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AIR & DD

Study of co-channel capture effect

in FM Band at

Vadodara, Surat & Ahmedabad

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RESEARCH REPORT NO. 903

GROUP	Propagation, Spectrum & Monitoring (PSM)
SUBJECT	Study of co-channel capture effect in FM Band at Vadodara, Surat & Ahmedabad
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INTRODUCTION

In compliance of DG: AIR letter no. 8/1/2012-EIII dated 14/8/12, a research team, consisting of Md Javed Shams (AE), Shri G.P. Srivastava (AE) and Shri Sushil Kumar(Tech.), was deputed on a tour to Vadodara(Gujarat) from 10th September 2012 to 20th September 2012 to carry out field strength measurement and subjective listening to assess the capture effect between co-channel FM transmitters situated in Vadodara, Ahmedabad and Surat.

OBJECTIVES OF SURVEY

Main objective of the survey was as follows:

- Field strength measurement of FM Transmitters operating on frequencies viz. 91.1 MHz, 92.7 MHz and 98.3 MHz en route Vadodara to Surat.
- F/S measurement on frequencies viz. 91.1 MHz, 93.5 MHz and 98.3 MHz en route Vadodara to Ahmedabad (Ahmd).
- Subjective listening of all four operating frequencies simultaneously along the routes from Vadodara to Ahmedabad and Vadodara to Surat.
- Assess the capture effect (corresponding L.O.S distance) between co-channel FM transmitters on two routes i.e., Vadodara to Ahmedabad and Vadodara to Surat.

INSTRUMENTS USED

Following equipment/instruments were utilized for collection of field strength data and subjective listening:-

1. Field Strength Meter (Anritsu Make, Model No. ML 524B)
2. Standard VHF dipole Antenna(25-250MHz) (Anritsu make, Model No. MP534)
3. AM/FM Receiver (Sony Make, Model No. ICF)
4. Portable AM/FM receiver (Phillips Make, Model No. DL167)
5. GPS Receiver (GRAMIN make, Model No. M5)

MEASUREMENT PROCEDURE

In order to know the L.O.S distance from two different FM transmitters for the purpose of capture effect following method was adopted during survey:-

- First of all, a proper route was selected between co-channel transmitters of Vadodara and Surat/Ahmedabad. The routes between Vadodara to Surat and Vadodara to Ahmedabad were marked along the National Highway/State Highway on a map. On

Vadodara-Surat and Vadodara-Ahmedabad route, F/S measurements were carried out starting from transmitting antenna site increasing the L.O.S distance at an interval of 5 km.

- Field Strength measurements were taken for a period of about 5 minutes on each of three frequencies using standard VHF dipole antenna. The stable readings were taken during this period to achieve best received signal at that particular location. Further F/S meter was calibrated for each frequency and the meter was **switched off** after every measurement at each spot to avoid any memory related effect on meter readings.

- Simultaneously, subjective listening of that particular operating frequency was also carried out along the directions from Vadodara to Ahmedabad, Vadodara to Surat and back.

- After observing full capture condition by co-channel transmitter on route from Vadodara to Surat/ Ahmedabad, the survey was again carried out on the reverse routes towards Vadodara starting from individual transmitter sites at Surat/ Ahmedabad.

COLLECTION OF DATA

- The field strength meter alongwith the standard VHF dipole antenna, GPS receiver and FM receivers were used for collection of data. The F/S meter was calibrated for each of three frequencies and the meter was switched off after every measurement in each spot to avoid any memory related effect on meter readings.

- Before undertaking the survey, location of transmitting antenna at Surat, Vadodara and Ahmedabad were ascertained and stored in GPS receiver so as to measure the L.O.S distance at each spot. The RF Power output of these transmitters were also recorded.

- The field strength measurements were carried out at antenna height of 1.5 meter compared to 10 meter standard I.T.U model. The L.O.S distance from both transmitting antennas were also recorded at every spot.

- The Field strength measurement and subjective assessment were carried out on two routes i.e., Vadodara to Surat and Vadodara to Ahmedabad in forward and reverse directions as shown in **Annexure I.**

- The measured field strength in dBμv/m and subjective reception quality of signal from all these transmitters were recorded at the interval of 5 km L.O.S distance and summarized in **table no. 1 to 12**.

- Table **1,3 and 5** are for 91.1 MHz, 92.7 MHz & 98.3 MHz frequencies respectively for measurements from Vadodara to Surat. Similarly Table **2,4 and 6** are for measurements from Surat to Vadodara.

