Chapter 3

Fig. 3-1

3-1.1 Some important abbreviations frequently in use of GSM network:-

Sr.no.	Abbreviations	Long forms
1	GSM	Global System for Mobile Communication
2	MS	Mobile Station (Handset)
3	BSS	Based Station Sub System
4	BTS	Base Transceiver Station
5	BSC	Base Station controller
6	MSC	Mobile Switching Center
7	HLR	Home Location Register
8	VLR	Visitor Location Register
9	ETSI	European Telecom Standard Institute
10	IMSI	International Mobile Subscriber Identity
11	LAC	Location Area Code
12	NCC	Network Color Code
13	OMC	Operation and Maintenance Center
14	SIM	Subscriber Identity Module
15	BCC	Base Color Code
16	MNC	Mobile Network Code
17	RT	Radio Terminal
18	MRIF	Mini Rack Interface
19	PG	Peripheral Group
20	ARFCN	Absolute Radio Frequency Channel No.
21	MSIDN	Mobile Sub's ISDN No
22	MSRN	Mobile Sub's roaming no.

3-1.2 **General: -**

1. Up link: - 890-915 MHz and Down link: - 935-960 MHz
2. GSM Bandwidth: - 25 MHz
3. Channel Bandwidth: - 200 KHz
4. No. of Channels $\frac{25 \times 10^6}{200 \times 10^3} = 125$

Numbers of 124 Channels are available and spread at 200 KHz intervals.
First carrier not used due to interference to other systems.

5. ARFCN Up link Frequency = 890 + 0.2 x N (N-CHL No. 1-62)
   Down link Frequency = 935 + 0.2 x N (N- CHL No. 63-124)

6. Pl. see block schematic of GSM network in Fig. 3-3 and Lucent BTS front view in Fig. no. 3-2, 3-4, & 3-5.

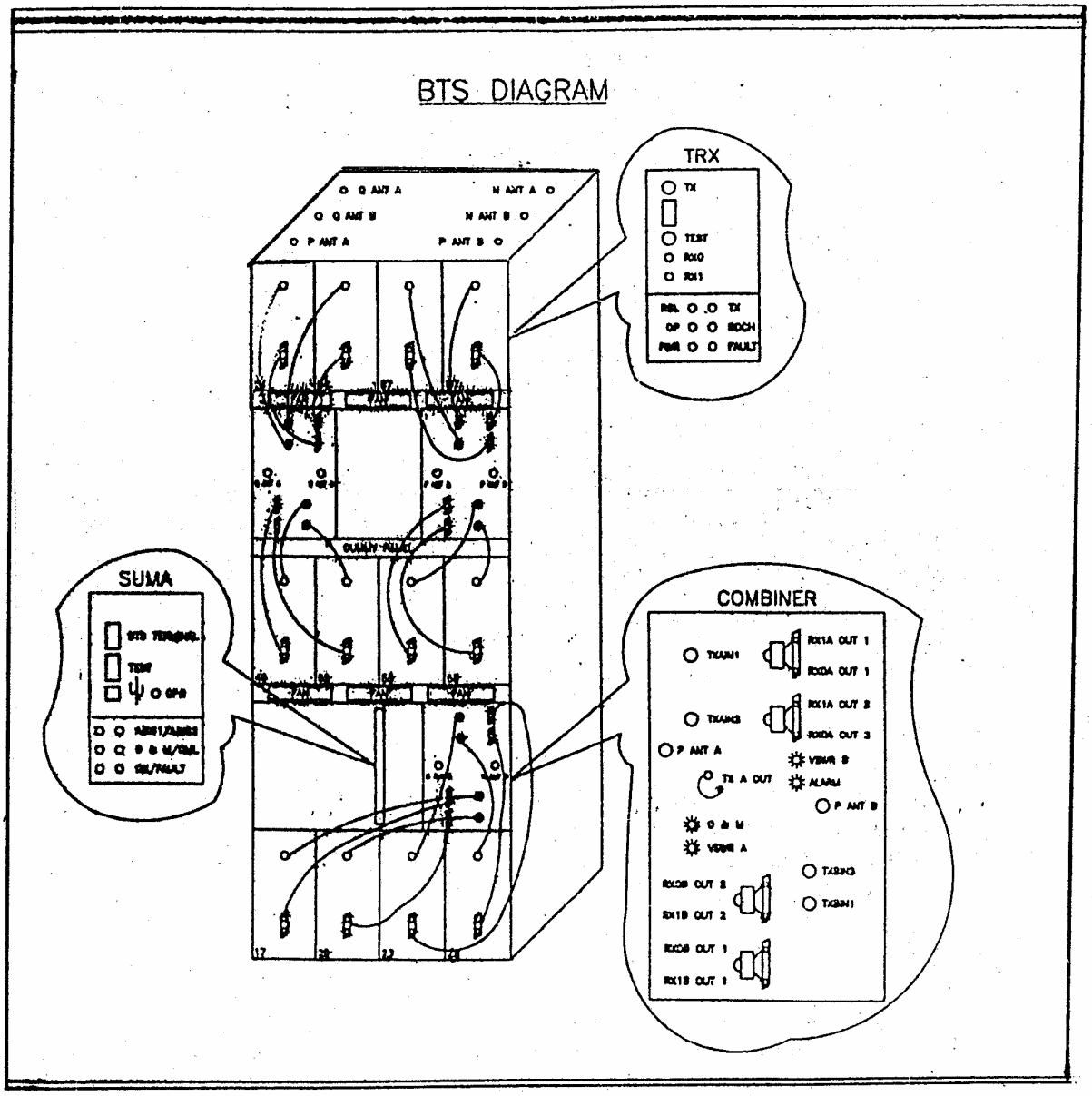


Fig. 3-2

Block schematic of GSM Network

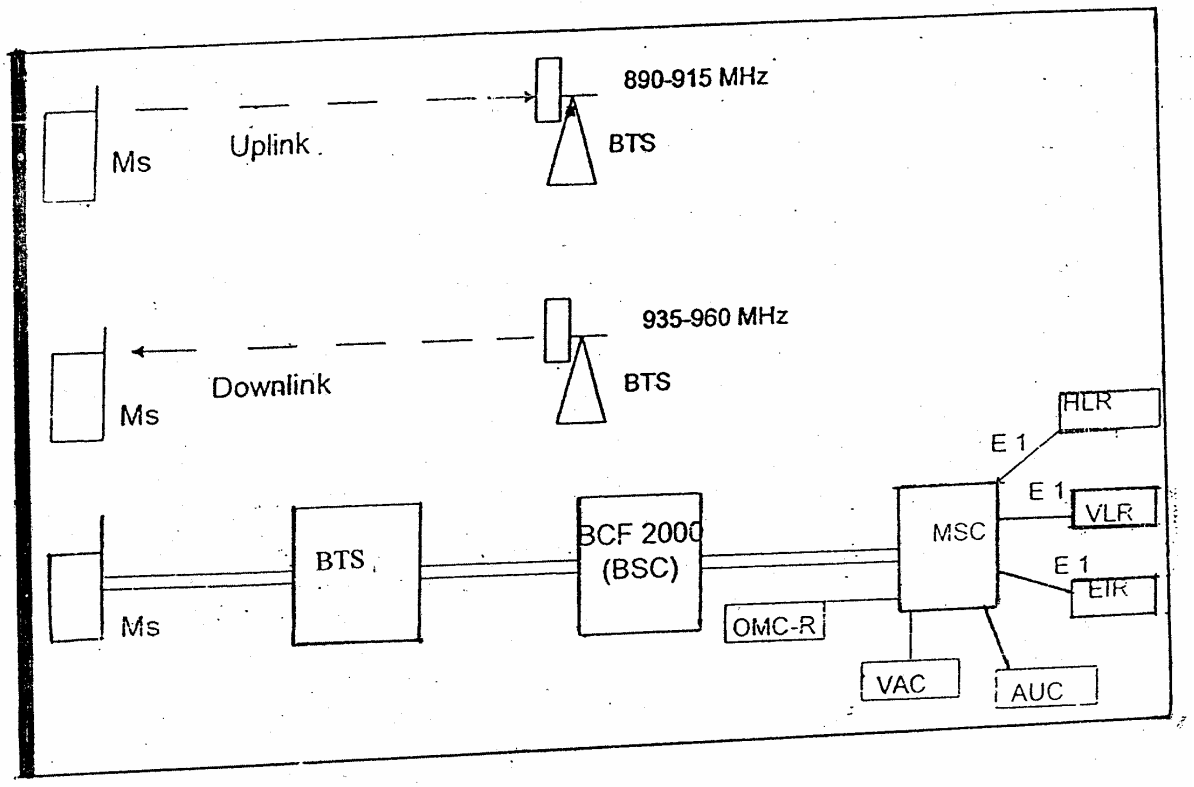


Fig. 3-3

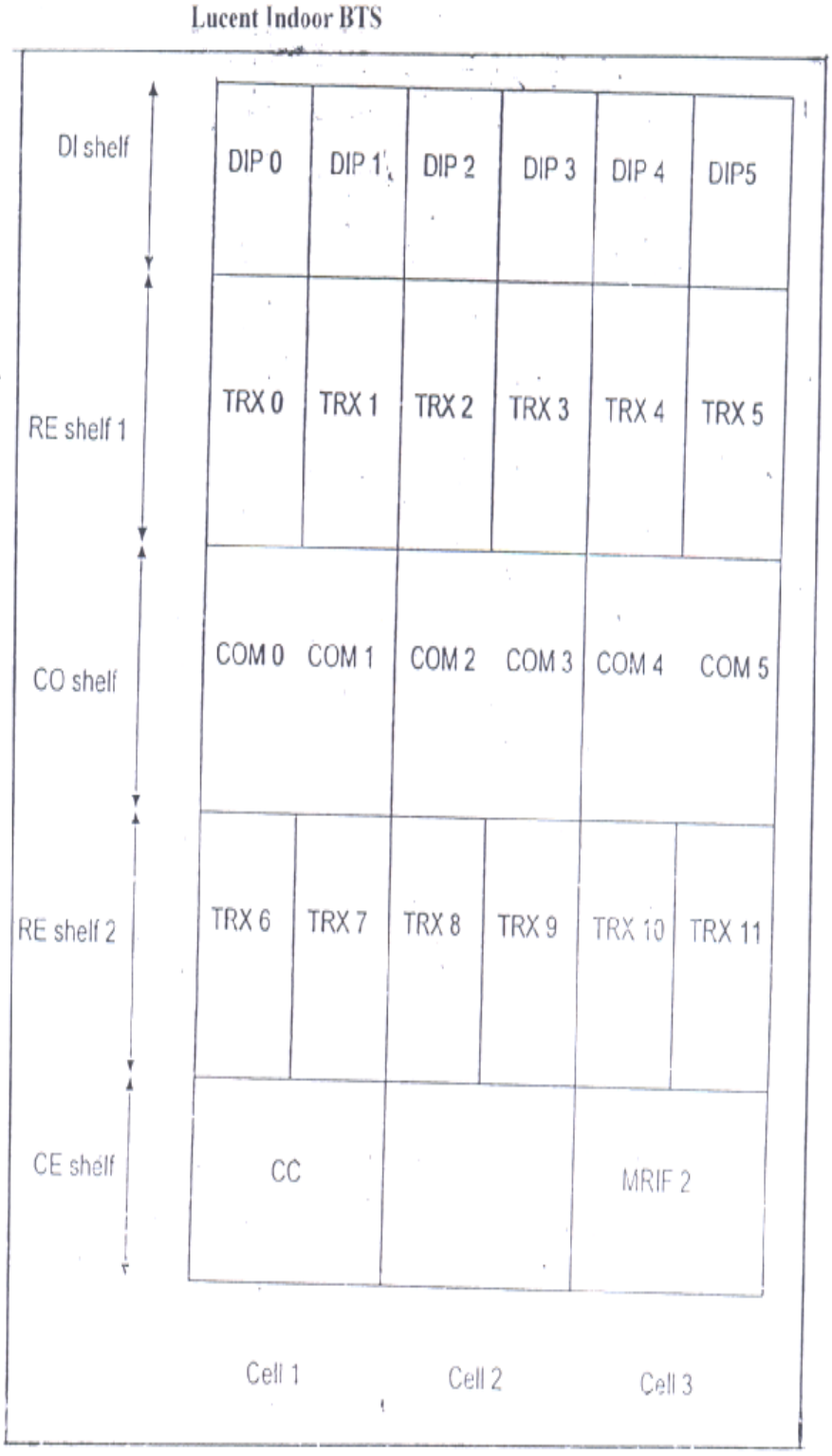

Lucent Indoor BTS
DI shelf
RE shelf 1
CO shelf
RE shelf 2
CE shelf
DIP 0
DIP 1
DIP 2
DIP 3
DIP 4
DIP5
TRX 0
TRX 1
TRX 2
TRX 3
TRX 4
TRX 5
COM 0
COM 1
COM 2
COM 3
COM 4
COM 5
TRX 6
TRX 7
TRX 8
TRX 9
TRX 10
TRX 11
CC
MRIF 2
Cell 1
Cell 2
Cell 3

