

Structured Cabling System

Invitation To Tender

Prepared for Cat.6 10G - F¹/UTP systems

Vendor / Contractor identification :

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1. Table of Contents

1.	Table of Contents	2
2.	Standards & Regulations	3
3.	Horizontal Cabling	4
3.1.	Horizontal distribution cable	4
3.2.	Telecom Outlets (TO)	5
3.3.	Copper Patch Panels (RJ45)	6
3.4.	Patch Cords	7
3.5.	Class E 10G Channel	7
4.	Backbone Cabling	8
4.1.	Voice Backbone	8
4.2.	Data Backbone	8
5.	Cabinet	12
6.	Testing	13
6.1.	Testing of Class E 10G Channel	13
6.2.	Vertical Copper testing	14
6.3.	Vertical Fibre testing	14
7.	Procedures	15
7.1.	Installation Guide	15
7.2.	Fire Protection	15
7.3.	Earthing	15
8.	Management of the Project	15
8.1.	Design of the Project	15
8.2.	Project Management	15
9.	Warranty	16
10.	Documentation	16
10.1.	Response inclusions to the bid price	16
10.2.	During the Presentation of the Offer	16
10.3.	Kick-off of the Project	16
10.4.	On completion of the installation	16

2. Standards & Regulations

This Invitation To Tender (ITT) provides a description for a generic structured cabling system based on the **ISO/IEC 11801: 2002** and IEEE802.3an standard specifying the 10 GBASE-T Ethernet application. The cabling system is to be tested against TIA TSB-155 Channel limits or ISO/IEC TR 24750 Channel limits. The object of the this ITT is to define the structured cabling independently of the applications, which it is capable of supporting.

This Tender document covers the design, supply, installation, testing and commissioning of a Category 6 10G cabling system.

The aim of this ITT is to describe a **Category 6 10G** universal cabling system which will function for voice, data and LAN communications, for video applications etc.

The cabling system is also open to new applications which require a Class E / Cat 6 cabling system as defined in the latest edition of the standard: **ISO/IEC 11801: 2002** and to all additional requirements of IEEE802.3an and TIA TSB-155 and ISO/IEC TR 24750 to support the 10Gbase-T application over 100 meters channel.

Furthermore, to allow for future demands, the cabling system must be easy to expand and maintain.

The terminology and references in this document as well as the Channel Performance figures for Class E 10G are based on **ISO/IEC 11801: 2002** and all additional requirements of IEEE802.3an

The data sheet showing the guaranteed values for the material proposed will be attached by the vendor to his tender documents.

All proposed components including the patch cords have to be produced by the same manufacturer. This issue will ensure that a « **Class E 10G Channel Warranty** » can be obtained from the manufacturer.

When using the best grade of Cat.6 10G patch cords available from the cabling system manufacturer, the channel requirement for 10GBASE-T as in IEEE802.3an shall be achieved over the full 100 meters channel.

3. Horizontal Cabling

3.1. Horizontal distribution cable

The horizontal 4 pair cable shall be **Category 6 10G F¹/UTP** to meet the quality and performance criteria necessary to ensure correct operation of the installation for frequencies to 500 MHz and to ensure the compliance with the warranty.

The installation design and routing of all cables shall take account of the manufacturer limits for the continued performance of the cables and the compliance with the warranty.

The cable shall be a 4 twisted pair cable with AWG 23 conductors. Having an external sheathing in a material that does not give off toxic fumes (Zero Halogen) in case of fire and offer flame propagation retardant properties. Trace ability numbers should accompany the cable supplied from the manufacturers packaging to assist in quality validation of the installed cable.

In order to provide alien cross-talk (AXT) immunity for 10 GBASE-T Ethernet transmission, the use of screened cable is mandatory.

Test data shall be provided by the manufacturer to show compliance to IEEE802.3an or TIA TSB-155 or ISO/IEC TR 24750 channel headroom requirements for both Alien NEXT (A-NEXT) and Alien FEXT (A-FEXT) parameters.

