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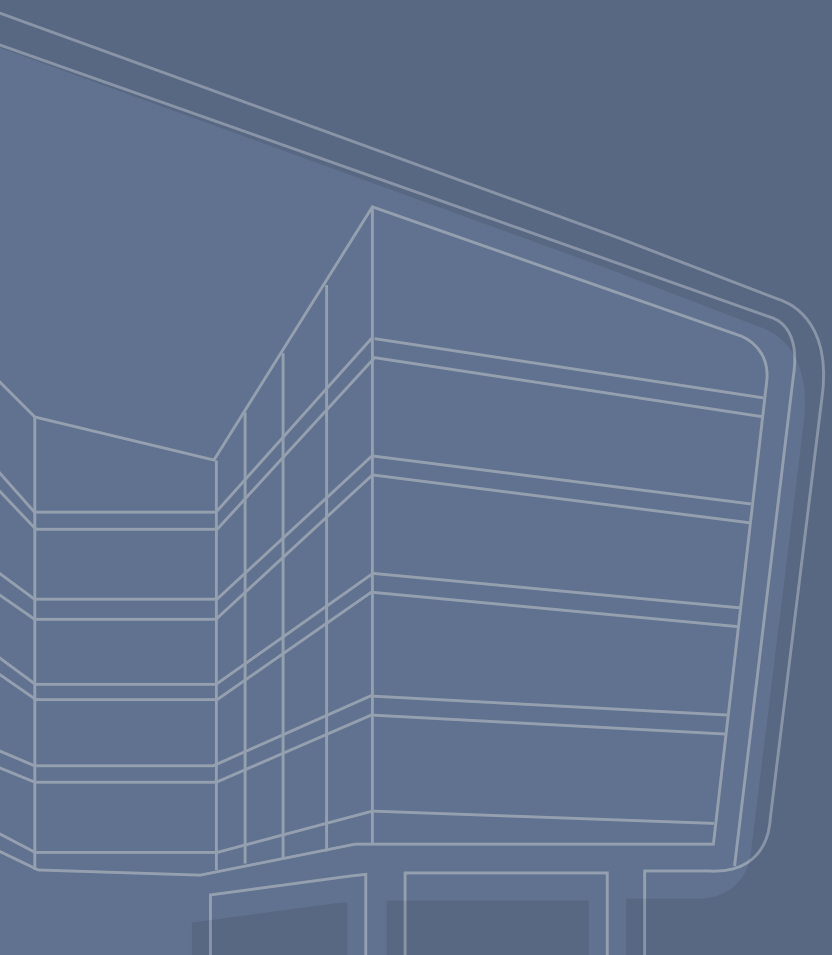
TELECOMMUNICATIONS AND DIGITAL GOVERNMENT REGULATORY AUTHORITY

United Arab Emirates

Buildings - Telecommunications

Network Specification Manual

Guidelines for FTTx in new Buildings
V3.0Released 2024



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Revision Table

Edition	Date	Revision Description	Notes
1.0	29.03.2017	First Version issued for market consultation .	
1.1	03.05.2017	Released after market consultation.	
2.0	11.3.2019	Administrative changes and addition specification for labor accommodation and smart home systems.	
3.0	04.10.2023	Administrative changes in all the sections and addition specification related to Smart cities solutions and Fiber new technologies and labor accommodations.	

Contents

Executive Summary

1 Executive Summary

With the rapid evolvement of the ICT sector in the last years, the requirements of residential and businesses for modern telecommunication services have increased considerably. Modern telecommunications services are an integral and beneficial element in the life of the local community and in the national economy. Advanced telecommunications services are seen as pre-requisites for attracting and retaining long-term tenants. The infrastructure for such services must be already planned at the very early stage of the design phase of a building to guarantee a future proof approach.

The Telecommunication and Digital Government Regulatory Authority (TDRA) is keen to constantly develop the telecom sector in the United Arab Emirates to allow fair competition between the licensees by ensuring that telecommunication infrastructure is suitable to cater for their requirements in new domestic and business developments and buildings and to foster new competition to ensure innovative and state of the art services for end-users. Therefore, TDRA took the decision to introduce a common and neutral standard for telecommunications network design infrastructure for the rollout of FTTx networks in new buildings/areas ("Greenfield") for the benefit of all stakeholder groups. This shall not only promote competition on the infrastructure level but also give the user the freedom of choice between operators, guarantee reasonable investment costs for developers by setting reasonable specifications and clear processes for municipalities and government. Moreover, this initiative will support and promote the deployment of fibre networks as key infrastructure in the ICT sector.

Based on the status quo assessment of the situation in the UAE and an international benchmark study performed to take a closer look on common approaches and best practices on an international level as well as the different needs and expectations of all stakeholders the following manual was developed.

A common framework in the manual ensures a future proof approach with regard to the design of telecoms networks for FTTx deployment. The provision of more detailed planning guidelines guarantee a high quality network operated by the current licensees of today but in addition taking the appearance of a further licensee into account. With this it fosters competition by a neutral, common approach supported and justified by international best practices, tailored to the needs of the UAE.

To ensure a proper application of the manual from the beginning of a development a so called "No Objection Certificate" – NOC admission and a corresponding process is defined. In this process the focus lies on the early design stage of any new building, villa, warehouse or other types of developments in the UAE. Based on the construction drawings the professional implementation of the design manual will be assessed and the NOC issued. This forms the basis to obtain a building permission for the project (covering the part of the telecom infrastructure).

In a second step, after a development is realized, clear processes for testing and acceptance of the infrastructure come in. This as well is reflected on a general level in this document.

The NOC, the respective process and the testing/completion of the cabling for FTTx deployment are outlined in this manual on a general level. It is up to the licensees to agree on a detailed specification of this process.

Developers are encouraged to engage with the licensees (telecommunications service providers) at an early stage so that any process and / or design issues may be resolved and to get it "First time right".

To keep the manual up to date and to guarantee always for the best technical and commercial approach in the future, the guidelines will be reviewed on a regular basis taking new developments and experiences into account. A close dialog with all stakeholders in parallel is the basis for constant improvement of the manual.

FTTx in new Buildings

2 FTTx in new Buildings

2.1 Introduction

This guideline document was developed to enable the application of a common, system-independent FTTx pre-cabling of single, and/or multi subscriber premises and the infrastructure needed in new buildings (Greenfield areas).

These guidelines

- provide telecommunications service providers (licensees)[1] with an application independent optical fibre cabling subsystem;
- serve an open market for cabling components
- provide building developers/owners with guidance allowing the accommodation of the telecommunication infrastructure and interfaces already in the initial planning either for construction or refurbishment.

The common specification manual was developed to suit the existing/future technical requirements of both licensees in addition to new licensees in the future with the effective utilization of resources.

The main driver for this is the intention to foster competition already on the network infrastructure level and give the end user the freedom to select a network provider of choice. Such competition will stimulate the development of the telecom sector due to attractive retail pricing and innovative service creation. Therefore all measures foreseen in this manual already cater for a possible third licensee .

This effort is spent in addition to the available bit stream service agreement and other passive infrastructure arrangements applicable in areas/buildings where only a single network infrastructure is available (brownfield areas) today.

The Telecommunication and Digital Government Regulatory Authority (TDRA) started this initiative to achieve a market consensus among all relevant stakeholder like municipalities, ministries, licensees, master plan developers, building developers and property owners.

1"Licensees" as used in this document refer to Etisalat by e&, EITC - du and other such licensed operators that may obtain public telecommunications licenses in accordance with the Federal Law by Decree and its Executive Order. At this time, existing Licensees refers to Etisalat by e& and EITC - du only.

2.2 Intention and Application

These guidelines specify the FTTx optical fibre access network infrastructure within single, and/or multi-subscriber premises (which may comprise single or multiple buildings, villas, warehouses etc.) and intends to support the deployment of optical broadband networks (capable of catering for e.g. triple play services) with the current state of fibre network technology. Copper access networks are not considered.

The application is intended for new buildings/areas, whereas this may also include areas of renovation or refurbishment of existing buildings. No precautions to enforce a certain fibre technology type or version shall be made. Up to now, Ethernet (ptp) and GPON (ptmp) are deployed.

All new buildings shall be equipped with physical infrastructure capable of hosting high-speed networks and access points which can be easily accessed by the telecommunications network providers. The same is valid for major renovations.

The cabling within the subscriber space (home, unit, flat, apartment, single family home or similar) for onward distribution of services beyond the customer premises equipment is not in scope of this document, although some minimum requirements for CAT6 cabling are provided.

This document constitutes minimum requirements to provide a baseline for the network setup in typical cases. Nevertheless, there is no restriction to extend the implementation by mutual agreements as long as those are not contradicting other baseline requirements and hindering (possible) competition by e.g. using proprietary standards.

With this a standardized network setup is pre-agreed by stakeholders allowing seamless interworking of all network parts. Further it will unload all planning and establishment efforts for most regular cases.
Fore sure special buildings or development areas (e.g. sport arenas, hospitals ...) may need further in-deep respectively individual agreements beyond of that.

Sharing of essential infrastructure elements like rooms, ducts, cable trays and cabling is one of the aspects in focus to optimize the involved investments for all parties to guarantee an effective utilization of resources. Moreover, all parties shall constantly try to optimize the infrastructure design by e.g. utilizing unused space in rooms for other functions like mobile connections where applicable. With this a balance between possible and future proof requirements and investments at a reasonable level can be guaranteed.

2.3 Securing Competition – The possibility of a further licensee [2]

For in-building cabling the use of a multi-fibre cable is mandated to satisfy the requirement for competition on the one hand and to optimizing investments on the other hand. At least one dedicated fibre from each competing operator's OLT accesses each home. Additional spare capacity shall be foreseen which eventually can be used for a possible new licensee in the future.

In an Ethernet (ptp) architecture, the operators connect their OLTs/Fibre switches directly to the dedicated fibres allocated to them.
In the GPON (ptmp) architecture, while connecting villas, all operators provide their own GPON splitter, co-locating them in a common location (e.g. Meet-Me-Room). In case of connecting buildings through GPON architecture, it is the developer

2 There are other licensed telecommunications service providers in the UAE, providing other types of telecommunications services.

or building owners' responsibility to supply and install the required splitters inside the Main Telecom for each competing operators. In addition, operators provide their own feeder fibre connecting the OLT to the splitter. In the unit of the end user a consolidation cabinet shall at least be able to house 2 ONTs in parallel.

Therefore, each operator has its own dedicated end-to-end FTTx network with full service delivery control.

This scheme allows for seamless service provisioning without necessary intervention in the building in case of an end user switches his contract from one service provider to the other. It must be possible to derive services from both (respectively more) operators in parallel. In case of more than two licensees the user has to choose which (max) two operators should be installed in the home/office consolidation cabinet as they can hold the ONT/CPEs of two operators as a minimum in parallel. However, this does not mean that there can't be a third operator used in parallel because an installation outside of the cabinet can be envisaged. This hassle-free choice for the end user will stimulate competition on the level of service delivery performance.

The dimensioning of required spaces for the telecommunication equipment satisfying the above scheme need to be optimized through sharing.

With sharing of rooms, floor spaces, ducts, cable trays, racks and cables the cost impact of parallel GPON network infrastructure elements (especially the splitters) is regarded overall as marginal.

The foreseen MTR room sizes in this manual already cater for the need of a possible third licensee. That means that already with this manual sufficient rack space is foreseen to introduce a third licensee without the need of any change to this manual. The same holds true as already outlined above for the cabling itself.

2.4 Licensees EITC (du) and Etisalat by e&

For the time being there are two licensees providing terrestrial fixed and mobile telecommunication networks and services in the UAE : Etisalat by e& and EITC (du). Therefore, the following planning guidelines are based on this situation taking into account possible further competition in the terrestrial fixed/mobile market through a new licensee, international best practices and common approaches.

The following principles and most of the guidelines are fairly independent from the number of licensees, but nevertheless some are foreseen to optimize today's investments and are in the sake of deployment clarity. Those guidelines have to be adapted in case a further licensee entering the market for Greenfield deployment areas under consideration to that point in time.

There are no principles established which would prevent a further licensee.

2.5 Common Master Plan developments [3]

2.5.1 Process

To optimize the overall process among the licensees a lead operator shall be nominated on a per project basis. The lead operator for a specific project shall be the single point of contact between the licensees and all other stakeholders like developers, building or property owners, municipalities or ministries and accordingly shall take responsibility of all coordination.

The lead operator will assist the property developers through a "No Objection Certificate" (NOC) process that includes OSP design drawing validation, ISP design drawing validation, validating ISP material to be from the pre-approved manufacturer

list and site inspections during implementation. Although electronic communication systems like email and online platforms are used widely for this task, there are merits in having also face to face discussions with the lead operator if needed. Therefore, telecommunications service operators are encouraged to foresee physical presence in an area/emirate if this would ease the overall processes.

Master plan Developers/Building developers are encouraged to engage with lead operator at an early stage so that any process and/or design issues may be resolved. If property developers or tenants have special requirements that may not be covered by these guidelines it is necessary to engage with lead operator's design teams at an early stage of development planning, to enable seamless delivery of premium telecommunications services at launch.

2.5.2 The NOC

NOC stands for "No Objection Certificate" and is issued by the lead operator for any Greenfield development (within Master Plans) confirming the compliance of the design drawings with the standards and requirements of the design manual of TDRA.

The lead operator of a project will assist Master plan property developers/building developers through a "No Objection Certificate" (NOC) process that includes design drawing validation, material samples checking and site inspections during implementation and final validation through testing,
The design manual of TDRA is the sole reference to all consultants and contractors during their NOC's submissions for Greenfield projects for Common and Non-Common Master plan development or existing Master plan.

Master plan Developers/Building developers are encouraged to engage with the lead operator at an early stage through the NOC process so that any process and / or design issues may be resolved. If property developers or tenants have special requirements that may not be covered by the common TDRA manual it is necessary to engage with the design teams of the lead operator at an early stage of development planning, to enable seamless delivery of premium telecommunications services at launch.

2.5.3 Acceptance after project realization

As outlined the NOC is issued at the beginning of a development. But once the building is finalised, the handover of the telecommunication infrastructure (e.g. the cabling, splitters ...) to the lead operator to facilitate services has to take place. Therefore, testing of the built telecom infrastructure in the building has to be performed and documented by the master plan developer/building developer. End-to-end testing may be performed by each of the licensees for their network.

As a result, the lead operator issues a completion respectively acceptance certificate for the master plan developer/building developer to obtain the completion certificate for the whole building.

2.5.4 Responsibilities

For any Greenfield project, which fall under the common Master Plan development in the UAE, one of the licensees will be assigned as the lead operator to the project and accordingly will take responsibility of coordination with the master plan developer/building developer for common infrastructure requirements. The lead operator will assist the master plan developers/building developer through a "No Objection Certificate" (NOC) process that includes OSP design drawing validation, ISP design drawing validation, validating ISP material to be from the pre-approved manufacturer list and site inspections during implementation.

3 This was referred to as "Taawun projects" before this manual.

To have a sound and smooth process it is important for master plan developers/building developer as well as municipalities to have a single point of contact for each project. Moreover, as some municipalities are streamlining the whole process of obtaining a building permit not only with regard to telecoms issues, it is of great importance to have a defined single point of contact at the licensees.

2.6 Non-Common Master Plan developments [4]

2.6.1 NOC Process

In case of Non-common Master Plan developments or existing Master Plans, Building developers shall approach the telecommunications service operators from design stage of the project to initiate "No Objection Certificates" (NOC) process that include design drawing validation, material samples checking and site inspections during implementation and final validation through testing.

The design manual of TDRA is the sole reference to all consultants and contractors during their NOC's submissions for Greenfield projects (for Common and Non-Common Master Plan developments or existing Master Plans).