- Table **7,9 and 11** are for 91.1 MHz, 93.5 MHz & 98.3 MHz frequencies respectively for measurements from Vadodara to Ahmedabad. Similarly Table **8,10 and 12** are for measurements from Ahmedabad to Vadodara.

PRESENTATION OF DATA

- In order to simplify the contents of all 12 tables, efforts have been made to differentiate the observations using colored presentation. Green zone shows the normal reception (excellent to very good) of particular FM frequency in which neither orientation of receiver is required nor additional antenna is needed i.e., reception is normal with inbuilt antenna of the receiver.

- In yellow zone, reception quality of concerned FM station is still very good to nearly good with little or more orientation of receivers i.e., with orientation effect (O/E).

- In orange zone, an interesting phenomenon was observed. In this zone concerned station is still available with good to fair assessment with orientation effect, however capture by co-channel FM transmitter frequency is also observed. Receiver was responding to FM transmitter of one city in one orientation and at the same time responding to co-channel FM transmitter of another city in different orientation.

- In red zone, previously observed signal completely disappeared and FM channel was completely captured by co- channel FM transmitter of nearby city. The L.O.S distance at this spot can be taken into consideration for full capture effect. Similar type of measurements were carried out in reverse direction also.

OBSERVATION

a. Route-Vadodara to Surat & back

This route was selected to observe capture effect on three transmitter frequencies i.e., 91.1 MHz, 92.7 MHz & 98.3 MHz of FM band. FM transmissions were being radiated by private FM broadcasters on all these three frequencies. The L.O.S distance between Vadodara and Surat was recorded approximately 126Km. The sum of L.O.S distances at particular measurement spot (from both transmitter locations) are not equal to 126 km as measurement spots are not exactly on the radial path connecting both transmitters. The Table **1**, **3** and **5** are for 91.1 MHz, 92.7 MHz & 98.3 MHz frequencies respectively for measurements from Vadodara to Surat. Similarly Table **2, 4** and **6** are for same frequencies for measurements from Surat to Vadodara. The observations on all above mentioned transmitter frequencies are as under:

- **91.1 MHz:** As per table 1 and 2 reception quality was normal (excellent to very good) up to L.O.S distance of 35 km from Vadodara and 40 km from Surat. From L.O.S distance of 35 km to 55 km, mixed observation was recorded as shown in yellow zone. Finally full capture was observed at a L.O.S distance of

80 km from Vadodara. Similarly in return path the full capture effect was observed at 75 km from Surat. At this point the L.O.S distance from the co-channel transmitters at Surat/Vadodara were 48 km & 51 km respectively. This L.O.S distance may be called full capture effect distance for this particular frequency at existing transmitting RF power on the route.

- **92.7 MHz:** As per table 3 and 4, reception quality is normal at the distances of 35-40 km. The capture effect was observed at L.O.S distance of 80 km from Vadodara(48 km from Surat) and 75 km from Surat (51 km from Vadodara) on return route.

- **98.3 MHz:** As per table 5 and 6, reception quality is normal up to 35-40 km L.O.S distance from concerned transmitters. The full capture effect was observed at L.O.S distance of 80 km from Vadodara (48 km from Surat) and 75 km from Surat (51 km from Vadodara) on return route.

The variation in the distance of capture effect is due to variation in time and location.

b. Route-Vadodara to Ahmedabad and back

This route was selected to observe capture effect on three transmitter frequencies i.e. 91.1 MHz, 93.5 MHz & 98.3 MHz of FM band. At all these three frequencies, FM transmissions were being radiated by private FM broadcasters. The distance between Vadodara and Ahmedabad was recorded approximately 110 Km. Table **7, 9 and 11** are for 91.1 MHz, 93.5 MHz & 98.3 MHz frequencies respectively for onward measurements from **Vadodara to Ahmedabad**. Similarly Table **8,10 and 12** are for 91.1 MHz, 93.5 MHz & 98.3 MHz frequencies respectively for measurements from **Ahmedabad to Vadodara**. The observations on all above mentioned transmitter frequencies were as under:

- **91.1 MHz:** As per table 7 and 8, reception quality is normal up to the distance of 35 km. The capture effect was observed at L.O.S distance of 65 km from Vadodara (42 km from Ahmedabad) and 65 km from Ahmd (47 km from Vadodara) on return route.

