R&D ***TECHNICAL REPORT***

No. RD/2017/931

AIR & DDI

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

Located at Raipur CHHATTISGARH

PRASAR BHARATI

RESEARCH DEPARTMENT

ALL INDIA RADIO & DOORDARSHAN

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

Located at Raipur, CHHATTISGARH

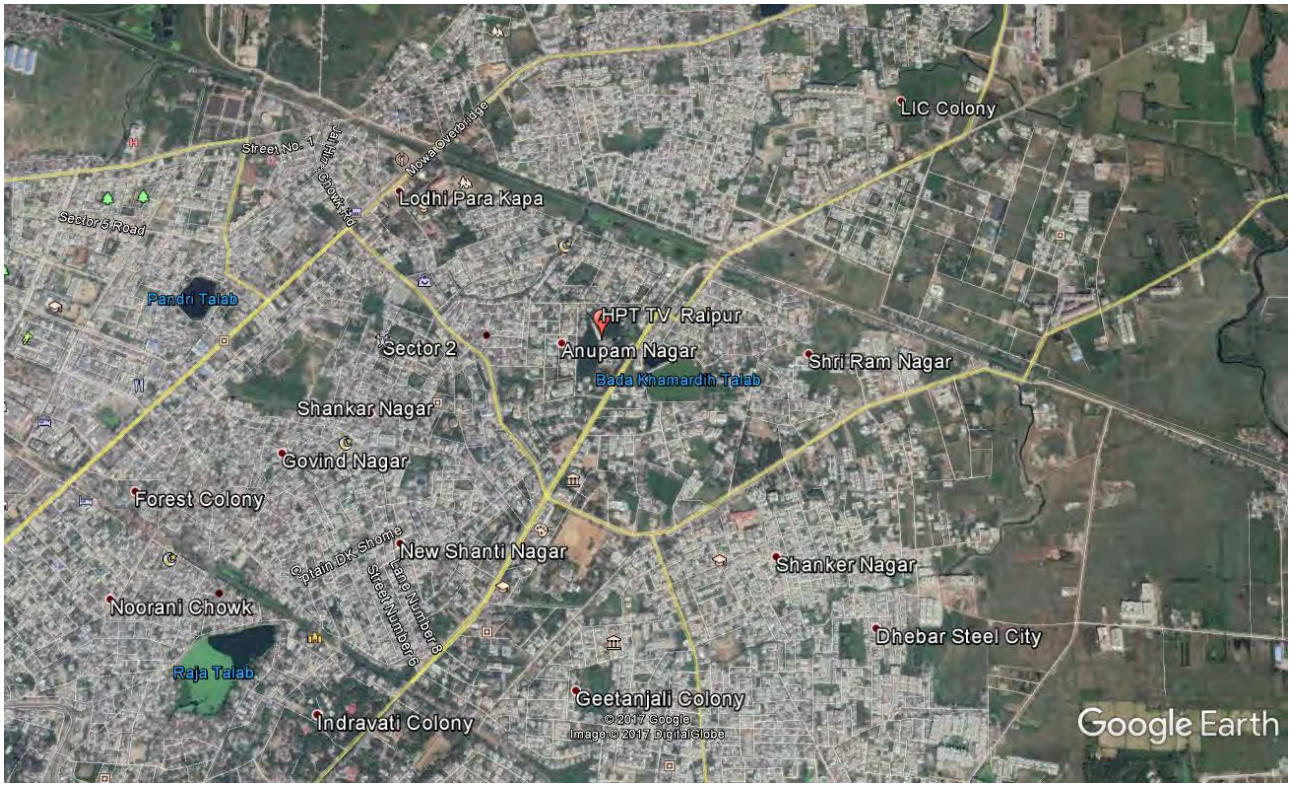
Survey period (21/01/2017 to 28/01/2017)

Field Strength Measurement/Reception Survey Team

PROPAGATION LAB

R&D Report No. 931

Team Leader	:	Bani Singh, Assistant Engineer.
Team Members	:	N. D. Das, SEA
	:	O. P. Upadhaya, Technician
	:	S. P Thakur, Senior Technician (DDK, Raipur)
	:	Lochan Das, Technician (DDK, Raipur)
Staff Car Drivers	:	H. N. Mishra.
Report Edited By	:	Md Javed Shams, AE
Supervised By	:	S. Hyder, DDG (E)
Guided By	:	Mrs. Anuradha Agarwal, ADG (E)



Location Map (3D View) of TV Tower Raipur (Chhattisgarh)

6.0kW DVB-T2 Transmitter

HPT (TV) Tower

Basic Data and Transmitter details

Transmitters Details:

Name of Station	:	HPT Raipur, Chhattisgarh.
Geometrical location of transmitter	:	N 21°15'24.4" E 85°18'49.9"
Height above MSL	:	298 meter
Surrounded area of transmitter	:	Urban, HDP, Heavy traffic
Rated power	:	6KW
Forward power	:	5.09KW
Reflected power	:	19.0 W
VSWR	:	1.12
Transmission mode	:	SDTV
Make	:	Harris
Model No.	:	Maxiva, ULX-6500 T2
Frequency of operation	:	490 MHz
Channel No.	:	23
Date of commission	:	25/02/2016

Transmitting Antenna Details:

Make	:	SIRA
Type/Model	:	UHF ANTENNA Panel / UTV -01/24(6X4)
Antenna Gain	:	13dB
Total Height	:	150 meter + 8.7 meter
Effective height (Mid bay)	:	150 meter + 4.35 meter
Polarization	:	Horizontal

Introduction:

Modern broadcasting scenario is changing so rapidly that viewer of today wants something more in addition to what is being received through analogue mode of TV transmission. Innovative efforts in the field of broadcast technologies and new habits of audio-visual content have driven the need to define new broadcasting standards that allow for such a social evolution. Earlier digital transmission began with DVB (H) & DVB (T) transmission that made possible for reception of broadcast signal through hand held (Mobile Phone) or fixed/mobile TV receiving devices. Further due to its limitation (spectral efficiency, bandwidth & robustness), in 2009, DVB finalized the development of the second generation terrestrial transmission system DVB-T2 which is the new DVB standard for DTT. It allows the simultaneous transmission of multiple services, each one with a different configuration, and thus, with different robustness and quality. This permits new type of reception scenarios for these digital terrestrial signals, like mobile and handheld pedestrian reception scenarios. So DVB-T2 can be used for providing both fixed and mobile services within the same channel with number of configurations supported. Although, this new standard has been fundamentally designed for fixed reception (receiver devices with rooftop and set-top antennas) but now the DVB-T2 reception is also feasible in portable and mobile devices (Smart Mobile Phones, PCs, laptops or in-car receivers).In the process of modernization Doordarshan India has established DVB T2 Transmitters in its network with future plan to replaced analogue transmitters with such DVB-T2 Transmitters. One of such transmitter is being established at HPT (TV) Tower Raipur **,** (Chhattisgarh) & commissioned for DD National Transmission on UHF Band, Ch#23 (490MHz). In this context Research Department is involved in carrying out propagation studies on DVB-T2 transmission to assist fixing of planning parameters/transmission configuration under existing terrain condition. The scope of work for the survey team of Research Department is to carry out field trial for prediction of coverage area for satisfactory reception. For this work a four member survey team carried out field strength survey during the period from 21/01/2017 to 28/01/2017 along with eight radials around the location of DVB-T2 Transmitter. The survey was carried out for fixed height (10 meter) antenna reception mode mounted on a vehicle.

Objective:

1. Ascertaining the coverage area for satisfactory reception of DVB-T2 Transmission.
2. To envisage minimum field strength value for satisfactory reception.