Fig. 3-4

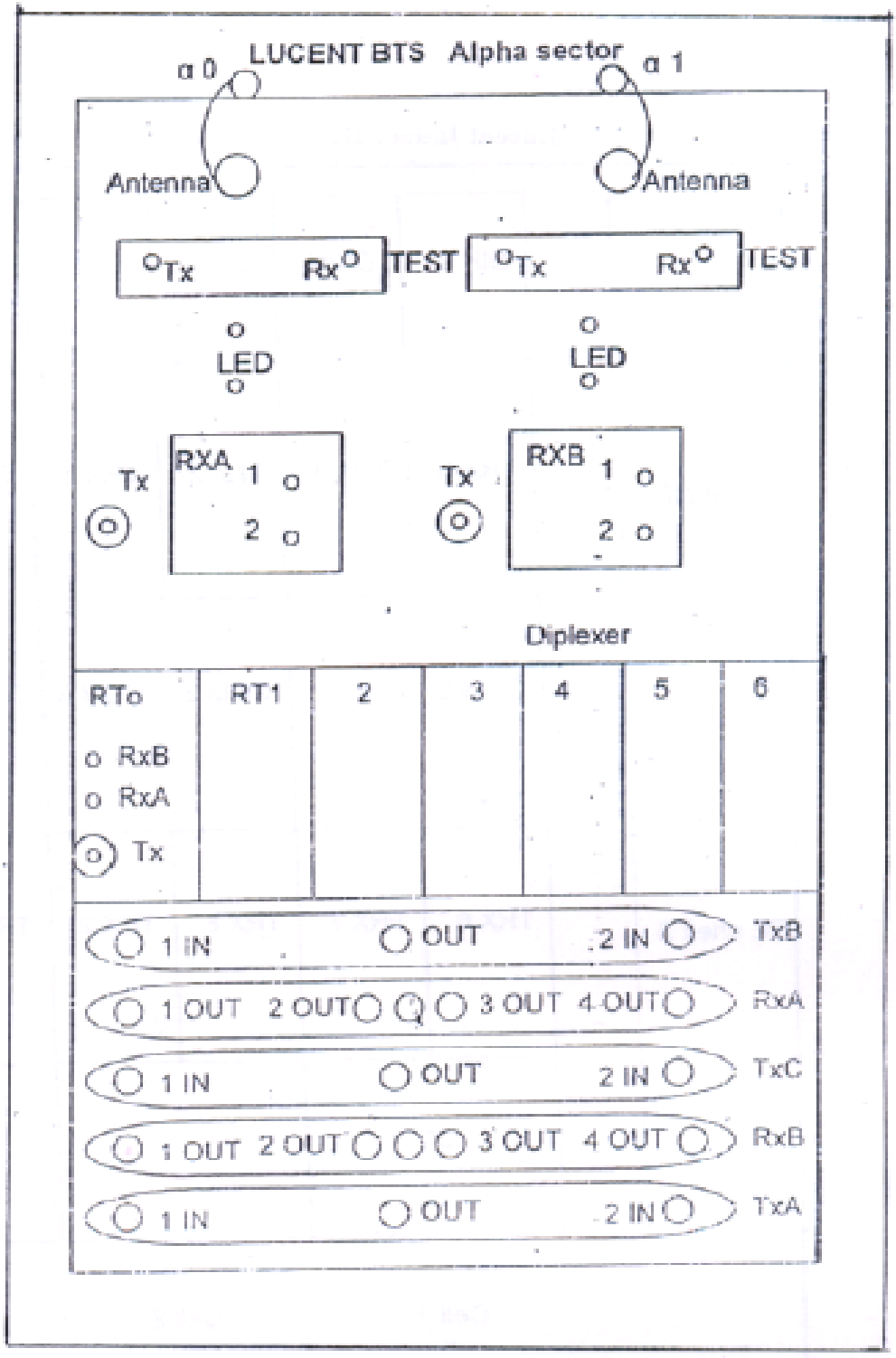
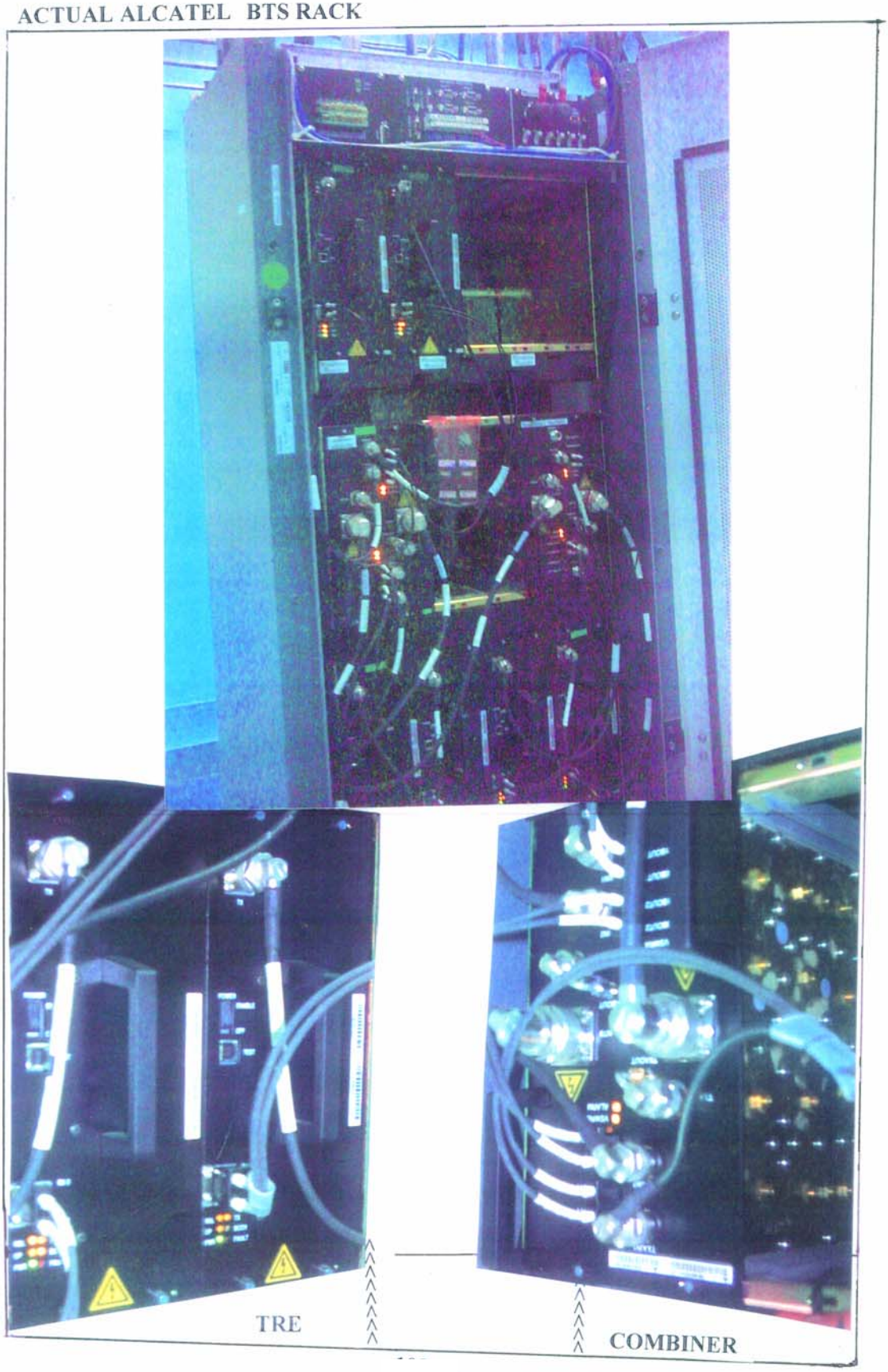
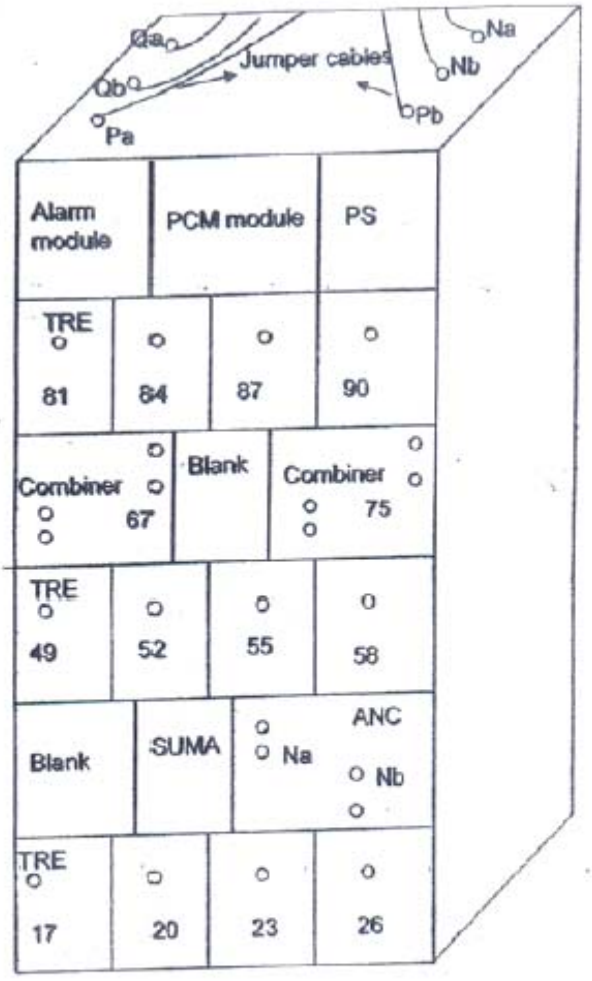

α 0
LUCENT BTS Alpha sector
α 1
Antenna
Antenna
Tx
Rx
TEST
Tx
Rx
TEST
LED
LED
Tx
RXA
1
2
Tx
RXB
1
2
Diplexer
RTo
RT1
2
3
4
5
6
RxB
RxA
Tx
1 IN
OUT
2 IN
TxB
1 OUT
2 OUT
3 OUT
4 OUT
RxA
1 IN
OUT
2 IN
TxC
1 OUT
2 OUT
3 OUT
4 OUT
RxB
1 IN
OUT
2 IN
TxA

Fig. 3-5

ACTUAL ALCATEL BTS RACK



ALCATEL BTS


Qa
Jumper cables
Na
Nb
Qb
Pb
Pa
Alarm module
PCM module
PS
TRE
81
84
87
90
Combiner
67
Blank
Combiner
75
TRE
49
52
55
58
Blank
SUMA
Na
ANC
Nb
TRE
17
20
23
26

