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11m EARTH STATION ANTENNAS OPERATING IN C-BAND

GENERIC REQUIREMENTS

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TEC

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HISTORY SHEET

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11m EARTH STATION ANTENNA SYSTEMS OPERATING IN C BAND **Amendment Issued: One**	GR/SAN-01/02.APR.2001	Second Release of GR Released on 28.06.04
11m EARTH STATION ANTENNA SYSTEMS OPERATING IN C BAND	GR/SAN-01/03.MAR 2007	• GR format modified • Modified clauses needing Retesting for renewal of existing TAC: 2.1.1, 2.1.2, 2.1.5, 2.2.1, 2.2.2, 2.2.5, 2.2.10, 2.2.12, 2.2.17, 2.2.18, 2.3.2, 2.3.3.1, 2.3.3.8, 2.4.19, 2.4.19, 2.5.12, 2.6.1,2.6.2, 3.11. • New clauses added: 2.3.3.1 (i) • Incremental charges for renewal of TAC: Category-I

REFERENCES:

All the standards are subject to revision. The versions/issues of the standards indicated in this GR, or their subsequent versions/editions shall be applicable.

TEC GRs/IRs:

TEC standard no. SD/EMI-02/03.MAY.2006 with Amendment if any.

QA Documents:

i) QM 115 (1997)—Reliability Methods and Predictions

ii) QM 118—Quality and Reliability in product Design

iii) QM 205—Guidelines for Standard of Workmanship for Printed Boards

iv) QM 206—Guidelines for Standard of Workmanship for Printed Board Assemblies

v) QM 210—Guidelines for Standard of Workmanship for Surface Mounted Devices

vi) QM 301—Transmission Equipment General Documentation.

vii) QM 333 (1990)—Specification for environmental testing of electronic equipments for transmission and switching use, for operation, transportation and storage.

ITU Recommendations:

ITU-R Recommendation S.580-6 (2004)—Off-axis transmit and receive radiation patterns.

Other Standards:

i) CISPR 22 (2003)—Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment.

ii) IEC 61000-4-2 (2001)—Testing and measurement techniques of Electrostatic discharge immunity test.

iii) IEC 61000-4-3 (2002)—Radiated RF Electromagnetic Field Immunity test.

iv) IEC 61000-4-4{(1995 with Amendment 1 (2000) and Amendment 2 (2001)}—Testing and measurement techniques of electrical fast transients/burst immunity test.

v) IEC 61000-4-5 (2001)—Test & Measurement techniques for Surge immunity tests.

vi) IEC 61000-4-6 (2001)—Immunity to conducted disturbances, induced by radio frequency fields.

vii) IP-65

viii) IS 168 (1993)—Ready mixed paint, air drying for general purpose.

ix) IS 8437 (1993)—Guide on the effects of current passing through the human body

x) IS 10437 (1986)—Safety requirements of radio transmitting equipments

xi) IS 11233 (1985)—Antenna Mounting

xii) IS 12063 (1987)—Classification of degree of protection provided by enclosures of the electrical equipment

xiii) IS 13252 (2003)—Safety of information technology equipment including electrical business equipment

xiv) ISO 9001:2000

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PART-I
TECHNICAL REQUIREMENT

11m EARTH STATION ANTENNA SYSTEMS OPERATING IN C BAND

1.0 SCOPE

This document contains the generic requirements of satellite earth station antenna systems of 11m diameter operating in C band. These antennas shall have auto steering capability to track satellite in inclined geostationary arc and also capability for frequency reuse with orthogonal polarization. Detailed requirements for antenna are given in paragraph 2.0 and associated subsystems in paragraph 3.0

2.0 FUNCTIONAL AND TECHNICAL REQUIREMENTS

2.1 Cassegrain/Gregorian Feed System

2.1.1 It shall be suitable for transmitting in 5.850-6.425 GHz frequency band and receiving in 3.625-4.2 GHz frequency band with orthogonal linear/circular polarization.

2.1.2 The four-port feed shall be capable of operating in both polarizations as defined below.

a) In case of linear polarisation

Polarisation 1:

Up-link: linear horizontal
Down link: linear vertical

Polarisation 2:

Up-link: linear vertical
Down link: linear horizontal

b) In case of circular polarisation

Polarisation 1:

Up-link: LHCP
Down-link: RHCP

Polarisation 2:

Up-link: RHCP
Down-link: LHCP

The adjustment of polarizer should be done by auto control.

