

*Reception Survey of 200kW
MW AM-DRM Transmitter at
Dharwad in Simulcast &
Pure DRM Modes*

***Reception Survey of
200kW MW AM-
DRM
Transmitter at
Dharwad in Simulcast
& Pure DRM Modes***

(Survey Period: 21/8/16 to 3/9/16)

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India's Public Service Broadcaster
O/o Additional Director General (R&D)
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Report No. RD/2016/922

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Basic Data and Transmitter details

Transmitters Details:

- | | | |
|---|---|---|
| 1. Name of Station | : | HPT(AIR), Dharwad |
| 2. Location of the Transmitters | : | LAT- 15.41387
LON- 75.04145
Ht. above MSL-722 Metre |
| 3. Description of terrain around the Transmitters | : | Urban with presence of vegetation |
| Traffic | | Moderate |
| 4. Classification(Large city/urban/rural) | : | Urban |
| 5. Rated power of the Transmitter | : | 200kW |
| 6. Make | : | Nautel |
| 7. Model No. | : | NX-200 |
| 8. Frequency of operation | : | 765 kHz |
| 9. Date of Commissioning | : | 19-9-2015 |
| | : | |

Transmitting Antenna Details:

- | | | |
|-------------------------|---|---------------------------------|
| 1. Type of Antenna | : | Vertical mast, Omni-directional |
| 2. Height of Tower | : | 115 Meter |
| 3. Type of Polarization | : | Vertical |

1. INTRODUCTION

Digital Radio Mondiale (DRM) is one of the worldwide digital radio standards accepted by the ITU. The DRM standard has configurations (modes) suitable for frequencies up to 30 MHz and additional modes (DRM+) for frequencies up to band III. In order to migrate from analog AM transmission to digital (DRM), simulcast technology will be used for suitable migration for a few years. Later, full DRM or DRM only transmission will be on air from the vast network of AIR radio transmitters spread across India.

2. OBJECTIVES

Director General, AIR has directed the Research Department to monitor the reception of the DRM signal originating from the medium-wave transmitter (200kW) of AIR-Dharwad for the purpose of obtaining coverage with the following configurations:

1. In Simulcast mode during normal transmission periods.
2. In pure DRM mode during night hours.
3. Survey to be done using professional as well as commercial receivers.

3. EQUIPMENTS USED

- Field strength meter and tripod make: Anritsu model MS2713E with Antenna (Loop) make: Schwarzbeck model FMZB 1513.
- Professional DRM receiver
Make: Fraunhofer
Model: DT700
- Garmin make Montana 650, GPS
- Avion commercial receiver
- Dell Studio laptop computer
- Su-Kam sine wave inverter (1400 VA)
- Philips commercial receiver
- DRM-PC radio, Make: WIN RADIO, Model:G313e
- Active Antenna, Schwarzbeck
- Passive 1 meter length antenna
- Tools- assorted
- Mobile set

4. METHODOLOGY

AIR's medium wave transmitter is situated near Dharwad (N 15.41387 E 75.04145). The antenna is a self-supported radiating mast. The transmitter is new with R.F. analog power of 200kW. It is capable of radiating Simulcast as well as pure DRM signals. In Simulcast mode, DRM power can be set @12dB, 14dB and 16dB less of full analog power.

The geographical location of Dharwad is very central in the state of Karnataka, and suitable radials in seven different directions were clearly identified for the purpose of survey.

For full DRM reception route South-West on Dharwad Bangalore road has been selected. For Simulcast transmission, AIR-Directorate has set parameters for Dharwad as follows:

DRM frequency	(Fc+9) kHz i.e., 774 Khz
Mode	A
MSC	16 QAM
SDC	4 QAM

One commercial vehicle has been equipped with all relevant equipments with one passive antenna of one meter length installed on rooftop of the vehicle.

5. DATA ANALYSIS (SIMULCAST)

A. North-East Direction (Table-1)(map-1)

The survey started with the GPS marking of the active radiating tower of HPT Dharwad. Initially we took measurements at an interval of 10 kilometers (L.O.S.) and increased it up to 20 kilometers as per requirements. The land soil in this direction is very fertile and possesses high water content. As such, we expected a longer range in this direction. For obtaining MER value of the received signal, a professional receiver, DT 700, was used. The same receiver was also used for checking the audio quality and other related parameters. One commercial DRM radio manufactured by AVION was also used for checking the audio quality of the digital signals.

As per the ITU guidelines, magnetic loop antenna is preferred over active Rod antenna for the purpose of obtaining field strength. Accordingly, Shwarzbeck's magnetic loop antenna was used to measure the correct field strength of the analogue signal. Two commercial portable radios were also used to check the analogue audio quality of the AM transmission. At each survey location, the corresponding GPS data was also saved for obtaining the LOS distance from the Antenna of the concerned transmitter.