Equipment Used:

1. Spectrum Analyzer (Make: Anritsu, Model: MS 2035B & MS 2013E)
2. UHF Dipole antenna (Make: Anritsu, Model: MP663A)/Log periodic Antenna
3. GPS Navigator (Make: Garmin, Model: Montana 650)
4. DVB-T2 Set Top Box
5. LED TV Receiver(Make: Sony)
6. IRD (Make: Ericsson)
7. Survey Van fitted with 10 Meters Mast & Portable Generator
8. Promax DTT Analyzer

DVB-T2 Broadcast System:

DVB-T2 is the world's most advanced digital terrestrial transmission (DTT) system, offering more robustness, flexibility and at least 50% more efficiency than any other DTT system. It supports SD, HD, mobile TV or any combination thereof. Like its predecessor, DVB-T2 uses OFDM (orthogonal frequency division multiplex) modulation with a large number of sub-carriers 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 optimized for any target transmission channel. The key new technologies in DVB-T2 are:

- 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) allows 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. For comparison, the two bottom rows show the maximum data rate at a fixed C/N ratio and the required C/N ratio at a fixed (useful) data rate.

Transmission Parameter	DVB-T	DVB-T2
FEC	Convolutional Coding + Reed Solomon(1/2,2/3,3/4,5/6,7/8)	LDPC + BCH(1/2,3/5,2/3,3/4,4/5,5/6)
Modes	QPSK, 16QAM, 64QAM	QPSK, 16QAM, 64QAM, 256QAM
Guard Interval	1/2, 1/8, 1/16, 1/32	1/4,19/128,1/8,19/256,1/16,1/32,1/128
FFT Size	2k, 8k	1k, 2k, 4k,8k,16k,32k
Scattered Pilot	8% of Total	1%,2%,4%,8% of total
Continual Pilot	2.6% of total	0.35% of total
Bandwidth	6,7,8 MHZ	1.7,5,6,7,8,10MHz

Typical data rate(UK)	29 Mbit/second	40 Mbit/second
Max data rate @20dB	29 Mbit/Second	47.8 Mbit/second
Required C/N Ratio @	16.7 dB	8.9dB

Modulation Parameters:

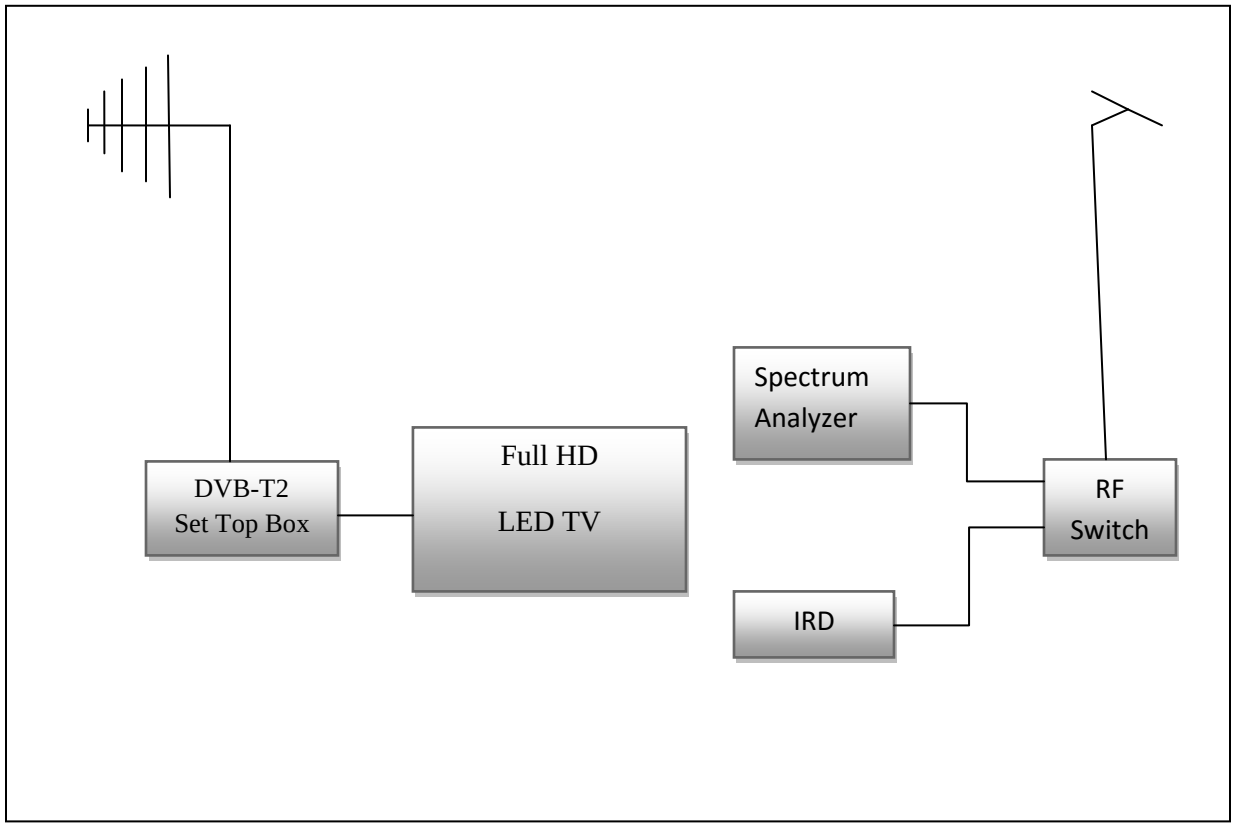
DVB-T2 standard offers a bigger choice of the OFDM parameters and modulation schemes depending upon application & reception mode. Combining various modulation schemes with FFT sizes and guard intervals allows construction of MFN and SFN networks designed for different applications: from low bit-rate but robust mobile reception to the high bit-rate fixed reception for domestic and professional use. Currently DVB-T2 transmitter at Raipur (Chhattisgarh) operating with following set of Modulation parameters targeted for fixed antenna & handheld portable (smart phone) reception mode.

Operating Frequency	490MHz
Channel No.	#23 (UHF, Band-IV)
Bandwidth	8 MHz
Number of Programme Content	TV : Five Services Radio: Nil
PLP Bit Rate:	6.17 M Bit/s
FFT	1K
Guard Interval	1/8
PLP Constellation	QPSK
PLP Rotation	Rotated
PLP Code Rate	1/2
Pilot Pattern	PP3

SISO/MISO	SISO
FEC Frame Length	Normal

System configuration:

The field trials system mainly consists of field strength measuring equipment, standard calibrated UHF Dipole antenna & Yagi receiving antenna for receiving horizontally polarized TV broadcast signal, Portable Generator, 10 Meters electromechanically operated telescopic mast housed in a customized Survey Van of Research Department. A pictorial diagram is given below.



Measurement Set Up:

The field trials were carried out by utilizing mobile survey van of Research Department having 03 meter to 10 meter pneumatic telescopic mast. Field strength measurement was carried out, using Anritsu make Spectrum Analyzer & UHF Dipole Antenna. The whole system was assembled in a mobile van with power generating system (portable generator set). The two main

components of the reception set up are DVB-T2 receiving system and field strength measuring system (Spectrum Analyzer). A calibrated UHF dipole antenna is used to receive the signal whereas for subjective assessment of the received signal was performed by using DVB-T2 set top box & a Sony make LED TV. To record Pre LDPC, BCH & MER data, Ericsson make professional IRD was used. In addition to this Garmin make GPS navigator was used for determination of the spot / location co-ordinate in six figures & radial distance from the transmitter locations.

Selection of sites for measurement:

As far as possible an open & safe spot / location (overhead power and telephone cables, trees and other hazards were avoided) was chosen for the measurement of received field strength. Instead of cluster measurement (measurement at four to five spot for a given location), single sample method in this survey is preferred, because of the additional time that may be taken in making cluster measurements (due to the frequent raising or lowering of the receiving antenna & insufficient space along the motor able road side), or because of the hazards in moving the measuring vehicle while the antenna is fully erected. High tension overhead wires, close to high raise buildings & elevated flyovers / underpasses were avoided while collecting field strength data along a radial route.

