

**Reception survey for
assessment of coverage area
for satisfactory reception of
DRM (MW-Simulcast)
Transmitter
*Located at Vijayawada
Andhra Pradesh***

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Field Strength Measurement/Reception Survey Team

PROPAGATION LAB

Team Leader : **Sh. G.P.Srivastava (AE)**

Team Members : **Sh. P.N.Mehta (SEA.)**
Sh. Om Prakash (Sr.Tech)
Sh. Hari Ram (Tech)

Guided By : **Sh. S.Hyder (DDG)**

Supervised By : **Sh.Pramjeet Singh (DDE)**

Inspired By : **Smt. Anuradha Agarwal (ADG)**

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TV Transmitter Hall, HPT(AIR) Vijayawada



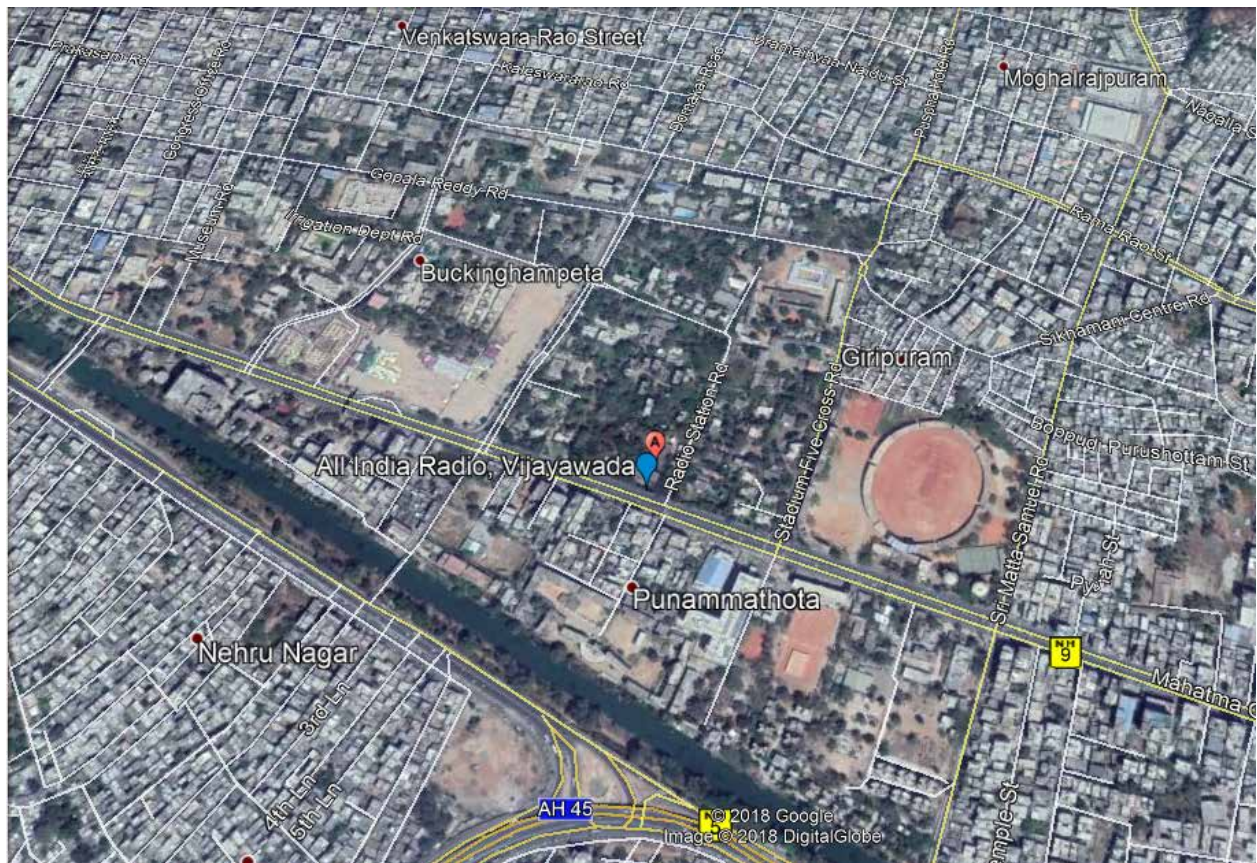
Transmitting Antenna Tower



100kW DRM (MW) Transmitter



Transmitter Control Unit



Location Map (3D View) of HPT (AIR) Vijayawada (Andhra Pradesh)

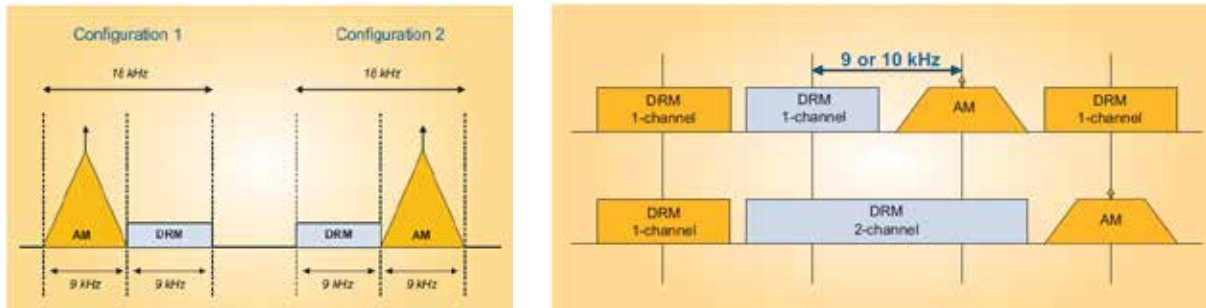
Introduction:

Digital technology has already made its way into vast areas of the information and communications landscape. In all areas of application, the conversion of information into strings of zeroes and ones allows data to be compressed on modern storage media without sacrificing its quality. The transition to digital technology results in an improved spectrum efficiency, where more program channels can be broadcast within the same bandwidth. The new digital radio broadcast technique known as Digital Radio Mondiale (DRM) allows a number of parameters to be adjusted to provide a better performance for the different propagation cases and reception conditions that can occur using these frequency bands. These parameters range from OFDM related parameters, such as number of carriers and guard interval, to symbol and bit-stream related parameters, such as interleaver depth and protection ratios. The designed measurement methodology takes this into account. It allows changing the transmitter parameters in order to test different signal configurations and also to perform different kinds of measurements. It also allows the simultaneous transmission of analogue & digital radio services each one with a different configuration, and thus, with different robustness and quality. DRM (Digital Radio Mondiale) is a non-proprietary digital radio system for broadcasting audio in the frequency bands below 30 MHz. The DRM system was designed to fit in with the existing AM broadcast band plan, based on signals of 9 KHz or 10 KHz bandwidth. The standard allows the use of many existing AM transmitters through easy modification and provides near-FM quality audio. This system has the capacity to broadcast data and text. One of such transmitter is being installed at Nambur (Guntur) under AIR Vijayawada (Andhra Pradesh) & commissioned for DRM MW Transmission in simulcast Mode. The location of the transmitter is in a rural area. Topography around the transmitter site consist of costal area (Bay of Bengal) along East, South- East & South Region whereas the North, North-East & South-West region consist of irregular hilly terrain, large vegetation & mostly low populated rural areas. In this context 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 of Medium Wave Analogue & DRM Transmission in simulcast mode. For this work a four member survey team carried out field strength survey during the period 25/08/2017 to 02/08/2017 along eight radials around the location of DRM MW Transmitter. The survey was carried out for fixed antenna reception mode.

The DRM system Overview:

Digital Radio Mondiale (DRM) is an international non-profit consortium set to revolutionize broadcasting on the long, medium and short wave bands. Since the very earliest days of broadcasting these transmissions are amplitude modulated & of low audio quality that's why recent years there has been a move away from these bands to find higher quality transmissions. The main advantage of DRM Transmission is to produce near FM audio quality on shortwave. The DRM signal, at its best, produces high fidelity sound and eliminates fading that are inherent in even the strongest analog shortwave signal as it is reflected from an uneven ionosphere. DRM technology has other advantages as well. Information such as station identity, can be sent over the signal & has potential for sending multiple program over the same channel like Music, Talk, Multimedia clip & text messages (Journaline). DRM requires less transmitted power, with 10kW rated transmitter power, DRM signal said to have about the same range with half power(5 kW) in comparison to that of analog signal. The main thrust of the development of DRM transmission

technique was to ensure better audio quality while keeping the transmissions in a form where they could operate alongside the existing AM transmissions. This meant having the ability for the transmissions to occupy a variety of different bandwidths dependent up the location and frequencies in use. In USA 10 kHz channel spacing is used on the medium wave band whilst in Europe there is 9 kHz spacing. On the short wave bands 5 KHz channel spacing has been adopted. The technique focused on simultaneous broadcasting of the AM analogue and DRM digital signals using the configuration known as MCS (Multi-Channel Simulcast). According to the DRM standard, there are two possible MCS configurations for ITU Region 3(i.e. Asia-Pacific region), as shown in following figure.



(MCS Configuration for ITU Region -3)

DRM transmissions:

The composition of DRM transmission system includes three parts

1. Source coding and multiplex, which is mainly used for audio source coding and multiplex processing.
2. Coding and modulation, which is used for channel coding and baseband modulation.
3. RF modulation, which is to do RF modulation and transmit signal via antenna. A brief framework is shown in Fig 1. Figure 1 DRM transmission system framework

The technique is based on a content multiplexer-server, called the DRM Content Server. A Configuration Interface Unit, which is part of this server, using programmable or predefined broadcasting templates and schemata, multiplexes audio, data, and other desired content like GPS info and streams it in the form of frames through an OFDM modulator into the air. There is now a transition taking place, moving away from analog transmissions to a full DRM system. In the interim, broadcasters are able to simultaneously broadcast both analog and DRM content through the same transmitter and antenna; thus they are *simulcasting*. DRM uses a modulation method known as Coded Orthogonal Frequency Division Multiplexing (COFDM) to combat noise, narrowband fading and multipath where each separate carrier (with a maximum of four) is QAM modulated with a selectable error coding. The choice of transmission parameters depends on signal robustness wanted and propagation conditions. Transmission signal is affected by noise, interference, multipath wave propagation and Doppler Effect. It is possible to choose among several error coding schemes and several modulation patterns (64-QAM, 16-QAM and 4-QAM). COFDM modulation has some parameters that must be adjusted depending on

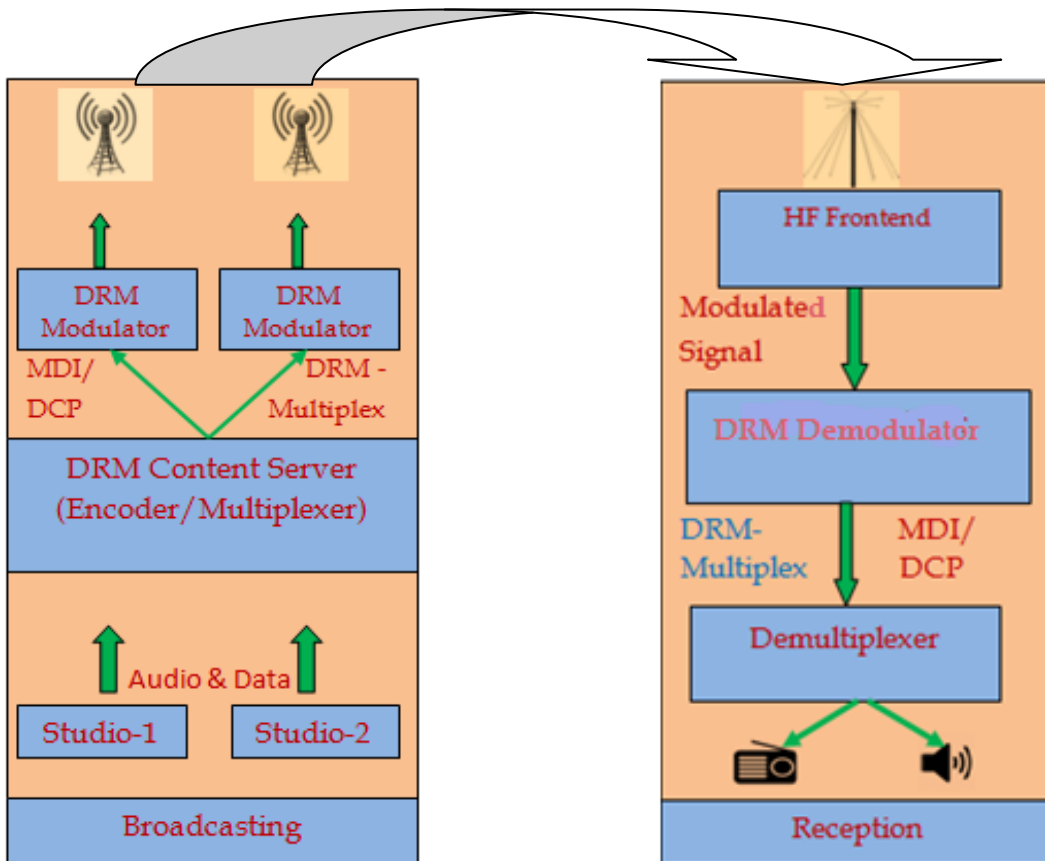
propagation conditions. This is the carrier spacing which will determine the robustness against Doppler Effect (which cause frequencies offsets, spread: Doppler spread) and OFDM guard interval which determine robustness against multipath propagation (which cause delay offsets, spread: delay spread). The DRM consortium has determined four different profiles corresponding to typical propagation conditions:

- i. **A:** Gaussian channel with very little multipath propagation and Doppler Effect. This profile is suited for local or regional broadcasting.
- ii. **B:** Multipath propagation channel. This mode is suited for medium range transmission. It is nowadays frequently used.
- iii. **C:** Similar to mode B, but with better robustness to Doppler (more carrier spacing). This mode is suited for long distance transmission.
- iv. **D:** Similar to mode B, but with a resistance to large delay spread and Doppler spread. This case exists with adverse propagation conditions on very long distance transmissions. The useful bit rate for this profile is decreased.

DRM transmission can be synchronized to support Single-Frequency Networks (SFNs) and Multi-Frequency Networks (MFNs). One DRM service normally occupies one AM channel. Alternative modes are available that use half a channel or two adjacent channels to support in-channel simulcast or enhanced audio services. The RF channel carries three separately decodable signals:

1. A very robust Fast Access Channel (FAC) which carries station identification and allows rapid band scanning by receivers to determine the available services.
2. A high capacity Main Service Channel (MSC) which carries the audio and/or data services.
3. A Service Description Channel (SDC), intermediate in robustness and capacity, which carries metadata for the main data channel.

The main audio encoding system employs two main techniques. The first is called Advanced Audio Coding (AAC). It is found that the ear does not perceive all the sounds that are heard. A strong sound on one frequency will mask out others close in frequency that may be weaker. AAC, therefore, analyses each section of the spectrum and only encodes those sounds that will be perceived. However AAC on its own does not provide sufficient compression of the data to enable the transmissions to be contained within the narrow transmission bandwidths required. To provide the additional data compression required a scheme known as Spectral Band Replication (SBR) is employed. These analyses the sounds in the highest octave which are normally from sounds such as percussion instruments of those that are harmonically related to other sounds lower in frequency. It analyses them and sends data to the receiver that will enable them to be reconstituted later. Following figure illustrate the DRM transmission system framework.



DRM transmission system framework

Objectives:

1. Subjective assessment for satisfactory reception of DRM MW Transmission in simulcast mode by using professional & commercial analogue & DRM radio receivers.
2. Evaluation of coverage range for both analogue & DRM MW transmission in simulcast mode under existing reception condition on the basis of field strength measurement.
3. Evaluation of areas having interferences caused by co-channel/adjacent channel transmission.

Measuring Instrument Used:

Following measuring Instrument/equipments have been used during the survey.

