

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

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

Located

at

Lucknow (Uttar Pradesh)

(21-10-16 to 29-10-16)

Field Strength Measurement/Reception Survey Team

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 Lucknow DVB-T2 TV transmitter, operating on 562 MHz (Channel # 32) in fixed reception mode.
- Identifying areas of poor reception of the transmitter, in the coverage areas of Lucknow DVB-T2 transmitter.

Equipment Used

1. Field strength cum Spectrum Analyzer, Anritsu MS 2035B & MS 2013E.
2. UHF standard Dipole Antenna, Anritsu MP663A.

3. GPS Navigator, Garmin Montana 650.
4. DVB-T2 STB.
5. Sony LCD TV receiver.
6. IRD, Ericsson RX-8200
7. Tata Safari Survey van equipped with 10 meter pneumatic mast and 3 KVA Honda generator.
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.

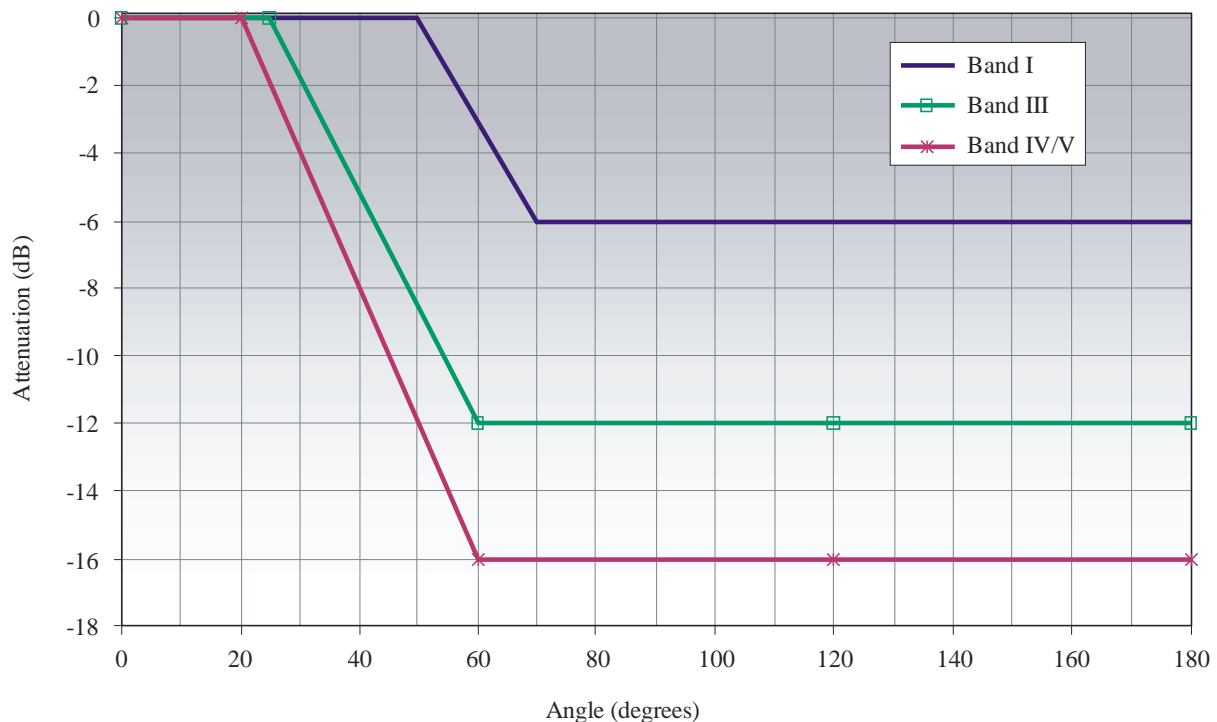


Figure-1

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.

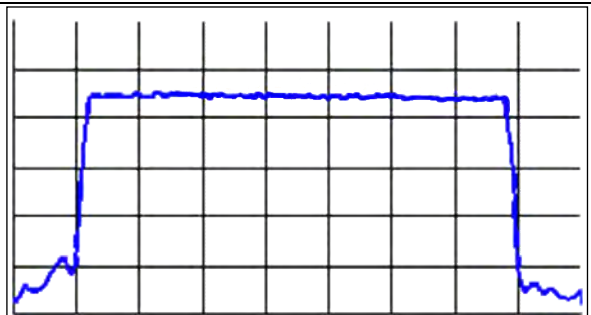
Reception Channel

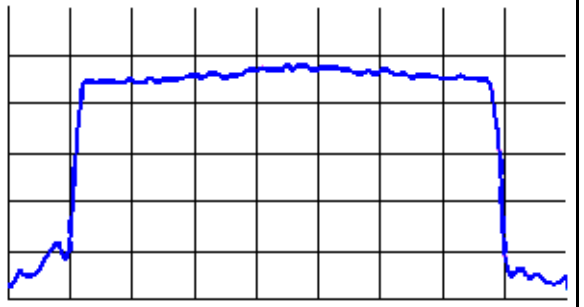
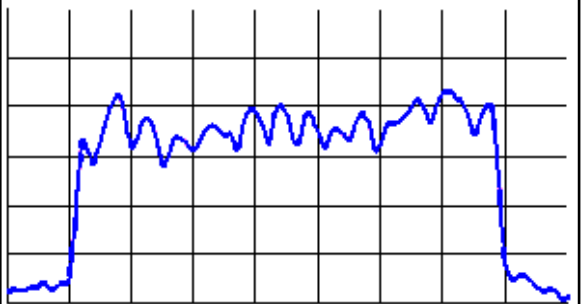
Due to reflections, shading and reception of signals from multiple transmitters of an SFN, the received spectrum can be degraded. The order of this degradation determines the reception channel