Measurement Methodology:

A map of the largest available scale was used to mark the location of the transmitters. From the transmitter location eight radials are drawn passing through the transmitter location along with North, East, South, West, North-East, North-West, South East & South West directions. For prediction of the coverage area, field strength measurement along a radial is carried out by employing mobile survey van having 10 Mtrs telescopic mast with rotor & tilt facility. For field strength measurement the survey vehicle was mostly parked in open space, raising the telescopic mast up to the required height of 10 meters & then rotating the antenna to align it along the direction of transmission source for getting optimum value of field strength & MER value. While taking static reception measurement LAT, LONG, MSL & radial distance of each & every location was also recorded. Once all measurements have been undertaken, mast is fully retracted & then driven away for the next location. Since the purpose of the survey was to determine the primary coverage area for satisfactory reception so that the measurement was carried out in static condition along motor able roads. The same procedures for field strength measurement / reception survey are adopted along all other eight radials. After data collection is over the FSM data are tabulated & interpreted on the basis of the findings.The quality of received audio / video was also analyzed by using DVB-T2 Set Top Box & SONY TV receiver under given terrain conditions. The environment classification criteria are:

Rural	Areas with scarce isolated buildings, open fields.
Suburban	Small towns; residential areas with low building density and buildings not higher than two stories; wide roads or streets between buildings.
Urban	Big to medium sized cities, residential areas with high density of buildings; areas where buildings are higher than two stories and close distances between them
Large Cities	Densely populated cities having cluster of township with high rise building & skyscrapers

TV Broadcast Signal Propagation:

TV broadcast signal propagates from the transmitter by space wave propagation mechanisms i.e. Line of sight propagation & travel straight way in propagating medium & undergoes all optical phenomena like Reflection, Refraction, Scattering, Diffraction etc while travelling through the medium. DVB T2 reception is largely affected by multipath, which changes along time due to the receiver travelling around the buildings. It is also important to point out other factors typical of urban reception environment such as traffic, speed change due to traffic lights and pedestrian crossings, etc. The field strength level, at a given point, not only depends on its distance from the transmitter, the frequency of transmission and the antenna heights but also on the long-term and short-term interferences caused by reflections of the natural environment (terrain configuration, vegetation) and the man-made environment. Thus the received signal must be considered as the vector sum of the wanted signal and many reflected signals. Due to the effect of reflected signals, the Field Strength / MER along a route show severe fluctuation. Since, the measurements are made on public roads the reflected signals coming from other vehicles cannot be avoided. The field strength test results therefore very rarely match the results of measurements obtained at the same place, at a different time.

Collection of field strength data:

The field strength data were collected along eight radials routes drawn (Map-10) around the transmitting antenna. At each & every spot / location along the radial the telescopic mast was expanded upto10 Meters from the ground level keeping the dipole antenna horizontally as the polarization of the radiated beam is horizontally polarized. The antenna position is being continuously rotated for optimized value of field strength in the direction of line of sight with respect to the transmitting antenna. The optimum field strength values are thus recorded. In addition to this the terrain a detail of each & every spot / location was also recorded along with the subjective assessment of the received audio / video quality on the basis of watching on DVB-T2 TV receiving system. These collected data's are being tabulated in proper sequence to make it convenient for discussion & correlation with other parameters. The subjective assessment of received audio / video quality on TV receiver is graded as OK, F-Freeze & NT- Not Traceable.

The field strength measurement values along with subjective assessment at each & every spot / location are recorded in a tabular form giving at an instance the trend for variation in received Field strength, MER & signal reception quality with distance. In this report the received field strength & subjective assessment data collected along eight radials are tabulated accordingly in Table No.-1 to Table No.-8. On the basis of Table-1 to Table -8, a coverage contour for DVB-T2 transmission has been drawn & annexed as in Map-9.The code used for grading of the received signal is illustrated as follows.

Criteria for grading of received signal on the basis of subjective assessment:

Signal	OK	No impairment in received audio/video quality.
	FF	Received frame simultaneously appearing-disappearing leading to irritable reception.
	F	Received frame freeze permanently.
	NT	Not Traceable or No Signal.

Broadcast Service Area:

The objective of broadcasting is to provide quality reception free from interferences & noise in a commercial domestic receiver, either fixed or mobile, to as much of population and area of the country as possible, In case of analogue transmission coverage area of broadcasting is decided by the minimum required received 'field strength' at the farthest end of the coverage area for satisfactory reception with commercially available domestic receivers but in digital terrestrial transmission one more transmission parameter (MER) is required along with the minimum field strength value for prediction of the coverage area. Studied has been carried out worldwide to determine the minimum required field strength & MER value for satisfactory reception of DTT signal. Rec. ITU-R BT.2254 give minimum equivalent field strength at receiving location for satisfactory reception of DVB-T2 transmission are as illustrated in following table:

Mode of reception	Minimum Field Strength
Fixed Scenario	54 dBµV/m, (Location probability 95 %)
Portable / Outdoor / Urban	60.1dBµV/m, (Location probability 95 %)
Mobile / Rural	73.5 dBµV/m, (Location probability 99 %)

Interpretation of the collected data along radials:

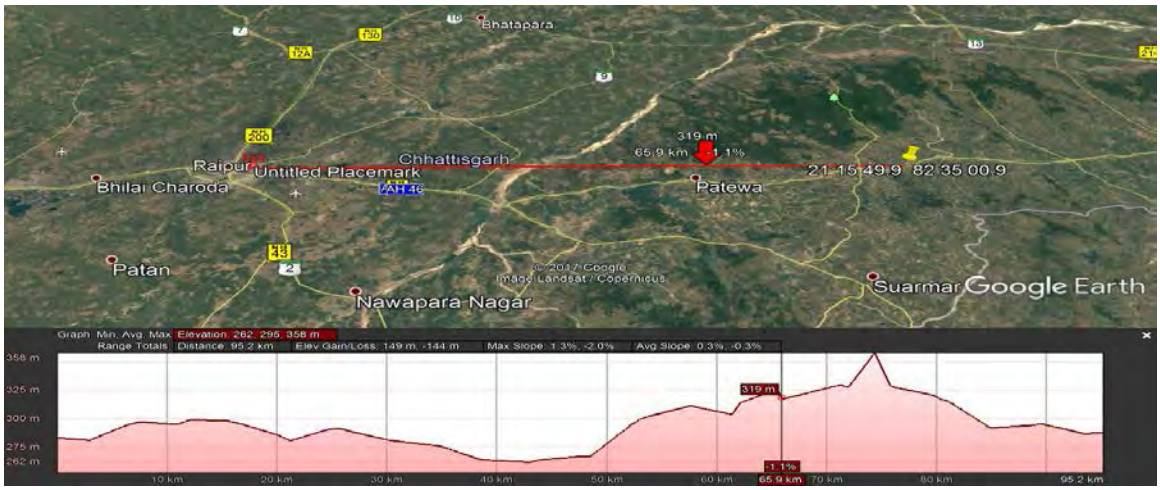
In this report, efforts are being made for the interpretation & analysis of the collected FSM data along a radial & then a coverage contour showing in Map-9 for satisfactory reception of DVB-T2 transmission was drawn on a map.

Map-1

NORTH (Map-1 & Table-1) :- Along this radial field strength measurement done at the location like Nimora, Kunra, Sakara, Simiga, Damakhera, Samariya, Nawagarh up to the distance of 74 km from the line of sight of Transmitter, the satisfactory reception was observed up to the distance of **41 km.** HT lines of 132 KV is installed on both the sides of main road. Effect of Faraday cage was also observed at few places.