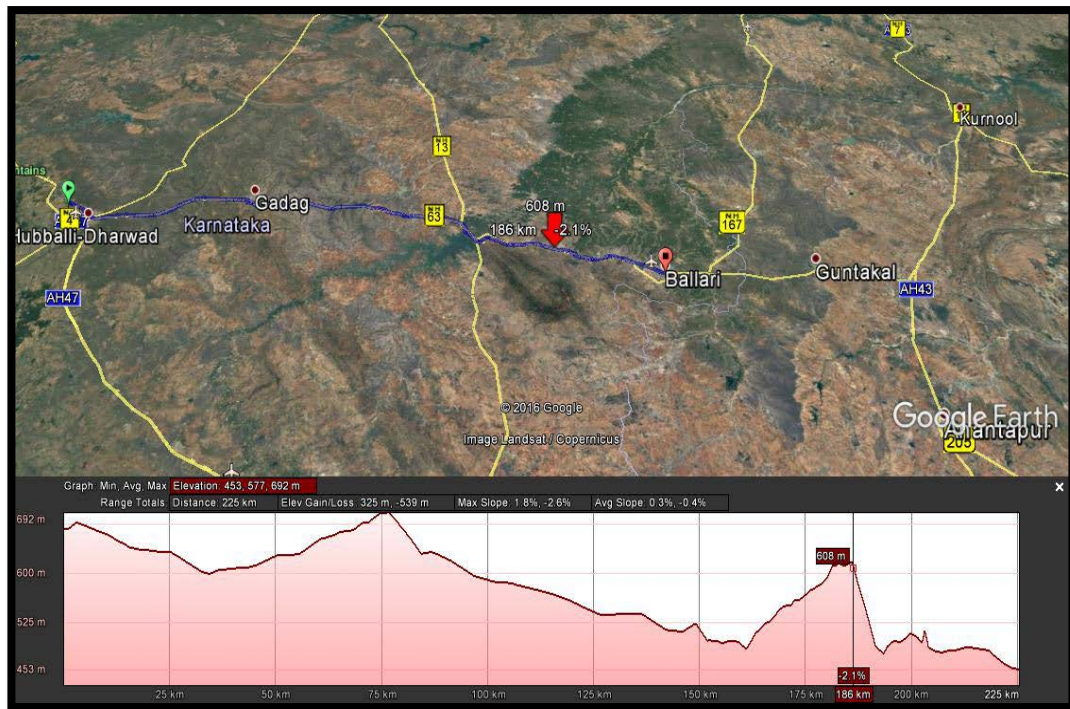
Map-1

The terrain profile (Map-1) clearly suggests a downward slope from Dharwad to Sholapur (Maharashtra), therefore, a sudden loss of field strength was not expected. Similarly, shadow zones were also not expected in this route.

Professional receiver DT700 worked very well in Simulcast mode and decoded the audio(Digital) of the DRM signal on 774 kHz frequency faithfully without audio drops up a distance of **160 Km**. The minimum signal requirement for Analog Medium Wave is 63 db μ V/ m as per the ITU recommendations. In this route the minimum signal level was observed in Vijayapura and Sholapur at an aerial distance of around **240 Km**. The analogue audio reception on Sony's portable receiver was fair whereas on commercial Philips small portable receiver, it was noisy at an aerial distance of 240 Km. At some locations it received good reception.

B. East Direction (Table-2)(Map-2)

This survey route goes up to Bellary via the historical city of Hampi. The total route length was approximately 190 Km. Soil conductivity was less as compared to the North-East route which can be attributed to the presence of mining areas in between the route. The terrain profile in that route is very different as compared to the earlier one. At a road distance of 184 km, a steep slope was present which emerged at a height of 612 metre MSL and ended at 497 metre MSL. The corresponding aerial distance from the transmitter was 150-160 Km. Normally, the DRM transmission degrades too much as compared to the analogue transmission in that situation. But the same could not be verified at that point as the DRM signal died out.



Map-2

The DRM signal received without any significant loss of audio packets was limited up to a range of **140 Km**, with the exception at Koppal town (Aerial distance from TX – 120Km). At that location, it may be due to the increased level of manmade noise. Similarly, the Analogue audio was received up to an aerial distance of approximately **180 Km**. It may be more but was not verified due to the sunset condition and the addition of Sky wave component with ground waves.

C. South-East (Table-3 & Map III)

This route proceeds up to Bangalore via the Mumbai-Chennai National Highway. The vehicular traffic was very high in that route. The terrain profile (Map-3) is very normal up to an aerial distance of 250 km. Up to an aerial distance of **120 Km**, the digital audio (DRM) was received in a good condition. With a few breaks in the audio, it worked up to an aerial distance of 170 km.

At Davengere town, located 141 km (Aerial distance) away from Transmitter site at Dharwad, the reception of DRM stopped completely. It was due to the presence of one hillock near highway. Similarly, for the Analogue signal of AIR Dharwad, the 63 db μ V/ m point was at a L.O.S distance of **220 Km**. At this point the subjective quality of the audio received on Sony's portable Radio was good, whereas the reception quality on portable commercial Radio (Philips) was fair. It is worth mentioning here that all the subjective assessments on DT 700 professional Digital receiver were observed using a one meter passive antenna, which was installed on the roof top of the survey vehicle.

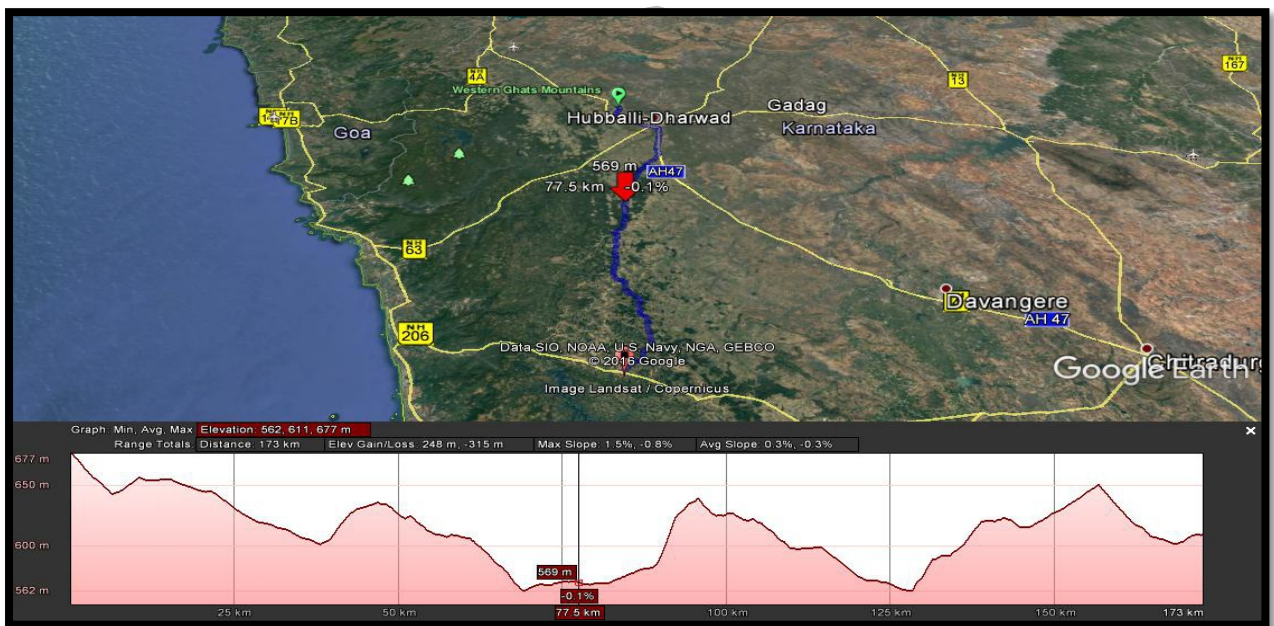


Map-III

It was a general observation that DT 700 decodes digital signal up to a MER of 12 db. Below this level, a few to large drops in audio were observed.

D. South (Table-4 & Map IV)

The South survey route goes up to the town of Sagar in Karnataka. Dense jungle with tall trees formed the highlights of that route.