In the construction of the cable cross-talk performance shall be maintained using a **C³ (Central dielectric Cross-talk Cancellation)** member set between the 4 pairs.

All pairs must have impedance of 100 Ohms, with a tolerance of +/- 15 Ohms.

The cable shall contain **1 foil screen**. The foil shall have the metallic side facing outwards, allowing the cable to be automatically grounded during the termination process without having to fold back the foil. This will ensure instant 360° grounding contact for optimal and reliable EMC performance and AXT immunity.

A tinned copper drain wire, shall be sandwiched between the screen and the external sheathing.

3.2. Telecom Outlets (TO)

The RJ45 connector shall be screened to ensure protection against EMI and for Alien cross-talk compliance. It is fully compliant to the **IEC 60603-7-5** category 6 standard, and moreover offers the 500 MHz performance

required to be used to form a 100 meters **Class E 10G channel** as specified in the IEEE802.3an

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Each connector shall provide both T568A and T568B colour code identification for the pins at the rear of the connector. The punch down is to be in accordance with the T568B colour code. Reassignment of pairs is forbidden.

All conductors from the 4 pair cable are to be terminated on the respective contacts.

To avoid installation errors, the wire organiser of the snap-in connector must be identified by the same standard colour coding as the wires.

All Category 6 10G RJ45 connectors shall be fully compliant with the **ISO/IEC 11801:2002** standard and shall provide the performances required to form a 10G base-T channel as per relevant standardisation documents.

All Category 6 10G RJ45 connectors shall be reusable.

When the Category 6 10G RJ45 connectors are to be reused, this shall be done in a safe and reliable way.

For this reason, a tool specially developed by the manufacturer shall be used.

In the case of a 3 or 4 connector Channel with CP, a specific version of connector having IDC contact suitable to receive stranded cable shall be used.

All outlets are fitted with removal shutters, which can be replaced by colour-coded shutters (red, green, blue, yellow) available from the manufacturer standard product range.

The presentation of the outlet shall provide for labelling and identification. A transparent window shall protect the labelling tag.

The screen continuity will be maintained all along the link.

3.2.1. Snap-in Format

The dimensions of the screened Snap-in format connectors are 23.2 mm x 16.8 mm x 36 mm (H x W x D)

The full metal rear shielding provided by default shall be used on the screened format connector to maximize screen connectivity and to ensure protection against EMI.

The same format connectors (screened) shall be used on each link.

The connector fits in specific structural hardware for Snap-in format of third parties. If not available, the Snap-in connector can be used in combination with a keystone clip and specific structural hardware for keystone connectors.

3.3. Copper Patch Panels (RJ45)

Patch panels must have 19" equipment practice dimensions to permit mounting in standard cabinets, racks or bays.

The vendor shall make their proposals for this tender using 24 port Snap-in format (Modular) patch panels equipped with a cable management mechanism that provides strain relief, earthing and grounding features.

The presentation of the Patch Panel with sliding mechanism shall provide for labelling using a printed numbering system.

If baluns, circuit cross over or impedance matchers are used, these shall be external to the Patch Panel.

The connector shall provide both T568A and T568B colour code identification for the pins at the rear of the connector. The punch down is to be in accordance with the T568B colour code. Reassignment of pairs is forbidden.

All conductors from the 4 pair cable are to be terminated on the respective contacts.

The screened connectors from the modular Patch Panel shall provide termination facilities for the drain wire of each Category 6 10G F¹/UTP cable.

To avoid installation errors, IDC blocks must be identified by the same standard colour coding as the wires.

Each Patch Panel shall provide a means to locate and clamp the incoming cables without causing damage to the cable or affecting the performance of the Link.

The installer must avoid any risk of cable pinching or compression during the installation or termination of the cables. Therefore the use of Velcro cable ties is preferred.

In the rack, the Patch Panels shall be separated by metallic patch-guides that have a closed front to protect the patch cords. The height of these guides will be 1U or 2U depending on the layout of the rack.