1. Spectrum Analyzer, Make: Anritsu, Model: MS 2013E (9 kHz-6.0 GHz).
2. DRM Monitoring Receiver, Make: Fraunhofer, Model: DT700
3. HF Professional Software Defined Radio, Make: Win Radio, Model: WR-G313e
4. Loop Antenna, Make: Schwarz beck, Model:FMZB1513
5. Monopole roof mounted receiving antenna designed by Antenna Lab (R&D)
6. GPS-Make: Garmin, Model: Montana 650
7. Radio Receivers-(Professional: Sony, Commercial: Philips)
8. DRM Commercial Radio, Make: Avion, Model: AV-DR-1401
9. Power Supply backup system (Su-kom Inverter 1400VA)
10. Mobile survey van provided by AIR Vijayawada.

Basic Data and Transmitter details

Transmitters Details:

1. Name of Station	:	HPT, Vijayawada, Andhra Pradesh
2. Location of the Transmitter	:	Nambur, Distt: Guntur
3. Location of the Transmitters (In 6 figure coordinates)	:	LAT- N 16° 21'32.3" LON- E 80° 30' 03.9" MSL-88 Meter
4. Description of terrain around the Site of Transmitters	:	Rural Area, Vegetation
5. Classification(Large city/urban/rural) :		Rural
6. Rated power of the Transmitter	:	100kW
7. Forward Radiated Power	:	97 kW(AM),3 kW(DRM)
8. Power Differential for DRM	:	16dB ↓
9. Reflected Power	:	0.01 kW
10. VSWR	:	1.02
11. Make	:	Nautel
12. Model No.	:	NX-100
13. Frequency of operation	:	AM (837 kHz) & DRM (846 kHz)
14. Mode of operation	:	Simulcast Mode
15. Date of Commissioning	:	12-May- 2015

Transmitting Antenna Details:

1. Type of Antenna	:	ECIL: Directional Antenna System
2. Number of Mast	:	2 Nos.
3. Spacing between the mast	:	131 Meter
4. Line of Mast	:	30° West to North
5. Height of Mast	:	138 Meter
6. Effective height of the mast	:	138.7 Meter
7. Antenna Gain(in dB)	:	NA
8. Type of Polarization	:	Vertical
9. Date of operation with 100 kW X'TR	:	13-September-1995

Modulation Parameters:

DRM standard offers a bigger choice of the OFDM parameters and modulation schemes depending upon application & their reception mode. DRM allows the independent selection of modulation parameters (code-rates, constellation, guard-intervals etc.) to enable an optimum trade-off between capacity and signal robustness. DRM also support both single frequency & multi frequency network operation designed for different applications. Currently the 100kW MW DRM transmitter, Vijayawada physically installed at Nambur (Guntur) operating with following set of Modulation parameters targeted for terrestrial reception mode within its coverage area.

Operating Frequency	Analogue: 837 kHz DRM: 846 kHz ($F_C + 9$) kHz
Bandwidth	9 kHz
Robustness Mode	A
Spectrum Occupancy	18 kHz
Main Service Channel(MSC)	16 QAM
Service Description Channel (SDC)	4QAM
Audio Mode	Mono
Interleaving	Short
Protection Level*	0
Average Code Rate	0.5
Number of audio	Analogue Service -1 DRM Service- 2
SBR	ON
Audio Coding	AAC

* Protection level is characterized by a specific parameter set for the two (16-QAM) or three (64-QAM) convolution encoders, resulting in a certain average code rate for the overall multilevel encoding process in the modulator.

Measurement Set Up:

The simulcast transmissions for field trials originating from 100kW Medium Wave Transmitter located at Nambur (Guntur), Andhra Pradesh. The field trial was made for simulcast mode of MW transmission along eight radial/routes. The analogue MW signal was transmitted on the allocated channel frequency (837 kHz) whereas DRM transmission on 846 kHz channels frequency. The daytime field strength measurement/survey work was carried out using Anritsu make spectrum analyzer & Schwarz beck makes loop Antenna. The whole system was assembled in a mobile van with power back up system. Main components of reception setup comprised of Professional DRM Monitoring analyzer, Commercial DRM Radio Receiver, Professional & commercial analogue radio receivers and a Field Strength Meter. A calibrated active loop antenna was used to receive the signal whereas for subjective assessment of the received signal Professional Radio Receiver Sengcan, Commercial DRM & analogue radio receivers were used. Garmin make GPS navigator was used for determination of the spot/location co-ordinates in six figures & radial distance from the transmitter location.

Measurement Methodology:

A map of the largest available scale was used to mark the location of the Transmitter & Radials. Assuming transmitter location as centre point eight radials (Annexure-I) were drawn along 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 was carried out initially at a distance of 20 km then 10km & later at 5 km steps as required till the end point where satisfactory reception was received. While taking static reception measurement it is desirable to record the LAT/LON, MSL & radial distance of each & every location. Since the purpose of the survey was to determine the coverage area for satisfactory reception for DRM & analogue (simulcast) transmission hence the measurement was carried out in static condition along motor able roads. The same procedure for field strength measurement/reception survey was adopted along all other eight radials. First set of measurements were captured along radial routes from the transmitter, featuring mainly rural and suburban environments where man-made noise level was expected to remain quite low. The sporadic presence of power plants, high-voltage power lines and urban settlements in certain locations of these rural-suburban routes was found to be main cause of atmospheric noise or manmade noise hence at these locations field strength measurement was avoided. After data collection is over FSM data were tabulated & interoperated on the basis of the findings. Quality of received audio was also analyzed using the professional/commercial/cheap radio receivers under given terrain conditions. The environment classification criteria are:

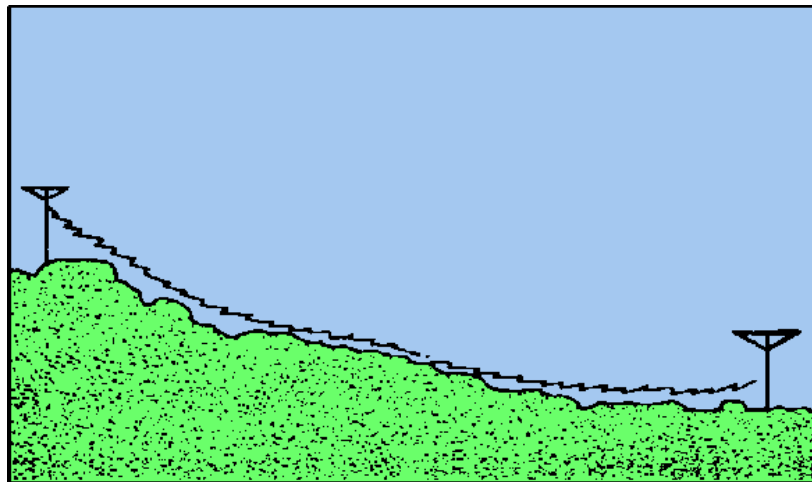
Rural: Areas with scarce isolated buildings, open fields.

Suburban: Small towns; residential areas with low building density and low rise 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.

MW/MF Signal Propagation:

AM broadcast signal propagates from the transmitter by three mechanisms i.e. Ground- Waves, Space -Waves & Sky- Waves. Ground waves travel along the earth curvature (In boundary between the earth & the atmosphere). Since these are surface waves, they penetrate into the ground resulting in energy dissipation due to absorption of energy in ground. Degree of energy lost or signal attenuation is a function of the conductivity & permittivity of near-surface ground, the frequency of operation & the presence of any major surface discontinuities such as mountain ranges etc. The conductivity along the transmission path is the parameter primarily used to determine the extent of ground wave propagation. Soil conductivity along salt water path (Sea) can be as high as 5000 millisiemens per meter while rocky terrain can have conductivity as low as 0.1 mS/m. Fertile farmland, alluvial plains & other flat open areas can have conductivities ranging from 4 to 30 mS/m. Depending upon the frequency, power level & soil conductivity, useful ground -wave signals may propagate from few tens of kilometers to several hundred kilometers from the transmitter. The current flowing in the antenna also produces space -wave, which travels through the atmosphere from transmitter to receiver. Space wave propagation is usually limited by intervening terrain obstacles or the curvature of earth. But space-wave propagation is not as important for AM broadcasting as the ground-wave or sky-wave propagation.



Surface Wave Propagation

A surface wave follows the contours of the Earth because of the process of diffraction. When a surface wave encounter an object in path having dimensioned smaller compared to its wavelength, the wave tends to curve or bend around the object. Smaller the object, more pronounced is the diffractive action. At night the D-region disappears, the MW signal proceeds towards the E-region where it got reflected & refracted & thus constituting sky wave. E-region is active both during day time & night time. The sky wave can contribute to a desired signal and also generate undesirable interference (co-channel & adjacent Channel) to the desired signal depending on the distance between the transmitter and receiver. If the transmitter and receiver are close to each other, the ground wave signal is usually predominant over the sky-wave signal, For large separations, the sky-wave signal predominates and is the desired signal.

Broadcast Service Area:

The objective of broadcasting is to provide quality reception free from interferences & noise even in a cheap simple domestic receiver, either fixed or mobile and to cover maximum of population and area of the country. The 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 standard, cheap domestic receivers. Day time ground-wave signal level protected by the allocation criteria is usually 0.5mv/m, although much higher signal strength of the order of 1.4mv/m or 63dB μ V/m may be necessary for MW analogue mode reception where as for MW DRM mode reception minimum field strength requirement is of the order of 43-44 dB μ V/m with BER threshold 1×10^{-4} (ITU-R BS.1615) to overcome noise from atmospheric & artificial sources, especially in highly urbanized areas. Also to ensure interference free reception of the desired transmitter a protection ratio (Minimum ratio of the wanted field strength to the unwanted field strength) should be maintained to prevent co-channel interferences from other transmitters radiating on same channel frequency. In case of Medium Wave transmission the co-channel protection ratio required is 40 dB. The extent of ground-wave service determined by using either theoretical calculations or by measurement of the field strength. Accuracy of theoretical prediction method is approximate and primarily due to limited accuracy of the available conductivity data taken from maps, and secondarily due to approximate nature of the mathematical formulas used for calculating radiation from antenna. Field strength measurements provide an efficient but definitive method of assessing station coverage. As discussed above the conductivity of the near surface ground plays dominating role in the propagation of Medium Wave broadcast signal & in the broadcast coverage area. Following table illustrates the coverage distance in **kM** at 500 kHz & 1000 kHz MW frequencies through ground waves for 1kW of Effective Radiated Power (ERP) for minimum field strength of 1mv/m or 60dB μ V/m.

Types of Ground	Coverage Distance(kM) at different MW frequency	
	500kHz	1000 kHz
Sea	250	200
Land	190	120
Wet Ground	140	70
Fresh Water	70	40
Medium Dry Land	40	20
Dry Ground	21	12
Very Dry Ground	15	9.5
Fresh Water Ice(-1° C)	13.5	9
Fresh Water Ice(-10° C)	13	9

The minimum usable field strength for MW DRM Transmission & a comparative study of MW analogue & DRM reception coverage area is described below to visualize the benefit of MW DRM transmission over existing analogue AM transmission.

Minimum usable field strength requirement for DRM Reception:

Minimum usable field strength (dB(μ V/m)) to achieve BER of 1×10^{-4} for DRM robustness mode A with different spectrum occupancy types dependent on protection level and modulation scheme for the MF frequency band (ground-wave propagation) (ITU-R-BS.1615-1)

Modulation Scheme	Protection Level No.	Average Code Rate	Robustness mode/spectrum occupancy type	
			A/0 (4.5 kHz), A/1 (5 kHz)	A/2 (9 kHz), A/3 (10 kHz)
16 QAM	0	0.5	33.3	33.1
	1	0.62	35.4	35.2
64 QAM	0	0.5	38.8	38.6
	1	0.6	40.3	39.8
	2	0.71	42.0	41.6
	3	0.78	43.7	43.2

Coverage Distance Coverage Distance as a function of necessary field strength for DRM reception:

Necessary Field Strength (dB μ V/m)	DRM-Mode Parameter	Coverage Distance (100 kW Transmitter)
43.1	Mode A, 16QAM, Code rate 0,5	417
48.6	Mode A, 64QAM, Code rate 0,5	366
49.8	Mode A, 64 QAM, Code rate 0,6	345
53.2	Mode A 64QAM, Code rate 0,78	309

Comparison of reception distance AM vs DRM30: Delhi 'A' MW Transmitter New Delhi:
Ground conductivity: typical for India
Transmission Frequency: 666 kHz, Transmitter power: 100 kW

	AM	DRM
Necessary field strength for reception	60 dB μ V/m	43 dB μ V/m
Coverage distance	245 km	417 km
Transmitted Power	106 kW (m=0,35)	63.7 kW (using Digital Power Enhancement of DRM DMOD3 and Trans radio TRAM Transmitters)
Power Consumption	122 kW (m=0 35)	73.3 kW

The comparison chart illustrated in previous page shows that there is an enhancement of almost 172 kM radial reception distance (i.e. 357.700 km² more coverage in DRM than in AM with the same transmitter) & a benefit of 48.7 kW saving in power consumption. In other way one can say that by switching over to DRM MW transmission a larger covered area with less power consumption can be achieved. This comparison is based on the study carried out by Jean-Francois Kipp Senior sales engineer AM and DRM transmitters & Jochen Huber CEO TRANSRADIO and Vice president of the DRM Consortium.

Collection of field strength data:

The field strength data were collected along eight radial routes drawn around the transmitting antenna at Nambur (Guntur). Initially field strength measurement were carried out at each & every spot/location at an interval of 10kM up to a distance where reception quality was excellent to very good .Thereafter at an interval of 5 kM until deterioration in received signal quality was noticed up to last point of satisfactorily reception of the radiated signal. Same procedure was adopted along all other radials. In addition to this the terrain details of each & every spot/location were also recorded along with the subjective assessment of the received audio quality on the basis of analogue & DRM audio listening quality on professional & commercial radio receivers. Collected data were tabulated in proper sequence to make it convenient for discussion & correlation with other parameters. In addition to this the geographical co-ordinates in six figures (LAT/LON/MSL) of each & every spot/location were recorded. The subjective assessment of received audio quality on radio receiver is graded as **E, VG, G, F, P, and NT** on the basis of overall listening audio quality on a given radio receiver. Besides this field strength values of analogue & DRM transmission in simulcast mode along with subjective assessment at each & every spot/location were recorded in a tabular form giving at an instance the trend for variation in received field strength & signal (audio) reception quality with distance. In this report the received field strength & subjective assessment data collected along eight radials have been provided in tabulated form in Tables No.1-8.In addition to this a set of field strength data (equivalent to 63dBµV/m) corresponding to the radial distances along all eight radials have been recorded in tabular form (Table No: 9) to make it convenient for determining the primary coverage area (Annexure-II) of the said transmission. Effort were also made to explore the radial distances up to which satisfactory reception on Professional, Commercial & Cheap radio receivers could be ascertain & co-related (Table No:10).The interpretation of code used for grading of the received signal is illustrated as follows.