Master plan Developers/Building developers are encouraged to engage with the operators at an early stage through the NOC process so that any process and / or design issues may be resolved. If property developers or tenants have special requirements that may not be covered by the common TDRA manual it is necessary to engage with the design teams of the operators at an early stage of development planning, to enable seamless delivery of premium telecommunications services at launch

2.6.2 Acceptance after project

As outlined the NOC is issued at the beginning of a development. But once the building is finalised, the handover of the telecommunication infrastructure (e.g. the cabling, splitters ...) to operators to facilitate services has to take place. Therefore, testing of the built telecom infrastructure in the building has to be performed and documented by the master plan developer/building developer. End-to-end testing may be performed by each of the licensees for their network.

As a result, the operators issues a completion respectively acceptance certificate for the master plan developer/building developer to obtain the completion certificate for the whole building.

2.6.3 Responsibilities

For any Greenfield project, which fall under the Non-common Master Plan developments or existing Master Plans in the UAE, the operators will take responsibility of coordination with the master plan developer/building developer for common infrastructure requirements. The operators will assist the master plan developers/building developer through a "No Objection Certificate" (NOC) process that includes OSP design drawing validation, ISP design drawing validation, validating ISP material to be from the pre-approved manufacturer list and site inspections during implementation.

To have a sound and smooth process it is important for master plan developers/building developer as well as municipalities to have a single point of contact for each project. Moreover, as some municipalities are streamlining the whole process of obtaining a building permit not only with regard to telecoms issues, it is of great importance to have a defined single point of contact at the licensees.

4 Formerly projects outside "Taawun"

Planning Guidelines

3 Planning Guidelines

This document covers the following building types:
- Villa complexes,
- Residential towers and groups of residential towers,
- Commercial towers and groups of commercial towers,
- Shopping malls,
- Groups of shops and retail outlets,
- Hospitals, hotels and other bulk service applications
- Warehouses and sheds.

Note – However the above-mentioned buildings types are not limited.

The document is structured to cover all aspects of infrastructure for:
- Meet-me-room spaces (MMR)/Plot (Fibre Concentration Point),
- Civil infrastructure and Entry ducts;
- Telecom rooms;
- IndoorMobile service and roof-top rooms;
- Building pathways;
- Outside plant (OSP) cables
- Inside plant (ISP) cables.

3.1 Definitions

3.1.1 Terms

Building Industry Consulting Service International (BICSI): Global professional/trade association supporting the advancement of the information and communications technology (ICT) community.

Building entry point (BEP): Point where external ducts physically enter a building. This can be a standalone location or incorporated into another telecoms space.
Cable pathway: Systems used to route cables, e.g. cable ducting, cable ladder, cable tray, conduit, duct, maintenance chamber.

Feeder cable: Cable that provides signals to a property from an ethernet or GPON-based SP network. Feeder cables can deliver signals for connection to optical splitters and distribution on the in-building telecom fibre to the x (FTTx) system, or provide a SP connection to a local optical line terminal (OLT) if the SP requires this locally within a development.
Fibre concentration point (FCP): Point where a high core count feeder cable is converted to multiple smaller core count distribution cables. The FCP can be located within the property boundary in a BEP, or outside the property in a meet-me-chamber (MMC).

Fibre to the x (FTTx): Delivery of optical fibre signals directly to a location. For SP telecom services, the x can be defined as B (building), C (cabinet), H (home) or P (premise).

Floor telecom room (FTR): Room located at each floor between the main telecom room (MTR) and multiple floor optical telecommunication outlets (TO), which allows the transition from vertical optical fibre cables to horizontal tenant cabling.
Handhole: Small maintenance chamber installed within a campus duct system specifically aiding the pulling of cables on long straight duct routes where cable pulling forces might otherwise be exceeded.

Meet-me-chamber (MMC): Maintenance chamber located in the vicinity of the property boundary and providing the first common element of the outside plant (OSP) installation, with three separate duct connections from SPs into the chamber then following a single OSP route into the development. For multi-building developments, this can also contain a FCP-

enabling feeder cables to split to separate cables to individual buildings on a plot when a meet-me-room (MMR) is not utilized.

Meet-me-room (MMR): Site-specific location for landing Etisalat & Du main feeder Cable and distribution TA'WUN cable from MMR to residential / commercial units in the community, as determined by the agreed master plan. MMRs form a common location for feeder cables from SPs to terminate and split to multiple cables feeding MTRs on different plots of a development.

Main telecom room (MTR): Location where feeder cables from SPs are terminated, allowing connection to the building inside plant (ISP) common infrastructure.

Optical line terminal (OLT): Centralized piece of equipment providing service to many end users through a PON solution. OLTs can support cable distances up to 20 km from centralized equipment subject to the optical fibre cabling design.

Optical network terminal (ONT): Active component of the FTTx optical network located at a tenant premises.

Optical splitter: Passive component of the FTTx optical network taking signal from either one or two input optical cores and equally dividing the signal to the splitter outputs.

Optical telecommunication outlet (TO): Fixed connecting device where tenant indoor optical fibre cable terminates. The TO provides an optical connection for the equipment connection cord of the ONT.

Passive optical network (PON): Point-to-multipoint FTTx network architecture utilizing unpowered optical splitters. Variants of PON using the same topology and passive components include GPON, XG-PON, XGS-PON and NG-PON2.

D54 & D56: uPVC duct used to connect joint boxes to allow pulling cables without destring the road furniture
Standard sizes of telecom nation uPVC ducts listed in the following table :

Duct No.	Avg. Outside Diameter	Wall Thickness	
mm	mm	Min (mm)	Max (mm)
D54	96.5	3.25	3.65
D56	53.9	1.55	1.70

JRC4,12,14: Standard types of Jointing chambers could be casted on site or pre-casted of reinforced concrete and currently available in UPVC .
To be covered by following ductile carriageway farm and cover with following sizes

Table 9 - For Manholes and Joint Boxes

Type of Frame and Cover	Used for Jointing chamber	Dimensions of Opening	Number of Covers
No.1	JRC4	610mm x 610mm	2
No.2	JRC12	1220mm x 685mm	4
No.3	JRC14	1830mm x 685mm	6

Service Providers (SP) or Telecommunications Service Providers: Providers of telecommunication services in the UAE licensed by the TDRA. SPs include EITC (du) and Etisalat by e& and any other entity as may be licensed by the TDRA, including their affiliates that are under direct or indirect control by the SP.

4 3.1.2 Acronyms and abbreviations

APC	angle polished connector
BEP	building entry point
BICSI	Building Industry Consulting Service International
CP	connection point
CD	Civil Defence
EITC-du	SP in UAE
EID	Etisalat Identification
EM	electromagnetic
EMI	electromagnetic interference
Etisalat by e&	SP in UAE
FCP	fibre concentration point
FFL	finished floor level
FTR	floor telecom room
FTTx	fibre to the x
G	ground floor
GAID	Global Alliance for ICT and development
GPON	gigabit passive optical network
GSM	global system for mobile communication
h	height
HDRF	heavy duty return flange
IBS	in-building service
ICT	information and communications technology
ISO	International Organization for Standardization

IT	information technology
ISP	inside plant
l	length
LC	lucent connector
LSZH	low smoke zero halogen
ODF	optical distribution frame
OLT	optical line terminal
ONT	optical network terminal
OSP	outside plant
MEP	mechanical, electrical, plumbing
MMC	meet-me-chamber
MMR	meet-me-room
MSR	mobile service room
MTR	main telecom room
NG-PON2	next generation PON2
PLC	planar light wave circuit
PoE	power-over-ethernet
PON	passive optical network
RFI	radio frequency interference
RoHS	restriction of hazardous substances
SC	standard connector
SLD	single line diagram
SM	singlemode
SP	service provider
STP	shielded twisted pair
TO	telecommunication outlet
TDRA	Telecommunications and Digital Government Regulatory Authority
UTP	unshielded twisted pair
w	width
XG-PON	10 gigabit PON
XGS-PON	symmetric XG-PON
FTTR	Fibre To The Room

3.2 References

Essential references

BS EN 13501-6, Fire classification of construction products and building elements – Classification using data from reaction to fire tests on power, control and communication cables

IEC/EN 60332-1-2, Tests on electrical and optical fibre cables under fire conditions – Tests for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame

ISO/IEC 11801-1, Information technology – Generic cabling for customer premises – Part: 1 General requirements

ISO/IEC 11801-2, Information technology – Generic cabling for customer premises – Part 2: Office premises

ISO/IEC 11801-3, Information technology – Generic cabling for customer premises – Part 3: Industrial premises

ISO/IEC 11801-4, Information technology – Generic cabling for customer premises – Part 4: Single-tenant homes

ISO/IEC 11801-6, Information technology – Generic cabling for customer premises – Part 6: Distributed building services

ISO/IEC 14763-1, Information technology – Implementation and operation of customer premises cabling – Part 1: Administration

ISO/IEC 14763-2, Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation

ISO/IEC 14763-3, Information technology – Implementation and operation of customer premises cabling – Part 3: Testing of optical fibre cabling

ISO/IEC 30129, Information technology – Telecommunications bonding networks for buildings and other structures

ITU-T G.657 A1/A2, Characteristics of a bending-loss insensitive single-mode optical fibre and cable

ef. G.2 UAE MINISTRY OF INTERIOR GENERAL COMMAND OF CIVIL DEFENCE, 2018.

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Further reading

BICSI, 2020. Telecommunications Distribution Methods Manual (TDMM), 14th ed. Florida: BICSI. BICSI, 2018.

Outside Plant (OSP) Design Reference Manual (DRM), 6th ed. Florida: BICSI.

BICSI 2017. Information Technology Systems, Installation Methods Manual (ITSIMM), 7th ed. Florida: BICSI.

BICSI, 2016. Essentials of bonding and grounding, 1st ed. Florida: BICSI.

Design and installation of telecommunications infrastructure

4 Design and installation of telecommunications infrastructure

4.1 General requirements

This section provides the requirements for the design of all telecommunications (telecom) infrastructure installations within any development including new build, “greenfield”, redevelopment, “brownfield”, and additions, alterations, renovations or refurbishments to existing buildings, in the all Emirates.

This section specifies the minimum requirements to provide a baseline infrastructure. There is no restriction to extending the baseline, provided that the design meets the requirements in this section and does not prevent competition, e.g. by using proprietary standards.

All telecom infrastructure shall enable each user/tenant freedom of choice between telecommunication service providers (SPs).

The requirements cover all of the following aspects of infrastructure:

a) civil infrastructure and entry ducts;
b) fibre concentration point (FCP) space(s) per development or plot;
c) meet-me-room (MMR) space(s) per development or plot;
d) telecom rooms;
e) indoor mobile service and rooftop rooms;
f) building pathways;
g) OSP cables;
h) ISP cables.

Passive optical fibre infrastructure shall be provided to support deployment of FTTx. Copper access networks shall not be used for SP services.

All buildings shall be equipped with physical infrastructure capable of supporting multiple high- speed SP networks which can be easily accessed by the SP. The developer shall assume a minimum of two active SPs in the region, but may future-proof the infrastructure by incorporating provision to support a possible third SP.

New installations shall be based upon a minimum of category 6 balanced twisted pair cabling as specified in ISO 11801-1. Designers may future-proof designs by providing category 6A cabling, which supports higher data rates and provides support for newer power-over-ethernet (PoE) standards that are typically used for video surveillance camera and wireless local area network access points. Where category 6A is specified, unshielded twisted pair (UTP) or shielded twisted pair (STP) may be utilized.

Category 6 cabling (structured cabling system) shall as a minimum conform to the requirements specified in G.10.6.10.7.

Cabling within the tenant space (e.g. multi-tenanted commercial/retail building, home, unit, flat, apartment, single family home or similar) for onward distribution of services beyond the tenant equipment is not in the scope of these requirements. The requirements of this section do not replace a detailed specification, act as instruction for untrained persons, or provide for every specific design circumstance. For situations beyond the scope of these requirements, the TDRA shall be consulted to obtain further clarity and guidance.

Special buildings or development areas (e.g. hospitals, shopping malls, stadiums, data centres, public buildings) will need further enhanced requirements. Individual agreements shall be bespoke and beyond that of the minimum requirements established in this section.
Installations where special telecom requirements might exist shall be referred to a registered SP at the preliminary design

stage to incorporate any specific requirements above that of this section.

4.2 Telecoms service

To support the deployment of SP optical broadband networks and services, the developer shall design and install elements of telecom infrastructure up to and within single and multi- tenant premises (to include single or multiple buildings, villa complex, warehouses, etc.).

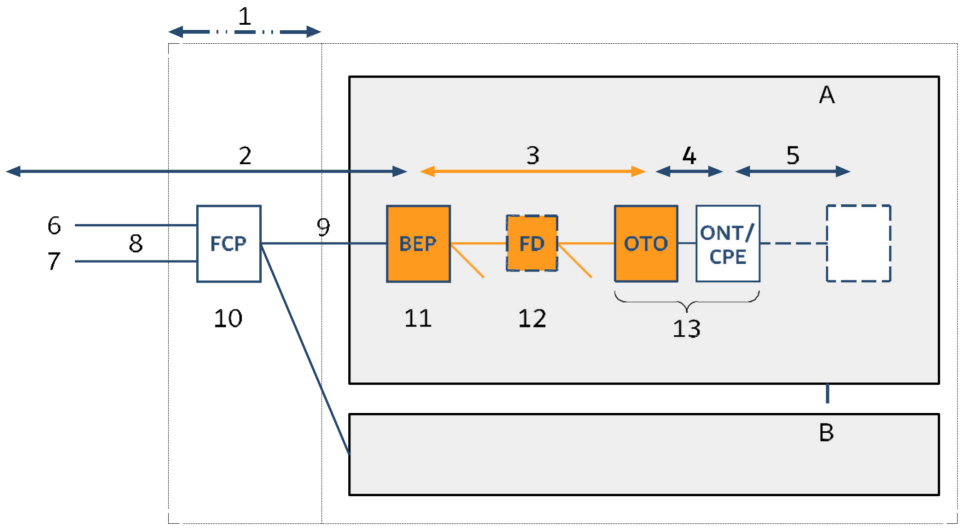
Standardized telecom infrastructure shall be provided for FTTx, to enable seamless interworking of all network parts. All designed infrastructure shall support ethernet and GPON.

To optimize investments, SPs shall share essential infrastructure elements including telecom rooms, ducts, cable pathways and cabling.

4.3 Reference architecture

The general schematics in Figure G.1 and Figure G.2 shall be used as the basis for infrastructure design. Adaptations which enhance the resilience or performance of telecom infrastructure are permitted, if agreed by consultation with all stakeholders. Any such adaptations shall meet the requirements of this section.
NOTE: The reference architecture shown in Figure G.1 allows the end user to change SPs. It also allows service to be provided by multiple SPs in parallel if required.