The metal frame of the Patch Panel must not be earthed to the cabinet with a separate earth strap if the Patch Panels automatically makes contact with the metal frame of the Cabinets. If the cabinet is not designed to provide the panels with an automatic contact with the earth, then the patch panels must be connected with a separate earth strap to the Earth Key.

3.3.1. 24 Port Modular Patch Panels

Those Modular Patch Panels shall have a standard Snap-in format for insertion of fully screened connectors equipped with a rear shielding in order to ensure full EMI protection and grounding.

The Modular Patch Panel shall provide an integrated Clip-on cable fastener for retention of the incoming horizontal cable.

Shutters also have to be integrated to the Panel to protect the RJ45 Ports.

The Modular patch panel shall be available with and without sliding mechanism.

The Patch Panel without sliding mechanism (Fixed) shall have an optional remote hanger set to facilitate front punch down. The fixed Modular Patch Panels shall be mounted in the cabinet after installation of the Snap-in connectors.

The Patch Panel with sliding mechanism has to be mounted in the cabinet before termination of the cables.

The installer shall locate the cables in the cabinet with enough slack to enable the termination of the connectors to be completed from the front of the cabinet.

The dimensions of the patch panel shall be 19" 1 U high, depth 125 or 85 mm (With or without sliding mechanism).

The patch panel shall provide support for 24 x fully screened Snap-in connectors.

3.4. Patch Cords

To achieve a **Class E 10G Channel performance** all Patch Cords will be Category 6 10G rated. All patch cord cable will be made from LSZH material.

3.4.1. Data Patch Cords

All Data patch cords will be full screened. The standard colour offered shall be orange for LSZH jacket.

The Category 6 10G cords must be fitted with the RJ45 plugs, booted at each connector. The characteristic impedance of the pairs must be identical to that of the horizontal cables.

The Patch Cords shall have a guaranteed performance level of greater than 750 insertions without degradation to the performance level of the solution.

The cable used for the Patch Cords shall be Category 6 10G LSZH screened patch cable.

The cable shall be a 4 twisted pair cable with stranded conductors.

This very high performance cable shall have an individual screen construction to provide outstanding Alien cross-talk and EMC performance up to 500 MHz.

All four pairs shall be individually screened with an aluminium foil.

Trace ability numbers should accompany the cables supplied from the manufacturers packaging to assist in quality validation of the installed cable.

All pairs must have an impedance of 100 Ohms.

3.4.2. Voice Patch Cords

The RJ45-RJ45 Patch cords used in the Cabinets for Voice applications will consist of a 4 twisted pair cable with stranded conductors.

The Patch cords RJ45 - RJ11, used in the work area (work area cords), will consist of a 2 twisted pair cable with stranded conductors.

When using 10 pair IDC module to terminate the multipair voice backbone, IDC-RJ45 cords have to be used to link the RJ45 ports from the horizontal distribution patch panels to the IDC patch panels.

Depending on the quantity of pairs needed different type of cords must be available:

- 1 RJ45 to 1 IDC (1 pair)
- 1 RJ45 to 2 IDC (2 pairs)

For all the voice cords the jacket shall be grey and all pairs must have an impedance of 100 Ohms.

3.5. Class E 10G Channel

Manufacturer should demonstrate guaranteed minimum worst-case performance to be compliant with class E 10G channel performance according to the IEEE802.3an or TIA TSB-155 Channel limits or ISO/IEC TR 24750 Channel limits.

The performance of both the components and channel should show stable performance up to 500MHz in order to allow for 10Gbit ETHERNET as per the above mentioned standardisation documents.

The system supplier must be able to demonstrate in house design and manufacturing expertise for all components used (e.g. cables, outlets, panels and cords) in order to ensure compatibility of system elements.

4. Backbone Cabling

4.1. Voice Backbone

This backbone will link the Floor Distributors to the Voice Main Distribution Frame.

4.1.1. Multi-Pair Voice Cables

To meet the Standard cabling practices outdoor grade Telephone Multi-pair cable may be used to connect the Inter-building distributors. This cable should also contain a separate earth conductor in addition to the required pair content. The number of pairs in the backbone cable for each voice circuit will be dependent on the type of PABX the client is using. As a guide a minimum of one pair per circuit should be used however a maximum of three pairs per voice circuit may be required, this will need to be clarified with the client prior to commencement of the project.

