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Field Strength Survey at AIR VADODARA for Channel Spacing and Co-channel Separation

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RESEARCH REPORT NO. 901

GROUP	**Propagation, Synergy & Monitoring (PSM)**
SUBJECT	Field Strength Survey at AIR VADODARA for Channel Spacing and Co-channel Separation
WORK DONE BY	**Shri. Javed Shams, Asstt. Engineer** **Shri. G.P. Srivastava, Asstt. Engineer** **Shri. Om Prakash, Sr. Tech.** **Shri Sushil Kumar, Tech.**
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ABSTRACT

The field strength measurements and subjective listening of FM signal being originated from All India Radio Vadodara along with other transmitters, were carried out by a team of Research Department . All measured data is recorded in the report. There was no interference or cross talk observed due to multi path signal among the transmitters.

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INTRODUCTION

In compliance of DG:AIR letter no.8/1/2012-E III dated 7/5/12 (Annexure 1), a research team consisting of S/sh. Md Javed Shams(AE), G.P.Srivastava(AE), Om Prakash (Sr. Technician) and Sushil Kumar(technician) were deputed on tour to Vadodara(Gujarat) from 25th May 12 to 5th June 12 to carry out field strength measurement and subjective listening of FM signal being originated from transmitters located at Vadodara, Surat and Ahmedabad. With the proliferation of transmitters in the network, the concept of maximum coverage and need to revisit the FM frequency plan to generate more channel/frequencies within the allotted band, these measurements were planned to assess the effect of interference/cross talk as well as capture effect among the multiple co-sited transmitters at Vadodara region.

OBJECTIVE OF SURVEY

Main objective of the survey was as follows:

- Field strength measurement/subjective listening of AIR Vadodara FM Transmitter operating at 93.9 MHz in six radial routes at antenna height of 1.5 meters..
- To assess the cross talk or interference of Red FM operating at 93.5 MHz in AIR Vadodara FM operating at 93.9 MHz (400 KHz apart) or vice versa.
- To assess the Capture Effect between FM transmitters at Ahmedabad and Vadodara operating at same frequency.
- The subjective listening in SID code of AIR FM and SFM(Red FM) being operated at Vadodara in FM Band.

INSTRUMENTS USED

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

1. Field strength meter (Make Anritsu , Model No. ML 5248)
2. Spectrum Analyser. Make Anritsu Model No- MS2713F
3. Standard VHF dipole Antenna(25-250MHz) , Make Anritsu, Model No. MP534-B
4. Four FM receivers:
    i. Sony ICF Receiver
    ii. Phillips Radio receiver
    iii. Local Cheap Receiver
    iv. Mobile Receiver (Samsung Mobile Model No. CHAMP 3.5G)
5. GPS Receiver M5 GRAMIN make

MEASUREMENT PROCEDURE

Field Strength measurements were taken for a period of about 5 minutes on each transmitter frequency using standard VHF dipole antenna . The stable readings were taken during this period to achieve best received signal at that particular location. The reception of each transmitter frequency was assessed subjectively in standard SIO code by monitoring the transmission using four different types of receivers including cheap FM receiver(*Low end Receiver*). Some of the samples were also recorded to assess the quality of reception on each transmitter frequency at some typical locations. Some spot measurements were also taken to assess the interference and cross talk resulting due to multi path signal reception at that location.

MEASUREMENT & COLLECTION OF DATA

The Field strength meter (Model No. ML 524B) along with standard VHF dipole antenna, GPS receiver and four types of FM receiver were used for collection of field strength data. The calibration of meter was checked up for better accuracy before and after the survey to ensure accurate data collection during the measurement. The field strength measurements were carried out at 1.5 meter antenna height (as desired by DG AIR) at every 5 Km (some times 10 Km depending on terrain and approach) distance from the Transmitter (Antenna site) along the out going radial path. Simultaneously, subjective listening was made using four different types of FM receivers. A vehicle was hired at Vadodara for survey work. As the area of survey was new to research team, the local engineering staff of AIR Vadodara also accompanied the survey team.

Before undertaking the tour, detailed information about various FM transmitters operating from Vadodara, Ahmadabad and Surat were obtained from DG:AIR. This also included antenna type and height of antenna mast. It is worth mentioning here that Antennas of all 5 transmitters including AIR FM at Vadodara are co-sited on single 100 meter tower.(**Annexure II**)

The survey team made field strength and subjective assessment on 6 different radials .Two radials omitted due to difficult terrain conditions and bad road network. Locations of radials are indicated in the attached map(**Annexure III**).

Part (A):

In the city of Vadodara , FM Transmitter of AIR is operating on 93.9 MHz and 5FM popularly known as RED FM on 93.5 MHz. Here the channel spacing is 400 KHz instead of present day standard of 800 KHz. The objective was to check interference of these two transmitters on each other. It also included subjective assessment on different types of FM radio receivers on different terrain conditions and different L.O.S distances in all selected six radials from Transmitter tower.

As per I.T.U standards, field strength should be taken at a height of 10 meters from ground level but instead of 10 meters, measurements were carried out at a height of 1.5 meter because this height is comparable to the height at which car FM radio and portable FM radio are generally being used for signal reception by general masses.

The help of G.P.S receiver was taken to locate exact bearing of the spot location on every radial route including L.O.S distance. Measurements and Subjective listening were carried out at interval of 5 Km and sometimes 10 Km depending upon actual approach to the spot and the local terrain conditions. The measured F/S in dBμV/meter and subjective reception quality of various FM signals in SIO code are summarized in Table 1 to 7. All six radials are shown in **Annexure III.** Field Strength as per given ERP of FM AIR Vadodara for Minimum usable field strength of 66 dBμV/meter is shown in **Annexure IV**. The corresponding reception quality through cheap FM radio receiver, was satisfactory, as shown in **Annexure V**.