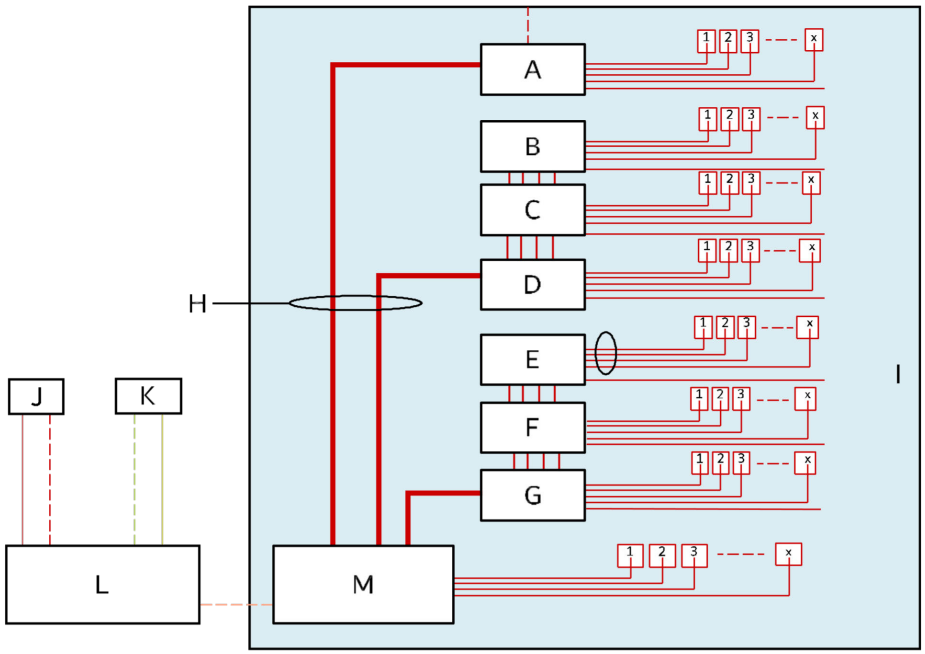
Figure G.1 Reference architecture



Key

1 Property boundary
2 External cabling (OSP)
3 In building cabling (ISP)
4 Equipment patch cord
5 Tenant / unit cabling
6 Service provider 1
7 Service provider 2
8 Feeder cabling
9 Distribution cabling
10 Meet me chamber / meet me room / cabinet
11 Main telecom room
12 Floor telecom room
13 Consolidation cabinet
A Building 1 boundary
B Building n boundary

Figure G.2 Schematic diagram for typical building connectivity



Key

A FTR-7th floor mini ODF (splicing point)
B FTR-6th floor
C FTR-5th floor
D FTR-4th floor mini ODF (splicing point)
E FTR-3rd floor
F FTR-2nd floor
G FTR-1st floor mini ODF (splicing point)
H Multicore indoor fibre cables
I 4 core SM drop fibre cables from each unit to mini ODF (splicing point) in FTR
J du PoP-A and B
K Etisalat PoP-A and B
L Meet me chamber / meet me room / cabinet
M MTR with splitters

The infrastructure design shall avoid single points of failure. The design shall enable physical diversity and redundancy in feeder and distribution cabling, and in site-wide distributor cabling. For example, a site with multiple buildings shall have more than one MMC and FCP.
The design shall include all the following elements of reference architecture:

a) duct infrastructure from SP stubs/development boundary to MMC;
b) development MMC;
c) campus duct from MMC to BEPs, including handholes, turning chambers and pulling chambers as required;
d) BEPs to accommodate SP and campus telecom cabling;
e) FCPs;
f) telecom rooms
g) in-building cabling.

Design standards shall be applied by building type:
1) residential, designed in accordance with ISO/IEC 11801-1, ISO/IEC 11801-4 and ISO/IEC 11801-6;
2) commercial, designed in accordance with ISO/IEC 11801-1, ISO/IEC 11801-2 and ISO/IEC 11801-6;
3) industrial, designed in accordance with ISO/IEC 11801-1, ISO/IEC 11801-2 and ISO/IEC 11801-3 and ISO/IEC 11801-6.

The design shall include:
i) shared SP infrastructure;
ii) performance requirements which achieve system resilience;
iii) a roles and responsibilities matrix (see G.10.4);
iv) safeguards for future adjacent developments and OSP extensions to these, clearly identified as such on the design drawings;
v) provision or cessation of service to enable each tenant to adopt either SP without on-site intervention;
vi) a choice of SP;
vii) provisions for a minimum of two SPs;

NOTE 1: The design may include an option to enhance this provision to support a future third SP.
viii) a minimum of four optical fibre cores per premise, for a two-SP design, enabling the possibility for either SP to provide an ethernet-based service;

ix) SP OLTs/fibre switches connected directly to the dedicated fibre cores allocated to them;

NOTE 2: Large developments can have local SP OLTs where high tenant numbers are expected.

x) an MTR for a minimum of two SPs.
xi) rack space and SP cabling allowances in the MTR for two SPs;
xii) dedicated end-to-end FTTx network with full-service delivery control for each SP;
xiii) the required splitters for GPON architecture inside the MTR for each of the two SPs (SPs shall provide their own feeder fibre connecting the OLT to the splitter);
xiv) in-building cabling with multicore optical fibre cable;
xv) at least one dedicated fibre from each SP OLT to each home, commercial/retail unit or other building;
xvi) within each tenant space, a consolidation cabinet configured to house a minimum of two ONTs in parallel.

4.4 Responsibility matrix

Developers shall comply with the design and supply requirements of the responsibility matrix in Table G.1.

Table G.1 Responsibility matrix

No.	Revision Description	Master plan developer (site wide)	Building owner (individual buildings)	Service Provider (SP)
1	Lead-in ducts, including connections to entry manholes outside building boundaries.	✓		
2	Installation of manholes and ducts outside the building/ boundaries (including cover).	✓		
3	Entry boxes inside the building/complex of villas boundaries (including the cover).		✓	
4	Supply and installation of -4core SM fibre terminal box with duplex LC/APC adaptors and pigtail and two SC/APC adaptors.		✓	
5	Fibre optic cable supply, pulling/ blowing, termination and testing from the MTR to FTR and drop fibre cables supply, pulling, termination and testing from the FTR to CP cabinet (except shell and core offices, which are under the tenant scope).		✓	
6	Fibre optic cables supply, pulling, termination and testing from the MTR to FTR and drop fibre cables supply, pulling, termination and testing from the FTR to CP cabinet.		✓	
7	Supply and installation of mini optical distribution frame (ODF) splice cabinet at splice point location.		✓	

No.	Revision Description	Master plan developer (site wide)	Building owner (individual buildings)	Service Provider (SP)
8	Splicing and labelling multicore fibre cables with -4core drop cables using wall-mounted mini ODF.		✓	
9	Horizontal cabling inside the unit/ apartment/office/retail (except shell and core offices, which are under the tenant scope).		✓	
10	FTTx components such as the fibre cables, 42U 800 mm × 800 mm free standing racks, ODF, high density fibre patch panel, low-density fibre patch panel, patch-free splitters, mini ODF for splice point, mini ODF for shell and core, -4port fibre terminal box (with LC/APC and SC/APC pigtails and adaptors), GPON splitters, open rack for splitters and fibre patch cords.		✓	
11	Fibre optic splitter supply and installation (from the approved lists of suppliers/vendors of both du and Etisalat).		✓	
12	Supply of fibre patch cords and pre- patching the fibre patch cords between splitter downlink ports to building fibre patch panels (ISP) and between splitter uplink ports to OSP fibre patch panels.		✓	
13	Supply of pigtail cords and splicing of patch-free splitter downlink cores with the pigtail cords and terminating pigtail cords in the fibre patch panels (ISP), splicing the patch-free splitter uplink cores with feeder cable (for Etisalat).		✓	
14	CP cabinet supply and installation (including accessories and related elements).		✓	
15	Supply and installation of vertical and horizontal cable trays, cable pathways, ducts and microducts.		✓	
16	Telecom rooms/spaces and related electrical, mechanical and civil requirements.		✓	
17	Plot of 10 m × 10 m for each MMR.	✓		
18	Construction of MMR.	✓		
19	Commissioning of MMR.			✓
20	Fibre optic cables supply, pulling, termination and testing from the MTR to each MSR and the rooftop room.		✓	
21	Supply and installation of fibre optic components for IBS connectivity (GSM)		✓	
22	SP identification labels (GAID and EID), supply and placement in the building unit.		✓	

No.	Revision Description	Master plan developer (site wide)	Building owner (individual buildings)	Service Provider (SP)
23	Adherence to the Building NOC conditions by SP.		✓	
24	Request for building site inspection.		✓	

Summary of responsibility matrix for villa scenario:

No.	Item description	Master Plan Develope	Villa's Developer	Operators
1	Lead-in ducts including connection to manhole outside villa boundaries	✓		
2	Manholes outside villa boundaries (including cover)	✓		
3	Pull box inside the villa boundaries (including the cover)		✓	✓
4	OSP fiber optic cables for single villa or complex villas connections (including supply, termination and testing)			
5	Supply and Installation of 4 core SM fiber Terminal Box		✓	
6	Patch cords supply		✓	
7	CP cabinet supply & installation (including accessories, power outlet and related elements)		✓	
8	Supply and Installation of splitters inside the stand alone Meet-me-Room's racks			✓
9	Plot of 10 x 10 meter to be provided for each MMR	✓		
10	Construction and Commissioning of Meet-Me- Room	✓		
11	GAID & EID supply and placement in the villa unit		✓	

Summary of responsibility split for setting up telecom network plot allocation.

No.	Item description	Master Developer	Operators
	Summary of responsibility matrix for Data Center scenario		
1	Plot reservation of 200 x 200 meter to be provided for each Data Center Plot in the master plan	✓	
2	Plot allocation process and affection plan issuance* of 200 x 200 meter to be provided for each Data Center Plot	✓	
3	Building Permit Process for each Data Center Plot		✓
4	Construction of Data Center		✓
5	Commissioning of Data Center		✓
6	Power Source Provision for each Data Center Plot	✓	
7	Power Application and Obtain Power Connection with account Number and Meter Number for each Data Center Plot		✓
	Summary of responsibility matrix for Exchange Building scenario		
1	Plot reservation of 50 x 50 meter to be provided for each Exchange Building Plot in the master plan	✓	
2	Plot allocation process and affection plan issuance* of 50 x 50 meter to be provided for each Exchange Plot	✓	
3	Building Permit Process for each Exchange Building Plot		✓
4	Construction of Exchange Building		✓
5	Commissioning of Exchange Building		✓
6	Power Source Provision for each Exchange Building Plot	✓	
7	Power Application and Obtain Power Connection with account Number and Meter Number for each Exchange Building Plot		✓
	Summary of responsibility matrix for MMR scenario		
1	Plot reservation of 10 x 10 meter to be provided for each MMR Plot in the master plan	✓	
2	Plot allocation process and affection plan issuance* of 10 x 10 meter to be provided for each MMR Plot	✓	
3	Building Permit Process for each MMR Plot		✓
4	Construction of MMR	✓	
5	Commissioning of MMR		✓

	Summary of responsibility matrix for MMR scenario		
6	Power Source Provision for each MMR plot	✓	
7	Power Application and Obtain Power Connection with account Number and Meter Number for each MMR Plot	✓	
	Summary of responsibility matrix for GSM scenario		
1	Plot reservation of 40 x 35 ,40 x 30 , 35 x 25 , 30 x 20 ,25 x 15 , 20 x 15 and 10 x 10 meter to be provided for each GSM Plot in the master plan	✓	
2	Plot allocation process and affection plan issuance* of 40 x 35 ,40 x 30 , 35 x 25 , 30 x 20 ,25 x 15 , 20 x 15 and 10 x 10 meter to be provided for each GSM Plot	✓	
3	Building Permit Process for each GSM Plot		✓
4	Supply & Construction of GSM Structure	✓	
5	Supply & Telecom of GSM		✓
6	Commissioning of GSM		✓
7	Power Source Provision for each GSM plot	✓	
8	Power Application and Obtain Power Connection with account Number and Meter Number for each GSM plot		✓

* Including fees, Power, Lease and/or Rental value

4.5 Outside plant (OSP) common infrastructure specifications

4.5.1 Lead-in ducts

4.5.1.1 General

A series of lead-in ducts shall be provided from the BEP (and MMRs where present) to MMCs within 2 m of the plot boundary. The lead-in ducts shall be reserved for the use of the SPs.

All developments shall have a minimum of two lead-in routes. These routes shall be geographically separated to support different SP routes. They shall provide physical diversity, if required by the development type.

The MMC at each position shall enable separate duct connections from three independent SPs. The SP connection to the chamber shall be a minimum of two 110 mm ducts. Alignment of each chamber shall allow the SP access face parallel to the plot boundary. Sealed stubs shall be pre- installed from the chamber to the actual boundary location.

Campus ducts from the MMC shall be installed to the BEP, installing additional turning chambers and handholds as required on each specific route. If required, at the entry to the BEP, a wide-angle long radius bend (factory-made) may be provided; alternatively, entry boxes (for main and redundant routes) may be provided.

NOTE: The BEP may be located within the MTR.

Where the masterplan includes MMRs, the duct route to the BEP shall be via the MMR plot(s). Six 110 mm ducts shall be installed to this route.

A maximum of two shallow bends up to 90° each may be included on any duct section between chambers. The distance between maintenance holes/handholes shall be not more than 200 m.

Handholes shall not be used for turns, junctions or accommodating any FTTx equipment.

The work required to connect a projects infrastructure to any SP infrastructure shall be minimized. Connection points at the plot boundary shall be designed after consulting with utilities records to establish existing SP infrastructure in the site area.

All ducts designed and installed by the developer shall:

a) be made from black uPVC or HDPE;
b) be of smooth bore construction;
c) be buried to a depth of 600 mm below the finished ground level;
d) be sloping away from the building;
e) be protected by concrete when running under permanent paved surfaces;
f) be sealed at each end to prevent the ingress of water, sub-soil, gas, or pests;
g) have an entry/pull box installed for any right-angled or sharp bends in the lead-in duct (main and redundant) routes; and
h) include a draw rope in each duct made of twisted, mildew-resistant polypropylene (minimum outside diameter of 6 mm; minimum tensile strength of 1,000 kg).

OSP shall meet the requirements that are summarized in Table G.2. OSP requirements for mosques and other places of worship shall be in accordance with Part K.

Table G.2 Summary of OSP requirements

No.	Item	Complex of villas	Building with less than 50 tenants or up to G+5 or building area up to 3,000 m^2	Building with 51 to 100 tenants or up to G+10 or building area up to 7,000 m^2	Building with 101 to 300 tenants or building area more than 7,000 m^2	Building with more than 300 tenants	Shopping mall	Bulk service buildings	Group of warehouses, worker accommodation and factories
1	Entry box	JRC 12 for every 10 villas JRC 12 for plot entry per villa	JRC 12 for main route JRC 12 for redundant route	JRC 12 for main route JRC 12 for redundant route	JRC 12 for main route JRC 12 for redundant route	JRC 12 for main route JRC 12 for redundant route	JRC 12 for main route JRC 12 for redundant route	JRC 12 for main route JRC 12 for redundant route	JRC 12 for every 10 warehouses JRC 12 for plot entry per warehouse
2	Entry duct	2 × D56 (50 mm) per villa 2 × D54 (100 mm) for plot entry	2 × 100 mm primary route 2 × 100 mm secondary route	2 × 100 mm primary route 2 × 100 mm secondary route	2 × 100 mm primary route 2 × 100 mm secondary route	2 × D54 (100 mm) primary route 2 × D54 (100 mm) secondary route	2 × D54 (100 mm) primary route 2 × D54 (100 mm) secondary route	2 × D54 (100 mm) primary route 2 × D54 (100 mm) secondary route	2 × 100 mm per warehouse 2 × 100 mm primary plot entry 2 × 100 mm secondary plot entry
3	MTR (w × l × h)	Not applicable	2 m × 2 m × 3 m	3 m × 3 m × 3 m	3 m × 3 m × 3 m	3 m × 3 m × 3 m	3 m × 3 m × 3 m	3 m × 3 m × 3 m	2 m × 2 m × 3 m
4	Rooftop mobile service room (w × l × h)	Not applicable	3 m × 3 m × 3m (considering G+10 floors or less)	3 m × 3 m × 3m (considering G+10 floors or less)	3 m × 3 m × 3m (considering G+10 floors or more)	3 m × 3 m × 3m (considering G+10 floors or more)	To be determined during design	To be determined during design	Not applicable
5	MSR (w × l × h)	Not applicable	Not applicable	Not applicable	3m × 3m × 3m every ten floors starting from the lowest basement/ ground floor (G+10 floors or more)*	3m × 3m × 3m every ten floors starting from the lowest basement/ ground floor (G+10 floors or more) *	To be determined during design	To be determined during design	Not applicable
6	FTR (w × l × h)	Not applicable	1m × 0.6m ×3m	1 m × 1 m × 3 m	1.5m×1.5m×3m	2 m × 2 m × 3 m	To be determined during design	To be determined during design	1 m × 1 m × 3 m
7	Riser cable containment main risers	Two of 50 mm conduit	1 × 450 mm × 50 mm cable tray for fixed services 1 × 300 mm × 50 mm cable tray for IBS	1 × 450 mm × 50 mm cable tray for fixed services 1 × 300 mm × 50 mm cable tray for IBS	1 × 450 mm × 50 mm cable tray for fixed services 1 × 300 mm × 50 mm cable tray for IBS	1 × 450 mm × 50 mm cable tray for fixed services 1 × 300 mm × 50 mm cable tray for IBS	1 × 450 mm × 50 mm cable tray for fixed services IBS tray to be determined during design	To be determined during design	Two of 50 mm conduit

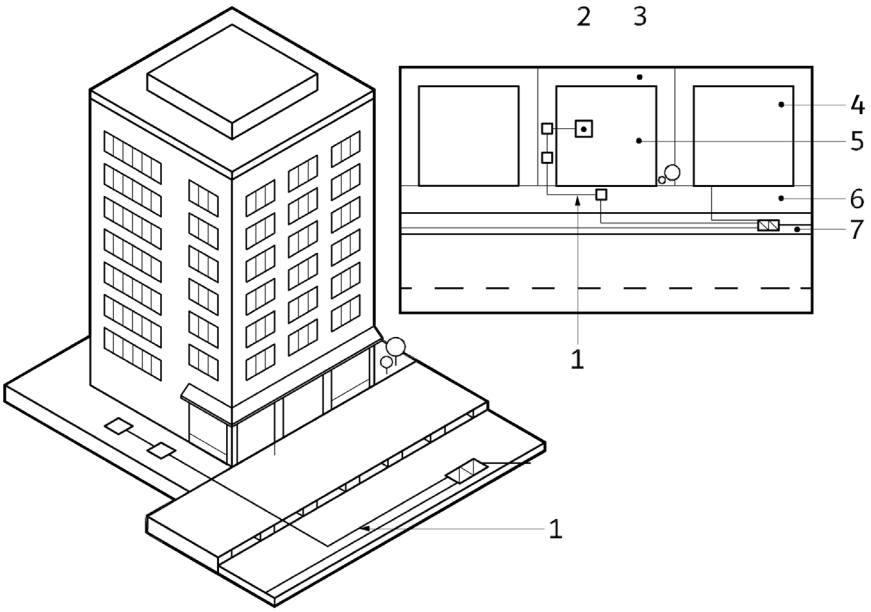
* reducing MSR rooms and utilizing FTR as MSR to be determined during NOC approval

4.5.1.2 Scenario 1 – Connection to existing SP duct infrastructure

The developer shall connect the development OSP to the existing SP duct systems or spur provided for the development plot (see Figure G.3). This shall include providing handholes, ducts and turning chambers as required to connect the SP duct to the MMC.