For indoor risers or backbones Category 3 or 5 Multi-pair cable (25, 50 or 100 pairs / impedance: 100 Ohms / 24 AWG solid copper wire) will be used to connect the Intra-building distributors. The number of pairs in the backbone cable for each voice circuit will be dependent on the type of PABX the client is using.

4.1.2. Voice Patch Panel

The Telephone multi-pair cable arriving from the Main Distribution Frame (MDF) will be terminated in the Floor Distributor. Several solutions can be used.

Termination is possible

- On 3HU IDC Patch Panels filled up with IDC Connection Modules for 10 pairs.
- On a 1HU / 50 RJ45 cat.3 voice patch panel using two pairs per RJ45 (Pins 4,5 and 3,6 connected)
- On a 1HU / 24 RJ45 cat.5e voice patch panel integrating a specific retention part adapted to multi-pair cables

4.2. Data Backbone

This backbone will link the Switches located in the Floor Distributors (FD) to the Data network server through the Building Distributor (BD).

4.2.1. Optical Fibre cable

The manufacturer shall provide the choice between the 7 different types of fibres described below. Enhanced OM1, OM2 & OM3 fibres providing warranted extended distance for the transmission of high rate data signals shall be available to avoid limitations due to bottlenecks in the longest building and campus backbone links. The choice of fibre will be made according to the present and future bandwidth needs for the longest OF backbone links.

If the 10Gbit Ethernet application has to be supported, the OM3 or OM3 enhanced fibres shall be used to ensure the transmission of the signal over 300 (or 450 m) metres at 850nm.

Due to their limited bandwidth, the use of OM1 optical fibres to form the backbones for Class E cabling systems is not recommended.

Technical Data – Fibre Transmission

Fibre type	OM1	OM1 Enhanced	OM2 (G651)	OM2 Enhanced	OM3	OM3 Enhanced	SM (G652)
Attenuation	@ 850 nm (dB/km)						@1310 nm
Typical	≤ 3.0	≤ 3.0	≤ 2.6	≤ 2.6	≤ 2.6	≤ 2.6	≤ 0.35
Max.	≤ 3.5	≤ 3.5	≤ 3.2	≤ 3.2	≤ 3.2	≤ 3.2	≤ 0.42
Attenuation	@ 1300 nm (dB/km)						@1550 nm
Typical	≤ 0.8	≤ 0.8	≤ 0.8	≤ 0.8	≤ 0.8	≤ 0.8	≤ 0.22
Max.	≤ 1.5	≤ 1.5	≤ 1.3	≤ 1.3	≤ 1.3	≤ 1.3	≤ 0.28
Application	Transmission max. distance @ 850 nm						
Fast Ethernet	300 m	300 m	300 m	300 m	300 m	300 m	-
1 Gigabit Ethernet	275 m	600 m	550 m	800 m	800 m	1100 m	-
10 Gigabit Ethernet	33 m	50 m	82 m	125 m	300 m	450 m	-
Fibre Channel 1Gbps	300 m	500 m	500 m	750 m	900 m	1.000 m	-
Fibre Channel 2Gbps	160 m	200 m	200 m	400 m	500 m	600 m	-
Fibre Channel 4Gbps	80 m	100 m	100 m	210 m	300 m	330 m	-
Application	Transmission max. distance @ 1300 nm						
Fast Ethernet	2.000 m	2.000 m	2.000 m	2.000 m	2.000 m	2.000 m	2.000 m
Gigabit Ethernet	550 m	1.000 m	550 m	2.000 m	550 m	550 m	10.000 m
10 Gigabit Ethernet	-	-	-	-	-	-	10.000 m

4.2.2. Tight Buffered Indoor and light duty Outdoor waterproof OF cable

This optical fibre cable shall be used for indoor home run back to patch panel routes in risers, horizontal applications and for outdoor duct applications where there is permanent water present i.e. flooded duct. This cable shall be selected where the required fibre count is from 2 to 24.