3-1.3 Configuration chart of Lucent BTS

Site ID	Sector ID	BSNL Cell Id	Site Name	Longitude	Latitude	ABH	Antenna type	Azimuth	Tilt			# of TRXs	TRX Config	# of TRXs/ Site	MSC	BSC	CGI						NCC	BCC	BCCH	ARFCN
									E tilt	M tilt	T tilt						MCC	MNC	LAC			Cell Id				
																			MSC	SSA	Area					
PUN048	PUN048_2	30112	Wanwari	73°54'8.2"E	18°29'47.1"N	30	730376	170	2	0	2	3			Pune	PUN_2	404	66	01	01	2	1472	5	0	120	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN048	PUN048_3	30121	Wanwari	73°54'8.2"E	18°29'47.1"N	30	730376	275	2	0	2	3			Pune	PUN_2	404	66	01	01	2	1473	5	0	73	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN049	PUN049_1	31151	Warje,BSNL	73°48'7.4"E	18°29'9.6"N	30	730376	330	2	0	2	3	3/3/3	9	Pune	PUN_4	404	66	01	01	1	1481	5	1	116	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN049	PUN049_2	31152	Warje,BSNL	73°48'7.4"E	18°29'9.6"N	30	730376	60	2	0	2	3			Pune	PUN_4	404	66	01	01	1	1482	5	3	75	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN049	PUN049_3	31161	Warje,BSNL	73°48'7.4"E	18°29'9.6"N	30	730376	170	2	0	2	3			Pune	PUN_4	404	66	01	01	1	1483	5	0	77	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN050	PUN050_1	31051	Yerwada	73°53'30.3"E	18°33'17.1"N	30	730376	0	2	0	2	4	4/4/4	12	Pune	PUN_1	404	66	01	01	3	1491	5	5	120	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN050	PUN050_2	31052	Yerwada	73°53'30.3"E	18°33'17.1"N	30	730376	120	2	0	2	4			Pune	PUN_1	404	66	01	01	3	1492	5	7	76	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN050	PUN050_3	31061	Yerwada	73°53'30.3"E	18°33'17.1"N	30	730376	240	2	0	2	4			Pune	PUN_1	404	66	01	01	3	1493	5	4	115	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN119	PUN119_1		Baramati	74°34'39.11"E	18°08'51.82"N	40	730376	113	0	0	0	3	3/3/3	9	Pune	PUN_1	404	66	01	01	3	2181	5	1	76	112
PUN119	PUN119_2		Baramati	74°34'39.11"E	18°08'51.82"N	40	730376	227	0	0	0	3			Pune	PUN_1	404	66	01	01	3	2182	5	0	119	123
PUN119	PUN119_3		Baramati	74°34'39.11"E	18°08'51.82"N	40	730376	305	0	0	0	3			Pune	PUN_1	404	66	01	01	3	2183	5	5	73	66
PUN120	PUN120_1		Dehuroad	73°43'57.90"E	18°40'36.03"N	40	730376	103	0	0	0	3	3/3/3	9	Pune	PUN_4	404	66	01	01	1	2191	5	2	74	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN120	PUN120_2		Dehuroad	73°43'57.90"E	18°40'36.03"N	40	730376	179	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2192	5	4	117	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN120	PUN120_3		Dehuroad	73°43'57.90"E	18°40'36.03"N	40	730376	322	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2193	5	2	76	63 64 66 67 68 69 70 71 80 81 82 87 88 111
PUN121	PUN121_1		Dukes	73°22'10.99"E	18°45'40.01"N	60	K73456.	77	0	0	0	3	3/3/3	9	Pune	pun_4	404	66	01	01	1	2201	5	1	73	88
PUN121	PUN121_2		Dukes	73°22'10.99"E	18°45'40.01"N	60	K73456.	148	0	0	0	3			Pune	pun_4	404	66	01	01	1	2202	5	0	77	82
PUN121	PUN121_3		Dukes	73°22'10.99"E	18°45'40.01"N	60	K73456.	242	0	0	0	3			Pune	pun_4	404	66	01	01	1	2203	5	6	118	80
PUN122	PUN122_1		Kamshet	73°32'34.00"E	18°44'10.04"N	60	K73456.	21	0	0	0	3	3/3/3	9	Pune	PUN_4	404	66	01	01	1	2211	5	3	74	69
PUN122	PUN122_2		Kamshet	73°32'34.00"E	18°44'10.04"N	60	K73456.	165	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2212	5	5	116	64
PUN122	PUN122_3		Kamshet	73°32'34.00"E	18°44'10.04"N	60	K73456.	278	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2213	5	3	118	88
PUN123	PUN123_1		Kanhephata	73°35'53.98"E	18°45'42.03"N	60	K73456.	128	0	0	0	3	3/3/3	9	Pune	PUN_4	404	66	01	01	1	2221	5	3	73	64
PUN123	PUN123_2		Kanhephata	73°35'53.98"E	18°45'42.03"N	40	K73456.	225	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2222	5	6	78	111
PUN123	PUN123_3		Kanhephata	73°35'53.98"E	18°45'42.03"N	60	K73456.	296	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2223	5	0	115	87
PUN124	PUN124_1		Karegaon MIDC	74°17'10.16"E	18°46'59.48"N	40	730376	62	0	0	0	3	3/3/3	9	Pune	PUN_1	404	66	01	01	3	2231	5	3	73	124
PUN124	PUN124_2		Karegaon MIDC	74°17'10.16"E	18°46'59.48"N	40	730376	149	0	0	0	3			Pune	PUN_1	404	66	01	01	3	2232	5	1	76	63
PUN124	PUN124_3		Karegaon MIDC	74°17'10.16"E	18°46'59.48"N	40	730376	237	0	0	0	3			Pune	PUN_1	404	66	01	01	3	2233	5	4	118	69
PUN125	PUN125_1		Karla	73°28'52.30"E	18°45'32.10"N	60	K73456.	96	0	0	0	3	3/3/3	9	Pune	PUN_4	404	66	01	01	1	2241	5	1	76	113
PUN125	PUN125_2		Karla	73°28'52.30"E	18°45'32.10"N	40	K73456.	170	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2242	5	2	73	66
PUN125	PUN125_3		Karla	73°28'52.30"E	18°45'32.10"N	60	K73456.	253	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2243	5	1	115	70
PUN126	PUN126_1		Khedshivapur	73°50'43.02"E	18°20'29.00"N	60	K73456.	153	0	0	0	3	3/3/3	9	Pune	PUN_6	404	66	01	01	3	2251	5	2	120	63
PUN126	PUN126_2		Khedshivapur	73°50'43.02"E	18°20'29.00"N	60	K73456.	269	0	0	0	3			Pune	PUN_6	404	66	01	01	3	2252	5	3	116	88
PUN126	PUN126_3		Khedshivapur	73°50'43.02"E	18°20'29.00"N	40	K73456.	350	0	0	0	3			Pune	PUN_6	404	66	01	01	3	2253	5	6	75	123
PUN127	PUN127_1		Kikwi	73°56'9.97"E	18°12'34.03"N	60	K73456.	143	0	0	0	3	3/3/3	9	Pune	PUN_6	404	66	01	01	3	2261	5	2	78	68
PUN127	PUN127_2		Kikwi	73°56'9.97"E	18°12'34.03"N	60	K73456.	236	0	0	0	3			Pune	PUN_6	404	66	01	01	3	2262	5	0	118	70
PUN127	PUN127_3		Kikwi	73°56'9.97"E	18°12'34.03"N	60	K73456.	315	0	0	0	3			Pune	PUN_6	404	66	01	01	3	2263	5	7	73	113
PUN128	PUN128_1		Koregaon Bhima	74°04'44.57"E	18°39'18.61"N	40	730376	97	0	0	0	3	3/3/3	9	Pune	PUN_1	404	66	01	01	3	2271	5	6	76	88
PUN128	PUN128_2		Koregaon Bhima	74°04'44.57"E	18°39'18.61"N	40	730376	240	0	0	0	3			Pune	PUN_1	404	66	01	01	3	2272	5	2	118	124
PUN128	PUN128_3		Koregaon Bhima	74°04'44.57"E	18°39'18.61"N	40	730376	324	0	0	0	3			Pune	PUN_1	404	66	01	01	3	2273	5	6	78	112
PUN129	PUN129_1		Lonavla	73°24'28.46"E	18°45'12.02"N	60	K73456.	20	0	0	0	3	3/3/3	9	Pune	PUN_4	404	66	01	01	1	2281	5	1	78	63
PUN129	PUN129_2		Lonavla	73°24'28.46"E	18°45'12.02"N	40	K73456.	119	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2282	5	1	120	81
PUN129	PUN129_3		Lonavla	73°24'28.46"E	18°45'12.02"N	60	K73456.	270	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2283	5	5	75	66
PUN130	PUN130_1		Parantwadi	73°39'32.99"E	18°41'47.99"N	60	K73456.	107	0	0	0	3	3/3/3	9	Pune	PUN_4	404	66	01	01	1	2291	5	2	115	66
PUN130	PUN130_2		Parantwadi	73°39'32.99"E	18°41'47.99"N	60	K73456.	194	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2292	5	0	73	111
PUN130	PUN130_3		Parantwadi	73°39'32.99"E	18°41'47.99"N	60	K73456.	280	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2293	5	5	119	70
PUN131	PUN131_1		Sahara Lake City	73°23'17.6"E	18°36'50.2"N	20	730376	0	0	0	0	3	3/3/3	9	Pune	pun_4	404	66	01	01	1	2301	5	5	73	66
PUN131	PUN131_2		Sahara Lake City	73°23'17.6"E	18°36'50.2"N	20	730376	150	0	0	0	3			Pune	pun_4	404	66	01	01	1	2302	5	4	78	82
PUN131	PUN131_3		Sahara Lake City	73°23'17.6"E	18°36'50.2"N	20	730376	270	0	0	0	3			Pune	pun_4	404	66	01	01	1	2303	5	2	120	124
PUN132	PUN132_1		Shikrapur	74°05'41.04"E	18°41'12.97"N	40	K73456.	108	0	0	0	3	3/3/3	9	Pune	PUN_1	404	66	01	01	3	2311	5	7	116	70
PUN132	PUN132_2		Shikrapur	74°05'41.04"E	18°41'12.97"N	60	K73456.	220	0	0	0	3			Pune	PUN_1	404	66	01	01	3	2312	5	5	118	80
PUN132	PUN132_3		Shikrapur	74°05'41.04"E	18°41'12.97"N	60	K73456.	304	0	0	0	3			Pune	PUN_1	404	66	01	01	3	2313	5	7	74	66
PUN133	PUN133_1		Talegaon	73°40'35.81"E	18°43'45.32"N	60	K73456.	79	0	0	0	3	3/3/3	9	Pune	PUN_4	404	66	01	01	1	2321	5	5	73	70
PUN133	PUN133_2		Talegaon	73°40'35.81"E	18°43'45.32"N	60	K73456.	141	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2322	5	1	78	82
PUN133	PUN133_3		Talegaon	73°40'35.81"E	18°43'45.32"N	60	K73456.	268	0	0	0	3			Pune	PUN_4	404	66	01	01	1	2323	5	4	78	68

3-1.4 Configuration chart of Alcatel BTS

Configuration Chart of Alcatel BTS

Sr No	Site Name	Site Code	Cell Name	Longitude	Lattitude	Antenna Type	Azimuth	Tilt	TRX Conf	LAC	MSC	BSC	MCC	MNC	LAC MSC	LAC SSA	Cell ID	NCC	BCC	BCCH	TCH
1	Durbhat	3GOA085	GOA3B R 085 1 Durbhal 2	073°58'14.83"E	15°22'45.90"N	65 degree	80	0	2	5181	KPR	Panj-1	404	66	5	1	18451	5	3	73	(73, 63)
			GOA3B R 085 2 Durbhal 2			65 degree	170	0	2	5181	KPR		404	66	5	1	18452	5	7	119	(119, 111)
			GOA3B R 085 3 Durbhal 2			65 degree	340	0	2	5181	KPR		404	66	5	1	18453	5	6	116	(116, 122)
2	Savoi Verem	3GOA083	GOA3B R 093 1 SavoiVerem 2	074°01'8.31"E	15°29'3.40"N	65 degree	20	0	2	5181	KPR	Panj-1	404	66	5	1	18841	5	5	117	(117, 82)
			GOA3B R 093 2 SavoiVerem 2			65 degree	190	0	2	5181	KPR		404	66	5	1	18842	5	6	120	(120, 68)
			GOA3B R 093 3 SavoiVerem 2			65 degree	280	0	2	5181	KPR		404	66	5	1	18843	5	4	74	(74, 63)
3	Madkai	3GOA089	GOA3B U 089 1 Madkai 2	073°57'5.59"E	15°25'5.80"N	66 degree	10	0	2	5181	KPR	Panj-1	404	66	5	1	18801	5	6	78	(78,82)
			GOA3B U 089 2 Madkai 2			67 degree	110	0	2	5181	KPR		404	66	5	1	18802	5	4	120	(120,88)
			GOA3B U 089 3 Madkai 2			68 degree	260	0	2	5181	KPR		404	66	5	1	18803	5	1	73	(73,113)
4	Belorda	3GOA081	GOA3N R 081 1 Belorda 2	074°01'26.41"E	15°24'15.71"N	65 degree	20	0	2	5181	KPR	Panj-1	404	66	5	1	18721	5	7	118	(118, 71)
			GOA3N R 081 2 Belorda 2			65 degree	150	0	2	5181	KPR		404	66	5	1	18722	5	3	78	(78, 66)
			GOA3N R 081 3 Belorda 2			65 degree	280	0	2	5181	KPR		404	66	5	1	18723	5	7	75	(75, 113)
5	Birondem	3GOA082	GOA3B-R 082 1 Birondem 2	074°08'3.70"E	15°29'17.11"N	65 degree	103	0	2	5183	KPR	Panj-3	404	66	5	1	18731	5	5	74	(74, 113)
			GOA3B-R 082 2 Birondem 2			65 degree	228	0	2	5183	KPR		404	66	5	1	18732	5	5	78	(78, 70)
			GOA3B-R 082 3 Birondem 1			65 degree	353	0	2	5183	KPR		404	66	5	1	18733	5	3	119	(119, 82)
6	Curti	3GOA130	GOA3N H 1 Curti-MW 3						3	5183	KPR	Panj-3	404	66	5	1	18501	5	0	77	(124, 123, 122, 113, 112, 111, 88, 87, 82, 81, 80, 71, 70, 69)
			GOA3N H 2 Curti MW 3						3	5183	KPR		404	66	5	1	18502	5	0	118	(124, 123, 122, 113, 112, 111, 88, 87, 82, 81, 80, 71, 70, 69)
7	Sancordem	3GOA097	GOA3B H 097 1 Sancordem 2	074°10'18.80"E	15°24'35.31"N	33 degree	100	0	2	5181	KPR	Panj-1	404	66	5	1	18881	5	2	118	(118, 111)
			GOA3B H 097 2 Sancordem 2			33 degree	300	0	2	5181	KPR		404	66	5	1	18882	5	3	115	(115, 63)
8	Bhati	3GOA098	GOA3B H 098 1 Bhati 2	074°11'41.07"E	15°11'36.17"N	33 degree	210	0	2	5183	KPR	Panj-3	404	66	5	1	18891	5	7	75	(75, 71)
			GOA3B H 098 2 Bhati 2			33 degree	330	0	2	5183	KPR		404	66	5	1	18892	5	4	119	(119, 88)
9	Altino M/W	3GOA106	GOA3B C 106 1 ALTIHNO M-W 4						4	5181	KPR	Panj-1	404	66	5	1	18971	5	1	76	(76, 124, 123, 122, 113, 112, 111, 88, 87, 82, 81, 80, 71, 70)
			GOA3B C 106 2 ALTIHNO-M-W 2						2	5181	KPR		404	66	5	1	18972	5	0	116	(116, 124, 123, 122, 113, 112, 111, 88, 87, 82, 81, 80,71,70)
			GOA3B C 106 3 ALTIHNO M-W 4						4	5181	KPR		404	66	5	1	18973	5	2	118	(118, 124, 123, 122, 113, 112, 111, 88, 87, 82, 81, 80,71,70)
10	Thana	3GOA146	GOA3B-R 146 1 Thana 2	074°08'29.52"E	15°36'20.61"N	65 degree	20	0	2	5183	KPR	Panj-3	404	66	5	1	19371	5	6	115	(115, 80)
			GOA3B-R 146 2 Thana 2			65 degree	190	0	2	5183	KPR		404	66	5	1	19372	5	2	75	(75, 111)
			GOA3B-R 146 3 Thana 2			65 degree	270	0	2	5183	KPR		404	66	5	1	19373	5	4	118	(118, 87)
11	Kasarpal	3GOA137	GOA3B R 137 1 KASARPAL 2	074°01'10.34"E	15°20'59.14"N	65 degree	160	0	2	5184	KPR	Panj-4	404	66	5	1	19311	5	2	120	(120,64)
			GOA3B R 137 2 KASARPAL 2			65 degree	350	0	2	5184	KPR		404	66	5	1	19312	5	7	73	(73,123)
			GOA3B R 137 3 KASARPAL 2			65 degree	240	0	2	5184	KPR		404	66	5	1	19313	5	3	77	(77,87)
12	Dabhal	3GOA084	GOA3B R 084 1 DABHAL 2	074°07'23.30"E	15°21'26.21"N	65 degree	20	0	2	5184	KPR	Panj-4	404	66	5	1	18751	5	7	77	(77,71)
			GOA3B R 084 2 DABHAL 2			65 degree	170	0	2	5184	KPR		404	66	5	1	18752	5	6	74	(74,82)
			GOA3B R 084 3 DABHAL 2			65 degree	290	0	2	5184	KPR		404	66	5	1	18753	5	3	118	(118,64)