2.1.3 The feed aperture shall be protected from the ingress of snow, dust and rain by covering with a feed aperture cover.

2.1.4 The feed aperture cover shall allow dry air pressurization below a maximum safety pressure of 30 g/cm^2.

2.1.5 Facility shall be provided for transmitted output monitoring

2.2 Antenna System

2.2.1	Material	:	Stretched Formed Aluminum
2.2.2	Operated frequency range	:	Transmit frequency: 5.850-6.425 GHz : Receive frequency: 3.625 – 4.20 GHz
2.2.3	Nominal diameter of dish	:	11m
2.2.4	Mount	:	AZ-EL
2.2.5	Tracking Mode	:	Auto/motorised and Manual
2.2.6	Tracking Rotation	:	Antenna system shall be able to rotate in two modes of speeds for azimuth and for elevation as follows a)High speed mode: 0.1°/second b)Low speed mode: 0.01°/second
2.2.7	Gain (in dBi)	:	Transmit (minimum) : 54.5+20logf/6 Receive (Minimum) : 51.5+20logf/4 (Where f is in GHz)\
2.2.8	VSWR	:	1.3:1 maximum
2.2.9	Power handling capacity	:	2KW
2.2.10	Pointing accuracy	:	Better than ± 0.02° for wind speed upto 70 Kmph

2.2.11 Cross Polerisation discimination : 35dB minimum

2.2.12 Isolation between 6GHz and 4GHz ports : 85dB without Transmit reject filter in circuit

2.2.13 OFF axis transmit and receive: As per ITU-R Recommendation S.580-6 radiation Pattern

Gain (G) of at least 90% of the side lobe peaks shall not exceed the following:

$G=29-25\log \theta$ dBi, for 1° {or $(100.\lambda/D)$ ° if greater} $<\theta\leq 20°$

$= -3.5$ dBi, $20° < \theta \leq 26.3°$

$= 32 - 25 \log \theta$ dBi, $26.3 < \theta \leq 48°$

$= -10$ dBi, $48° < \theta \leq 180°$

Where G is the gain relative to an isotropic antenna diameter and wavelength of the RF transmission.

2.2.14 Weight : To be specified by the manufacturer

2.2.15 Enclosure dimension : Diameter : 1.3m
Depth : 1.1m

2.2.16 Wind velocity

a) Operational : Upto 70 Kmph
b) Survival : Upto 200 Kmph

2.2.17 Noise temperature: Noise temperature at the LNA output of antenna at different elevation angles

10°EL : 35°K
30°EL : 28°K
50°EL : 20°K

2.2.18 Interface

GHz Transmit : PDR 70
4GHz Receive : PDR 40

2.3 TRACKING MECHANISM

2.3.1 **Mechanism**

The antenna driving system, consisting of screw jack with AC motors, shall include the following:-

a) Antenna Control Unit with motor control unit.
b) Beacon detectors
c) Angle detectors

2.3.2 **Motor Controller**

a) Mode selection: Local/Remote (ACU)
b) Built in power supply unit
c) Emergency stop available
d) Toggle switches provided for locking in local mode in 4-directions
e) All weather proof, wall, pad, foot mounted unit
f) Protection against single phase failure and power supply cut off

2.3.3 Antenna Control Unit

2.3.3.1 Operational modes:-

a) Manual
b) Step Track
c) Program Track
d) Standby, also system should revert automatically to standby in case of any of the fault condition.
e) Orbit prediction track

2.3.3.2	Alarm indications and Monitoring (visual & ressettable audible)	:	-Limit switch alarm -Synchor Conversion/Angle detection alarm -System interlock - Low signal alarm -Beacon level low -PLL out of lock
2.3.3.3	Signal level monitor	:	To monitor beacon signal level in dB relative to peak
2.3.3.4	Angle indication	:	AZ-EL mount AZ: 0° -360°, EL: 0° -90° Resolution: 0.01°, Accuracy: 0.02°
2.3.3.5	Parameter check and Updating data entry	:	Satellite position scan system