Map-2

NORTH-EAST(Map-2 & Table-2) :- Along this radial field strength measurement done at the location like Vidhan sabha rd, Donde kala, Sara village, Kharora gaon, Bhaisa gaon, Kodawa, Palari, Amesh sakara, Chhviha, Raseda up to the distance of 75 km from the line of sight of Transmitter, the satisfactory reception was observed up to the distance of **50 km.**



Map-3

EAST(Map-3 & Table-3) :- Along this radial field strength measurement done at the location like NH-53 near Jora, Kumariya village, Arang, Birkoni, Pirda, Patewa, Banpachari, Jhalap, Dumparpali, Pithora, Raja savaya khurd, Vimalpur up to the distance of 95 km from the line of sight of Transmitter, the satisfactory reception was observed up to the distance of **66 km.**

Map-4

SOUTH EAST (Map-4 & Table-4):- Along this radial field strength measurement done at the location VIP Rd, Near airport, NIT Raipur campus, Sunder khera, Rajim, Village Tera, Baruka, Garia band, up to the distance of 84.5 km from the line of sight of Transmitter, the satisfactory reception on TV was observed

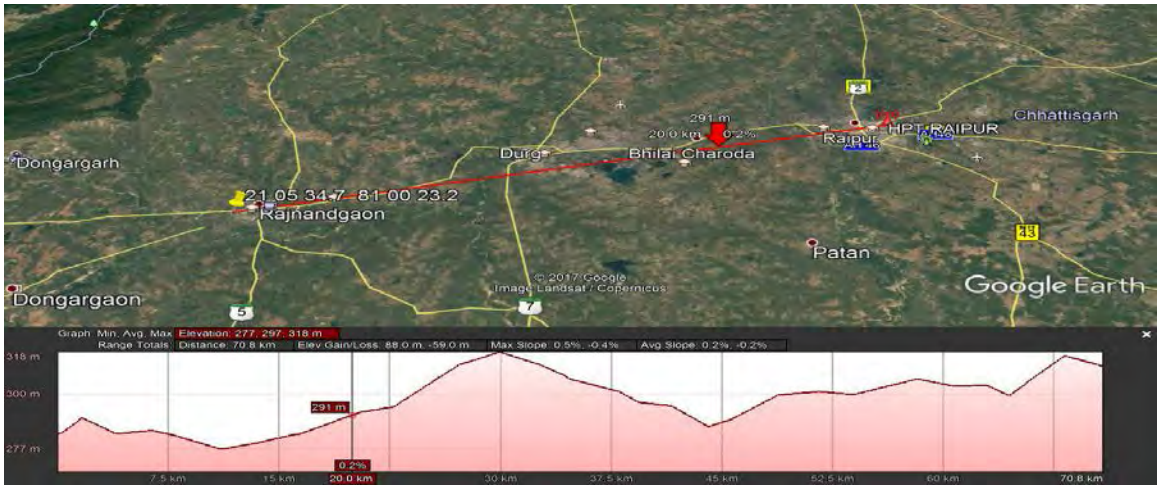
up to the distance of **60 km,** where as minimum required field strength was observed up to the LOS distance of **80 Km**.

Map-5

SOUTH (Map-5 & Table-6):- Along this radial, field strength measurement was done at the location Lal pur, IIT/IIM Raipur, Bada Khorpa, Kurud, Maroud, Sani chuaa, Dhaamtari, Rudree, Gangrel dam, Dhaamtari outer industrial area up to the distance of 67.5 km from the line of sight of Transmitter, the satisfactory reception was observed up to the distance of **20 km.** The field strength in this route does not follow standard distance versus f/S values due to the some unknown technical reasons. The same is required further study.

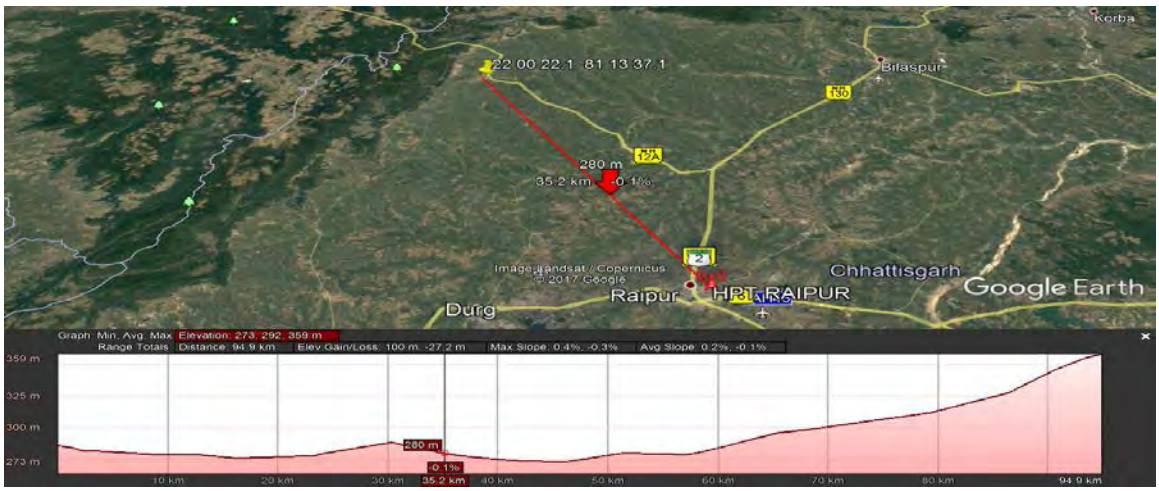
Map-6

SOUTH WEST(Map-6 & Table 6):- Along this radial field strength measurement done at the location Dudha dhari math, Amleshwar, Jaam gaon, Santara, Kumli, Fata gaon, Ruda village, Limora up to the distance of 55 km from the line of sight of Transmitter, the satisfactory reception was observed up to the distance of **20 km** only. The reason of low f/s is not known.



Map-7

WEST (Map-7 & Table-7): - Along this radial field strength measurement done at the location Rajkumar college, Tati bandh chowk, Charoda, Bhilai power house rly stn, Durg city bus stop, Anjora, Dewada, Somni, Mankee, Raipur naka, PTS Rajnand gaon up to the distance of 70 km from the line of sight of Transmitter, the satisfactory reception was observed up to the distance of **20 km.** Hillock of approximately 320 meters at the LOS distance of 30 Km may have the reason for low field strength. Moreover the entire area is surrounded by HT lines which are one of the reasons of manmade noise. One Steel plant and Power house is also situated in this area.



Map-8

NORTH WEST(Map-8 & Table-8):- Along this radial field strength measurement done at the location New Patharidih URLA, Pirda, Sakara, Sondh, Kodwa, Saja, Khelka, Khamariya, Rampur, Gochhiya, Bamvahni Village, Kawardha city up to the distance of 94 km from the line of sight of Transmitter, the satisfactory reception was observed only up to the distance of **30 km.** Long trees in the dense forest

reduces the f/s in UHF bands, and same is the explanation for low f/s at the LOS distance of 30 Km and more.

C**onclusion:**

On the basis of received field strength & MER values at the spot / location along eight radials & coverage contour (Map-9) drawn on the basis of table prepared / compiled for satisfactory reception of DVB-T2 transmission, following conclusions can be stipulated.

1. The coverage along North direction it is up to a radial distance of 41 km. In North-East & East directions coverage is up to 50 km & 66 km respectively. In South-East it is up to 80 km, in South it is up to 20 km. In South-West direction the coverage area is up to 20Km, West & North-West direction it is up to a radial distance of 20 km & 30 km respectively.

2. The coverage along South & East as well as North-East was the least compared to the other directions. The reason of very low field strength in South, South-West and West is not clear. Performance of transmitting antenna panel may be checked to ascertain the cause.

S.NO.	Radial direction	LOS Distance (KM)as per ITU standard
1	NORTH	41
2	NORTH-EAST	50
3	EAST	66
4	SOUTH-EAST	80
5	SOUTH	20
6	SOUTH-WEST	20
7	WEST	20
8	NORTH-WEST	30

Scope of further study:

The purpose of this field trial is to determine the coverage contours for satisfactory reception of DVB-T2 Transmission under existing environmental condition. A comprehensive field strength survey of the said transmitter for reception in portable devices like smart mobile phone in densely populated areas, narrow lanes etc. to assess poor pocket zone & inside different types of

building falling within the coverage contour & also reception on go inside moving vehicles is suggested for further propagation study under different environment conditions.

