

Impact of DCC On Coverage Area And Audio Quality

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On Coverage area
And audio Quality**

PROPAGATION LAB

Research Department

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Introduction

Prohibitive increase in cost of energy has prompted manufacturers of AM-DSB High power Transmitters to explore possible ways of increasing the efficiency and thereby reduction of energy consumption of the plant. However, any such modification in the characteristics of the radiated AM-DSB signal should not demand changes in the characteristics of the existing domestic AM-DSB receivers. That means whatever system is adopted; it should be compatible with the existing receivers.

In Dynamic Carrier Control system, the carrier component of AM-DSB is companded dynamically in accordance with some law, instead of keeping it as static as in a conventional transmitter, thus reducing the power drawn from mains

Objectives of Survey

DG: AIR vide letter no. 8/14/2017-E1 dated 7/11/17 has instructed the Research Department to study the impact of DCC on coverage areas and audio quality compared to static carrier system presently in use all over the country. For this purpose the AIR Directorate has suggested to take necessary measurements on DCC signals originating from 200 KW MW DRM transmitter of Delhi-A service.

Equipment Used

1. Field strength cum Spectrum Analyzer, Anritsu MS 2035B & MS 2013E.
2. Magnetic loop antenna (Schwarzbeck)
3. GPS, Garmin Montana 650.
4. Sony Synthesized portable receiver.
5. Philips Bahadur Portable receiver.
6. R&S make EMI test receiver ESPC.

7. Tata Safari Survey van with Sine wave UPS.
8. Other accessories as per requirements.

DCC Modes

Delhi-A transmission is being radiated by Nautel make 200 KW (NX-200) transmitter located near Nangli area of Delhi. The NX 200 is capable of several DCC modes, each with varying performance in terms of energy savings and effects on the reproduced signal. The selectable options are:

- AMC
- EAMC
- DAM (Basic)
- DAM (Full)
- DCC1

In AMC and EAMC the standard reduction in carrier is 3 dB, where as in rest others the reduction goes up to 4.4 dB.

Transmitter Details:

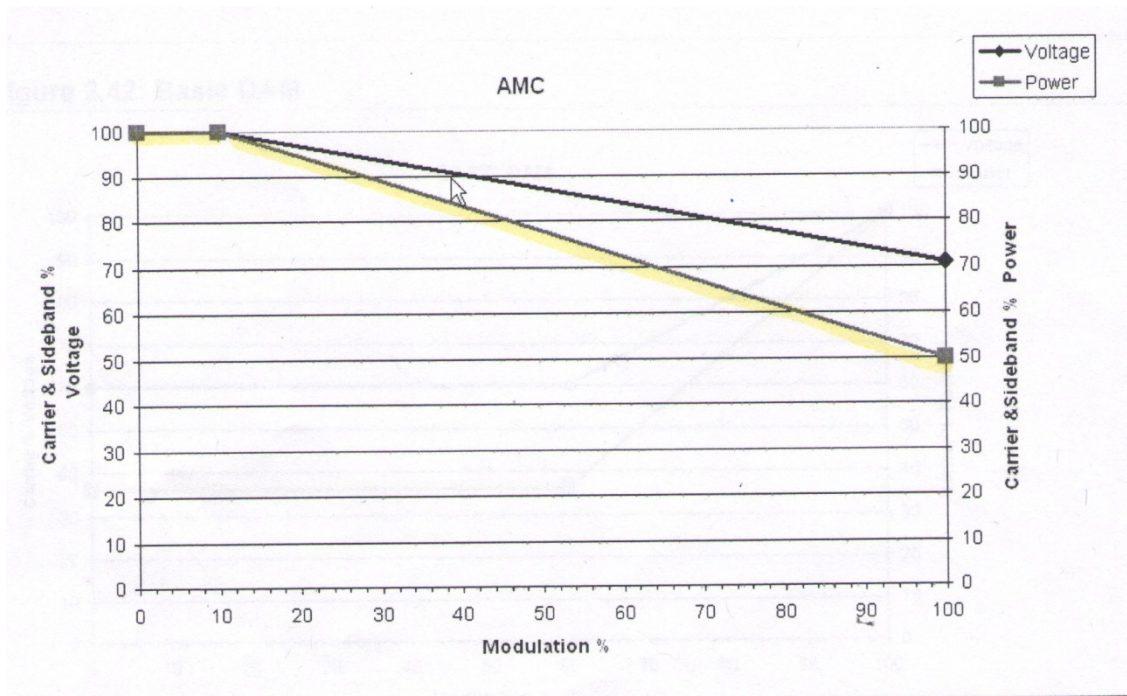
- | | |
|--------------------------------------|-----------------------------------|
| 1. Name of the Station | : HPT, AIR, Khampur-Delhi |
| 2. Co-Ordinates of transmitting mast | : N 28° 46' 09.9" E 77° 08' 13.2" |
| 3. Terrain around Transmitter | : Urban/ Populated/ Residential |
| 4. Rated power of the transmitter | : 200 KW |
| 5. Make | : Nautel |
| 6. Frequency of operation | : 819 KHz (Analogue-DSB) |