2.3.3.6 Step track Performance :

a) Tracking accuracy : Better than 1/10th of the half power beamwidth for wind speed upto 70 Km/hour

b) Auto track select :

i. Interval: 10 minutes, 30 minutes, 60 minutes, 120 minutes

ii. Signal level select settable 0.5 dB nominal

c) Auto track signal level : Settable

2.3.3.7 Angle detectors:

a) Detector type :Synchro/Resolver/optical encoder

b) Resolution :0.01°

c) Accuracy :0.03°

2.3.3.8 Capability to drive the system from remote terminal through RS-232C/RS-485/RS-422 interface.

2.3.3.9 Default mode to bypass the enable manual control

2.4 Beacon Down -converter

2.4.1 Input frequency : 3.625-4.20GHz Synthesiser, Step size 125 KHz

2.4.2 Operational range : -100 to -60 dBm

2.4.3	Output frequency	: 70±18 MHz
2.4.4	Input impedance	: 50 ohms, unbalanced
2.4.5	Input VSWR	: 1.25 maximum
2.4.6	Output impedance	: 70 ohms, unbalanced
2.4.7	Input Connector	: Type N Female
2.4.8	Output Connector	: BNC
2.4.9	Frequency stability of local Oscillator	: 0.1 ppm/24hours
2.4.10	Output return loss	: 22 dB
2.4.11	Noise Figure	: 14 dB
2.4.12	Frequency response	: 1 dB/80 MHz
2.4.13	SSB Phase Noise	: -55 dBc/Hz at 100Hz offset -70 dBc/Hz at 300Hz offset -80 dBc/Hz at 1 KHz offset
2.4.14	Spurious (Non harmonics)	: -55 dBc/Hz at Nominal output
2.4.15	Tuneability (steps)	: 125 KHz synthesized
2.4.16	Image rejection	: 60 dB
2.4.17	Intermodulation	: -50 dBc with two carriers at an output products level 3 dB below nominal and 1 MHz separation.
2.4.18	Control and Adjustment Status display	: Beacon Frequency select Local off
2.4.19	MTBF	: 90,000 hours

2.5 Beacon receiver

If any manufacturer offers an integrated unit – combining Beacon receiver and Down-converter, it should be acceptable provided that it meets the overall input and output parameter requirements.

2.5.1	Input Frequency	: 70 MHz
2.5.2	Input impedance	: 75 ohms, unbalanced
2.5.3	Operational Range	: -50 to -10 dBm
2.5.4	Tracking mode	: Coherent through AFC or PLL
2.5.5	Dynamic range	: 8 dB
2.5.6	Search and lock range	: 100 KHz
2.5.7	C/No acquisition	: Manual mode: 40 dB Hz minimum Auto mode : 40 dB Hz minimum
2.5.8	Noise Figure	: 10 dB
2.5.9	Output	: i) Signal gradient at any point within 3 dB>0.88V/dB ii) Output voltage range 3 to 10V DC across 10K ohms impedance iii) Noise output level<50mV peak to peak (for minimum 50dBHz signal)
2.5.10	Alarms	: Unit fail
2.5.11	Controls	: **local** — **remote** Power on/off — power on/off Local/remote — local/remote Auto/manual mode- Open/close loop- Set RF level — set RF level
2.5.12	Remote Interface	: RS-232/RS-422/RS-485

2.5.13 MTBF : 90,000 hours

2.6 Antenna System Mounting

2.6.1 Antenna foundation and mounting and mounting detail conforming to IS-11233 1985(latest standard including amendment, if any) shall be given for 5 tons/m^2 and 10 tons/m^2 soil bearing capacities. Templates and anchor bolts shall form part of the supply of system.

2.6.2 The transmission shall be provided with lightning protection rod having a provision for connecting the earth Strip. Ohmic value of the lightning conductors including the earth shall not exceed 0.5 ohms. The design of the lightning protection shall be such that the ± 30º cone from the top of rod shall cover the entire structure of antenna in any position.

2.7 Special Environmental Condition

2.7.1 The antennas are for installation and operation under fully exposed weather conditions. These shall be capable of withstanding the effects of industrial pollution, salinity of atmosphere in costal areas and etc.

2.7.2 The performance shall not deteriorate beyond values specified in this GR for temperatures from -20°C to +70°C and relative humidity from near dry to 95% at 40°C.

(Note: - Optional compliance for temperature lower than -20°C shall be called for specific sites basis).