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, Ericsson made IRD 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	Portable indoor/urban
Frequency	Freq	MHz	650	650	650
Minimum C/N required by system	C/N	dB	20.0	17.9	18.3
System variant (example)			256-QAM FEC 2/3, 32k, PP7 Extended	64-QAM FEC 2/3, 32k, PP4 Extended	64-QAM FEC 2/3, 16k, PP1 Extended
Bit rate (indicative values)		Mbit/s	35-40	26-29	23-28
Receiver noise figure	F	dB	6	6	6
Equivalent noise bandwidth	B	MHz	7.77	7.77	7.77
Receiver noise input power	P_n	dBW	-128.0	-128.3	-127.9

DVB-T2 in Band IV/V			Fixed	Portable outdoor/urban	Portable indoor/urban
Min. receiver signal input power	$P_{s\ min}$	dBW	-109.1	-111.2	-110.8
Min. equivalent receiver input voltage, 75Ω	U_{min}	dBμV	29.7	27.6	28.0
Feeder loss	L_f	dB	4	0	0
Antenna gain relative to half dipole	G_d	dB	11	0	0
Effective antenna aperture	A_a	dBm ²	-4.6	-15.6	-15.6
Min power flux-density at receiving location	Φ_{min}	dB(W)/m ²	-100.5	-95.6	-94.2
Min equivalent field strength at receiving location	E_{min}	dBμV/m	45.3	50.2	50.6
Allowance for man-made noise	P_{mmn}	dB	0	1	1
Penetration loss (building or vehicle)	L_b, L_h	dB	0	0	11
Standard deviation of the penetration loss		dB	0	0	6
Diversity gain	Div	dB	0	0	0
Location probability		%	70	70	70
Distribution factor			0.5244	0.5244	0.5244
Standard deviation			5.5	5.5	8.1
Location correction factor	C_l	dB	2.8842	2.8842	4.24764
Minimum median power flux-density at reception height ⁽¹⁾ , 50% time and 50% locations	Φ_{med}	dB(W)/m ²	-97.6	-91.7	-79.0
Minimum median equivalent field strength at reception height ⁽¹⁾ , 50% time and 50% locations	E_{med}	dBμV/m	48.2	54.1	66.8
Location probability		%	95	95	95
Distribution factor			1.6449	1.6449	1.6449
Standard deviation			5.5	5.5	8.1
Location correction factor	C_l	dB	9.04695	9.04695	13.32369
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	75.9

⁽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 Lucknow
2. GPS data of TV transmitter tower	: N 26.87344° & E 80.86574°
3. Terrain around Transmitter	: Urban, Populated Residential
4. Rated power of the transmitter	: 6.0 KW
5. Forward radiated power	: 5.5 KW
6. Reflected Power	: 7 Watt
7. Transmission mode	: SDTV
8. Make	: HARRIS
9. Model	: MAXIVA
10. Frequency of operation	: 562 MHz
11. Date of commissioning	: 25/2/2016

Transmitting Antenna Details

1. Make	: SIRA SISTEMI RADIO
2. Type/Model	: UTV-01/24(6×4)
3. Antenna Gain	: 12.9 db (Nominal)
4. Effective height of antenna (Midbay)	: 183 meters.
5. Polarization	: Horizontal

Transmission Parameters of DTT transmission at DDK, Lucknow

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:	1/8
9. SISO/MISO:	SISO
10. PLP BIT RATE:	5.99 Mbits/S
11. FREQUENCY:	562 MHz
12. CONTENT:	TV: FIVE SERVICES

Measurement Method

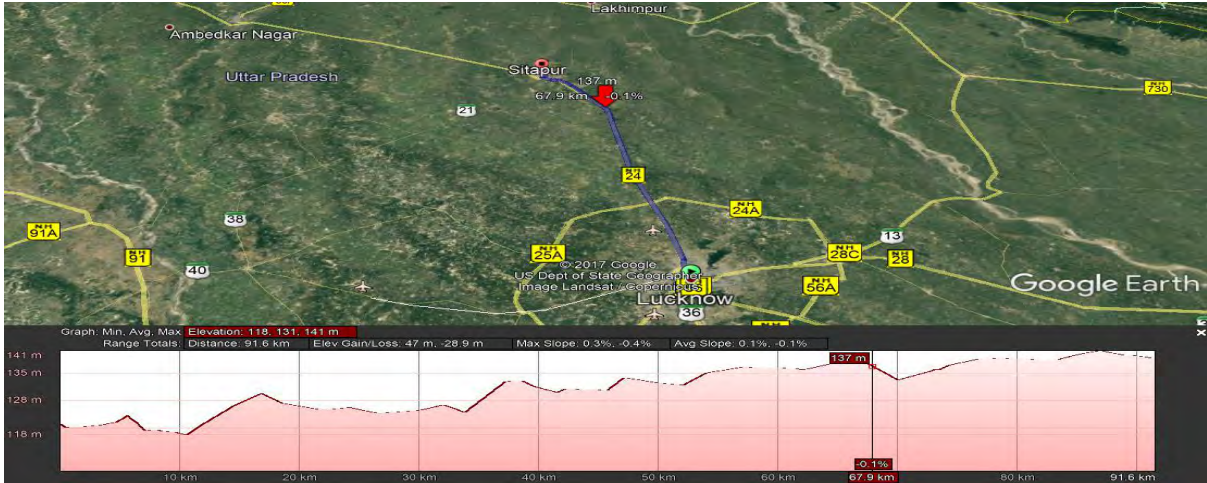
Google and Garmin maps were used throughout the survey for making different routes. Location of the transmitter tower was marked using GPS for reference purpose. Using this reference all the routes and survey points were decided keeping in consideration the type of terrain encountered. Since the purpose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

Route Analysis

1. North :(Table-1)

The elevation profile in this route was not with much irregularity as clear from map-1. The survey started from transmitter with stop at regular interval for obtaining field strength value and other parameters.