1.Radial route North-West (Table 1):

This radial route was the busiest one in terms of traffic movement on NH#8. R&D team started from L.O.S distance of 5 Km which lies in Vadodara city itself and progressively increasing L.O.S distance on NH#8 en- route to Ahmadabad. In between lies the city of Anand, Nadiad and Mehmedabad. Subjective assessment of audio quality on different types of Radio receiver was good up to L.O.S distance of 40Km. However Sony receiver(Synthesized) worked well up to distance of 50-55 Km. No cross talk or interference of Red FM in AIR Vadodara FM or vice versa was observed.

Note: - North-West direction from AIR Vadodara antenna mast lies on side lobe of radiation pattern, hence less field strength, compared to East and West directions, was found.

2.Radial route North (Table 2):

This radial route does not cover any major city en route but pockets of semi-urban and urban settlements are scattered throughout the length. Major urban settlements are Savli, Dakor and Kapadvanj. The last spot was the town of Kapadvanj where F/S falls to 18-20 dBμV/m. It is 85 Km L.O.S distance from Vadodara. Cheap receiver(Low end Receiver) worked satisfactorily up to L.O.S distance of 35-40 Km. As such no cross talk or interference of Red FM in AIR Vadodara FM or vice versa was observed.

3.Radial route North-East (Table 3):

This particular radial was rural area except few urban settlements like Halol and Devgadbaria. Road condition was also not up to the mark. Mostly fields and low height green plants were observed en route. No tall structure etc. found. Cheap receiver worked well up to the L.O.S distance of 45-50 Km. The signal strength of 34 dBμV/m was recorded up to L.O.S distance of 85 Km. It is due to fact that this area comes closer to the main lobe of radiation pattern of AIR Vadodara FM Tower. This route also shown satisfactory reception as for as cross talk or interference of Red FM in AIR Vadodara FM or vice versa is concern.

4.Radial route East (Table 4):

This route area comes under the main lobe of AIR FM radiation pattern. It is due to the fact that Maximum area of Vadodara district lies in east direction. Many semi-urban settlements like Sankheda, Chota Udaipur and Jetpur pavi were encountered on the route. The reception of FM transmission of AIR as well as of private broadcasters were satisfactory. Last recorded F/S of 29dBμv/m was at a L.O.S distance of 80 Km. Here also cross talk or interference of Red FM in AIR Vadodara FM or vice versa seems satisfactory.

5. Radial route South(Table 5):

On NH#8 towards Surat, in between lies the industrial township of Bharuch and Ankleshwar. Very heavy traffic was observed on this stretch. Measurement team shifted to Jhagadia from NH#8 to maintain proper south direction with the aid of GPS receiver. In this radial route also cheap receiver was able to decode AIR Vadodara FM at a L.O.S distance of 45-50 Km. Reception quality suffered in all type of receivers at L.O.S distance of 65 Km. It may be due to very high traffic on NH#8. No cross talk or interference of Red FM was observed in AIR Vadodara FM or vice versa.

6.Radial route West(Table 6):

This radial route goes to west direction from AIR Vadodara towards Arabian sea and further to old port town of Cambay now known as Khambhat. In this route poor quality of reception was observed in all type of receivers in Port city of Cambay, which is just 60 Km L.O.S distance of AIR Vadodara tower. In general city population does not receive AIR Vadodara signals. F/S observed was 16-22 dBμV/m in the market area of Cambay. Though signal reach was less in this route compared to other radials but no cross talk or interference of Red FM in AIR Vadodara FM or vice versa , was observed.

7. Vadodara city area(Table 7):

R&D survey team made few spot measurements also in different crowded as well as residential areas in city for F/s and subjective quality for the purpose of interference of AIR Vadodara FM in RED FM(Vadodara)and vice versa. No cross talk or capture effect was observed.

Part(B)

Observation on Capture effect

The distance between Vadodara and Ahmadabad is approximately 100 Km. SFM i.e., Red FM operates on 93.5 MHz from both cities. However content is different. North-West route gave us the opportunity to observe capture effect due to co-channel operation of Red FM transmission.

Up to L.O.S distance of 60 Km, Red FM Vadodara observed in Sony Synthesized receiver. However Cheap Receiver, Branded Receiver and Mobile receiver was not able to pick up signals of Red FM Vadodara as well as Red FM Ahmadabad. Station identity was confirmed on the basis of content verification from Vadodara. Slight change in directivity of Sony receiver loses reception of Red FM from Vadodara. However Red FM Ahmadabad was picked up in different orientation of Sony Receiver. It was much weaker than Red FM Vadodara reception. The Field strength observed for Red FM was 25dBμV/m in Vadodara direction. This was the observation in Nadiad city.

On further movement towards Ahmadabad , it was observed that Field strength of Red FM is increasing slowly. At L.O.S distance of 65 Km the F/S was 30dBμV/m. Certainly this was the Red FM Ahmadabad signal as confirmed by Radio receivers content on 93.5 MHz of Red FM Ahmadabad.

As distance between two co-channel XTR was more than 100 Km, the team was not able to witness sudden capture of Red FM Vadodara by Red FM Ahmadabad. In other words under given ERP of

Transmitter and antenna height, 100 km separation does not exhibit capture effect. F/S comes down to a very low value and it is unable to drive even branded receivers.

