GR/SLC-01/02.TSTP-1

Provisional Test schedule for Structured LAN Cabling

(GR No. GR/SLC-01/02.AUG 2005)

GR Clause No.	Test Procedure	Test result	remark
1.0 Introduction	This chapter defines the different structured LAN cabling methods that shall be deployed in the LAN cabling for different applications of Indian Telecom network. The structured LAN cabling is one of the important requirements to allow the usage of multi-media and to support speeds up to 1 Gbps in the LAN environment. The structured cabling consists of elements like cables, faceplates, patch panels, outles and frames , etc. which shall conform to the standards mentioned in this document so that they can be used for Gigabit transmissions.	Information only	
1.1 Conformity to Standard	Check that the Structured Cabling System should meet the following standards: a) ISO/IEC ISO 11081 : International standard for generic cabling for customer premises b) TIA/EIA TSB 75 : Additional horizontal cabling practices for open office (August 1996) c) TIA/EIA TSB 95 (TBA end 1999): Additional transmission performance guidelines for 100 ohm 4 –pair Category 5 Cabling d) TIA/EIA – T568-A Commercial Building Telecommunications cabling Standard (Category 5e cabling) - for characteristics specified up to 100MHz and supports full duplex 1000 Base-T, 100 Base-TX , 10 Base-T. e) TIA/EIA – T568-B.2.1 Telecommunications cabling Standard (Category 6 cabling) - for characteristics specified up to 250MHz and supports full		

	Duplex 1000 Base –T, 100 Base-TX, 10 Base-T.		
1.2 Structured cabling.	Check that the cabling design to the department LAN cabling should be as per the TIA/EIA-T568-A standards / TIA/EIA-568-B standards.		
1.2.1	The structured cabling system design considerations is concerned with the following six sub –systems.		
(a) Building Entrance.	Check that Building entrance should be the place where –in the interface equipment to the public network is positioned. The example for this is interface to the WAN through Routers/Leased lines etc.		
(b) Equipment Room.	Check that the equipment room should house the Active components for data ie the Server and in case of voice the EPABX . Check that the equipment room should also house the Main Building Cross Connect connecting various floors of the building.		
(c) Backbone Cabling	Check that the backbone cabling should consist of cables connecting the various floors of the building . Check that the type of cable used should be either Category-5e 25 pair UTP Cable or preferably be of Fibre optic cable.		
(d) Telecommunications Closet.	Check that the telecommunications Closet should be placed in each floor which is a consolidation point for the Horizontal Cabling termination that interfaces with the Backbone cabling. Check that the telecommunication closet should also house the active equipment such as the Hubs/Switches catering to that particular floor.		
(e) Horizontal Cabling	Check that the horizontal Cabling should consist of cables connecting the Telecommunication Closet to the Work area Telecommunication Out let. Check that the cable type used should be either Category6, 4 pair UTP cable		

	Or Category 5e, 4 Pair UTP cable or a 2-core 62.5 / 125 µm multi-mode fiber optic cable.		
(f) Work Area :	Check that the work area should consist of the Telecommunications Outlet/Information Outlet wherein the horizontal cabling is terminated . Check that the patch cord connecting the Telecommunication outlet/Information outlet to the node is also form the part of the Work Area.		
1.2.1 Category 6 Cables.	The Transmission performance of Cat 6 is better than Cat 5e Cable. a) The characteristics for Cat 6 Channel are specified (requires a positive PSACR) up to 200 MHz. and tested to 250 MHz.(ref.: Annex 1) a-2) Characteristics for Cat 6 Cable are specified (requires a positive PSACR) up to 250 MHz._(ref: Annex 2) b) The Cat 6 link and channel requirements are backward compatible to Cat 5e. c) The Category 6 standard has specifications for patch cords and connectors that are intended to assure interoperable Cat 6 performance (ref.: Annex 3). d) Category 6 cables are covered under TIA/EIA -T568-B standar5ds.		
1.2.2 Backbone Cabling	Check that the backbone cabling for the EIA/ TIA-T568-A 5e or EIA/TIA-T568-B.2.1 Cat6 provides interconnection between telecommunications closets, equipment rooms, and entrance facilities. Check that it consists of the backbone cable , intermediate and main cross-connects, mechanical terminations and patch cords or jumpers for backbone-to-backbone cross connection.		