3-1.5 METERS REQUIRED FOR BTS A/T INCLUDING INFRASTRUCTURE:-

1. SMPS:-

1) Power Factor Meter 4) DC Load 7) Clip-on meter
2) Insulation Tester 5) Digital Multimeter
3) Psophometer 6) Thermometers

2. Battery:-

1) Thermometers 3) DC Load
2) Multimeter 4) Shunt and Clip-on meter

3. DG:-

1) Earth Megger with cranker (old) or digital (Earth Tester) Make: - WACO
2) 500V Insulation Tester.
3) Thermometer
4) A/C load
5) Tacho meter (for RPM) for conventional / for 15 KVA not applicable.
6) Voltmeter/ Ammeter (Clip-on Meter)
7) Spirit level. 8) Noise level meter

4. BTS:-

1) Through watt Meter: - (Trans Power only) Make: - Radarf for
- It is a Analogue meter to be operated with 50 Ω Heat sink Termination. Type: - 3551 with 12048 Directional Watt Meter.
- Sl no. 2806 Through Watt meter. VXL technologies Ltd Faridabad. 400 - 1000 MHz 50 W to read middle scale.
- Bird through Watt Meter Model no. APM-16 with 25, 50, 100 W Knobs. (All will read RT/TRE Power in watt directly.)

2) Bird Antenna Tester :- (VSWR only) 806 – 960 MHz.
3) Site Master Make -

Anritsu: Models - S113 B (5-1200 MHz)
- S114 B (5-1200 MHz) + 100-1200 MHz spectrum analysis.
- S331 B (25-3300 MHz)
- S332 B (25-3300 MHz) + 25-3300 MHz spectrum analysis.
- S331 B Model called Insta Cal Module and it is to be calibrated with OSL method. (Open, Short, Load)

Bird Site Master (Bird Electronics Corporation)
Models – SA 1700 EX, 25-1700 MHz No power measurement.
- SA 1700 EXP ----do---------- with -----do--------.
- SA 2500 EX, 780-2500 MHz------do-------.
- SA 6000 EX, 25-6000 MHz-----do-------.

4) Digital Multimeter.
5) Laptop 6) RF cords 7) Spirit level. 8) Earth tester

5. TOWER:-

1) Theodolite (Digital)
2) Earth Tester
3) Torque wrench
4) Digital Camera
5) Binocular

3-1.6 GSM NETWORK FREQUENCY

Sl. No	ARFCN	TRANS FREQUENCY IN MHz	RECEIVE FREQUENCY IN MHz
1	63	947.6	902.6
2	64	904.7	902.8
3	66	948.2	903.2
4	67	948.4	903.4
5	68	948.6	903.6
6	69	948.8	903.8
7	70	949.0	904.0
8	71	949.2	904.2
9	73	949.6	904.6
10	74	949.8	904.8
11	75	950.0	905.0
12	76	950.2	905.2
13	77	950.4	905.4
14	78	950.6	905.6
15	80	951.0	906.0
16	81	951.2	906.2
17	82	951.4	906.4
18	87	952.4	907.4
19	88	952.6	907.6
20	111	957.2	912.2
21	112	957.4	912.4
22	113	957.6	912.6
23	115	958.0	913.0
24	116	958.2	913.2
25	117	958.4	913.4
26	118	958.6	913.6
27	119	958.8	913.8
28	120	959.0	914.0
29	122	959.4	914.4
30	123	959.6	914.6
31	124	959.8	914.8

3-1.7 GSM BTS A/T (Lucent)

General:-

The GSM network started in Western zone by January 2002 with Lucent switch. All over India GSM network is covered by several switches like,

East zone : - Nortel
West zone: - Lucent, Alcatel
North zone: - Motorola
South zone: - Motorola, Erickson, Nokia.

The GSM network in India is to be followed in phase's as below:-

Phase i: - Lucent
Phase ii: - Configuration enhancement by Lucent.
Phase iii: - ---------
Phase iv: - Alcatel 1 M. 4.5 L. Equipment + management
Phase iv +:- ITI 3 M 13.5 L Equipment + management
Phase iv ++:- ITI 2 M 6.5 L. Swap sites W/O Tower

First time in Maharashtra, Lucent A/T was started by September 2002 and Swapping of Lucent BTS started by Dec 2004. Here A/T of both Lucent and Alcatel BTS is explained. Please see figure 3.3 for Trunking diagram of GSM network .

BTS A/T comprises of 1) Infrastructure A/T which mainly includes SMPS, Battery, DG and Tower.
2) BTS equipment A/T
3) 15 GHz M/W system.
4) Coverage A/T.

Before proceeding for BTS A/T:-

- Obtain TT-0 as well as check offer in ATOM, Whether all relevant information particularly Power plant and its adequacy is correctly filled or not?
- Obtain approved layout of equipment room duly signed by DET (In-charge)
- Get site configuration chart which is very useful to know site name, ID, configuration, cell ID, NCC, BCCH, BCC, Longitude, latitude, ARFCN and LAC, Specification.
- Note down type of BTS i.e. BSNL/ Non BSNL, Swap or New, or Redeployment?
- If BTS is installed in Tele. Exchange then you have to fill up all information about PP i.e. SMPS, Battery and E/A , make, capacity, total load of Exchange including BTS, and it is adequate or not ?
- If BTS is installed on existing tower then ask for A/T report of tower and if a tower is new then conduct tower A/T.

N.B. - Sample configuration chart is attached here. Pl. see chart no. 3-1.3 and 3-1.4 for Lucent / Alcatel BTS.

BTS A/T started:-

Note that the following tests are deleted from the Test schedule.

1. Trans frequency ,
2. Check of feeder cable loss,
3. Check of frequency stability,
4. Check of C/I,
5. Spurious and harmonics.

Vide letter no, TD/NT-GSM-Vol ii -----Dated 14.10.2003.

Check of infrastructure:-

- Earth measurement: - Ask for Earth value record. How much and when measurement was taken, get the details. Also measure the Earth value for Exchange as well as tower. Limit :- 0.5 Ω
- Antistatic flooring: - Many sites it is observed that antistatic floor is provided but not connected to earth through 5W/ 1 MΩ resistance. In some stations copper strip is available but not connected to earth.
- Verify the provision of Fire Detection and alarm system, Fire fighting equipment, and Emergency light arrangement
- Check Location, Alignment, as per the approved layout plan and Rigidity of BTS Bay by shaking the Bay.
- Check the status of Power plant and battery if existing, also note down the peak hour load of the exchange.
- Check the status of existing E/A.

Hardware check of Equipment:-

- As per the specification and purchase order, note and confirm No of Rack, Rack serial no, no of sectors and thereby no of RTs installed per sectors.
- Note down sector wise Cell ID and ARFCN.
- Write SACFA clearance no as per record.
- Note down no. of TDMA channels, (Eight), LAC, NCC, and BCC.
- Write down all details of Tower and point out the discrepancies.
- Verification of iron work:- As per layout drawing check following items with respect to cabling and wiring.
    - Positioning of equipment
    - Leveling of Rack by spirit level
    - Quality of RF conectorisation
    - Crimping of cables
    - Grounding of feeder cable, Rack, DDF,
    - Sealing of Feeder cable connection.
- Note down the tilting of Antennas and spacing between the sectors.
- Check the availability of tools, necessary spare modules, and documents of BTS .

Confirm Q/A report of Power plant, Battery if existing or new. On Lucent BTS there is no Q/A stamp as it is supplied by vendor

Before starting BTS A/T lock BTS site i.e. all the 3 sectors from OMC-R .Put off the Rack. Again restart and check that all Hardware getting restored or not?

Initialization: - **Proceed as follows,**

- Connect LCT to BTS at MRIF -2 (Mini Rack Interface) which is in the Bottom of BTS Rack by RS-232 cable.
  (One end USB port and other end 9 pin serial port).
- Open CMA -2000, click RBT -2000,
- File- Eqpt- configuration- Software load- Hardware test.

Files- New or load, if BTS is new then write some file name for example A/T test,
Eqpt. - Create BTS type- Micro cell OD12- ABIs type- DMCS.
GSM type- 900- edit component - BTS rack is displayed on screen of LCT.
Open configuration- 4.4.4 (Standard mode)
Set standard- Select all BTS- Rack contents of 4-4-4 configuration- O.K
Click RBT-2000- Files- equipment- Configuration- Central configuration-
O and M slots as Cell 1 - 31 slots
Antenna type - 1 or 2
Cell 2 - 30 slots
Cell 3 - 29 slots (all are default values)
PTT/ PCM setting,
Link configuration- BSC
Link type – E1
Clock configuration- 2 MB / GPS O.K
Cell configuration- Feeder cable loss Power reduction from 0 to 26 dB – O.K
Alarm editor – Select alarm as active low or active high
Check LCD – Passed/ Fail- O.K
Check Equipment- auto command for equipment check- EPROM assess – read or write.
Read – Checks all internal connections between all components in the rack.
Write – Write in EPROM of MRIF-2
Hardware test- Cell shelf- MRIF 2, CC, EAB, FAN- Check.
Check all section is results as door open, Clock setting, Configuration read and configuration.
ACE shelf – Self test for combiner and diplexer.
RE shelf – Select RT No. 0 to 11
Assess mode – MRIF or TRX
Self test with power- TX power ON, TX power OFF.

Trans power measurement:-

- Connect Through Watt Meter/ Site Master to RT O/P cable,
- Select RT no and click on Trans ON, Trans power ON,
- Tran's power will be displayed on Watt Meter /Site Master.
- Check whether power is in range or not?

VSWR Test:- See Fig. 3-1 for RF cable W/G.
There are two types of VSWR meters.

1. Site Master Anritsu or Bird (with power measurement)
2. Bird Antenna Tester (without power measurement)

In both type of Meters
- Remove jumper cable from bay top.
- Select start and stop frequencies, 880 MHz and 970 MHz
- Mark amplitude as 1.0 lower and upper as 1.3,
- Calibrate with open, short and load connector,
- Connect jumper cable to meter and see trace on display,
- Note down VSWR maximum reading at the peak of trace.

Forward and Reverse power:-

1. Measure Trans power at Bay top ,
2. Reverse the knob, measured power should go off , i.e. reading is zero.

Redundancy Test: - As such there is no redundancy modules provided this test can not be carried out.

Alarm Test: - Check whether all alarms are locally terminated or not?
The various main alarms are:-

1. Rectifier fails
2. DG fails to start
3. Low Voltage by BTS
4. High Temperature
5. Mains power failure
6. Door open
7. Air condition

All these alarms can be created and monitored on Laptop and at OMC-R:-
Operation and maintenance centre which is installed in MSC. It performance the function of – Configuration management i.e. Creating, modifying and deleting BSS objects. -

- Fault management: - Alarm monitoring and event reporting.
- Performance management: - Collection, store and analyze measurements

.

Alarm severity and colors: -
Red – Critical,
Yellow – Major
Cyan – Minor
White – Warning

Alarm status:-
Open – Alarm still exists
Acknowledged – Alarm is noted
Cleared - Alarm attended
Stale - Alarm was there but Object deleted, so no alarm exists.

- Carry out end commissioning when all tests are over.
- Inform OMC-R to unlock the site.
- Before leaving the site check signal on mobile handset to confirm restoration.

3-1.8 ALCATEL BTS

Please see BTS front view , TRE, and Combiner in Fig. 3-6, 3-7.

Alcatel project was launched in DEC 2004. There were three types of BTS installation.

1. New site
2. Swap site
3. Redeployment site.

New site : - It is a purely new site either BSNL or Non BSNL.

Swap site: - Wherever Lucent BTS was already working and replaced by Alcatel. .

Redeployment site: - Installation of Lucent BTS at a new station after removing from any working station which is swapped out.

There are three types of BTS: -

1. Indoor BTS.
2. Outdoor BTS
3. Micro BTS

BTS Load in Ampere;-

1. 2/2/2 config. 10 Amps
2. 3/3/3 config. 15 Amps
3. 4/4/4 config. 20 Amps

Obtain TT- O, AT- 101, from M/S Alcatel and DE (Mobile) before proceeding for A/T, Approved layout of equipment room, SACFA clearance.