Similar effect was observed with Radio Mirchi signals of Vadodara and Surat at L.O.S distance of 55-65 Km from Vadodara. Both the transmitters are operating on same frequency. If distance between two co-channel transmitter is less than 70 to 60 Km, then effects will be more visible under given ERP conditions.

CONCLUSION

Part (A)

Field strength measurement/subjective listening of AIR Vadodara FM Transmitter operating at 93.9 MHz were carried out successfully in six radial routes and crowded Vadodara city. The reception of AIR FM Vadodara and SFM(Red FM) operating on 93.5 MHz (channel separation of 400 KHz) was satisfactory using different types of FM radio receivers including local cheap receivers. No interference observed of Red FM in AIR Vadodara FM operating at 93.9 MHz (400 KHz apart) or vice versa. Also no cross talk was observed as such due to multipath signal among them.

Further it is worth to mention here that these observations are specifically for Vadodara region and not necessary that same is applicable to other regions of the country at different locations as well as in different terrain conditions.

The past studies shows that in VHF band(FM) F/S of vertical polarized component significantly increases (more than 8dB) than the horizontal component as height of the antenna decreases, resulting very good signal reception in spite of poor F/S. Therefore, further studies are required where height of transmitting antenna is different and transmitters are not co-sited using 10 meter height of receiving antenna to ascertain reduction of channel spacing In VHF band.

Part(B)

Further, Research team did not observe full capture effect due to large distance between the co-channel transmitters under survey. However partial capture effect was observed when radio receiver's orientation was changed with respect to the transmitter's antenna direction. Further studies are required at different places where co-channel Transmitters are operating in near vicinity.

FIELD STRENGTH SURVEY FOR CHANNEL SPACING

TABLE: 1

AIR FM(VBS) FREQ: 93.9 MHz XTR POWER: 10KW

SFM(RED FM):FREQ:93.5MHz XTR POWER: 5KW

Radial Route: North West

S.No	Location	Distance (KM)	Field Strength dB µV/meter at a hight of 1.5 Meter				Subjective listening on various type of radio receivers in SIO code								Terrain	Remarks
			AIR		SFM		Synth.Recv.		Brand.Recv.		Mob.Recv.		Low End Recv.			
			H	V	H	V	AIR	SFM	AIR	SFM	AIR	SFM	AIR	SFM		
1	Sayajee baug	5	72	81	61	74	555	555	555	555	555	555	454	454	MT/U	
2	Chhani	10	71	66	64	56	555	555	555	555	555	555	454	454	HT/V	
3	NH8 AHMD	15	59	60	57	53	555	555	555	555	555	555	454	454	MT/V	
4	NAV DURGA	20	58	60	56	57	555	555	555	555	555	555	454	343	MT/V	
5	NH8	25	51	53	51	54	555	555	555	555	454	454	454	454	HT/V	
6	NH8	30	42	43	40	42	454	454	454	454	454	454	454	343	HT/V	
7	ANAND CIRCLE	40	41	42	40	42	454	454	454	454	454	454	343	343	HT/J	
8	NH8	50	29	32	28	30	343	343	343	343	342	342	**142**	142	HT/J	
9	NADIAD	60	21	26	22	25	242	**222**	242	141	141	141	**131**	**131**	U/MT/LRB	O/E CAPT.
10	NH8	75	20	19	31	37	242	**222**	131	131	141	222	141	**322**	HT/V	O/E CAPT.
11	NH8(AHMB)	85	20	22	37	38	342	**424**	242	221	141	**424**	141	343	HT/LRB/V/SU	
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13																
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15																
16																

Terrain Legends:– **DU**-Dense Urban, **SU**-Semi Urban, **U**- Urban, **V**-vegitation and Field, **J**-Forest/Toll Tree, **HT**-High Traffic, **MT**- Moderate Traffic
LT-Low Traffic/No Traffic, **HRB**-High Rise Buildings, **LRB**- Low Rise Buildings, **MKT**-Market Area.
O/E- Orientation effect, **CAPT**. -Capture effect.

