

R&D TECHNICAL
REPORT

No. RD/2016/923



AIR & DDI

*Reception Survey of
Rajdhani & Indraprasth
channels of AIR in
NCR of Delhi*

PRASAR BHARATI
RESEARCH DEPARTMENT
ALL INDIA RADIO & DOORDARSHAN

*Reception Survey of
Rajdhani & Indraprasth
channels
Of AIR in
NCR of Delhi*

(Survey Period: 21/09/2016 to 1/10/2016)

Prasar Bharati
(India's Public Service Broadcaster)
Research Department
AIR & Doordarshan
New Delhi

R&D Report number: 923

Introduction:

DG AIR has received complaints from general public that at certain locations within NCR of Delhi the quality of reception on Rajdhani & Indraprastha AIR channels are not up to the mark. Through letter no. 13/61/2015-PIII (Pt.) dated 19/8/16, DG-AIR has directed this office to check the reception at various locations within NCR of Delhi and report the observations.

Objective:

Our objective was to ascertain the subjective quality of received signals of AIR Rajdhani and Indraprasth channels on good quality medium wave receiver as well as low quality receivers and measure the field strength of both the channels to check the poor reception in NCR of Delhi.

Equipment Used:

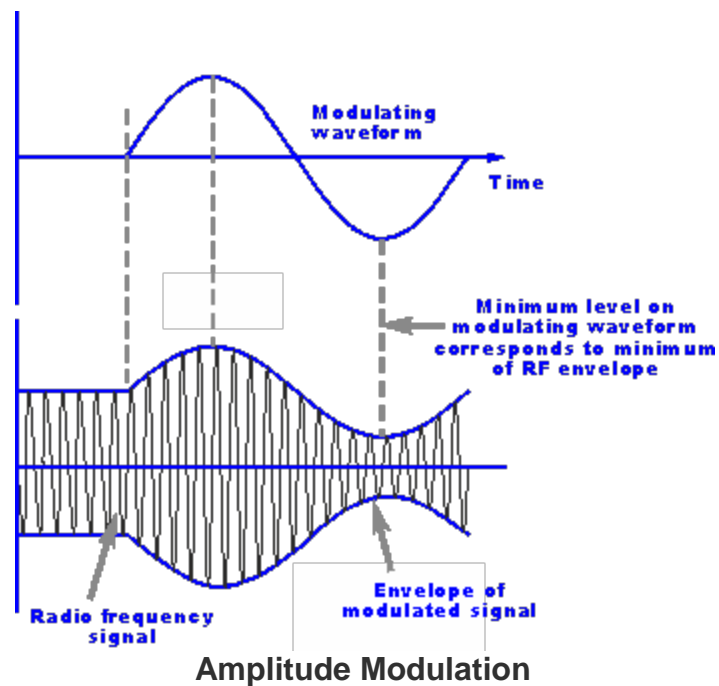
- ◆ Anritsu make VNA field strength meter.
- ◆ Schwarzbeck make active loop Antenna.
- ◆ Sony Double super heterodyne good quality medium wave receiver.
- ◆ Philips cheap medium wave receiver.
- ◆ Garmin Make Montana 650 GPS receiver.
- ◆ UPS for power supply
- ◆ Required tools etc.

Rajdhani and Indraprasth Channels of AIR:

The Rajdhani channel on medium wave band operates on 666 KHz i.e. 450.5 meters and similarly Indraprasth channel on 819 KHz corresponding to 366.3 meter. The authorized RF power of 819 KHz is 200 KW while for 666 KHz it is 100 KW. The transmitters are located in Nangli area of North Delhi near Sindhu border. The coverage of these transmitters intended for NCR of Delhi and nearby other areas.

AM modulation:

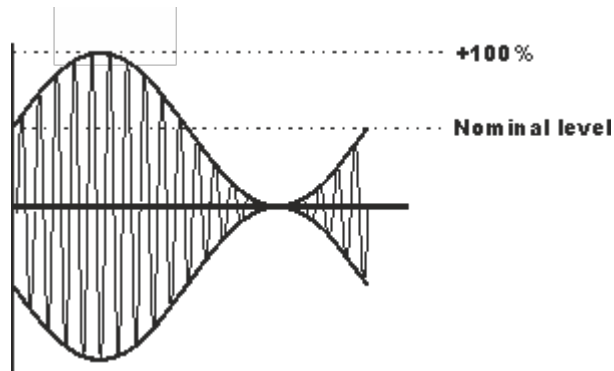
When an amplitude modulated signal is created, the amplitude of the signal is varied in line with the variations in intensity of the sound wave. In this way the overall amplitude or envelope of the carrier is modulated to carry the audio signal. Here the envelope of the carrier can be seen to change in line with the modulating signal.