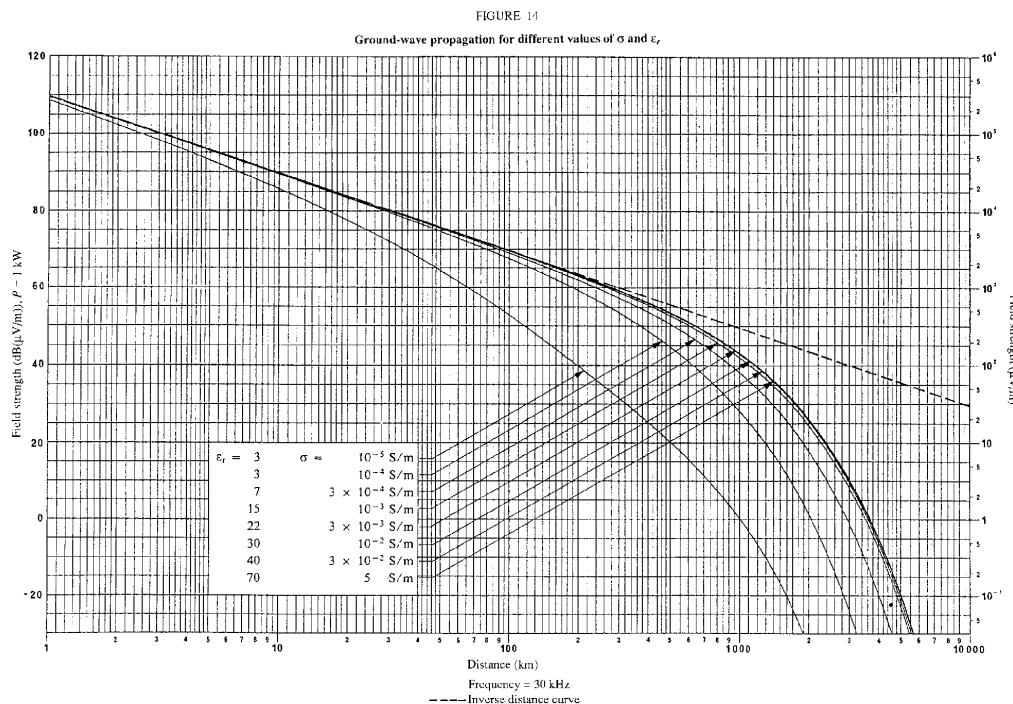
Grading	Code	Interpretation
Excellent	E	Enjoyable and useful reception free of trouble.
Very Good	VG	Enjoyable and useful reception free of trouble needs direction.
Good	G	Everything plainly audible with just a little less than the very good quality.
Fair	F	Voices plainly audible and easily understood. Music plainly audible although lacking clarity.
Poor	P	Voices audible and sometimes understood. Most musical notes audible.
Not Traceable	NT	Terrible signal. Barely detectable. Voices audible but not understood.

Collection of field strength data at a distance of 1 kM:

The field strength data at a distance of 1 kM around the transmitting antenna location in respect of analogue & DRM transmission in simulcast mode was also collected & tabulated in Table 10 for evaluation of antenna radiation pattern. The field strength value at a distance of 1 kM is depicted in a map (Annexure-) showing very little variation in measured field strength values in despite of directive nature of the medium wave transmitting antenna.

Ground conductivity map of India:

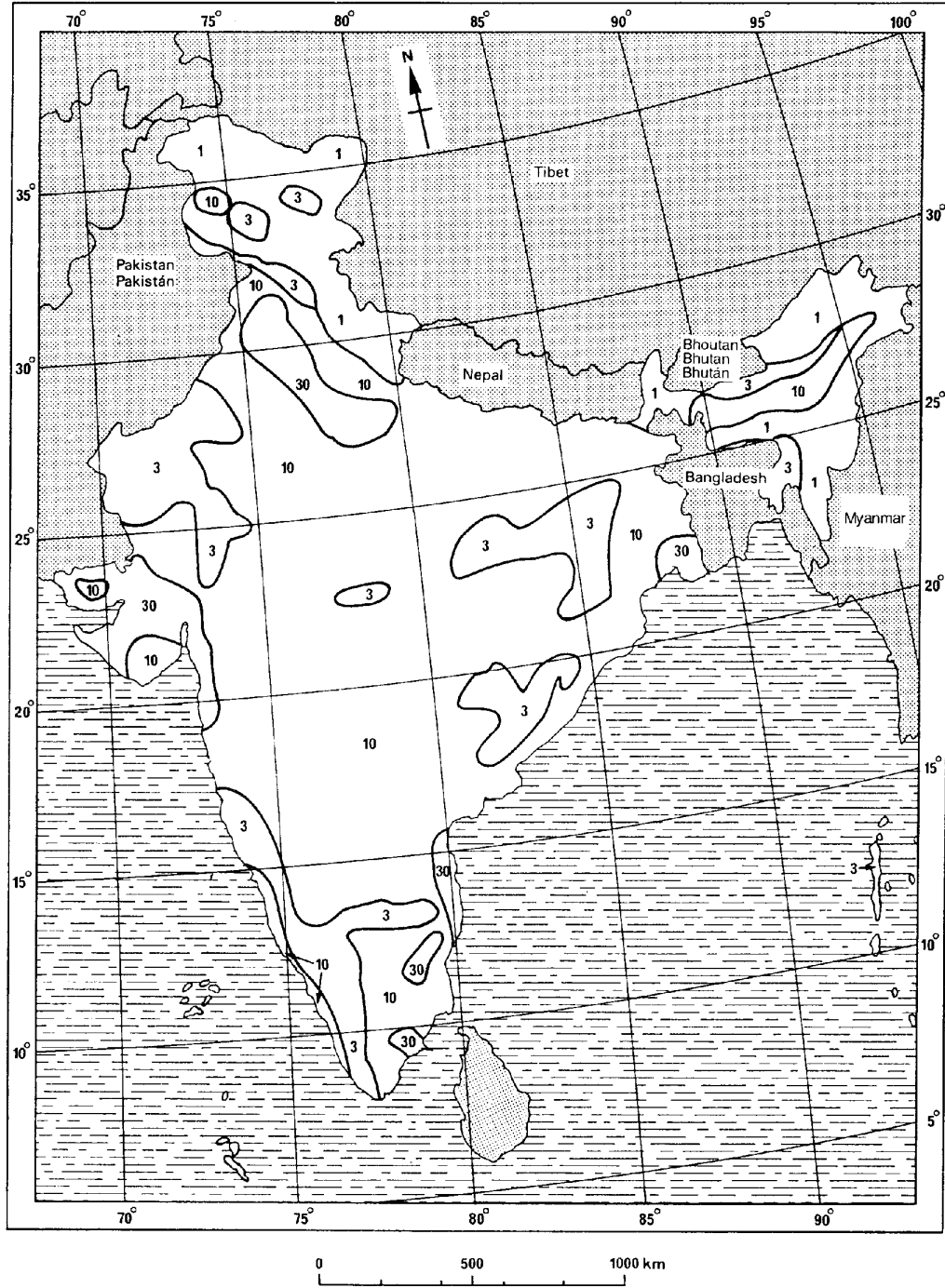
The ground conductivity map of India as illustrated at page-8 was taken from the World Atlas of Ground Conductivities (Recommendation ITU-R P.832-2 [8]) used for field strength predictions in connection with the ground-wave propagation curves contained in Recommendation 368. The maps for MF, give the effective ground conductivities in mS/m. This map shows moderate ground conductivity of 10mS/m around all route direction from the location of transmitter (Nambur, Guntur). The effect of ground conductivity of the earth surface on propagation of MW (MF) radio signal may be visualized that affects the coverage of MF transmission. The higher the conductivity the farther away the station's signal will be accessible. It is being observed that a 600 kHz signal at the 50kW power level at 15mS/m ground conductivities will produce a very capable signal at a distance of 375 kilometers. At an average to poor ground conductivity of 4 mS/m, coverage is reduced to under 200 kilometers. Excellent ground conductivity of 30 mS/m takes the same signal out to more than 500 kilometers! A purely over-seawater path (5000 mS/m) should result in a fair signal out to about 750kMs. The effect of ground conductivity on MW ground wave propagation is illustrated in following propagation curves for different value of ground conductivity(σ) & relative permittivity(ϵ_r).



Ground Wave Propagation Curves for Different Value Ground Conductivity & Permittivity (Rec. ITU R.P.368- 8)

Ground Conductivity Map of India

India (Republic of)



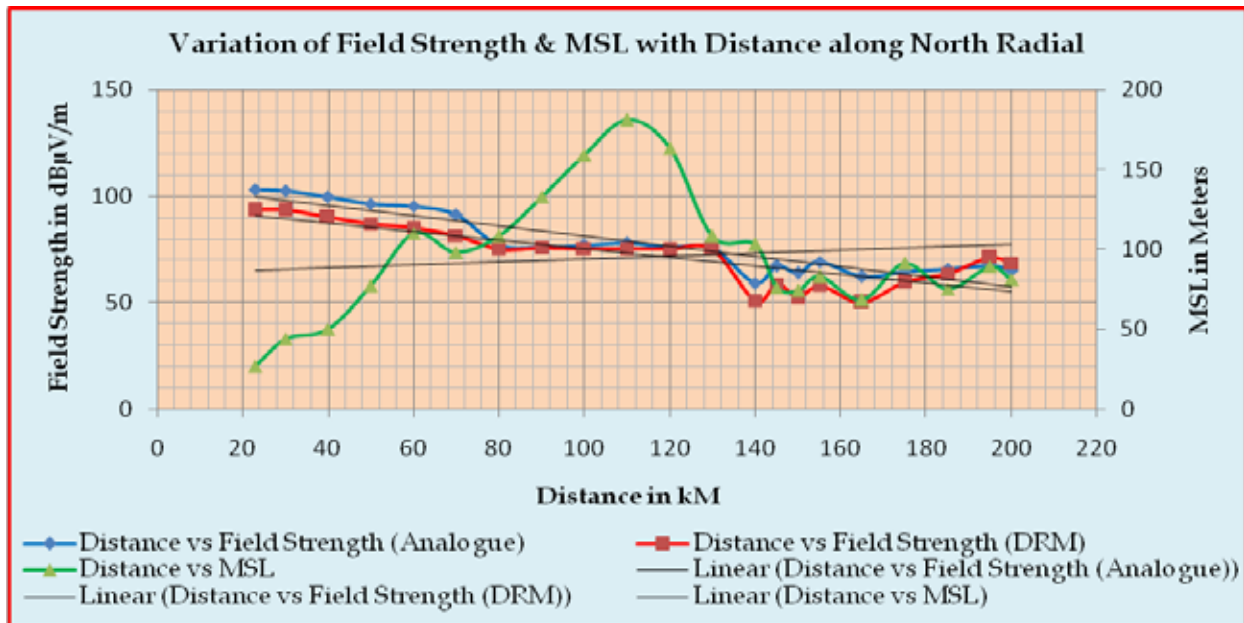
Interpretation of the collected data along radials:

In this report efforts are being made for the interpretation & analysis of the collected FSM data in following two ways.

A) On the Basis of Quantitative Analysis(Field Strength Measurement):

Radial-1(North):

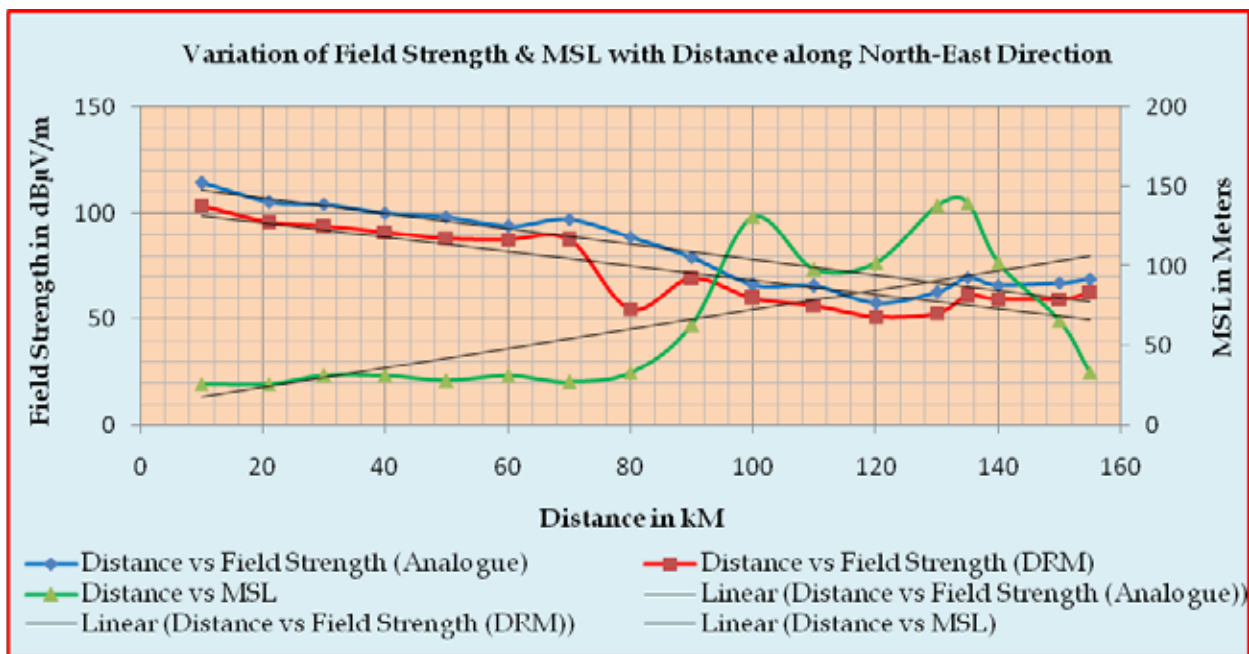
Route along Radio tower (Nambur)-St.Colony (Guntupali) - Venkatapuram-Cheemalapadu-Laxmipuram- Rangarao Banjara- Penagadapa- Nava Nagar Colony – Musatimadugu-Gollagudem (Burgampadu)- Ramanujavaram-Rajupeta was followed. Terrain along this route was irregular with varying MSL (27-180 Meters). The coverage for satisfactory reception in simulcast mode of transmission was observed for analogue transmission up to a distance of 175 km (Sammakka Sarakka Temple, Kothagudem- Manuguru Rd) & DRM Transmission up to a distance of 70 km (Kambhampadu, Maylavarm-Tiruvuru Rd) in case of professional DRM receiver whereas in case of commercial radio receiver (Avion) coverage limited to only a distance of 50 km (Chandragudem, Maylavarm-Tiruvuru Rd) A graphical illustration of variation of field strength & MSL with distance along north radial is given below.



While survey was carrying out effect of night time sky wave reception observed beyond predicted coverage area. Consequently variation in field strength of the received signal was observed with fading effect in the received audio quality.

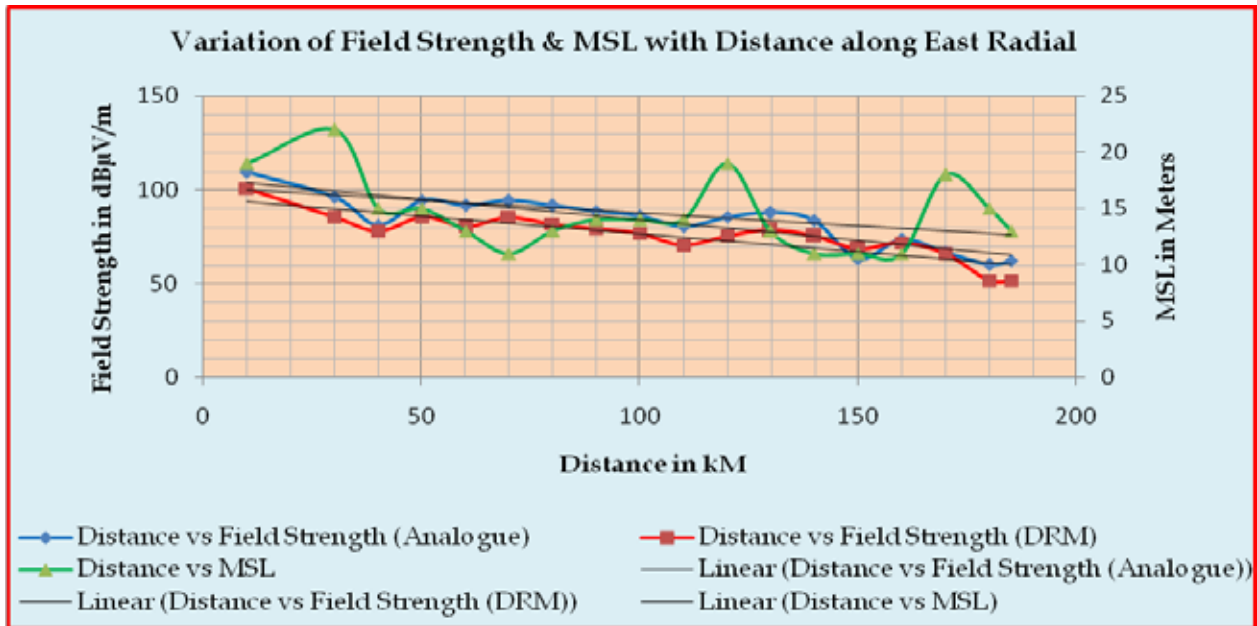
Radial-2(North-East):

Route originating from Radio tower (Nambur) towards Air (Studio)-Vepakunta- Hanuman junction- Gopannpalem (Kavagunta) - Adamilli- Jangareddyguden-Padma Vari Gudem- Kovadda Kalva Reservoir- Girijigoya- Polavaram was followed. Terrain along this route was irregular with varying MSL (26-140 Meters).The coverage for satisfactory reception in simulcast mode of transmission could not be determined for analogue transmission as there was no motor able road to cross the Godavari river but predicted upto a distance of 200km on the basis of field strength measurements along the North direction. Coverage for DRM Transmission up to a distance of 90 kM (Ramasingavaram Elaru-Jangareddygudem) in case of professional DRM receiver whereas limited to only a distance of 40 kM (Vepakunta Chennai-Srikakulam Highway) in case of commercial radio receiver (Avion). A graphical illustration of variation of field strength & MSL with distance along north radial is given below.



