RADIO DIVISION
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TOWER MOUNT AMPLIFIER

GENERIC REQUIREMENTS
No: TEC/GR/TX/TMA-01/01. JAN 2011

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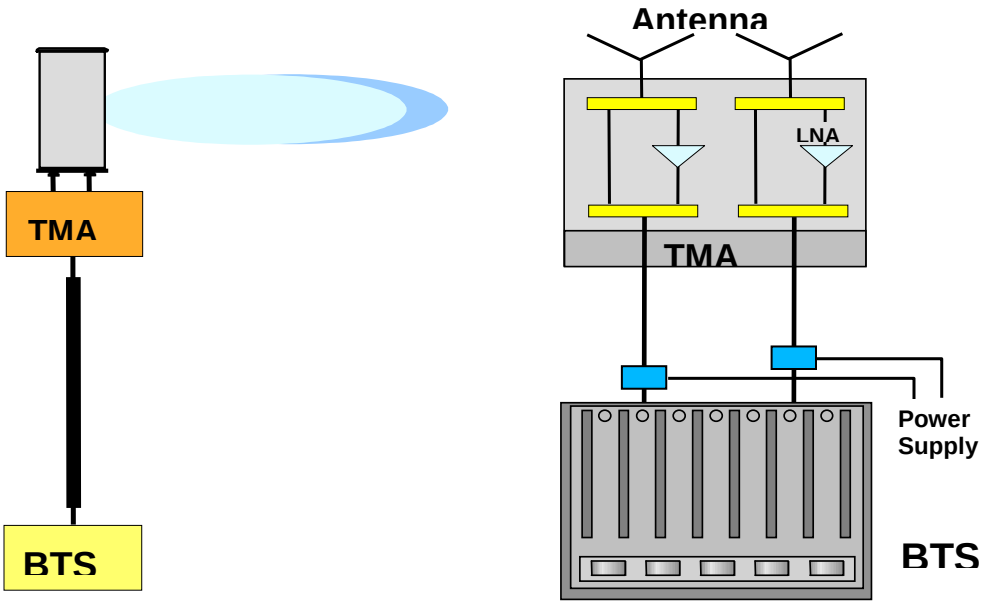
HISTORY:

GR TITLE	GR No.	REMARKS
TOWER MOUNT AMPLIFIER	No: TEC/GR/TX/TMA-01/01. JAN 2011	New GR

TOWER MOUNTED AMPLIFIER

1.0 INTRODUCTION:

The tower mounted amplifier (TMA) is designed to expand signal coverage through enhancing the uplink receiving sensitivity of the Base station. The employment of TMA will result in an increase of successful call attempts, reduction of call drops, maximized data transmission rate and improved call quality. It is installed on the top of telecommunication tower and below the BTS antenna to amplify the mobile signal via a low-noise amplifier before the signal is transmitted to the BTS.



2.0 TECHNICAL REQUIREMENTS:

2.0.1	Frequency	:	i. GSM 900: 890-915 (MHz) ii. GSM 1800: 1710-1785 (MHz) iii. UMTS: 1920-1980 (GHz)
2.0.2	Gain at rated output	:	12 dB
2.0.3	Gain Adjustment	:	In 1dB step size
2.0.4	Gain ripple	:	< 1 dB
2.0.5	Gain variation over entire band	:	± 1.5 dB

2.0.6	Gain Stability driver	:	±0.25 dB/24 hour max. over constant and temperature
2.0.7	Alarm Management	:	According to AISG v 2.0
2.0.8	Inter modulation, Downlink	:	<-50 dBc (4 channel)
2.0.9	VSWR	:	Input : <1.5
2.0.10	Spurious 9 KHz to 1 GHz	:	≤-36 dBm /100 KHz.
	1GHz to 12.75GHz	:	≤-30 dBm /1 MHz
2.0.11	Intermodulation , 2*43 dBm	:	-110 dBm
2.0.12	Max. Group delay in	:	≤ 3000 n sec
2.0.13	Insertion Loss Bypass mode	:	≤ 1.0 dB
2.0.14	Noise Figure (Up link)	:	≤ 1.8 dB
2.0.15	Input RF power(Uplink)	:	+10 dBm
2.0.16	Impedance:	:	50 ohm

2.0.17 **Bias Tee (Current Injector)**

i. Injects dc power onto the feeder for the TMA.
ii. Acts as a surge protector.
iii. N or 7/16 connectors in any combination.