FIELD STRENGTH SURVEY FOR CHANNEL SPACING

TABLE: 2

AIR FM(VBS) FREQ: 93.9 MHz XTR POWER: 10KW

SFM(RED FM):FREQ:93.5MHz XTR POWER: 5KW

Radial Route: NORTH

S.No	Location	Distance (KM)	Field Strength dB μV/meter at a hight of 1.5 Meter				Subjective listening on various type of radio receivers in SIO code								Terrain	Remarks
			AIR		SFM		Synth.Recv.		Brand.Recv.		Mob.Recv.		Low End Recv.			
			H	V	H	V	AIR	SFM	AIR	SFM	AIR	SFM	AIR	SFM		
1	FATEHPURA	5	78	81	70	71	555	555	555	555	555	555	555	555	DU/MT/LRB	
2	SAMA SAV RD	10	65	72	57	58	555	555	555	555	555	555	454	454	U/LRB/MKT	
3	SAVLI RD	15	57	65	51	54	555	555	555	555	555	555	454	454	MT/V/SU	
4	MANJUSAR	20	57	59	44	50	555	555	555	555	555	555	454	453	MT/V/SU	
5	SAVLI RD	26	48	57	40	47	555	555	555	555	343	342	343	343	LT/J/V	
6	SAVLI RD	30	46	46	41	39	343	342	343	342	342	242	342	242	MT/SU/J	O/E
7	SAVLI RD	35	49	52	41	41	454	453	454	453	342	242	454	342	MT/V	
8	SAVLI RD	40	51	52	43	40	453	242	342	242	342	342	342	131	MT/V	
9	DASAR RD	45	41	44	35	34	454	343	454	343	342	242	342	342	MT/V	
10	DASAR RD	50	31	34	30	27	454	333	342	242	242	131	342	131	J/LT	
11	DAKOR RD	55	35	38	30	31	343	342	343	242	242	141	342	242	V/LT	
12	DAKOR RD	60	37	36	29	27	342	222	342	141	141	141	141	141	U/LT/LRB	CAPT(AMD)
13	D-KAPADVANJ	65	31	33	29	34	453	423	342	323	131	131	342	332	MT/V	
14	D-KAPADVANJ	75	28	32	34	37	343	323	141	332	131	131	131	332	MT/V	
15	KAPADVANJ	85	18	20	30	34	342	333	141	332	141	222	141	332	LRB/LT/U	
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Terrain Legends:-- **DU**-Dense Urban, **SU**-Semi Urban, **U**- Urban, **V**-vegitation and Field, **J**-Forest/Toll Tree, **HT**-High Traffic, **MT**- Moderate Traffic
LT-Low Traffic/No Traffic, **HRB**-High Rise Buildings, **LRB**- Low Rise Buildings, **MKT**-Market Area.
O/E- Orientation effect, **CAPT**. -Capture effect.

FIELD STRENGTH SURVEY FOR CHANNEL SPACING

TABLE: 3

AIR FM(VBS) FREQ: 93.9 MHz XTR POWER: 10KW

SFM(RED FM):FREQ:93.5MHz XTR POWER: 5KW

Radial Route: **NORTH EAST**

S.No	Location	Distance (KM)	Field Strength dB μV/meter at a hight of 1.5 Meter				Subjective listening on various type of radio receivers in SIO code								Terrain	Remarks
			AIR		SFM		Synth.Recv.		Brand.Recv.		Mob.Recv.		Low End Recv.			
			H	V	H	V	AIR	SFM	AIR	SFM	AIR	SFM	AIR	SFM		
1	UMA COKDI	5	81	84	74	73	555	555	555	555	555	555	555	555	DU/MT	
2	SAGAR ST	10	70	77	63	62	555	555	555	555	555	555	555	555	U/MT	
3	NIMETA	15	70	75	63	67	555	555	555	555	555	555	555	555	V/MT	
4	N JAROD	20	57	70	51	58	454	454	454	454	454	454	454	453	V/LT	
5	AJWA LAKE	25	54	63	50	51	454	454	454	454	454	342	454	453	V/LT	
6	MOHAN PURA V	30	52	61	51	50	454	454	454	454	454	342	443	443	V	
7	BASKA VILL	35	56	61	52	52	454	454	454	454	343	343	454	343	V	
8	HALOL	40	52	52	47	47	454	343	454	454	342	342	343	342	U	
9	KUKVARI	45	38	50	34	35	454	343	343	242	342	242	342	242	J/LT	
10	PARDI V	55	35	45	36	35	343	332	242	131	242	242	342	131	J/LT	WEAK CAPT O/E
11	BORIA V	60	41	52	41	49	343	343	343	343	343	343	342	342	HT/V	
12	N BORIA	65	39	46	43	43	343	343	343	343	242	242	342	342	J/Ht/LT	
13	MALU GORADA	70	33	42	33	37	343	343	343	342	242	242	343	242	LT/V	
14	DUDHIA	80	21	36	20	24	343	242	342	131	141	141	141	141	Ht/LT/RURAL	
15	JUMA BADIA	85	21	36	20	24	343	242	342	141	141	141	141	141	MT/SU/Ht	
16	BADIA	90	18	17	16	15	141	141	141	141	141	141	141	141	U/LT/Ht	

Terrain Legends:– **DU**-Dense Urban, **SU**-Semi Urban, **U**- Urban, **V**-vegitation and Field, **J**-Forest/Toll Tree, **HT**-High Traffic, **MT**- Moderate Traffic **LT**-Low Traffic/No Traffic, **HRB**-High Rise Buildings, **LRB**- Low Rise Buildings, **MKT**-Market Area. **O/E**- Orientation effect, **CAPT**. -Capture effect.

FIELD STRENGTH SURVEY FOR CHANNEL SPACING

TABLE: 4

AIR FM(VBS) FREQ: 93.9 MHz XTR POWER: 10KW

SFM(RED FM):FREQ:93.5MHz XTR POWER: 5KW

Radial Route: EAST

S.No	Location	Distance (KM)	Field Strength dB μV/meter at a hight of 1.5 Meter				Subjective listening on various type of radio receivers in SIO code								Terrain	Remarks
			AIR		SFM		Synth.Recv.		Brand.Recv.		Mob.Recv.		Low End Recv.			
			H	V	H	V	AIR	SFM	AIR	SFM	AIR	SFM	AIR	SFM		
1	Thuvavi rd	5	80	91	79	76	555	555	555	555	555	555	555	555	MT/V	
2	THUVAVI RD	10	76	84	69	72	555	555	555	555	555	555	555	555	MT/V	
3	L THUVAVI RD	15	57	73	53	59	555	555	555	555	555	555	555	555	V/LT	
4	VAGHODIA RD	20	53	64	51	52	555	555	555	555	555	555	555	555	V/LT	
5	FIELD	25	54	63	52	51	555	555	555	555	555	555	555	555	V	
6	VAGHO-SAMKH RD	30	49	61	44	50	555	555	555	555	555	555	555	555	MT/V	
7	BODELI RD	40	44	52	39	37	555	555	555	555	555	555	555	454	MT/V	
8	BODELI RD	50	38	45	30	32	454	343	454	343	242	242	343	242	MT/V	
9	BOD C.UDAIPUR	60	32	44	31	32	454	343	343	242	242	141	342	242	J/MT	
10	BOD C.UDAIP RD	70	31	35	19	21	342	342	342	242	141	141	242	141	MT/V/SH	
11	BOD C.UDAIP RD	80	29	29	17	22	342	242	342	141	141	141	141	141	MT/V.SH	
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13																
14																
15																
16																