	Check the types and distances as referred in the following table: **Cabling Types Backbone Distance (Max)** 100 ohm UTP 22 AWG To 26AWG (American Wire Gauge) : 800 meter for Voice 100 Ohm : 90 meters For Data Multi-mode 62.5/125 µm Optical fiber : 2,000 Meters Single-mode 8.3 / 125µm optical Fiber : 3,000 meters		
1.2.3 Horizontal Cabling	Check that the Horizontal Cabling system for the TIA/ EIA-T568-A 5e Standard or Cat 6 Standard extends from the telecommunications outlet in the work area (or workstation) to the telecommunications closet. Check that the following media types should be used as options for horizontal cabling, each extending a maximum distance of 90 meters: a) 4-pair 100 Ohm UTP cable (24 AWG or 23 AWG solid conductors). b) 2 fiber 62.5 / 125 µ meter Optical fiber cable.		
1.2.3.1	Check that the horizontal cable meets the following requirements: **(a)** Horizontal cables shall be NEXT compliant - 4 pair UTP cable (unshielded 5e or category 6 standard, to connect each telecommunication outlet (TO) or consolidation point (CP) to the backbone sub-system on the same floor. **(b)** The UTP cable shall be of 24 AWG minimum for cat 5e and 23 AWG minimum for cat 6 cable bare solid copper conductors insulated with high density, PE sheath , jacketed with Fire retardant PVC. The insulated conductors shall be twisted into		

	Pairs , with pair balanced for attenuation. The twist ratio shall be between 12 twist per feet to 30 twist per feet; with different for all the pairs. **(c)** The UTP cable shall be run using a star topology format from the cross connect at the floor distributor (FD) administration outlet. A 25 pair UTP cable shall be run from the cross connect at the floor distributor (FD) administration subsystem on each floor to a consolidation point (CP) on the same floor. **(d)** The 4-pair UTP cable shall be able to meet EIA/TIA 568 B Cat 6 Specification. It must be proven to ensure as mentioned in Annex 4 from the Floor Distributor (FD) wiring closet to the telecommunications outlet at the work area. **(e)** Each run of cable from the cross connect at the floor distributor (FD) and the telecommunication outlet shall be continuous without any joints or splices except for the open office design , when a consolidation point (CP) , is proposed. **(f)** The length of each individual run of fixed horizontal cable from the administration subsystem (FD) on each floor to the telecommunication outlet shall not exceed 90 meters (at 20 degree Celsius, if the temperature is 40 degrees the length shall not cross 84 meters). **(g)** The Cable design shall be such that they are installation stress proof. **(h)** The 4 pair UTP cable shall meet or exceed the following		

	Specifications i. TIA/EIA 568-A Commercial Building Telecommunications Cabling Standard ii. TIA/EIA 568-B.2 Cat 6 Cable Specifications Mentioned in Annexure2. iii. All application as per Annexure 4. iv. Conductor DC Resistance (Max) : 28.6Ω/1kft@20C v. DC Resistance unbalanced (Max): 5% vi. Insulation Resistance (Min): 500MΩ/1kft@20C vii. Mutual Capacitance (Typical): 15pF/ft; viii. Characteristics impedance: 100+/-5%Ω@100 MHz ix. Typical Cable Skew : 15 nsec /100 Meters.		
1.2.4. Telecommunication closet.	Check that each piece of UTP cabling connecting a device to a hub should be no longer than 90 meters for the reasons given below : a) Attenuation b) Interference c) Noise		
1.2.4.1	Check that the UTP connecting hardware used in the patch cords per 100 meters @ 20 ° C should meet the Attention and NEXT (Near End Cross Talk) specifications defined in the TIA / EIA recommendations.		
1.2.4.2	Check that the termination method for UTP connecting hardware should utilize the Insulation Displacement Contact (IDC) method.		
1.2.4.3	Check that outlets are securely mounted. Check that outlet boxes with un-terminated cables must be covered and marked. Check that performance markings are provided to show the applicable		