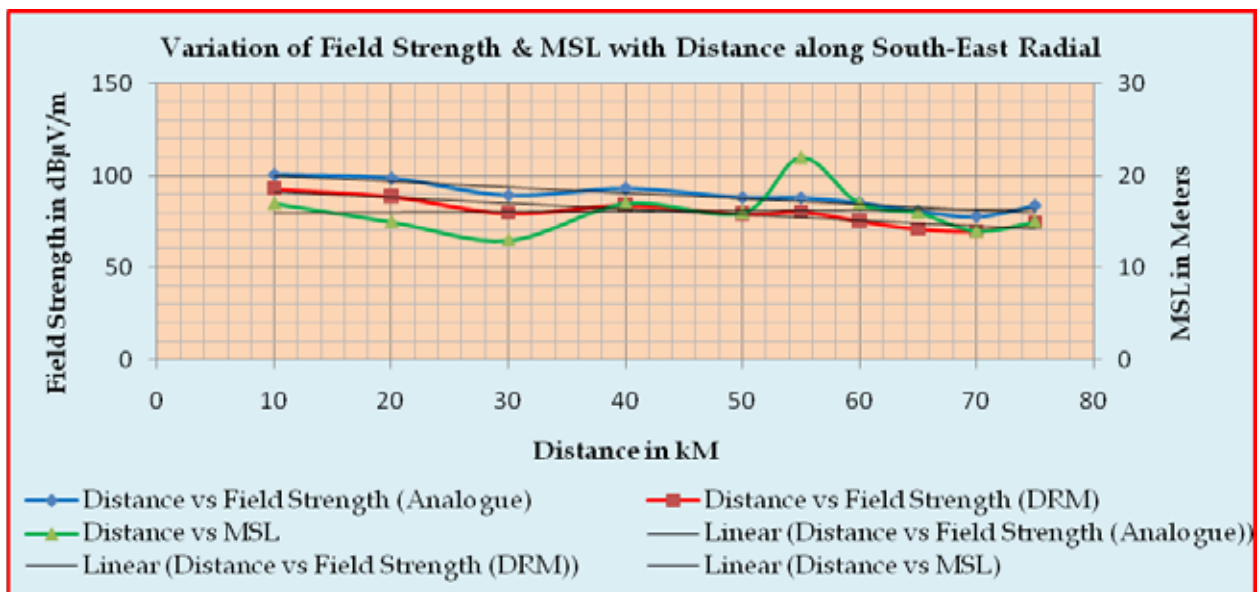
Radial-3(East):

Route originating from Radio tower (Nambur) towards Kantamraju Konduru- Tadanki- PadlavPoruPalu- Jayapuram- Krvhivennv- Mogalturu- Sivakodu Palem - Perurupetta (Amalapuram) - Manipala Cheruru- Muramalla- Yanam Bridge) was followed. Terrain along this route was low level plane land with varying MSL (10-22 Meters).The coverage for satisfactory reception in simulcast mode of transmission was observed for analogue transmission upto a distance of 180 kM (Yanam Bridge, Amlapuram- Talareru Road).Coverage for DRM Transmission up to a distance of 70 kM (Singarayapalem, Bantumilli Road) in case of professional DRM receiver whereas limited to only a distance of 50 kM (Sai Nagar, Pamarru-Gudivada Road) for commercial radio receiver (Avion). A graphical illustration of variation of field strength & MSL with distance along north radial is given in next page.



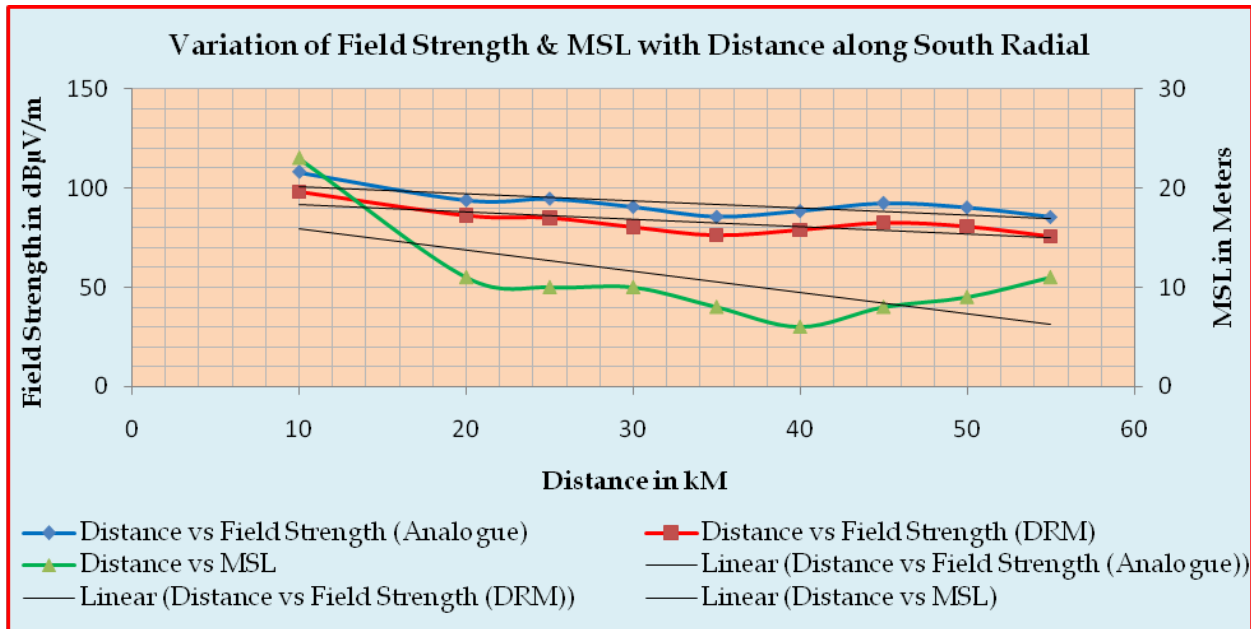
Radial-4(South- East):

Route originating from Radio tower (Nambur) towards Haafpet Cherur-Vemuru-Palipalem-Bandalai Cheruru-Nagayalanka-Near Barrankulla-Sangameswaram Temple was followed. Terrain along this route was low level plane land with varying MSL (13-22 Meters).The coverage for satisfactory reception in simulcast mode of transmission was observed for analogue transmission could not be determined due to existence of sea (Bay of Bengal).Coverage for DRM Transmission up to a distance of 65 kM (Nagayalanka, Nagayalanka-Chodavaram) in case of professional DRM receiver whereas limited to only a distance of 55 kM (Penumudi-Pulligada, Bridge Puligada-Repalle) for commercial radio receiver (Avion). A graphical illustration of variation of field strength & MSL with distance along north radial is given below.



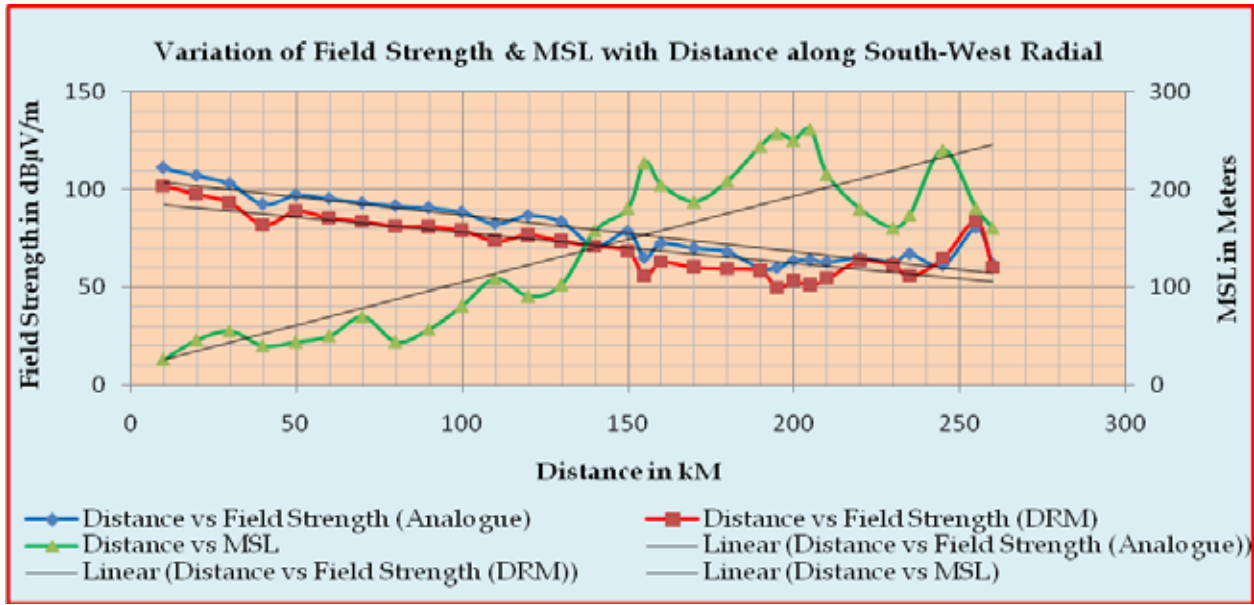
Radial-5(South):

Route originating from Radio tower (Nambur) towards GVR & S College of Engineering- Thotempudi- Chintalapudi- Etheru- Bharthipudi- Bapatla- Ramnagar was followed. Terrain along this route was low level plane land with varying MSL (8-23 Meters).The coverage for satisfactory reception in simulcast mode of transmission was observed for analogue transmission could not be determined due to existence of sea (Bay of Bengal).Coverage for DRM Transmission up to a distance of 55 km (1km ahead Ramnagar, Surya Lanka Beach Road) in case of professional DRM receiver whereas limited to only a distance of 50 km (Bapatla, GBC Road) for commercial radio receiver (Avion). A graphical illustration of variation of field strength & MSL with distance along north radial is given below.



Radial-6(South-West):

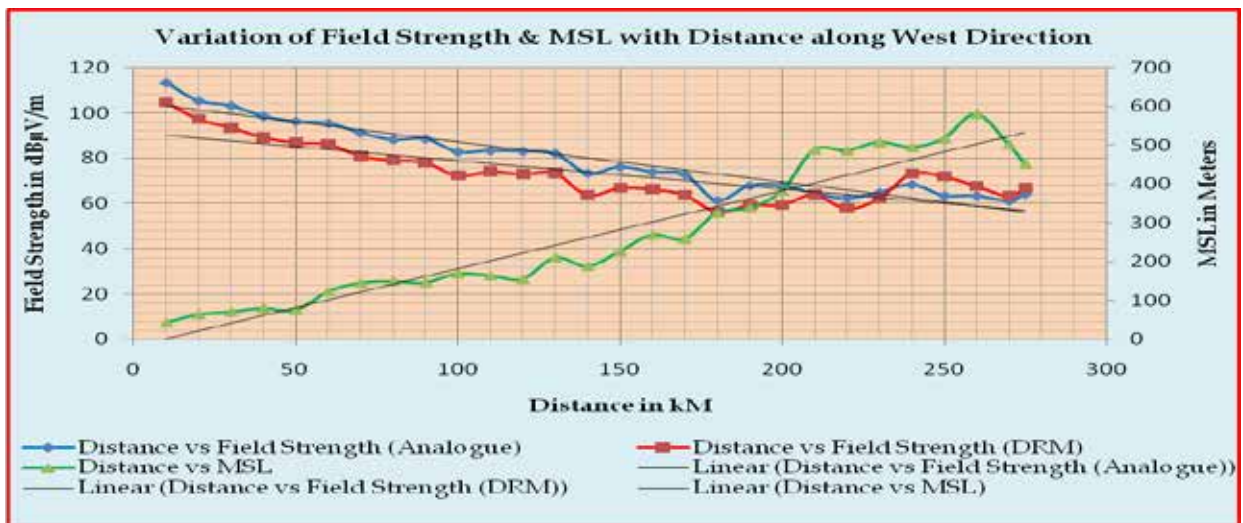
Route originating from Radio tower (Nambur) towards Pothur – Thimmapuram - Martur (Jonnanthali) - Kasyapuram - Ullagallu - Dasala Palle- Batchalakurapadu- Tadviri Palle- Dathara Krishnapuram- Taticherla- Thamballapalle- Edamakallu- Giddalur- Akkalreddipalle- Tekurpeta (Porumamilla)- Boppapuram- Itigulapadu (Mallepalle)- Mudireddypalle- Onipenta- Mydukur was followed. Terrain along this route was irregular containing vegetation & hill forest range with varying MSL (26-258 Meters). The coverage for satisfactory reception in simulcast mode of transmission was observed for analogue transmission up to a distance of 210 km (Akkalreddipalle, Komaloru- Markapuram Road) & for DRM Transmission up to a distance of 100 km (Ullagallu, Addanki-Darsi Road) in case of professional DRM receiver whereas in case of commercial radio receiver (Avion) coverage limited to only a distance of 90 km (Vempadu, Addanki-Darsi Road). A graphical illustration of variation of field strength & MSL with distance along south-West radial is given below (Next Page).



While survey was carrying out effect of night time sky wave reception observed beyond the distance of satisfactory reception of analogue transmission (210-260 km). Consequently variation in field strength of the received signal was observed with fading effect in the received audio quality.