As per Test schedule check and note down all infrastructure information and fill up in Test sheet.

In Alcatel BTS, each TRE is assigned by a slot no and to recognize them, evaluate as Follows:-

TRE no = 16 X sub rack no + slot no.

e.g. = 16 X 5 + 1

= 81

Here sectors are designated as N, P, Q instead α, β, γ in Lucent.

In this way N sector TRE no.s will be - 17, 20, 23, 26

P sector -------do-------- - 49, 52, 55, 58

Q sector --------do ------- - 81, 84, 87, 90.

A / T of Swap site:-

Note down – Site name, site code, NCC (National color code):- A specific no to distinguish between two public land mobile networks (PLMN),

BCC (Base station color code):- A specific no within same PLMN,

LAC (Local area code)

- Type of Tower whether RTT / GBT / POLE and type of BTS as above. (Roof top tower / Ground base tower, / three poles on terrace)
- All information regarding Tower, Antenna, Feeder cable and its protection.
- Type of interface between BTS and BSC, mostly OFC system and rarely 15 GHz M / W along with no. of E1.
- Confirm whether system acceptance tested or not?
- Equipment configuration as No of sectors, Racks, Rack Sl no, no of TRXS (Trans Receive Modules) per sector.
- Cell ID, ARFCN (Absolute Radio Frequency Channel No.) And Corresponding frequencies.(please see chart)
- Details of Power plant (SMPS, Battery, DG) and its adequacy, Peak hour Load of the Exchange including BTS (BTS load 10 to 15 A depending Upon no of TREs)

Before starting Transmission A/T of BTS, lock BTS site from OMC-R, and confirm.

Carry out initialization of BTS as

- Start Laptop (BTS terminal), connect it to BTS by a RS – 232 a sync. Link (USB- serial port) cable to MMI (Man Machine interface) port of SUMA card.
- Click on BTS Terminal Release B-8 (B-8 a software version) Log in.(AVO2E.01)
- File – commissioning- cmds –Show – Monitor – Extras – View –Window – Help.
- File- Connect
- Commissioning- Download- BTS- sw- BTS Software download- Enter-
- BTS software download in progress- Observe download process.
- Initialization in progress- Reading all Remote inventories.
- Edit frequencies- Add 6 dummy frequencies (If 6 TRE's installed)- Sector mapping window- Shows sector mapping- Save
- Select setting- Board configuration
- SUM board configuration- Abis mapping with TRE no.s- Select transmit
- All sector initialization- sector mapping with TRE and sectors
- For this initialization near about 5 minutes takes place.

Checking of HTS configuration (Hardware technical status):-

This is nothing but a Hardware conformity test to check no. of TRE's per sector installed.

- Show – sector mapping- show TRE no.s as per installed position.
- HW configuration check
- commissioning –initialization- HW check as sector 1
- 2 antennas – power range maximum 46.5
- No of TRE matching frequency range.
- No of TRE not matching frequency.

Check of Trans power TRE wise- (TRE O/P)

- Connect TRE O/P cable (3 BK 07919 AE AAA) to Site Master (Anritsu / Bird)
- Commissioning- O/P power test
- GMSK (Gaussian Minimum Shift Keying) - O/P power test - TRE no. Select- All Time slots ON- Start-UT.
- Is sending- Meter will show TRE O/P power in Watt as well as in dBm .Compare with Limits mentioned on next page.
- Stop- Remove watt meter- Close file (abort)
- Carry out same test for all equipped TRE's at TRE O/P

. **Trans power at Bay Top**

- Connect meter to Bay top ports as Na, Nb, Pa, Pb, Qa, Qb
- Carry out the Trans power test as above on Bay top.
- Compare the reading, it may show 4 to 5 dBm less than TRE O/P.

End commissioning: -

- When power check is over start End commissioning- Loading
- Commissioning- End commissioning- Success- Success

Check of VSWR

- Connect Site Master to jumper cable by a RF cable ,
- Carry on the VSWR test as mentioned in Lucent BTS.
- The Limit is same 1.3

Forward power and Reverse power test:-

Measure Trans power on Bay top and reverse the knob of Through Watt meter, see that the reading is zero.

There are some tests which are to be seen in RI (Remote Inventory). Simulate the condition and check in RI as follows,

1. Checking of Antenna mapping in RI
2. Checking of Additional modules in RI
3. Checking VSWR setting in RI
4. Checking Alarm Mapping in RI

In Laptop – Show –select Remote Inventory.- Select required test and get results – save- take out prints also for reference.

Check BTS Initialization by OMC - R operator command and also by putting Bay power supply off .Check the Hardware reset.

Redundancy test: - As there is no stand by module of power supply unit and E1 link, moreover being only one Suma (Station unit module) card is available so this test is not applicable.

Alarm test:-

There are 16 alarms produced by BTS as follows: -

1. Rectifier fails
2. Mains power failure
3. Door/ Window alarm
4. Door/ Window over ride
5. Fire alarm
6. Water break in
7. Air condition (1)
8. Temperature alarm- 35^0 C
9. Temperature alarm- 40 C
10. Hazard light alarm (1)
11. Battery deep discharge
12. Air conditioned (2)
13. Hazard light alarm (2)
14. Hazard light alarm (3)
15. Door alarm failure
16. Inverter failure

These alarms are wired on 16 pins push type Tag block at the top of Bay.

These alarms are extended locally by cable on wall mounted crone type tag block by BSNL, but at the time of A/T if not extended, then test locally on push back tag block by loop or no loop condition on Laptop as well as with OMC-R.

- On laptop- monitor- active alarms- message
- Remove loop on push back tag block one by one
- Message display will show all above alarms as BTS- 1 BTS EXTERN [9]- type of alarm [1]-1
- If looped back, display of alarm goes off automatically.

After all tests are over ask OMC- R operator to unlock the BTS site.

Wait for the restoration of BTS

Now if BTS is restored, start BCCH recovery test.

- Open communication terminal, BTS terminal- Enter user name and password
- File- Connect/ Disconnect- BTS terminal window opens
- Open SBL management- Select TRE no.- Disable- Request- Report as in working status- Some TRE gets put off
- Message will appear upgraded- Files as monitored data update and BCCH will shift on shifted TRE
- BCCH LED also glow on shifted TRE
- Again select TRE- initialize- original BCCH TRE restore.

Alarm test by OMC- R:-

Some alarms are checked from OMC –R,

1. When BTS is locked or E1 is disconnected, display shows as AIS 2 Mb.
2. When E1 restores, there will not be any alarm on OMC as site is locked.
3. When site is unlocked – TRE restored, put off power supply then in OMC display shows as loss of all channels and AIS.

4. If any unit is extracted then display shows as Hardware degraded, if put in then there will be no alarm on display.
5. If VSWR out then LED on TRE , red LED on SUMA card flashes and warning alarm of VSWR appears on OMC.

Check BTS status in OMC as OK, Check Add/ delete / Modify BTS from OMC.

Limits of BTS Power and VSWR. - LUCENT

Sl No	Where?	In Watt	In dBm
1	RT O/P	36	45.5 ± 0.5
2	Bay Top – If 2H Combiner used.	18	42.5 (Loss 3 dB)
3	- If 4H Combiner used.	9	39.5 (Loss 6 dB)

VSWR: - 1.3 Feeder cable loss: - 4.2 dB / 100 meter at 890 MHz
4.5 dB / 100 meter at 960 MHz

N.B. Please read VSWR in M/W system, Meters are different.

Limits for ALCATEL.

Sr. No	Where?	In Watt	In dBm
1	TRE O/P	40 – 63	46.02 – 47.99
2	Bay Top	13 - 22	41.13 – 43.42
3	ANC Loss		4 -5 dB
4	ANY Loss		3.3 dB

VSWR: - 1.3

ANC (Antenna Network Combiner):-

- For duple Xing the Transmit and Receive path towards common Antenna.
- Combines O/P of Transmitters.
- It supervises VSWR.

ANY (Antenna Network Unit) :-

- Combines up to four Transmitters into two outputs. Both ANC +ANY
- Normally used when six TREs are installed.

3-1.9 **Meters required for Power and VSWR measurement:-**

1. Through Watt Meter(Analogue and only for power),
2. Bird antenna tester (only for VSWR)
3. Site Master (Digital and for both power & VSWR)

1. Through Watt Meter: - It is a Analogue meter to be operated with 50 Ω Heat sink Termination and 50 Watt element Type: - 3551with 12048 Directional Watt Meter. Sl no 2806 Through Watt Meter.VXL Technologies Ltd Faridabad. 400 – 1000 MHz 50 W.

- Bird through Watt Meter Model no APM-16 with 25, 50,100 W Elements to read the required scale on meter.
- Both will read RT/ TRE power in Watt directly.

2. Site Master: - Make: Anritsu and Bird.

Anritsu: - Models
- S 113 B (5-1200 MHz), See Fig. 3-8
- S 114 B (----‘’-----) + 100-1200 MHz spectrum analysis.
- S 331 B (25-3300 MHz)
- S 332 B (-----‘’---------) + 25- 3300 MHz spectrum analysis.
- S 331 B Model called Insta Cal Module and it is to be calibrated With OSL method. (Open, Short, Load)

Site Master reads power measurement in Watt as well as in dBm also.

Select Power measurement:-

- Press Mode key – scroll to Power Monitor – Enter.
- Press zero soft key and see ZERO ADJ: ON on display.
- Insert attenuator between RF cable and Site Master.
- Press OFFSET key.
- Enter attenuation in dBm –Enter.
- Press Watt or dBm
- Note down power in both Watt and dBm.
-

VSWR Measurement:-

- Press Mode. - Scroll FREQ-SWR –Enter.
- Press FREQ/DIST key.
- Press F1 –Enter 890 MHz
- Press F2 – Enter 960 MHz.
- Press AMPLITUDE / LIMIT key.
- Press Top 1.0 and Bottom 1.3 – Enter.
- Start Calibration.
- Connect Open, Short, and Termination to RF O/P Port.-Enter.
- Observe CAL ON on display.
- Connect Jumper cable through RF cable to test port of Site Master.
- Read Max VSWR value in Auto scale.
-

Bird Site Master (Bird Electronics Corporation) See Fig 3-9

- Models -- **SA** 1700 EX**,** 25- 1700 MHz, no power measurement.
- SA 1700 EXP 25- 1700 MHz With power measurement.
- SA 2500 EX, 780 – 2500 MHz With power measurement
- SA 6000 EX, 25 – 6000 MHz With power measurement

Power measurement:-

- Press Mode,
- Select power mode.
- Connect power sensor to Site Analyzer.
- Make 0 on display as offset 0.00 dBm.
- Select reading in Watt / dBm.
- Note down power reading in both and check power of all TREs.

VSWR Measurement by Bird Site Master.

- Press Configuration – Frequency ,
- Press soft digit keys to enter start and stop frequencies as 880 and 970 MHz along X-axis.-enter.
- Press scale, - Press digit keys and enter top and bottom limit as 1.0 to 1.4 along Y-axis.
- Press CALI – open, short, load displayed.
- Connect Open port of CAL- MN- C bullet to Site Master's port.- listen Beep.
- Connect Short – listen Beep, connect load – Beep – Cal full displayed.
- connect RF cable jumper to Site Master's port.
- Press Mode – meas match – wait for 10 sec for sweep of data ,
- A signal trace appears on screen of Site Master with cursor and 238 points.
- Move cursor to the peak of trace ,VSWR reading is displayed in the bottom.
- Repeat test for all feeder cable and note down VSW reading.
- If it is more than 1.3 then ask to tighten all loose joints of jumper cable, RF cable up to Antenna and still not coming to the limit then detect the fault from jumper to RF cable to antenna at the top and replace it.

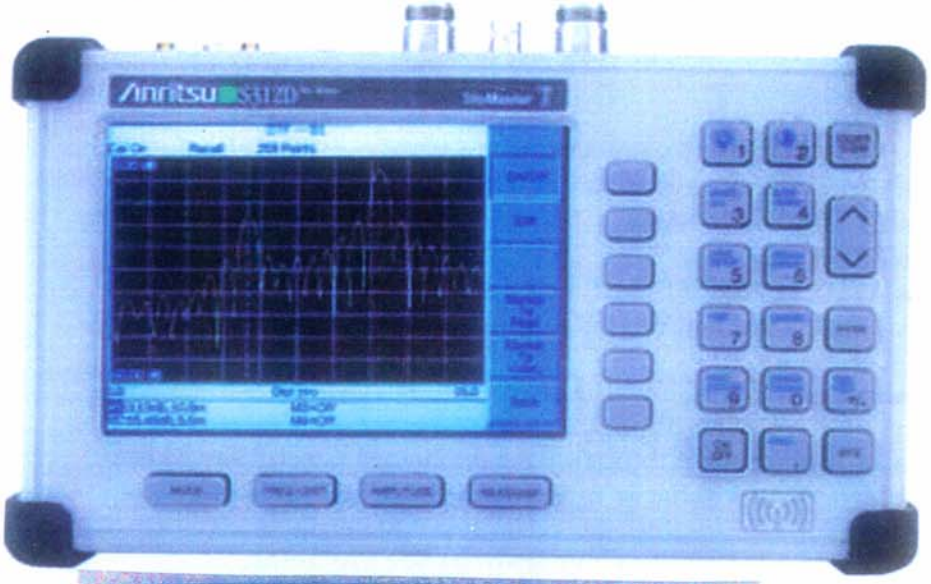


Fig 3-8

Fig. 3-9

BIRD SITE MASTER

3-1.10 GSM frequency band and Site Mast

Systems	Uplink MS-BTS	Downlink BTS-MS
R GSM-900	876-890 MHz	921-935 MHz
P GSM-900	890-915 MHz	925-960 MHz
E GSM-900	880-890 MHz	925-935 MHz
GSM-1800	1710-1785 MHz	1805-1880 MHz
PCS -1900	1850-1910 MHz	1930-1990 MHz

Agilent Site Master:-

New Site Master is introduced in GSM Network as Agilent technology- E 7495B.
There are several test facilities in this Site Master which are as follows,
Press Mode- Antenna Cable, Spectrum analyzer, power meter, back haul, Tx analyzer, over AIR, test software and GPS unlock.