	Transmission category and should be visible during installation (to Cat 6) in addition to safety markings. Check that installed connectors are protected from physical damage and moisture.		
1.2.5 Work Area System	Check that Work Area system should consist of wiring or interconnect that connects active terminal devices to telecommunication outlets such as face plates, connectors, patch cards and terminal leads needed to make connections.		
1.2.5.1. Faceplate :	Check that faceplate should meet the following requirements: **a)** Shall have the ability to fit a dust cap or shutter to prevent dust and dirt getting into the outlet for single and dual outlets. **b)** shall have clear label for application identification **c)** Shall be able to have 1,2,3,4,6 or 12 outlets **d)** Shall have options for vertical style or horizontal style. **e)** The faceplate housing the UTP connector modules shall have no visible mounting screws. **f)** The faceplate housing the UTP connector modules shall have aperture plugs to cover any unused openings in the faceplate. **g)** The faceplate housing the UTP connector modules shall provide flexibility in configuring multimedia workstation outlets that respond to present of future network needs such as audio , video, coaxial and optical fiber applications.		
1.2.5.2 Telecommunication Outlets	Check that the telecommunication outlets should meet the following requirements: **a)** All telecommunication outlets		

	Shall be universal RJ45 type **b)** The shall be NEXT compliant (as per Annex 3) ISDN 8-position/ 8-conductor standard type and shall be capable of receiving conventional 4,6 and 8 pin jack/ plug of 23/24 AWG solid wire. **c)** Shall have Surface or flush mounted single or dual sockets **d)** Shall be able to support all application as per Annexure 4. **e)** Shall be made from high-impact, flame –retardant, UL-rated 94 VO thermoplastic **f)** Shall meet or exceed ISO/IEC 11801 Class E, EN 50173 Cat components Specifications **g)** Shall apply the cross-over lead concept using cross talk techniques to Crosstalk (NEXT) performance of 43 dB @ 100MHz for Cat 5E and 54 dB @ 100 MHz. **h)** The telecommunication outlet shall be of the insulation displacement connector (IDC) wiring termination. Minimum of 4 mechanical forces shall be applied to the axis of the wire to provide a reliable and stress-free resistant connection. IDC termination shall have a Straight configuration when connecting with the cable conductor to improve termination hold. **i)** The Outlet shall have a built in mechanism to prevent pair untwist of more than ¼ inch as specified by TIA/EIA. **j)** The IDC contact element shall be spring special crass with 5µm Nickel plating to reduce Oxidation of IDC & contact and sharper termination of copper cable, angularity of copper cable , angularity arranged across the axis of conducting wire to maximize the gas tight connection. The contact range		

	Shall be 5 µm Nickel-plated to ensure minimum oxidization impact. **k)** The insulation displacement connectors of the outlets shall accept two insulated solid conductors of 22 to 24 AWG of the same size. **l)** The RJ45 jack offered shall confirm to EIA-T568A or EIA-T568B wiring schemes. **m)** The RJ45 jack technology shall be Lead – frame type to have high reliability and better frequency compensation. n) The telecommunication outlet shall meet the following electrical performance:- **i.** RJ Interface resistance : 20 m Ω **ii.** Insulation resistance 100 MΩ at 500 VDC **iii.** Contact resistance of 20 mΩ maximum (1 mΩ typical) **iv.** Current rating of 2A at 20 deg. C per IEC Publication 512-3. Test 5b. **o)** The telecommunication outlet shall meet the following mechanical performance : **i.** Insertion life of Level B reliability to IEC 603-7 **ii.** Plug/ jack contact force: 100 g minimum per contact using FCC-approved plug. **iii.** Plug retention force; 30 Ib (133 N) minimum. **iv.** Temperature range : -20 to 70 deg.C.		
1.2.6. Modular Jack connector.	TIA/ EIA- T568-A defines four basic modular jack styles. The 8-position and 8-position keyed modular jacks are commonly referred as RJ-45 (Registered Jack) connector and keyed RJ45 . The 6-position modular jack is commonly referred as RJ11. RJ45 is the standard connector for unshielded twisted pair cabling. Check that RJ 45 is a plastic connector with eight pins and it allows	Information only	