2.8 Corrosion

Corrosion resistant painting shall be provided to overcome the sever climatological conditions where sub – zero temperatures are recorded for long periods which may result in snow fall and formation of ice on the antenna and feed horn.

2.9 De-Icing

De-icing shall be provided to overcome the severe climatological conditions for stations where sub – zero temperatures are recorded for long periods which may results in snow fall and formation of ice on the antenna and feed horn.

2.10 Finish

The finish on reflector and feed shall be olive green. The paint used for reflector, feed and shroud assembly shall be as per BIS standard IS-168 {1993} “ready mixed paint,

air drying for general purpose-specification (Third revision)" and it is to be tested as per BIS standard IS-101 {1996} "Method of sampling and test for paints, varnishes and related products (Third revision)". Mount assemblies need not be painted.

2.11 **Field Trial:** Four Weeks

PART-II
GENERAL REQUIREMENT

3.0 General Requirements

3.1 Engineering Requirements

3.1.1 The equipment shall adopt state of the art technology

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

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

3.1.4 All connectors shall be reliable and of standard type to ensure failure free operation over 500 matings and under environmental conditions specified in this GR.

3.1.5 All connectors and the cable used shall be of low loss type and suitably shielded.

3.1.6 The equipment shall be housed in standard 19" rack, 600mm rack or slim rack with a maximum height of 2250mm and with front access.

3.1.7 The equipment shall have natural cooling arrangement which shall not involve any forced cooling such as by using fans etc. either inside or outside the equipment. However, in case this is unavoidable and the fans are to be used, these shall be used, these shall be DC operated and shall not impact on the MTBF of the equipment.

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

3.1.9 The mechanical design and construction of each card/unit shall be inherently robust and rigid under all conditions of operation, adjustment, replacement, storage and transport and conforming to Para 12 of BSNL QA document no. QM-333 {issue-1: September 1990} "Specification for environmental testing of electronic equipments for transmission and switching use".

3.1.10 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.

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

3.1.12 All controls, switches, indicators etc. shall be clearly marked to show their circuit.

3.2 Operational Requirements

3.2.1 The antenna system shall consist of suitable sized dish with Cassegrain/Gregorian dual feed system and azimuth-elevation mount with steering capability to track

satellite in geostationary arc. The antenna shall be so designed as to have azimuth coverage from 90º to 270º in two segments each of 110º or any other suitable arrangement not involving more than three segments, without dismantling the antenna. Further antenna shall have the capability of elevation change from 5º to 90º.

3.2.2 The manufacturer shall guarantee the satisfactory performance of the equipment without and degradation at an altitude upto 3600 meters above mean sea level.

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

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

3.2.5 Wherever the visual indications are provided, green colour for healthy and red colour for unhealthy conditions should be provided. Some other colour may be used for non urgent alarms.

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

3.2.7 Antenna Control Unit having capability for controlling antenna in manual/automatic step tracking by means of beacon receiver may be provided. It shall provide antenna position read out with resolution of ±0.01°

3.2.8 Supervision display, alarms and limiting switches shall be provided to ensure safety of antenna structure and satisfactory antenna drive performance.

3.2.9 Tracking time for auto tracking shall not exceed 4 minutes failing which an alarm shall be displayed.

3.2.10 Antenna Control Unit shall be microprocessor based and shall provide an integrated capability to control the antenna in either 'Manual' or 'Autotrack' mode. The LED indicators signal level meters and controls shall facilitate simple and reliable operation of the complete antenna sub-system.

3.2.11 The drive mechanism which is installed on each axis shall incorporate screw jacks and manual handles.

3.2.12 Provision of two hand cranks shall be made for manual positioning of the antenna-one for elevation and other for azimuth.

3.3 Quality Requirements

3.3.1 The joints in the feed assembly 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.

3.3.2 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**.**
Additionaly, 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.

3.3.3 RF connector used shall be reliable and of the standard type to ensure failure free operation over 500 matings and environmental conditions specified in the GR.

3.4 Environmental Requirements

The equipment shall conform to the requirements for Environmental specified in BSNL QA document QM-333 {issue-1: September 1990} "Specification for environmental testing of electronic equipments for transmission and switching use" for operation, transportation and storage. The applicable tests shall be for environmental category B2 for indoor equipment and Category D for outdoor equipment including vibration and corrosion (salt mist).'

