980	55	40	noise	0	1.0, E-01	1.0, E-07	OK	NT	HT/Veg./ Hills	C/N 05dB.

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Reception Survey for satisfactory coverage of DVB - T2 Transmitter (538 Mhz, Ch # 29) Guwahati.

Direction :- SOUTH WEST

Table no :- 5

Route :- Rani Road → Lokhra Chowk.

Date :- 01/05/2017

Time (Hrs)	Spot / Location	Location Co-ordinates	MSL (Mtrs)	Radial Distanse (KM)	Field Strength (dB μ V/m)		COFDM (Promax) Parameter @ 10Mtrs			Subjective Assessment on TV PROMAX	Subjective Assessment on Mobile	Terrain	Remarks
					10Mtrs	1.5Mtrs	MER (dB)	BER (Pre)					
								LDPC	BCH				
2000	Lokhra Chowk	26.10909 91.75069	55	5.3	88	81	37	1.7, E-06	1.0, E-07	OK	OK	LT/LRB Veg.	C/N 42dB.
1800	Rani Road SH-3	26.05421 91.59779	45	20.3	< 39	<i>Noise Floor</i>			NT	NT	MT/LRB/ Veg.	C/N <04dB.	
1825	Rani Road SH-3	26.01951 91.56632	52	25.1	< 39	<i>Noise Floor</i>			NT	NT	MT/LRB/ Veg.	C/N <04dB.	

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Reception Survey for satisfactory coverage of DVB - T2 Transmitter (538 Mhz, Ch # 29) Guwahati.

Direction :- WEST

Table no :- 6

Route :- Tx-Kamakhya Temple Road → Goalpara Road

Date :- 24/04/2017

Time (Hrs)	Spot / Location	Location Co-ordinates	MSL (Mtrs)	Radial Distanse (KM)	Field Strength (dB μ V/m)		COFDM (Promax) Parameter @ 10Mtrs			Subjective Assessment on TV PROMAX	Subjective Assessment on Mobile	Terrain	Remarks
					10Mtrs	3Mtrs	MER (dB)	BER (Pre)					
								LDPC	BCH				
1200	Main Road below Kamakhya Temple	26.16756 91.72049	62	5	64	63	36	1.9, E-06	1.0, E-07	OK	OK / F	HT/Veg. Hillock	<i>C/N 31dB.</i>
1305	Guwahati University Campus	26.15645 91.66689	56	10	63	53	37	2.0, E-06	1.0, E-07	OK	OK / F	LT/LRB/ Veg.	<i>C/N 39dB.</i>
1335	Dharapur near Airport	26.13793 91.62163	48	15	59	54	35	2.3, E-04	1.0, E-07	OK	OK / F	MT/LRB/ Veg.	-
1400	New Air port Road, NH - 31	26.12146 91.60164	59	17	47	48	26	1.8, E-06	1.0, E-07	OK	F	MT/OA	-
1530	VIP-Airport Road crossing, NH - 31	26.09833 91.59437	64	18.5	61	52	33.6	1.9, E-06	1.0, E-08	OK	F	HT/LRB/ Veg.	<i>C/N 25dB.</i>
1600	Guwahati -Goalpara Rd. Rampur P.O.	26.08496 91.47768	42	30	53	50	23	1.6, E-06	1.0, E-07	OK	F	HT/LRB/ Veg.	<i>C/N 18dB.</i>
1648	Guwahati -Goalpara Rd near Kharabhanga	26.06909 91.42255	46	35	45	-	17.4	6.0, E-06	1.0, E-07	OK	NT	HT/LRB/ Veg.	-

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Reception Survey for satisfactory coverage of DVB - T2 Transmitter (538 Mhz, Ch # 29) Guwahati.

Direction :- NORTH WEST - 1

Table no :- 7

Route :- IIT Guwahati → Pandu Port → Nalbari.

Date :- 27-30/04/2017

Date :- 02/05/2017

Time (Hrs)	Spot / Location	Location Co-ordinates	MSL (Mtrs)	Radial Distanse (KM)	Field Strength (dBμV/m)		COFDM (Promax) Parameter @ 10Mtrs			Subjective Assessment on TV PROMAX	Subjective Assessment on Mobile	Terrain	Remarks
					10Mtrs	1.5Mtrs	MER (dB)	BER (Pre)					
								LDPC	BCH				
1110 27/04/17	Near Inland Water Transport, T.R.Park	26.17911 91.7349	58	4.4	89	78	37	1.8, E-06	1.0, E-07	OK	OK	HT/LRB/ POP	C/N 48dB. C/N 40dB.
1118 2/5/2017	Pandu Port near Pandu Rly. Station	26.17167 91.68628	57	8.44	56	46	29.8	3.8, E-06	1.0, E-07	OK	F	LT/LRB/ Veg.	C/N 30dB. 0
1235 27/04/17	IIT Guwahati Campus	26.19149 91.69161	60	8.7	75	76	36	1.5, E-06	1.0, E-07	OK	OK	VLT/LRB/ Veg.	C/N 34dB. C/N 41dB.
1700 30/04/17	Dolibari NH-427	26.21416 91.63152	47	15.23	48	44	21	7.0,E-06	1.0, E-07	OK	NT	HT/LRB/ Veg.	C/N 12dB. 0
1735 30/04/17	Damdama NH-427	26.24751 91.57803	41	21.6	52	43	26	1.9, E-06	1.0, E-08	OK	NT	MT/LRB/ Veg.	C/N 26dB. C/N 14dB.
2110 30/04/17	Nalbari Road, SH-9	26.28559 91.50547	38	30	52	40	25	2.1, E-06	1.0, E-07	OK	NT	LT/LRB/ Veg.	C/N 24.7dB. 0
2150 30/04/17	Vill- Tarmatha, SH-9	26.35958 91.44558	39	39.5	40	0	3.9	1.0, E-01	1.0, E-06	OK	NT	LT/LRB/ Veg.	C/N .04dB. 0

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Reception Survey for satisfactory coverage of DVB - T2 Transmitter (538 Mhz, Ch # 29) Guwahati.

Direction :- NORTH WEST - 2

Table no :- 8

Route :-Brahmaputra bridge → Damdama → Barpeta Rd.→ Sapkata NH-427.

Date :- 27-30/04/2017

Time (Hrs)	Spot / Location	Location Co-ordinates	MSL (Mtrs)	Radial Distanse (KM)	Field Strength (dBμV/m)		COFDM (Promax) Parameter @ 10Mtrs			Subjective Assessment on TV PROMAX	Subjective Assessment on Mobile	Terrain	Remarks
					10Mtrs	1.5Mtrs	MER (dB)	BER (Pre)					
								LDPC	BCH				
1150 27/04/17	Middle of New Bramhaputra bridge	26.17719 91.67174	81	10	58	58	27	6.4, E-05	1.0, E-07	OK	OK	HT/OA	C/N 32dB. C/N 18dB.
1835 30/04/17	Bangal Para, NH-427	26.27391 91.50324	39	29.6	53	42	26.8	1.7, E-06	1.0, E-07	OK	NT	HT/LRB/ Veg.	C/N 26dB. 0
1915 30/04/17	Sapkata NH-427	26.28716 91.39136	35	40.4	59	53	25.5	2.1, E-06	1.0, E-08	OK	NT / F	HT/OA/ Veg.	C/N 32dB. C/N 25dB.
2000 30/04/17	NH-427	26.27601 91.28651	34	50	44	0	19	4.2, E-06	1.0, E-07	OK	NT	HT/OA/ Veg.	C/N 08dB. 0

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