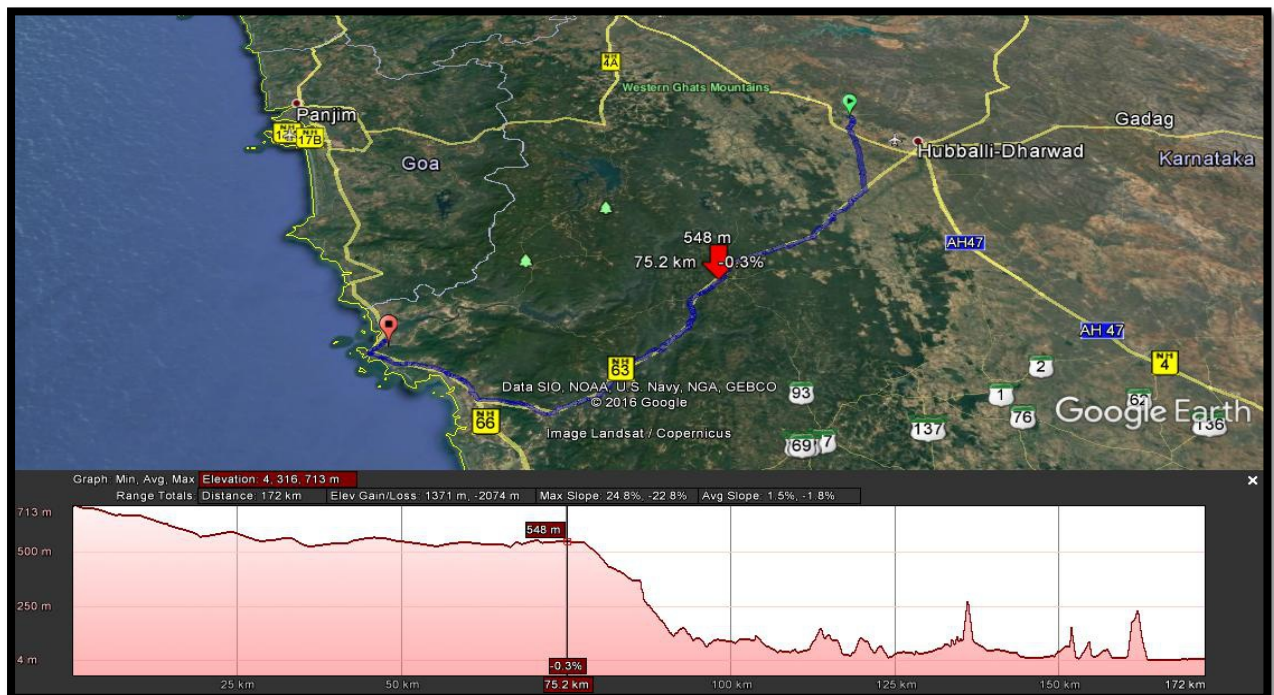


MAP-IV

Further terrain profile (Map-IV) clearly indicates the height above MSL of the ground fluctuating by more than 100 metres at several places. Multipath environment is not suitable for DRM signals. In addition to creating multipath, tall trees attenuate the RF signal up to a considerable level. The field survey in this route, clearly confirm these statements. The digital signal using DRM technology worked only up to an aerial distance of **70 Km**. Similarly, the Analogue audio was good up only up to a distance of **130 km**. The field strength of $63 \text{ dB}\mu\text{V}/\text{m}$ was at a distance of **130 Km** only. The good quality of the analogue audio at those points having low field strength on Sony's portable receiver was due to the very low manmade noise in those areas.

E. South-West (Table-V)(Map-V)

In this route lies the Western Ghats, famous for its dense jungle and cliff-like terrain. The height above MSL drops to 500 meters within a distance of 20 Km. The terrains like these can create problems for ground wave signals.

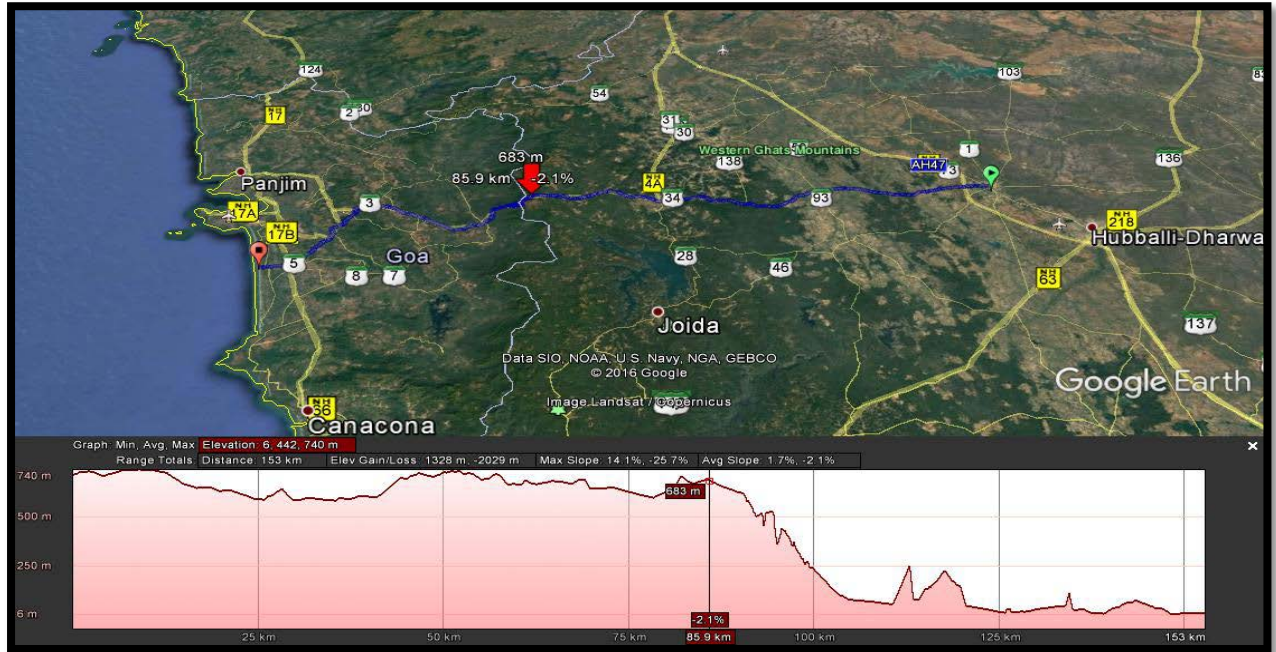


Map-V

Field strength drops rapidly in those types of terrain. The presence of dense jungles, possessing long trees also attenuate the RF signal rapidly. The DRM reception stopped fully at an aerial distance of just **45 Km**. The minimum field strength of $63 \text{ dB}\mu\text{V}/\text{m}$ was observed at an aerial distance of **126 km**. In between there was a long stretch of Jungle area where field strength was less than $63 \text{ dB}\mu\text{V}/\text{m}$. The analogue field strength again rises to $60\text{--}63 \text{ dB}\mu\text{V}/\text{m}$ at an aerial distance of 126 Km near the sea side town of Gokarna. With respect to Sony's portable receiver and Philips' portable commercial receiver, the analogue audio reception was fair and poor respectively.