Acknowledgement:
The propagation studies presented in this document are carried out by the Propagation Lab of Research Department of All India Radio & Doordarshan, New Delhi. The field trial was successfully done with the sincere support & cooperation of the shift duty staff of HPT (TV) Transmitter, Raipur The survey team expresses deepest sense of gratitude to Mrs. Anuradha Agarwal, ADG (E) & Sh. S.Hyder, DDG (E) whose motivation, suggestion & cooperation at every step helped in the successful completion of the survey

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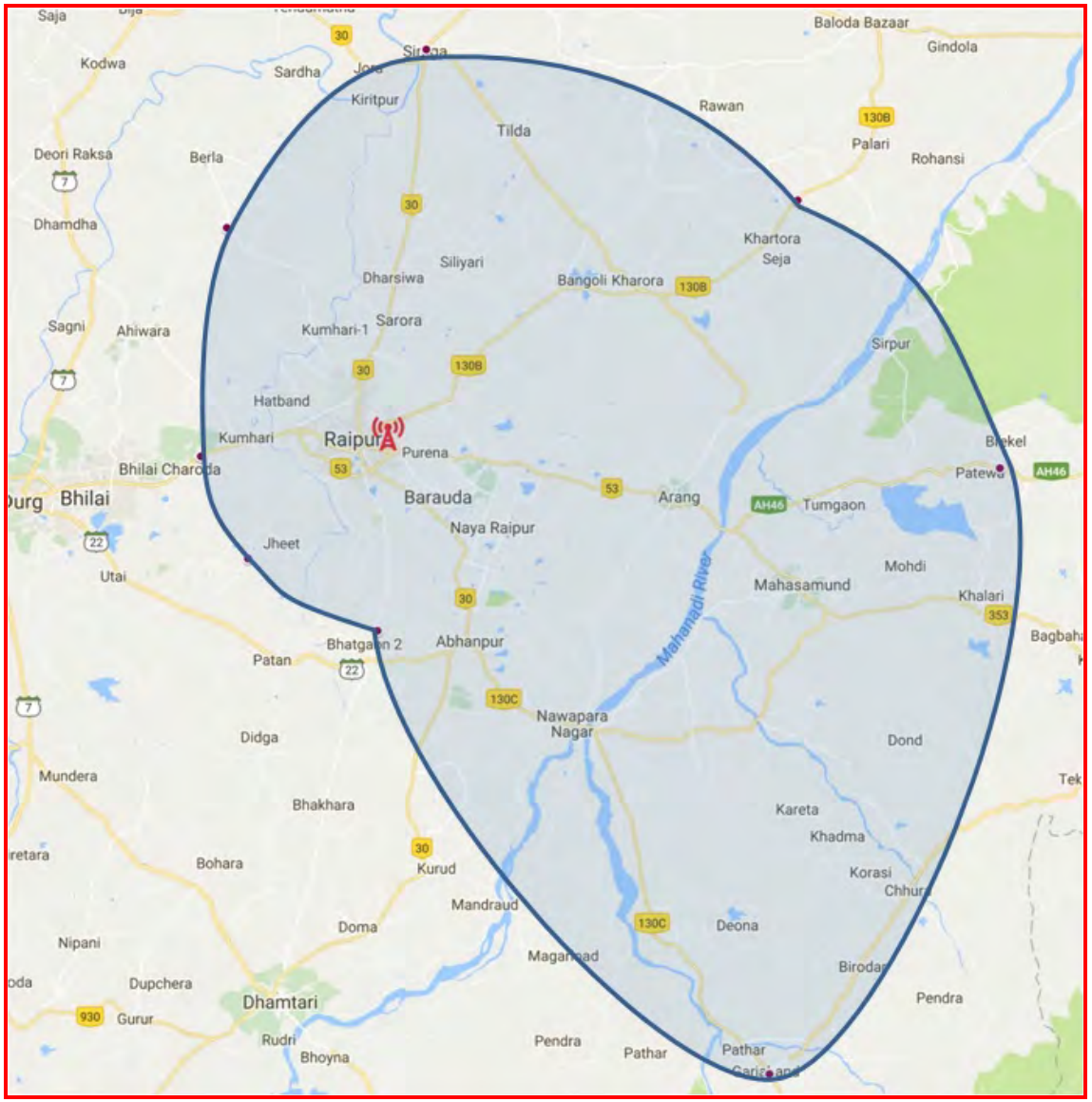
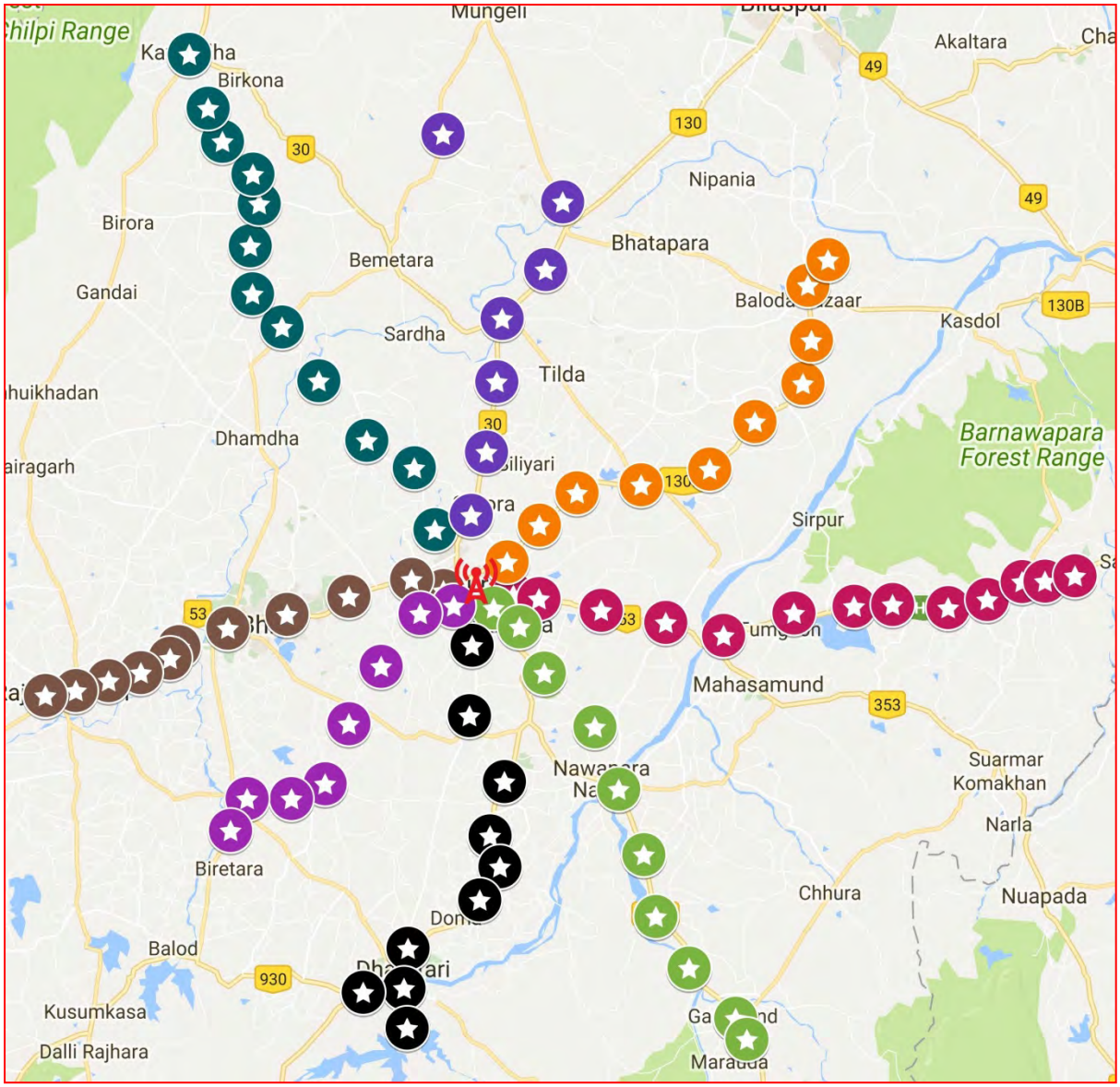
Coverage Map of DTT of DDK, Raipur

Map-9



Survey Location in Raipur

MAP-10



Reception Survey of DVB-T2 of DDK, HPT - RAIPUR

Channel no:- 23 **Frequency- 490 MHz** **Date:- 28/01/2017**

Direction:- North . **Table 1**

Route:- TV tower - Nimora 1 - Sakara - Simga - Damakhera - Nawagarh.