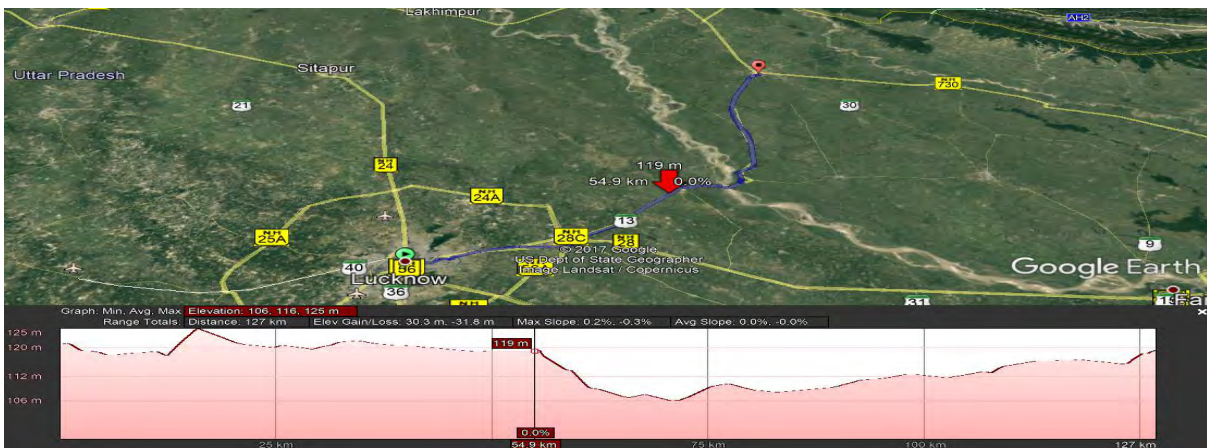


Map-1

This area is covered with vegetation along the route with open fields all around the road. The maximum height above MSL was 140 meters at a distance of 70 km approximately. The Subjective assessment was excellent up to LOS distance of 70 Km. The field strength was $60 \text{ dB}\mu\text{V/m}$ at this point. Sitapur town which lies at a LOS distance of 80 Km does not get enough RF signal for good reception.

2. North-East :(Table-2)

Barabanki and Bahraich are two major towns on this route. The elevation profile (Map-2) is normal up to a distance of 54 Km, afterwards there is a drop of 25 to 30 meters which continues up to the rest of the routes

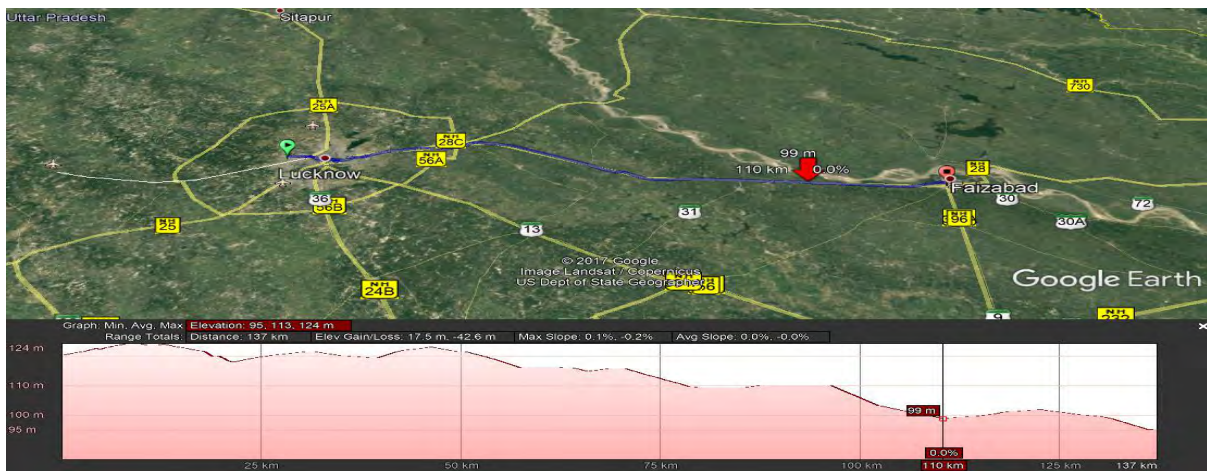


Map-2

In this route field strength of, 52 db μ V/m was observed at a LOS distance of 70 Km. Major town is Bahraich which does not receive required field strength for good reception as LOS distance is more than 100 Km from transmitter tower of DDK Lucknow.

3. East :(Table-3)

Barabanki and Faizabad are two towns in this route. Faizabad does not get minimum required signals of DTT due to the LOS distance of more than 125 Km. The elevation irregularity is very low and the only obstacle is free space attenuation which restricts the range to 77 Km in addition to vegetation

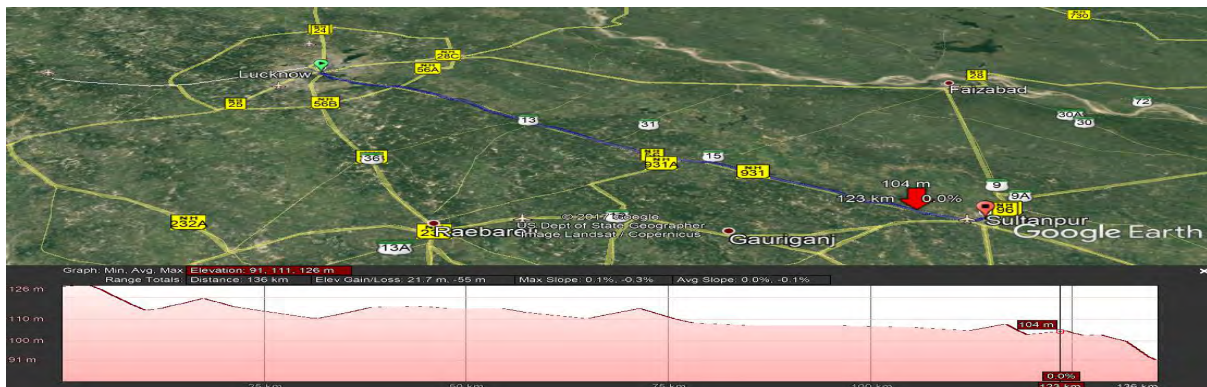


Map-3

of significant heights. The field strength was 54 db μ V/m at this location.