The cable shall be suitable for connector manufacturer field termination processes (SC or LC connectors) and for OF pigtails splicing.

The cable shall be a dry construction i.e. with no gel content. The jacket material shall be waterproof LSZH with a minimum fire performance of IEC 332 part 3C.

Every fibre shall be 900µm diameter secondary coated each being a different colour or suitably identified for termination identification.

The cable strength member shall be glass yarn laid longitudinally between the fibres and the inside wall of the outer jacket. The cable shall be dielectric construction, i.e. with no metallic content.

Applications support

FDDI	100 Mbps
Ethernet	10 base FL 100 base FX 1000 base SX 1000 base LX
Fibre Channel	266 Mbps 1000 Mbps
ATM	155 Mbps 622 Mbps

4.2.3 Optical Fibre Telecom Outlets

The dimension of the Optical Fibre Telecom Outlet are 125 mm x 74 mm x 34 mm (H x W x D)
Standard LC, SC, DSC and MT-RJ snap-ins couplers shall be available to load the OF Telecom Outlet.
Direct Termination of the connectors (SC & LC) on to the fibres as well as splicing of pigtails (SC, LC & MT-RJ) shall be possible.
The front plate of the OF Telecom Outlet shall be compatible with the following connector types: SC, LC and MT-RJ.
The fully loaded Outlet shall support up to 2 fibres when working with SC snap-in couplers and up to 4 fibres when working with LC or MT-RJ snap-ins couplers.
The OF Telecom Outlet shall provide management for 50 cm of fibre per link after breaking the fibres out from the cable. The OF Telecom Outlet shall accommodate the aluminium splice protections as well as the heat-shrink ones.
In the OF Outlet, the fibres have to be wired in such a way that the dual OF channel polarity is maintained. Wiring of the fibres has to be done according to the guidelines provided by the manufacturer.
All Outlets are fitted with removal shutters, which can be replaced by colour shutters (red, green, blue, yellow) available from the manufacturer standard product range.
The presentation of the outlet shall provide for labelling and identification. A transparent window shall protect the labelling tag.

4.2.4 Optical Fibre Patch Panel

Optical fibre Patch Panels shall be mounted in 19" frames of the cabinets. The patch panels shall be equipped with a mechanism that ensures the retention and support of incoming cables. The patch panel shall be designed with a sliding mechanism enabling front side installation and maintenance work to be carried out without having to remove the entire panel.

The patch panel shall provide facilities to recess the front connector plate deeper than the front of the 19" rails of the cabinet. This will provide sufficient bend radius for the patch cords once connected to the panel. This shall also prevent damage to the patch cords when the cabinet doors are closed.

Direct Termination of the connectors (SC & LC) on to the fibres as well as splicing of pigtails (SC, LC & MT-RJ) shall be possible.
The Patch Panel shall provide management for 1m of fibre per link after breaking the fibres out from the cable.

The front plate of the 24 port modular Patch Panel shall be compatible with the following connector types: SC, LC and MT-RJ.

Standard LC, SC, DSC and MT-RJ snap-ins couplers shall be available to load the modular patch panel. The fully loaded panel (One height unit or 1HU) shall support up to 24 fibres when working with SC snap-in couplers and up to 48 fibres when working with LC or MT-RJ snap-ins couplers.

Up to four optional splice trays should be supported to manage up to 48 splices.

In the panels, the fibres have to be wired in such a way that the dual OF channel polarity is maintained. Wiring of the fibres has to be done according to the guidelines provided by the manufacturer.

4.2.5 Optical Fibre Patch Cords

The Fibre snap-ins adapters will be connected to the active equipment by means of "Cross-over" duplex patch cords. In order to maintain the duplex OF channel polarity.

The patch cords should be available in lengths of 2 and 5 meters and have a LSHF-FR outer sheath.

When using OM3 optical fibre cables, patch cords produced with the same OM3 fibre have to be installed.