Radial-7(West):

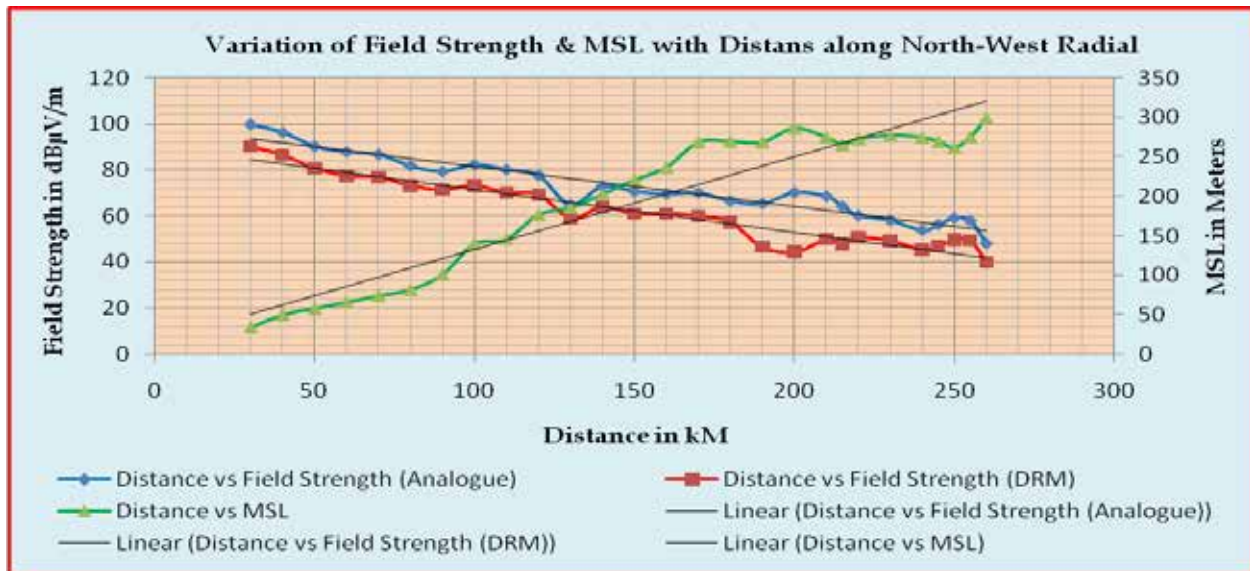
Route originating from Radio tower (Nambur) towards Medikonduru- Chagallu- Nekarikallu- Petasannigandla- Obulesunnipalle- Kothapalle- Thungathurthi- Palwai – Turupupalle - Thurkalapally - Marchala - Munnatur- Koduparthy - Nakkala Banda Thanda – MehbubNagar – Dharmapur was followed. Terrain along this route was irregular high level land with varying MSL (44-580 Meters). The coverage for satisfactory reception in simulcast mode of transmission was observed for analogue transmission up to a distance of 220 km (Near Marchala, Jadcherla- Kalwakurthy) & for DRM Transmission up to a distance of 120 km (1 km ahead Kothapalle Link Rod) in case of professional DRM receiver whereas in case of commercial radio receiver (Avion) coverage limited to only a distance of 90 km (Narmalapadu, Macharla-Karempadu). A graphical illustration of variation of field strength & MSL with distance along south-West radial is given below



While survey was carrying out effect of night time sky wave reception observed beyond the distance of satisfactory reception of analogue transmission (220-275 km). Consequently variation in field strength of the received signal was observed with fading effect in the received audio quality.

Radial-8 (North-West):

Route originating from Radio tower (Nambur) towards Saidapuram- Konakanchi- Garikapadu- St,Ann’s Nagar (Medepalli)- Dhammaigudem- Pedda Nagaram- Rayaparthi - Rangasaipet - Hasanparthy – Yellapur- PENCHIKALPETA- Singapuram- Golapalli- Venkayagudem - Gattududdenapally - Chengerla was followed. Terrain along this route was irregular high level land with varying MSL (34-300 Meters). The coverage for satisfactory reception in simulcast mode of transmission was observed for analogue transmission up to a distance of 215 km (Hasanparthy, Warangal-Huzurabad Road) & for DRM Transmission up to a distance of 80 km (Near Garikapadu, Vijayawada-Hyderabad Hwy) in case of professional DRM receiver whereas in case of commercial radio receiver (Avion) coverage limited to only a distance of 70 km (Chillakallu, Vijayawada-Hyderabad Hwy). A graphical illustration of variation of field strength & MSL with distance along south-West radial is given below.



B) On the Basis of Qualitative Analysis (Subjective Assessment):

On the basis of subjective listening of Audio Quality on analogue radio receiver & DRM radio receivers (Professional & Commercial) following conclusion has been drawn-

1. The coverage on the basis of listening quality on analogue radio receiver for simulcast mode of transmission is evaluated to be extended over a distance of 175-220km all around the location of MW DRM Transmitter.

2. The coverage on the basis of listening quality on DRM radio receiver (Professional Brand) for simulcast mode of transmission is evaluated to be extended over a distance of 65-120 km all around the location of MW DRM Transmitter.
3. The coverage on the basis of listening quality on DRM radio receiver (Commercial Brand) for simulcast mode of transmission is evaluated to be extended over a distance of 40-90 km all around the location of MW DRM Transmitter.

Conclusion:

On the basis of received field strength values at the spot/location along eight radials & coverage contour(Annexure-IV) drawn on the basis of table prepared/compiled for primary coverage of 63dB μ V/m following conclusions can be stipulated.

1. The variation in field strength is not linear it's due to the tropical variation & environmental condition around the measurement location. The measured field strength value at a particular location is the vector sum of the received signals resulting out due to various optical phenomenon.
2. The coverage for analogue transmission along South-West to North-West direction is maximum (210-220 km) compared to other radial/direction. This is mainly because of two reasons one less populated region having low rise buildings & rural environment & secondly due to the directivity of the transmitting antenna towards this region. Soil conductivity of the ground that also contributes a lot in propagation of the MW broadcast signal but in this case surrounding region around the location of the Transmitting Antenna falls under uniform soil conductivity (10 mS/m -see ground conductivity map of India, Page-8) as such extension of coverage along this region is mainly due to the directivity of the transmitting antenna.
3. The coverage along South-East & South region could not be access due to the existence of sea (Bay of Bengal) however it could be predicted that the coverage over sea water path may be several times more than the coverage on land body because of extremely high conductivity (5000mS/m) of a purely over sea water path. As such the coverage over sea water path along this region may be more than 1000 km (See Ground Wave Propagation Curves for Different Value Ground Conductivity & Permittivity-Rec.ITU R P.368-8).
4. While carrying out field strength/reception survey work along radials, poor pocket of reception zone/shadow zones were also noticed in suburban areas & Industrial areas where atmospheric noise dominated the wanted broadcast MW signal. The existence of HT power line & power substation was also noticed to be contributing major noise source that affects reception.
5. Interference due to co-channel/adjacent channel was not observed in this field trial during the day time measurement on both professional & commercial radio receiver however during night time measurement after 1900 hrs interference due to sky wave was observed in analogue mode of reception.

Scope of further study:

The purpose of this day time field trial was to determine the primary coverage region & to access the areas for satisfactory reception of the signal on radio receivers. But in view of different possible DRM transmission parameter configuration & terrain conditions following study recommended to be carried out.

1. Study of the mobile DRM reception with different transmission modes and determine on the field the critical reception factors.
2. Analysis of the DRM coverage range and field strength threshold in static reception for each analyzed mode comparatively with the corresponding AM range.
3. A comparative study of AM and DRM transmission powers that are needed to obtain similar coverage range.
4. Evaluation of indoor DRM reception & outdoor DRM reception in dense populated urban areas.

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 survey team is heartily thankful to the shift duty staff of HPT (AIR), Vijayawada for their support & assistance extended to the survey team during the field trial. The survey team expresses their deepest sense of gratitude to Sh. Mohd.Khamaruddin (DDG) AIR, Vijayawada & Sh. S.Hyder (DDG) Propagation Lab for providing necessary support & expertise guidance during the entire period of the field trial. The survey team is especially indebted to Smt. Anuradha Aggrawal (ADG) whose motivation, suggestion & cooperation at every step helped in the successful completion of the survey.

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: North (Radial-1)

Table-1

Route: Radio tower (Nambur)-St.Colony (Guntupali)- Venkatapuram-Cheemalapadu- Laxmipuram- Rangarao Banjara- Penagadapa.....

Date: 25/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
1005	St.Colony (Guntupali) Vijayawada –Hyderabad Rd	N16°33'51.0" E80°33'14.9"	23	27	103.2	93.4	28.0	28.0	SDR OK	OK	E	E	Rural, Open, Vegetation,Low Traffic	
1024	Kondapalli Vijayawada- Maylavarm Rd	N16°37'39.9" E80°32'42.0"	30	44	102.6	93.3	34.8	-	OK	AD	E	E	Rural, Kondapalli Hill Forest, Low Traffic	Rainy
1119	Venkatapuram Vijayawada- Maylavarm	N16°42'23.2" E80°36'42.7"	40	50	99.6	90.1	29.8	26.0	OK	OK	E	E	Rural, Open, Vegetation,Low Traffic	
1204	Chandragudem Maylavarm-Tiruvuru Rd	N16°47'40.3" E80°37'38.4"	50	77	96.4	87.1	26.8	24.0	OK	OK	E	E	Rural, Open, Vegetation,Low Traffic	
1233	Cheemalapadu Maylavarm-Tiruvuru Rd	N16°53'02.4" E80°38'34.1"	60	110	95.2	85.2	21.9	-	OK	NT	E	E	Rural, Open, Vegetation,Low Traffic	Rainy Near hill
1250	Kambhampadu Maylavarm-Tiruvuru Rd	N16°58'33.5" E80°39'09.9"	70	98	91.4	81.5	21.7	-	OK	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1311	Laxmipuram Maylavarm-Tiruvuru Rd	N17°04'21.3" E80°37'39.4"	80	108	76.9	75.2	10.3	-	AD	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1419	Kotha Kuppenkuntla Tiruvuru-Penubali Rd	N17°09'59.3" E80°38'04.8"	90	133	75.9	75.9	6.8	-	NT	NT	E	VG	Rural, Open, Vegetation,Low Traffic	Rainy
1443	Rangarao Banjara Tiruvuru-Penubali Rd	N17°14'46.2" E80°40'56.5"	100	159	76.6	75.4	7.8	-	NT	NT	E	E	Rural, Open, Vegetation,Low Traffic	Cloudy
1504	Gumpena Penubali – Kothagudem	N17°20'10.9" E80°41'30.9"	110	181	77.8	75.3	9.9	-	NT	NT	G	G	Rural, Open, Vegetation,Low Traffic	25.8 SNR 26.7 MER
1535	Penagadapa Penubali – Kothagudem	N17°26'00.5" E80°39'21.6"	120	163	75.8	75.2	-	-	NT	NT	G,N	G,N	Rural, Open, Vegetation,Low Traffic	
1601	Kothagudem Penubali – Kothagudem Rd	N17°31'48.2" E80°37'45.6"	130	108	75.5	75.1	-	-	NT	NT	G,N	G,N	Rural, Open, Vegetation,Low Traffic	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: North (Radial-1)

Table-1

Route: Nava Nagar Colony – Musatimadugu- Gollagudem (Burgampadu)- Ramanujavaram-Rajupeta

Date: 25/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBµV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
1650	Nava Nagar Colony Kothagudem- Manuguru Rd	N17°36'15.0" E80°44'08.8"	140	103	59.2	50.8	-	-	-	-	G	F	Rural, Open, Vegetation,Low Traffic	
1714	Morampalli Banjar Kothagudem- Manuguru Rd	N17°38'15.2" E80°48'29.6"	145	76	67.1	58.5	-	-	-	-	G	F	Rural, Open, Vegetation,Low Traffic	
1732	Musatimadugu Kothagudem- Manuguru Rd	N17°41'11.0" E80°49'00.4"	150	74	63.8	52.2	-	-	-	-	VG	G	Rural, Open, Vegetation,Low Traffic	
1745	Tekula (Mamillvai) Kothagudem- Manuguru Rd	N17°43'35.8" E80°49'34.4"	155	83	69.2	57.6	-	-	-	-	E	VG	Rural, Open, Vegetation,Low Traffic	
1802	Gollagudem (Burgampadu) Kothagudem- Manuguru Rd	N17°48'59.5" E80°49'50.7"	165	68	62.1	49.9	-	-	-	-	G	G	Rural, Open, Vegetation,Low Traffic	
1821	Sammakka Sarakka Temple Kothagudem- Manuguru Rd	N17°54'35.6" E80°49'47.2"	175	91	64.4	59.4	-	-	-	-	VG	VG	Rural, Open, Vegetation,Low Traffic	
1855	Ramanujavaram Manuguru –Eturnagaram Rd	N18°00'51.2" E80°44'49.5"	185	75	65.9	63.6	-	-	-	-	G	F	Rural, Open, Vegetation,Low Traffic	
1925	Singireddipalle Manuguru –Eturnagaram Rd	N18°06'52.9" E80°39'28.8"	195	89	67.2	71.1	-	-	-	-	P	P	Rural, Open, Vegetation,Low Traffic	
1939	Rajupeta Manuguru –Eturnagaram Rd	N18°09'46.0" E80°37'20.3"	200	81	65.2	68.7	-	-	-	-	VP	VP	Rural, Open, Vegetation,Low Traffic	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: North-East (Radial-2)

Table-2

Route: Radio tower (Nambur) - Air (Studio)-Vepakunta- Hanuman junction- Gopannpalem (Kavagunta)- Adamilli- Jangareddyguden..... Date: 26/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
	Mangalagiri Chennai-Vijayawada Hwy	N16°25'10.0" E80°34'16.1"	10	26	114.1	103.9	39.3	30.0	OK	OK	E	E	U,O,LT	
	Air (Studio) Vijayawada Road	N16°30'18.4" E80°38'04.4"	21	26	105.3	96.1	21.9	25.0	OK	OK	E	E	Rural, Open, Vegetation,Low Traffic	Rainy
0914	Nidamanuru Chennai-Srikakulam Hwy	N16°30'39.7" E80°44'06.7"	30	31	104.2	94.1	22.6	-	OK	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1018	Vepakunta Chennai-Srikakulam Hwy	N16°32'58.9" E80°49'15.4"	40	31	100.3	91.3	12.6	19.0	OK	OK	E	E	Rural, Open, Vegetation,Low Traffic	
1035	Ampapuram (Baliparu) Chennai-Srikakulam Hwy	N16°36'06.1" E80°53'52.9"	50	28	98.5	88.2	20.4	-	OK	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1050	Hanuman junction Chennai-Srikakulam Hwy	N16°38'22.4" E80°59'00.6"	60	31	93.9	87.6	17.9	-	OK	NT	E	E	Rural, Open, Vegetation,Low Traffic	Cloudy
1112	Vatluru Bypass Road	N16°41'33.8" E81°03'31.0"	70	27	97.1	87.3	18.2	19.0	OK	OK	E	E	Rural, Open, Vegetation,Low Traffic	
1215	Gopannpalem (Kavagunta) Elaru-Jangareddygudem	N16°46'20.8" E81°07'02.2"	80	33	88.7	54.7	-	-	NT	NT	E	E	Rural,Vegetation, Low Traffic	
1240	Ramasingavaram Elaru-Jangareddygudem	N16°52'00.5" E81°09'37.2"	90	63	79.2	69.5	18.1	-	OK	NT	E	E	Rural,Vegetation, Low Traffic	
1308	Adamilli Vadlpatlanuphan Elaru-	N16°57'50.6" E81°11'53.3"	100	131	66.4	59.7	-	-	NT	NT	E	VG	Rural, Open, Vegetation,Low Traffic	Cloudy
1330	Ravikampadu Elaru-Jangareddygudem	N17°03'15.2" E81°14'30.5"	110	98	65.8	56.6	-	-	NT	NT	VG	VG	Rural,Vegetation, Low Traffic	Cloudy
1450	Jangareddyguden Elaru-Jangareddygudem	N17°07'25.6" E81°17'58.0"	120	102	57.5	51.2	-	-	NT	NT	G	F	Urban,Vegetation, Low Traffic	Market

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: North-East (Radial-2)

Route:..... Padma Vari Gudem- Kovadda Kalva Reservoir- Girijigoya- Polavaram

Table-2

Date: 26/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBµV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
1520	Padma Vari Gudem Buttayagudem-Kannapuram Rd	N17°12'32.1" E81°20'42.4"	130	138	62.9	52.9	-	-	NT	NT	VG	VG	Rural, Open, Vegetation,Low Traffic	Cloudy Popikonda National Park
1541	Kotaramachandra Puram Kannapuram -Dondapudi Rd	N17°11'28.6" E81°25'38.1"	135	140	69.8	61.1	11.9	-	NT	NT	VG	VG	Rural, Open, Vegetation,Low Traffic	Cloudy Popikonda National Park
1603	Kovadda Kalva Reservoir Kannapuram -Dondapudi Rd	N17°12'13.6" E81°29'21.7"	140	102	66.1	59.6	-	-	NT	NT	VG	VG	Rural, Open, Vegetation,Low Traffic	Popikonda National Park
1641	Girijigoya Link Road	N17°14'26.8" E81°34'12.2"	150	66	67.3	59.6	-	-	NT	NT	VG	VG	Rural, Open, Vegetation,Low Traffic	Hilly Area Popikonda National Park
1746	Polavaram Thotagondi Rd	N17°14'49.9" E81°37'43.3"	155	33	69.2	62.2	-	-	NT	NT	VG	VG	Rural, Open, Vegetation,Low Traffic	Hilly Area Popikonda National Park
Ahead Godavari river no motor able road to cross the river														

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: East (Radial-3)

Table-3

Route: Radio tower (Nambur) - Kantamraju Konduru- Tadanki- PadlavPoruPalu- Jayapuram- Krvhivennv- Mogalturu.....