3.0 QUALITY REQUIREMENTS:

3.0.1 The manufacturer shall furnish the MTBF value. MTBF shall meet the value specified in GR. The calculations shall be based on the guidelines in either BSNL QA document no. QM-115 {January 1997} "Reliability Methods and Predictions" or any other international standard.

3.0.2 The equipment shall be manufactured in accordance with international quality management system ISO 9001:2000 for which the manufacturer should be duly accredited. A quality plan describing the quality assurance system, being followed by the manufacturer, should be submitted.
And
The equipment shall meet the latest BSNL QA Guidelines indicated in Quality Manuals QM 118—Quality and Reliability in product Design., QM 205—Guidelines for Standard of Workmanship for Printed Boards, QM 206—Guidelines for Standard of Workmanship for Printed Board Assemblies, QM 210—Guidelines for Standard of

Workmanship for Surface Mounted Devices and QM 301—Transmission Equipment General Documentation. The supplier shall furnish a certification from the manufacturer to this effect, which shall be verified at the time of technical specifications evaluation.

3.0.3 The equipment shall conform to the requirements for environment specified in the standard QM-333{issue March-2010} document "Specification for environmental testing of electronic equipment's for transmission and switching use" for operation, transportation and storage. The applicable tests shall be for environmental category B2 including vibration and corrosion (salt mist).

4.0 ELECTROMAGNETIC COMPATIBILITY (EMC):-

4.0.1 **General Electromagnetic Compatibility (EMC) Requirements: -**
The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report from accredited test lab shall be furnished from a test agency.

a) Conducted and radiated emission (applicable to telecom equipment):
Name of EMC Standard: "CISPR 22 (2005) with amendment 1 (2005) & amendment 2 (2006) - Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment".

Limits:-

i) To comply with Class A of CISPR 22 (2005) with amendment 1 (2005) & amendment 2 (2006).

ii) The values of limits shall be as per TEC Standard No. TEC/EMI/TEL-001/01/FEB-09.

b) Immunity to Electrostatic discharge:

Name of EMC Standard: IEC 61000-4-2 {2001) "Testing and measurement techniques of Electrostatic discharge immunity test".

Limits: -

i) Contact discharge level 2 {± 4 kV} or higher voltage;

ii) Air discharge level 3 {± 8 kV} or higher voltage;

c) Immunity to radiated RF:
Name of EMC Standard: IEC 61000-4-3 (2006) "Testing and measurement techniques-Radiated RF Electromagnetic Field Immunity test"

Limits:-
For Telecom Equipment and Telecom Terminal Equipment with Voice interface (s)

i) Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and

ii) Under test level 3 (10 V/m) for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

For Telecom Terminal Equipment without Voice interface (s)
Under Test level 2 {Test field strength of 3 V/m} for general purposes in frequency range 80 MHz to 1000 MHz and for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

d) Immunity to fast transients (burst):
Name of EMC Standard: **IEC 61000- 4- 4 {2004) "Testing and measurement techniques of electrical fast transients/burst immunity test"**
Limits:-
Test Level 2 i.e. a) 1 kV for AC/DC power lines; b) 0. 5 kV for signal / control / data / telecom lines;

e) Immunity to surges:
Name of EMC Standard: IEC 61000-4-5 (2005) "Testing & Measurement techniques for Surge immunity test"

Limits:-
i) For mains power input ports : (a)1.0 kV peak open circuit voltage for line to ground coupling (b) 0.5 kV peak open circuit voltage for line to line coupling

ii) For telecom ports : (a) 0.5 kV peak open circuit voltage for line to ground (b) 0.5 KV peak open circuit voltage for line to line coupling.