Measurement Method

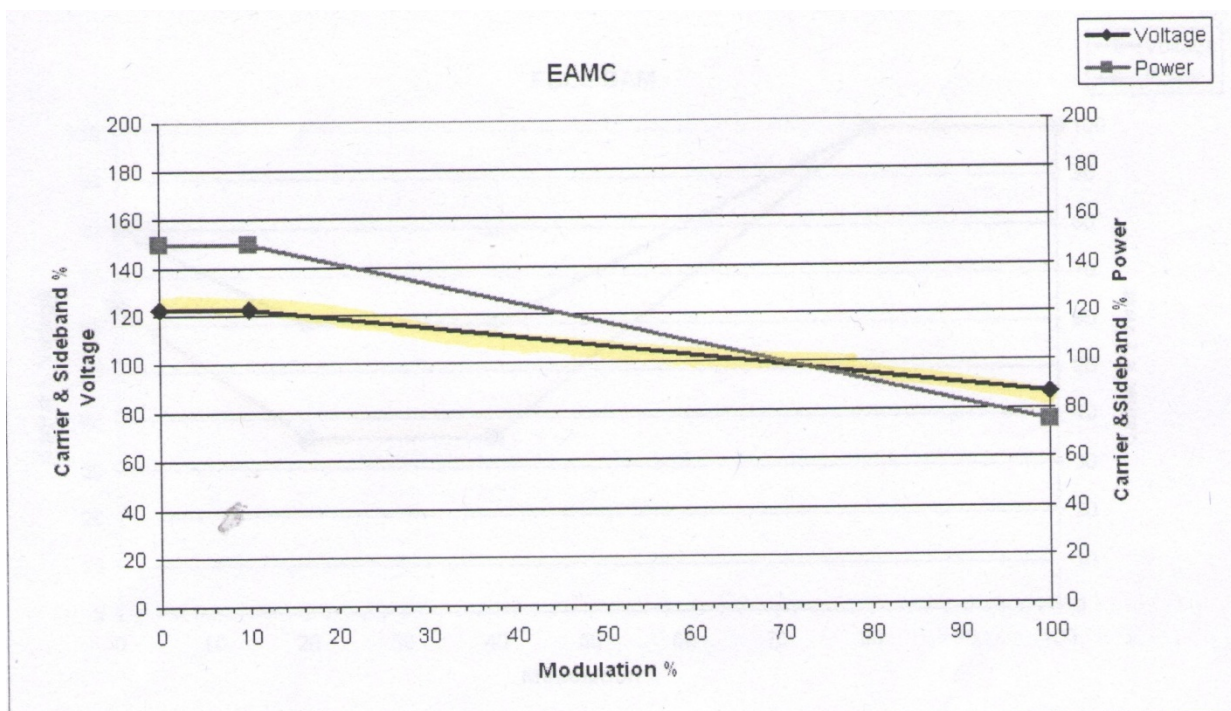
As per the instructions of the AIR Directorate, DCC survey was conducted on Delhi-Jaipur, Delhi-Amritsar and Delhi-Agra routes. At later stage additional

one route was also tested for DCC in West-Bengal. Following types of DCC is available in Nautel Medium Wave transmitter.