F. West Direction (Table-VI) (Map-VI)

This route goes to Goa via the Western Ghats. Similar to the earlier one, the ground waves of the MW transmitter suffer in terms of field strength.



Map-VI

The DRM signal is received without breaks only up to a distance of **60 Km**. The dense jungle attenuates as well as creates multipath situation for digital signals. The severe multipath under the given mode cannot produce sufficient numbers of audio frames and therefore, no audio at all was received in that situation. The analogue field strength of 63 $\text{db}\mu\text{V}/\text{m}$ was received at an aerial distance of **122 Km**. The quality of the analogue signal was good for both the portable receivers.

G. North-West (Table-VII & Map-VII) Dharwad-Pune Highway.

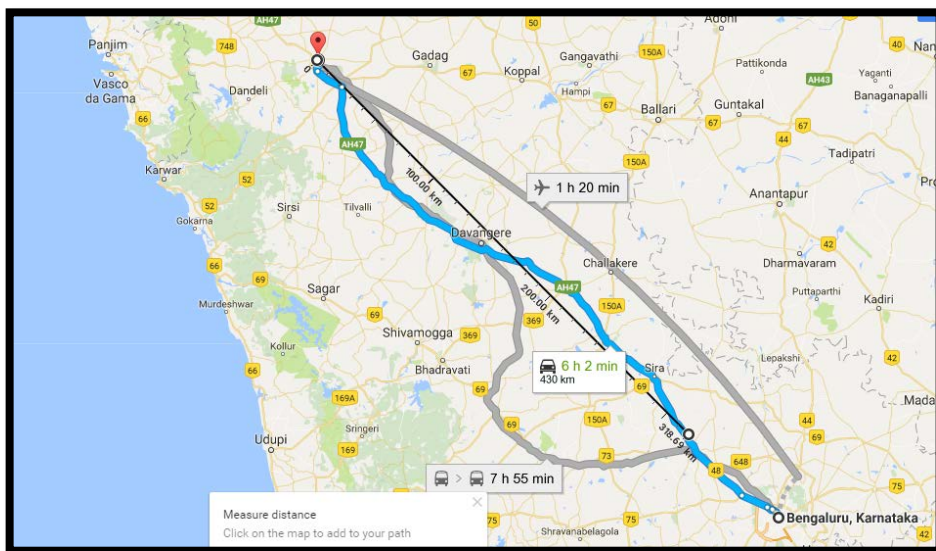
This was one of the busiest routes in terms of vehicular traffic. There exists a cliff-like terrain between Dharwad and Karad, similar to that in the Western Ghats but without any jungle. The entire stretch is present with agricultural land. Such lands are very good conductors for MF waves. The DRM signal was available up to a LOS distance of **150 Km**. Similarly, the minimum signal for a satisfactory reception of analogue transmission in medium wave band, i.e. 63 $\text{db}\mu\text{V}/\text{m}$, was present at a LOS distance of **226 Km** (Karad city). The subjective quality at that point was good in Sony's portable receiver. In Philips' portable Radio, there existed a fair reception.



Map-VII

Full DRM (80 KW) Transmission (Map-VIII)

In order to check the coverage as well as quality of the full DRM transmission mode i.e., without any analogue signal, a survey was conducted on Dharwad to Bangalore route, from midnight to dawn of the next day. The quality of the received audio was excellent up to 220 km LOS distance with the MER fluctuating between 32 to 28 db. Due to the presence of hillocks, the MER value dropped to 1-2 db. It can be attributed to out of range Doppler or echo values. Later, DRM started working in an excellent manner up to an aerial distance of **300 Km**. We could not proceed further due to the small pause period as the regular transmission was about to commence in the morning. We received excellent quality of audio on the DRM receiver at a field strength value of 50 dB μ V/ m.



Map-VIII

6. Conclusion

Coverage by Analogue & DRM Signal in Simulcast mode (16 db ↓)(Map-VIII)

Direction from Tx Dharwad	LOS Distance from Tx	
	Analogue 63db μ V/ m	DRM Excellent Audio on DT 700 Professional Receiver
North–East(Dharwad-Naval Gund-Bijapur-Sholapur)	240 Km	160 Km
East (Dharwad-Gadag-Koppal- Hampi-Bellari)	180 Km	140 Km
South-East (Dharwad-Haveri- Davangere-Bangalore)	220 Km	120 Km
South (Dharwad-Hubbali-Sirsi- Soraba-Sagar)	130 Km	70 Km
South-West (Dharwad-Yellapur- Karwar-Gokarna)	126 Km	45 Km
West (Dharwad-Honnapur- Ramnagar-Panjim-Colva)	122 Km	60 Km
North-West (Dharwad-Belgavi- Kolhapur-Karad)	226 Km	150 Km

Coverage in Pure DRM mode

The 200 KW AM-DRM transmitter of AIR Dharwad was operated in pure DRM mode with a power of 80 KW to assess the coverage in any direction. Dharwad to Bangalore route was selected for this purpose as the terrain is normal with respect to soil conditions. The DRM reception was very good up to a LOS distance of 300 Km, with a field strength value of 50 db μ V/ m. It could be more, but due to the small pause period, the same could not be checked.

R.F. POWER AT 1 KILOMETRE

Ten locations, having a LOS distance of 1 Km from the radiating mast, were selected to ascertain the radiation pattern and the power of the transmitter. The field strength was lowest in the south direction. The difference was in the range of 10 db with respect to the North direction (Table-VIII).

Acknowledgement

Completing this rigorous report would not have been possible without the support and the help extended by our colleagues.

We would like to thank the officials of the transmitter design section at the AIR Directorate in Delhi.

We are also grateful to the Office of the ADG(E), South Zone, Chennai for providing logistical support to our team.