f) Immunity to conducted disturbance induced by Radio frequency fields:
Name of EMC Standard: IEC 61000-4-6 (2003) with amendment 1 (2004) & and. 2 (2006) "Testing & measurement techniques-Immunity to conducted disturbances induced by radio- frequency fields"

Limits:-
Under the test level 2 {3 V r.m.s.}in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.

g) Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any):

Name of EMC Standard: IEC 61000-4-11 (2004) "Testing & measurement techniques- voltage dips, short interruptions and voltage variations immunity tests"

Limits:-
i) a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms(i.e. 70 % supply voltage for 500 ms)

ii) a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e. 40% supply voltage for 200ms) and

iii) a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.

Note: - For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC Standard No. TEC/EMI/TEL-001/01/FEB-09 and the references mentioned therein unless otherwise specified specifically. Alternatively, corresponding relevant Euro Norms of the above IEC/CISPR standards are also acceptable subject to the condition that frequency range and test level are met as per above mentioned sub clauses (a) to (g) and TEC Standard No. TEC/EMI/TEL-001/01/FEB-09. The details of IEC/CISPR and their corresponding Euro Norms are as follows:

IEC/CISPR	**Euro Norm**
CISPR 11	EN 55011
CISPR 22	EN 55022
IEC 61000-4-2	EN 61000-4-2
IEC 61000-4-3	EN 61000-4-3
IEC 61000-4-4	EN 61000-4-4
IEC 61000-4-5	EN 61000-4-5
IEC 61000-4-6	EN 61000-4-6
IEC 61000-4-11	EN 61000-4-11

5.0 SAFETY REQUIREMENTS:

5.0.1 The operating personnel should be protected against shock hazards as per IS 8437 {1993} "Guide on the effects of current passing through the human body" [equivalent to IEC publication 479-1 {1984}].

5.0.2 The equipment shall conform to IS 13252 {1992} "Safety of information technology equipment including electrical business equipment" [equivalent to IEC publication 950 {1986}] and IEC 215 {1987} "Safety requirements of radio transmitting equipments".

5.0.3 The equipment should follow proper construction practice to minimize unintended radiations due to leakage from any gap or monitoring points. All unused IF/RF ports and monitoring points should be terminated. The power flux density shall not exceed 1 mW/cm^2 at a distance of 2.5 cms.

6.0 SECURITY REQUIREMENTS:

6.1 PROTECTION REQUIREMENTS

6.1.1 The equipment shall have a terminal for grounding the rack.

6.1.2 Protection against short-circuit/open-circuit in the accessible points shall be provided.

6.1.3 All switches/controls on front panel shall have suitable safeguards against accidental operation.

6.1.4 The equipment shall be adequately covered to safeguard against entry of dust, insects etc.

6.2 OPERATIONAL REQUIREMENTS

6.2.1 The manufacturer shall guarantee the satisfactory performance of the equipment without any degradation in performance up to at an altitude of 3,000 metres.

6.2.2 The equipment shall be able to work without any degradation in performance in saline atmosphere near coastal areas and should be protected against corrosion.

6.2.3 Visual indication to show power ON/OFF status shall be provided.

6.2.4 Suitable visual indications shall be provided. It is suggested that green colour for healthy and red colour for unhealthy conditions may be provided. Some other colour, preferably amber, may be used for non urgent alarms.

6.2.5 The software/hardware in equipment shall not pose any problem due to changes in date and time caused by events such as changeover of leap year, in the normal functioning of the equipment.

6.2.6 The equipment shall be provided with the proper dummy load connecting facilities, cooling arrangements, input/output, isolations/monitoring ports, as required.

6.3 MAINTENANCE REQUIREMENTS

6.3.1 Maintenance philosophy is to replace faulty units/subsystems after quick on-line analysis through monitoring sockets, alarm indications and built-in test equipment/laptop computer/hand-held terminal. The actual repair will be undertaken at centralised repair centre(s). The corrective measures at site shall involve replacement of faulty units/sub-systems.