Time	Location	Location Co ordinate LAT / LONG	MSL (Mts)	Radial Distance (Km)	Field Strength (dBµV/m)	COFDM (IRD) Parameters 10mts			Subjective Assessment	Terrain	Remarks
						MER (dB)	BER (Pre)				
							LDPC	BCH			
1054	Nimora-1	21°21'01.4" 81°39'30.0"	285	10	72	26.7	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, HTL, IA	
1143	Kunra	21°26'25.2" 81°40'55.8"	277	20	65	28.1	1.0 E-6	1.0 E-8	TV OK Mob OK	HW, HT, HTL, IA	**Surrounded by HIGH TENSSION LINE**
1215	Sakara	21°32'26.1" 81°41'50.9"	277	31	60	28.7	1.0 E-6	1.0 E-8	TV OK Mob OK	HW, HT, HTL, IA	**Surrounded by HIGH TENSSION LINE**
1245	**Simiga**	**21°37'49.2" 81°42'22.5"**	**275**	**41**	**54**	**27.8**	**1.0 E-6**	**1.0 E-8**	**TV OK Mob NT**	**HW,HT, HTL, HRB**	
1332	Damakhera	21°41'59.5" 81°46'20.9"	273	50	50	26.2	1.0 E-6	1.0 E-8	TV OK Mob NT	HT,HW,VEG	
1403	Samariya	21°47'46.9" 81°47'55.6"	259	61	35	18.4	7.2 E-5	1.0 E-8	TV OK Mob NT	HTL, VEG, MT	Village area **HIGH TENSSION LINE**
1600	Nawagarh	21°53'34.9" 81°36'54.9"	277	74	31	7.2	5.8 E-4	1.0 E-8	TV Freeze Mob NT	HW(State), LT, VEG	Mungali Rd, HP pump
	Road diverted on the way from Samariya to Nawagarh by 32 Km due to an accident on that road .										

LEGENDS:- LT-low traffic LRB-low rising building MRB-medium rising building VEG-vegetation

HT-high traffic HRB-high rising building MT-medium traffic OA-open area

HDP-high Density population IA-industrial area HW-high way LWR-Low width road

HTL - High Tenssion Line

Reception Survey of DVB-T2 of DDK, HPT - RAIPUR

Channel no:- 23 **Frequency- 490 MHz** **Date:- 27/01/2017**

Direction:- North East . **Table 2**

Route:- TV tower - Vidhan sabha Rd - Sara - Bhoinsa gaon - Palari - Baloda bazar - Raseda.

Time	Location	Location Co ordinate LAT / LONG	MSL (Mts)	Radial Distance (Km)	Field Strength (dBµV/m)	COFDM (IRD) Parameters 10mts			Subjective Assessment	Terrain	Remarks
						MER (dB)	BER (Pre)				
							LDPC	BCH			
920	Vidhan sabha road	21°17'02.0" 81°42'49.5"	288	5	69.5	28.2	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, HTL,HRB,	Surrounded by HIGH TENSSION LINE
949	Donde kala high way Road	21°20'09.3" 81°45'47.7"	284	13	68.2	27.1	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, HTL,HRB,	Surrounded by HIGH TENSSION LINE
1139	Sara village	21°22'55.8" 81°49'15.2"	290	21	72	28.7	1.0 E-6	1.0 E-8	TV OK Mob OK	HW, OA,	ABC Public school
1211	Kharora gaon	21°23'37.5" 81°55'06.9"	309	30	70	28.2	1.0 E-6	1.0 E-8	TV OK Mob OK	HW,HT, HTL, MRB	Mob - OK 0n running Car
1251	Bhaisa gaon	21°24'58.1" 82°01'27.0"	290	41	49	27.3	1.0 E-6	1.0 E-8	TV OK Mob OK	HW, HT, HTL, MRB Low population	Mob - OK 0n outside of running Car
1310	**Kodawa**	**21°29'01.9" 82°05'36.1"**	**284**	**50**	**50**	**27.1**	**1.0 E-6**	**1.0 E-8**	**TV OK Mob OK**	**HW, HT, HTL, MRB Low population**	**Mob - OK 0n outside of running Car**
1346	Palari	21°32'16.8" 82°09'59.6"	277	60	34	12.1	1.6 E-3	1.0 E-8	TV OK Mob NT	HT, HDP, WH	
1413	Amesh sakara Baloda bazar	21°35'56.9" 82°10'46.2"	264	65	37	17	1.0 E-4	1.0 E-8	TV NT Mob NT	HT, HW, Med population	
1525	Chhviha	21°40'41.3" 82°10'27.3"	260	70	33	14.2	1.5 E-4	1.0 E-8	TV OK Mob NT	LT, OA, VEG Low population	
1550	Raseda	21°42'52.0" 82°12'18.0"	256	75	33	Nil	Nil	Nil	TV NT Mob NT	IA,LT, OA, VEG Low population	Cement factory

LEGENDS:-

LT-low traffic LRB-low rising building MRB-medium rising building VEG-vegetation

HT-high traffic HRB-high rising building MT-medium traffic OA-open area

HDP-high Density population IA-industrial area HW-high way LWR-Low width road

HTL - High Tenssion Line

Reception Survey of DVB-T2 of DDK, HPT - RAIPUR

Channel no:- 23 **Frequency- 490 MHz** **Date:- 25/01/2017**

Direction:- East . **Table 3**

Route:- TV tower - Jora - Arang - Pirda - Jhalap - Pithora- Vimal pur.

Time	Location	Location Co ordinate LAT / LONG	MSL (Mts)	Radial Distance (Km)	Field Strength (dBµV/m)	COFDM (IRD) Parameters 10mts			Subjective Assessment TV & Mob	Terrain	Remarks
						MER	BER (Pre)				
						(dB)	LDPC	BCH			
845	NH 53 near Jora	21°14'09.4" 81°43'23.4"	296	6	80	28	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, HW, HDP,HTL	Village area BOTH SIDE HIGH TENSSION LINE
855	NH 53 Monnatis Ispat energy Ltd	21°13'52.7" 81°45'45.3"	306	10	79	27.9	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, HW, HDP,HTL	**Surrounded by HIGH TENSSION LINE**
930	Kumariya village NH 53 Raipur Rd.	21°12'53.0" 81°51'29.1"	286	20	65	28.6	1.0 E-6	1.0 E-8	TV OK Mob OK	HDP, LRB, HT	Near M M College
1025	Arang	21°11'50.3" 81°57'23.2"	281	30	58	28.7	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, HW, HDP	Village area
1110	Birkoni	21°10'42.0" 82°02'42.7"	289	40	61	28.1	1.0 E-6	1.0 E-8	TV OK Mob OK	HW, HT, VEG	Village area
1130	Pirda NH 53	21°12'38.6" 82°09'11.3"	288	50	55	27.9	1.0 E-6	1.0 E-8	TV OK Mob Freeze	HW, HT, VEG	Village area
1150	Patewa NH 53	21°13'12.9" 82°14'41.7"	319	60	34	15.1	3.3 E-5	1.0 E-8	TV OK Mob NT	HT, HW, Forest & Hill area	Village area
1215	***Banpachari village NH 53***	***21°13'22.4" 82°18'13.5"***	***335***	***66***	***50***	***27.7***	***1.4 E-1***	***1.3 E-5***	***TV OK Mob Freeze***	***HT, HW, Forest & Hill area***	***Forest area***
1230	Jhalap NH	21°13'05.2" 82°23'21.6"	338	75	36	17.7	7.2 E-5	1.0 E-8	TV OK Mob NT	HT, HW, Forest & Hill area	Forest area
1300	Dumparpali NH	21°13'47.2" 82°26'57.4"	311	81	31	9.2	1.2 E-4	1.0 E-8	TV OK Mob NT	HT, HW, Forest & Hill area	Forest area
1330	Pithora NH	21°15'20.8" 82°30'08.1"	298	86.7	32	11.8	4.9 E-4	1.0 E-8	TV OK Mob NT	HW, HT, VEG	Forest area
1345	Raja savaya khurd	21°15'21.7" 82°32'14.5"	295	90	31	7.7	2.4 E-4	1.0 E-8	TV OK Mob NT	HW, HT, VEG	Village area
1400	Spos near NH 53 Vimal pur	21°15'49.9" 82°35'00.9"	289	95	31	Nil	Nil	Nil	TV NT Mob NT	HW, HT, VEG	Memra pass