We would also like to thank the Engineering Head of AIR Dharwad for extending his help during the survey period.

Furthermore, we would like the following officials of AIR Dharwad:-

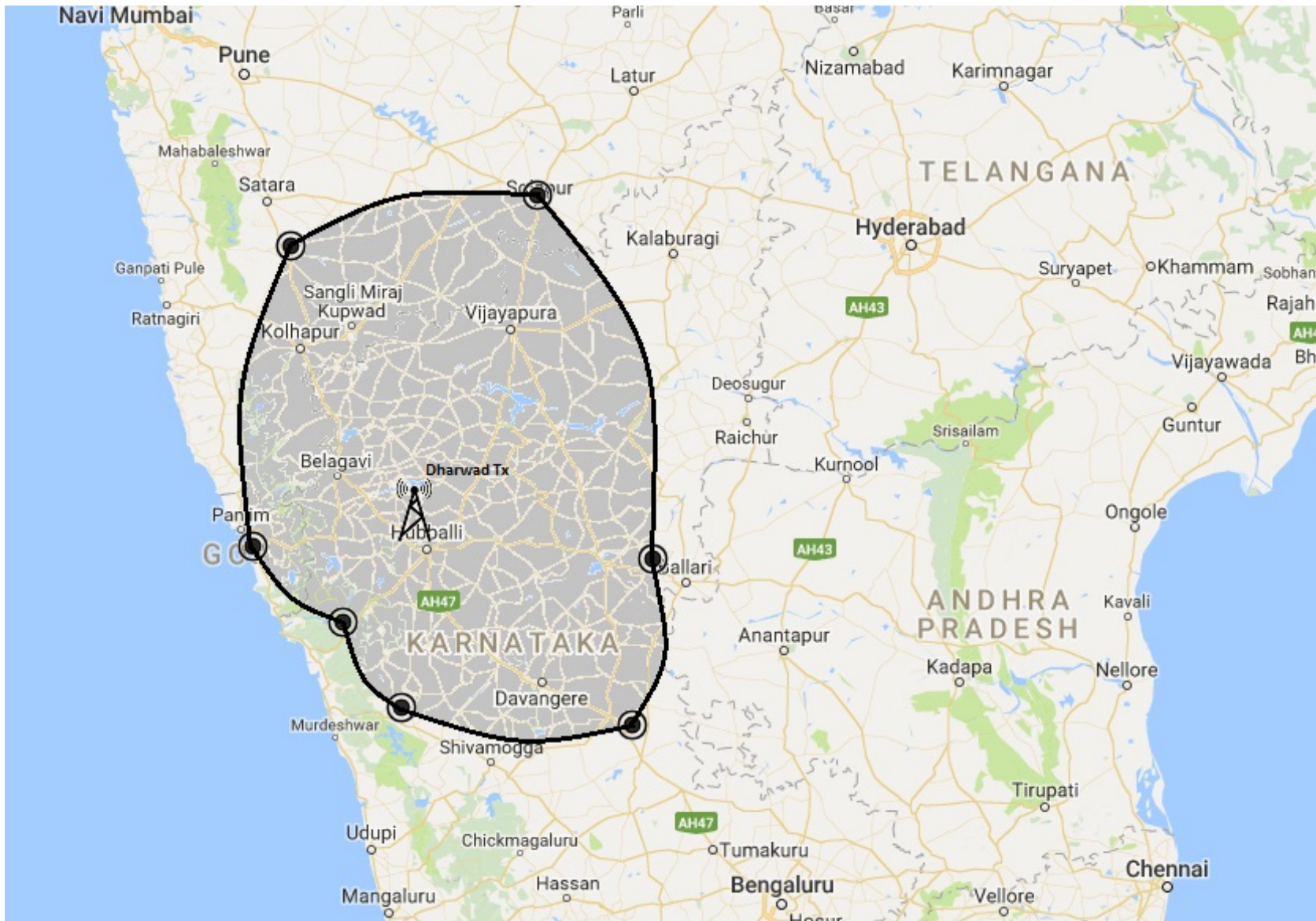
1. Sh. Sharatchandra Mohan Nair, AE
2. Sh. Umesh F. Talawai, EA
3. Sh. B.F. Hanumannavar, EA
4. Sh. Abdul Kareem Budihal, Technician
5. Sh. A. Renjith Kumar, EA
6. Sh. M. Muralidhar, EA
7. Sh. S.K. Kulkarni, EA

Moreover, we would like to extend our gratitude to Sh. B.S. Natesh Raman, EA for providing invaluable technical support, suggestions and moral guidance during the completion of the survey.

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Analog coverage Map of 200kW AM-Dharwad Transmitter in Simulcast mode
DRM Power 16 db down

Map-VIII



Reception Survey of 200kW AIR (MW), DRM Transmitter (Dharwad) in Simulcast transmission mode (16db↓)
Route: Dharwad-Vijaypur Direction: North -East Date:-31/8/16

Sr. No	Time	Spot/Location	Radial Distanc (km)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
				Analog 765 Khz	Digital 774 Khz	DT-700 Professional	Avion Commercial	DT 700 Digital	Avion Digital	Sony Analogue	Philips Analogue		
1	1110	Dharwad City	5	111	104	25	20	Excellent	Excellent	Excellent	Excellent	LRB/MT	
2	1150	Naval Gund	20	106	97	30	30	--do--	--do--	--do--	--do--	OA/LT	
3	1240	Hubli Vijaypur Rd	40	101	94	33	19	--do--	--do--	--VG--	--VG--	OA/LT/Veg	
4	1300	Nargund city	50	97	87	22	18	--do--	--do--	--VG--	--VG--	LRB/Town	
5	1340	Hubli Vijaypur Rd	60	95	86	25	17	--do--	Drops	--VG--	--VG--	Veg/NHW/MT	
6	1400	---do---	80	---	---	--	0-6	--do--	NT	--VG--	--VG--	--do--	Light Rain.
7	1450	---do---	90	84	71	21	0	--do--	NT	--VG--	--VG--	NHW/LT/Veg	
8	1510	Highway near Bagalkot	100	85	75	19	0	--do--	NT	--VG--	-Good-	NHW/LT/Veg	
9	1550	Hubli Vijaypur Rd	130	83	73	16	0	--do--	NT	--VG--	-Good-	NHW/LT/Veg	
10	1630	Near Vijyapura	160	79	71	12	0	Excellent	NT	--Fair--	--Poor--	OA/NHW/LT	In between vegetation. SNR: 11-12 db
11	1830	Vijayapura-Solapur Road	200	71	63	7	0	NT	NT	--Fair--	--Poor--	NHW/MT/Veg	Audio Breaks on DT700 Started at 175 Km
12	1910	---do---	223	69	61	0	0	NT	NT	--Fair--	--Poor--	NHW/MT/Veg	
13	1945	---do---	240	65	58	0	0	NT	NT	--Fair--	--Poor--	NHW/MT/Veg	
14	2020	Solapur	260	60	55	0	0	NT	NT	--Good--	--Fair--	City/LRB/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.