4. South-East :(Table-4)

The only major town in this route was Sultanpur which is situated at a LOS distance of more than 130 Km. The field strength of 56db μ V/ m was observed at an aerial distance of 60 Km only. At more LOS distance field value was below 50 db μ V/ m.

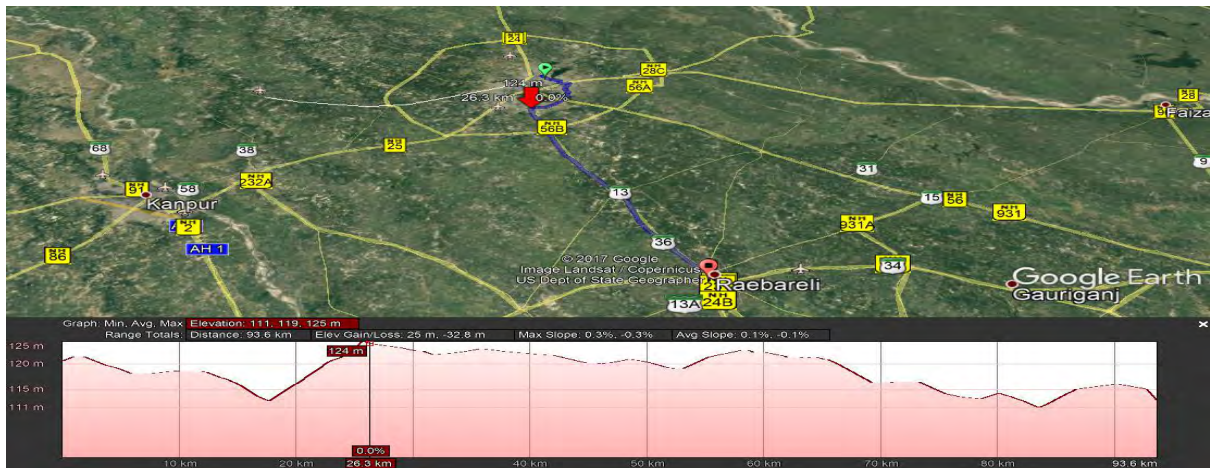


Map-4

In spite of normal elevation profile, the coverage in this route was restricted to just 60 Km. It may be due to the thick vegetation of considerable heights along the motor able road.

5. South :(Table-5)

The required minimum field strength was found up to the LOS distance of 60 Km in this route. The terrain profile was normal. Even though field strength was just 44 db μ V/ m only in the Raibareilly town, the reception quality was excellent in the TV.

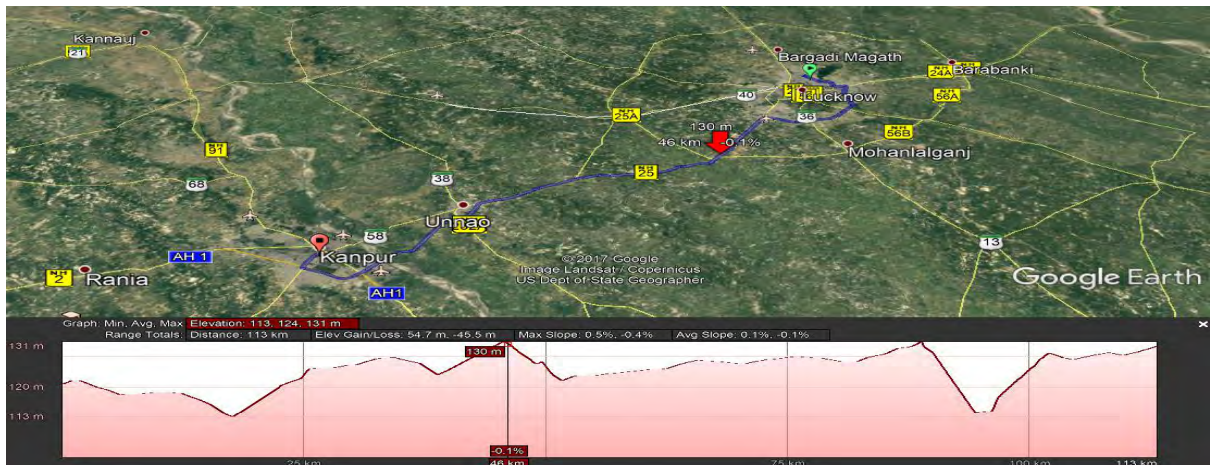


Map-5

It may be due to the low manmade noise as well as good RF front end of the IRD.