Date: 27/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
0918	Kantamraju Konduru Link Road	N16°21'01.0" E80°35'53.9"	10	19	109.2	100.7	34.0	20.0	OK	OK	E	E		Rainy
0903	Kankipadu	N16°25'43.9" E80°46'21.0"	30	22	96.1	85.7	34.1	26.0	OK	OK	E	E	Rural,Vegetation, Moderate Traffic	Cloudy
0937	Tadanki Vijayawada –Pamaru Road	N16°21'22.6" E80°52'33.3"	40	15	81.1	78.1	7.2	-	AD	NT	E	E	Urban,Vegetation, Moderate Traffic	Cloudy
1001	Sai Nagar Pamarru-Gudivada Road	N16°19'48.8" E80°58'07.6"	50	15	94.5	85.5	33.5	18.0	OK	OK	E	E	Sub Urban,Vegetation, Moderate Traffic	Cloudy
1635	PadlavPoruPalu Gudivada to Mundlinipali	N16°25'49.7" E81°03'30.1"	60	13	91.6	80.2	-	-	NT	NT	E	E	Sub Urban,Vegetation, Moderate Traffic	Cloudy
1704	Singarayapalem Bantumilli Road	N16°24'29.1" E81°09'16.7"	70	11	94.2	85.4	15.2	-	OK	NT	E	E	Urban,Vegetation, Moderate Traffic	Cloudy
1731	Jayapuram Bantumilli Road	N16°22'52.8" E81°15'02.3"	80	13	91.5	81.8	10.3	14.0	AD	NT	E	E	Rural, Open, Vegetation	Cloudy
1202	Addaparra Penduru- Losari Road	N16°22'42.3" E81°20'39.7"	90	14	88.6	79.4	07.2	-	NT	NT	E	E	Rural, Open, Vegetation	FS-68.5,LOOP ANT,NO
1255	Krvhivennv Penduru- Losari Road	N16°23'47.5" E81°26'13.5"	100	14	86.1	76.9	-	-	NT	NT	E	E	Rural, Open, Vegetation	Cloudy
1338	Kalipatram Losari –Mogalturu Road	N16°23'40.1" E81°31'52.5"	110	14	80.2	70.3	-	-	NT	NT	E	E	Rural, Open, Vegetation	Cloudy
1408	Mogalturu Mugalturu-Narsapur Road	N16°25'02.2" E81°37'23.7"	120	19	85.4	75.4	-	-	NT	NT	E	E	Rural,Vegetation, Low Traffic	Cloudy
1520	Digamaru Narsapur-Palakollu Road	N16°29'07.4" E81°42'41.5"	130	13	87.9	78.3	-	-	NT	NT	E	VG	Rural,Vegetation, Moderate Traffic	Cloudy

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: East (Radial-3)

Table-3

Route:Sivakodu Palem - Perurupetta (Amalapuram)- Manipala Cheruru- Muramalla- Yanam Bridge

Date: 27/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
1544	Sivakodu Palem Polakollu -Razole Road	N16°27'37.4" E81°48'28.8"	140	11	83.7	75.2	-	-	NT	NT	VG	VG	Rural,Vegetation, Moderate Traffic	Cloudy
1609	Ramalayam Tatipaka-Amlapuram Road	N16°29'54.5" E81°53'55.0"	150	11	63.1	68.2	-	-	NT	NT	VG	G	Rural,Vegetation, Moderate Traffic	Cloudy
1634	Perurupetta (Amalapuram) Peruru Road	N16°32'50.9" E81°59'14.3"	160	11	73.3	71.8	-	-	NT	NT	P	VP	Rural,Vegetation, Moderate Traffic	Cloudy, Noisy
1715	Manipala Cheruru Amlapuram- Talareru Road	N16°36'56.9" E82°04'17.4"	170	18	66.2	66.1	-	-	NT	NT	P	NT	Rural,Vegetation, Moderate Traffic	Cloudy
1746	Muramalla Amlapuram- Talareru Road	N16°40'25.6" E82°09'21.0"	180	15	60.1	51.4	-	-	NT	NT	G	F	Rural,Vegetation, Moderate Traffic	Cloudy
1807	Yanam Bridge Amlapuram- Talareru Road	N16°42'33.9" E82°12'03.0"	185	13	62.3	51.4	-	-	NT	NT	VG	VG	Rural,Vegetation, Moderate Traffic	Cloudy
Sea Bitch No Motor able Road (Bay Of Bengal)														

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: South-East (Radial-4)

Table-4

Route: Radio tower (Nambur) - Haafpet Cherur-Vemuru-Palipalem-Bandalai Cheruru-Nagayalanka-Near Barrankulla-Sangameswaram Temple Date: 28/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
0959	Haafpet Cheruru Guntur Road	N16°18'00.8" E80°34'20.1"	10	17	100.7	92.8	37.8	24.0	OK	OK	E	E	Rural, Open, No Traffic	Rainy
1025	Tenali Guntur Road	N16°14'27.9" E80°38'37.7"	20	15	98.7	88.7	31.2	18.0	OK	OK	E	E	Rural, Moderate Traffic	Rainy
1048	Vemuru Tenali- Kollur Road	N16°11'21.2" E80°43'11.9"	30	13	89.4	79.6	22.6	16.0	OK	OK	E	E	Rural, Moderate Traffic	Rainy
1121	Donepudi Donipudi-Kollur Road	N16°09'37.5" E80°48'58.3"	40	17	93.2	84.0	22.7	16.0	OK	OK	E	E	Rural, Moderate Traffic	Rainy
1141	Palipalem Repalle Road	N16°04'07.7" E80°51'46.6"	50	16	88.1	79.2	13.1	12.0	OK	OK	E	E	Rural, Open, Vegetation, No Traffic	Rainy
1155	Penumudi-Pulligada Bridge Puligada-Repalle	N16°02'25.2" E80°53'47.3"	55	22	88.0	80.4	23.1	12.0	OK	OK	E	E	Rural, Open, Vegetation, No Traffic	Cloudy
1239	Bandalai Cheruru Avanigadda- Vekanuru	N16°00'07.0" E80°55'26.8"	60	17	85.2	75.4	11.4	-	OK	NT	E	E	Rural, Open, Vegetation, No Traffic	Cloudy
1255	Nagayalanka Nagayalanka-Chodavaram	N15°56'05.7" E80°55'23.3"	65	16	80.7	71.0	11.3	-	OK	NT	E	E	Rural, Open, Vegetation, No Traffic	Cloudy
1313	Near Barrankulla Talagadadevi- Barrankulla	N15°54'03.3" E80°57'10.9"	70	14	77.7	69.8	-	-	NT	NT	E	E	Rural, Open, Vegetation, No Traffic	Cloudy,
1344	Sangameswaram Temple Nagayalanka-Hamsaladevi	N15°54'01.2" E81°01'03.6"	75	15	83.7	74.3	10.0	-	AD	NT	E	E	Rural, Open, Moderate Traffic	Cloudy
Sea Bitch No Motor able Road (Bay Of Bengal)														

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: South (Radial-5)

Table-5

Route: Radio tower (Nambur) - GVR & S College of Engineering- Thotempudi- Chintalapudi- Etheru- Bharthipudi- Bapatla- Ramnagar

Date: 29/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBµV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
929	GVR & S College of Engineering Guntur-Chennai Hwy	N16°16'23.0" E80°28'24.2"	10	23	107.9	98.1	28.3	28.0	OK	OK	E	E	Urban, Open, Moderate Traffic	
959	Vinayakudi Gudi Guntur-Ponnur Road	N16°10'41.4" E80°31'57.0"	20	11	93.7	86.2	10.9	22.0	OK	OK	E	E	Rural, Open, Heavy Traffic	
1012	Thotempudi Guntur-Ponnur Road	N16°08'06.9" E80°32'30.3"	25	10	94.4	85.0	13.3	18.0	OK	OK	E	E	Rural, Open, Heavy Traffic	
1024	Vyshnavinagar (Ponnur) Guntur-Ponnur Road	N16°05'18.8" E80°32'51.0"	30	10	90.3	80.3	-	16.0	OK	OK	E	E	Rural, Open, Heavy Traffic	DT- 700 D*
1047	Chintalapudi GBC Road	N16°02'39.6" E80°32'33.0"	35	8	85.3	76.2	-	14.0	OK	AD	E	E	Sub Urban, Vegetation, Moderate Traffic	Cloudy, Market DT- 700 D*
1103	Etheru GBC Road	N15°59'50.4" E80°31'02.0"	40	6	88.2	78.9	-	15.0	OK	AD	E	E	Rural, Open, Low Traffic	DT- 700 D*
1120	Bharthipudi GBC Road	N15°57'06.6" E80°30'13.1"	45	8	92.2	82.5	-	16.0	OK	OK	E	E	Rural, Open, Low Traffic	DT- 700 D*
1135	Bapatla GBC Road	N15°54'27.1" E80°28'41.7"	50	9	90.0	80.6	-	15.0	OK	OK	E	E	Sub Urban, Moderate Traffic	DT- 700 D*
1203	1 km ahead Ramnagar Surya Lanka Beach Road	N15°51'41.4" E80°29'43.1"	55	11	85.2	75.6	-	-	OK	NT	E	E	Rural, Open, Vegetation, Low	DT- 700 D*
Sea Bitch No Motor able Road (Bay Of Bengal)														

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: South-West (Radial-6)

Table-6

Route: Radio tower (Nambur) – Pothur – Thimmapuram - Martur (Jonnanthali) - Kasyapuram - Ullagallu - Dasala Palle.....

Date: 30/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
0911	Sampath Nagar G T Road	N16°17'30.0" E80°26'18.9"	10	26	111.1	101.9		25.0	OK	OK	E	E	Rural, Open, Vegetation Moderate Traffic	Market DT- 700 D*
0940	Pothur Chennai-Vijayawada Hwy	N16°15'34.8" E80°20'33.8"	20	46	107.1	97.6		31.0	OK	OK	E	E	Rural, Open, Vegetation Moderate Traffic	DT- 700 D*
1036	Thummalpalem Chennai-Vijayawada Hwy	N16°11'48.3" E80°16'29.6"	30	55	103.0	93.3		17.0	OK	OK	E	E	Rural, Open, Vegetation Moderate Traffic	DT- 700 D*
1105	Thimmapuram Chennai-Vijayawada Hwy	N16°08'39.4" E80°11'51.9"	40	40	92.5	82.0		14.0	OK	AD	E	E	Rural, Open, Vegetation Moderate Traffic	DT- 700 D*
1152	Bappudi Chennai-Vijayawada Hwy	N16°03'37.6" E80°08'55.2"	50	44	97.2	88.9		13.0	OK	NT	E	E	Rural, Open, Vegetation Moderate Traffic	DT- 700 D*
1219	Martur (Jonnanthali) Chennai-Vijayawada Hwy	N15°58'42.5" E80°06'00.2"	60	50	95.4	85.4	17.0	11.0	OK	NT	E	E	Rural, Open, Vegetation Moderate Traffic	SDR WIN Radio
1241	Bollapalli Chennai-Vijayawada Hwy	N15°52'57.9" E80°04'12.4"	70	70	93.1	83.7	13.0	13.0	OK	OK	E	E	Rural, Open, Vegetation Moderate Traffic	
1301	Kasyapuram Addanki-Inkollu Road	N15°48'29.2" E80°00'58.3"	80	44	91.7	81.2	14.0	14.0	OK	OK	E	E	Rural, Open, Vegetation Low Traffic	
1347	Vempadu Addanki-Darsi Road	N15°48'38.0" E79°52'39.8"	90	57	90.7	81.1	13.0	13.0	OK	OK	E	E	Rural, Open, Vegetation Moderate Traffic	
1408	Ullagallu Addanki-Darsi Road	N15°48'17.1" E79°45'43.6"	100	81	88.5	79.1	12.0	10.0	OK	AD	E	E	Rural, Open, Vegetation Low Traffic	
1513	Darsi Addanki-Darsi Road	N15°45'47.6" E79°40'35.9"	110	109	82.7	73.9	-	-	D*	NT	E	E	Suburban, Moderate Traffic	
1532	Dasala Palle Podlli Road	N15°39'56.2" E79°38'15.4"	120	91	86.7	76.8	-	-	D*	NT	E	E	Rural, Open, Low Traffic	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: South-West (Radial-6)

...Table-6

Route: Batchalakurapadu- Tadivari Palle- Dathara Krishnapuram- Taticherla- Thamballapalle- Edamakallu- Giddalur- Akkalreddipalle..... Date: 30/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBµV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
1555	Near Pothavaram Kumool-Ongole Main Road	N15°35'15.4" E79°35'03.1"	130	103	83.6	73.8	-	-	D*	NT	E	E	Rural, Open, Vegetation Low Traffic	
1611	Batchalakurapadu Kumool-Ongole Main Road	N15°33'29.7" E79°29'16.1"	140	158	71.3	71.1	-	-	D*	NT	E	E	Rural, Open, Vegetation Low Traffic	
1628	Near Salanuthala Kumool-Ongole Main Road	N15°33'04.0" E79°22'29.0"	150	181	78.6	68.6	-	-	D*	NT	E	E	Rural, Open, Vegetation Low Traffic	
1643	Tadivari Palle Kumool-Ongole Main Road	N15°34'43.1" E79°17'52.2"	155	228	65.2	55.7	-	-	D*	NT	E	E	Rural, Hill Forest Range, No Traffic	Kumbum Forest Range
1654	Pathepuram Kumool-Ongole Main Road	N15°34'36.7" E79°14'36.9"	160	205	72.6	62.9	-	-	D*	NT	VG	VG	Rural, Hill Forest Range, No Traffic	Kumbum Forest Range
1706	Dathara Krishnapuram Kumool-Ongole Main Road	N15°33'11.1" E79°08'54.9"	170	188	70.2	60.3	-	-	D*	NT	E	E	Rural, Hill Forest Range, No Traffic	Kumbum Forest Range
1730	Shantinagar Kumool-Ongole Main Road	N15°29'20.0" E79°04'50.1"	180	209	68.2	59.6	-	-	D*	NT	VG	VG	Rural, Hill Forest Range, No Traffic	Surrounded by Forest Range
1746	Taticherla Kumool-Ongole Main Road	N15°23'14.7" E79°02'15.3"	190	245	59.8	58.5	-	-	D*	NT	F	G	Rural, Hill Forest Range, No Traffic	
1758	Thamballapalle Giddalur-Komaloru Road	N15°20'24.5" E79°00'53.6"	195	258	60.1	49.8	-	-	D*	NT	VG	VG	Rural, Hill Forest Range, No Traffic	
1812	Edamakallu Giddalur-Komaloru Road	N15°16'57.2" E79°00'02.7"	200	251	63.8	53.2	-	-	D*	NT	VG	VG	Rural, Hill Forest Range, No Traffic	
	Giddalur Giddalur-Komaloru Road	N15°11'54.9" E79°00'36.1"	205						D*				Rural, Hill Forest Range, No Traffic	
1850	Akkalreddipalle Komaloru- MarkapuramRd	N15°07'02.5" E79°01'07.3"	210	216	63.1	54.4	-	-	D*	NT	VG	VG	Rural, Hill Forest Range, No Traffic	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: South-West (Radial-6)

Table-6

Route: Tekurpeta (Porumamilla)- Boppapuram- Itigulapadu (Mallepalle)- Mudireddypalle- Onipenta- Mydukur

Date: 30/08/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
1917	Tekurpeta (Porumamilla) Markapuram-Porumamilla	N15°00'48.7" E78°59'20.6"	220	180	65.2	63.7	-	-	D*	NT	G	G	Rural, Hill Forest Range, No Traffic	
1935	Boppapuram Porumamilla-Onipenta	N14°57'50.9" E78°58'23.0"	230	161	63.1	61.3	-	-	D*	NT	VG	VG	Rural, Hill Forest Range, No Traffic	
1957	Itigulapadu (Mallepalle) Porumamilla-Onipenta	N14°54'39.4" E78°53'50.1"	235	174	67.2	55.8	-	-	D*	NT	VG	VG	Rural, Hill Forest Range, No Traffic	Nallamala Forest Range
2017	Mudireddypalle Porumamilla-Onipenta	N14°51'51.8" E78°48'52.4"	245	241	61.4	64.8	-	-	D*	NT	VG	VG	Rural, Hill Forest Range, No Traffic	Nallamala Forest Range
2046	2 km ahead Onipenta Onipenta – Mydukur Road	N14°46'35.5" E78°46'09.0"	255	181	80.5	84.0	-	-	D*	NT	NT	NT	Rural, Hill Forest Range, Traffic	Nallamala Forest Range
2058	Near Mydukur Onipenta – Mydukur Road	N14°44'12.8" E78°44'40.6"	260	161	62.2	60.0	--	-	D*	-	-	-	Rural, Hill Forest Range, Traffic	Nallamala Forest Range

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: West (Radial-7)

Table-7

Route: Radio tower (Nambur) - Medikonduru- Chagallu- Nekarikallu- Petasannigandla- Obulesunnipalle- Kothapalle.....