For VSWR proceed as follows: -

- Press Antenna cable- RET loss- Start and Stop.
- Select frequency as Start 890 MHz and Stop frequency as 960 MHz.
- Calibrate by connecting open, short, load, to the jumper cable.
- Connect jumper to jumper cable of feeder cable.
- Direct read out best/worst with trace,
- Press marker and take it to the pick of the trace, read worst reading.
- Press average sweep, note down worst reading.
- For Stop press recall.
- Power meter is disabled here.

Lucent: - The OMC is installed in MSC and it controls, manages BSS in GSM network. Various function of OMC-R:-

1. All BSS entities are configured by OMC, a configuration management.
2. To monitor alarms, detect and localize a fault management.
3. To control measurement initiated by OMC for planning and analysis, a performance management. It collects stores and analyzes the data.
4. To load software from OMC to hard disk of BCF and memory of other network element.
5. Perform system administration.
6. To switch over to the redundant equipment..

In BTS A/T, all the relevant external alarms like BTS door open are monitored by OMC. OMC runs on HP equipment and D380 / N4000 server is central equipment of OMC-R. When it is started the following functions are displayed on the desktop.
OMC- 2000 Network, Performance, Fault and Configuration Management.
Please see the following Graphical user interface of Lucent GSM OMC. Fig 3-10

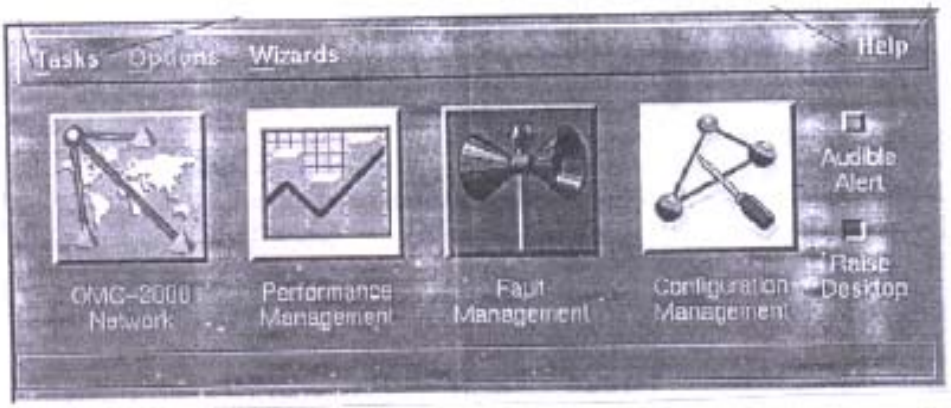


Fig. 3-10

Alcatel OMC:- 1. Manages BSS software version.
2. The BSS configuration is stored.
3. Manages fault and performance management reports.
4. Handles supervision of alarms and events.

After BTS Trans power and VSWR test over, check all external alarms along with OMC. When BTS is unlocked after end commissioning is over, ask OMC operator about the status of BTS. If any alarm like VSWR o/o limit, Fan faulty etc, are displayed and will be intimated to the maintenance staff.

3-2 - : GSM COVERAGE A/T :-

3-2.1 General -

A coverage with content and quality has got to be quite rarity,
To overcome the terror of serious unfaithful quality,
better to handover coverage of appropriate parity.

It is assumed that GSM BTS A/T is over and Trans power, VSWR both are ok, then we have to proceed for coverage A/T.

Before proceeding for coverage A/T, following points are to be confirmed first,

- Coverage prediction map should reach to you.
- Annexure -2 Link budget showing details of site, Rx thresholds, frequency, Handover margin, NCC, etc should reach to you.
- Verify prediction map with assigned colors for Rx level thresholds, duly signed by DGM mobile.

3-2.2 **Accessories: -** 1. Drive test tool, 0 db gain GPS antenna, Sagem mobile, Laptop.
2. 2-3 Mobile handsets for making all types of calls.
3. BTS area map / city map.
4. UPS for laptop.
5. Analysis tool by different companies for BSNL. e.g.
   a] Neptune tool by Aircom company.
   b] Actice tool by Agilent company.
6. Alcatel has to set Receive level threshold e.g. Receive level Optimization as per the tender requirements.

In coverage A/T we have to check - 1. Rx level by Drive tool.
2 .Quality of call by making manual calls.

3-2.3 **Assigned Receive level and colors to distinguish Rx levels :-**

No coverage -----	Black	< - 95 dBm
Poor coverage----	Blue	-95 dBm to -85 dBm
Out door coverage-------	Yellow	-85 dBm to -75 dBm
Car coverage -------	Green	-75 dBm to -65 dBm
Building -------	Red	> -65 dBm

As per Lucent Mobile: -	Bldg, street	Green	> -75 dBm
	Car	Blue	-75 dBm to -85 dBm
	Outdoor	Red	- 85 dBm to -95 dBm

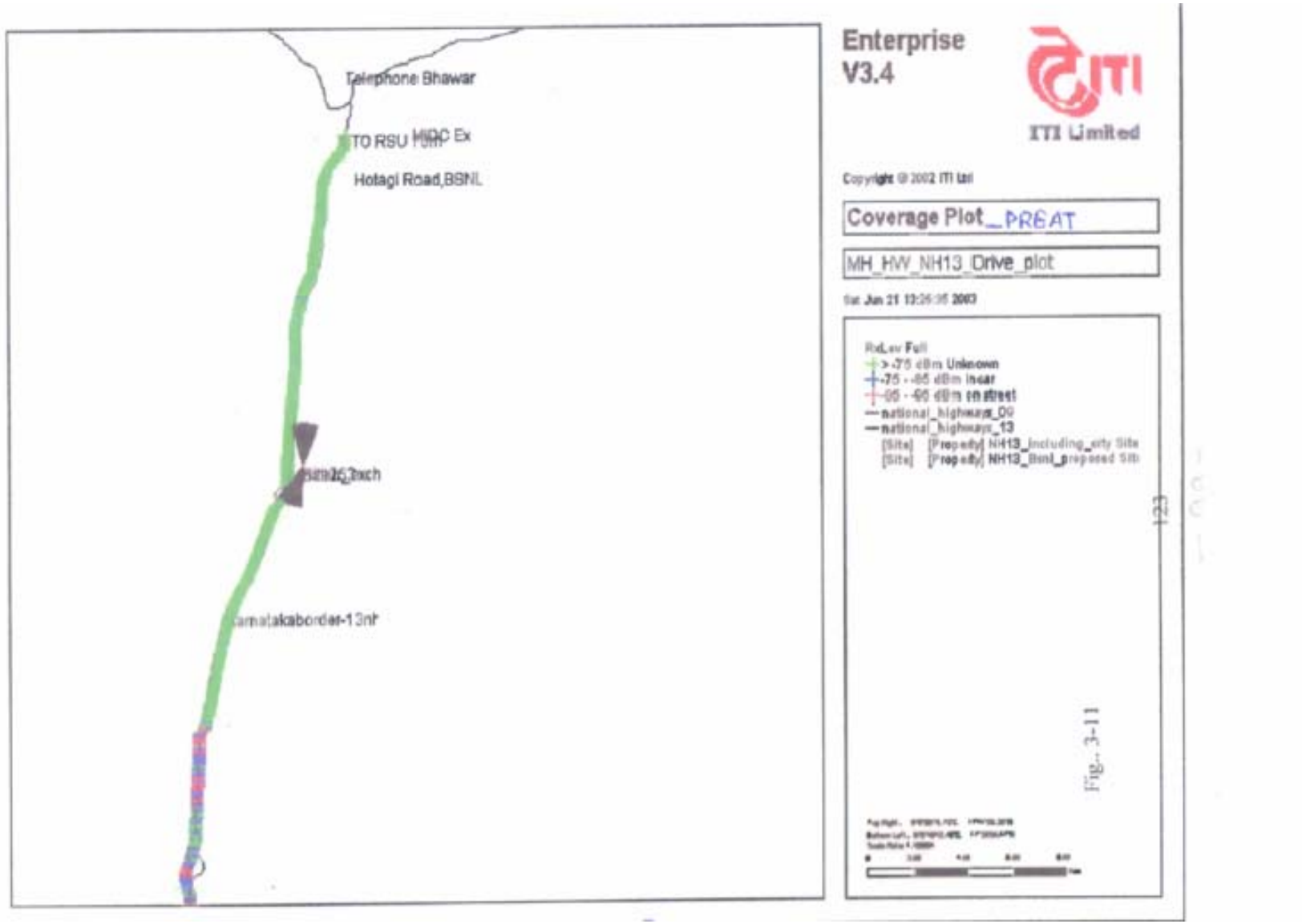
3-2.4 **Types of Manual calls: -** 1. Mobile to Mobile
2. Mobile to PSTN and vice- versa.
3. STD and ISD
4. Special services e.g. 197, 133.
5. Emergency services calls.

3-2.5 Proceed for coverage :-

1. First of all take a local JTO/SDE who knows all important places, gullies of the city where coverage is necessary.
2. Ask vendor to arrange vehicle with all essential accessories.
3. Make connection of GPS antenna which is fitted on the top of vehicle and Mobile handset with Laptop. Start laptop as below,
   Agilent E 74 xx series – Document -2 Micro version E 74 xx – open data- select Project- com -1 select GPS receiver7, - Measurement/Alert – call continuous- GPS –Layer 3- phone – time of day –add-Measurement type – collection- phone (Data page appears) – Mobile state – Dial no –wait for answer – Mobile –record file - name –call on Sagem – OK – Recording starts.
4. Drive vehicle along major roads, gullies, inside some shops, shopping, commercial complexes, also make a long call by Sagem handset.
5. Start all types of calls which are mentioned as above from 2-3 mobile handsets.
6. Note down the receive level e.g. field strength , call quality .
7. In call quality take a note of clear conversation, noise free, hum free and echo free and no coverage area..
8. Check for any call dropping, disconnecting, section handover takes place or not?
9. Note down locations, landmarks.
10. Go on driving the vehicle around the BTS area and speed is to be maintained at 40 Km / hr.
11. The locations where vehicle can not go, no of manual calls are to be dialed.
12. A city with more than 5 BTS s, cover all BTS area.
13. After coverage A/T is over Drive data is submitted to Analysis tool by which actual coverage map can be obtained with color.
14. Submit manual report in the following table and write the punch points for coverage problems e.g. call disconnection, low speech, muffled speech, echoes, no coverage area, no handover, etc.
15. Note down as below:-

Sl no	Location	Field strength	Call status ,established, failed	Speech quality	Remarks
1	Market yard	-87 dBm	established	ok	Expected -75
2	Model colony	-65 dBm	established	Ok but	Call disconnected
3	Shivaji Nagar	-75 dBm	failed	----	-------

16. No of calls :- 2 BTS city Minimum 50 calls
    3-10 BTS city Minimum 200 calls
    > 10 BTS city Minimum 200-1000 calls
17. One sample of prediction and actual coverage map attached herewith.
    Please see Fig. 3-11 and 3-12.


Telephone Bhawar
TO RSU
Hotagi Road,BSNL
Enterprise
V3.4
ITI Limited
Coverage Plot_PREAT
MH_HW_NH13_Drive_plot
RxLev Full
national_highways_09
national_highways_13
123
Fig.- 3-11

3-2.6 Sample of: -

1. Link budget consideration:-

The objective of the link budget is to determine the limiting factors on the RF signal and thus determine the maximum path loss that can be tolerated for a set of given system parameters. Link budgets for Lucent proposed Flexent BTS had been calculated. Subsequently the effective radiated power (ERP) for the various BTS configuration was determined and used in the coverage prediction.

1.1 Parameter Assumptions

Parameter Description	Value
Polarization/Special receiver diversity gain	+3 dB
Mobile station type	GSM 900 Class 4 2 W or +33 dBm
BTS Transmit power at TRX port	+46 dBm or 39.8 W
BTS receiver sensitivity	-110 dBm
Duplexer loss	1.55 dB
Hybrid combiner loss per stage	3.5 dB
Filter combiner loss	2.7 dB
Feeder cable loss	3 dB (Typical)
MS antenna gain	2 dB
Body loss	2 dB
BTS antenna gain (Urban/ Suburban/ Rural)	+18 dB
BTS antenna gain (Highway/ railway)	+20 dB
Typical antenna heights for (Urban/ Suburban coverage)	30 M
Typical antenna heights for highway coverage	60M

Above table shows typical parameter assumptions for link budget calculations.

Clutter classification	Received signal level(dBm)
Urban indoor	-75
Suburban indoor	-85
Outdoor	-95
Highway/ Railway coverage	-85

Above table shows signal strength Threshold requirement.