	Insertion in only one way. Check the jack wiring specification is as per the Universal Service Ordering Codes (USOC).		
1.2.7. Patch Cord.	Check that the Patch Cord I meets the following requirements: **(a)** Shall consist of 8 solid copper conductors terminated with RJ 45 plugs at both ends. **(b)** Shall meet transmission performance and comply to EIA/TIA 568-B.2 and ISO/IEC 11801 -CAT 6 minimum standard for patch cord testing (as per Annexure 3). **(c)** Factory terminated with options for 1.2 meter, upto 12.8 meters with a long flexible boot and in different colors. The boot material should be injected into the plug to retain the position of the conductors. The Boot shall be at least 2" long with built-in bend radii maintaining technology. **(d)** Shall have Characteristics impedance of 100Ω +/- 5%@ 100 MHz. **(e)** the patch cord shall have a central cross web to reduce cross talk and improve strength.		
1.2.8 Patch Panel.	Check that rack mounted patch panels should be used for termination of copper cables or rack termination unit shall be used for termination of optical fiber cable.		
1.2.8.1	Check that patch cords are provided for cross-connections to facilitate Moves, Adds and Changes (MACs). Check that they should be able to support up to Category 6 applications and shall be NEXT compliant.		
1.2.8.2	Check that the cross connect module should be **(a)** Fire -retardant , molded plastic		

	Modules UL 94 VO rate , consisting of horizontal index strips termination of Cat5 25 pair module to ensure ease of re-termination in case of wrong pair termination or **(b)** NEXT compliant RJ 45 Modular jack panel. **(c)** 10/25 pair disconnection module for incoming voice or 8/10/25 pair disconnection module for all data services.		
1.2.9 Termination Module.	Check that the termination module should be able to accommodate over 200 repeated insertions without incurring permanent deformation and it should pass the reliability test of no more than one contact failure in 1000 connections.		
1.2.9.1	Check that the termination module is of the disconnection type to minimize wiring termination and allow test cords to isolate the cabling system for testing purposes.		
1.2.9.2	Check that the wiring module should be able to accommodate 22-26 AWG cable conductors. Check that the termination module is accessible from front without any contact element exposed.		
1.2.9.3	Check that the components of the wire termination module should meet the Category 5e standards.		
1.2.9.4	Check that the termination module should be 25 pair module with IDC contact element and fully compliant to TIA/EIA 568 B.2 Category 6 requirement.		
1.2.9.5	Check that the IDC contact element should be spring special brass with 0.5 micron Nickel plating . Check that the contact range should be 5 micron silver-plated to ensure maximum reliability.		