MMC positions shall be coordinated with the existing SP infrastructure, as the SPs might have different infrastructure connection points for the specific development.

Figure G.3 Lead-in duct connection to existing infrastructure



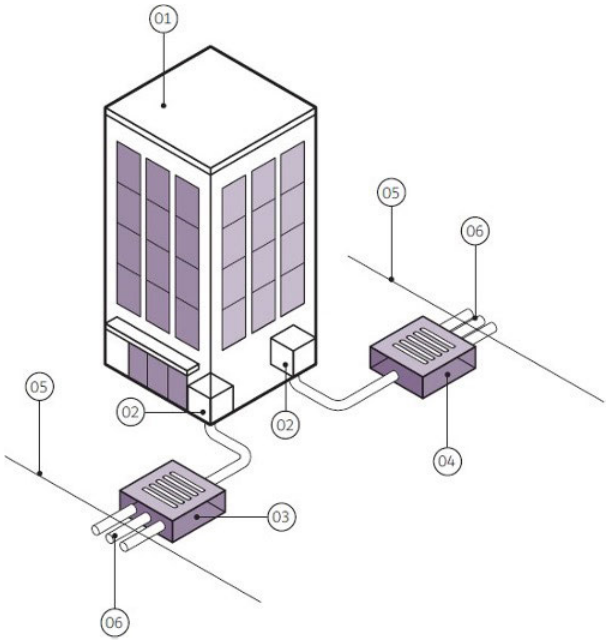
Key

1 Developer connection to SP chamber
2 BEP / MTR
3 Building plot
4 Vacant plot
5 Building
6 Footpath
7 SP chamber in parking bays

4.5.1.3 Scenario 2 – SP duct network is still to be built

The developer is responsible for extending MMC stub ducts to 1 m outside the plot boundary (see Figure G.4). The building developer is responsible for locating and clearly identifying lead-in ducts.

Figure G.4 Lead-in duct connections prepared for new SP infrastructure



Key

01 Building with dual entry points
02 Building entry point
03 Development meet me chamber A
04 Development meet me chamber B
05 Development boundary
06 Developer ducts capped 1m outside plot boundary for future SP connection

4.5.1.4 Entry boxes

Entry boxes and MMC shall be provided for SPs to install their cables through the main and redundant lead-in ducts inside the plot. The type and size of entry/pull boxes shall be selected to suit the characteristics of the building development. All lead-in ducts shall be designed in coordination with the design of other buried services.

4.5.1.5 BEP

The BEP may be the FCP interface between the feeder cabling and the in-building network if not completed within the MMC. The transition from outdoor to indoor cable shall be performed in the BEP within 2 m of the cable exiting the duct where either:

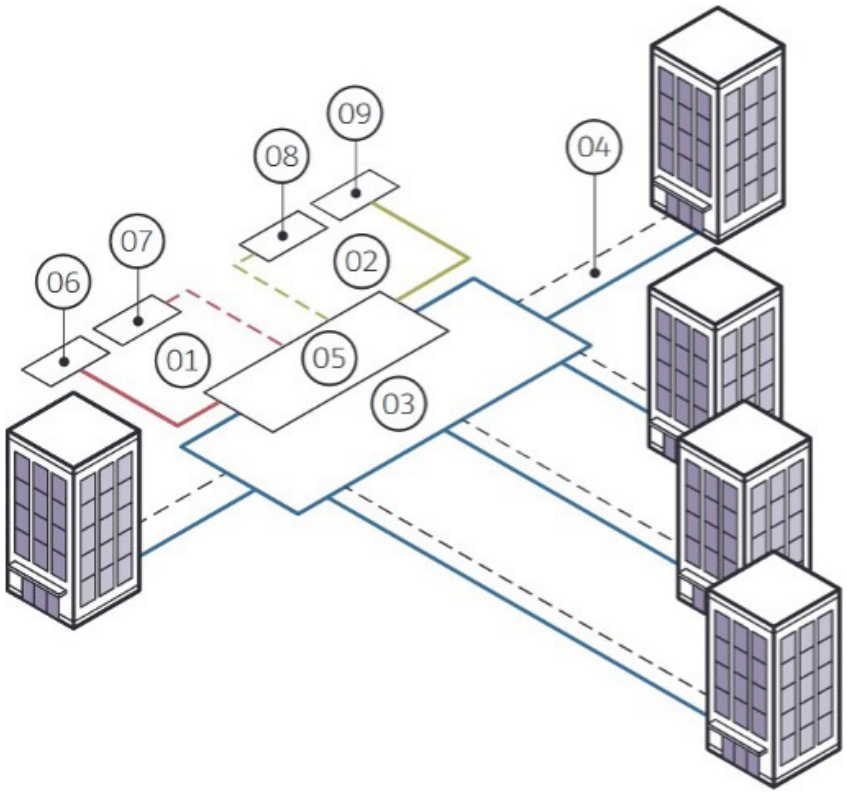
a) sheath material of OSP cables is not suitable for installation within buildings; or
b) metallic armouring forms part of the cable construction.

Where main and redundant lead-in ducts cannot be routed directly into the MTR, steel cable trays shall be provided from the BEP. The trays shall be located in common areas, and shall be easily accessible to allow cables to be added in future. The trays shall be covered if they are in an area accessible to the public and are less than 4.8 m above the floor.
A cable tray of minimum dimensions 300 mm × 100 mm (w × h) with heavy duty return flange (HDRF) shall be provided for each plot BEP (main and redundant).

4.5.2 Meet-me-room (MMR)

Where a need for one or more MMRs has been determined by the masterplan, the MMRs shall be positioned in accordance with the agreed site layout (see Figure G.5 and Figure G.6).

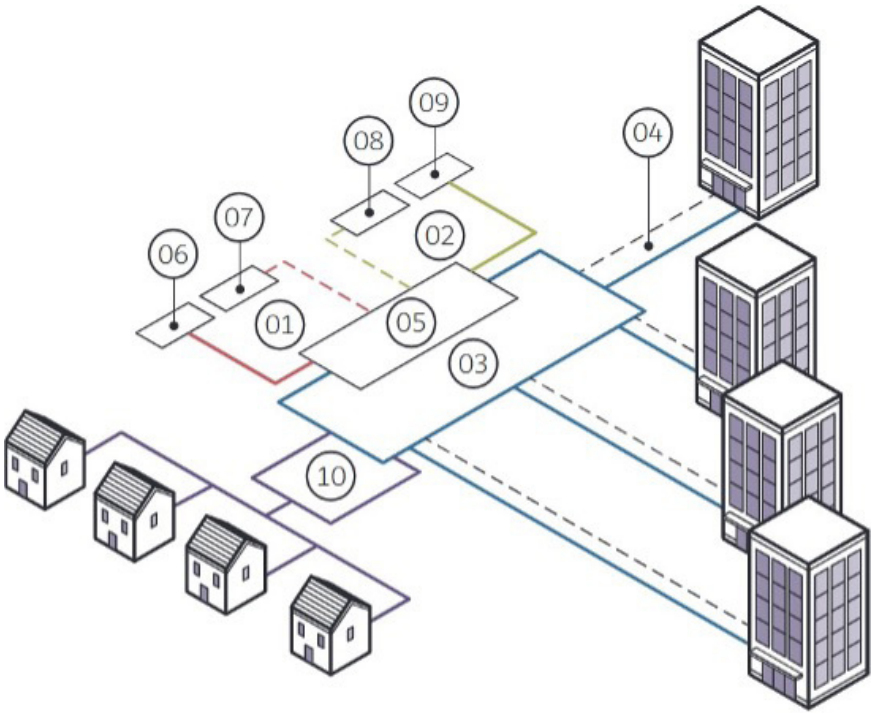
Figure G.5 Incorporation of single MMR in a commercial multi-building development



Key

— Main route cables
--- Redundant route cables
01 du feeder cables
02 Etisalat feeder cables
03 Distribution cables for buildings
04 Distribution cables for buildings by lead operator
05 MMR
06 du POP-A
07 du POP-B
08 Etisalat POP-B
09 Etisalat POP-A

Figure G.6 Incorporation of single MMR in a mixed use multi-building environment



Key

— Main route and cables
--- Redundant route and cables
01 du feeder cables
02 Etisalat feeder cables
03 Distribution cables for buildings
04 Distribution cables for buildings by lead operator
05 MMR
06 du POP-A
07 du POP-B
08 Etisalat POP-B
09 Etisalat POP-A
10 Distribution cables for villas

Inside plant common infrastructure specifications (ISP)

5 Inside plant common infrastructure specifications (ISP)

5.1 Telecom rooms

• 5.1.1 General

The following types of telecom rooms shall be provided based on the needs of the project.

a) main telecom room (MTR);
b) floor telecom room (FTR);
c) mobile service room (MSR)
d) rooftop mobile room (RTMR).

In multi-storey buildings, telecom rooms shall be vertically aligned and linked by a shared cable pathway. This cable pathway shall not reduce the minimum required room space.

All telecom rooms shall be for the sole use of SPs. The rooms shall be accessible to SP personnel 24 hours a day and be secured from unauthorized entry.

NOTE: It is common for a key to be kept with the facilities manager.

All telecom rooms shall conform to the fire safety requirements of UAE FLSC [Ref. G.2]. If the building developer has any concerns about access or the required fire safety provisions, these shall be highlighted at the design stage.

• 5.1.2 Location

Telecom rooms shall be located away from any sources of:

a) heat;
b) moisture;
c) corrosive atmospheric or environmental conditions; high voltages;
d) radio frequency interference (RFI); and electromagnetic interference (EMI).

Telecom rooms shall not be located directly beneath or next to wet areas such as showers, washrooms, swimming pools and garbage areas.

• 5.1.3 Maintenance

Telecom rooms shall be designed to be free of the following items unless otherwise indicated in this section:

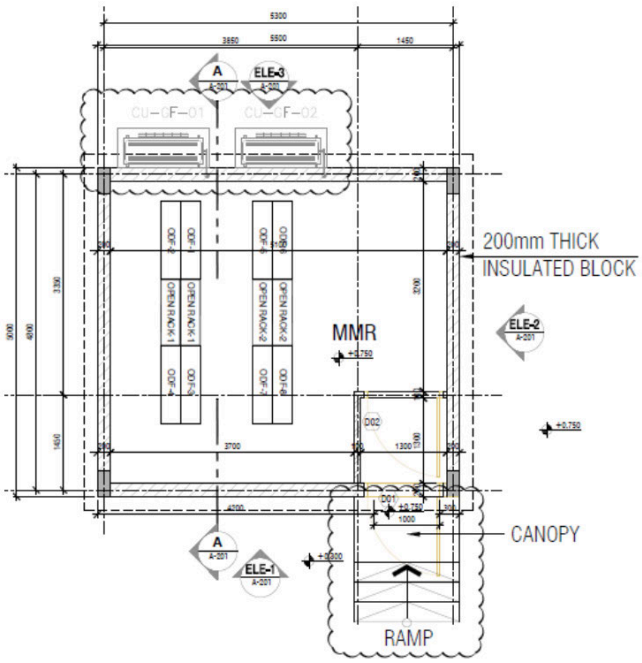
a) equipment not associated with the room;
b) utility pipes;
c) cables;
d) sprinkler systems;
c) windows.

5.1.4 Meet Me Room (MMR)

The requirements and services provision for MMR accordance with table

Parameter	MMR requirements
Minimum room size	Clear internal minimum size 5x5x4m
Layout Requirements	10x10m plot under lead operator ownership
Exist & Entrance Requirements	3.7m wide main Gate for the Boundary wall, 2Hrs fire rated 1m door for MMR with 1.8m wide ram
Floor Loading	250kg/sqm
Distance between each MMR Room	To be decided base on Master Plan of project
MMR capacity	1500 units
Cooling	Dedicated air conditioning system to maintain the temperature at 21 °C ± 1 °C and the relative humidity at 50% ± 10%.
The required height	Ground Floor only, MMR finished floor level should be 0.75m form from Interlock level (elevational height), 4m clear Hight within MMR

NOTE: A typical MMR layout is shown in below Figure



5.2 Main telecom rooms (MTRs)

The layout and service provision for MTRs shall be in accordance with Table G.3.

NOTE: A typical MTR layout is shown in Figure G.7.

MTR frame layouts shall be as detailed in Figure G.8 and Figure G.9.