AM power efficiency basics:

In terms of power, the amplitude modulation efficiency is very low. To see why this occurs, it is necessary to look at the composition of the radio signal.

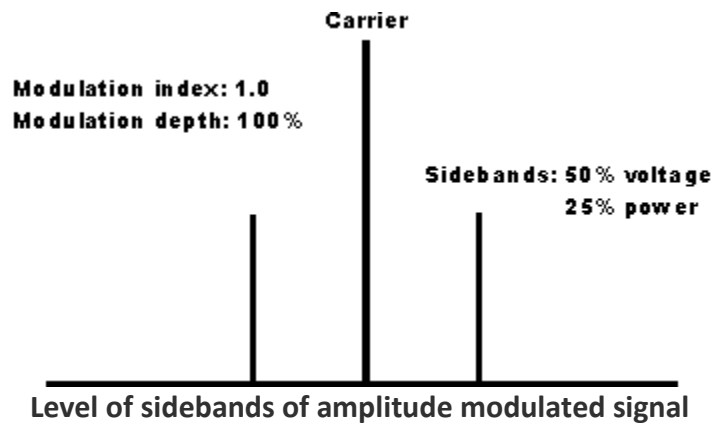
When a radio frequency signal is modulated by an audio signal the envelope will vary. The level of modulation can be increased to a level where the envelope falls to zero and then rises to twice the un-modulated level. Any increase on this will cause distortion because the envelope cannot fall below zero. As this is the maximum amount of modulation possible it is called 100% modulation.



A fully modulated carrier, i.e. 100% modulation

Even with 100% modulation, i.e. modulation index of 1.0, the power utilization is very poor.

When the carrier is modulated sidebands appear at either side of the carrier in its frequency spectrum. Each sideband contains the information about the audio modulation. To look at how the signal is made up and the relative powers take the simplified case where the 1 kHz tone is modulating the carrier. In this case two signals will be found 1 kHz either side of the main carrier.



When the carrier is fully modulated i.e. 100% the amplitude of the modulation is equal to half that of the main carrier, i.e. the sum of the powers of the sidebands is equal to half that of the carrier. This means that each sideband is just a quarter of the total power. In other words for a transmitter with a 100 watt carrier, the total sideband power would be 50 watts and each individual sideband would be 25 watts. During the modulation process the carrier power remains constant. It is only needed as a reference during the demodulation process. This means that the sideband power is the useful section of the signal, and this corresponds to $(50 / 150) \times 100\%$, or only 33% of the total power transmitted.

In order to receive medium wave AM signal properly, it is important to modulate the carrier of RF power with 100% level. Low level of modulation will increase noise in the receivers.

Measurement Methodology:

Survey sites were selected keeping in consideration the demographic condition, vehicular traffic, industrial noise, distance from transmitter etc. The minimum signal level required for city like Delhi and adjoining areas of NCR like Sonipat, Ghaziabad, Noida, Gurgaon and Faridabad is 63dB μ V/ m during day hours and more than 70 db μ V/ m during night hours.

At each selected location, the field strength was measured and subjective reception on two different types of receivers was checked. The same is tabulated in Table-1 to 7.