3.5 Maintenance Requirements

3.5.1 Maintenance philosophy is to replace faulty units/subsystems after quick on-line analysis through monitoring sockets, alarm indications. The actual repair will be undertaken at centralized repair centers. The corrective measures at site shall involve replacement of faulty units/sub-systems.

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

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

3.5.4 Suitable potential free contact points shall be provided for extension of summary alarms.

3.5.5 As and when software bugs are found/determined, the manufacturer shall provide patches/firmware replacement if involved free of cost for three years. Modified documentation whenever applicable shall also be supplied free of cost.

3.5.6 Ratings and types of fuses used are to be indicated by the supplier.

3.5.7 The manufacturer/supplier shall furnish the list of recommended spares for three years maintenance.

3.5.8 The supplier shall have maintenance/repair facility in India.

3.5.9 Supplier shall guarantee the spares so long as the equipment is in service, at least for 10years from the date of supply. The purchaser would like to stock spares as and when the supplier decides to close down the production of the offered equipment. In such an event, supplier shall give a town years notice to the purchaser so as to stock the spares.

3.6 Power Supply

3.6.1 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.

3.6.2 Nominal power supply is -48 Volts DC, with a variation over the range -44V to -57V. The equipment should operate over this range without any degradation in performance.

3.6.3 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.

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

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

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

3.6.7 The equipment requiring AC mains shall operate from AC power supply without any degradation in the performance.

(a) Nominal AC voltage for Single Phase shall be 230V with variation of -15% to +10%, at 50 ± 2Hz.

(b) b.Nominal AC voltage for Three Phase shall be 415V with variation of -15% to +10%, at 50 ± 2Hz.

3.7 Accessories

3.7.1 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, adopters to be used and the accessories of the approved quality shall be clearly indicated in the operating manuals which should be conformity with the detailed list in the GR;

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

Additional sets may be ordered optionally.

3.7.2 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.

3.7.3 Special tools, extender boards, cables and accessories essential for repair of the equipment shall be clearly indicated and supplied in case the same are ordered.

3.8 Documentation

Technical literature in English with complete layout, detailed block schematic and circuit diagram of various assemblies with test voltage/waveforms 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 manuals shall include the following

3.8.1 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, and troubleshooting and sub-assembly replacement.

d) Illustration of internal and external mechanical parts.

3.8.2 Repair Manual

a) List of replacement 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) Procedures 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 repair remedial actions.

3.9 Protection Requirements

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

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

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

3.9.4 The equipment shall be adequately safeguarded to prevent entry of dust, insects and lizards.

3.9.5 The tubes, if any, used in the equipment shall be of implosion type, and not explosion type

3.10 Safety Requirements

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

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

3.10.3 The equipment should follow proper construction practice to minimize unintended radiations due to leakage from any gap of monitoring points. All unused if/rf ports and monitoring points should be terminated. The power flux density shall not exceed 1m W/cm2 at a distance of 2.5 cms.

3.11 Electromagnetic Compatibility (EMC)

3.11.1 The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report shall be furnished from test agency. Following test results should be furnished:-

3.11.2 Conducted and radiated emissions (applicable to telecom equipment):

Name of EMC Standard: CISPR 22 (2006)—Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipments.

Limits:-

i) To comply with class A (to be mentioned in GR/IR as per the specific requirement) of CISPR 22 {2006}.

ii) The values of limits shall be as per TEC standard No.SD/EMI-02/03May.2006

Alternatively the testing conducted against the CISPR 22(2003) or its later editions with associated limits for class A as applicable, as given in tables 4a,5a,6 & 7 of TEC standards No. SD/EMI-02/03 MAY 2006 shall also be acceptable till March 2008

3.11.3 Immunity to Electrostatic discharge:

Name of the EMC standard: IEC 61000-4-2 (2001)—"Testing and measurement techniques of Electrostatic discharge immunity test".

Limits:

i. Contact discharge level 2 (± 4 kV)

ii. Air discharge level 3 (± 8 kV)

3.11.4 Immunity to radiated RF:

Name of the EMC standard: IEC 61000-4-3 (2006) — "Testing and measurement techniques- Radiated RF Electromagnetic Field Immunity test".