6. South-West :(Table-6)

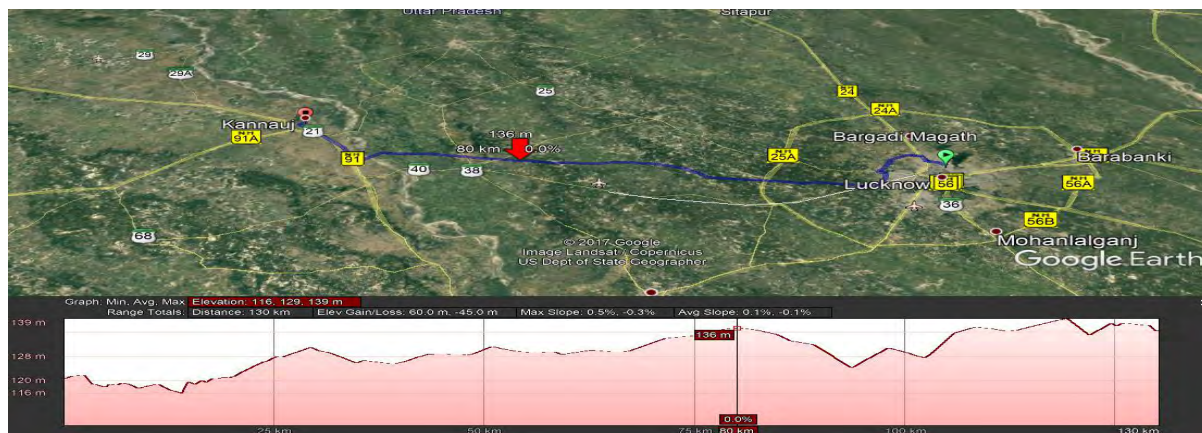
The required minimum signal was observed at a LOS distance of 72 Km. The coverage was excellent



Map-6

in the entire Unnao town. Few areas of Kanpur City were also found to be covered in terms of subjective assessment only. Field strength was low in the entire Kanpur city. The terrain profile of this route was nearly normal.

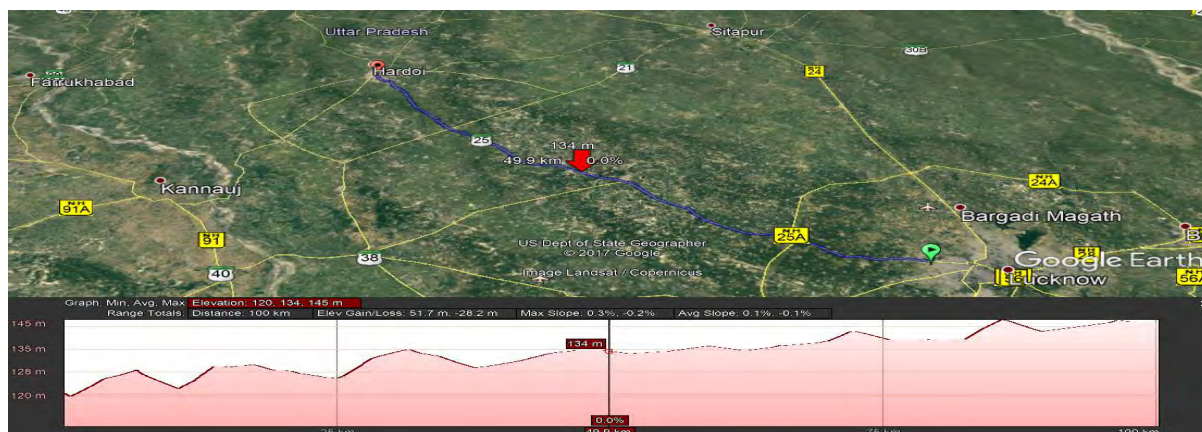
7. West :(Table-7)



Map-7

The entire route towards west from transmitter tower is normal with respect to terrain profile. The minimum required field strength was available at an aerial distance of 59 Km. Throughout the route MER value was above 18 db.

8. North-West :(Table-8)



Map-8

Two town lies in this route, Sandila and Hardoi. The coverage in terms of field strength was available at an aerial distance of 65 Km. The elevation from transmitter to Hardoi town increases slowly from 120 meter to 145 meters above MSL. If we take curvature of earth and height of transmitter antenna tower in consideration, then coverage is good in this direction.

Conclusion:

The field strength measurement has been carried out as per ITU-R recommendations BT.2254-2. The coverage in different direction are as under and shown in Map-9.

Direction from Antenna tower	Coverage in Km
North	70
North-East	70
East	77
South-East	60
South	60
South-West	72
West	65
North-West	65

The coverage in the South-East and South direction has been found minimum.

Acknowledgement:

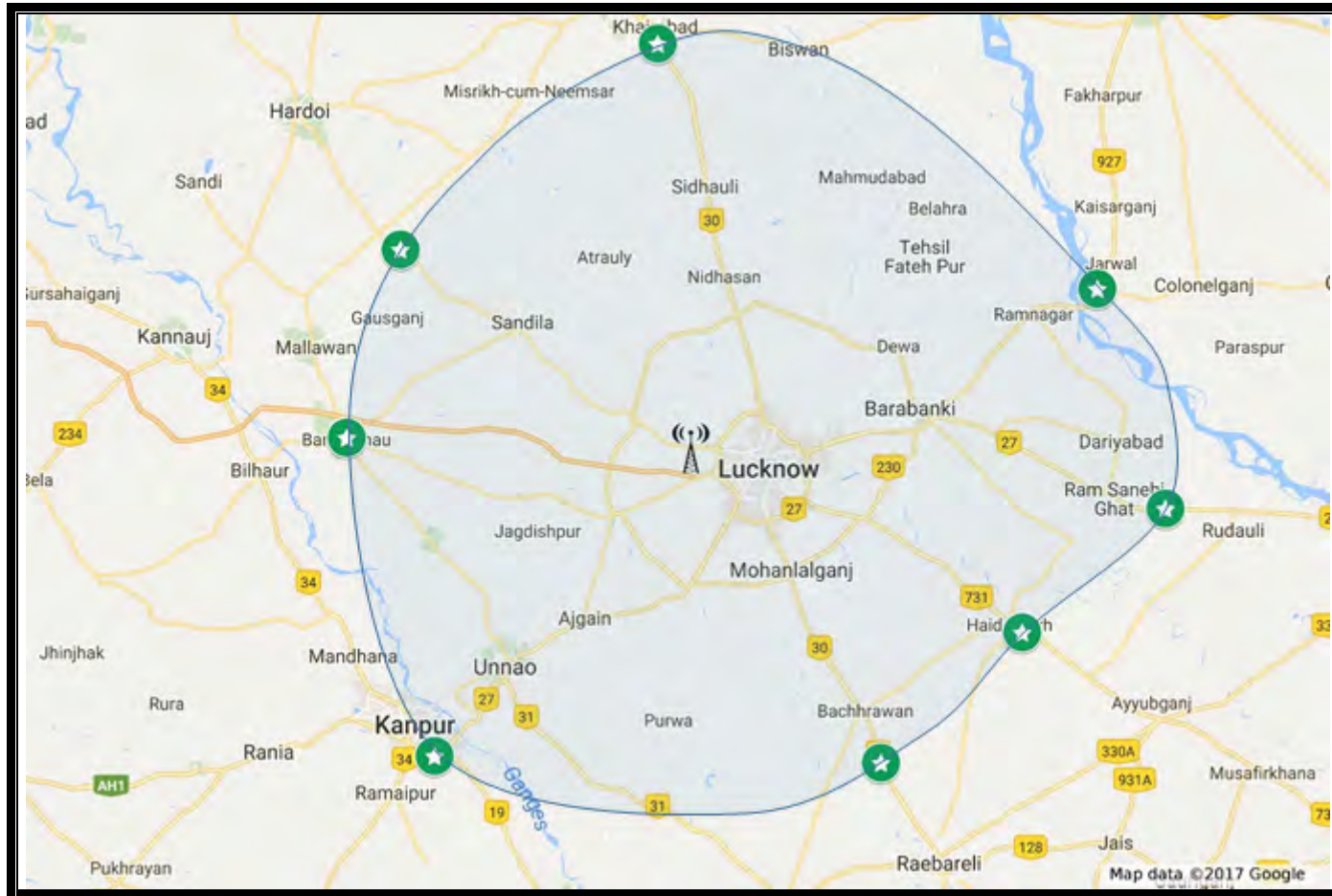
The DTT coverage survey of DDK, Lucknow was carried out by the Propagation labs of The Research department of AIR & DD, New Delhi. The field trial was successfully done with the sincere support of Engineers of DD HPT, Lucknow. The survey team also extends their gratitude to Sh. P P Shukla, DDG (E), Sh. Md Javed, DD (E) and Sh. Rohit Bhatt, AE of DDK Lucknow for providing all required logistic support.

Further study:

Lucknow is a big city surrounded by medium height buildings and dense population. Reception of DTT on smart TV requires street by street survey using latest software based instruments like ETL with unidirectional calibrated antennas mounted on vehicle top. Automatic recording of data with GPS marking will provide excellent report on such coverage. Doordarshan Directorate may explore the possibility of such surveys in metropolitan cities.

Coverage map of DTT of Lucknow

Map-9



Survey Locations

Map-10



Legends: 1. Green circles denotes excellent reception of DVB-T2 signals 2. Red circles denotes bad reception of DVB-T2 Signals (Receiving Antenna height @10 meters)

Reception Survey of DTT from DDK-Lucknow transmitter on Channel 32 (562 MHz)

Direction from Tx: North
Route: Tx-Sidhauli-Sitapur

Table: 1
Date: 26-10-16

Time	Location	Ground Height above MSL in meters	Line of Sight distance in Km.	Field strength in dB μ V/ m	DVB-T2 Parameters			Subjective Assessment On TV	Terrain Profile	Remarks
					MER	BER (Pre)				
						LDPC	BCH			
1010	IIM Road	102	5.5	100	20	4.4 E-5	1.0 E-8	Excellent	POP/HT/MRB	
1025	Sitapur Road	107	10	84	19	3.0 E-6	1.0 E-8	Excellent	MT/OA/LRB	
1056	---do---	114	20	91	29	1.0 E-6	1.0 E-8	Excellent	MT/OA	
1119	---do---	113	31.6	72	16	5.0 E-4	1.0 E-8	Excellent	HT/OA	
1150	---do---	116	50.48	63	18	1.0 E-4	1.0 E-8	Excellent	MT/MRB	
1206	---do---	115	60	62	0.6	1.3 E-1	1.5 E-4	Excellent	MT/OA	
1225	---do---	115	70	60	3	1.0 E-1	1.5 E-4	Excellent	MT/OA	
1240	---do---	113	75	52	2	-	-	Freezing	MT/OA	
1305	Sitapur City	112	80	Noise Floor	-	-	-	NT	MT/OA	

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways 5. HDP-High density population 6.HT-High Traffic 7.MT-Moderate traffic 8.LT-Low Traffic 9.Veg-Vegetation 10. MKT-Market areas. 11. SH-State highway/Other Roads.12. POP-Populated areas.