6.3.2 The equipment shall have easy access for servicing and maintenance.

6.3.3 Suitable alarms shall be provided for identification of faults in the system and faulty units.

6.3.4 Suitable provision shall be made for extension of summary alarms.

6.3.5 Ratings and types of fuses used are to be indicated.

6.4 POWER SUPPLY

6.4.1 The power supply to the equipment shall be fed from the station power plant. The equipment shall meet the following requirements in respect of the power supply.

6.4.2 Nominal power supply is 12±4 Volts DC. The equipment should operate over this range without any degradation in performance.

6.4.3 The equipment shall be protected in case of voltage variation beyond the above-specified range and also against input reverse polarity. The manufacturer shall furnish the value of guaranteed input voltage up to which no irreversible damage to the equipment will occur.

6.4.4 The actual power consumption shall be furnished by the manufacturer.

6.4.5 The derived DC voltages in the equipment shall have protection against over-voltage, short-circuit and overload.

6.4.6 The equipment shall have the option of operating from two independent sources of input power supply.

6.4.7 The equipment requiring AC mains shall operate from AC power supply without degradation in the performance at

a. Nominal single phase AC voltage shall be 230V with variation of -15% to + 10%, at 50± 2 Hz.

OR

b. Nominal AC voltage for three phase shell be 415V with variation of -15% to +10%, at 50± 2 Hz.

Note: Purchaser shall specify the power supply requirement as above.

7.0 DESIRABLE REQUIREMENTS:

7.1 ENGINEERING REQUIREMENTS

7.1.1 The joints in the equipment shall have protection as per BIS standard IS 12063 (1987) - Classification of degree of Protection provided by enclosures of the electrical equipment (equivalent to IEC-529) to meet at least the protection level of IP-65.

7.1.2 The equipment should follow proper construction practice to minimise unintended radiations due to leakage from any gap or monitoring points. All unused IF/RF port and monitoring points should be terminated. The power flux density shall not exceed 1m W/cm at a distance of 2.5 cm.

7.1.3 The equipment shall adopt state-of-the-art technology.

7.1.4 The equipment shall be of compact and composite construction and lightweight. The actual dimensions and weight of the equipment shall be furnished by the manufacturer.

7.1.5 All connectors shall be reliable and of the standard type to ensure for over 500 failure-free mating operations under the environmental conditions specified.

7.1.6 All connectors and the cables used shall be of low-loss type, and suitably shielded.

7.1.7 he equipment shall preferably work on natural cooling. However, the use of in-built DC operated fans is permitted in some equipment. In such cases, two sets of fans are envisaged one as normal and the other as hot standby, working alternately. An alarm shall be extended to indicate failure of fan/fans. MTBF of each fan shall be more than 50,000 hours.

7.1.8 The supervisory indications and other control switches shall be provided at convenient locations on the bay preferably at a height around 1500 mm for ease of viewing, operation, and maintenance.

7.1.9 The plug-in units shall be hot swappable to allow their removal/insertion even while the equipment is in energised condition.

7.1.10 Each sub-assembly shall be clearly marked with schematic reference to show its function, so that it is identifiable from the layout diagram in the handbook.

7.1.11 Each terminal block and individual tag shall be numbered suitably with clear identifying code, and shall correspond to the associated wiring drawings.

7.1.12 All controls, switches, indicators etc. shall be clearly marked to show their functions.

7.1.13 Important Do's and Don'ts about the operation of the equipment shall be clearly indicated at a convenient place on the equipment.