Terrain Legends:-- **DU**-Dense Urban, **SU**-Semi Urban, **U**- Urban, **V**-vegitation and Field, **J**-Forest/Toll Tree, **HT**-High Traffic, **MT**- Moderate Traffic
LT-Low Traffic/No Traffic, **HRB**-High Rise Buildings, **LRB**- Low Rise Buildings, **MKT**-Market Area.
O/E- Orientation effect, **CAPT**. -Capture effect.

FIELD STRENGTH SURVEY FOR CHANNEL SPACING

TABLE: 5

AIR FM(VBS) FREQ: 93.9 MHz XTR POWER: 10KW

SFM(RED FM):FREQ:93.5MHz XTR POWER: 5KW

Radial Route: **SOUTH**

S.No	Location	Dist. (KM) L.O.S	Field Strength dB μV/meter at a hight of 1.5 Meter				Subjective listening on various type of radio receivers in SIO code								Terrain	Remarks
			AIR		SFM		Synth.Recv.		Brand.Recv.		Mob.Recv.		CheapFM Rec.			
			H	V	H	V	AIR	SFM	AIR	SFM	AIR	SFM	AIR	SFM		
1	NH8,out city	5	84	95	82	85	555	555	555	555	555	555	454	454	HT/V	
2	NH8	10	72	78	70	71	454	454	454	454	454	454	454	454	HT/V	
3	NH8	20	55	64	50	53	454	454	454	454	454	454	454	454	HT/V	
4	KARJAN NH8	25	54	60	44	51	454	454	454	454	454	453	454	453	LRB/SU/HT	
5	NH8	30	50	57	46	47	454	454	454	454	343	343	454	343	HT/V	
6	NH8	40	49	52	43	38	454	454	454	454	343	343	443	343	HT/V	
7	NABIPUR NH8	50	38	44	32	30	454	343	454	243	242	242	343	242	HT/V	
8	NH8	55	34	40	30	31	454	443	454	443	242	141	343	242	SU/HT	
9	NH8 NEAR JHAGADIA	60	34	41	31	30	454	343	343	342	343	242	343	242	V/LT	
10	NH8	65	31	42	27	32	343	343	343	242	242	141	242	141	V/LT	
11	NH8	70	28	26	21	18	342	242	242	141	141	141	141	141	MT/V/J	
12	ANKLESHWAR	80	23	34	20	24	242	231	242	141	141	141	141	141	HT/U	
13	NH8	85	22	29	18	19	242	222	242	141	141	141	141	141	HT/SU	
14																

Terrain Legends:-- **DU**-Dense Urban, **SU**-Semi Urban, **U**- Urban, **V**-vegitation and Field, **J**-Forest/Toll Tree, **HT**-High Traffic, **MT**- Moderate Traffic **LT**-Low Traffic/No Traffic, **HRB**-High Rise Buildings, **LRB**- Low Rise Buildings, **MKT**-Market Area. **O/E**- Orientation effect, **CAPT**. -Capture effect.

FIELD STRENGTH SURVEY FOR CHANNEL SPACING

TABLE: 6

AIR FM(VBS) FREQ: 93.9 MHz XTR POWER: 10KW

SFM(RED FM):FREQ:93.5MHz XTR POWER: 5KW

Radial Route: **WEST**

S.No	Location	Dist. (KM)	Field Strength dB µV/meter at a hight of 1.5 Meter				Subjective listening on various type of radio receivers in SIO code								Terrain	Remarks
			AIR		SFM		Synth.Recv.		Brand.Recv.		Mob.Recv.		Low End Recv.			
			H	V	H	V	AIR	SFM	AIR	SFM	AIR	SFM	AIR	SFM		
1	PADRA RD	5	82	73	75	76	555	555	555	555	555	555	555	555	DU	
2	PADRA PON TURN	10	64	61	58	62	555	555	555	555	555	555	555	555	MT/LRB	
3	PADRA CROSS RD	15	59	59	56	59	555	555	555	555	555	555	555	555	MT/V	
4	STATE HIGH WAY	20	55	53	50	53	555	555	555	555	555	555	555	555	LT/V	
5	BHADARNIYA RD	25	49	43	51	46	555	555	555	555	555	555	555	555	MT/V	
6	BHADRAN	30	52	51	47	49	555	555	555	555	555	555	555	555	LT/V	
7	DHUVRAN RD	35	50	43	42	41	555	555	555	555	555	555	555	454	LT/V	
8	DHUVRAN RD	40	28	29	28	29	454	***434***	454	***434***	454	232	343	141	LT/V	AHMD-84 KM CAPT.
9	DHUVRAN RD	45	40	31	36	30	454	454	454	454	343	131	343	343	LT/V	
10	CAMBAY RD	50	39	35	35	35	454	343	454	343	454	***332***	343	***222***	LT/V	
11	KHAMBHAT	60	29	24	27	27	242	131	242	131	131	131	131	131	U/MT/MKT	
12	CAMBAY-GOLANA RD	65	16	22	30	30	343	***323***	242	***423***	141	141	141	***323***	AHMD-77KM LT/V CAPT.	
13																
14																
15																
16																

Terrain Legends:-- **DU**-Dense Urban, **SU**-Semi Urban, **U**- Urban, **V**-vegitation and Field, **J**-Forest/Toll Tree, **HT**-High Traffic, **MT**- Moderate Traffic
LT-Low Traffic/No Traffic, **HRB**-High Rise Buildings, **LRB**- Low Rise Buildings, **MKT**-Market Area.
O/E- Orientation effect, **CAPT**. -Capture effect.