Link budget calculations were performed for all clutter areas including in car and in train.

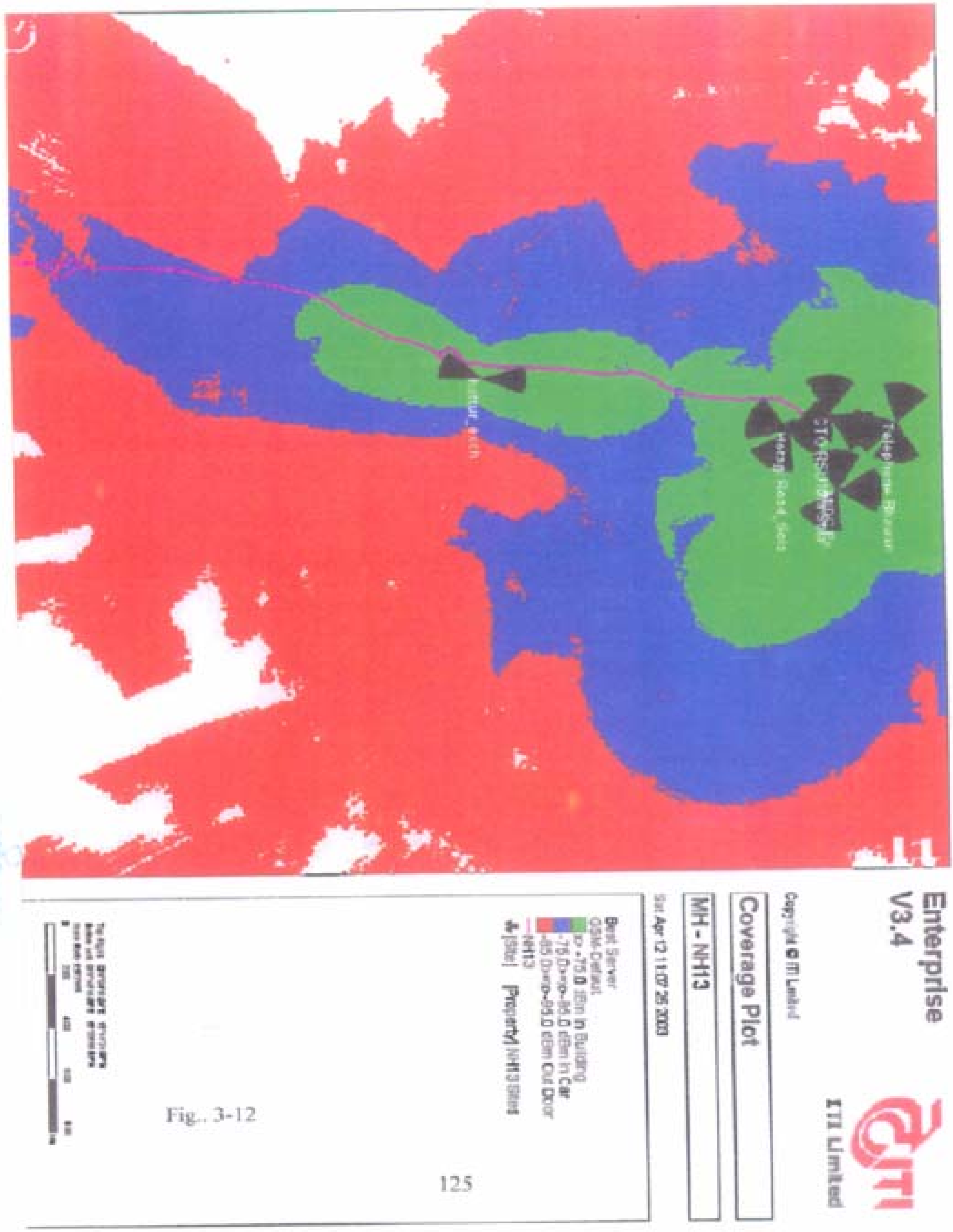
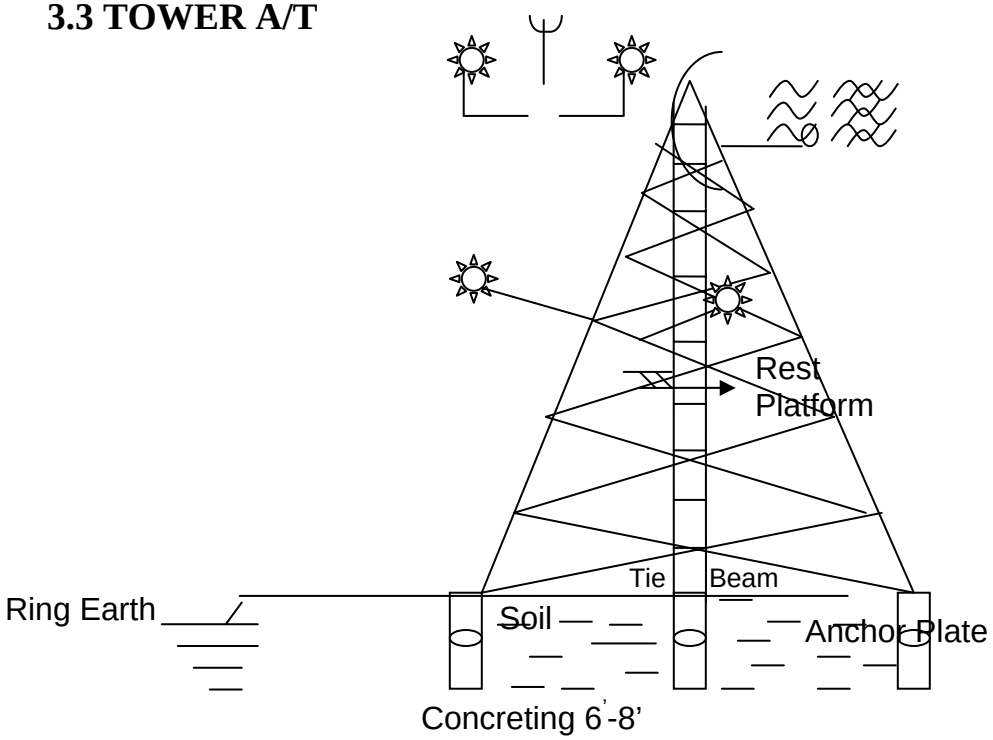

Enterprise
V3.4
ITI Limited
Coverage Plot
MH - NH13
Sat Apr 12 11:07:25 2003
Best Server
GSM-Default
125

Fig.. 3-12

3.3 TOWER A/T



3-3.1 1] SACFA clearance: - What is SACFA?

Standing Advisory Committee for Frequency Allocation, Headquarter is at Delhi and regional offices are at Mumbai, Chennai and Hyderabad. Main function of SACFA committee is to allotted the frequency and spectrum to M/W system / GSM- BTS Network, taking into consideration the interference due to other nearby Radio frequencies. The application should be submitted for full sitting clearance in form no. WPC –S2 along with map to the following agencies.

1] SACFA Secretariat
2] Each SACFA member
3] Concerned RAC member.

Forms ---- WPC –S1 for exemption from mast height clearance.
WPC –S2 for full sitting clearance
WPC – S3 for an additional antenna.

As per revised SACFA procedure dated 5.8.1997 an ID (Identification no) should be obtained first.

2] Type and height of tower: - There are three types of tower,

- GBT: - Ground base tower.
- RTT: - Roof top tower
- Pole: - Pole type tower.

GBT: - further classified as: -

Light weight	LW
Heavy weight	HW
Special heavy weight	SHW.

LW – It is a narrow base self supporting tower, Leg to leg distance 1.99 meter and diagonal distance 2.7 meter, used for MARR,GSM, CDMA ,in low traffic routes where there is no possibilities of future loading.

Capacity: - 4 Nos. of 3 M Dia. or 2 No. of 4 M Dia.

HW – used for long haul microwave system and where there is concentration of more Narrow band routes. Capacity: - 4 Nos. of 4 M Dia.

SHW- Where no of antennas are more, highest loading capacity in a major cities. Capacity: - 8 antennas of 4 meter dia.
All above towers are designed so as to bear a wind speed of 200 Km / hour.

3-3.2 **Height and Weight of material of tower:-**

Type	Weight
40 M LW BTS, MARR	16.33 MT
40 M HW BTS, WLL	21.0 MT
60 M HW M/W	35.0 MT
60 M LW BTS	23.5 MT
60 M LW M/W	30.51 MT
80 M HW M/W	60.0 MT
80 M LW M/W	48.0 MT
100 M LW M/W	76.83 MT
100 M HW M/W	89.73 MT
100 M SHW M/W	150 .0 MT

3] Check of verticality:-

As per T& D circular 6.6.1997 the verticality of small footprint rectangular tower and TTH (Tubular Triangular Hybrid) tower need not be taken but GBT LW, HW, and SHW rectangular towers and RTT verticality need to be checked. The verticality should be checked by a Telescope called "Theodolite. It is a LYNX model from Lawrence & Mayo. Maximum deviation allowed is 25 mm. Plum bob is suggested for the verticality of Roof top tower (RTT).

Procedure in brief:- 1) It is assumed that center point is already marked, if not then fix a center point of tower first with diagonal threads. 2) Keep Theodolite at the center point , then focus one leg and rotate it towards other legs by 90^0, 180^0, 270^0 respectively. 3) Take Theodolite in the straight line of center 40 -50 meter away from one face of tower.4) Fix it on the tripoid and level it properly.5) Focus the center red mark done at the center of horizontal member.6) Move it in vertical plane withought disturbing towards the top center bolt of member. 7) Point out any tilt , limit is 25 mm and carry out this test for at least two faces of tower.

4] Provision of working platform of each antenna height and rest platform at a Periodic interval: -

Confirm the numbers of working and rest platforms as follows:-

40 M LW	: -	First rest at 18.5 M
40 M HW	: -	Second rest at 28.5 M and working at 38.5 M
60 M	:-	Rest platform at 24 and 36 M, mid light platform at 40 M and working at 57 Meter.
100 M	: -	working at 90 M + rest 70 M + rest 50 M+ rest 30 M.

3-3.3

5] Painting of tower as per standard: - The main purpose of tower painting is day time warning to Aircraft and to avoid rusting of tower material. As per standard the tower to be painted by alternate deep orange & white paint which should be of a reputed manufacturing companies like Asian , Nerolac, Berger and ICI which is approved. The ISI specification of paints is as follows:

Deep Orange paint	---- IS 2932 – 1974
White paint	---- IS 2932 – 1974
Prime (Zink chromate)	---- IS 2074 – 1994
Thinner -101	-----IS 101 - 1974

For new Tower – one coat of primer, two coats of red and white as per instruction of Erection in-charge.

6] Provision of staircase with proper protection: - Check Staircase and protection ring net at proper height is provided or not, also check detachable ladder provided or not?

7] Check of proper size of nut bolts, spring washers: - Ensure that all bolts are having lock nuts with spring washers. Under no circumstances bolts of smaller lengths without lock nut and washer permitted, also check nuts and bolts are ripened.

8] Grouting of foundation nut and bolts: - In LWNB tower grouting is done up to 3'' above the anchor bolts, and not up to the nut and bolt of base plate as per tender document..

9] Check of tower members: - The all tower members should be checked as per structural drawing of manufacturer also check for any missing of member. The edges of members should fit properly.

10] Position of lightning spike: - Check whether lightning spike is fitted or not? It should be earthed properly. Previously spike was being connected to earth by means of a copper strip which is connected to ring earth , but now spike is directly connected to tower material only so as to get low resistance path to ground , as per circular dtd , 15.9.2006 for GSM project phase iv and phase iv ++ .

Spike height is 1.5 M in 40M tower.

11] Antenna details: - Note down the no, type, diameter, and height of antenna.

UHF antenna:- 2,3,& 4 M dia Parabolic.

M/W system antennas: - Parabolic 0.6, 1.2, 1.8, 2.4, 3.0, 3.7 M.diameter, Horn reflector,

GSM antennas:- The Sectorial antenna , dipole antenna .

Omni directional antenna, leaky coax antenna and Polarized single 900, dual band 900& 1800. Beam width 33 for High way, 65 for city, and 90 for rural (Alcatel)

Antenna height of single port 3.0 meter and that of double port is 2.7 meter.

12] Feeder cable :- Types of feeder cable – for M/W – Coaxial cable, air dielectric type, Andrew type HJ 5-50, 7-50 up to 2 GHz and rigid rectangular, circular and Helix elliptical W/G for UHF and 2 GHz system.

Rectangular W/G :-

4 GHz -	WR 229
6 GHz -	WR 137, WR 159, EW-70
7 GHz -	WR112, PDR -70 Flange.
11 GHz -	EW-90, WR 90
13 GHz -	PDR -120 Flange, WR 75

Circular W/G WC 81 for 6 GHz

Elliptical W/G 4 GHz EW – 37, 6 GHz EW- 56, 7 GHz EW-71, 11 GHz EW - 107 and 13 GHz EW -122

And for GSM system, it is a RF cable with jumper cable which are inter connected by surge arrestor on Bay top.

3-3.4

13] Protection for feeder cable :- A GI half round trough is to be provided for the protection of feeder cable .For GSM feeder cable ,also check W/G runway is properly supported from ground or not ? Runway is painted or not?

14] W/G pressurization: - Pressurization is applicable in only coaxial / elliptical W/G.