LEGENDS:-

LT-low traffic LRB-low rising building MRB-medium rising building VEG-vegetation

HT-high traffic HRB-high rising building MT-medium traffic OA-open area

HDP-high Density population IA-industrial area HW-high way LWR-Low width road

HTL - High Tenssion Line

Reception Survey of DVB-T2 of DDK, HPT - RAIPUR

Channel no:- 23 **Frequency- 490 MHz** **Date:- 21/01/2017**

Direction:- South East .

Table 4

Route:- TV tower-VIP Rd- NIT Raipur-Sunder Kera-Rajim-Panduka-Baruka-Garia band.

Time	Location	Location Co ordinate LAT / LONG	MSL (Mts)	Radial Distance (Km)	Field Strength (dBµV/m)	COFDM (IRD) Parameters			Subjective Assessment	Terrain	Remarks
						MER	BER (Pre)				
						(dB)	LDPC	BCH	TV & Mob		
1350	VIP Road	21°13'04.8" 81°41'34.1"	301	5	82.4	27.6	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, HDP, VEG	Open area
1412	VIP Road before Air Port	21°11'26.7" 81°43'58.9"	311	10	82.1	27.8	1.0 E-6	1.0 E-8	TV OK Mob OK	HW, HT, VEG	Forest & Airport area
1445	NIT Raipur campus	21°07'29.6" 81°46'14.0"	325	20	72.4	26.3	1.0 E-6	1.0 E-8	TV OK Mob OK	Rural, OA, LT, VEG	Open area
1520	Sunder kera high school	21°02'53.6" 81°50'52.8"	297	30	75.2	28.5	1.0 E-6	1.0 E-8	TV OK Mob OK	Rural, OA, LT, VEG	Village area
1620	Rajim village Sai darbar mandir	20°57'32.0" 81°53'04.5"	289	40	60.4	22.4	1.0 E-6	1.0 E-8	TV OK Mob OK	Rural, LRB, LT, VEG	
1650	Village Terra	20°51'53.8" 81°55'21.8"	304	50	62.1	18.6	2.6 E-2	1.0 E-8	TV OK Mob Freeze	Rural, OA, LT, VEG	Village area
1745	Village Panduka NH 130C	20°46'36.5" 81°56'29.6"	322	60	61.3	24.6	1.0 E-6	1.0 E-8	TV OK Mob Freeze	Rural, OA, LT, VEG	Open area
1815	Village Baruka	20°42'09.9" 81°59'32.6"	327	70	58.2	11.1	Nil	Nil	TV NT Mob NT	Forest, LT, VEG	Forest area
1845	**Village Garia band**	**20°37'52.2" 82°03'48.8"**	**348**	**80**	**54.6**	**4.3**	**5.4 E-2**	**3.0 E-8**	**TV Freeze Mob NT**	**Forest, LT, VEG**	**Hill vally**
1900	Village Garia band outer	20°36'03.3" 82°04'51.4"	362	84.5	37.2	2.2	1.2 E-1	2.6 E-4	TV NT Mob NT	Forest, LT, VEG	Forest area

LEGENDS:-

LT-low traffic LRB-low rising building MRB-medium rising building VEG-vegetation

HT-high traffic HRB-high rising building MT-medium traffic OA-open area

HDP-high Density population IA-industrial area HW-high way LWR-LOW width road

HTL - High Tenssion Line

Reception Survey of DVB-T2 of DDK, HPT - RAIPUR

Channel no:- 23 **Frequency- 490 MHz** **Date:- 22/01/2017**

Direction:- South . **Table 5**

Route:- TV tower- Lalpur-Kurud- Dhamtari- Sondur Dam.

Time	Location	Location Co ordinate LAT / LONG	MSL (Mts)	Radial Distance (Km)	Field Strength (dBµV/m)	COFDM (IRD) Parameters 10mts			Subjective Assessment TV & Mob	Terrain	Remarks
						MER (dB)	BER (Pre)				
							LDPC	BCH			
915	Lal pur	21°12'34.8" 81°39'49.6"	299	5	83	26.8	1.0 E-6	1.0 E-8	TV OK Mob OK	HW, Low population VEG, OA	
1007	IIT/IIM Raipur campus	21°09'51.3" 81°39'35.2"	293	10	73	27.8	1.0 E-6	1.0 E-8	TV OK Mob OK	HW, Low population VEG, OA	
1036	**Bada khorpa**	**21°03'51.1" 81°39'20.2"**	**296**	**20**	**50**	**23.5**	**1.0 E-6**	**1.0 E-8**	**TV OK Mob OK**	**HW, Low population VEG, OA**	
1125	Kurud, Dhamantri Rd	20°58'11.2" 81°42'33.4"	316	31	35	15.1	5.2 E-4	1.0 E-8	TV OK Mob Freeze	HW, Low population VEG, OA	Village Birejhear
1200	Maroud	20°53'32.6" 81°41'14.4"	323	40	32	10.1	6.6 E-3	1.0 E-8	TV OK Mob Freeze	OA, LT, VEG	
1225	Main Rd Kurud Dhamtari Rd	20°50'52.1" 81°42'09.6"	322	45	35	15.6	1.9 E-4	1.0 E-8	TV OK Mob Freeze	HW, HT, VEG, Low population	
1255	Sani chuaa	20°48'01.6" 81°40'17.5"	224	50	31	0	5.5 E-2	1.0 E-8	TV NT Mob NT	HW, HT, VEG, No population	Suneelam fuel pump
1324	Dhaamtari outer area	20°43'50.7" 81°33'42.7"	325	59	35	16.1	8.9 E-5	1.0 E-8	TV OK Mob Freeze	MT, Med population	Outer city
1410	Rudree Satsang ashram	20°40'27.2" 81°33'19.1"	331	65	31	0.9	8.3 E-2	3.7 E-4	TV NT Mob NT	HT, HDP	
1445	Gangrel dam top	20°37'00.4" 81°33'37.7"	362	71.7	32	12	5.9 E-4	1.0 E-8	TV OK Mob Freeze	OA, VEG, WATER BODY	
1644	Dhaamtari outer Industrial area	20°40'05.2" 81°29'36.1"	338	67.5	31	0.3	1.2 E-1	1.0 E-5	TV NT Mob NT	Village, IA, MT	

LEGENDS:- LT-low traffic LRB-low rising building MRB-medium rising building VEG-vegetation

HT-high traffic HRB-high rising building MT-medium traffic OA-open area

HDP-high Density population IA-industrial area HW-high way LWR-Low width road

HTL - High Tenssion Line

Reception Survey of DVB-T2 of DDK, HPT - RAIPUR

Channel no:- 23 **Frequency- 490 MHz** **Date:- 24/01/2017**

Direction:- South West . **Table 6**

Route:- TV tower- Dudha dhari math- Santara- Fata gaon- Limora.