- **93.5 MHz:** As per table 9 and 10, reception quality is normal at the distance of 35-40 km. The capture effect was observed at L.O.S distance of 65 km from Vadodara (42 km from Ahmedabad) and 65 km from Ahmd (47 km from Vadodara) on return route.

- **98.3 MHz:** As per table 11 and 12, reception quality is normal up to 35-40 km L.O.S distance from concerned transmitters. The full capture effect was observed at L.O.S distance of 60 km from Vadodara (52 km from Ahmedabad) and 60 km from Ahmedabad (52 km from Vadodara) on return route.

The variation in the distance of capture effect is due to variation in time and location.

CONCLUSION

Field strength measurement/subjective listening of FM Transmitters operating on frequencies 91.1 MHz, 92.7 MHz, 93.5 MHz and 98.3 MHz on route Vadodara to Surat and Vadodara to Ahmedabad were successfully carried out using two different types of portable FM receivers viz. Sony and Philips. After analyzing the measured/recorded data it is concluded that -

1. Before full capture effect, a partial capture effect was observed between all pairs of co-channel transmitters. In this zone FM receiver may pick up any co-channel signal depending upon orientation of receiving antenna, L.O.S distance and field strength at this particular spot.
2. Full capture effect was observed at L.O.S distance of 51 km from Vadodara and on return route 48 km from Surat.
3. Similarly, full capture effect was observed at 52 km from Vadodara and on return route 42 km from Ahmedabad.

NOTE: All these observations were made under given RF power of transmitters and height of transmitting antennas during the measurement. Results may vary under different operating conditions of transmitter and terrain conditions.

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 1

Co-Channel Frequency: 91.1 MHz, Rated Power(Vadodara): 5 KW , Actual Power: 5KW
Rated Power(Surat) : 10 KW Actual Power: 7.5KW

ROUTE: VADODARA TO SURAT

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBμV/m(1.5meter)		Subjective assessment		Terrain	Remarks
		From Vdra	From Surat	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	Jamvuva, Vadodara	5		80	81	Excellent	Excellent	Urban	
2	Varnama NH-8	10		69	65	"	"	"	O/E-Orientation effect
3	Por NH-8	15		62	60	"	"	Highway	C/E-Capture effect
4	NH-8	20		59	56	"	"	"	VG-Very Good
5	NH-8	25		51	49	VG	VG	"	
6	Toll NH-8	30		47	48	"	"	"	
7	NH-8	35		45	45	"	"	"	
8	NH-8	40		41	37	VG O/E	VG O/E	"	
9	NH-8	45		40	36	"	"	"	
10	NH-8	50		37	36	Good O/E	Fair O/E	"	
11	NH-8	55		35	31	"	"	"	
12	NH-8 Narmada	60	61	34	31	G O/E C/E	Fair O/E C/E	"	
13	NH-8	65		35	31	Good,O/E C/E	Good ,O/E C/E		
14	NH-8	70	58	31	28	Fair O/E C/E	Fair O/E C/E		
15	NH-8	75	52	33	35	Good,O/E C/E	Fair O/E C/E		Prominent Tx--SURAT
16	NH-8 Sanjali	80	48	34	30	Good	Good		Full Capture Tx--SURAT
17	NH-8,Rose Gard	85	44	45	47	VG	VG		Full Capture Tx--SURAT

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 2

Co-Channel Frequency: 91.1 MHz, Rated Power(Surat): 10 KW , Actual Power: 7.5KW
Rated Power(Vadodara) : 5 KW Actual Power: 5KW

ROUTE: Surat to Vadodara

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBμV/m(1.5Meter)		Subjective assessment		Terrain	Remarks
		From Surat	From Vdra	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	Market,Surat	5		72	68	Excellent	Excellent	Urban	
2	Outskirts,Surat	10		73	64	"	"	"	O/E-Orientation effect
3	Outskirts,Surat	15		60	63	"	"	"	C/E-Capture effect
4	Tapi Toll	20		67	62	"	"	High way	VG-Very Good
5	Kanyasi,Surat	25		60	54	VG	VG	"	
6	NH-8	30		54	48	"	"	"	
7	NH-8	35		48	45	"	"	"	
8	NH-8	40		50	49	VG	VG	"	
9	NH-8	45(44)		41	41	Good,O/E	Good,O/E	"	Measurement at 44 km.
10	NH-8	50(48)		39	38	Good,O/E	Fair	"	Measurement at 48 km.
11	Ankleshwar	55		26	27	Poor	Poor	City.	
12	Golden Bridge	60	68	35	33	Poor, Weak C/E	Weak , O/E C/E	City outskirts.	
13	NH-8	65		36	35	Good,O/E	Good ,O/E	NH-8	
14	NH-8	70	57	35	30	Fair O/E C/E	Fair O/E C/E	"	
15	NH-8	75	51	35	37	Good	Fair	"	Full Capture Tx--Vadodara