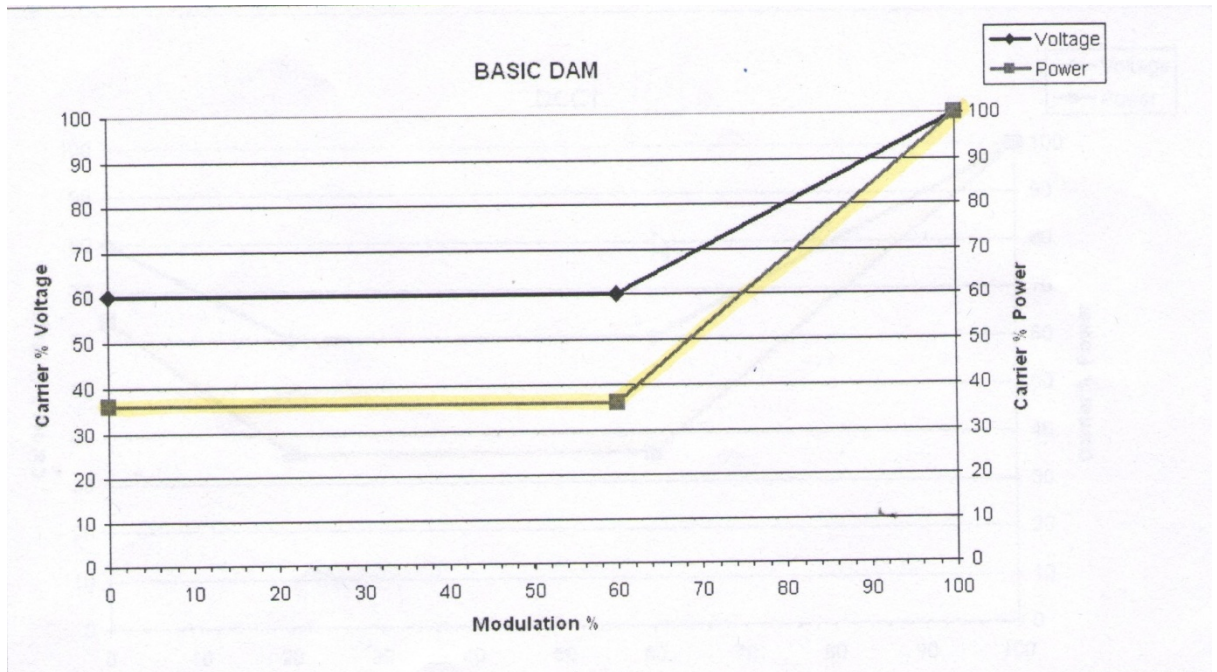
1. AMC



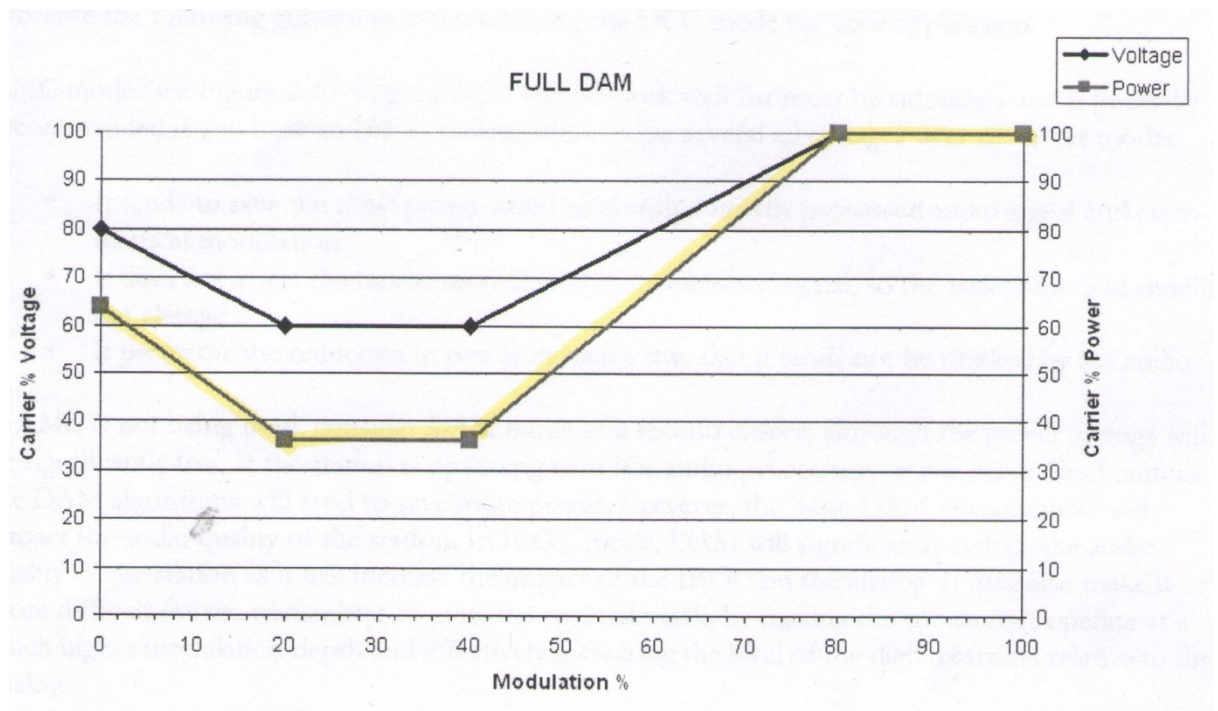
2. EAMC



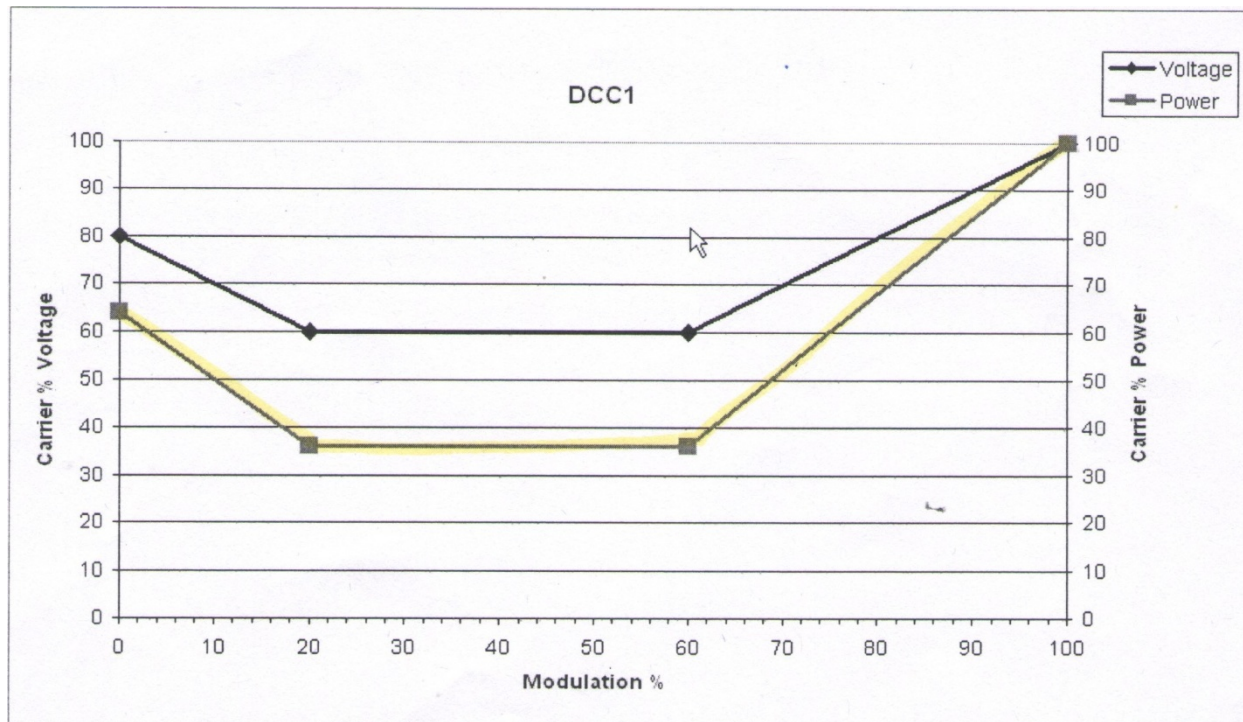
3. DAM (Basic)



4. DAM FULL



5. DCC1



All the above DCC options in Medium Wave transmitter were tested on Delhi-Jaipur route to finalize the particular mode of DCC as per best possible reception with less reduction in coverage. The survey results of Jaipur route clearly suggest the application of DCC in AMC (3db) (Table-1) is better choice in terms of quality of subjective reception and coverage compared to the normal 200 KW transmission.

In order to check the performance of DCC in different terrain conditions in different areas, additional routes of Delhi-Jalandher-Amritsar and Delhi-Agra-Dholpur route were also selected for survey. Meanwhile on the basis of preliminary results of Delhi-Jaipur route survey, the DG-AIR has decided to assess the AMC (3 db) mode of DCC only in remaining routes. It was also suggested to check the performance of transmission in Pre-Emphasis on mode also.