1.2.9.6	Check that the Termination module shall have the option of mounting on wall or a 19' rack.		
1.2.9.7	Check that the Termination module shall be able to accept Category 6 jumper wire solution for Cross connect or Modular patch cords.		
1.2.10: Modular Jack Panel.	Check that Modular Jack panel should meet the following requirements: a) The panel shall be fully flexible and able to accept Category 6, Category 5e RJ45 jack, Multi media Outlets, and Fiber modules. **b)** The panel shall come empty and can be loaded as per the requirement. **c)** The panel shall come empty and can be loaded as per the requirement. **d)** The panel shall be able to accept upto 24 RJ45 jacks in a 1U space. **e)** The panel shall be mountable on a 19" rack f) The panel shall have a large front labeling space to facilitate port identification. **g)** The panel shall have a 16-gauge sheet metal construction and the module holder shall be of UL 94V-0, black, fire-retardant plastic construction.		
1.2.11: Rack Mount Fiber Termination Unit.	Check that the 19" rack mount fiber termination unit should provide cross-connect , interconnect or splicing capabilities.		
1.2.11.1	Check that the 19" rack mount fiber termination unit should consist of a frame mountable housing for terminating and / or splicing fiber optic cables and allow for organization of the fiber optic interconnects. Check the assembly should have rear slots for cable entry , with grommets fiber retainers for holding buffered fiber in place and fiber storage guide for maintaining bend radius.		

1.2.11.2	Check the 19" rack mounting unit should be either 12 or 24 ports for one rack unit (1RU) and come with a removable lid for access and can be either a fixed position unit or have a Swing able tray to improve access.		
1.2.11.3	Check that the adapter plates are pre loaded for ST (Straight Tip) , SC (Subscriber Connector) Simplex, SC duplex and LC Simplex or Duplex couplings, and the adapter plates should be installed to angled through adapters to the left or to the right of the panel , this improves the patch cord management and provides safety from possible damage to the eye from active fibers.		
1.2.12 Patch Cords.	Check that patch cords should be used for cross-connection and inter-connection of termination modules, patch panels and fiber termination unit. **a)** The patch cord shall be available in 2 and 4 pair versions with length of 1.2 through 12.8 meters. **b)** The type of patch cord shall depend on the termination module used, i.e. 8-pair termination module, patch panel or a rack mount fiber termination unit. c) The patch cord shall have built in exclusion features to prevent accidental polarity reversals and split pairs. It shall have a latching mechanism to prevent accidental dislodging of the plug for the termination module or modular jack panel (e.g RJ45) d) The patch cord shall provide air-tight connection for cross-connection for cross-connection and shall comply with proposed Cat.5E and/or Cat 6 requirement and Power SUM NEXT requirement.(ref.:Annex 3) e) Patch Cords for Moves, Adds and Changes and only hard wire		

	Jumper shall be needed for the permanent wring of the modules, thereby providing better cable management.		
1.2.13: **Fiber Patch Cord.**	Check for the Fiber Patch Panel Cord shall meet the following requirements. **a)** Shall consists of one or two single, tight buffered , multi-mode graded index fibers with a 62.5 micron or OM3 core and 125 micron cladding. **b)** The fiber patch shall be used for optical cross connects and interconnects. **c)** The fiber cladding shall be covered by aramid yarn and jacket of flame retardant PVC. **d)** The fiber patch cord shall be factory terminated with ST (Straight Tip), SC (Subscriber Connector), LC or hybrid ceramic connectors at each end. **e)** The fiber patch cord shall meet the following specifications: i. Minimum band radius 90° at min 25.4 mm. ii. Operating temperature:-42to +75°C iii. Loss : 5 db / mated connector. iv. Return loss maximum -45db. v. Cable Outer diameter: 3mm. vi. Tip material : Ceramic.		
1.3: **The UTP copper cables**	Check for the UTP copper cables meet the following requirements:- (a) Shall be CMR, LSZH, CMP, or MPR rated form. (b) Shall consists of 23-24 AWG, twisted pair copper conductor with UL approved insulator. (c) Fire retardant PVC Sheath shall have improved frictional properties, allowing it to be pulled through conduit without the use of lubricants. (d) The insulation shall be made from polyolefin for ruggedness. (e) Available in the form of 25 pairs.-		