Table G.3 Layout and service requirements for MTRs and FTRs

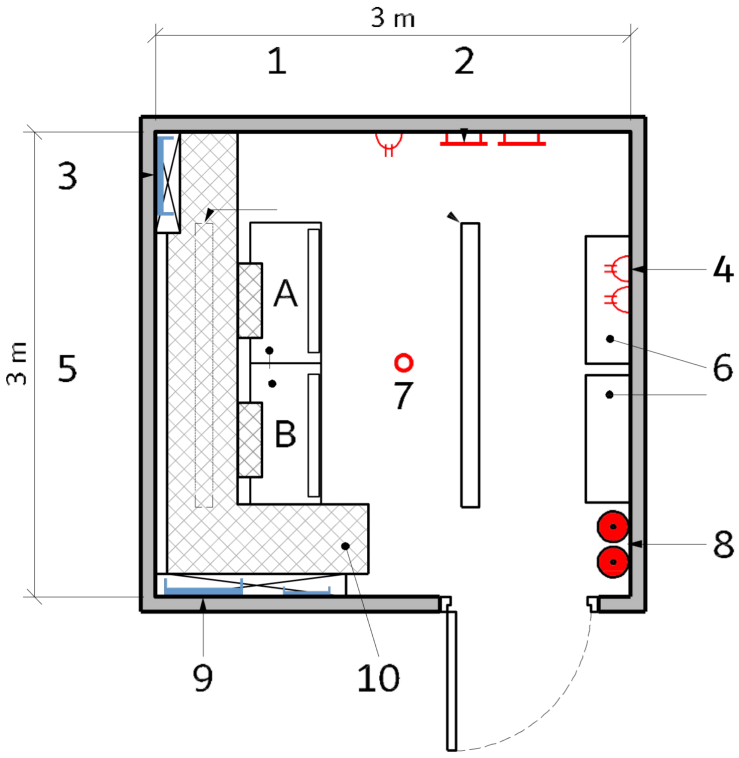
Parameter	Details and requirements		
	MTR (residential buildings)	MTR (commercial and mixed use buildings)	FTR
Purpose	Termination of telecom cables and housing telecom equipment.		The routing, splicing or termination of telecom cables.
Location	Ground or basement floor level. NOTE: Where single-tenant buildings have tenant IT server rooms, the MTR should be located adjacent to this position.		One per floor of multi-tenant buildings (e.g. commercial or residential buildings).
Minimum size and layout requirements	See Table G.2. This shall be reviewed based on the building use and number of tenants and the size increased accordingly. Room design shall enable safe and free access within the MTR. All equipment cabinets shall be provided with 1 m free space to the front and rear of every cabinet position. Wall-mounted equipment shall be positioned to provide safe and adequate working areas for the installation and maintenance of equipment.		See Table G.2.
Floor loading	10 kNm2 (distributed load).		10 kNm2 (distributed load).
Doors	Doors shall swing in the direction of egress with an automatic door closer system fitted on the hinged edge. Minimum opening of 1 m × 2.1 m (w × h). All doors shall be solid wood core or steel construction with a minimum fire resistance rating of 90 min.		Two doors shall swing in the direction of egress with an automatic door closer fitted on the hinged edges. At least one door shall be 810 mm wide in accordance with Ch. 3 of UAE FLSC [Ref. G.2]. Total minimum opening of 1.5 m × 2.1 m (w × h). All doors shall be solid wood core or steel construction with a minimum fire resistance rating of 90 min.
Labelling	Doors with du and Etisalat telecom room labels.		Doors with du and Etisalat telecom room labels.
Penetrations	All penetrations and openings to telecom rooms shall be protected or fire-stopped in accordance with Section 2 and Section 3, Ch. 1 of UAE FLSC [Ref. G.2]. All ducts directly entering a telecom room shall be water-sealed and gas-sealed.		All penetrations and openings to telecom rooms shall be protected or fire-stopped in accordance with Section 2 and Section 3, Ch. 1 of UAE FLSC [Ref. G.2]. All ducts directly entering a telecom room shall be water-sealed and gas-sealed.
Access requirement	In order to move equipment into and out of telecom rooms, access routes and doorways from outside the building to these rooms shall be greater than 1 m × 2.1 m (w × h).		Not applicable.

Parameter	Details and requirements		
	MTR (residential buildings)	MTR (commercial and mixed use buildings)	FTR
Wall and floor finish	Rooms shall be free of contaminants and pollutants. All walls, floors and ceilings shall be finished in such a way as to minimize dust and static electricity. Surfaces shall be painted with primer and a light-coloured finish coat.		Rooms shall be free of contaminants and pollutants. All walls, floors and ceilings shall be finished in such a way as to minimize dust and static electricity. Surfaces shall be painted with primer and a light-coloured finish coat.

Parameter	Details and requirements		
	MTR (residential buildings)	MTR (commercial and mixed use buildings)	FTR
Compartmenta-tion and egress	Rooms shall conform to the fire and life safety requirements of Table 1.9, Ch. 1 and the applicable sections of Ch. 3 to Ch. 10 of UAE FLSC [Ref. G.2].		Rooms shall conform to the fire and life safety requirements of Table 1.9, Ch. 1 and the applicable sections of Ch. 3 to Ch. 10 of UAE FLSC [Ref. G.2].
Fire suppression	Water sprinklers shall not be used. Rooms → 16 m2 in gross area shall be protected with clean agent as required by Table 9.30, Ch. 9 of UAE FLSC [Ref. G.2]. NOTE: CD permit the 10 m2 limit in Table 9.30 of UAE FLSC [Ref. G.2] to be increased to 16 m2.		Water sprinklers shall not be used. Clean agent suppression systems are not required in typical FTRs (see Ch. 9 of UAE FLSC [Ref. G.2]).
Fire extinguishers	One handheld CO2 cylinder extinguisher and one handheld multi-purpose powder extinguisher to be provided inside the room.		One handheld CO2 cylinder extinguisher and one handheld multi-purpose powder extinguisher to be provided inside the room.
Task lighting	Task lighting shall be provided to the front and rear face of equipment cabinets, with a minimum of 500 lux maintained at 1,000 mm above finished floor level (FFL).		Task lighting shall be provided to the front and rear face of equipment cabinets with a minimum of 500 lux maintained at 1,000 mm above FFL.
Emergency lighting	To be provided in accordance with Ch. 6 of UAE FLSC [Ref. G.2].		To be provided in accordance with Ch. 6 of UAE FLSC [Ref. G.2].
Smoke detectors	To be provided in accordance with Ch. 8 of UAE FLSC [Ref. G.2].		To be provided in accordance with Ch. 8 of UAE FLSC [Ref. G.2].
General power	Four 13 A twin sockets fed from the essential power supply with a dedicated 20 A circuit breaker.		One 13 A twin socket.
Telecoms power	Two ×32 A TP isolator fed with dedicated feeder from essential power supply (EDB).	Two × 40 A TP isolator fed with dedicated feeder from essential power supply (EDB).	Not applicable.

Parameter	Details and requirements		
	MTR (residential buildings)	MTR (commercial and mixed use buildings)	FTR
Earthing arrangements	Two ×32 A TP isolator fed with dedicated feeder from essential power supply (EDB).	Two × 40 A TP isolator fed with dedicated feeder from essential power supply (EDB).	One room earth bar.
Cooling design	All cooling shall be designed such that cold air is delivered to the front working face of the telecom equipment cabinets. This may be directly from the air handling unit (AHU) or by ducted supply. Return air shall be allowed to circulate to the AHUs naturally. AHUs shall be positioned such as to maintain efficiency of the system by avoiding mixing of the return air and cold air paths.		All cooling shall be designed such that cold air is delivered to the front working face of the telecom equipment cabinets. This may be directly from the air handling unit (AHU) or by ducted supply. Return air shall be allowed to circulate to the AHUs naturally. AHUs shall be positioned such as to maintain efficiency of the system by avoiding mixing of the return air and cold air paths.
Cooling	Air conditioning unit to maintain the temperature at 24°C.	Dedicated air conditioning system to maintain the temperature at 21 °C ± 1 °C and the relative humidity at 50% ± 10%. A/C system (ducted split FCU), duty and standby units with interlocking. A/C power from essential power supply (EDB). Heat dissipation 300 W m2/3 kW per rack.	Not applicable.

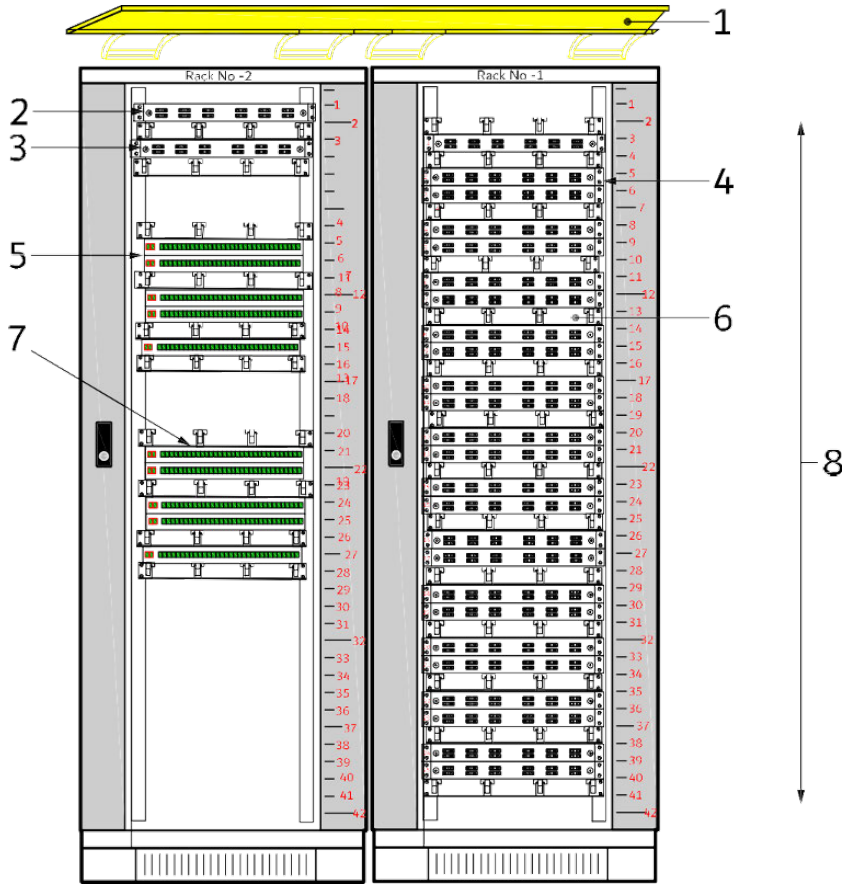
Figure G.7 Typical layout for a main telecom room (MTR) (m)



Key

1 Lighting (including emergency lighting per Ch. 6 of UAE FLSC [Ref. G.2)
2 AC clean earth bar
3 OSP fibre cable entry
4 General power 4 × 13 A twin sockets fed from essential power supply
5 Telecom power 2 × 40 A TP above racks from essential power supply
6 Air handling unit (duty and standby)
7 Fire detector(s)
8 2 × handheld fire extinguishers
9 Building riser
10 450 mm × 50 mm cable tray at high level
A Open rack
B Building ODF

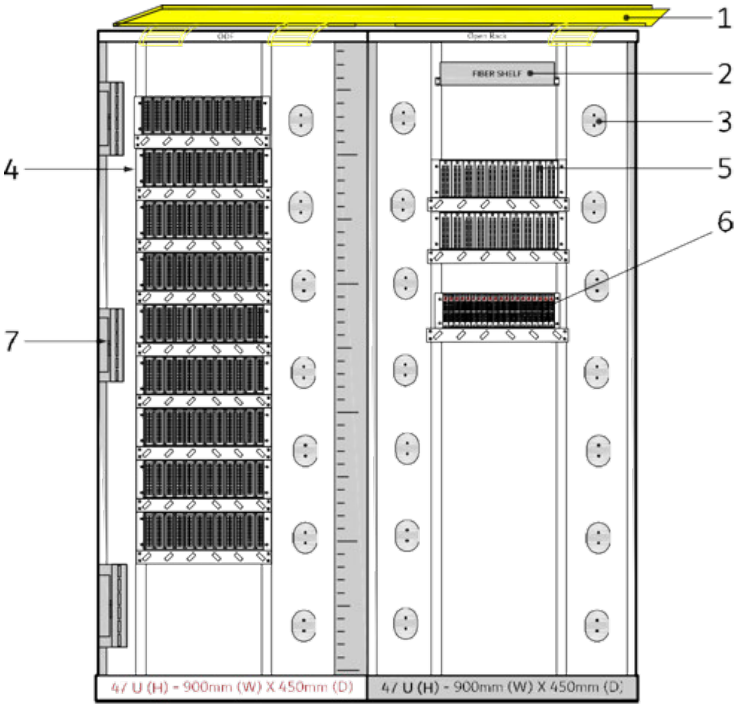
Figure G.8 MTR building fibre terminations using SC/APC optical patch panel



Key

1 High level overhead fibre pathways
2 Uplink fibre patch panels SC/APC (for main cable)
3 Uplink fibre patch panels SC/APC (for redundant cable)
4 24 port SC/APC optical patch panel – 1U
5 2 × 32 SC/APC splitters for Etisalat
6 Cable manager – 1U
7 2 × 32 LC/APC splitters for du
8 Building fibre cable termination

Figure G.9 MTR open rack elevation using SC/APC ODF



Key

1 High level overhead fibre pathways
2 Uplink fibre patch panels SC/APC
3 Cable guide
4 144-port high density SC/APC optical patch panel
5 10 high density connectorized 2 × 32 SC/APC splitters for Etisalat
6 10 high density connectorized 2 × 32 LC/APC splitters for du
7 Cable holder/lacing bar

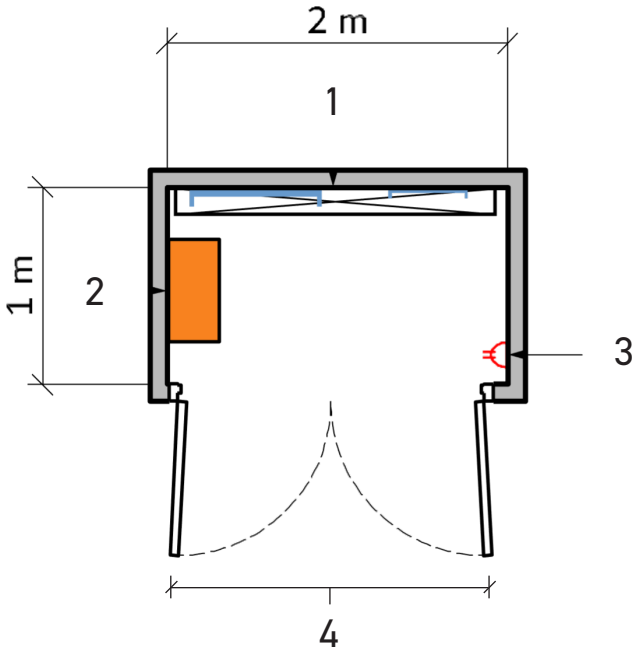
Floor telecom rooms (FTRs)

5.3 Floor telecom rooms (FTRs)

The layout and service provision for FTRs shall be in accordance with Table G.3. NOTE: A typical FTR layout is shown in Figure G.10.

The mini ODF layout shall be as shown in Figure G.11.

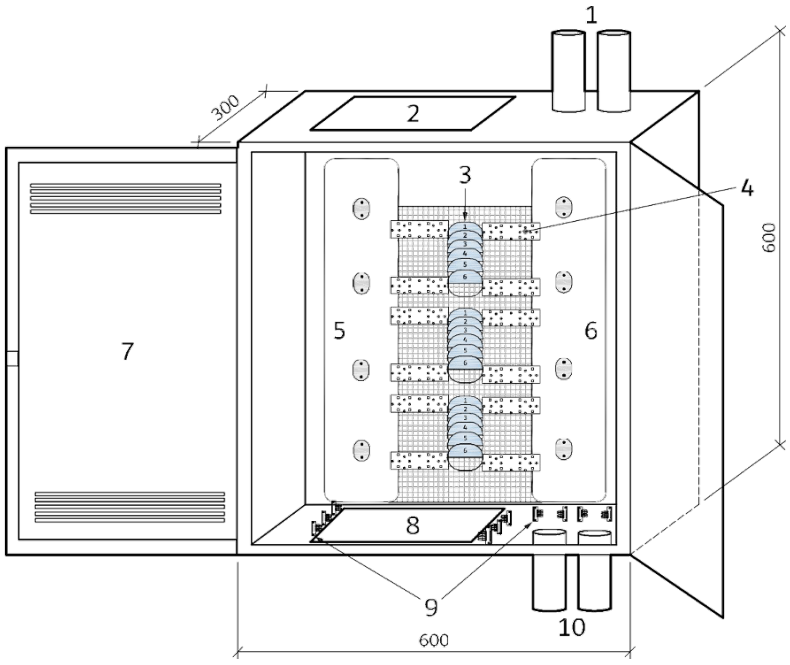
Figure G.10 Typical FTR room layout (m)



Key

1 Building riser and containment
2 Mini ODF (splice cabinet)
3 13A twin socket
4 1.5 m outward opening 90 min fire rated doors

Figure G.11 Mini ODF (splice cabinet) (mm)



Key

1 Cable entry for multicore indoor fibre cables
2 Opening for drop fibre cables from building rises
3 Flip type splice tray with storage capacity of 12-core fibres
4 Cable/tube holder
5 Storage space for drop fibre cables
6 Storage space for fibre tubes
7 Mini ODF (wall mount)
8 Opening for drop fibre cables from building rises
9 Cable holder
10 Cable entry for multicore indoor fibre cables

5.4 Mobile network services

• General

NOTE 1: The technologies associated with mobile/cellular network services are evolving and new requirements will arise over time. In all emirates, the FTTx SPs, du and Etisalat, are also the mobile network operators (MNOs).