A survey map is also annexed with this report for comparison purpose.

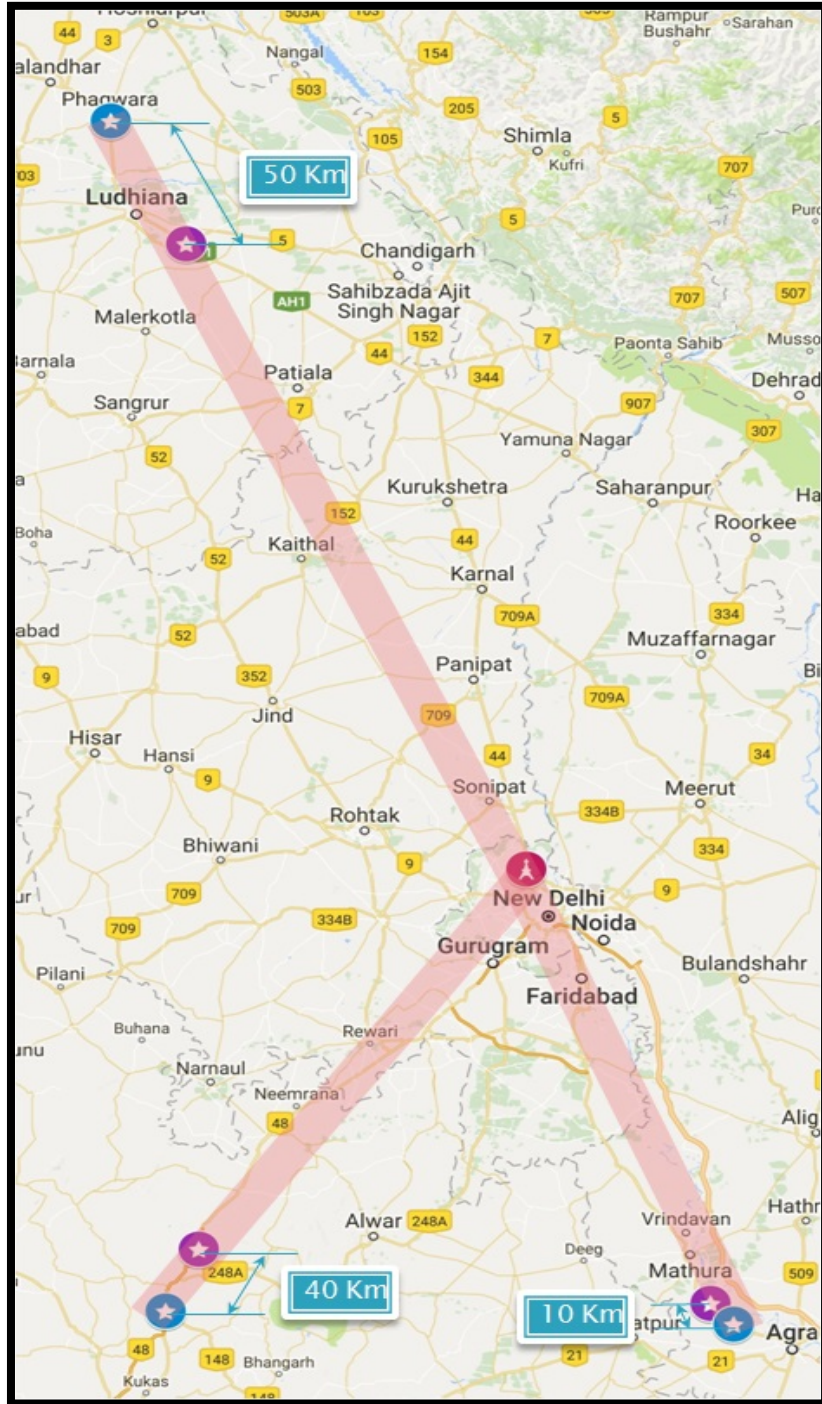
Accordingly remaining survey on different routes was carried out (Table-2 &3) and data collected were analyzed for final observations. The findings of surveys are as follows:

Conclusion

Route	Normal coverage on 200 kw transmission as per ITU defined minimum signal requirement	Coverage after application of DCC in AMC (3db) mode	Reduction in coverage compared to normal transmission of 200 Kw
Delhi-Jaipur	200 Km	175 Km	25 Km
Delhi-Jalandher	300 Km	250 Km	50 Km
Delhi-Agra	180 Km	170 Km	10 Km

Based on the findings of survey, it is suggested that any one 200 KW medium wave transmitter in AIR network may be used for DCC-AMC (3db) mode for three to four months for assessment of power supply savings. However, it is a tradeoff between power supply savings at the cost of reduction in coverage.