- a) Multimode connector performances
 - Maximum insertion loss at 850nm (IEC 61300-3-4): 0.5dB (ST, LC & SC)
0.75dB (MT-RJ)
 - Minimum return loss (IEC 61300-3-6): 40dB
 - Durability (IEC 61300-2-2): < 0.2dB
- b) Single mode connector performances
 - Maximum insertion loss at 1300nm (IEC 61300-3-4) 0.5dB (ST, LC & SC)
 - Minimum return loss (IEC 61300-3-6) 50dB
 - Durability (IEC 61300-2-2) < 0.2dB
- c) Compliance
 - ST connector compliant with IEC61754-02 specifications
 - SC connector compliant with IEC61754-04 specifications
 - LC connector compliant with IEC61754-20 specifications
 - MT-RJ connector compliant with IEC61754-18 specifications

5. Cabinet

The metal cabinets shall have a footprint of 800x800 mm. In the frames 19" components can be mounted by means of the standard cage nuts. The front door consists of a metal framework with hinges and a central security glass. Front and rear doors shall be equipped with a lock system. The side panels have to be equipped with a hinge on the left or the right side in order to facilitate the access to the equipment. A 42 HU cabinet is preferred providing enough space for active equipment.

The front and rear 19" frames shall not be painted as the frames will be used to earth the network. Both frames can be installed in three different positions to increase the free space between the doors and the equipment front plates when necessary.

For an orderly cord storage and easy to manage installation, the following accessories have to be used:

- Closed 1 or 2 HU patch guides between the patch panels;

- Lateral cable rings installed at both sides of the frames. The patch rings can be removed very easily by rotation and have to be located on the front rails of the 19" frames in the cabinets.

The Submitter of the Tender also has to include prices for power bars and signal grounding keys. Enough space for the cabinets has to be foreseen by the owner or his representative. He also has to foresee a room that is big enough and equipped with air conditioning to avoid overheating.

The cabinets shall be able to host all standard types of active and passive equipment and provide facilities for extension to form a suite of cabinets with no modification to the structure.

Each cabinet shall be supplied in 6 separate boxes or ready assembled depending on the site access provisions.

Optionally, the cabinets can be supplied with:

- A power bar with six 240VAC electrical sockets and a mains isolator switch

- Up to 8 fans (240VAC) for expelling air, approximately 220W each

Other Items Required

Each Panel will be connected to the cabinet chassis and the cabinet connected to the earth by green-yellow conductor.

The metal frame of the Patch Panel must not be earthed to the cabinet with a separate earth strap if the Patch Panels automatically makes contact with the metal frame of the Cabinets. The use of this type of cabinet will be preferred.

If the cabinet is not designed to provide the panels with an automatic contact with the earth, then the patch panels must be connected with separate earth straps to the Earth Key.

Earthing has to be achieved by means of the 19" frame attachments, thus ensuring continuity. The cabinet and frame assembly when installed will also serve as equipotential plane so that damaging external EMI currents can be drained off. To this end, the inter-cabinet connections shall also be made off by extending the earth connection from cabinet to cabinet in a suite of cabinets. The suite of cabinets shall be connected to the grounding network of the building.

The Earth key of the cabinet must be connected to the protective earth. The dimension of the earth conductor is 6mm².

If no or only a poor protective earth system is present in the building, a separate earthing to the main earth terminal of the building is required. The dimensions of the conductor should then be 16mm².

6. Testing

The manufacturer of the cabling system shall provide copper (Data) and optical fibre testing procedures that clearly describes the tools and settings to be used to ensure correct measurements of the system.

6.1. Testing of Class E 10G Channel

100 % of the installed horizontal links have to be tested. The testing procedure has to comply with the IEEE802.3an for Class E 10G, according to the procedure for "Channel".

The cabling system is to be tested against TIA TSB-155 Channel limits or ISO/IEC TR 24750 Channel limits. The measurements shall be done using Level IV testing equipment. Channel testing is mandatory. The testing equipment must be yearly calibrated by the manufacturer and the copy of the calibration certificate must be included in the warranty request.