Date: 01/09/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
831	Navabharat Nagar(Guntur) Palakaluru Road(Ring Road)	N16°19'07.5" E80°25'02.8"	10	44	113.3	104.6	19.0	19.0	OK	OK	E	E	Urban, Vegetation, Moderate Traffic	
910	Medikonduru Guntur-Sattenapalli Road	N16°20'30.7" E80°18'48.1"	20	65	105.3	97.1	20.0	16.0	OK	OK	E	E	Rural, Open, Vegetation, Moderate Traffic	
931	Kantepudi Guntur-Sattenapalli Road	N16°22'37.6" E80°13'11.8"	30	72	103.2	93.4	19.0	19.0	OK	OK	E	E	Rural, Open, Low Traffic	
953	Chagallu Chagallu-Kandlakunta	N16°21'54.6" E80°01'34.2"	40	81	98.5	89.1	20.0	12.0	OK	OK	E	E	Rural, Open, Vegetation,Low Traffic	
1058	Narasaraopet Palnadu Road	N16°14'11.6" E80°02'51.1"	50	76	96.2	86.7	14.0	11.0	OK	NT	E	E	Urban, Moderate Traffic	Market
1128	Nekarikallu Piduguralla Road	N16°22'48.5" E79°56'22.2"	60	124	95.5	86.1	13.0	-	OK	NT	VG	VG	Rural, Open, Vegetation,Low Traffic	
1155	Near Guttikunda Nekarikallu-Zulakallu	N16°25'13.9" E79°50'47.8"	70	146	91.2	80.9	12.0	15.0	AD	OK	E	E	Rural, Open, Vegetation,Low Traffic	
1215	Petasannigandla Zulakallu-Karempudi Road	N16°26'19.2" E79°45'22.9"	80	150	88.2	79.0	13.0	-	OK	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1239	Narmalapadu Macharla-Karempadu	N16°26'28.0" E79°39'44.1"	90	147	88.6	78.0	13.0	13.0	OK	OK	E	E	Rural, Open, Vegetation,Low Traffic	
1259	Near Obulesunnipalle Macharla-Karempadu	N16°25'30.3" E79°33'47.3"	100	170	82.8	72.3	12.0	-	OK	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1318	Rayavaram Macharla-Karempadu Road	N16°27'57.1" E79°28'23.3"	110	165	83.4	74.1	12.0	-	OK	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1426	1KM ahead Kothapalle Link Road	N16°29'05.1" E79°23'05.0"	120	156	83.1	73.0	11.0	-	OK	NT	E	E	Rural, Open, Vegetation,Low Traffic	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: West (Radial-7)

Table-7

Route: Thungathurthi- Palwai – Turupupalle - Thurkalapally - Marchala - Munnanur.....

Date: 01/09/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
1446	Chenchu Colony Link Road Nagarjuna Sagar	N16°30'09.5" E79°17'33.8"	130	211	82.1	73.4	9.0	-	AD	NT	VG	VG	Rural, Open, Vegetation,Low Traffic	
1559	Thungathurthi Nagarjuna Sagar Road	N16°42'21.9" E79°14'10.9"	140	189	73.4	63.7	8.0	-	AD	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1617	Rangareddygudem Nagarjuna Sagar Road	N16°42'50.4" E79°08'34.3"	150	227	76.2	66.8	-	-	NT	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1635	Palwai Nagarjuna Sagar Road	N16°42'59.9" E79°02'55.0"	160	270	74.0	66.2	-	-	NT	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1656	Near Devarakonda Devarakonda Road	N16°42'03.8" E78°56'54.2"	170	259	72.9	63.8	-	-	NT	NT	G	G	Rural, Open, Vegetation,Low Traffic	
1736	Turupupalle Kalwakurthy Road	N16°41'22.7" E78°50'55.2"	180	326	61.4	56.3	-	-	NT	NT	VG	VG	Rural, Open, Vegetation,Low Traffic	
1752	Erragunta Pally Kalwakurthy Road	N16°41'43.1" E78°45'17.7"	190	339	67.9	59.3	-	-	NT	NT	E	E	Rural, Open, Vegetation,Low Traffic	
1818	New Thurkalapally Kalwakurthy Road	N16°41'34.4" E78°39'31.6"	200	382	68.1	59.4	-	-	NT	NT	E	VG	Rural, Open, Vegetation,Low Traffic	
1839	Lingaveddipalle Kalwakurthy Road	N16°39'53.0" E78°33'24.5"	210	488	64.4	63.9	-	-	NT	NT	VG	VG	Rural, Open, Vegetation,Low Traffic	
1859	Near Marchala Jadcherla- Kalwakurthy Road	N16°41'12.7" E78°28'02.6"	220	486	62.4	57.8	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Low Traffic	
1925	Revally Jadcherla- Kalwakurthy Road	N16°44'08.8" E78°22'52.3"	230	508	64.8	62.1	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Moderate Traffic	
1946	1 km ahead Munnanoor Jadcherla- Kalwakurthy	N16°44'42.1" E78°17'16.7"	240	495	68.4	73.2	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Moderate Traffic	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: West (Radial-7)

Table-7

Route: Koduparthu - Nakkala Banda Thanda – MehbubNagar – Dharmapur

Date: 01/09/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
2004	Near Koduparthu Jadcherla- Kalwakurthy	N16°45'52.6" E78°11'47.5"	250	517	63.5	71.9	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Moderate Traffic	
2032	Nakkala Banda Thanda Mahbubnagar Jadcherla	N16°46'03.3" E78°06'03.7"	260	580	63.4	67.7	-	-	NT	NT	VG	G	Rural, Open,Vegetation, Moderate Traffic	
2104	MehbubNagar Mahbubnagar Jadcherla	N16°44'56.7" E78°00'14.7"	270	502	61.2	63.2	-	-	NT	NT	F	P	Urban, Heavy Traffic	
2124	Dharmapur Raichur-Mahbubnagar	N16°42'01.6" E77°56'54.5"	275	452	64.2	66.8	-	-	NT	NT	VG	G	Rural, Open, Low Traffic	Night Stay at Hyderabad

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: North-West (Radial-8)

Table-8

Route: Radio tower (Nambur) - Saidapuram- Konakanchi- Garikapadu- St,Ann's Nagar (Medepalli)- Dhammaigudem- Pedda Nagaram..... Date: 02/09/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
2140	Kachavaram Vijayawada-Hyderabad	N16°37'37.3" E80°26'49.7"	30	34	99.7	90.3	18.0	20	OK	OK	E	E	Rural, Open,Vegetation, Low Traffic	Downward direction
2122	Saidapuram Vijayawada-Hyderabad	N16°41'50.6" E80°21'56.8"	40	50	96.3	86.6	17.0	24	OK	OK	E	E	Rural,Open,Vegetation, Low Traffic	
2105	Nandigama Vijayawada-Hyderabad	N16°45'51.3" E80°17'31.2"	50	58	90.2	80.8	14.0	13	OK	OK	E	E	Rural, Open,Vegetation, Low Traffic	
2047	Konakanchi Vijayawada-Hyderabad	N16°50'04.7" E80°13'44.2"	60	66	87.8	77.5	12.0	14	OK	OK	E	E	Rural, Open,Vegetation, Low Traffic	
2031	Chillakallu Vijayawada-Hyderabad Hwy	N16°53'29.1" E80°08'39.9"	70	74	86.7	77.0	13.0	14	OK	OK	E	E	Rural, Open, Moderate Traffic	
2017	Near Garikapadu Vijayawada-Hyderabad Hwy	N16°56'36.1" E80°03'30.6"	80	82	81.7	73.3	12	-	OK	NT	E	E	Rural, Open, Moderate Traffic	
2000	Kodad Kodad-Khammam Road	N17°00'03.5" E79°58'49.3"	90	101	79.3	71.5	9.0	-	AD	NT	E	VG	Rural, Open, Low Traffic	
1927	St,Ann's Nagar (Medepalli) Kodad-Khammam Road	N17°10'09.7" E80°04'55.0"	100	140	82.2	73.3	4.0	-	NT	NT	E	E	Rural, Open,Vegetation, Low Traffic	
1856	Barugudem Khammam-Warangal Hwy	N17°16'01.4" E80°04'35.4"	110	146	80.1	70.2	-	-	NT	NT	E	E	Rural, Open,Vegetation, Low Traffic	
1834	Dhammaigudem Khammam-Warangal Hwy	N17°19'07.3" E79°58'25.3"	120	177	77.6	69.3	-	-	NT	NT	E	E	Rural, Open,Vegetation, Low Traffic	
1807	Maripeda Bunglow Khammam-Warangal Hwy	N17°22'53.2" E79°54'00.7"	130	186	64.9	59.1	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Low Traffic	
1751	Pedda Nagaram Khammam-Warangal Hwy	N17°26'43.8" E79°49'31.9"	140	203	72.9	63.9	-	-	NT	NT	VG	E	Rural, Open,Vegetation, Low Traffic	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: North-West (Radial-8)

..... Table-8

Route: Thorrur- Rayaparathi - Rangasaipet - Hasanparthy - Yellapur- Penchikalpeta- Singapuram- Golapalli.....

Date: 02/09/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBµV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
1736	Datla Khammam-Warangal Hwy	N17°30'24.8" E79°45'03.1"	150	221	70.7	60.9	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Low Traffic	
1719	Near Thorrur Khammam-Warangal Hwy	N17°33'56.9" E79°40'21.6"	160	237	69.6	61.1	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Low Traffic	
1701	Nancharimadur Khammam-Warangal Hwy	N17°37'45.7" E79°36'06.3"	170	269	70.1	60.1	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Low Traffic	
1643	3 km ahead Rayaparathi Khammam-Warangal Hwy	N17°44'06.9" E79°35'49.6"	180	270	66.5	57.3	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Low Traffic	
1623	Panthini Khammam-Warangal Hwy	N17°50'42.2" E79°36'15.3"	190	269	65.4	46.4	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Low Traffic	
1602	Rangasaipet Khammam-Warangal Hwy	N17°56'49.6" E79°35'57.5"	200	287	70.2	44.3	-	-	NT	NT	NT	NT	Urban, Moderate Traffic	Market
1441	Vidya Nagar(Hanamkonda) Warangal-Huzurabad Road	N18°01'25.5" E79°32'53.1"	210	275	68.6	49.7	-	-	NT	NT	VG	VG	Rural, Open,Vegetation,	
1430	Hasanparthy Warangal-Huzurabad Road	N18°03'44.5" E79°31'28.5"	215	266	64.2	47.7	-	-	NT	NT	VG	VG	Rural, Open,Vegetation,	
1218	2 km ahead Yellapur Warangal-Huzurabad Road	N18°05'33.7" E79°29'05.3"	220	273	60.2	50.7	-	-	NT	NT	VG	VG	Rural, Open,Vegetation, Low Traffic	
1238	Penchikalpeta Warangal-Huzurabad	N18°09'38.0" E79°25'16.1"	230	278	58.2	49.2	-	-	NT	NT	G	G	Rural, Open,Vegetation, Low Traffic	
1358	Singapuram Warangal-Huzurabad	N18°14'12.4" E79°22'05.1"	240	275	53.8	45.3	-	-	NT	NT	F	P	Rural, Open,Vegetation, Low Traffic	
1259	Golapalli Karimnagar-Warangal	N18°16'06.3" E79°19'51.5"	245	270	56.3	46.8	-	-	NT	NT	E	VG	Rural, Open,Vegetation, Low Traffic	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Direction: North-West (Radial-8)

Table-8

Route: Venkayagudem – Gattududdenapally - Chengerla

Date: 02/09/2017

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Terrain	Remark
					Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)			
									DT 700	Avion	Sony	Philips		
1313	Venkayagudem Karimnagar-Warangal	N18°18'02.0" E79°17'51.1"	250	262	59.1	49.6	-	-	NT	NT	VG	G	Rural, Open,Vegetation, Low Traffic	
1324	Gattududdenapally Karimnagar-Warangal Road	N18°19'58.2" E79°15'37.7"	255	276	57.9	49.3	-	-	NT	NT	G	G	Rural, Open,Vegetation, Low Traffic	
1334	Near Chengerla Karimnagar-Warangal	N18°22'00.5" E79°13'50.3"	260	300	48.1	39.8	-	-	NT	NT	F	P	Rural, Open,Vegetation, Moderate Traffic	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Compiled Table for coverage contour for satisfactory reception of DRM MW Transmission in Commercial (Analogue & DRM) & Professional DRM Radio Receiver