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

Vdra-Vadodara

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 3

Co-Channel Frequency: 92.7 MHz, Rated Power(Vadodara): 5 KW , Actual Power: 5KW
Rated Power(Surat) : 10 KW Actual Power: 8.5KW

ROUTE: Vadodara to Surat

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBµV/m(1.5 meter)		Subjective assessment		Terrain	Remarks
		From Vdra	From Surat	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	Jamvuva, Vadodara	5		80	79	Excellent	Excellent	Urban	
2	Varnama NH-8	10		65	64	"	"	"	O/E-Orientation effect
3	Por NH-8	15		60	60	"	"	Highway	C/E-Capture effect
4	NH-8	20		56	55	"	"	"	VG-Very Good
5	NH-8	25		51	51	"	"	"	
6	Toll NH-8	30		51	49	"	"	"	
7	NH-8	35		43	43	"	VG O/E	"	
8	NH-8	40		42	39	VG O/E	VG O/E	"	
9	NH-8	45		40	36	"	"	"	
10	NH-8	50		37	35	Good O/E	Fair O/E	"	
11	NH-8	55		36	31	"	"	"	
12	NH-8 Narmada	60(61)	61	34	31	G O/E C/E	Fair O/E C/E	"	Measurement at 61 km.
13	NH-8	65		31	33	Good,O/E C/E	Good ,O/E C/E		
14	NH-8	70	58	31	28	Fair O/E C/E	Fair O/E C/E		
15	NH-8	75	52	34	35	Good,O/E C/E	Fair O/E C/E		Prominent Tx--SURAT
16	NH-8 Sanjali	80	48	31	32	Good	Fair		Full Capture Tx--SURAT
17	NH-8,Rose Gard	85	44	39	41	Good	Good		Full Capture Tx--SURAT
18	Canal crossing NH	90		45	47	Very Good	Good		"

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 4

Co-Channel Frequency: 92.7 MHz, Rated Power(Surat): 10 KW , Actual Power: 8.5KW
Rated Power(Vadodara) : 5 KW Actual Power: 5KW

ROUTE: SURAT to VADODARA.

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBμV/m(1.5Meter)		Subjective assessment		Terrain	Remarks
		From Surat	From Vdra	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	Market,Surat	5		77	70	Excellent	Excellent	Urban	
2	Outskirts,Surat	10		75	67	"	"	"	O/E-Orientation effect
3	Outskirts,Surat	15		64	63	"	"	"	C/E-Capture effect
4	Tapi Toll	20		66	62	"	"	High way	VG-Very Good
5	Kanyasi,Surat	25		59	57	VG	VG	"	
6	NH-8	30		54	49	"	"	"	
7	NH-8	35		48	46	"	"	"	
8	NH-8	40		50	52	VG	VG	"	
9	NH-8	44		45	42	Good,O/E	Good,O/E	"	
10	NH-8	48		42	40	Good,O/E	Fair	"	
11	Ankleshwar	55		27	27	Poor	Poor	City.	
12	Golden Bridge	60		35	35	Poor.	Weak.	City outskirts.	
13	NH-8	65		36	36	Good,O/E	Good.	NH-8	
14	NH-8	70	57	32	32	Fair O/E C/E	Fair O/E C/E	"	
15	NH-8	75	51	36	38	Good	Fair	"	Full Capture Tx--Vadodara

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 5

Co-Channel Frequency: 98.3 MHz, Rated Power(Vadodara): 5 KW , Actual Power:4.5KW
Rated Power(Surat) : 10 KW Actual Power: 8.8KW