	Min Cat5 UTP cable. (f) The UTP multi pair cable shall meet the following electrical specifications:- i. EIA/ TIA 568 A commercial wiring standard. ii. All applications as per Annexure 4. iii. Mutual capacitance (at) 1Khz: 22 nF/ 1000 feet. iv. Dc resistance (Ohms / 1000 feet : 28.6 v. Characteristics Impedance : 100 ohms + / - 15% @ 1.0 MHz (except 4Pr) vi. Electrical specification as per Annex 2.		
1.4 Optical fiber requirements :			
1.4.1	Cable must be Armoured Single Mode (OM1), Multi mode (OM1, OM2 or OM3) color coded fibers, jelly filled color coded loose tubes, around the dielectric central strength member, jelly filled, plastic tape , dielectric strength member and outer PE jacket for outdoor use and shall be tight buffered with color-coded PVC for identification for multi-core fibre optic cable (OM1 , OM2 , OM3 , and OS1) for indoor use.		
1.4.2 Fiber Specification OM1 (62.5/125 Multimode)	Check the Specifications mentioned in clause 1.4.2 of the GR.		
1.4.3 Fiber Specification OM2 (50/125 Multimode)	Check the Specifications mentioned in clause 1.4.3 of the GR.		
1.4.4 Fiber Specification OM3 (50/125 Multimode)	Check the Specifications mentioned in clause 1.4.4 of the GR.		
1.4.5 Fiber Specification OS1 (9/125 Single mode)	Check the Specifications mentioned in clause 1.4.5 of the GR.		

1.4.6 CABLE CONSTRUCTION – Outdoor Armoured Type	Check the Specifications mentioned in clause 1.4.6 of the GR.		
1.4.7 FIBER AND LOOSE BUFFER TUBE IDENTIFICATION	Check the Specifications mentioned in clause 1.4.7 of the GR.		
1.4.8 Equipment Room System	Check that 10 pair disconnect type terminal module to terminate incoming trunk cables, outgoing trunk cables to PABX and PABX Extension lines / cables should be provided. Check that each of them should have lighting over-voltage protection with arrestors, which should be in 1 pair or 10 pair form. The gas tube protector units should meet the following standards : a) DC breakdown voltage (at 100V/sec): 230 V ± 20% b) Surge Breakdown Voltage (at 100V/ microsec): 500 Volts c) Insulation Resistance : Min 10,000 MΩ d) DC Holdover Voltage: Max 135 Volts e) Capacitance (1 MHz) : Max 3.0 p F		
1.4.9 Channel performance	Check that channel performance is based on ISO 11801 Class D and E and Proposed TIA/ EIA 568-A-5 draft 12 Cat 5E channel specifications.		
2.1 SCOPE:	This document specifies the generic requirements for the structured cabling components which are to be used for LAN wiring for different applications usage in the Indian Telecom network.	Information only	
2.2	**General Requirements**		
2.2.1 Engineering Requirements :	Check that the system should meet the following engineering requirements: a) The equipment shall be fully solid		

	State and adopt state of the art technology b) The equipment shall be compact, composite construction and lightweight . The actual dimensions and weight of the equipment shall be furnished by the manufacturers. c) All connectors shall be reliable low loss and standard type so as to ensure failure free operations over long operations. The connectors and cable shall provide 20 years standards compliance warranty and 15 to 25 years. On line warranty for one year for the structured cabling system from the certified practical completion date shall be provided. D) All cables shall be of Gigabit Ethernet ready standards (EiA/TIA 568A/568B-Cat 5e/Cat 6 standards). e) Each terminal block and individual tags shall be numbered suitably with clear identification code and shall correspond to the associated wiring drawings.		
2.2.2 Operational Requirement (OE):	Check that the system should meet the following maintenance & operational requirements: a) The equipment shall be designed for continuous operation. b) The equipment shall be able to perform satisfactorily without any degradation at an altitude upto 3000 meters above mean sea level. c) The design of the equipment shall not allow plugging of a module in the wrong slot or upside down. d) Special tools required for wiring shall be provided along with the equipment. e) The Hardware and software components shall not pose any problems in the normal		