DCC Coverage Map



Red Star: Coverage in DCC (AMC-3db)

Blue Star: Coverage in Full 200 Kw

DCC SURVEY

Table-1

ROUTE: Delhi –Jaipur-Ajmer

Sr. No	Time & Date	Place & LOS Distance from Tx.	Filed Strength (dBμ V/m) (F/S) & Subjective Assessment on popular Philips Radio (S/A)														Remarks
			SURVEY PARAMETERS														
			Full Power 200 kW		Half Power 100 kW		AMC (3db)		EAMC (3db)		DAM (Basic)		DAM (Full)		DCC 1		
			F/S	S/A	F/S	S/A	F/S	S/A	F/S	S/A	F/S	S/A	F/S	S/A	F/S	S/A	
1.	1900 15/12/17	25	101	VG	98	VG	99	VG	100	VG	98	VG	98	VG	98	VG	Main Road
2.	1725 15/12/17	50	82	G +2	78	G +3	80	G +2	80	G +2	79	G +3	79	G +3	78	F +4	Highways
3.	1626 15/12/17	75	84	VG	81	VG +1	83	VG +1	82	VG +1	81	VG +2	82	VG +2	81	VG +2	Open Field
4.	1528 15/12/17	100	82	VG LM	78	VG LM	80	VG	80	VG	78	VG	79	VG	78	VG	Highways
5.	1355 15/12/17	126	79	VG	75	VG +1	77	VG +1	77	VG	75	VG	76	VG	75	VG +1	National Highways
6.	1340 14/12/17	151	71	G	67	G	66	G +1	66	G +2	64	G +2	65	G +2	64	G +2	Highways
7.	1448 14/12/17	175	65	G	61	G +3	61	G +3	61	G +3	61	G +4	60	G +4	61	G +4	Highways
8.	1550 14/12/17	200	62	F +2	57	F +4	52	F +4	53	F +4	56	F +3	57	F +3	55	F +4	Highways
9.	1655 14/12/17	226	57	F +4	48	P +5	55	P +5	52	P +5	54	P +4	45	P +4	53	P +3	Highways
10.	1020 15/12/17	249	45	P +5	← Very Noisy →											City Outskirts	

LEGENDS:-

Subjective noise in normal receivers compared with background noise of reception in 200 kHz (Analog) mode

VG-Very Good G-Good F-Fair P-Poor LM- Low Modulation

+1 - Light Noise +2 - Clear Noise +3 - Moderate Noise +4 - High Noise +5 - Very High Noise/Not Audible