The developer shall consult the MNOs at an early stage of design development to determine their specific requirements and any impacts on the design of the building(s). Guidance is provided in Table G.4.

Table G.4 Sizes of MSR and RTMR rooms

Number of floors	MSR Size (w × l × h)	RTMR Size (w × l × h)
Up to G+10	Not applicable.	3 m × 3 m × 3 m
G+11 to G+100	3 m × 3 m × 3 m (every 10 floors starting from the basement level/ground floor).	3 m × 3 m × 3 m
Shopping mall/bulk service buildings	To be determined in consultation with MNOs.	
Cluster of buildings with each having more than G+5 floors	To be determined in consultation with MNOs.	

The developer shall follow the requirements of the MNOs associated with mobile network services within buildings and surrounding outdoor areas.

NOTE 2: This includes, but is not limited to, provision of rooms and associated MEP services (e.g. cable pathways, electrical and mechanical) required by the MNOs to deploy any in-building and external infrastructure.

Rooftop mobile rooms (RTMRs)

An RTMR shall be provided by developers on all multi-tenant buildings.

Space shall be reserved on the rooftop for the installation of mobile service antennas.

NOTE: Antenna arrangements vary between buildings. They are typically positioned at the corners of buildings or on any raised structure on the rooftop.

The need for RTMR, coordination of position on the rooftop and detailed antenna arrangement shall be determined by the developer during consultation with the MNOs at the early design stage.

On sites with multiple buildings, the MNO consultation shall determine which buildings require an RMTR.

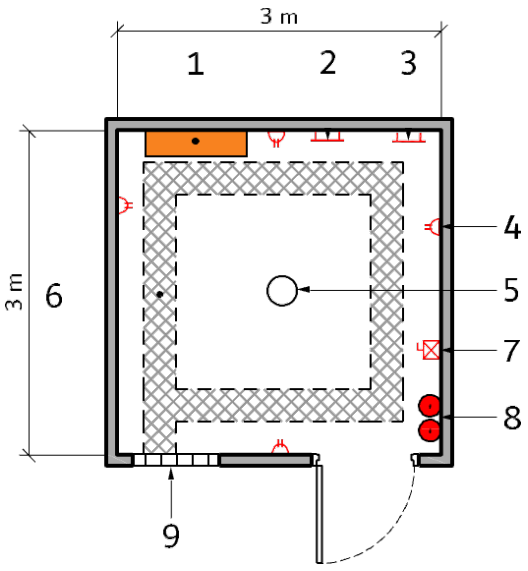
The layout and service provision for RTMRs shall be in accordance with Table G.5. NOTE: A typical RTMR layout is shown in Figure G.12.

Table G.5 Layout and service requirements for RTMRs and MSRs

Parameter	Details and requirements	
	RTMRs	MSRs
Purpose	Supports the deployment of installations for area mobile coverage.	Supports the deployment of installations for area mobile coverage.
Location	Rooftop	In all multi-tenant buildings which are above G+10 floors, provided on every 10th floor starting from the basement/ground floors. Where possible, located adjacent to the FTR position
Minimum size and layout requirements	3 m × 3 m × 3 m (w × l × h)	3 m × 3 m × 3 m room (w × l × h)
Floor loading	10 kNm2 (distributed load).	10 kNm2 (distributed load).
Doors	Door shall swing in the direction of egress with an automatic door closer system fitted on the hinged edge. Minimum opening of 1 m × 2.1 m (w × h). All doors shall be solid wood core or steel construction with a minimum fire resistance rating of 90 min.	Door shall swing in the direction of egress with an automatic door closer system fitted on the hinged edge. Minimum opening of 1 m × 2.1 m (w × h). All doors shall be solid wood core or steel construction with a minimum fire resistance rating of 90 min.
Labelling	Doors labelled as "Mobile Service Room". with standard EID & GID plate	Doors labelled as "Mobile Service Room". with standard EID & GID plate
Penetrations	All penetrations and openings to telecom rooms shall be protected or fire-stopped in accordance with Section 2 and Section 3, Ch. 1 of UAE FLSC [Ref. G.2]. All ducts directly entering a telecom room shall be water-sealed and gas-sealed.	All penetrations and openings to telecom rooms shall be protected or fire-stopped in accordance with Section 2 and Section 3, Ch. 1 of UAE FLSC [Ref. G.2]. All ducts directly entering a telecom room shall be water-sealed and gas-sealed.
Cable pathways	External antenna cable routes. Openings shall be 600 mm × 400 mm (w × h), 500 mm below the room ceiling in walls facing the building's rooftop area. Connected to building riser through 300 mm × 50 mm vertical cable tray.	Connected to building riser through 300 mm × 50 mm vertical cable tray.
Wall and floor finish	Rooms shall be free of contaminants and pollutants. All walls, floors and ceilings shall be finished in such a way as to minimize dust and static electricity. Surfaces shall be painted with primer and a light-coloured finish coat.	Rooms shall be free of contaminants and pollutants. All walls, floors and ceilings shall be finished in such a way as to minimize dust and static electricity. Surfaces shall be painted with primer and a light-coloured finish coat.
Compartmentation and egress	Rooms shall conform to the fire and life safety requirements of Table 1.9, Ch. 1 and the applicable sections of Ch. 3 to Ch. 10 of UAE FLSC [Ref. G.2].	Rooms shall conform to the fire and life safety requirements of Table 1.9, Ch. 1 and the applicable sections of Ch. 3 to Ch. 10 of UAE FLSC [Ref. G.2].
Fire suppression	Water sprinklers shall not be used. Rooms → 16 m2 in gross area shall be protected with clean agent as required by Table 9.30, Ch. 9 of UAE FLSC [Ref. G.2]. NOTE: CD permit the 10 m2 limit in Table 9.30 of UAE FLSC [Ref. G.2] to be increased to 16m^2.	Water sprinklers shall not be used. Rooms → 16 m2 in gross area shall be protected with clean agent as required by Table 9.30, Ch. 9 of UAE FLSC [Ref. G.2]. NOTE: CD permit the 10 m2 limit in Table 9.30 of UAE FLSC [Ref. G.2] to be increased to 16m^2.

Parameter	Details and requirements	
	RTMRs	MSRs
Fire extinguishers	One handheld CO2 cylinder extinguisher and one handheld multi-purpose powder extinguisher to be provided inside the room.	One handheld CO2 cylinder extinguisher and one handheld multi-purpose powder extinguisher to be provided inside the room.
Task lighting	Task lighting shall be provided to the front and rear face of equipment cabinets with a minimum of 500 lux maintained at 1,000 mm above FFL.	Task lighting shall be provided to the front and rear face of equipment cabinets with a minimum of 500 lux maintained at 1,000 mm above FFL.
Emergency lighting	To be provided in accordance with Ch. 6 of UAE FLSC [Ref. G.2]	To be provided in accordance with Ch. 6 of UAE FLSC [Ref. G.2]
Smoke detectors	To be provided in accordance with Ch. 8 of UAE FLSC [Ref. G.2].	To be provided in accordance with Ch. 8 of UAE FLSC [Ref. G.2].
General power	Four 13 A twin sockets fed from the essential power supply with a dedicated 20 A circuit breaker.	Four 13 A twin sockets fed from the essential power supply with dedicated 20 A circuit breaker.
Telecoms power	Two 63 A TP isolator fed with dedicated feeder from essential power supply (EDB).	Two 63 A TP isolators fed with dedicated feeder from essential power supply (EDB).
Earthing arrangements	Two room earth bars connected to dedicated earth pits with resistance less than 1 Ω.	Two room earth bars connected to dedicated earth pits with resistance less than 1 Ω.
Cooling design	All cooling shall be designed such that cold air is delivered to the front working face of the telecom equipment cabinets. This may be directly from the air handling unit (AHU) or by ducted supply. Return air shall be allowed to circulate to the AHUs naturally. AHUs shall be positioned such as to maintain efficiency of the system by avoiding mixing of the return air and cold air paths.	All cooling shall be designed such that cold air is delivered to the front working face of the telecom equipment cabinets. This may be directly from the air handling unit (AHU) or by ducted supply. Return air shall be allowed to circulate to the AHUs naturally. AHUs shall be positioned such as to maintain efficiency of the system by avoiding mixing of the return air and cold air paths.
Cooling	Dedicated air conditioning system to maintain the temperature at 21 °C ± 1 °C and the relative humidity at 50% ± 10%. A/C system (ducted split FCU), duty and standby units with interlocking. A/C power from essential power supply (EDB). Heat dissipation 36 kW.	Dedicated air conditioning system to maintain the temperature at 21 °C ± 1 °C and the relative humidity at 50% ± 10%. A/C system (ducted split FCU), duty and standby units with interlocking. A/C power from essential power supply (EDB). Heat dissipation 12 kW.

Figure G.12 Typical layout for RTMR and MSRs (m)



Key

1 Cross connect cabinet
2 AC clean earth bar
3 DC clean earth bar
4 32 A twin socket fed from utility power with dedicated circuit breaker
5 Smoke detector connected to BMS
6 300 mm width cable ladder at high level
7 2 × 63 A three phase isolator fed from essential building power
8 2 × handheld extinguishers
9 Opening for containments

Mobile service rooms (MSRs)

The layout and service provision for MSRs shall be in accordance with Table G.5. NOTE: A typical MSR layout is shown in Figure G.12.

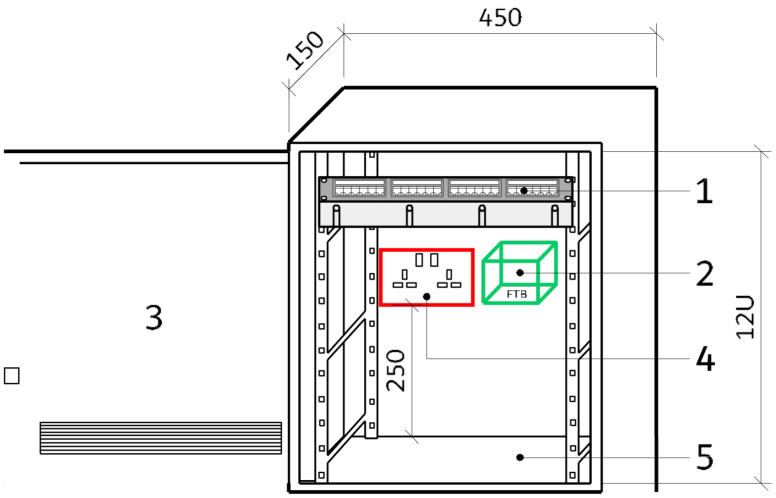
For major developments including malls, airports, stadiums and other large buildings all mobile service room provisions are subject to specific requirements to be agreed by the developer with the MNOs with consideration of the specific mobile capacity requirements of the development.

5.5 Apartment/office/retail consolidation cabinets

Each tenant space shall be provided with a consolidation cabinet (see Figure G.13 or Figure G.14) Each cabinet shall be capable of accommodating two telecom operators' requirements at the same time (see Figure G.15).

Optical fibre cabling from the FTR to each consolidation cabinet shall comprise one 4-core fibre cable.
Consolidation cabinets shall be provided in accordance with Table G.6.

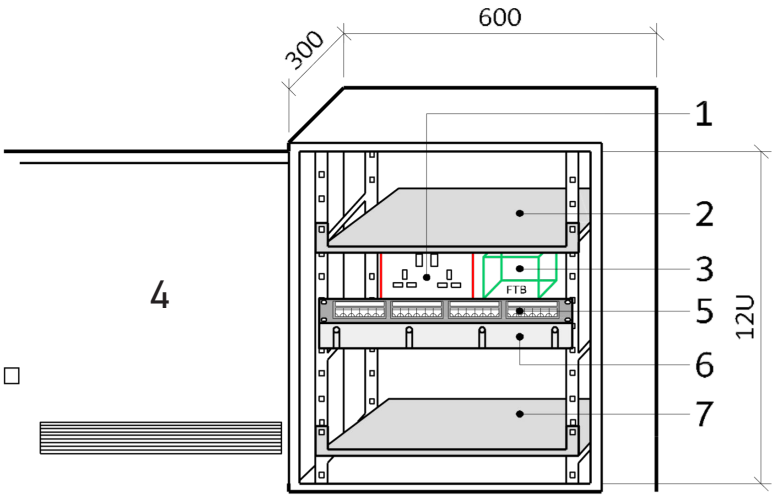
Figure G.13 Consolidation cabinet 450 mm × 150 mm – to serve premises up to 8-port



Key

1 Category 6 RJ45 patch panel – 1U and cable management panel – 1U
2 4 port fibre termination box (2-ports SC/APC and 2 ports LC/APC)
3 Perforated door
4 13 A twin socket (from dedicated circuit breaker)
5 Bottom area left with free space for operator's use

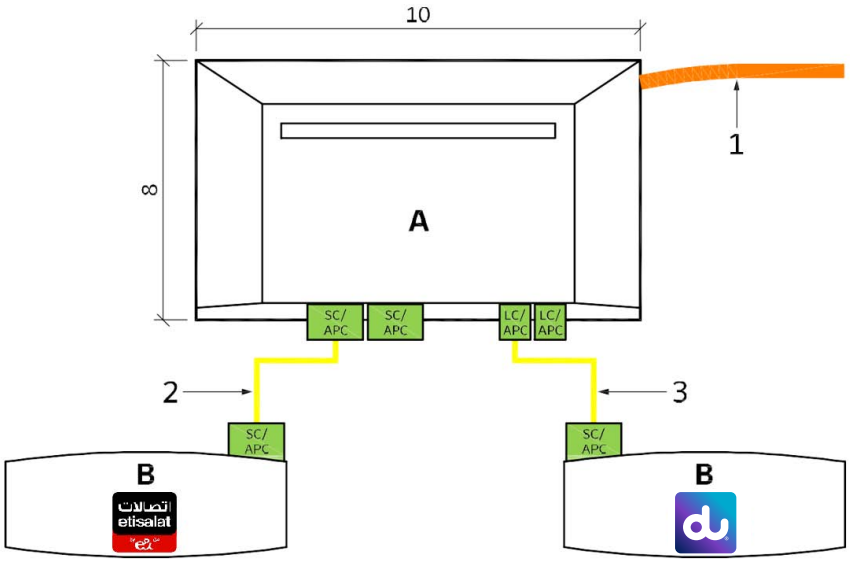
Figure G.14 Consolidation cabinet 600 mm × 300 mm – to serve premises more than 8-port



Key

1 13 A twin socket (from dedicated circuit breaker)
2 1U metallic shelf for Etisalat
3 4 port fibre termination box (2-ports SC/APC and 2 ports LC/APC)
4 Perforated door
5 Category 6 RJ45 patch panel – 1U
6 Cable management panel – 1U
7 1U metallic shelf for du

Figure G.15 Fibre termination box fitted within consolidation cabinet (cm)" in page 40



Key

1 4 core SM indoor drop fibre cable – flat cross-section
2 SC/APC to SC/APC simplex patch cord
3 LC/APC to SC/APC simplex patch cord
A Fibre termination box with 2-port SC/APC and 2-port LC/APC
B Optical network terminal

Table G.6 Minimum specifications for consolidation cabinet

Parameter	Details and requirements	
	Apartment/office/retail up to eight loaded copper port	Apartment/office/retail eight to 24 loaded copper ports
Minimum internal dimension (h × w × d)	12U, 450 mm × 150 mm	12U, 600 mm × 300 mm or 150 mm
Mounting location	Concealed in the wall with the front of the cabinet flush with the wall.	
Mounting restrictions	Located in an accessible area inside the tenant premises, close to the entrance and not inside the kitchen, pantry, washroom, laundry room or bedroom. Not close to sources of water or heat. Not close to any electrical distribution or bus bars.	
Mounting height	Installed with the bottom of the cabinet at a height of 600 mm to 1,200 mm above FFL, according to site conditions.	
Equipment clearance	1 m free space to the front of the cabinet.	
Area lighting	Minimum of 500 lux maintained at 1,000 mm above FFL.	
Ventilation	Minimum of one air change per hour.	
Copper cabling patch panel	24-port 450 mm copper patch panel.	24-port 600 mm copper patch panel.
Twisted pair copper cabling	24 copper cables or less per tenant.	More than 24 copper cables per tenant.
Cable management	Cable entries to accommodate incoming fibre optic and copper cables. Horizontal cable management for copper patch cables.	
Optical fibre termination	Fibre terminal box with adapters and pigtails for two LC/APC ports and two SC/APC ports for a 4-core SM fibre drop cable termination.	
Security	Lockable front door.	
Power	13 A dual socket outlet inside the consolidation cabinet, with dedicated circuit breaker on the domestic supply and not looped with other general power socket outlets.	
Labelling	Floor/flat number.	