	Functioning of all network elements wherever interfacing with Indian Telecom network for voice, data and transmission systems, as the case may be.		
2.2.3 QUALITATIVE REQUIREMENTS (QR):	Check that the system should meet the following qualitative requirements: a) The supplier / manufacturer shall manufacturer with international quality standards ISO 9002 for which the manufacturer shall be duly accredited. The quality plan describing the quality assurance system followed by the manufacturer shall conform to the guidelines given by CGM QA from time to time and shall be submitted. b) The equipment locally manufactured in India shall be as per guidelines issued by Chief General Manager, Quality Assurance Wing of the BSNL vide Documents No. QM 118, QM 205, QM 206, QM 210 and QM 301. c) The equipment shall meet the environmental requirements as per category A of QM-333/Issue- 1/Sept 1990. d) All components used shall be as per approval procedures prescribed by BSNL in document QM-324. e) Marking and identification of the equipment , sub assemblies , PCBs etc. shall be as per guidelines given in para 5.1.7 Quality Assurance Telecom Document QM 351/Issue 2 / Jan.'95. f) The MTBF (Mean Time Between Failure) and MTTR (Mean Time To Restore) predicted and observed values shall be furnished along with calculations by the manufacturer.		

2.2.4 Other Requirements:	Check that wherever, the standardized documents like ITU-T, IETF, QA and TEC documents are referred, the latest issue and number with the amendments should be applicable.		
2.2.5 Electromagnetic Compatibility (EMC) Requirements:	Check that Equipment should conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report shall be furnished:- a) Conducted and radiated emissions: To comply with Class A of CISPR 22 { 2003} "Limits and methods of measurement of radio disturbance characteristics of Information Technology equipment"; b) Electrostatic discharge: To comply with IEC 61000-4-2 {2001}"Testing and measurement techniques of Electrostatic discharge immunity test" under following test levels: Contact discharge level 2 {± 4 kV}; Air discharge level 3 {± 8 kV}; c) Fast transients common mode (burst): To comply with IEC 61000-4-4 {1995 with Amendment 1 (2000) and Amendment 2 (2000)}" Testing and measurement techniques of electrical fast transients/ burst immunity test" under Level 2 {1 kV for DC power lines; 1 kV for signal control lines}; d) Immunity: IEC 61000-4-3{2002} Radiated RF Electromagnetic Field Immunity test under test level 2 (test field strength 3 v / m) for general purposes in frequency range 80 MHz to 1000 MHz and under test	Take the certificate from the accredited lab and test results are submitted by the vendors. The test results should meet with the EMC requirements test results.	

	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. e) Surges line to earth coupling and line to line coupling : To comply with IEC 61000-4-5{2001} Test & Measurement techniques for Surge immunity tests" under test levels of 0.5 kV for line to line coupling and 1kV for line to earth coupling ; f) Radio frequency common Mode: To comply with IEC 61000-4-6 {2001}"Immunity to conducted disturbances, induced by radio frequency fields" under the test level 2 {3 V r.m.s.} clamp injection method for DC lines and Signal Control lines. Note (ii): For tests for checking compliance to above EMC requirements, the methods of measurements shall be in accordance with TEC standard No. SD/EMI-02/02 Sep 2001 and the references mentioned therein. Alternatively, corresponding relative 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 (f) and TEC standard No. SD/EMI-02/02 Sep 2001. The details of IEC/CISPR and corresponding Euro Norms are as follows: IEC/CISPR — Euro Norm CISPR22 — EN55022 IEC61000-4-2 — EN61000-4-2 IEC61000-4-3 — EN61000-4-3 IEC61000-4-4 — EN61000-4-4 IEC61000-4-5 — EN61000-4-5 IEC61000-4-6 — EN61000-4-6		