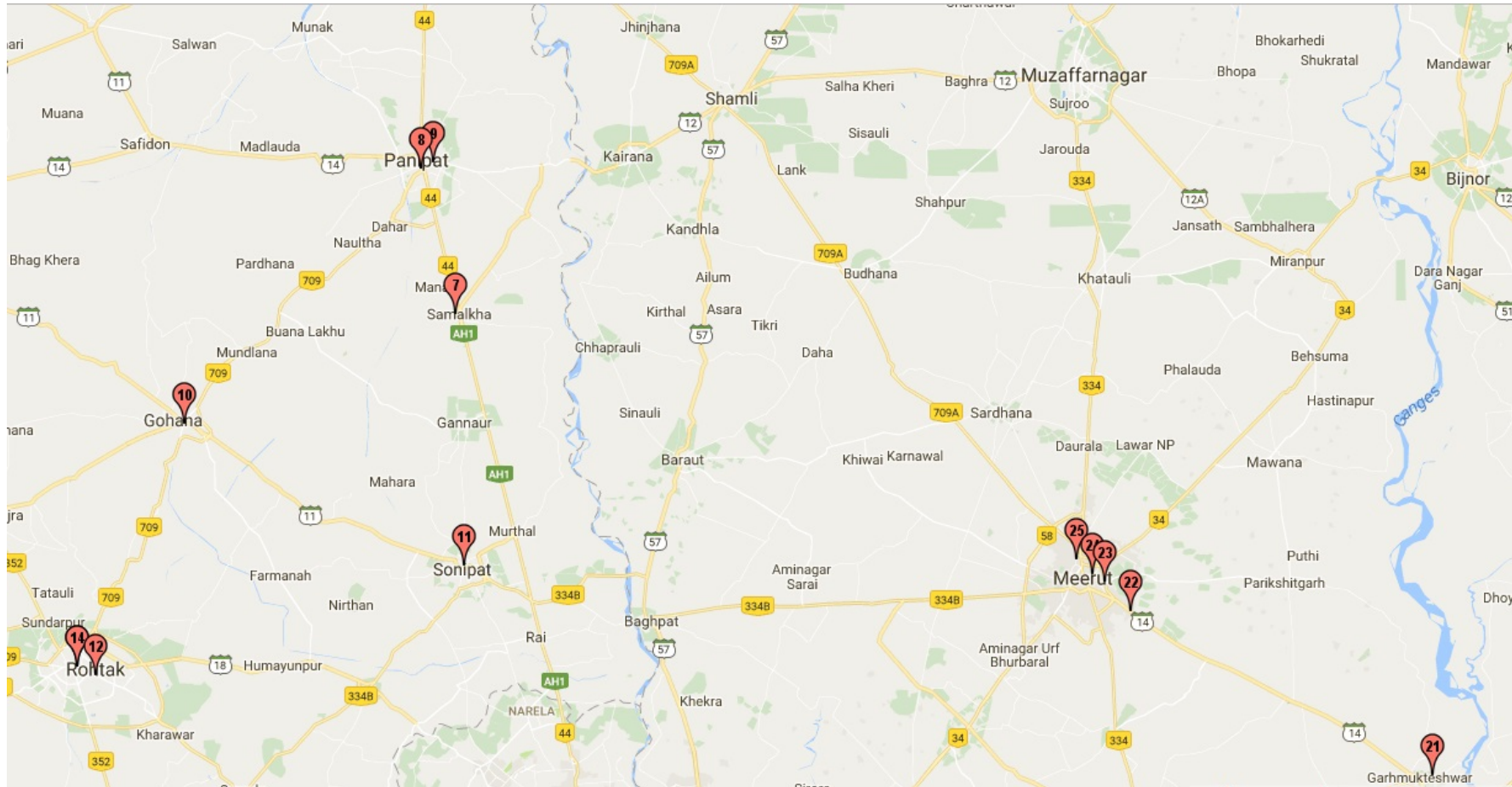
Conclusion: [Refer to tables (1-7) and attached location map (1-3)]

On the basis of survey conducted at different places in NCR of Delhi, following observations were obtained with respect to poor reception in some parts of NCR.

- ◆ In Delhi city areas, the line of sight distance from transmitters to various locations lies within 1 to 30 Km. As power of transmitters are quite high the field strength is more than 75 db μ V/m at most of the locations. Such high level of field strength gives better Signal to Noise ratio and receivers are able to provide good reception. The medium level of modulation does not give much problem in Delhi city.
- ◆ Reception problem observed in few locations in Ghaziabad even though field strength was more than 90 db μ V/ m. It was mainly due to the poor signal to noise ratio. The cause of such poor S/N is due to the large industrial activity in vicinity.
- ◆ Reception problem observed in new settlements of Faridabad in Indraprasth Channel (819 KHz) due to the low level of modulation at the time of observation. Maintaining high level of modulation will give better reception.
- ◆ Poor quality of reception observed in Garh Mukteshwar area (LOS distance 93 Km) on both the channels due to the low field strength and poor S/N ratio.
- ◆ Alwar city which is 141 Km LOS distance from transmitters also recorded poor reception due to the low level of S/N ratio. High modulation level will increase the reception quality.