- Maximum operating pressure 0.25 kg / cm
- Minimum ---------‘’---------- 0.10 kg / cm
- Low pressure alarm 0.08 kg / cm
- It should hold for 12 hrs.

For details pl see M/W system.

15] EARTH details: - Limit for ring earth: - 0.5 Ohm.

i. - Type of earthing system: - Ring earth. Earth resistance:-

- Measure earth resistance by disconnecting all 4 legs earth GI strips.
- Earth can be measured by two instruments – Conventional (cranking) or Digital earth resistance tester e.g. WACO instrument.
- Loop C1 & P1and connect earth wire under test to this loop, bea a C2 spike at 15 meter and P2 spike at 30 meter in same direction or otherwise as per the guidelines by earth Megger manufacturer. Press button or crank handle and read earth value. If not within limit check all connection, still no then ask to improve it.

ii. Check top and bottom ends of W/G are properly earthed or not?

iii. Confirm each leg of tower is connected to ring earth by means of GI strip.

iv Check that armoring of aviation light cable is earthed at both ends.

v. Earth connectors are soldered or not?

16] Aviation warning light: - Aviation lights are very important for warning to Air – craft during the night period. Power to these lights supplied by photo switch (Twilight). .Previously this switch was being installed in eqpt. Room, but now this switch is in built with light, Pl confirm. No of aviation lights to be provided as follows:-

40 M---------One at the top.

60 M---------Three (one at top and second at 40 M diagonally)

80 M-------- As above

100 M --------Five (First at top, second at 40 M and third at 70 M diagonally apposite to 40 M)

It is operated on – 48 DC (from AC to DC converter) make: - ALTOS Electronics. Aviation light is with filament of Wipro or GEC make.

3-3.5

17] Concreting of tower base plates:-To avoid rusting of base plate, theft of nut and bolts and to keep tower structure undisturbed, concreting is necessary and to be done up to a height just below 3 bolts of the first joint. It should have slope and plastered using water proof cement and painted gray at the top on three sides. The forth side should be painted blue and tower particulars are to sign written by white paint. As per new circular it should not be done (dtd 9th Aug. 2006)

18] A foundation certificate :- A tower foundation and erection certificate should be obtained from the tower erection in-charge/Project that foundation and erection work has been executed as per the specification .No tower member may be locally fabricated unless the quality of steel is ensured as per specification All these members should be got deep galvanized after thoroughly cleaning with HCL acid.

A/T of Roof Top Tower: - It is a 15 M tower erected upon the terrace of the building and weight is 5 MT. All the relevant information as above to be filled up except verticality test .Verticality test to be taken by a plumb method. Tie up apposite legs with a thread straightway and release the plumb from the top of the tower. It should touch to the crossing of the apposite leg thread. The limit is ± 10.5 mm.
Check tower leg earthing which is connected by a 50x 3 mm GI strip to ring earth and carry out earth measurement as usual. Limit – 0.5 ohm.

A/T of Pole type antenna: - It is a 4 M / 6M height 100 mm GI pipe antenna. Is is erected above the terrace of building and fitted to parapet with clamps and cross stays of mild steel or embedded in a cement concrete block of 1:2:4 mix. The poles should be painted with 2 coats of synthetic enamel paint over a coat of Eatch primer. All relevant information to be filled up and earth measurement should be carried out. as usual.

3-3.6 Brief about 40 M NBLW (Narrow base light weight) Microwave tower:-

- **40 M** four leg with a base of 2 M square and top of 0.950 M.
- 8 segment of 5 M length, capacity maximum 2 grid parabolic antennas
- Nuts and Bolts grade 4.6 as per IS : 6639 (1972) , 1364 (1967), 1367 part 8 (1992). plain washers as per IS: 6610 (1972),& spring washers of type B as per IS : 3063 (1994)
- Nuts, Bolt, Washer are to be hot dip galvanized as per IS: 1367.
- Ladder: - externally right through from ground level up to 35 m and internally from 35 – 40 m with safety rings.
- Platform :- Two working platforms external at 38.5 and 28.5 m with railings all round . Rest platform at 20 m , optional platform at 18.5m , no rest platform if optional platform is provided.
- Verticality limit ± 10 mm (bottom of the line joining the center of the top of tower and the center of the base of tower.)
- Earthing by tin coated copper IS mark gauge 7/20 to be provided from lower end of lightning rod to the lug with a hole provided at 0.5 m below the top of tower.(Ref. GR/TWR-04/01.DEC2000)

3-3.7 New procedure for Tower A/T :-

As per the new circular dated 02/07/2007, Tower A/T should be completed as per new test schedule w.e.f. 01/08/2007.
Here after Tower check will be done in three stages:-

1] Stage I & II: - Inspection by a joint team of SDE Telecom (GSM/ WLL), SDE (Civil) and Representative of Vendor.

2] Stage III : - T & D A/T along with SDE (Mobile), after receipt of inspection report only. If case of foundation/ erection being executed by civil wing then inspection will be carried by SDE (Civil), Representative of contractor and concerned SDE (Telecom).

The following Meters/Instruments are required for Tower A/T:-

1. Binocular: - For visual check of nuts and bolts.
2. Digital camera: - For Tower member's photographs.
3. Torque wrench: - To check size and ripe of nut and bolts on sample basis.
4. Digital Theodolite: - For Tower verticality.

3-4 **A/T of 15 GHz/ 8 MB, Digital M/W system as a BTS media**

3-4.1General:-

15 GHz /8 MB digital microwave system is working in the frequency band of 15 GHz and frequency range is 14.400 – 15.350 GHz. Wherever OFC system installation is not possible due to difficult terrain; 15 GHz microwave system is useful for point to point Radio link between GSM BTS and BSC.

15 GHz /8 MB digital microwave system consists of Indoor unit (IDU), Outdoor unit (ODU) and NMS (Laptop). See the diagram of actual ODU in Fig 3-14 and system structure in Fig 3-13.

Fig 3-14

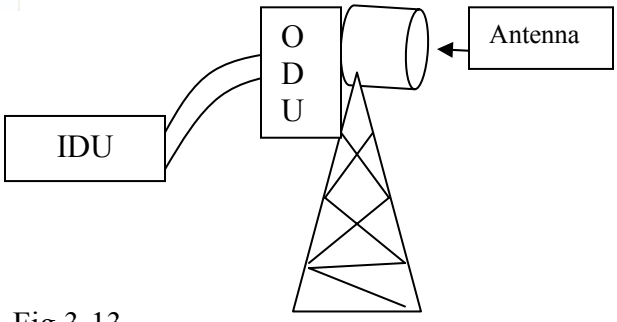


Fig 3-13

3-4.2 Meters required: - !) Laptop 2) DTA Set

3-4.3 Software provided: - Application software NECTAS Version 4.1 X
Equipment Version 946 LUX – 4.0

Wherever OFC systems are not installed for BTS, M/S Alcatel installed 15 GHz/ 8 MB M/W system, out of four E1`s only one E1 is being used for BTS.
Here all A/T parameters are to be checked on Laptop only.

3-4.4 Pre- A/T:-

- Get TT0 as well as installer has to offer in Atom along with survey report .
- Note down A Site, B Site, IDU, and ODU No. from laptop, and confirm.
- Check physical installation of the above modules.
- Check ODU, IDU and DDF are grounded or not?
- Check connectors of IDU, ODU and also in BTS are tightened properly or not?
- Check Hardware conformity as per BOM (Bill of material).
- Check all necessary 2 MB cable is terminated or not?
- Check E1 cable and DDF is labeled or not?

3-4.5 Acceptance Testing:-

- Carry out test at Location A ands B on laptop, expected Rx level and compare it with survey report. The limit is ± 4 dBm.
- Frequency measurement is on laptop. Tx and Rx both frequency are to be noted down and Compare with survey report
- Note down E1 no which is used for BTS.
- Verify Trans power setting as per site data i.e. 0 dBm.
- Generate tributary alarm in near and far end stations and monitor on laptop.
- Stability for 48 Hrs to be put on, on distant station loop.
- In through A/T, check continuity of all 4 tributaries by arranging loop at other End.

NB. Sample survey report is attached here with.

3-4.6 Sample surve report :-

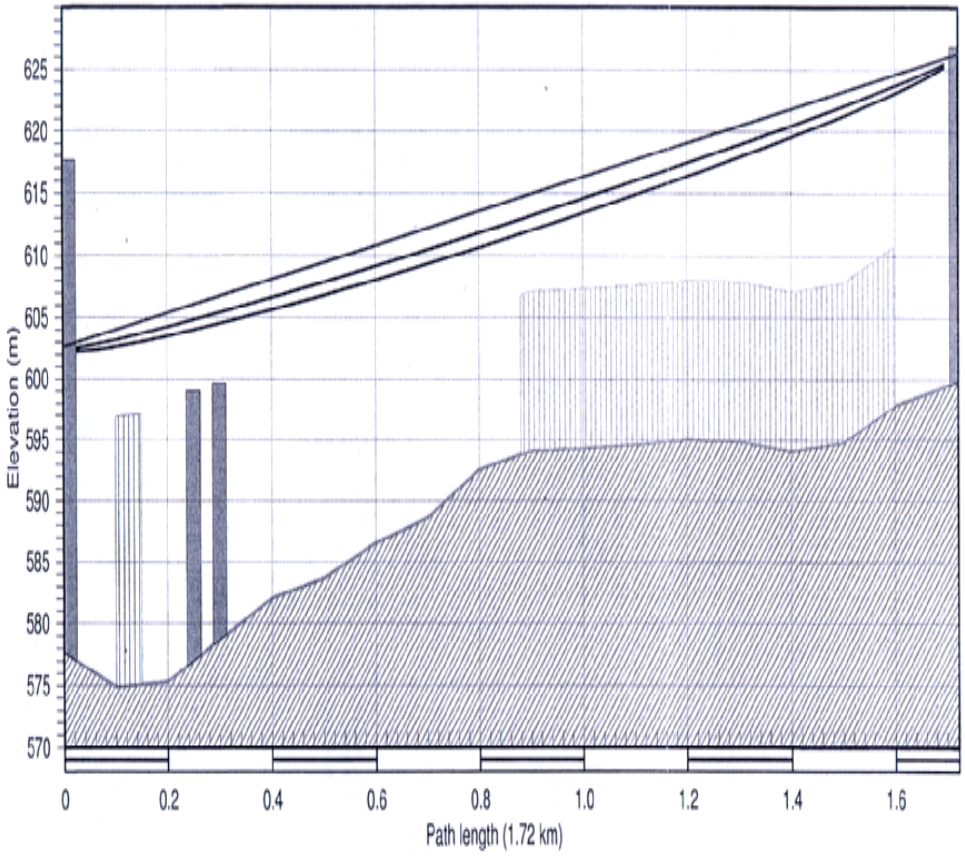
	BHOSERY EXCHANGE 4	INDRAYANI NAGAR PUN112
Elevation (m)	577.77	599.89
Latitude	18 37 17.60 N	18 37 59.70 N
Longitude	073 49 53.60 E	073 50 32.70 E
True azimuth (°)	41.52	221.52
Vertical angle (°)	0.78	-0.79
Antenna model	SB2-142B	SB2-142B
Antenna height (m)	25.00	26.50
Antenna gain (dBi)	37.30	37.30
Frequency (MHz)	15000.00	
Polarization	Horizontal	
Path length (km)	1.73	
Free space loss (dB)	120.74	
Atmospheric absorption loss (dB)	0.05	
Net path loss (dB)	46.19	46.19
Radio model	9415-UX (16E-1)	9415-UX (16E-1)
TX power (watts)	1.00e-03	1.00e-03
TX power (dBm)	0.00	0.00
EIRP (dBm)	37.30	37.30
Emission designator	28MOD7W	28MOD7W
TX Channels	12h 15243.0000H	12l 14823.0000H
RX threshold criteria	BER 10-6	BER 10-6
RX threshold level (dBm)	-80.00	-80.00
RX signal (dBm)	-46.19	-46.19
Thermal fade margin (dB)	33.81	33.81
Climatic factor	1.00	
Terrain roughness (m)	6.10	
C factor	3.29	
Fade occurrence factor (Po)	1.53E-04	
Average annual temperature (°C)	10.00	
Worst month - multipath (%)	99.99999	99.99999
(sec)	0.17	0.17
Annual - multipath (%)	100.00000	100.00000
(sec)	0.50	0.50
(% - sec)	100.00000 - 1.00	
0.01% rain rate (mm/hr)	90.00	
Flat fade margin - rain (dB)	33.81	
Rain attenuation (dB)	33.81	
Annual rain (%-sec)	99.99986 - 43.04	
Annual multipath + rain (%-sec)	99.99986 - 44.05	

Sat, Jun 10 2006
BHOSERY EXCHANGE-INDRAYANI NAGAR.pl4
Reliability Method - Vigants - Barnett
Rain - ITU-R P530-7

Bhosari Exchange	
Latitude	18 37 17.90 N
Longitude	073 49 53.60 E
Azimuth	41.72°
Elevation	578 m ASL
Antenna CL	25.0 m AGL

Frequency (MHz) = 15000.0
K = 1.33
%F1 = 100.00, 60.00

Indryani Nagar	
Latitude	18 37 59.70 N
Longitude	073 50 32.70 E
Azimuth	221.73°
Elevation	600 m ASL
Antenna CL	26.5 m AGL



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Aster Teleservices Pvt. Ltd.

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LOS Plot-Bhosari Exchange - Indrayani Nagar	AST-ALC-MR-PUN15	