Time	Location	Location Co ordinate LAT / LONG	MSL (Mts)	Radial Distance (Km)	Field Strength (dBµV/m)	COFDM (IRD) Parameters 10mts			Subjective Assessment TV & Mob	Terrain	Remarks
						MER (dB)	BER (Pre)				
							LDPC	BCH			
947	Dudha dhari math Raipur	21°13'15.1" 81°37'53.7"	293	5	76	28.9	1.0 E-6	1.0 E-8	TV OK Mob OK	HDP, HT	
1015	Amleshwar	21°12'37.1" 81°34'49.5"	280	10	70	28.1	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, VEG Low population	Near Magar ghata
1045	**Jaam gaon**	**21°08'04.7" 81°31'13.7"**	**302**	**20**	**54**	**26.7**	**1.0 E-6**	**1.0 E-8**	**TV OK Mob OK**	**HT, VEG Low population**	
1130	Santara	21°03'09.5" 81°28'16.8"	309	30	46	25.6	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, VEG Low population	Village area
1215	Kumli	20°57'59.9" 81°26'04.7"	326	40	42	24.1	1.0 E-6	1.0 E-8	TV OK Mob OK	LT, VEG Low population	Near Jam gaon
1246	Fata gaon	20°56'44.3" 81°22'59.2"	331	45	32	Nil	6.2 E-6	4.0 E-4	TV NT Mob NT	LT, VEG Low population	Cannal side Village area
1330	Ruda village	20°56'44.3" 81°18'54.3"	318	50	Nil	Nil	Nil	Nil	TV NT Mob NT	LT, VEG Low population	Village area
1430	Limora	20°54'00.2" 81°17'23.4"	313	55	31	Nil	Nil	Nil	TV NT Mob NT	LT, VEG Low population	Village area

LEGENDS:- LT-low traffic LRB-low rising building MRB-medium rising building VEG-vegetation

HT-high traffic HRB-high rising building MT-medium traffic OA-open area

HDP-high Density population IA-industrial area HW-high way LWR-Low width road

HTL - High Tenssion Line

Reception Survey of DVB-T2 of DDK, HPT - RAIPUR

Channel no:- 23 **Frequency- 490 MHz** **Date:- 23/01/2017**

Direction:- West. **Table 7**

Route:- TV tower-Tati bandh chowk- Anjora- Somni- PTS Rajnand gaon.

Time	Location	Location Co ordinate LAT / LONG	MSL (Mts)	Radial Distance (Km)	Field Strength (dBµV/m)	COFDM (IRD) Parameters 10mts			Subjective Assessment TV & Mob	Terrain	Remarks
						MER (dB)	BER (Pre)				
							LDPC	BCH			
930	Rajkumar college	21°14'33.4" 81°36'57.2"	297	5	71.2	27.2	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, HDP, MRB,	**Surrounded by HIGH TENSSION LINE**
945	Tati bandh chowk	21°15'32.1" 81°34'02.5"	283	10	63	26.4	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, HDP, MRB,	
1022	**Charoda**	**21°14'03.6" 81°28'16.6"**	**303**	**20**	**57**	**27.3**	**1.0 E-6**	**1.0 E-8**	**TV OK Mob OK**	**LT, HDP, HW**	
1105	Bhilai power house Rly Stn	21°12'30.9" 81°22'35.7"	314	30	45	21.3	1.0 E-6	1.0 E-8	TV OK Mob NT	HW, HT, HDP,	Rly. Station area
1130	Rajnand gaon Durg city bus stop	21°11'21.1" 81°17'09.4"	302	41	32	Nil	Nil	Nil	TV NT Mob NT	HDP, HT, LRB	School ground
1234	Anjora (Durg)	21°09'46.2" 81°12'39.6"	295	46	32	1.8	1.0 E-6	1.0 E-8	TV OK Mob NT	LRB, MT, VEG	
1300	Dewada (Durg)	21°08'46.7" 81°11'51.0"	306	50	34	12.4	1.0 E-6	1.0 E-8	TV NT Mob NT	HW, HT, HDP, HRB	IOC Petrol Pump
1315	Somni (Durg)	21°07'31.8" 81°09'08.4"	312	55	37	19.1	1.0 E-6	1.0 E-8	TV OK **Mob Freeze**	HW, HT, VEG Low Population,	Oxygen plant
1345	Mankee (Rajnand gaon)	21°06'50.6" 81°06'10.7"	301	60	30	0	Nil	Nil	Nil	HW, HT, Low Population,	BP Petrol Pump
1400	Raipur naka (Rajnand gaon city)	21°05'59.6" 81°03'10.5"	308	65	33	1.2	1.0 E-6	1.0 E-8	TV OK Mob NT	HT, Medium population, MRB	City entry point
1458	PTS Rajnand gaon	21°05'34.7" 81°00'23.2"	315	70	32	Nil	Nil	Nil	Nil	HT, Medium pop population, HDP	

LEGENDS:- LT-low traffic LRB-low rising building MRB-medium rising building VEG-vegetation

HT-high traffic HRB-high rising building MT-medium traffic OA-open area

HDP-high Density population IA-industrial area HW-high way LWR-Low width road

HTL - High Tenssion Line

Annexure-01

Reception Survey of DVB-T2 of DDK, HPT - RAIPUR

Channel no:- 23 **Frequency- 490 MHz** **Date:- 26/01/2017**

Direction:- North West . **Table 8**

Route:- TV tower - URLA - Pirda - Kodwa - Saja - Khamariya - Kawardha city.

Time	Location	Location Co ordinate LAT / LONG	MSL (Mts)	Radial Distance (Km)	Field Strength (dBµV/m)	COFDM (IRD) Parameters 10mts			Subjective Assessment	Terrain	Remarks
						MER (dB)	BER (Pre)				
							LDPC	BCH			
935	New Patharidih URLA	21°19'46.8" 81°36'11.4"	274	10	68	27.4	1.0 E-6	1.0 E-8	TV OK Mob OK	HT, IA, HTL Low population	Surrounded by HIGH TENSSION LINE
1044	Pirda	21°25'03.8" 81°34'17.8"	281	20	70	28.3	1.0 E-6	1.0 E-8	TV OK Mob OK	Low population MT,VEG	Village area
1115	**Sakara (Bemetra)**	**21°27'25.3" 81°29'55.3"**	**296**	**30**	**68**	**28.1**	**1.0 E-6**	**1.0 E-8**	**TV OK Mob OK**	**MRB, MT, VEG**	**Village area**
1158	Sondh	21°32'29.6" 81°25'30.1"	284	40	48	25.7	1.0 E-6	1.0 E-8	TV OK Mob NT	HW(State), VEG,LT	Village area
1233	Kodwa	21°37'05.9" 81°22'06.8"	285	50	39	19.2	1.0 E-6	1.0 E-8	TV OK Mob NT	VEG, MT, LRB	Village area
1303	Saja	21°39'57.4" 81°19'26.0"	305	58.5	41	23.1	1.0 E-6	1.0 E-8	TV OK Mob NT	HDP, MRB, MT, VEG	School ground
1425	Khelka	21°44'01.9" 81°19'11.6"	296	63	35	17.2	3.3 E-5	1.0 E-8	TV OK Mob NT	MT, LRG, VEG	Village area
1448	Khamariya	21°47'39.1" 81°20'01.2"	301	68	32	0.3	1.4 E-1	1.3 E-5	TV NT Mob NT	HDP, MRB, MT,	
1530	Rampur	21°50'09.9" 81°19'27.1"	316	73	35	17.4	7.2 E-5	1.0 E-8	TV OK Mob NT	LT, LRB, VEG Med. Population	
1600	Gochhiya	21°52'57.1" 81°16'39.9"	324	80	35	10	1.2 E-4	1.0 E-8	TV OK Mob NT	LT, HDP, MRB	
1615	Bamvahni village	21°55'47.3" 81°15'20.0"	337	85	32	10.1	4.2 E-4	1.0 E-9	TV NT Mob NT	LT, HDP, MRB	
1630	Kawardha city	22°00'22.1" 81°13'37.1"	349	94	31	Nil	Nil	Nil	TV NT Mob NT	HDP, MRB, HT	

LEGENDS:- LT-low traffic LRB-low rising building MRB-medium rising building VEG-vegetation

HT-high traffic HRB-high rising building MT-medium traffic OA-open area

HDP-high Density population IA-industrial area HW-high way LWR-Low width road

HTL - High Tenssion Line