Reception Survey of 200kW AIR (MW), **DRM Transmitter (Dharwad)** in Simulcast transmission mode (16db↓)
Route: Dharwad-Bellary Direction: **East** Date:-28/8/16

Sr. No	Time	Spot/Location	Radial Distanc (km)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
				Analog 765 Khz	Digital 774 Khz	DT-700 Professional	Avion Commercial	DT 700 Digital	Avion Digital	Sony Analogue	Philips Analogue		
1	1030	Amargole-Ammin Bhavi Road	5	116	108	34	21	Excellent	With breaks	Excellent	Excellent	OA/LT/Veg	Avion radio did not Work due to the some
2	1100	2.5 Km before Shivahalli	10	114	106	33	3	--do--	--NT--	--do--	--do--	OA/LT/Veg	Settings in DRM at Tx end.
3	1120	Hebsur Road	15	106	97	35	0-11	--do--	--NT--	--do--	--VG--	OA/LT/Veg	
4	1140	Hebsur	28.4	105	97	17	0	--do--	--NT--	--VG--	--VG--	LRB/Village	
5	1220	Before Annigeri	40	102	93	37	17	--do--	Good	--VG--	--VG--	OA/Highway/LT	
6	1250	Before Gadag	50	101	93	16	3	--do--	NT	--VG--	--VG--	--do--	
7	1310	Gadag Town	62	97	89	23	0	--do--	NT	--VG--	--VG--	NHW/HT/Veg	
8	1420	NHW	80	94	86	24	0	--do--	NT	--VG--	-Good-	NHW/LT/OA	
9	1445	National high Way	100	91	81	15	0	--do--	NT	--VG--	-Good-	NHW/LT/Veg	Occasional breaks in DT 700 Audio.
10	1515	Koppal	120	88	81	15	0	Excellent	NT	--VG--	--Good-	HT/Mkt/Town	
11	1530	Koppal Town, Res	-do-	-	-	10	0	NT	NT	--VG--	-Good-	Residential area	
12	1545	Ginigera	130	68	51	12	0	Excellent	NT	--VG--	--Good-	OA/LT/Veg	
13	1605	Highway	140	--	--	13	0	Excellent	NT	--VG--	-Good-	NHW/HT/OA	
14	1620	Hosapete	144	81	73	7	0	NT	NT	--Good--	-Good-	City/LRB/MT/Veg	

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.

Reception Survey of 200kW AIR (MW), **DRM Transmitter (Dharwad)** in Simulcast transmission mode (16db↓)
Route: Dharwad-Bellary Direction: **East** Date: -28/8/16

Sr. No	Time	Spot/Location	Radial Distance (km)	Field Strength (dB μ V/m)		MER (dB)		Subjective Quality				Terrain	Remark
				Analog 765 Khz	Digital 774 Khz	DT-700 Professional	Avion Commercial	DT 700 Digital	Avion Digital	Sony Analogue	Philips Analogue		
15	1645	Mallapanna Guddi	150	82	73	8	0	NT	NT	-Very Good	Good	MKT/LT/LRB	
16	1730	Hampi	153	74	66	6	0	--do--	NT	Fair	Poor	LT/HRB/Ruins	
17	1805	Highway	160	75	67	0	0	--do--	NT	Good	Good	MT/NHW/OA	
18	1830	---do---	180	69	60	0	0	NT	NT	Good	Good	HT/OA/	
19	1915	Before Ballari	190	76	65	0	0	NT	NT	Fair	Poor	--do--	Sky wave addition.

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.

Table No.III (1)

Reception Survey of 200kW AIR (MW), DRM Transmitter (Dharwad) in Simulcast transmission mode (16db↓)
Route: Dharwad-Bangaluru Direction: South-East Date:-30/8/16

Sr. No	Time	Spot/Location	Radial Distanc (km)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
				Analog 765 Khz	Digital 774 Khz	DT-700 Professional	Avion Commercial	DT 700 Digital	Avion Digital	Sony Analogue	Philips Analogue		
1	950	Amargol Village Hubbali	5	118	110	28	24	Excellent	Excellent	Excellent	Excellent	LRB/MKT/Residential	
2	1010	Vidya Nagar, Hubbali	10	110	102	30	18	Excellent	V Good with Breaks	Excellent	Excellent	Resi/Highway/HRB	
3	1035	Hubbali	15	111	102	27	24	Excellent	Few Breaks	Excellent	Excellent	Resi/LRB/LT	
4	1055	NHW Bengaluru	20	105	97	27	18	Excellent	Excellent	Excellent	Excellent	Veg/NHW	
5	1105	---do----	30	103	94	27	18	Excellent	Excellent	Excellent	Excellent	NHW/OA/HT	
6	1120	---do---	40	102	94	26	19	Excellent	Excellent	Excellent	Excellent	-----do-----	
7	1140	Moula Ali Nagar	50	91	84	13	15	Excellent	Ex/ Breaks	Excellent	V Good	-----do-----	Does not work near Vehicle
8		NHW	60	--	--	24	13	Excellent	Breaks	Excellent	V Good	-----do-----	
9	1230	---do----	70	93	83	21	13	Excellent	Breaks/NT	Excellent	V Good	OA/HT/NHW	Orientation effect on Avion DRM Radio
10	1250	Haveri Town	80	88	80	17	13	Excellent	Breaks/NT	Excellent	V. Good	MKT/HT/HDP	Orientation effect on Avion DRM Radio
11	1320	NHW	102	83	72	17	7-10	Excellent	Breaks/NT	Excellent	V.Good	OA/NHW/HT	----do----
12	1345	----do-----	120	84	75	17	10	Excellent Few breaks	Breaks/NT	Excellent	Excellent	NHW/HT/OA	
13	1420	----do----	140	80	70	16	4-8	Ok/Breaks Few	NT	V Good	V Good	----do----	
14	1450	Davangere	141	87	77	0	0	NT	NT	V Good	Good	MKT/LRB/MT/HDP	Due to Hillocks

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.