The following parameters have to be tested:

- ✓ Pair continuity (wiremap)
- ✓ Pair length
- ✓ DC Loop resistance per pair
- ✓ Insertion loss (Attenuation) per pair
- ✓ Next and Powersum Next for every pair combination
- ✓ Fext and Powersum Fext for every pair combination
- ✓ Return Loss (impedance match, retransmitted signal)

The complete test results of all the installed links or channels have to be collected in a certification file. It is preferred to have the test result in electronic format to facilitate the certification procedure.

Apart from all the test results mentioned above, a few more documents have to be added to the file: a list of material used for the project, a design of the network, a Cable schedule per distributor and finally all the necessary co-ordinates of the persons responsible of the project.

Class E Channel : Specific values for channels guaranteed as in **TIA TSB-155 or ISO/IEC TR24750**.

Chan nel	Attn (dB)	NEXT (dB)	PSNEXT (dB)	ELFEXT (dB)	PS ELFEXT (dB)	PS ANEXT (dB)	PS AELFEX T (dB)	RL (dB)	Prop Delay (ns)
1	2,1	65,0	62,0	63,3	60,3	80,0	73,7	19,0	0,580
4	4,0	63,0	60,5	51,2	48,2	76,0	61,7	19,0	0,562
10	6,3	56,6	54,0	43,3	40,3	72,0	53,7	19,0	0,555
16	8,0	53,2	50,6	39,2	36,2	70,0	49,6	18,0	0,553
20	9,0	51,6	49,0	37,2	34,2	69,0	47,7	17,5	0,552
31,25	11,4	48,4	45,7	33,4	30,4	67,1	43,8	16,5	0,550
62,5	16,5	43,4	40,6	27,3	24,3	64,0	37,8	14,0	0,549
100	21,3	39,9	37,1	23,3	20,3	62,0	33,7	12,0	0,548
200	31,5	34,8	31,9	17,2	14,2	57,5	27,7	9,0	0,547
250	35,9	33,1	30,2	15,3	12,3	56,0	25,7	8,0	0,546
300	39,8	31,7	28,8	13,7	10,7	54,8	34,2	7,2	0,546
400	46,9	26,8	24,5	11,2	8,2	53,0	21,7	6,0	0,546
500	53,4	22,0	20,4	9,3	6,3	51,5	19,7	6,0	0,546

6.2. Vertical Copper testing

Multi-pair copper backbone cable will be continuity tested only with the results presented in spreadsheet format.

6.3. Vertical Fibre testing

The procedure shall comply with the ISO/IEC 14763-3 standard.

The ISO/IEC 14763 standard specifies the implementation and operation of customer premises cabling.

The part 3 of this ISO document (14763-3) details test procedures for optical fibre cabling designed in accordance with ISO/IEC 11801:2002 and installed according to the recommendations of ISO/IEC 14763-2 (Planning and installation of customer premises cabling).

For Multimode fibres, the test procedure is based on the use of the "one-jumper method" specified by Method 2 of IEC 61280-4-1. This procedure is used for testing links for which the connector loss is a significant portion of the total link attenuation. This is the case for LAN premises links.

For singlemode fibres, the test procedure to be applied is the same and is based on the use of the "one-jumper method" specified by Method 1a of IEC 61280-4-2.

Fibre-optic Tests applied to links and exclude equipment and work area cord.

OF Attenuation testing is used to verify the initial performance of the installed link.

All 100 % of the installed OF links have to be tested and must pass the acceptance criteria.

The attenuation of the link is measured using the insertion loss method. This method uses an optical source and an optical power meter to compare the difference between two optical power levels.