ROUTE: Vadodara to Surat

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBµV/m(1.5Meter)		Subjective assessment		Terrain	Remarks
		From Vdra	From Surat	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	Jamvuva, Vdra	5		81	81	Excellent	Excellent	Urban	
2	Varnama NH-8	10		64	65	"	"	"	O/E-Orientation effect
3	Por NH-8	15		67	64	"	"	Highway	C/E-Capture effect
4	NH-8	20		60	58	"	"	"	VG-Very Good
5	NH-8	25		55	54	VG	VG	"	
6	Toll NH-8	30		51	51	"	"	"	
7	NH-8	35		50	50	"	VG O/E	"	
8	NH-8	40		46	47	Very Good,O/E	VG O/E	"	
9	NH-8	45		40	37	"	"	"	
10	NH-8	50		39	39	Good O/E	Fair O/E	"	
11	NH-8	55		36	34	"	"	"	
12	NH-8 Narmada	60	61	34	33	Good, O/E C/E	Fair O/E C/E	"	
13	NH-8	65		30	32	Good,O/E C/E	Good ,O/E C/E		
14	NH-8	70	58	30	30	Fair,O/E,C/E	Fair O/E C/E		
15	NH-8	75	52	36	37	Good,O/E C/E	Fair O/E C/E		Prominent Tx--SURAT
16	NH-8 Sanjali	80	48	30	33	Good	Fair		Full Capture Tx--SURAT
17	NH-8,Rose Gard	85	44	45	47	VG	VG		Full Capture Tx--SURAT

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 6

Co-Channel Frequency: 98.3 MHz, Rated Power(Surat): 10 KW , Actual Power: 8.8KW
Rated Power(Vadodara) : 5 KW Actual Power:4.5KW

ROUTE: SURAT to VADODARA.

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBμV/m(1.5meter)		Subjective assessment		Terrain	Remarks
		From Surat	From Vdra	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	Market,Surat	5		76	69	Excellent	Excellent	Urban	
2	Outskirts,Surat	10		74	70	"	"	"	O/E-Orientation effect
3	Outskirts,Surat	15		61	63	"	"	"	C/E-Capture effect
4	Tapi Toll	20		66	62	"	"	High way	VG-Very Good
5	Kanyasi,Surat	25		55	53	VG	VG	"	
6	NH-8	30		56	54	"	"	"	
7	NH-8	35		47	49	"	"	"	
8	NH-8	40		50	53	VG	VG	"	
9	NH-8	44		44	39	Good,O/E	Good,O/E	"	
10	NH-8	48		36	41	Good,O/E	Fair,O/E	"	
11	Ankleshwar	55		26	27	Poor	Poor	City.	
12	Golden Bridge	60		34	33	Good,O/E	Fair,O/E	City outskirts.	
13	NH-8	65		30	34	Fair,O/E	Fair.	NH-8	
14	NH-8	70	57	28	26	Weak,O/E,C/E	Weak,O/E,C/E	"	
15	NH-8	75	51	35	38	Good	Fair	"	Full Capture Tx--Vadodara

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 7

Co-Channel Frequency: 91.1 MHz, Rated Power(Vadodara): 5 KW , Actual Power:5.0KW
Rated Power(Ahmedabad): 10 KW Actual Power:6.0KW

ROUTE: Vadodara to Ahmedabad

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBµV/m(1.5 meter)		Subjective assessment		Terrain	Remarks
		From Vdra.	From Ahmd	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	City,Vadodara	5		76	69	Excellent	Excellent	Urban	
2	City,Vadodara	10		65	54	"	"	"	
3	NH-8	15		56	56	"	"	outskirts	O/E-Orientation effect
4	NH-8	20		51	50	"	"	High way	C/E-Capture effect
5	NH-8	25		53	51	VG	VG	"	VG-Very Good
6	NH-8	30		44	48	"	"	"	
7	NH-8	35		39	42	"	"	"	
8	NH-8	40		35	31	Good,O/E	Good,O/E	"	
9	NH-8	45		35	38	Good,O/E	Fair,O/E	City outskirts.	
10	NH-8	50		33	32	Fair,O/E	Fair,O/E	"	
11	NH-8	55	56	39	37	Poor,O/E,C/E	Poor,O/E	State Highway	
12	Nadiad	60	52	31	26	Weak,O/E,C/E	Weak,O/E,C/E	City.	
13	Nadiad-Mehmeda	65	42	36	39	Good.	Good.	NH-8	Full capture by Ahmedabad.
14	Meh-NH-8	70	42	48	54	Good.	Good.	SH-NH8	Full capture by Ahmedabad.