Table No. III (2)

Reception Survey of 200kW AIR (MW), DRM Transmitter (Dharwad) in Simulcast transmission mode (16db↓)
 Route: Dharwad-Bangaluru Direction: South-East Date:-30/8/16

Sr. No	Time	Spot/Location	Radial Distanc (km)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
				Analog 765 Khz	Digital 774 Khz	DT-700 Professional	Avion Commercial	DT 700 Digital	Avion Digital	Sony Analogue	Philips Analogue		
15	1630	Bengaluru Highway	170	78	71	12	0	Excellent	NT	Good	Fair	OA/HT/NHW	DT 700 DRM Radio Worked up to 180 Km.
16	1810	NHW	220	62	53	0	0	NT	NT	Good	Fair	-----do-----	
17	1830	NHW	200	62	54	0	0	NT	NT	Good	Fair	-----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.

Table No.IV

Reception Survey of 200kW AIR (MW), DRM Transmitter (Dharwad) in Simulcast transmission mode (16db↓)
Route: Dharwad-Sagar Direction: South

Date:-29/8/16

Sr. No	Time	Spot/Location	Radial Distanc (km)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
				Analog 765 Khz	Digital 774 Khz	DT-700 Professional	Avion Commercial	DT 700 Digital	Avion Digital	Sony Analogue	Philips Analogue		
1	0910	Amargol Village Hubbali	5	113	109	32	18	Excellent	Excellent	Excellent	Excellent	HT/NHW/OA	
2	0945	Challamatti	15	107	97	32	18	Excellent	Excellent	Excellent	Excellent	NHW/OA & Veg	
3	1030	Kalghatgi-Mundgod Road	30	96	88	27	24	Excellent	Few Breaks	Excellent	Excellent	Resi/LRB/LT	
4	1120	---do---	50	91	83	16	----	Excellent	Regular breaks	Excellent	Excellent	LT/Veg/Road side	
5	1200	Hubli-Sirsi Road	70	83	75	11	----	With Breaks	---NT---	Excellent	V good	Heavy veg/LT/jungle	
6	-----	---do---	75	----	-----	---	-----	NT	Excellent	Excellent	V Good	-----do-----	
7	1230	Dasanakoppa Banavasi Road	80	73	65	----	-----	--NT--	--NT--	V Good	Good	OA/Low veg/LT	
8	1250	----do-----	90	67	60	-----	-----	--NT--	--NT--	V Good	Good	OA/LT/Paddy fields	
9	1310	SH77 before Soraba	110	63	58	-----	-----	--NT--	--NT--	V Good	Good	Thick Forest/LT	
10	1420	Mathana , SH 77	130	60	48	---	---	--NT--	--NT--	V Good	Good	---do---	
11	1530	Sagar Town	140	55	47	---	---	--NT--	--NT--	Fair	Poor	OA/Low Veg/LT	
12	1550	Near Chikkabilagodu	150	53	45	---	---	--NT--	--NT--	Poor	Poor	--do--	
13	1625	Sagar-Talaguppa Road	135	62	54	---	---	--NT--	--NT--	V Good	Good	Forest/LT/ Patch OA	
14	1700	Before Jog Falls	133	58	51	---	---	--NT--	--NT--	V Good	Good	Forest/LT	

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.

Table No.V

Reception Survey of 200kW AIR (MW), DRM Transmitter (Dharwad) in Simulcast transmission mode (16db↓)
Route: Dharwad-Sagar Direction: South-West

Date:-26/8/16

Sr. No	Time	Spot/Location	Radial Distanc (km)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
				Analog 765 Khz	Digital 774 Khz	DT-700 Professional	Avion Commercial	DT 700 Digital	Avion Digital	Sony Analogue	Philips Analogue		
1	0850	From Transmitter	5	120	110	31	4	Excellent	NT	Excellent	Excellent	OA/HT/	
2	0920	Dhumvada, SH1	10	112	103	33	3	Excellent	NT	Excellent	Excellent	HT/NHW/Veg	
3	0935	Hirehonni Halli	20	99	90	25	0	Excellent	NT	Excellent	Excellent	Veg/LT	
4	1020	Hubli-Karwar Road	30	98	91	27	0	Excellent	NT	Excellent	Excellent	---do---	
5	1040	Kalghatgi-Yellapur Road	40	92	82	21	0	Excellent	NT	Excellent	Excellent	NHW/Veg	
6	1100	---do---NH 52	50	79	69	7	0	NT	NT	Excellent	Excellent	Thick Jungle/LT Long Trees	
7	1120	Bisgod Mangnese Mines	60	67	57	0	0	NT	NT	V Good	V Good	---do-----	516 meter
8	1140	Before Yellapur	70	69	58	0	0	NT	NT	V Good	Good	---do---	448 meter
9	1210	Near Raman Gul NH 52	80	67	55	0	0	NT	NT	V Good	Good	Thick Forest/LT	71 meter
10	1230	NH 52	90	60	53	0	0	NT	NT	V Good	Good	---do---	50 meter
11	1240	Hubli Karwar Road	100	58	56	0	0	NT	NT	V Good	Good	Dense Jungle/LT	37 meter
12	1315	Hubli-Karwar Road	110	56	50	0	0	NT	NT	V Good	Good	Veg/LT/High rise Trees	30 meter
13	1355	Before Karwar Port	120	57	52	0	0	NT	NT	Fair	Poor	Forest/LT/ NHW	15 meter
14	1650	GOKARNA	126	60	51	0	0	NT	NT	Fair	Poor	Om Beach	5 meter

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.