Reception Survey of DTT from DDK-Lucknow transmitter on Channel 32 (562 MHz)

Direction from Tx: North-East
Route: Tx-Barabanki-Bahraich

Table: 2
Date: 27-10-16

Time	Location	Ground Height above MSL in meters	Line of Sight distance in Km.	Field strength in dBμV/m	DVB-T2 Parameters			Subjective Assessment On TV	Terrain Profile	Remarks
					MER	BER (Pre)				
						LDPC	BCH			
0958	Near Kursi Road (NH-30 Xing) Aliganj	105	10.12	97	20	2.2 E-6	1.0 E-8	Excellent	City Road MT/LRB/Pop	
1025	Kursi Road	110	20	83	22	1.0 E-6	1.0 E-8	---do---	---do---	
1100	Kursi Deva Road X-ing	104	30	81	26	1.0 E-6	1.0 E-8	---do---	MT/OA/SH	
1204	Barabanki Ramnagar	103	40	68	18.5	8.6 E-5	1.0 E-8	---do---	NH/HT/Veg. Sparse Population	
1300	Near Aima-Ramnagar	94	60	58	0.4	1.3 E-1	4.1 E-5	---do---	HW/MT/VEG/OA	Veg. on Road Side Long Tree
1400	Bahraich Road	109	70	52	3	2.5 E-1	3.8 E-5	---do---	MT/OA/LRB	
1430	---do---	104	77	47	0.3	1.2 E-1	3.9 E-5	NT	MT/OA/LRB	

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways 5. HDP-High density population 6.HT-High Traffic 7.MT-Moderate traffic 8.LT-Low Traffic 9.Veg-Vegetation 10. MKT-Market areas. 11. SH-State highway/Other Roads.12. POP-Populated areas.

Reception Survey of DTT from DDK-Lucknow transmitter on Channel 32 (562 MHz)

Direction from Tx: East
Route: Tx-Barabanki-Faizabad

Table: 03
Date: 27-10-16

Time	Location	Ground Height above MSL in meters	Line of Sight distance in Km.	Field strength in dB μ V/ m	DVB-T2 Parameters			Subjective Assessment On TV	Terrain Profile	Remarks
					MER	BER (Pre)				
						LDPC	BCH			
0900	Near International Convention Center-KGMC	98	5.4	90	15	1.2 E-4	1.0 E-8	OK/Excellent (Severe Multipath)	POP/HT/MRB	
1100	Faizabad Road Tikonia	100	10	90	20	1.0 E-6	1.0 E-8	Excellent (Multipath)	MT/VEG/NHW	
1640	Faizabad Road	93	20	73	17	1.4 E-5	1.0 E-8	Excellent	OA/NHW/MT	
1625	---do---	93	30	79	20	1.8 E-5	1.0 E-8	Excellent	OA/NHW/LT	
1445	---do--- (off Barabanki)	115	40	60	9	2.7 E-2	4.5 E-8	Excellent with few drops	LT/LRB/NHW	
1512	Barabanki-Faizabad Road	104	50	60	12	4.3 E-4	1.0 E-8	Excellent	LT/OA	
1535	---do---	97	60	59	-	-	-	NT	LT/VEG/NHW	
1600	---do---	93	55	60	13.0	1.0 E-1	3.0 E-8	Excellent	OA/MT/NHW	
1620	---do---	115	77	54	12	1.0 E-2	1.0 E-8	Excellent	OA/MT/NHW	
1700	---do---	113	88	48	2.0	1.0 E-2		NT	LRB/NHW/MT	

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways 5. HDP-High density population 6.HT-High Traffic 7.MT-Moderate traffic 8.LT-Low Traffic 9.Veg-Vegetation 10. MKT-Market areas. 11. SH-State highway/Other Roads.12. POP-Populated areas.

Reception Survey of DTT from DDK-Lucknow transmitter on Channel 32 (562 MHz)

Direction from Tx: South-East
Route: Tx-NH731-HaiderGarh-Ayyubganj-Sultanpur

Table: 4
Date: 25/10/16

Time	Location	Ground Height above MSL in meters	Line of Sight distance in Km.	Field strength in dB μ V/ m	DVB-T2 Parameters			Subjective Assessment On TV	Terrain Profile	Remarks
					MER	BER (Pre)				
						LDPC	BCH			
0955	Gulistan Colony Near Dilkushan Cabin	102	10	81	27.5	1.0 E-6	1.0 E-8	Excellent	HT/POP/LRB	
1025	Sultanpur Road NH731	101	20	81	28.0	1.0 E-6	1.0 E-8	Excellent	HT/OA/	
1055	---do---	102	30	63	14.0	2.7 E-3	1.0 E-8	Excellent	HT/OA	
1140	---do---	101	40	50	10.5	1.9 E-3	1.0 E-8	Excellent	HT/OA	
1230	---do---	97	50	59	3	6.0 E-2	1.0 E-8	V.Good	HT/OA/VEG	
1315	---do--- Near Haidergarh	100	60	56	↓	↓	↓	NT	HT/OA	
1500	NH731 SULTANPUR RD	103	80	50	--	--	--	NT	HT/OA	

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways 5. HDP-High density population 6.HT-High Traffic 7.MT-Moderate traffic 8.LT-Low Traffic 9.Veg-Vegetation 10. MKT-Market areas. 11. SH-State highway/Other Roads.12. POP-Populated areas.

Reception Survey of DTT from DDK-Lucknow transmitter on Channel 32 (562 MHz)

Direction from Tx: South
Route: Lucknow-NH30-Mohanlalganj-Raebareli

Table: 5
Date: 24/10/16

Time	Location	Ground Height above MSL in meters	Line of Sight distance in Km.	Field strength in dB μ V/ m	DVB-T2 Parameters			Subjective Assessment On TV	Terrain Profile	Remarks
					MER	BER (Pre)				
						LDPC	BCH			
2025	Nadan Mahal Road	99	5	80	26.3	1.0 E-6	1.0 E-8	Excellent	POP/HRB/MRB/	
0920	Cantonment Lucknow	112	10	65	24	1.2 E-5	1.0 E-8	Excellent	Veg.Long/HT/LRB	Thick Vegetation
1005	Raebareli Road	108	20	67	25	1.0 E-6	1.0 E-8	Excellent	OA/HW/MT/LRB	
1035	---do---	102	40	64	21	4.0 E-5	1.0 E-8	Excellent	OA/HW/MT	
1135	Bachrawar District Raebareli	100	51	61	15	3.3 E-4	1.0 E-8	Excellent	HW/MT/LRB	
1515	---do---	99	60	52	17.6	1.4 E-4	1.0 E-8	Excellent	HW/HT/OA/Veg	
1545	Raebareli	96	70	47	10.2	7.5 E-4	1.0 E-8	Excellent	HW/HT/OA	
1610	Chajjlapur Raebareli	93	80	46	0.5-0.8	1.0 E-1	1.2 E-7	Excellent	NH/MRB/POP/	

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways 5. HDP-High density population 6.HT-High Traffic 7.MT-Moderate traffic 8.LT-Low Traffic 9.Veg-Vegetation 10. MKT-Market areas. 11. SH-State highway/Other Roads.12. POP-Populated areas.