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

Vdra- Vadodara
Ahmd- Ahmedabad

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 8

Co-Channel Frequency: 91.1 MHz, Rated Power(Vadodara): 5 KW , Actual Power:5.0KW
Rated Power(Ahmedabad): 10 KW Actual Power:6.0KW

ROUTE: Ahmedabad to Vadodara.

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBµV/m(1.5 meter)		Subjective assessment		Terrain	Remarks
		From Ahmd	From Vdra	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	Ahmd City Area	5		85	76	Excellent	Excellent	Urban	
2	Narod,Ahmd.	10		71	73	"	"	"	
3	Outskirts, NH-8	15		68	67	"	"	outskirts	O/E-Orientation effect
4	NH-8	20		66	65	"	"	High way	C/E-Capture effect
5	NH-8	25		63	64	VG	VG	"	VG-Very Good
6	NH-8	30		60	66	"	"	"	
7	NH-8	35		56	60	"	"	"	
8	NH-8	40		42	39	Good,O/E	Good-Fair,O/E	Nadiad rd.	
9	NH-8	45	67	42	39	Fair,O/E,C/E	Fair,O/E,C/E	State high way.	
10	NH-8	50	61	33	23	Fair,O/E,C/E	Fair,O/E,C/E	"	
11	NH-8	55(56)	56	34	36	Fair,O/E.	Fair,O/E	"	
12	SH-NH8	60	52	36	35	Fair,O/E	Fair,O/E	"	Vadodara.
13	NH-8	65	47	40	41	Very Good.	Very Good.	NH-8	Full capture by Vadodara.
14	Anand circle	70	40	49	47	Very Good.	Very Good.	City Outskirts.	Full capture by Vadodara.

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

Vdra- Vadodara
Ahmd- Ahmedabad

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 9

Co-Channel Frequency: 93.5 MHz, Rated Power(Vadodara): 5 KW , Actual Power:5.0KW
Rated Power(Ahmedabad): 10 KW Actual Power:6.0-5.0KW

ROUTE: Vadodara to Ahmedabad.

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBμV/m(1.5 meter)		Subjective assessment		Terrain	Remarks
		From Vdra.	From Ahmd	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	City,Vadodara	5		75	68	Excellent	Excellent	Urban	
2	CityVadodara	10		65	55	"	"	"	O/E-Orientation effect
3	NH-8	15		54	54	"	"	outskirts	C/E-Capture effect
4	NH-8	20		54	53	"	"	High way	VG-Very Good
5	NH-8	25		55	51	VG	VG	"	
6	NH-8	30		45	47	"	"	"	
7	NH-8	35		40	39	"	"	"	
8	NH-8	40		32	28	Good	Good	"	
9	NH-8	45		36	37	Good,O/E	Noisy	City outskirts.	
10	NH-8	50	62	35	34	Fair,O/E	Noisy	"	
11	NH-8	55	56	36	32	Fair,O/E	Poor,O/E	"	
12	Nadiad	60	52	33	31	Weak,O/E,C/E	Weak,O/E,C/E	City.	Audio mixed.
13	Nadiad-Mehmeda	65	42	40	45	Good.	Good.	NH-8	Full capture by Ahmedabad.
14	Meh-NH-8	70	42	46	56	Good.	Good.	SH-NH8	Full capture by Ahmedabad.
15	NH-8	75	51	62	61	Very Good	Very Good.	"	Full Capture Tx--Vadodara

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

Vdra- Vadodara
Ahmd- Ahmedabad

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 10

Co-Channel Frequency: 93.5 MHz, Rated Power(Vadodara): 5 KW , Actual Power:4.50KW
Rated Power(Ahmedabad): 10 KW Actual Power:6.0-5.0KW

ROUTE: Ahmedabad to Vadodara.

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBµV/m(1.5 meter)		Subjective assessment		Terrain	Remarks
		From Ahmd	From Vdra	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	Ahmd City Area	5		90	79	Excellent	Excellent	Urban	
2	Narod,Ahmd.	10		64	67	"	"	"	O/E-Orientation effect
3	Outskirts, NH-8	15		66	65	"	"	outskirts	C/E-Capture effect
4	NH-8	20		70	67	"	"	High way	VG-Very Good
5	NH-8	25		65	66	VG	VG	"	
6	NH-8	30		61	67	"	"	"	
7	NH-8	35		58	60	"	"	"	
8	NH-8	40		41	44	Good,O/E	Good-Fair,O/E	"	
9	NH-8	45	67	38	42	Fair,O/E,C/E(W)	Fair,O/E,C/E	State high way.	
10	NH-8	50	61	30	29	Fair,O/E,C/E	Fair,O/E,C/E	"	Fair to weak capture by Vadodara.
11	NH-8	55(56)	56	42	37	Fair,O/E	Fair,O/E	"	Vadodara signal.Ahmd NT
12	SH-NH8	60	52	31	33	Fair,O/E,C/E	Fair,O/E,C/E	"	bothVadodara & Ahmd Weak.
13	NH-8	65	47	47	41	Good, C/E(W)	Good.	NH-8	capture by Vadodara.
14	Anand circle	70	40	46	43	Very Good.	Very Good.	City Outskirts.	capture by Vadodara.