DCC SURVEY

Table-2

ROUTE: DLEHI-JALLANDHAR

Date/ Time	Location	L.O.S Distance In Km from Nangli Tx.	Full Power 200 KW			DAM – BASIC (3dB)						AMC (3dB)						Terrain	Remarks
						Pre-Emphasis -OFF			Pre-Emphasis -ON			Pre-Emphasis -OFF			Pre-Emphasis -ON				
			F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment			
				Sony	Philips		Sony	Philips		Sony	Philips		Sony	Philips		Sony	Philips		
16/2/18 2145	NEAR SONIPAT	25	102.2	VG	VG	99.8 TX POWER 94-107 KW	VG	VG	99.9 TX POWER 97-128 KW	VG	VG	101.2 TX POWER 131-157 KW	VG	VG	100.8 TX POWER 166-178 KW	VG	VG	OA/HT	
16/2/18 1820	TEHSIL CAMP PANIPAT	75	88.7	VG	VG	86.5 TX POWER 93-124 KW	VG	VG	86.7 TX POWER 90-145 KW	VG	VG	87.5 TX POWER 140-161 KW	VG	VG	87.1	VG	VG	HT/MRB	
15/2/18 1145	BEFORE KURUKSH ETRA	125	80	VG	VG	77.4	VG	VG	77.5 TX POWER 112-145 KW	VG	VG	78.9 TX POWER 130-180 KW	VG	VG	78.7 TX POWER 125-180 KW	VG	VG	HT/LRB	
15/2/18 1330	PUHOWA PATIALA ROAD	150	77.5	VG	VG	74.6 TX POWER 112-195 KW	VG	VG	74.9 TX POWER 94-134 KW	VG	VG	76.4 TX POWER 154-184 KW	VG	VG	77.1 TX POWER 114-186 KW	VG	VG	VEG/LT/LRB	
15/2/18 1425	PANJETA PUNJAB	175	74.5	VG	VG	71.7 TX POWER91- 118 KW	VG	G +1	71.9 TX POWER 93-137 KW	VG +1	G +1	73.1 TX POWER 115-174 KW	G +1	G +1	73.7 TX POWER 124-185 KW	VG	G +1	VEG/LT	
15/2/18 1650	PATIALA NABHA SH	200	74	G +1	G +1	69.2 TX POWER 129-196 KW	G +2	G +2	70.8 TX POWER 88-134 KW	G +2	G +2	65.6 TX POWER 129-196 KW	G +2	G +2	65.8 TX POWER 124-180 KW	G +2	G +2	VEG/LT	
15/2/18 1730	NEAR MALERK OTLA PUNJAB	225	72.6	G AUDIB LE NOISY	G NOISY	61.8	G +2	F +3	65.8	G +2	G +2	69.2 TX POWER 112-180 KW	G +2	G +2	72.2 TX POWER 120-175 KW	G +2	G +3	VEG/LT/LRB	

DCC SURVEY

ROUTE: DLEHI-JALLANDHAR

Table-2

Date/ Time	Location	L.O.S Distance In Km from Nangli Tx.	Full Power 200 KW		DAM – BASIC (3dB)						AMC (3dB)						Terrain	Remarks	
					Pre-Emphasis -OFF			Pre-Emphasis -ON			Pre-Emphasis -OFF			Pre-Emphasis -ON					
			F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment			
				Sony	Philips		Sony	Philips		Sony	Philips		Sony	Philips		Sony			Philips
16/2/18 1530	DORAHA PUNJAB	250	65.6	G	F NOISY	<u>62.7</u>	G +1	F +1	<u>63.6</u> TX POWER 99-125 KW	G	F +2	<u>63.5</u> TX POWER 101-175 KW	G +1	F +2	<u>64.5</u> TX POWER 119-180 KW	G	F +2	HT/MRB	
16/2/18 1435	NEAR PHILLAUR	275	57.6	P	NT	54.8 TX POWER 92-114 KW	P +1	NT	55.2 TX POWER 96-137 KW	P P+2	NT	56.1 TX POWER 129-170 KW	P +2	NT	56.6	P +2	NT	HT/VEG/OA	
16/2/18 1350	URBAN ESTATE PHAGWARA	300	<u>62.2</u>	F	P	60.5 TX POWER 96-115 KW	F +2	P +2	60.2 TX POWER 95-138 KW	F +1	P +1	61.3 TX POWER 125-140 KW	F	P	61.4 TX POWER 124-150 KW	F +2	P +1	LRB/VEG/LT	
16/2/18 1130	OLD GT ROAD JALLANDHAR	330	49	NT	NT	---	NT	NT	---	NT	NT	---	NT	NT	---	NT	NT	VEG/LRB/LT	
16/2/18 1220	JALLANDHAR AMRITSAR ROAD	350	50	P	NT	---	NT	NT	---	NT	NT	---	NT	NT	---	NT	NT	HT/OA	

- Legends:
1. SA-SUBJECTIVE ASSESSMENT, E-Excellent, VG-Very Good, G-Good, F-Fair, P-Poor
 2. NT-Not Traceable, LRB-Low rise buildings, VEG-Moderate vegetation near survey locations, OA-Open areas, LT-Low vehicular traffic, HT-High vehicular Traffic, MRB-Medium rise building (3-5 storey buildings).
 3. The corresponding increase in noise w.r.t Subjective Assessment of 200 Kw signal is shown as: +1-Clear increase in background noise, +2-Moderate Increase in noise, +3-Large increase in noise masking transmission content.