Labour accommodation consolidation cabinet

5.6 Labour accommodation consolidation cabinet

General

The SP general internet service to labour accommodation buildings shall be provided as a dedicated service in each accommodation unit. Designs may allow for the future deployment of WiFi-based access.

A single MTR/MMR can serve multiple accommodation buildings on the same site. Where cable is run between buildings, the cable shall be internal/external grade. Cables shall be installed within a flexible sub-duct for all external routes, owing to their small diameter.

Consolidation cabinets shall be provided in accordance with Table G.7.

Each cabinet shall be capable of accommodating two-SP ONTs at the same time.

Copper cabling to final TO positions shall be a minimum specification of category 6. Developers may future-proof the installation through use of category 6A cabling, especially if future use of a WiFi overlay is anticipated.

Table G.7 Minimum specifications for consolidation cabinet

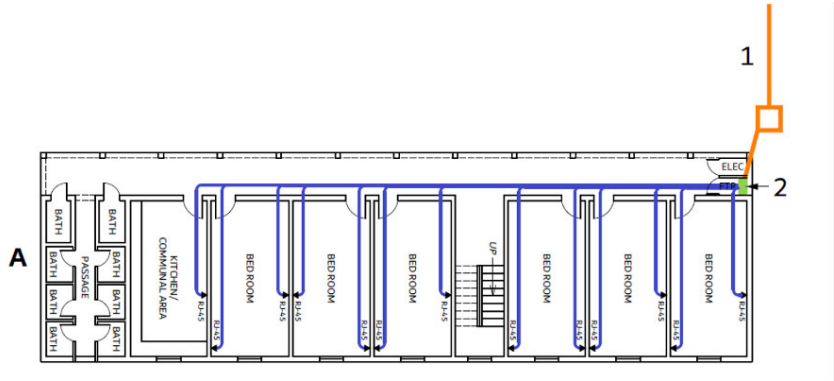
Parameter	Details and requirements	
	Accommodation building consolidation cabinet	Accommodation unit consolidation cabinet
Minimum internal dimension (h × w × d)	12U, 600 mm × 300 mm	12U, 450 mm × 150 mm
Mounting location	Concealed in the wall with the front of the cabinet flush with the wall.	
Mounting restrictions	Located in an accessible area inside the tenant premises close to the entrance and not inside the kitchen, pantry, washroom, laundry room or bedroom. Not close to sources of water or heat. Not close to any electrical distribution or busbars.	
Mounting height	Installed with the bottom of the cabinet at a height of 600 mm to 1,200 mm above FFL, according to site conditions	
Equipment clearance	An adequate safe working space around the location.	
Area lighting	Minimum of 500 lux maintained at 1,000 mm above FFL.	
Ventilation	Adequate ventilation shall be provided; minimum of one air change per hour.	
Copper cabling patch panel	One or more 24-port 600 mm copper patch panel as required.	24-port 450 mm copper patch panel.
Twisted pair copper cabling (maximum 90m cable length)	Cables as required per block area.	Up to 24 cables per unit.
Cable management	Cable entries to accommodate the incoming fibre optic and copper cables. Horizontal cable management for twisted pair patch cables.	
Optical fibre termination	Fibre terminal box with adapters and pigtails for two LC/APC ports and two SC/APC ports for a 4-core SM fibre drop cable termination.	
Security	Lockable front door.	
Power	13 A dual socket inside the consolidation cabinet with dedicated circuit breaker on the domestic supply and not loop with other general power sockets.	
Labelling	Accommodation building number.	Accommodation unit number.

Scenario 1: Low-density occupation/single occupier tenant organizations

In this scenario, the design shall allow individual buildings to be wired with copper cabling to the fixed TO positions for each accommodation unit's communal area televisions and telephones (see Figure G.16).

Designers shall provide the minimum number of cabinets required. Cabinets shall be located in a central position. Cabling can serve multiple building levels, maximizing the area covered by each unit, provided that cable lengths are within the 90 m permanent link limitation. One or two cabinets might be able to serve single or double storey accommodation blocks of up to 150 m building length.

Figure G.16 Copper cabling to each unit



Key

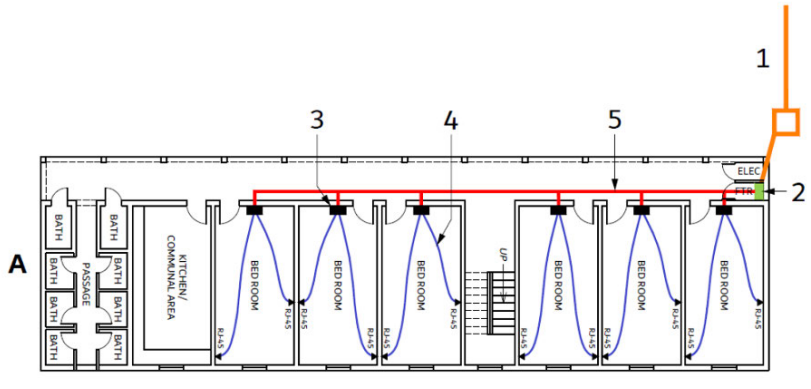
1 Manhole (600 × 600 × 900) mm with grade (A) cover positioned close to the building wall
2 Category-6 cable from each TO (RJ45) to FTR
A Ground floor plan

Scenario 2: High density occupation/multiple occupier tenant organizations

Where a more flexible service provision is required, the design shall feature optical fibre drop cabling directly from an FTR, MTR or MMR to a consolidation cabinet in each accommodation unit (see Figure G.17). Local copper cabling shall provide connections for services from the consolidation cabinet.

Each unit connection shall comprise one 4-core singlemode drop cable per cabinet.

Figure G.17 Fibre drop cable to each accommodation unit



Key

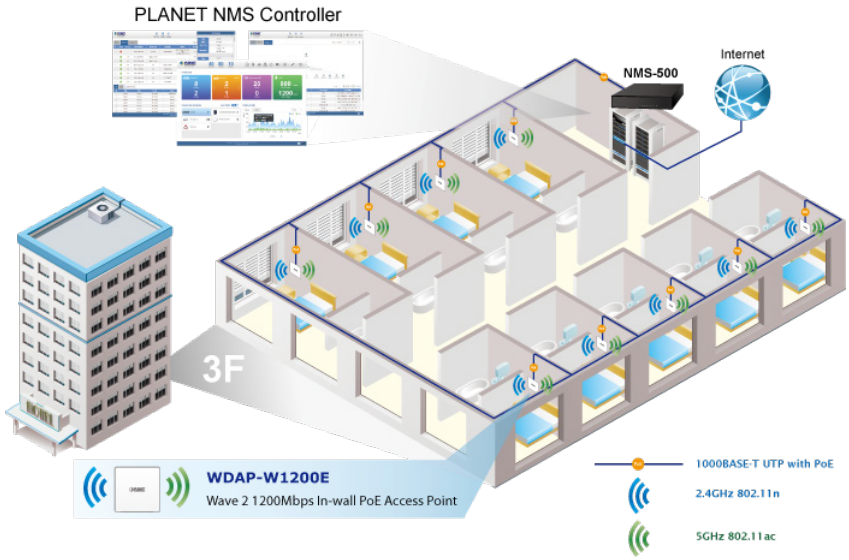
1 Manhole (600 × 600 × 900) mm with grade (A) cover positioned close to the building wall
2 Mini ODF splice cabinet
3 Consolidation cabinet
4 Category-6 cable from each copper TO (RJ45) to FTR
5 4 core drop fibre from FTR to consolidation cabinet in each room
A Ground floor plan

Scenario 3: serve labour accommodation with WIFI system

If the Building Owner would like to get the service through WIFI, he shall provide the required containments from FTR to WIFI drop point (one point inside each room as wall mount socket and one access point in corridor for each four rooms as ceiling mount) and provide containments for outdoor zone area points for every 50 square meter. Distance should not exceed 90 meter from FTR to any access point. In addition, the building owner to retained requirements form FTTH model:

- FTR spaces with same power and cooling requirements
- Containments form MTR to FTR
- RJ45 TO socket inside each room

WIFI system provisioning to be discussed with the SP during the construction stage



5.7 Business consolidation cabinet – Commercial shell and core

The developer shall provide one mini ODF in each FTR (see Table G.8 and Figure G.18).

Each FTR ODF shall have singlemode fibre cable connection to the MTR. This shall comprise multicore fibre cables with a minimum core count, to allow through-connection of four cores of fibre per 200 m2 of leasable space to support a two-SP design.

Multicore fibre cables shall be spliced on the dedicated splice trays in the ODF.
4-core singlemode drop cables shall be pulled for every 200 m2 of leasable floor space or to each tenant consolidation cabinet.

Drop cables shall be routed to the FTR mini ODF on the same building level.

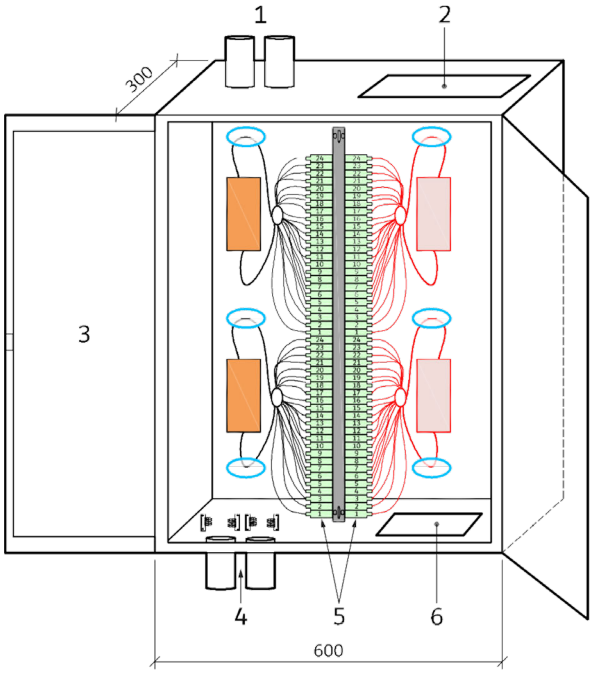
Drop cables shall be spliced on the dedicated splice trays in the ODF. All fibre cores shall be clearly labelled.

Tenant area distribution cables shall be coordinated directly between the building owner and the tenant.

Table G.8 Minimum specifications for consolidation cabinet

Aspect of cabinet	Minimum specification
Minimum internal dimension	600 mm × 600 mm × 300 mm (h × w × d)
Mounting location	Side wall of FTR.
Mounting height	1,500 mm above FFL. Fully loaded with pre-terminated SC/APC pigtail and SC/APC adaptors for SPs. Dedicated splice tray for multicore fibre cables. Dedicated splice trays for drop cables.
Fittings	Multicore SM fibre cable capacity from MTR to each FTR ODF. Minimum cable core count calculated for each floor, based on four fibre cores for every 200 m2 of leasable space +25% to support a two-SP design.
Fibre connectivity	Multicore cables spliced on dedicated multicore splice trays in the FTR ODF. 4-core SM drop cable from the FTR ODF for every tenant consolidation cabinet per 200 m2 of leasable floor space on the same level. Drop cables spliced on dedicated drop cable splice trays in the FTR ODF.
Security	Lockable panels all round. Lockable front door.
Cable entries	To accommodate the multicore SM fibre cables and drop fibre cables. To accommodate the incoming fibre optic cables.
Labelling	Floor number.

Figure G.18 Business consolidation cabinet, mini ODF provided in each FTR (mm)



Key

1 Cable entry for multicore fibre cables from MTR
2 Opening for drop fibre cables from tenants
3 Door
4 Cable entry for multicore fibre cables from MTR
5 AC/APC pigtails
6 Opening for drop fibre cables from tenants
Splice tray for splicing drop fibre cables
Splice tray for splicing multicore fibre cables
Adapter holder

5.8 Cable pathways

General

Cable pathway specifications shall conform to Table G.9.

The following requirements shall be met for risers and all cable trays, conduits, ducts and microduct pathway systems.

a) Pathways shall be designed such that installed cables do not exceed the minimum specified bend radius during or after installation.

b) Day one installation shall not exceed 50% of the cable tray capacity.

c) All cable trays shall be made from hot dip galvanized slotted steel and shall be of HDRF construction.

d) All metal parts shall be free from sharp edges and shall be earth bonded in accordance with ISO/IEC 30129.

e) Riser openings, slab penetrations and wall penetrations for pathways passing through fire-rated construction shall be sealed with approved fire-stopping material in accordance with Section 3, Ch.1 of UAE FLSC [Ref. G.2]. Fire-stopping shall be reinstated whenever cables are installed after completion of initial fire-stopping works.

f) Vertical pathways shall be continuous between all levels. There shall be no reduction of capacity through penetrations.

g) Pathways shall not run through areas exposed to:

    1) excessive heat (i.e. areas in direct sun or rooms with heat generating equipment);
    2) moisture;
    3) corrosive atmospheric or environmental conditions;
    4) high voltages;
    5) radio frequency interference (RFI)
    6) electromagnetic interference (EMI).

h) The separation of telecom and electrical pathways shall conform to ISO 14763-2.

i) Cable trays shall be easily accessible in common areas to facilitate any future provision of additional cables.

j) Cable trays in publicly accessible areas and less than 4.8 m above the floor level shall have removable protective covers.

k) All conduit junctions/pull boxes shall have minimum internal dimensions of 300 mm × 300 mm × 150 mm (W × H × D).

l) The developer shall select telecom riser locations to provide a continuous route through the building, and taking into account the location and distribution of other services. On some developments, multiple risers might be required to provide service resilience.

m) Risers and cable pathways allocated for SP use shall not be shared with landlord or tenant cabling systems. In specific developments where space optimization might be advantageous, the developer shall agree riser sharing principles for FTTx cabling and bespoke landlord/tenant cabling.

n) Minimum in-building service (IBS) pathways shall be adapted to accommodate specific design requirements of MNOs per development.

Table G.9 Cable pathway specifications

Parameter	Multi-tenant building	Warehouse and labour accommodation	Groups of towers
Risers	Two dedicated telecom risers. Riser one shall be in or adjacent to the FTR.	One dedicated telecom riser.	Two dedicated telecom risers. Riser one shall be in or adjacent to the FTR.
Slab opening	To allow vertical routing of IBS and telecom trays.	To allow vertical routing of telecom conduits.	To allow vertical routing of IBS and telecom trays.
Vertical pathway – riser	One 450 mm × 50 mm cable tray (telecom) One 300 mm × 50 mm cable tray (IBS)	Two 50 mm conduits (copper), junction/pull box per floor per conduit.	One 450 mm × 50 mm cable tray (telecom) One 300 mm × 50 mm cable tray (IBS)
Horizontal pathway – riser 2 to FTR	One 100 mm × 50 mm cable tray (telecom) One 100 mm × 50 mm cable tray (IBS)	Not applicable.	One 100 mm × 50 mm cable tray (telecom). One 100 mm × 50 mm cable tray (IBS)
Horizontal pathway – FTR to: a) common corridors b) lift lobbies c) podium levels d) basement levels	150 mm × 50 mm cable tray (IBS)	Not applicable.	150 mm × 50 mm cable tray (IBS)
Horizontal pathway – FTR to consolidation cabinet	200 mm × 50 mm corridor cable tray from FTR, small tray or conduit from corridor tray to consolidation cabinet.		
Horizontal pathway – FTR to consolidation cabinet (low-density buildings or permanent consolidation cabinet position)	200 mm × 50 mm corridor cable tray from FTR, small tray or conduit from corridor tray to consolidation cabinet. or Dedicated 50 mm conduit, one per route.		
Horizontal pathway – consolidation cabinet to telecom outlets	Not applicable.	One 25 mm conduit per dual copper outlet from cabinet. Increase conduit size if multiple dual outlets fed on the same route. Junction/pull boxes at sharp/90° bends or routes over 30 m.	Not applicable.
Horizontal pathway – MTR links (development with podium link level)	Not applicable.	Not applicable.	300 mm × 100 mm tray linking MTRs of each tower
Horizontal pathway – MTR links (development without podium link level)	Not applicable.	Not applicable.	OSP duct system, 2 × D54 (100 mm) ring of ducts between buildings, two entry points per building to OSP.