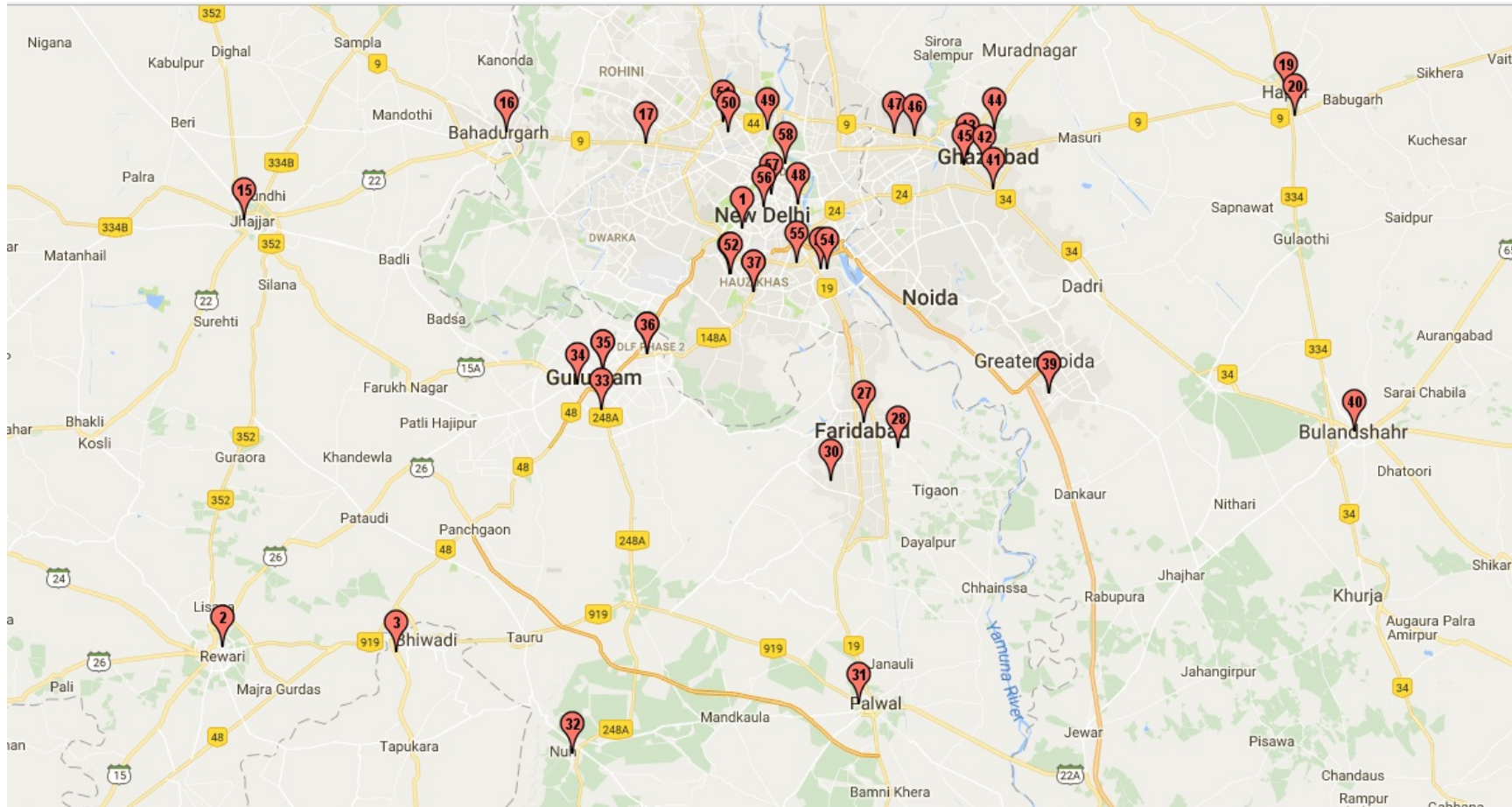
Low modulation is one of the major problems in receiving good quality AM medium wave reception in NCR areas, except at few selected place where S/N is poor due to increased industrial activity and manmade noise. No major reception problem observed in Delhi City areas. However low level of modulation observed at few places as measured on VNA analyzer. As this particular problem observed in different timings of the same transmitter, same can be attributed to error by operational staff. **Maintaining high level of modulation during entire transmission timings will certainly improves the reception.**