Limits:

i) Under test level 2 (test field strength of 3 v/m) for general purposes in frequency range 80 MHz to 1000 MHz.

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 6.0GHz.

Alternatively till March 2008, the testing against 61000-4-3(2002) or its later editions with the following test limits shall also be acceptable.

Limits:

i) Under test level 2 (test field strength of 3 v/m) for general purposes in frequency range 80 MHz to 1000 MHz

ii) Under test level 3 (10 v/m) for protection against digital radio telephones in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 2.0 GHz.

3.11.5 Immunity to Fast transients (burst):

Name of EMC standards: IEC 61000-4-4 {2004}—"Testing and measurement techniques of electrical fast transients/burst immunity test"

Limits:

i) Under Level 2 (1 kV for AC/DC power lines; 0.5 kV for signal/ control/Data/telecom lines.

Alternatively till March 2008, the testing against 61000-4-4(1995) with amendment no. 1(2000) & amendment no.2 (2001) or its later editions with the test levels as mentioned above in this case, shall also be acceptable

3.11.6 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) 0.5kV 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 coupling (b) 0.5kV peak open circuit voltage for line to line coupling

Alternatively till March 2008, the testing against 61000-4-5(2001) or its later editions with the test levels as mentioned above in this case, shall also be acceptable

3.11.7 Immunity to conducted disturbance induced by Radio frequency fields:

Name of EMC standard: IEC 61000-4-6(2004) with amendment 1 (2004) & 2 (2006) "Testing & Measurement techniques-Immunity to conducted disturbances induced by radio frequency fields".

Limits:-

Under the test level 2(3V r.m.s.) in the frequency range 150 kHz-80 MHz for AC/DC lines and signal/control/telecom lines.

Alternatively till March 2008, the testing against 61000-4-6 (2001) or its later editions with the above mentioned voltage & frequency limits shall also be acceptable.

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

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

Limits:

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

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

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

Alternatively till March 2007, the testing conducted against the IEC 61000-4-11(2001)) or its later editions with the following test levels shall also be acceptable

i) a voltage dip corresponding to a reduction of the supply voltage of 60% for 100ms;

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

For checking compliance with the above EMC requirements, the method of measurements shall be in accordance with TEC standard no. SD/EMI-02/03.MAY2006 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 levels are met as per the above mentioned sub clauses (a) to (g) and TEC standard No. SD/EMI-02/03 MAY 2006.. The details of IEC/CISPR and corresponding Euro Norms are as under

IEC/CISPR	**Euro Norm**
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

4.0 ABBREVIATIONS

AC	- Alternating current
ACU	- Antenna control unit
AFC	- Automatic frequency control
AZ	- Azimuth
BCD	- Binary code decimal
BIS	- Bureau of Indian standards
BNC	- Bayonet nut coupling
BSNL	- Bharat Sanchar Nigam Limited
°C	- degree Celsius
CISPR	-International Special Committee on Radio Interference
D	- Diameter
dB	- decibel
dBc	- decibels referenced to the carrier level
dBi	- decibels over an isotropic (antenna)
dBm	- decibels referenced to a milli Watt
EL	- Elevation
EMC	- Electromagnetic Compatibility
EMI	- Electromagnetic Interference
f	- Frequency
G	- Gain
GHz	- Giga Hertz
GR	- Generic Requirements
IEC	- International Electrotechnical Commission
IP	- International protection: designator for degrees of Protection in conjunction with two numerals
IS	- Indian Standard
ISO	- International Standardisation organization
ITU	- International Telecommunication Union
KHz	- Kilo Hertz
Km	- Kilometer
Kmph	- Kilometer per hour
kV	- kilovolt
kW	- Kilo Watt
°K	- degree Kelvin
LHCP	- Left Hand Circular Polarisation
m	- Meter
MHz	- Mega Hertz
MTBF	- Mean Time Between Failure
PDR	- Pressurisable type D Rectangular Flange
PLL	- Phase locked loop
ppm	- parts per million

QA	- Quality Assurance
QM	- Quality Manual
RF	- Radio Frequency
RHCP	- Right Hand Circular Polarisation
TTL	- Transistor transistor logic
VSWR	- Voltage Standing Wave Ratio
W	- Watt
λ	- Wavelength
θ	- Off axis angle.

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