When testing multimode optical fibre links with a Light Source and a Power Meter, this measurement kit has to be capable of operating at

- ✓ 850nm and 1300nm for multimode fibres (OM1, OM2 & OM3)
- ✓ 1310nm and 1550nm for singlemode fibres (OS1)

The test scenario with a Light Source and a Power Meter shall be one of the following for each link:

- Single direction @ 850nm and @ 1300nm for multimode fibres
- Single direction @ 1310nm and @ 1550nm for singlemode fibres

The use of certification tool is recommended. Those tools are capable of producing a report logging the time of the test the link identification under test, the link length, the attenuation at the window tested and the acceptable link attenuation. The report shall also identify in which direction the testing was implemented.

when testing with basic optical source and power meter, the operator will fill up a report logging

- ✓ the time of the test,
- ✓ the link identification under test,
- ✓ the link length and attenuation at the window tested.
- ✓ The report shall also identify in which direction the testing was implemented.
- ✓ Acceptable link attenuation (To be calculated)

The measured attenuation of the links shall have a lower value than the acceptable link attenuation calculated.

7. Procedures

7.1. Installation Guide

All the components have to be installed according to the procedures prescribed by the supplier. During the whole period of installation, the installer has to put an Installation Guide at the disposal of the client, so that he can verify the compliance of the installation to the guidelines of the supplier.

7.2. Fire Protection

The installer has to closely follow the local regulations concerning fire protection. The integrity of the firebreak has to be maintained or restored.

7.3. Earthing

For the earthing of all the proposed products, the installer has to closely follow the related recommendations of the supplier, in accordance with local regulations. The earthing procedure that has to be followed shall be put at the disposal by the supplier under an official document.

8. Management of the Project

8.1. Design of the Project

The vendor will first make a site survey. This will allow him to propose a complete turnkey solution without any additional costs for unforeseen labour. If possible, the installer will try to use the existing infrastructure as much as possible. If cable supports or cable trays are lacking, then the vendor will have to evaluate the necessary quantities and price and take up a detailed description in his offer.

To ensure the transparency of the installation and the maintenance of the structured cabling, the vendor has to develop a numbering and labelling scheme in agreement with the owner or his representative in order to identify all the components without ambiguity. After the temporary reception of the project, all the cabinets' layouts and the drawings of the building will be completed referring to this numbering scheme.

8.2. Project Management

For the complete duration of the project the vendor will appoint a Project Manager, who will work on his behalf. He will be the single point of contact to ensure a smooth co-ordination.

For project with an estimated duration over 2 weeks, the vendor will appoint a Site Manager, who will be permanently present on site on behalf of the vendor. The Site Manager will report to the Project Manager, in order to ensure that the correct information is communicated from the commencement of the project until the hand-over of the network to the client

9. Warranty

The manufacturer must guarantee to the End User that the products referenced within the specific Warranty Modules (Class E 10G System) when correctly installed in accordance with installation guidelines:

- Will be free from product defects in materials and workmanship
- Are guaranteed to exceed the following performance criteria:
 - IEEE 802.3an, TIA TSB-155 and ISO/IEC TR 24750
 - Class E Permanent Link and Channel component requirements as specified in ISO/IEC 11801:2002
- Supports the following application (not limited):
 - 10baseT Ethernet
 - 100baseTX Fast Ethernet
 - 1000baseTX Gigabit Ethernet
 - 10G base-T Ethernet IEEE 802.3an
 - 155Mbit ATM
 - 1200Mbit ATM
- For a duration of 25 years
- Provide a guaranteed headroom
 - of at least 10 dB on A-NEXT
 - of at least 15 dB on A-ELFEXT

All components including the Cat 6 10G patch cords have to be produced by the same cabling system manufacturer to ensure warranted performances and applications against the standards.

10. Documentation

10.1. Response inclusions to the bid price

- Datasheets of the proposed components
- Table with the guaranteed values for the proposed twisted pair cables
- Detailed warranty conditions
- Certificate of Approved/Certified Installer granted by the supplier
- Schedule of execution with the expected start and end dates
- Summarized plan of the backbone philosophy + cabinets layouts that have to be submitted to the customer for approval.

10.2. During the Presentation of the Offer

- Presentation of the proposed products
- Technical justification of the backbone concept

10.3. Kick-off of the Project

- Installation guide of the supplier
- Schedule of execution in agreement with the customer

10.4. On completion of the installation

- Certification file
- "Class E and 10G Channel Warranty" delivered by the supplier
- Plans "as built"