DCC SURVEY

Table-3

ROUTE: DLEHI-AGRA-DHOLPUR

Date/ Time	Location	L.O.S Distance In Km from Nangli Tx.	Full Power 200 KW			DAM – BASIC (3dB)						AMC (3dB)						Terrain	Remarks
						Pre-Emphasis -OFF			Pre-Emphasis -ON			Pre-Emphasis -OFF			Pre-Emphasis -ON				
			F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment			
				Sony	Philips		Sony	Philips		Sony	Philips		Sony	Philips		Sony	Philips		
22/3/18 0945	FBD BY PASS NH	50	78.4	G	G	77.2 TX POWER 87-114 KW	G +1	G +2	75.7 TX POWER KW	G	G +1	77.7 TX POWER 131-140 KW	G	G	77.3 TX POWER - KW	G +1	G +1	LRB/HT	
22/3/18 1200	EXPRESS WAY PALWAL NH	75	81.6	VG	VG	79.2 TX POWER 96-110 KW	VG +1	VG +1	79.1 TX POWER 87-120 KW	VG	VG	80.7 TX POWER 112-146 KW	VG +1	VG +1	79.9	VG	VG	LRB/HT/OA	
22/3/18 1315	AGRA NH NEAR SEMRI	126	73.9	VG	VG	70.4	VG	VG	70.3 TX POWER 82-153 KW	VG	VG	72.3 TX POWER 130-145 KW	VG	VG	71.8 TX POWER 115-180 KW	VG	VG	LRB/HT/OA/ NH/	
22/3/18 1405	MATHUR A CITY	150	69.5	G	G	66.4 TX POWER 95-113 KW	G	G	66.6 TX POWER 93-133 KW	G	G	67.8 TX POWER 124-170 KW	G	G	67.6 TX POWER 124-181 KW	G	G	LRB/HT/CITY	
23/3/18 1120	BEFORE AGRA	170	66.6	G	G	<u>63.3</u> TX POWER 73-115 KW	G	G +1	<u>63.5</u> TX POWER 82-115 KW	G +1	G +1	<u>65.4</u> TX POWER 130-170 KW	G +1	G +1	<u>65.2</u> TX POWER 132-174 KW	G	G +1	OA	
23/3/18 1200	DELHI AGRA NH	175	64	G	F	59.8 TX POWER 88-112 KW	G	F +1	59.9 TX POWER 96-118 KW	G	F +1	61.3 TX POWER 130-190 KW	G +1	F +2	61.6 TX POWER 118-180 KW	G	G +1	HT/OA	
23/3/18 1220	NEAR AGRA BYPASS	180	<u>63.5</u>	G	G	<u>60.3</u> TX POWER 91-119	G	G	<u>60.7</u> TX POWER 92-121 KW	G +1	G +1	<u>62</u> TX POWER 130-145 KW	G	G +1	<u>62.4</u> TX POWER 111-190 KW	G	G +1	NH/NEAR FLYOVER	

DCC SURVEY

Table-3

ROUTE: DLEHI-AGRA-DHOLPUR

Date/ Time	Location	L.O.S Distance In Km from Nangli Tx.	Full Power 200 KW			DAM – BASIC (3dB)						AMC (3dB)						Terrain	Remarks
						Pre-Emphasis -OFF			Pre-Emphasis -ON			Pre-Emphasis -OFF			Pre-Emphasis -ON				
			F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment		F/S dBµV/m	Subjective Assessment			
				Sony	Philips		Sony	Philips		Sony	Philips		Sony	Philips		Sony	Philips		
23/3/18 1000	TAJ NAGRI AGRA CITY	200	59	F	F	56	F +3	F +3	56.4	F +3	F +3	55.8	F +2	F +2	55.4	F +2	F +2	LT/MRB/HD P	
22/3/18 1630	AGRA CANTT AREA	200	57.0	F	F	55	F +1	F +1	55.3	F +1	P	55.6	F +1	P	55.7	F +1	P	HT/VEG/OA	
22/3/18	AGRA DHOLPUR ROAD	225	<u>60</u>	G	G	58.5 TX POWER 88-150 KW	G +2	G +2	57.7 TX POWER 96-154 KW	G +2	G +2	59.6 TX POWER 115-155 KW	G +1	G +2	59 TX POWER 125-173 KW	G +1	G +2	OA/VEG/MT	

- Legends:
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 2. NT-Not Traceable, LRB-Low rise buildings, VEG-Moderate vegetation near survey locations, OA-Open areas, LT-Low vehicular traffic, HT-High vehicular Traffic, MRB-Medium rise building (3-5 storey buildings).
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