Table No.VI

Reception Survey of 200kW AIR (MW), DRM Transmitter (Dharwad) in Simulcast transmission mode (16db↓)

Route: Dharwad-Goa

Direction: WEST

Date:-24/8/16

Sr. No	Time	Spot/Location	Radial Distance (km)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
				Analog 765 KHz	Digital 774 KHz	DT-700 Professional	Avion Commercial	DT 700 Digital	Avion Digital	Sony Analogue	Philips Analogue		
1	1040	Madras-Mumbai Highway	5	120	110	35	0	Excellent	NT	Excellent	Excellent	OA/HT/NHW	
2	1115	Near Nigadi	10	112	102	30	0	Excellent	NT	Excellent	Excellent	HT/NHW/Veg	
3	1245	Honnapur, SH 34	20	103	92	27	0	Excellent	NT	Excellent	Excellent	HT/NHW/Veg	
4	1305	SH 34	30	100	90	27	0	Excellent	NT	Excellent	Excellent	---do---	
5	1330	SH 34	40	92	83	22	0	Excellent	NT	Excellent	V Good	Dense Jungle	
6	1400	Kumbharda SH 34	50	82	73	13	0	Excellent	NT	Excellent	V Good	Thick Jungle/LT Long Trees	
7	1545	Ramnagar-Sitwada NHW	60	77	70	11	0	Audio with Breaks	NT	V Good	V Good	---do-----	Audio Breaks from 55 Km onwards
8	1605	Panjim-Belgaum Road	70	75	65	4	0	NT	NT	V Good	Good	---do---	
9	1630	Near Goa Border Panjim-Belgaum Rd	80	66	55	0	0	NT	NT	Good	Fair	Thick Forest/LT	
10	1735	Panjim Belgaum Road	90	64	52	0	0	NT	NT	Good	Fair	---do---	
11	1755	Piliem, Panjim Belgaum Road	100	55	50	0	0	NT	NT	Good	Poor	Dense Jungle/LT	
12	1835	Bandoda near Ponda	115	70	62	0	0	NT	NT	Good	Fair	LRB/LT	
13	1100 (25/8)	Colva Beach	122	64	54	0	0	NT	NT	Good	Good	OA/Sea Beach	12 meter above MSL

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways/State 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.

Reception Survey of 200kW AIR (MW), DRM Transmitter (Dharwad) in Simulcast transmission mode (16db↓)
Route: Dharwad-Karad Direction: NORTH WEST

Date:-27/8/16

Sr. No	Time	Spot/Location	Radial Distance (km)	Field Strength (dB μ V/m)		MER (dB)		Subjective Quality				Terrain	Remark
				Analog	Digital	DT-700 Professional	Avion Commercial	DT 700 Digital	Avion Digital	Sony Analogue	Philips Analogue		
				765 Khz	774 Khz								
1	0915	Bagal Kot	5	119	111	25	0	Excellent	NT	Excellent	Excellent	OA/HT/NHW/LRB	
2	0935	AGRICULTURE UNIVERCITY	10	103	97	20	0	Excellent	NT	Excellent	Excellent	HT/NHW/Veg	
3	0955	Kotur, NH48	15	102	95	25	0	Excellent	NT	Excellent	Excellent	HT/NHW/Veg	
4	1010	Before Kittur	30	100	91	27	0	Excellent	NT	Excellent	Excellent	---do---	
5	1025	NH 48	40	--	--	24	0	Excellent	NT	Excellent	V Good	---do---	
6	1040	Pune Highway	50	93	84	27	0	Excellent	NT	Excellent	V Good	---do---	
7	1135	Madras Bombay Rd NH 48	60	90	81	22	0	Excellent	NT	Excellent	V Good	HT/NHW/OA	
8	1145	Before Belagavi	70	87	77	22	0	Excellent	NT	V Good	V Good	---do---	
9	1155	Honaga, NH 48 Kakti	80	82	74	15	0	Excellent	NT	V Good	V Good	---do---	
10	1235	NH 48	90	73	64	11	0	Excellent	NT	V Good	V Good	---do---	
11	1255	Before Sankaeshwar	100	78	65	11	0	Excellent	NT	V Good	V Good	---do---	
12	1315	Near Sankeshwar	110	77	68	11	0	Excellent	NT	V Good	V Good	---do---	
13	1345	Before Nipani NH 48	120	72	67	12	0	Excellent	NT	V Good	V Good	---do---	
14	1445	Nipani Kolhapur Road	130	75	66	11	0	Excellent	NT	V Good	V Good	---do---	

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways/State 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.

Reception Survey of 200kW AIR (MW), DRM Transmitter (Dharwad) in Simulcast transmission mode (16db↓)
Route: Dharwad-Karad Direction: NORTH WEST Date:-27/8/16

Sr. No	Time	Spot/Location	Radial Distance (km)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
				Analog	Digital	DT-700 Professional	Avion Commercial	DT 700 Digital	Avion Digital	Sony Analogue	Philips Analogue		
				765 Khz	774 Khz								
15	1455	Nipani-Kolhapur Road	140	77	67	13	0	Excellent	NT	V Good	Good	OA/NHW/HT	
16	1515	Somver Peth/ NH 48	150	73	63	11	0	Excellent	NT	V Good	Good	---do---	
17	1530	Outskirts KOLHAPUR	160	65	55	5	0	NT	NT	V Good	Good	---do---	
18	1600	Karad Road	180	69	61	11	0	Good	NT	V Good	Good	---do---	
19	1630	---do---	190	64	56	9	0	NT	NT	Good	Fair	---do---	
20	1645	Kase Gaon, NH 48	210	66	56	6	0	NT	NT	Good	Fair	---do---	
21	1710	Karad City	226	63	54	0	0	NT	NT	Good	Fair	LRB/HT/City/ High population	
22	1820	Near UMBRAJ	240	58	45	0	0	NT	NT	Fair	Poor	HT/OA/NHW	

Terrain Legends: 1.LRB-Low rise building, 2.HRB-High rise building, 3.OA-Open areas or fields 4.NHW-National Highways/State 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.

Transmitter Power: 200kW MW Analog

Frequency: 765 KHz

Date of measurement: 23/8/16

Field strength measurement, at 1kM distance around the radiating mast.

Sr.No.	Direction/Radial	Spot/Location	LAT/LONG	Field Strength (dB μ V/m)	Terrain	Remark
1	South	Vanasree Nagar	N 15.40500 E 75.04082	122	Open Area, No Traffic	
2	South-1	---do---	N 15.40506 E 75.03866	113	-do-	
3	South-East	Near Rajaji Nagar	N 15.40741 E 75.04803	130	Vegetation No Traffic	
4	East	Hubbali Road	N 15.41664 E 75.05034	130	High Traffic Road side, Veg	
5	North	Near Railway Track	N 15.42279 E 75.04235	132	Open Area, No Traffic	
6	North-West	Near Akshay club	N 15.42183 E 75.03690	132	Light Traffic Open Area/HW	
7	North-West	Near KHB colony	N 15.41784 E 75.03211	130	Open Area/ Vegetation	
8	North-West-1	---do---	N 15.41867 E 75.03321	132	Nearby Tall trees Open Area	
9	West	Sattur-KHB colony Road	N 15.41211 E 75.03230	132	Light Traffic Open Area	
10	South-West	Sattur-KHB Layout	N 15.40799 E 75.03361	131	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.