Survey Locations in Meerut, Sonipat, Panipat, Gohana & Rohtak



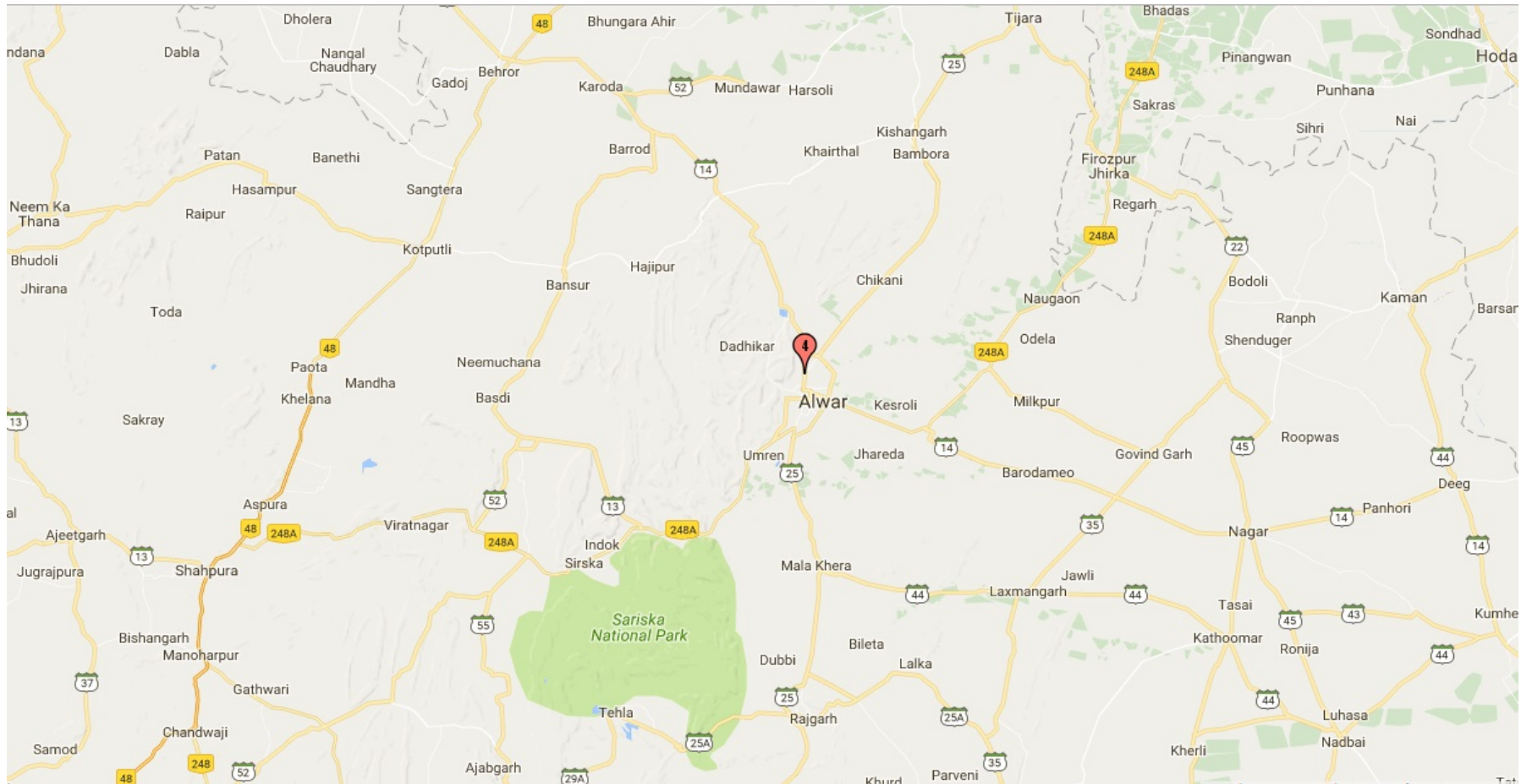
Map-1

Survey Locations in Hapur, Bulandshahr, G Noida, Delhi, Jhajjar, Ghaziabad, Gurgaon, Bhiwadi, Rewari & Nuh