2.2.6	**Safety Requirements:**		
2.2.6.1	The operating personnel shall be protected against shock hazards as per IS 8473 (1993) – Guide on the effects of current passing through the human body equivalent to IEC publications 479-1 (1984). The manufacturer/supplier shall submit a certificate in respect of compliance to these requirement.	Take the certificate from the accredited lab and test results are submitted by the vendors. The test results should meet with the safety requirements test results.	
2.2.6.2	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 equipment" {for Radio equipment only}. The manufacturer/supplier shall submit a certificate in respect of compliance to this requirement.	Take the certificate from the accredited lab and test results are submitted by the vendors. The test results should meet with the safety requirements test results.	
2.2.7: DOCUMENTATION.	Check that all technical documents should be in English language both in CD-ROM and in hard copy.		
2.2.7.1	Check that the documents should Comprise of: 1. System description documents 2. Installation, Operation and Maintenance documents 3. Training documents 4. Repair manual		
2.2.7.2 System description documents.	Check that the following system description documents should be supplied along with the system. a) Cabling and wiring diagrams. b) Adjustment procedures, if there are any field adjustable units. c) Spare parts catalogue – including information on individual component values, tolerances, etc. enabling procurement from alternative sources.		

2.2.7.3 Operational documents.	Check that the following Operational document shall be made available. a) Installation manuals and testing procedures. b) Precautions for installation. operations and maintenance. c) Safety measures to be observed in handling the equipment. d) Fault location and trouble shooting instructions including fault dictionary. e) Test jigs and fixtures required and procedures for routine maintenance, preventive maintenance and unit / card / sub-assembly replacement. f) Emergency action procedures		
2.2.7.4 Repair Manual:	Check for the following a) List of replaceable parts used b) Detailed ordering information for all the replaceable parts. c) Procedure for trouble shooting and sub-assembly replacement d) Test fixtures and accessories for repair e) Systematic trouble shooting charts (fault tree) for all the probable faults with their remedial actions		
2.2.8: INSTALLATION	Check for the following. a) All necessary interfaces, connectors, connecting cables and accessories required for satisfactory installation and convenient operations shall be supplied. Type of connectors, adopters to be used shall be in conformity with the interfaces defined in this GR. b) It shall be ensured that all testers, tools and support required for carrying out the stage by stage testing of the equipment before final commissioning of the network shall be supplied along with the equipment. c) All installation materials, consumables and spare parts to be supplied.		

	d) All literature and instructions required for installation of the equipment testing and bringing it to service shall be made available in English language. e) All cable labels shall be machine typed labeled at each end 100 mm from the termination point. f) The cabling system shall be planned and the routing shall be selected to ensure system integrity and performance, and it shall not present problems to maintenance access. g) All cables trays, catenaries and ductworks required to complete the installation shall be supplied. h) All necessary penetrations and access between floors and sealing of the same after installation shall be carried out by the supplier. Support of all cabling within the false space or under raised flooring by steel cable tray, trunking and /or duct, catenary wires, fixed by approved hanger and methods shall be done. i) Cables shall be neatly bundled into a neat group (50 cables per bundle). j) Maintain at all times a minimum of 150 mm spacing from parallel runs of electrical cabling and 300 mm from fluorescent lights. All telecommunication cables shall cross electrical cables at right angles. k) Shall support adequately all the cabling that is vertically installed. l) Shall provide and use screwed moulded plastic bushes to protect cable, with the use of locknuts inside the trunking or tray work to ensure bush remaining securely in place.		

	m) Shall ensure that the tray shall be thoroughly cleaned of an any extraneous material, such as cable scraps, dust, dirt and construction debris after the installation is completed. n) Shall provide proper protective earthing for all the cable trays and catenary wires. o) Shall ensure that the cables are secured with plastic or Velcro cable ties on cable trays and / or catenaries. p) Shall not have free protrusion of sharp edges where cabling is done in free spaces. q) Shall have cables installed using a bending radius not less than eight (8) times the overall diameter of the cable. The hauling tension shall not exceed 11.3 Kg. r) Any Single pull shall be restricted to not more than two (2) 90 degrees bends, in conduit and ducts. <u>End of Document</u>		