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

Vdra- Vadodara
Ahmd- Ahmedabad

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 11

Co-Channel Frequency: 98.3 MHz, Rated Power(Vadodara): 5 KW , Actual Power: 4.5 KW
Rated Power(Ahmedabad): 10 KW Actual Power:-

ROUTE: Vadodara to Ahmedabad.

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBμV/m(1.5 meter)		Subjective assessment		Terrain	Remarks
		From Vdra.	From Ahmd	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	City, Vadodara	5		75	74	Excellent	Excellent	Urban	
2	City, Vadodara	10		67	63	"	"	"	O/E-Orientation effect
3	NH-8	15		52	56	"	"	outskirts	C/E-Capture effect
4	NH-8	20		56	57	"	"	High way	VG-Very Good
5	NH-8	25		58	53	VG	VG	"	
6	NH-8	30		49	48	"	"	"	
7	NH-8	35		41	43	"	"	"	
8	NH-8	40		36	30	"	"	"	
9	NH-8	45		37	38	Good,O/E	Good,O/E	City outskirts.	
10	NH-8	50	62	39	38	Good,O/E,C/E	Weak,O/E,C/E	"	Partial capture by Ahmedabad.
11	NH-8	55	56	39	36	Fair,C/E,O/E	Fair,O/E,C/E	State Highway.	Combined signal of Ahmd & Vadodara.
12	Nadiad	60	52	29	28	Good,O/E	Good,O/E	City.	Vadodara signal NT.Ahmedabad good.
13	Nadiad-Mehmeda	65	42	55	56	Very Good.	Very Good.	NH-8	Full capture by Ahmedabad.
14	Meh-NH-8	70	42	51	55	Excellent	Excellent	SH-NH8	Full capture by Ahmedabad.
15	NH-8	75	37	59	60	Excellent	Excellent	"	Full Capture Tx--Vadodara

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

Vdra- Vadodara
Ahmd- Ahmedabad

CO-CHANNEL CAPTURE EFFECT IN FM BAND

Table: 12

Co-Channel Frequency: 98.3 MHz, Rated Power(Vadodara): 5 KW , Actual Power:4.50KW
Rated Power(Ahmedabad): 10 KW Actual Power:----