Map-2

Survey Location in Alwar



Map-3

Reception Survey for Rajdhani & Indraprastha AIR channels, Nangli Transmitter

Table-1

Date: 21.09.16

NCR Area: Alwar, Rajsathan

Time HRS.	Map Ref.no.	Location	Rajdhani(666KHz)			Indraprastha(819KHz)			GPS Coordinates	L.O.S. Distance (Km)	Terrain	Remarks
			F/S dBμV/m	Sony Double Superhet	Philips Cheap receiver	F/S dBμV/m	Sony Double Superhet	Philips Cheap receiver				
1245	1	Malcha Marg	102	VG	VG	104	VG	G	28.60074 77.18771 225mt.	19.3	LRB/LT/VEG	Moderate Modulation
1500	2	Circular Rd., Rewari	87	G	G	86	G	G	28.20162 76.62359 256mt.	80	LRB/LT/MKT	More orientation reqd in receivers.
1630	3	Bhiwadi	84	VG	G				28.19655 76.81203	71	HRB/ LT/ Residential	Noisy (666 KHz) Low Modulation
1750	4	Alwer jail chauraha	74	G	F	64	NT	NT	27.58010 76.61494	141	HT/LRB/MKT/RES	Low Modulation

Legends: **LRB**-Low rise building, **HRB**-High rise buildings, **MKT**-Market area, **VEG**- Vegetation of 3-5 meter height, **MT**-Moderate Traffic, **LT**- Low Traffic, **HT**-High Traffic, **RES**-Residential area, **POP**- High density population, **NHW**-National Highway, **OA**-Open Area, **E**-Excellent, **VG**-Very Good, **G**-Good, **F**-Fair, **P**-Poor

Reception Survey for Rajdhani & Indraprastha AIR channels, Nangli Transmitter

Table-2

Date: 22.09.16

NCR Area: Sonipat, Gohana

Time HRS.	Map Ref.no.	Location	Rajdhani(666KHz)			Indraprastha(819KHz)			GPS Coordinates	L.O.S. Distance (Km)	Terrain	Remarks
			F/S dBμV/m	Sony Double Superhet	Philips Cheap receiver	F/S dBμV/m	Sony Double Superhet	Philips Cheap receiver				
1350		Medium wave xmitter,Nangli	119	VG	VG	134	VG	VG	28.46099 77.08132 202mt.	1	HT/OA	
1530	7	Railway Rd. market,Samal Khan	99	VG	VG	93	VG	VG	29.24112 77.00673 231mt.	54	LRB/LT/POP/MKT/RES	More orientation reqd.
1600	8	Katki Market,Panipat	87	VG	VG	85	VG	VG	29.38256 76.96889 233mt.	70	LRB/LT/POP/MKT	Noisy (666 KHz)
1620	9	Sonari Rd.Panipat	91	VG	G	93	VG	G	29.38831 76.98222 232mt.	70	LRB/LT/POP/MKT	Moderate Modulation
1715	10	Gohana Petrol pump	92	VG	VG	98	VG	VG	29.13416 76.70456 219mt.	58	LRB/LT POP/MKT	---do---
1900	11	Mohallah Kallan,Sonipat	94	VG	G	100	VG	G	28.99653 77.01749 223mt.	28	LRB/MKT	---do---

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Date: 23.09.16

NCR Area: Rohtak,Maham(Haryana)

Time HRS.	Map Ref.no.	Location	Rajdhani(666KHz)			Indraprastha(819KHz)			GPS Coordinates	L.O.S. Distance (Km)	Terrain	Remarks
			F/S dB μ V/m	Sony Double Superhet	Philips Cheap receiver	F/S dB μ V/m	Sony Double Superhet	Philips Cheap receiver				
1345	12	Model Town,Rohtak	90	VG	VG	98	VG	VG	28.88965 76.60629 217mt.	53	HT/LRB/MKT	
1400	13	Civil line,Apna bazaar,Chotu ram chowk,Rohtak	84	VG	VG	93	VG	VG	29.89751 76.58589 217mt.	55	HT/LRB/MKT	
1450	14	Azad chowk,Maham	89	VG	VG	88	VG	VG	28.89745 76.58583 225mt.	84	HT/LRB/MKT	
1700	15	Chikkara chowk,JHAJJAR	91	VG	G	96	VG	G	28.60876 76.64771 219mt.	51	HT/LRB/MKT	
1810	16	Billo pakode wala,Bahadurgarh,H/Way Rohtak	101	VG	G	107	VG	G	28.69127 76.93195 209mt.	21	HT/LRB/MKT/POP	
1900	17	Peeragarhi metro station	110	VG	G	114	VG	G	28.68108 77.08324 205mt.	11	LRB/HT/HIGHWAY	

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Reception Survey for Rajdhani & Indraprastha AIR channels, Nangli Transmitter

Table-4

Date: 26.09.16

NCR Area: Meerut, Ghaziabad (U.P.)