7.2 CONTROLS, METERING, PROTECTION AND INDICATION:-

7.2.1 Controls

- Mains power: On/Off
- High current alarm
- Low Current
- High Impedence

7.2.2 Metering

- RF drive power
- RF output power
- RF Reflected power

7.2.3 Protection

- Collector over temperature
- High VSWR
- Power supply fault
- Cabinet & external interlock

7.2.4 Indication

a) Status - Power On

b) Fault
- power supply
- Collector over temperature
- High reflected power
- Interlocks open
- Summary

c) Alarm
- Low RF power
- High RF power
- High reflected power

7.3 **MTBF** **:** 50,000 hours minimum

7.4 ACCESSORIES

7.5.1. The supplier shall provide one complete set of

a. All the necessary interfaces, connectors, connecting cables and accessories required for satisfactory and convenient operation of the equipment. Types of connectors, adapters to be used, and the accessories of the approved quality shall be clearly indicated in the operating manuals, which should be in conformity with the detailed list in the GR.

b. Software and the arrangement to load the software at site.

7.5.2. Special tools, extender boards, extender cables and accessories essential for installation, operation and maintenance of the equipment shall be clearly indicated and supplied along with the equipment.

7.5.3. Special tools, extender boards, extender cables and accessories essential for repair of the equipment shall be clearly indicated and supplied.

7.5 DOCUMENTATION

Technical literature in English or Hindi with complete layout, detailed block schematic, and circuit diagram of various assemblies with test voltages/wave-forms at

different test points of the units, shall be provided. All aspects of installation, operation, maintenance and repair shall be covered in the manuals. The soft copy as well as hard copy of the manuals shall also be provided. The manuals shall include the following manuals.

7.6.1. INSTALLATION, OPERATION AND MAINTENANCE MANUAL

a. Safety measures to be observed in handling the equipment

b. Precautions for installation, operation and maintenance

c. Test jigs and fixtures required, and procedures for routine maintenance, preventive maintenance, troubleshooting and sub-assembly replacement

d. Illustration of internal and external mechanical parts

e. Detailed description about the operation of the software used in the equipment including its installation, loading, debugging, etc.

7.6.2. REPAIR MANUAL

a. List of replaceable parts used, including their sources and the approving authority;

b. Detailed ordering information for all the replaceable parts shall be listed in the manual to facilitate reordering of spares as and when required;

c. Procedure with flow-charts for troubleshooting and sub-assembly replacement shall be provided. Test fixtures and accessories required for repair shall also be indicated. Systematic trouble-shooting charts (fault-tree) shall be given for the probable faults with their remedial actions.

8.0 FIELD TRIAL : Four Week minimum

Annex for the Reference of the Purchaser

(To form part of the GR)

Following clauses are for the reference of the purchaser only, and are not to be tested during Type Approval process.

a) As and when software bugs are found/determined, the manufacturer shall provide patches/firmware replacement if involved as mutually agreed between purchaser of equipment and supplier. Modified documentation wherever applicable shall also be supplied.

b) The manufacturer/supplier shall furnish the list of recommended spares.

c) The purchaser shall specify the required interfaces against the clause no. 2.0.17.

d) Purchaser shall specify the power supply requirement as mentioned in clause 6.5.7

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ABBREVIATION

Am	**–**	Amplitude Modulation
Bw	**-**	Bandwidth
Cispr	**-**	International Special Committee on Radio Interference
DC	**-**	Direct Current
EMC	**-**	Electromagnetic Compatibility
GHz	**-**	Giga Hertz
GR	**-**	Generic Requirements
HPA	**-**	High Power Amplifier
HTD	**-**	Heater Time Delay
IEC	**-**	International Electrotechnical Commission
IF	**-**	Intermediate Frequency
IM	**-**	Inter-modulation
IS	**-**	Indian Standard
ISO	**-**	International Standardisation Organisation
KHz	**-**	Kilo Hertz
LHCP	**-**	Left Hand Circular Polarised
Max.	**-**	Maximum
Min.	**-**	Minimum
MTBF	**-**	Mean Times Between Failure
PDR	**-**	Pressurisable Type D Rectangular Flange
PM	**-**	Phase Modulation
p-p	**-**	Peak to peak
QA	**-**	Quality Assurance
RHCP	**-**	Right Hand Circular Polarised
RF	**-**	Radio Frequency
Rx	**-**	Receive
Tx	**-**	Transmit
TWT	**-**	Traveling Wave Tube
VSWR	**-**	Voltage Standing Wave Ratio