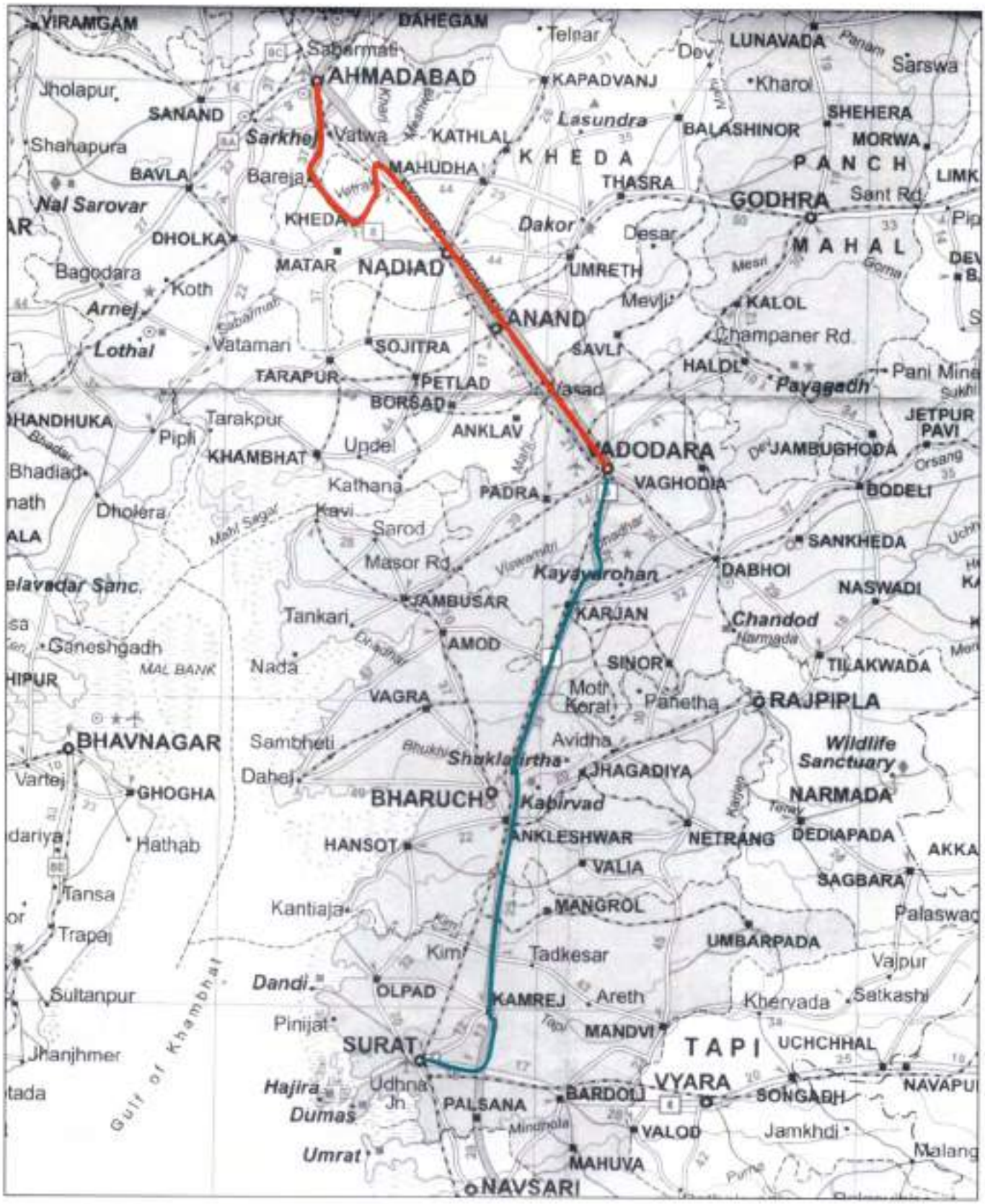
ROUTE: Ahmedabad to Vadodara.

S.No.	Location	Radial Distance(LOS) (Km)		Field Strength dBμV/m(1.5 meter)		Subjective assessment		Terrain	Remarks
		From Ahmd	From Vdra	V	H	High quality FM Receiver	Normal quality FM Receiver		
1	Ahmd City Area	5		88	79	Excellent	Excellent	Urban	
2	Narod,Ahmd.	10		83	77	"	"	"	O/E-Orientation effect
3	Outskirts, NH-8	15		71	68	"	"	outskirts	C/E-Capture effect
4	NH-8	20		63	60	"	"	High way	VG-Very Good
5	NH-8	25		57	58	VG	VG	"	
6	NH-8	30		56	57	"	"	"	
7	NH-8	35		55	56	"	"	"	
8	NH-8	40		46	47	Good,O/E	Good-Fair,O/E	"	
9	NH-8	45	67	41	44	Good,O/E,C/E(W)	Fair,O/E,C/E	State high way.	
10	NH-8	50	61	37	31	Fair,O/E	Fair,O/E,C/E	"	
11	NH-8	55(56)	56	50	43	Good,O/E	Good,O/E	"	Vadodara signal.
12	SH-NH8	60	52	36	32	Good,O/E,C/E	Good,O/E	"	Vadodara.
13	NH-8	65	47	47	42	Good, C/E(W)	Good.	NH-8	capture by Vadodara.
14	Anand circle	70	40	46	43	Very Good.	Very Good.	City Outskirts.	capture by Vadodara.

Green Zone	Excellent to Very good reception without any orientation etc.
Yellow Zone	Very good reception with orientation etc.
Orange Zone	Good to Fair reception with orientation and weak to fair capture by co-channel transmitter.
Red Zone	Good to Very Good reception after capturing.

Vdra- Vadodara
Ahmd- Ahmedabad

Annexure-1



RADIAL ROUTES:

VADODARA TO AHMEDABAD

VADODARA TO SURAT