Time HRS.	Map Ref.no.	Location	Rajdhani(666KHz)			Indraprastha(819KHz)			GPS Coordinates	L.O.S. Distance (Km)	Terrain	Remarks
			F/S dB μ V/m	Sony Double Superhet	Philips Cheap receiver	F/S dB μ V/m	Sony Double Superhet	Philips Cheap receiver				
1400	19	Near Tehsil chowraha, Hapur	90	G	F	91	G	F	28.72767 77.77695 245mt.	62	HT/POP/MKT	Low Modulation
1405	20	NHW, Moradabad	91	G	F	91	G	F	29.70758 77.78601 213mt.	63	HT/OA	---do---
1515	21	Garh Mukteshwar	69	P	P	63	P	P	28.79148 78.09611 193mt.	93	LRB/LT/RES	---do----
1620	22	Garh Road, Meerut	74	G	G	72	G	F	28.95143 77.75959 215mt.	64	LRB/HT/VEG/NHW	---do---
1650	23	Near jail chungi chowraha, Meerut	88	G	G	84	G	G	28.98083 77.73114 218mt.	62	LRB/HT/VEG	----do----
1700	24	Civil lines , Meerut	78	G	F	86	G	F	28.98767 77.71714 220mt.	61	LRB/HT/VEG	---do--

Legends: **LRB**-Low rise building, **HRB**-High rise buildings, **MKT**-Market area, **VEG**- Vegetation of 3-5 meter height, **MT**-Moderate Traffic, **LT**- Low Traffic, **HT**-High Traffic, **RES**-Residential area, **POP**- High density population, **NHW**-National Highway, **OA**-Open Area, **E**-Excellent, **VG**-Very Good, **G**-Good, **F**-Fair, **P**-Poor

Date: 27.09.16

NCR Area: Faridabad (Haryana)

Time HRS.	Map Ref.no.	Location	Rajdhani(666KHz)			Indraprastha(819KHz)			GPS Coordinates	L.O.S. Distance (Km)	Terrain	Remarks
			F/S dBμV/m	Sony Double Superhet	Philips Cheap receiver	F/S dBμV/m	Sony Double Superhet	Philips Cheap receiver				
1145	26	Sarai Gullena				95	VG	VG	28.56183 77.27256 221mt.	26	HT/VEG/RES	Low Modulation
1225	27	Old Faridabad	88	VG	VG	70	VG	VG	28.41609 77.31854 206mt.	43	HT?LRB/NHW	---do---
1245	28	Sec.81,Nahar park Faridabad	72	G	G	82	F	F	28.39097 77.34666 197mt.	46	LRB/LT/RES	Low Modulation in 819
1315	29	NIT,Faridabad	81	G	G	64	F	F	28.37962 77.29765 194mt.	46	LRB/HT/MKT	Low Modulation in 819.
1340	30	Parvatiya colony,Faridabad	77	G	G	73	F	F	28.35950 77.28387 197mt.	47	LT/POP/MKT	---do---
1540	31	Pallaval,Sec.2,Faridabad	84	G	F	78	G	G	28.14724 77.31350 210mt.	71	LT/NHW/OA	
1640	32	Nuh (Mewat)	66	F	P	68	P	P	28.09975 77.00300 188mt.	75	LT/VEG/RES	Low Modulation
1800	33	Near Central park-II,Railway Rd.,Gurugram	91	G	G	92	G	G	28.42770 77.03471 235mt.	39	HT/OA	
1850	34	Krishna Ngr,Pattaudi Rd.,Gurugram	95	G	G	80	P	P	28.45212 77.00832 304mt.	37	HT/MKT/OA	Poor S/N Ratio
1915	35	Delhi Rd.,Gurugram	86	VG	VG	93	VG	VG	28.46425 77.03559 237mt.	35	HT/LRB	
1945	36	M.G. Rd.,Gurugram	94	VG	VG	84	VG	VG	28.48030 77.08366 228mt.	32	HT/HRB	
2040	37	Arvindo Marg	87	VG	VG	92	VG	VG	28.54003 77.19919 216mt.	26	HT/POP/MKT	

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Reception Survey for Rajdhani & Indraprastha AIR channels, Nangli Transmitters.