Reception Survey of DTT from DDK-Lucknow transmitter on Channel 32 (562 MHz)

Direction from Tx: South-West
Route: Tx-Mohan Road-NH27-Unnao-Kanpur

Table: 6
Date: 23-10-16

Time	Location	Ground Height above MSL in meters	Line of Sight distance in Km.	Field strength in dB μ V/ m	DVB-T2 Parameters			Subjective Assessment On TV	Terrain Profile	Remarks
					MER	BER (Pre)				
						LDPC	BCH			
1215	Mohana Road	112	6	79	26.6	1.0 E-6	1.0 E-8	Excellent	HW/LT/OA	
1300	----do----	109	10	77	2.6	1.0 E-6	1.0 E-8	Excellent	HW/Veg/LT/VillageArea	
1350	Mohana	111	20	54	3.0- 7.5	4.2 E-2	1.5 E-8	Excellent	HW/Veg.Long/MT	
1440	Towards Kanpur	105	30	53	19.4	5.4 E-5	1.0 E-8	Excellent	HW/Veg.Long/MT	
1615	Unnao Bypass	108	51	45	21.0	3.6 E-5	1.0 E-8	Excellent	Outskirts of city LRS/OA	
1710	Kanpur NH	111	72.3	52	17	9.3 E-5	1.0 E-8	Excellent	HW/HT/Flyover	
1750	Kanpur City	113	75	47	0	-	-	NT	HW/HT/H.Pop/Noisy	
1900	Unnao Bypass	100	60	49	14	9.2 E-5	1.0 E-8	Excellent	HT/HW/OA	

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways 5. HDP-High density population 6.HT-High Traffic 7.MT-Moderate traffic 8.LT-Low Traffic 9.Veg-Vegetation 10. MKT-Market areas. 11. SH-State highway/Other Roads.12. POP-Populated areas.

Reception Survey of DTT from DDK-Lucknow transmitter on Channel 32 (562 MHz)

Direction from Tx: WEST
Route: Fatehganj-Mohan-Miyaganj-Bangarmau-Kannauj

Table: 7
Date: 21-28/10/16

Time	Location	Ground Height above MSL in meters	Line of Sight distance in Km.	Field strength in dB μ V/ m	DVB-T2 Parameters			Subjective Assessment On TV	Terrain Profile	Remarks
					MER	BER (Pre)				
						LDPC	BCH			
2150	Fatehganj Rd	108	10	82	28	1.0 E-6	1.0 E-8	Excellent	SH/HT/OA	
2120	---do---	109	20	58	21	5.8 E-6	1.0 E-8	---DO---	---DO---	
2100	---do---	110	30	58	23.1	2.7 E-5	1.0 E-8	---DO---	---DO---	
1930	---do---	108	40	59	19.8	3.4 E-6	1.0 E-8	Excellent	SH/HT/OA/VEG	
1835	---do---	115	59	55	19	1.0 E-5	1.0 E-8	---DO---	---DO---	
1900	Bangarmau	110	65	53	18	1.0 E-5	1.0 E-8	---DO---	Small town	
1800	Bangarmau-Kannauj Rd	107	70	45	1.2to5	--	--	---DO---	---DO---	

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways 5. HDP-High density population 6.HT-High Traffic 7.MT-Moderate traffic 8.LT-Low Traffic 9.Veg-Vegetation 10. MKT-Market areas. 11. SH-State highway/Other Roads.12. POP-Populated areas.

Reception Survey of DTT from DDK-Lucknow transmitter on Channel 32 (562 MHz)

Direction from Tx: North-West
Route: Tx-Malihabad-Hardoi

Table: 8
Date: 21/10/16

Time	Location	Ground Height above MSL in meters	Line of Sight distance in Km.	Field strength in dB μ V/m	DVB-T2 Parameters			Subjective Assessment On TV	Terrain Profile	Remarks
					MER	BER (Pre)				
						LDPC	BCH			
1500	Tiraha Sandila Road	117	5.2	102	28	2.4 E-4	1.5 E-8	Excellent	SH/LT/VEG/ CITY Outskirts	
1700	Malihabad	108	15	81	26	1.5 E-3	1.5 E-8	Excellent	SH/MT/LRB	
1745		105	25	72	27	1.0 E-8	1.0 E-8	---do---	SH/MT/VEG	
1210	Hardoi Road	115	45	66	26.4	1.0 E-4	1.0 E-8	Excellent	SH/MT/VEG	
1305	---do---	117	55	60	22.7	1.0 E-6	1.0 E-8	Excellent	SH/MT/VEG	
1350	---do---	117	65	53	2.4	1.0 E-1	1.2 E-8	Excellent	SH/MT/VEG/Fields	
1435	---do---	122	70	44	-	-	-	NT	SH/MT/Village Market	

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways 5. HDP-High density population 6.HT-High Traffic 7.MT-Moderate traffic 8.LT-Low Traffic 9.Veg-Vegetation 10. MKT-Market areas. 11. SH-State highway/Other Roads.12. POP-Populated areas.