PSM LAB

FIELD STRENGTH SURVEY FOR CHANNEL SPACING

TABLE: 7

AIR FM(VBS) FREQ: 93.9 MHz XTR POWER: 10KW

SFM(RED FM):FREQ:93.5MHz XTR POWER: 5KW

Radial Route: **Vadodara City Area**

S.No	Location	Dist. (KM)	Field Strength dB µV/meter at a hight of 1.5 Meter				Subjective listening on various type of radio receivers in SIO code								Terrain	Remarks
			AIR		SFM		Synth.Recv.		Brand.Recv.		Mob.Recv.		Low End Recv.			
			H	V	H	V	AIR	SFM	AIR	SFM	AIR	SFM	AIR	SFM		
1	NAYAY MANDIR	4	84	90	77	79	555	555	555	555	555	555	555	555	DU/MKT/LRB/HRB/HT	
2	MANDVI	4.2	87	90	74	72	555	555	555	555	555	555	555	555	DU/LRB/MT	
3	FABLIPUR	5	74	79	63	69	555	555	555	555	555	555	555	555	DU/MT/LRB	
4	MENTAL HOSP.	5.9	72	72	63	60	555	555	555	555	555	555	555	555	DU/MT/LRB	
5	RAILWAY ST	5.7	79	72	75	66	555	555	555	555	555	555	555	555	DU/MKT/LRB/MT	
6	AKSHAR CHOWK	4.7	79	74	74	75	555	555	555	555	555	555	555	555	LRB/U/MT	
7	AMIT CIRCLE	7	70	76	60	67	555	555	555	555	555	555	555	444	HT/U/V	
8	SOUTH TO AMIT C.	5	71	73	68	59	555	555	555	555	555	555	555	555	U/LRB/LT	
9																
10																
11																
12																
13																
14																
15																
16																

SIO CODE detials

Grade	Signal	Interference	Over all
5	Excellent	nil	Excellent
4	good	Slight	good
3	fair	Moderate	fair
2	poor	Severe	poor
1	barely audible	Extreme	unusable

Terrain Legends:-- **DU**-Dense Urban, **SU**-Semi Urban, **U**- Urban, **V**-vegitation and Field, **J**-Forest/Toll Tree, **HT**-High Traffic, **MT**- Moderate Traffic
LT-Low Traffic/No Traffic, **HRB**-High Rise Buildings, **LRB**- Low Rise Buildings, **MKT**-Market Area.
O/E- Orientation effect, **CAPT**. -Capture effect.

Annexure: 1

PRASAR BHARATI
Directorate general, All india radio
(Spectrum Management & Synergy)

No. 8/1/2012-EIII | 914 916 To 919 New Delhi, dated 7th May, 2012

All India Radio has planned their FM network on the basis of Lattice Planning and maximum coverage. With the proliferation of transmitters in the network, we may reconsider the concept of maximum coverage and revisit the FM frequency plan so that more no. of frequencies could be spared/ generated within allotted band(100-103.7MHz) which may also, help us in providing more than one frequencies in a city.

Keeping these issues in view subjective listening and field Strength survey study has been proposed to be carried by Research Deptt. Of AIR & DD.

(A) Channel Spacing:

In city of Vadodra, FM Tx of AIR is operating at 93.9MHz and SFM Tx(Private) is operating at 93.5MHz. It is an ideal place to experiment on Channel spacing. Both the Txs are operating at 10kW power on different antennae.

At Vadodra, field strength measurement and subjective listening need to be carried out in following radial routes for about 100kM each. These routes may be:

1. North :- NH8 by pass, Savli, Thasra, Vadol
2. North west - Chhani, Vasad, Anand, Nadiad, Mehmodabad(65 km), Ahmedabad
3. North East:- Sarnlaya, Iotna,Kalol, Godhra(60km) Morwa
4. East :- Vaghodia, morkhala, Bodeli, Chota Udaipur, (75km) Alirajpur(MP)
5. South:- Makarpura, Por, Karjan ,Bharuch, Ankleshwar(70 km)Kamrej/Mandvi
6. West:- Padra, bharaniya, Undel, khambhat(60km) , Vadgam (70 km) Fedra

Results be tabulated and analysed for broadcasting on frequencies 400 kHz apart.

(B) Co-channel separation

Ahmedabad, Vadodra and Surat are about 100km apart. In these cities private FM operators are also present. These Txs are operating at the same frequency for a particular broadcaster. However, content is different. Some typical examples are:

Operator	Cities	Distance(kM)
ENIL (Times of India)	Vadodra, Surat	129
ADLAB(Reliance)	Vadodra, Surat	129
SFM(South Asia)	Vadodra, Ahmedabad	101
MIRPL(Radio City)	Vadodra, Surat	129
	Vadodra, Ahmedabad	101
	Ahmedabad, Surat	108
Synergy Media	Ahmedabad, Surat	108

Field strength measurement and subjective listening will also, be carried out for this study along with Channel spacing monitoring to find out the effect of co channel operation.