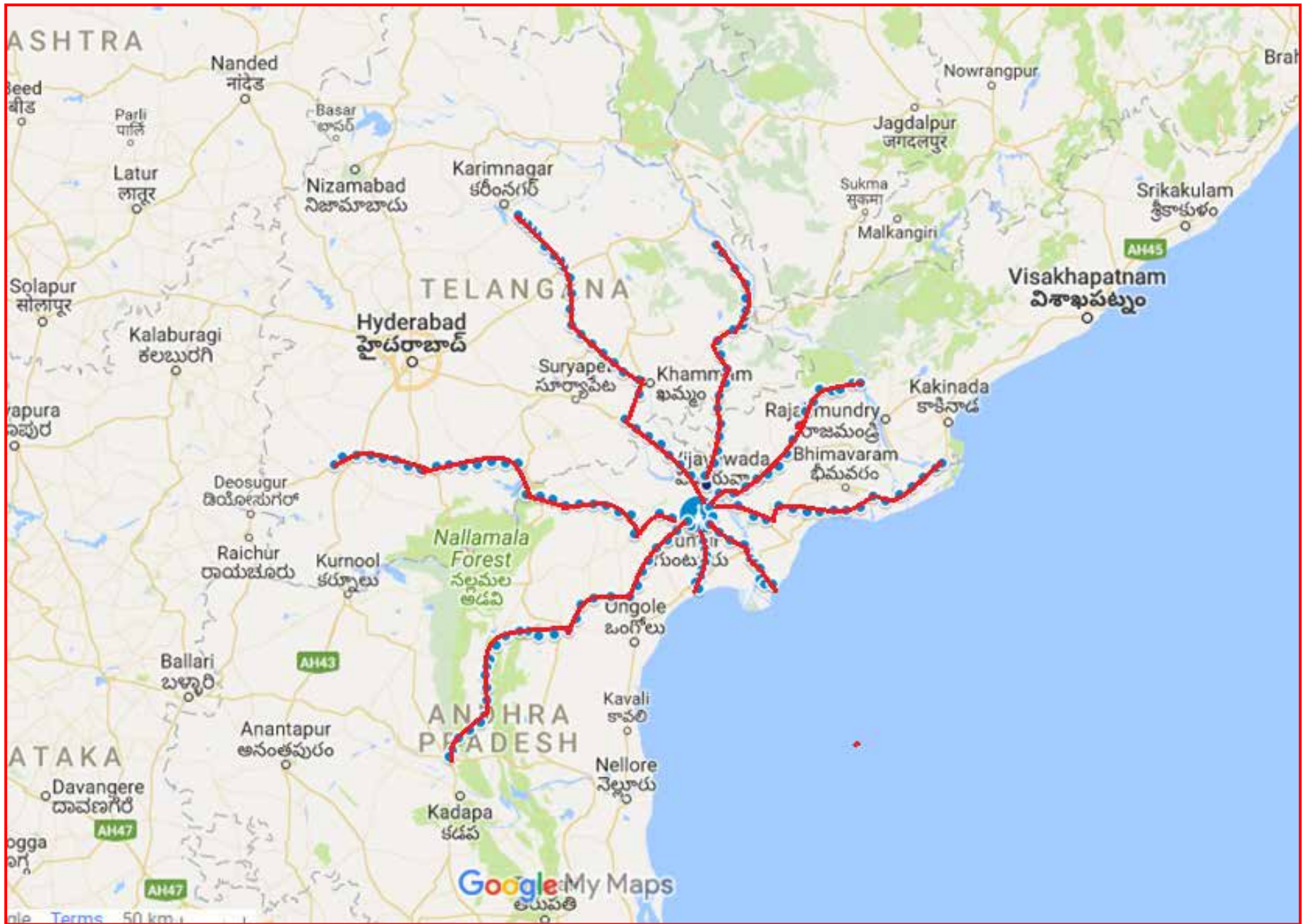
Direction	Mode of Recept		Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dBμV/m)		MER (dB)		Subjective Quality				Remark
							Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)		
											DT 700	Avion	Sony	Philips	
North	Analogue		Manuguru Kothagudem- Manuguru Rd	N17°54'35.6" E80°49'47.2"	175	91	64.4	59.4	-	-	-	-	VG	VG	
	Digital	DT-700	Kambhampadu Maylavarm-Tiruvuru Rd	N16°58'33.5" E80°39'09.9"	70	98	91.4	81.5	21.7	-	OK	NT	E	E	
		Avion	Chandragudem Maylavarm-Tiruvuru Rd	N16°47'40.3" E80°37'38.4"	50	77	96.4	87.1	26.8	24.0	OK	OK	E	E	
North East	Analogue		Ahead Godavari river no motor able road to cross the river	-	-	-	-	-	-	-	-	-	-	-	
	Digital	DT-700	Ramasingavaram Elaru-Jangareddygudem	N16°52'00.5" E81°09'37.2"	90	63	79.2	69.5	18.1	-	OK	NT	E	E	
		Avion	Vepakunta Chennai-Srikakulam Hwy	N16°32'58.9" E80°49'15.4"	40	35	100.3	91.3	12.6	19.0	OK	OK	E	E	
East	Analogue		Yanam Bridge Amlapuram- Talareru Road	N16°42'33.9" E82°12'03.0"	185	13	62.3	51.4	-	-	NT	NT	VG	VG	
	Digital	DT-700	Singarayapalem Bantumilli Road	N16°24'29.1" E81°09'16.7"	70	11	94.2	85.4	15.2	-	OK	NT	E	E	
		Avion	Sai Nagar Pamarru-Gudivada Road	N16°19'48.8" E80°58'07.6"	50	15	94.5	85.5	33.5	18.0	OK	OK	E	E	
South-East	Analogue		Sea Bitch No Motor able Road (Bay Of Bengal)	-	-	-	-	-	-	-	-	-	-	-	
	Digital	DT-700	Nagayalanka Nagayalanka-Chodavaram	N15°56'05.7" E80°55'23.3"	65	16	80.7	71.0	11.3	-	OK	NT	E	E	
		Avion	Penumudi-Pulligada Bridge Puligada-Repalle	N16°02'25.2" E80°53'47.3"	55	22	88.0	80.4	23.1	12.0	OK	OK	E	E	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

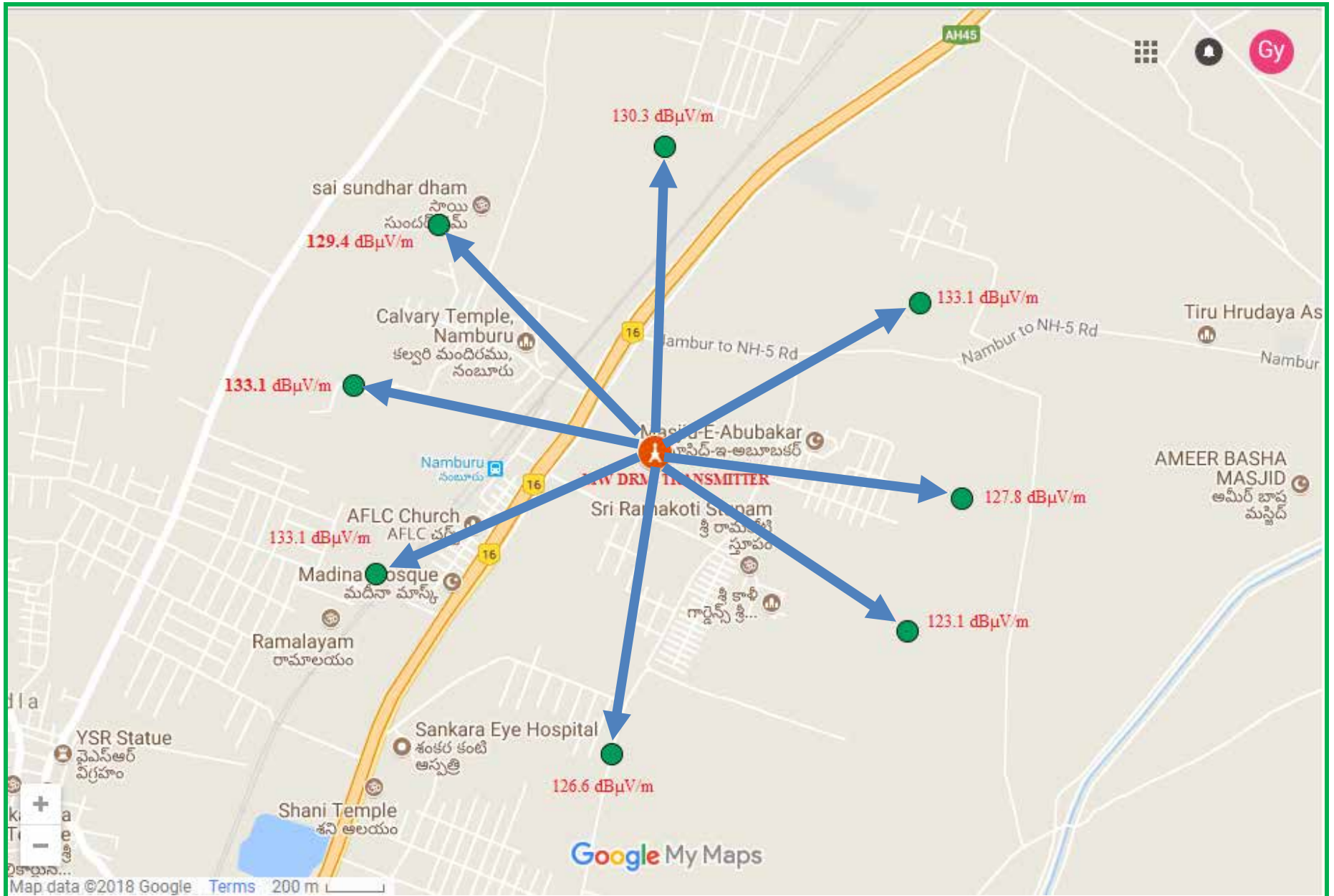
Direction	Mode of Recept		Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dB μ V/m)		MER (dB)		Subjective Quality				Remark
							Analogue 837kHz	Digital 846 kHz	DT-700 Professional	Avion Commercial	Digital (846 kHz)		Analogue (837 kHz)		
											DT 700	Avion	Sony	Philips	
South	Analogue		Sea Bitch No Motor able Road (Bay Of Bengal)	-	-	-	-	-	-	-	-	-	-	-	
	Digital	DT-700	Sea Bitch No Motor able Road (Bay Of Bengal)	-	-	-	-	-	-	-	-	-	-	-	
		Avion	Bapatla GBC Road	N15°54'27.1" E80°28'41.7"	50	9.0	90.0	80.6	-	15.0	OK	OK	E	E	
South-West	Analogue		Akkalreddipalle Komaluru- Markapuram Rd	N15°07'02.5" E79°01'07.3"	210	216	63.1	54.4	-	-	NT	NT	VG	VG	
	Digital	DT-700	Ullagallu Addanki-Darsi Road	N15°48'17.1" E79°45'43.6"	100	81	88.5	79.1	12.0	10.0	OK	AD	E	E	
		Avion	Vempadu Addanki-Darsi Road	N15°48'38.0" E79°52'39.8"	90	57	90.7	81.1	13.0	13.0	OK	OK	E	E	
West	Analogue		Near Marchala Jadcherla- Kalwakurthy	N16°41'12.7" E78°28'02.6"	220	486	62.4	57.8	-	-	NT	NT	VG	VG	
	Digital	DT-700	1KM ahead Kothapalle Link Road	N16°29'05.1" E79°23'05.0"	120	156	83.1	73.0	11.0	-	OK	NT	E	E	
		Avion	Narmalapadu Macharla-Karempadu	N16°26'28.0" E79°39'44.1"	90	147	88.6	78.0	13.0	13.0	OK	OK	E	E	
North-West	Analogue		Hasanparthy Warangal-Huzurabad	N18°03'44.5" E79°31'28.5"	215	266	64.2	47.7	-	-	NT	NT	VG	VG	
	Digital	DT-700	Near Garikapadu Vijayawada-Hyderabad	N16°56'36.1" E80°03'30.6"	80	82	81.7	73.3	12	-	OK	NT	E	E	
		Avion	Chillakallu Vijayawada-Hyderabad Hwy	N16°53'29.1" E80°08'39.9"	70	74	86.7	77.0	13.0	14	OK	OK	E	E	

Reception Survey of 100kW AIR (MW), DRM Transmitter, Vijayawada (837kHz) in Simulcast transmission mode (16db↓)

Time	Spot/Location	Location Co-ordinates (LAT/LONG)	Radial Distance (km)	MSL (Meter)	Field Strength (dB μ V/m)		Subjective Quality			Terrain	Remark
					Analogue 837KHz	Digital 846 kHz	Digital (846 kHz)	Analogue (837 kHz)			
							Avion	Sony	Philips		
1315	North	N16°22'04.7" E80°30'05.0"	1	37	130.3	121.25	OK	OK	OK	Rural, Open, Vegetation	
1505	Northeast	N16°21'48.2" E80°30'33.3"	1	29	133.1	123.40	OK	OK	OK	Rural, Open, Vegetation	
1402	East	N16°21'27.4" E80°30'37.8"	1	33	127.8	118.69	OK	OK	OK	Rural, Open, Vegetation	
1441	South East	N16°21'13.4" E80°30'31.8"	1	30	123.1	114.01	OK	OK	OK	Rural, Open, Vegetation	
1715	South	N16°21'00.3" E80°29'59.1"	1	27	126.6	117.55	OK	OK	OK	Rural, Open, Vegetation	
1801	Southwest	N16°21'19.4" E80°29'33.0"	1	34	133.1	123.80	OK	OK	OK	Rural, Open, Vegetation	Near Rlystation
1630	West	N16°21'39.4" E80°29'30.5"	1	41	131.2	121.72	OK	OK	OK	Rural, Open, Vegetation	
1608	Northwest	N16°21'56.5" E80°29'39.9"	1	39	129.1	120.14	OK	OK	OK	Rural, Open, Vegetation	

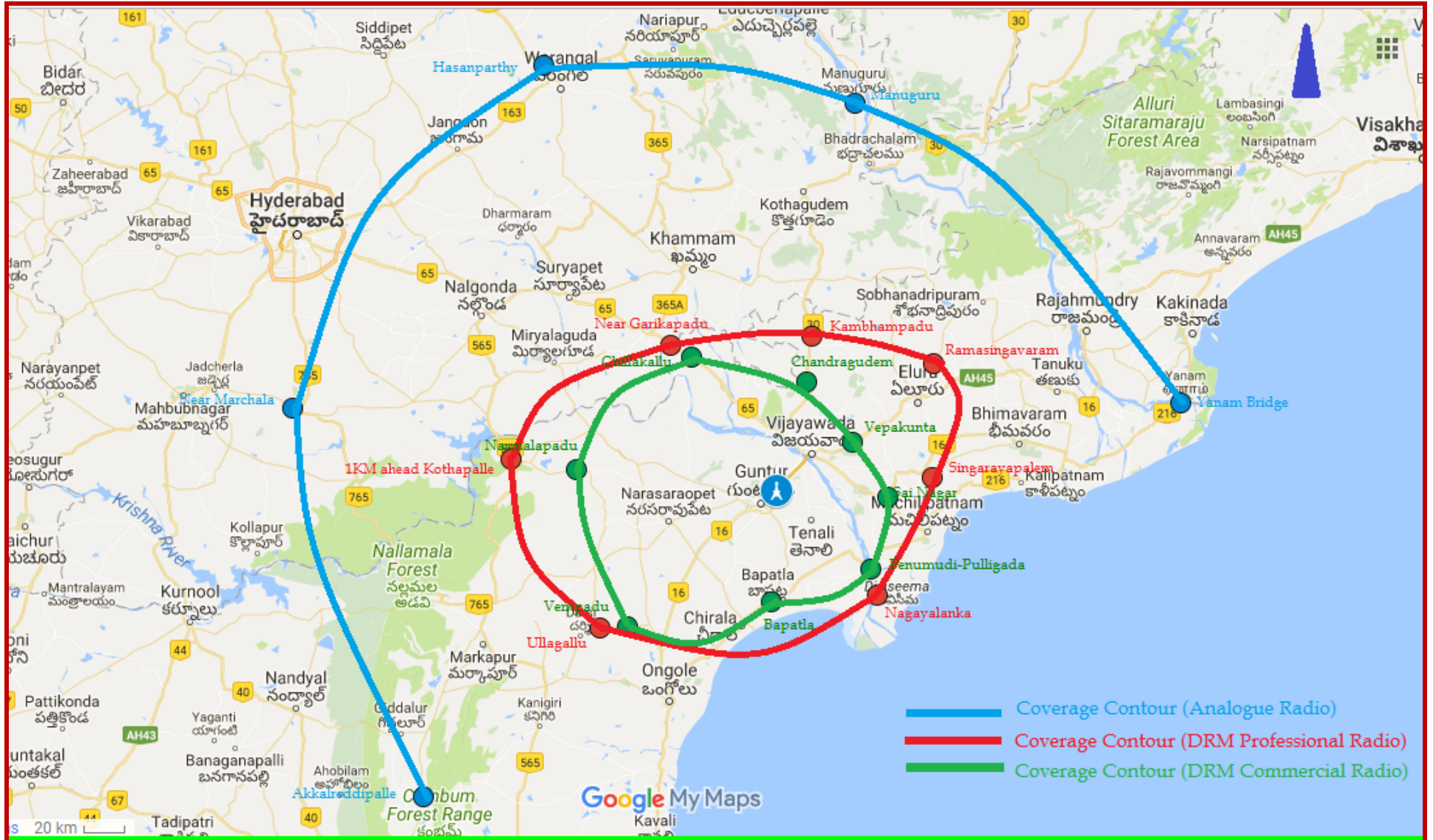


Radial Route Map originating from MW DRM Transmitter Vijayawada (Andhra Pradesh)



Field Strength at a radial distance of 1 km around the transmitting MW antenna

Coverage contour for satisfactory reception on Analogue Radio & Commercial/Professional DRM Radio Receivers



Coverage Contour Map of DRM-MW Transmitter Located at HPT (AIR) Tower, Vijayawada