Table-6

Date: 28.09.16

NCR Area: Greater Noida, Ghaziabad (U.P.)

Time HRS.	Map Ref.no.	Location	Rajdhani(666KHz)			Indraprastha(819KHz)			GPS Coordinates	L.O.S. Distance (Km)	Terrain	Remarks
			F/S dB μ V/m	Sony Double Superhet	Philips Cheap receiver	F/S dB μ V/m	Sony Double Superhet	Philips Cheap receiver				
1315	38	Sec. phi -2, Greater Noida	78	G	G	87	G	G	28.44316 77.51889 186mt.	52	OA/VEG	
1400	39	Sikandarabad (UP)	86	G	G	70	G	G	28.44315 77.51885 203mt.	65	LT/LRB/MKT	
1430	40	Kala aankh chauraha, Bulandshehar	69	F	F	79	G	F	28.40691 77.85000 190mt.	80	LRB/HT/RES	Low Modulation
1645	41	Lal kuan ,Ghaziabad	97	G	G	85	G	F	28.63794 77.45869 220mt.	36	LRB/HT/Noisy	---do---
1700	42	Naasirpur phatak, Ghaziabad	86	G	G	97	G	G	28.65907 77.44918 205mt.	32	HT/VEG/RES	
1710	43	Old bus stop Chowk ,near Santosh hospital	100	G	G	102	G	G	28.67011 77.43174 206mt.	30	HT/NHW	
1720	44	Block G, Sanjay ngr., Ghaziabad	100	F	G	99	G	G	28.69392 77.46027 208mt.	32	LT/VEG/RES/LRB	
1745	45	Near Railway stn., Ghaziabad	96	G	F	97	F	F	28.65997 77.42765 202mt.	30	HT/LRB/MKT	Low modulation
1815	46	Hindon Air Force chowk	92	G	G	99	G	G	28.68805 77.37397 201mt.	24	HT/OA	
1850	47	Yamuna Vihar, Block C-4	104	G	G	96	G	F	28.69010 77.35229 194mt.	15	HT/NHW	

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Date: 30.09.16

NCR Area: Delhi

Time HRS.	Map Ref.no.	Location	Rajdhani(666KHz)			Indraprastha(819KHz)			GPS Coordinates	L.O.S. Distance (Km)	Terrain	Remarks
			F/S dB μ V/m	Sony Double Superhet	Philips Cheap receiver	F/S dB μ V/m	Sony Double Superhet	Philips Cheap receiver				
1120	48	Red Fort(backside)	96	VG	VG	98	VG	VG	28.62322 77.24696 223mt.	16	HT/OA	
1135	49	Vivhva vidyalaya metro stn.	101	VG	VG	101	VG	VG	28.69447 77.21502 205mt.	11	HT/LRB/ Metro station	
1205	50	DDA Flats,Ashok Vihar,Phase -1	113	VG	VG	109	VG	VG	28.69208 77.17224 214mt.	09	LRB/LT/VEG	
1410	51	Wazirpur	101	VG	VG	100	VG	VG	28.70201 77.16711 236mt.	23	LRB/HT/POP/MKT	
1545	52	Munirka mkt.	99	VG	VG	96	VG	VG	28.55623 77.17505 240mt.	24	HT/LRB/MKT	
1615	53	Kalkaji main mkt.	84	VG	VG	91	VG	VG	28.55682 77.17411 233mt.	27	LT/HRB/POP/MKT	
1700	54	Jamia Millia university	97	VG	VG	93	VG	VG	28.56130 77.27942 209mt.	30	LT/LRB/VEG	
1720	55	Lajpat Ngr Mkt.				91	VG	VG	28.56746 77.24683 243mt.	24	HT/HRB/POP/MKT	
1800	56	Akashwani Bhawan	104	VG	VG	104	VG	VG	28.62041 77.21042 202mt.	18	HT/HRB/VEG	
1815	57	Connaught Place	105	VG	VG	106	VG	VG	28.63321 77.21843 202mt.	17	HT/LRB/VEG	
1840	58	Red Fort ,main gate (Bus Stand)	103	VG	VG	103	VG	VG	28.63318 77.21842 205mt.	16	HT/POP/MKT/LRB	
1900	59	Opp.old Railway Stn.DELHI	106	VG	VG	107	VG	VG	28.66226 77.23336 206mt.	15	HT/LRB/POP/MKT.	

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