Annexure : 1

Research Department of AIR & Doordarshan is requested to depute a team and time table to carry out above field Strength measurements and subjective listening. Name and mobile no. of team leader may please be intimated for coordination. A report on each study may please be prepared and expedite to this Directorate.

(M. S. Ansari)
DDG(SMS)
For Director General

To,
Addl. Director General,
All India Radio & Doordarshan,
Research Department,
14, B. I P Estate, Ring Road,
New Delhi-110002

Copy to:

1. DDG, All India Radio, Navrangpura, Ahmedabad-380009(Gujrat)
2. DE, All India Radio, Bhatar Road, Surat-395001(Gujrat)
3. DE, All India Radio, Makarpura Road, Vadodra-390009(Gujrat)

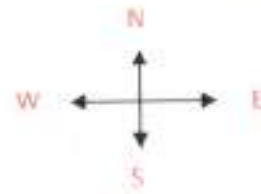
ERP (in dBk) & Urban Coverage(in Km)

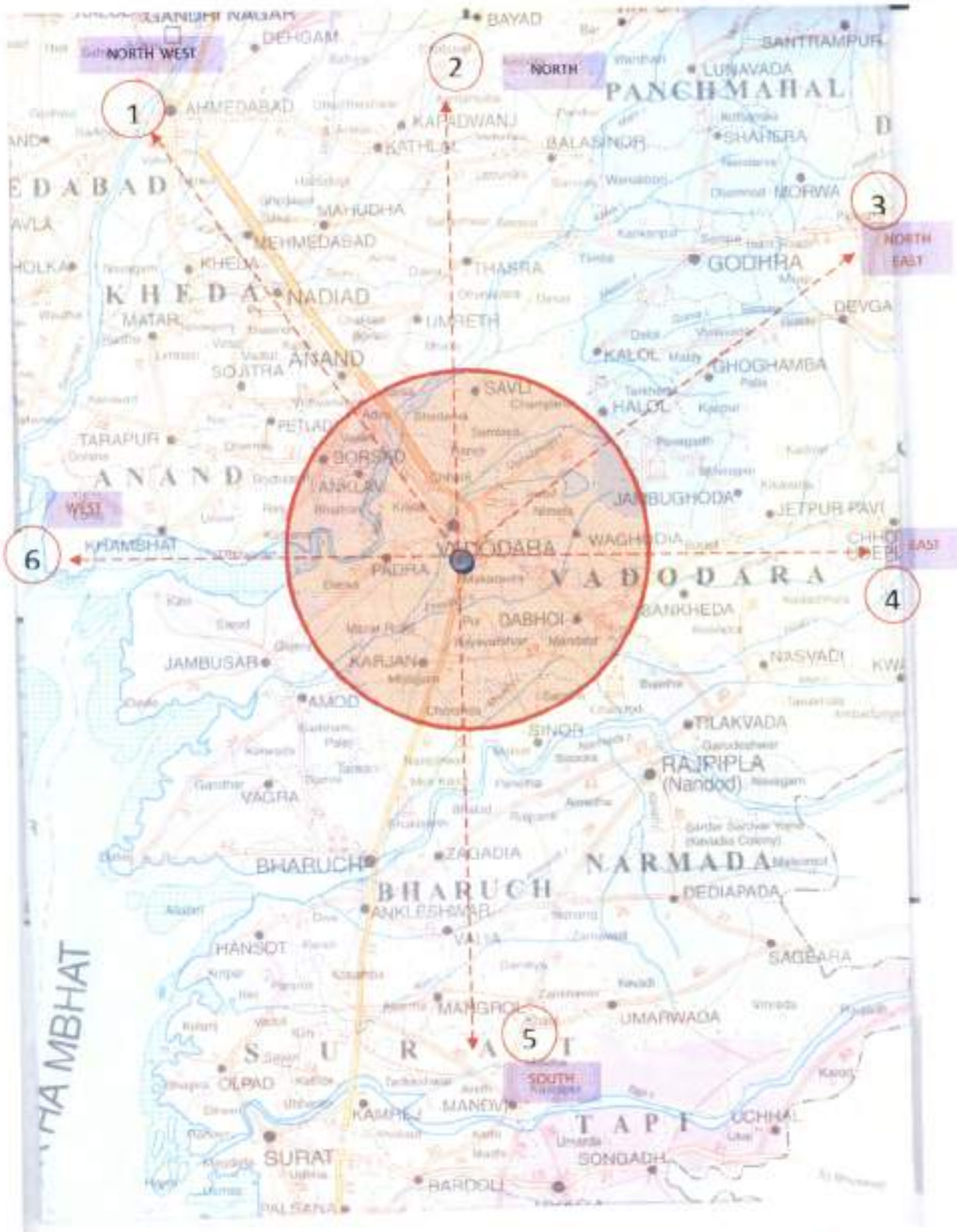
CITY	NAME OF CHANNEL	Freq. (MHz)	ERP dBk	Coverage Km (urban)	Distance seperation (in Km) among Transmitters(in given cities)							
					RAJKOT	VADODARA	SURAT	AHEMADABAD	GODHARA	BANSWADA	DHULE	NASIK
RAJKOT	AIR	102.4	14	30	0	243	241	201	293	397	438	399
	ENIL	98.3	12	27								
	ADLAB	92.7	12	27								
	SFM	93.5	12	27								
VADODARA	AIR	93.9	14	30	243	0	129	101	66	188	228	264
	ENIL	98.3	12	27								
	ADLAB	92.7	12	27								
	SFM	93.5	12	27								
	MBPL	91.1	12	27								
SURAT	AIR	101.1	14	30	241	129	0	208	190	309	204	166
	ENIL	98.3	15	30								
	ADLAB	92.7	15	30								
	MBPL	91.1	15	30								
	SYNERGY	94.3	15	30								
AMEMDABAD	AIR	96.7	14	30	201	101	208	0	107	196	328	360
	MBPL	91.1	15	30								
	SFM	93.5	15	30								
	SYNERGY	94.3	15	30								
	MID DAY	95	15	30								
GODHRA	AIR	102.2	12	27	293	66	190	107	0	122	238	306
BANSWADA	AIR	101.3	14	30	397	188	309	196	122	0	295	399
DHULE	AIR	100.5	12	27	438	228	204	328	238	295	0	143
NASIK	AIR	101.4	12	27	399	264	166	360	306	396	143	0

Coverage: Urban
Tower Hieght: 100 meter
Signal Type Stereo

ANNEXUE II

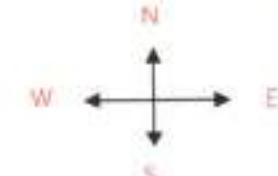
RADIAL ROUTES



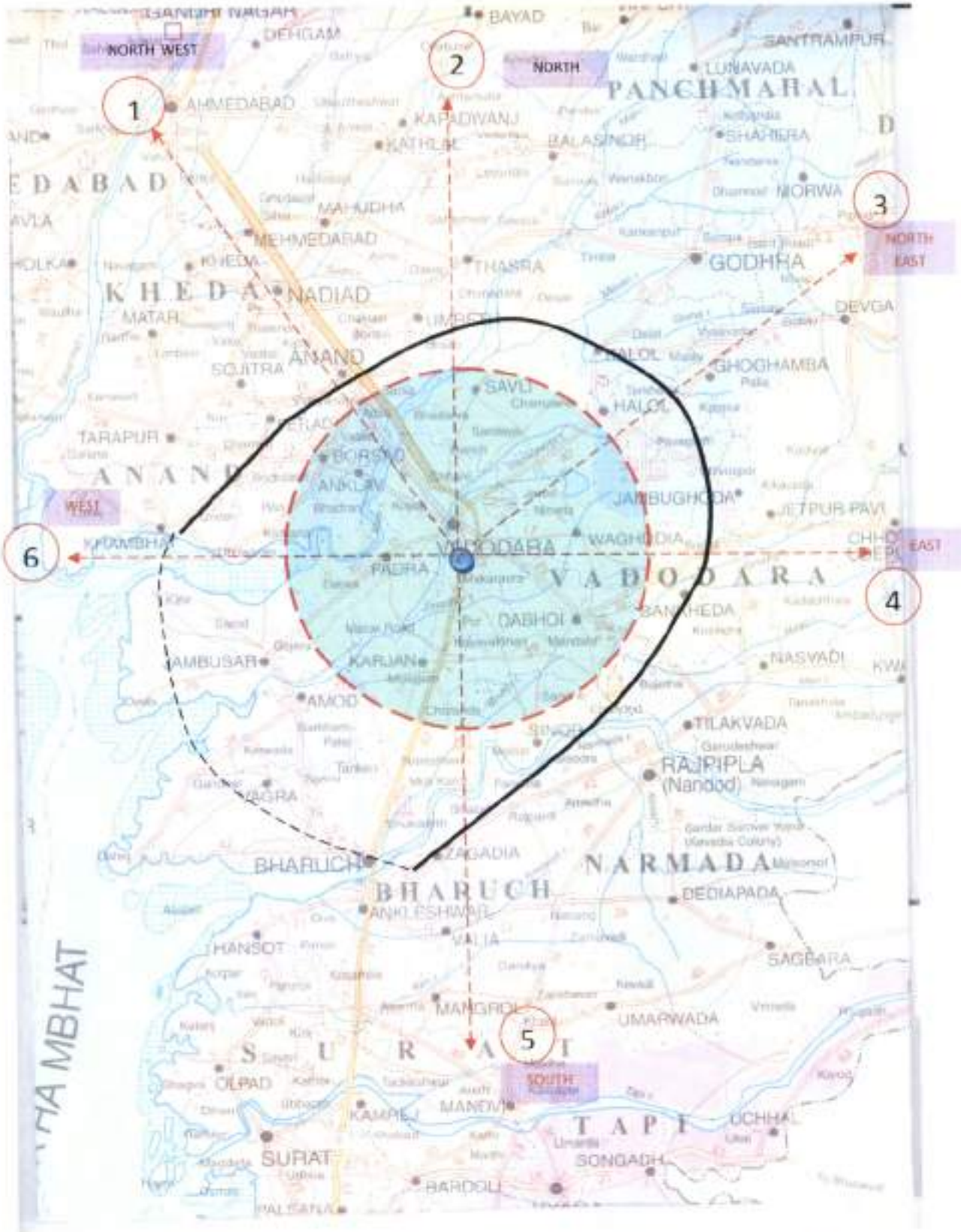


Legend:

1. 66 dBUV/meter Curve as per ITU Rec- BS-412-9, AIR FM Vadodara
2. Transmitter Power: 10 KW, ERP : 14 KW,
3. Urban Stereophonic Service



ANNEXURE V



Legend:

1.Thick Line: Reception curve of AIR Vadodara FM on Cheap radio receiver

2.Dotted line: 66 dBUV/meter Curve as per ITU Rec- BS-412-9, AIR FM Vadodara