• Microduct

Horizontal microduct shall only be used when:

a) the consolidation cabinet locations are permanent;
b) the cable density is low;
c) the flexibility to modify routing is not required
d) the ducts in Table G.10 can be installed from the FTR to each tenant.

Table G.10 Microduct specifications

Parameter	Multi-tenant building	Warehouse
MTR to each FTR	One-way 12/8 mm microduct per required multicore cable + 30% spare empty microduct tubes	Not applicable.
MTR to each MSR	One-way 12/8 mm microduct per required multicore cable + 30% spare empty microduct tubes	Not applicable.
MTR to RTMR	One-way 12/8 mm microduct per required multicore cable + 30% spare empty microduct tubes	Not applicable.
FTR ODF to consolidation cabinet	Two-way 8/5 mm microduct (one tube for drop cable, one tube spare)	Two-way 8/5 mm microduct (one tube for drop cable, one tube spare)

5.9 Fibre termination components and GPON splitters

• Approved optical fibre components

All optical fibre components shall be selected from the approved product list held by SP

GPON splitter calculation per building

The number of GPON splitters required for each SP per building shall be calculated using Equation F.1.

Equation F.1
GPON splitters required for each SP per building = number of tenants/units of building ÷ 30 where:
30 is the downlink ports of (2 in × 32 out) splitters.

Two downlink ports of (2 in × 32 out) splitters shall be provided as spare ports for operational maintenance.
The number of GPON business splitters required for each SP per building shall be calculated using Equation F.2.

Equation F.2
GPON business splitters required for each SP per building = (Number of business tenants x 1.1) ÷ 8

• GPON optical splitter requirements

Optical splitters shall:

a) be planar light wave circuit (PLC) type;
b) have RoHS-compliant metal plating and plastic;
c) have the operating wavelength range 1,260 nm to 1,635 nm;
d) have the operating temperature range –24 °C to +85 °C; and
e) have dust covers on the uplink and downlink connectors.

In addition, optical splitters shall meet the following requirements.

1) (2 in × 32 out) optical splitters shall have the maximum insertion loss + connector loss (at operating wavelength from 1,260 nm to 1,635 nm) to ≤18 dB (for residential tenants).
2) (2 in × 8 out) optical splitters shall have the maximum insertion loss + connector loss (at operating wavelength from 1,260 nm to 1,635 nm) to ≤11 dB (for business tenants).

• High density connectorized modular splitter specification

High density (2 in × 32 out and 2 in × 8 out) connectorized modular splitters shall be used for buildings of more than 100 units. They shall meet the following requirements.

a) The modular splitters shall be fitted inside the splitter chassis (sub-rack).
b) Each splitter chassis (sub-rack) shall be 483 mm (19 in) with in-built cable management facility to route the uplink and downlink fibre patch cords.
c) Each splitter chassis (sub-rack) shall have eight (2 in × 32 out) modular splitters with LC/APC connector type.
d) Each splitter chassis (sub-rack) shall have four (2 in × 32 out) modular splitters with SC/APC connector type.
e) Each splitter chassis (sub-rack) shall have 12 (2 in × 8 out) modular splitters with operator specific connector type.
f) Each splitter chassis (sub-rack) shall be 3U to 4U in height.
g) Each modular splitter shall have visible label holder for unique identification.
h) The modular splitters shall have an easy snap-in design which requires no tools.
i) For du, uplink and downlink ports of (2 in × 32 out and 2 in × 8 out) modular splitters shall have LC/APC connectors.
j) For Etisalat:
    2) for buildings up to 256 units, (2 × 32) and (2 × 8) patch-free splitters with splicing trays shall be provided;
    3) for buildings of 256 or more units, uplink and downlink ports of (2 in × 32 out and 2 in × 8 out) modular splitters shall have SC/APC connectors.

• Low-density connectorized splitter specification

Low-density (2 in × 32 out and 2 in × 8 out) connectorized splitters shall be used for a building with less than 100 units. They shall meet the following requirements.

a) Low-density splitters shall be 19 in, 1U, rack mountable.
b) Low-density splitters shall have an in-built cable management facility to route the uplink and downlink fibre patch cords.
c) Uplink and downlink ports of (2 in × 32 out and 2 in × 8 out) splitters shall have LC/APC connectors for du.
d) For buildings with less than 256 units, (2 × 32) and (2 × 8) optical patch-free splitters with splicing trays shall be provided for Etisalat.
e) Each splitter shall have two uplink ports (two inputs). The uplink ports of splitters with uplink patch panels shall be connected in the following order:
    1) the first uplink port of splitter shall be connected to the main uplink patch panel;
    2) the second uplink port of splitter shall be connected to the redundant uplink patch panel.

• Multicore fibre cable termination

Fibre termination components shall be provided to splice multicore singlemode fibre cables with 4- core SM drop cables. Termination components shall meet the following requirements.

a) 4-port fibre terminal box (with LC/APC and SC/APC pigtails and adaptors) inside the 12U cabinet of tenant premises (office/retail/warehouse);
b) fully loaded high- or low-density fibre patch panels with adaptors and pigtails inside MTR for SPs;
c) FTR mini ODFs with splice trays to splice multicore fibre cables with respective 4-core drop cables.

5.10 Fibre and copper cables

General

All cables (and connecting accessories) shall be selected from the approved product list held by SPs.

All fixed and permanently installed telecom cables within a building shall be halogen-free, achieve a minimum rating of Euroclass Cca-s1b, d2, a2 when tested in accordance with BS EN 13501-6 and be CE marked.

NOTE: CE marking represents a manufacturer's declaration that products conform to the applicable manufacturing and testing standard.

All other cables, microduct and conduit including patch cords shall meet the minimum requirements of IEC/EN 60332-1-2.

Unless for a specific development type, fibre optic cables shall be supplied, spliced, labelled and tested inside the MTR, FTR, and consolidation cabinets by the developer. This shall include the supply and installation of fibre optic cables and their related accessories.

The fibre optic design shall be based on building type, number of tenant units and structure. All fibre cables shall be continuous lengths free from joints and splices.

A minimum of 25% spare fibre cores shall be included in the design while calculating multicore fibre core capacity, to allow for maintenance and additional service demands.

All optical fibre testing shall be completed in accordance with ISO/IEC-14763-3. The optical fibre cable required shall have the common general specifications of:

a) singlemode;
b) indoor grade;
c) cable jacket and microducts to be halogen-free and flame-retardant material (LSZH type);
d) air blown micro-cable in accordance with ITU-T G.657 A1/A2;
e) fibre optic colour coding in accordance with ISO 11801-1;
f) microducts for air blown micro-cables installation
g) bend-insensitive. Drop fibre cable shall be:
    1) flexible drop fibre; and
    2) 4-core cable, flat cross-section. Multicore fibre cable shall:
i) be flexi-tube (gel free) micro-cable/micro-bundle cable of 24 fibre cores and above
ii) have a tight buffer structure up to 12 fibre cores.

• Villa complexes and warehouses

For villa complexes and warehouse developments, the SP shall provide the fibre optic cables.

The developer shall supply the consolidation cabinet and a 4-core fibre termination box installed inside the consolidation cabinet.

For the scenario where the landlord / developer has added multiple of villas or warehouses under single plot:

a) SP shall not take responsibility for changes in Master Plan.
b) Each Villa/Town House has to be treated as a separate plot.
c) Extra House connections required to be done by the owner / building contractor.
d) Entire Connections done by the owner / building contractor shall be after obtaining the required NOC from the SP and under his supervision and the same to be applied for all similar cases.

• MTR to consolidation cabinet (direct fibre)

Direct fibre installation may be applied in mixed use developments of low-rise buildings, accommodation blocks and/or villa complexes having a common MTR.

The fibre optic cables shall be provided from the MTR to each consolidation cabinet. The fibres shall pass through the FTR and shall be continuous lengths, free from joints, branches or patching.

• MTR to FTR mini ODF (multicore fibre)

Multicore fibre installation may be installed in high-rise buildings, malls or other large buildings, based on building type, quantity of tenant units and structure.

The number of fibre cores required per floor FTR is calculated as shown in Table G.11. The multicore fibre cable shall be provided from the MTR to the mini ODF inside the FTR.

Table G.11 Fibre provision relative to tenant numbers

Number of tenants per building	Number of fibre cores per building (two core fibre each for two SPs)	MTR optical patch panels (simplex SC/APC ports)	Rack/ODF size
0 to 150	(Total number of tenants × 4-core) +25%	Total fibre cores per building / 24 = No. 24-port patch panels	Free standing rack 42U 800 mm × 800 mm (W × D)
151 to 300		Total fibre cores per building / 144 = No. 144-port patch panels	Floor-mounted ODF 47U 900 mm × 450 mm (W × D)
301 to 600			Floor-mounted ODF 47U 900 mm × 450 mm (W × D)

Locations of mini ODFs in a high-rise buildings shall start from the first floor and then cover a maximum of three floors. For example, a mini ODF installed at the first floor shall cover the first, second and third floors, the next mini ODF location shall be on the fourth floor serving the fourth, fifth and sixth floors, the next mini ODF shall be on the seventh floor, etc.

Multicore fibre cables shall be directly spliced to 4-core fibre cables using the mini ODF cabinet inside the FTRs.

Multicore fibres shall be terminated directly into optical patch panels in the MTR. These patch panels shall be used to patch to each SP's splitter.

All fibre optic cables shall be supplied, spliced, labelled and tested inside the MTR and FTRs. Detailed fibre cores shall be allocated in accordance with Table G.12.

For buildings with less than 256 units, patch-free splitters shall be used for Etisalat.

Feeder cables shall be directly spliced with the splitter inputs and fixed in the splicing trays.
Splitter outputs shall be spliced with the fibre pigtail cords and terminated in the optical distribution patch panels.

• MTR To MTR (cluster of buildings in single plot)

Multicore Fibres shall be installed between the main MTR (where OSP fibre is terminated) and the sub MTR of other buildings. Fibre quantity will depend on the number of splitters, number of units and number of GSM rooms.

Table G.12 Building fibre termination core assignments by using 483 mm (19 in) 1U – 24-port SC/APC optical patch panel

Details and requirements		Horizontal distribution	Vertical distribution		Building MTR		
Tenant No.	4-port fibre terminal box with 2 LC/APC and 2 SC/APC	4-core indoor SM Drop fibre cables	Wall mount splice cabinet with 24 fibre splice tray capacity	24-core indoor SM multicore fibre cable - micro module/flexi- tube	24port SC/APC optical patch panel	Etisalat – 2 × 32 SC/APC GPON splitter	du – 2 × 32 LC/APC GPON splitter
Tenant 1	Port-1 - SC/APC - Etisalat	Blue - core - 1	Splice tray - 1	Blue - core - 1	SC/APC-Port-1	ETC, splitter downlink port-1	
	Port-2 - SC/APC - Etisalat	Orange - core - 2	Splice tray - 1	Orange - core - 2	SC/APC-Port-2		
	Port-3 - LC/APC - du	Green - core - 3	Splice tray - 1	Green - core - 3	SC/APC-Port-3		du, splitter downlink port-1
Tenant 2	Port-4 - LC/APC - du	Brown - core - 4	Splice tray - 1	Brown - core - 4	SC/APC-Port-4		
	Port-1 - SC/APC - Etisalat	Blue - core - 1	Splice tray - 1	Slate - core - 5	SC/APC-Port-5	ETC, splitter downlink port-2	
	Port-2 - SC/APC - Etisalat	Orange - core - 2	Splice tray - 1	White - core - 6	SC/APC-Port-6		
	Port-3 - LC/APC - du	Green - core - 3	Splice tray - 1	Red - core - 7	SC/APC-Port-7		du, splitter downlink port-2
	Port-4 - LC/APC - du	Brown - core - 4	Splice tray - 1	Black - core - 8	SC/APC-Port-8		
Tenant 3	Port-1 - SC/APC - Etisalat	Blue - core - 1	Splice tray - 1	Yellow - core - 9	SC/APC-Port-9	ETC, splitter downlink port-3	
	Port-2 - SC/APC - Etisalat	Orange - core - 2	Splice tray - 1	Purple - core - 10	SC/APC-Port-10		
	Port-3 - LC/APC - du	Green - core - 3	Splice tray - 1	Pink - core - 11	SC/APC-Port-11		du, splitter downlink port-3
	Port-4 - LC/APC - du	Brown - core - 4	Splice tray - 1	Aqua - core - 12	SC/APC-Port-12		
Tenant 4	Port-1 - SC/APC - Etisalat	Blue - core - 1	Splice tray - 1	Blue/black stripe - core - 13	SC/APC-Port-13	ETC, splitter downlink port-4	
	Port-2 - SC/APC - Etisalat	Orange - core - 2	Splice tray - 1	Orange/black stripe - core - 14	SC/APC-Port-14		
	Port-3 - LC/APC - du	Green - core - 3	Splice tray - 1	Green/black stripe - core - 15	SC/APC-Port-15		du, splitter downlink port-4
	Port-4 - LC/APC - du	Brown - core - 4	Splice tray - 1	Brown/black stripe - core - 16	SC/APC-Port-16		
Tenant 5	Port-1 - SC/APC - Etisalat	Blue - core - 1	Splice tray - 1	Slate/black stripe - core - 17	SC/APC-Port-17	ETC, splitter downlink port-5	
	Port-2 - SC/APC - Etisalat	Orange - core - 2	Splice tray - 1	White/black stripe - core - 18	SC/APC-Port-18		
	Port-3 - LC/APC - du	Green - core - 3	Splice tray - 1	Red/black stripe - core - 19	SC/APC-Port-19		du, splitter downlink port-5
	Port-4 - LC/APC - du	Brown - core - 4	Splice tray - 1	Black - core 20	SC/APC-Port-20		
Tenant 6	Port-1 - SC/APC - Etisalat	Blue - core - 1	Splice tray - 1	Yellow/black stripe - core - 21	SC/APC-Port-21	ETC, splitter downlink port-6	
	Port-2 - SC/APC - Etisalat	Orange - core - 2	Splice tray - 1	Purple/black stripe - core - 22	SC/APC-Port-22		
	Port-3 - LC/APC - du	Green - core - 3	Splice tray - 1	Pink/black stripe - core - 23	SC/APC-Port-23		du, splitter downlink port-6
	Port-4 - LC/APC - du	Brown - core - 4	Splice tray - 1	Aqua/black stripe - core - 24	SC/APC-Port-24		

• FTR mini ODF to consolidation cabinet

4-core fibre cables shall be provided from each consolidation cabinet to its respective mini ODF inside the FTR (see Table G.13).

Each fibre cable shall be directly spliced to multicore fibre cables within the FTR mini ODF.

Table G.13 4-core fibre cables core assignments, two connected SPs

Fibre core	Port number	Assign to
1 - Blue	1-SC/APC	1-SC/APC
2 – Orange	2-SC/APC	2-SC/APC
3 - Green	3-LC/APC	3-LC/APC
4 - Brown	4-LC/APC	4-LC/APC

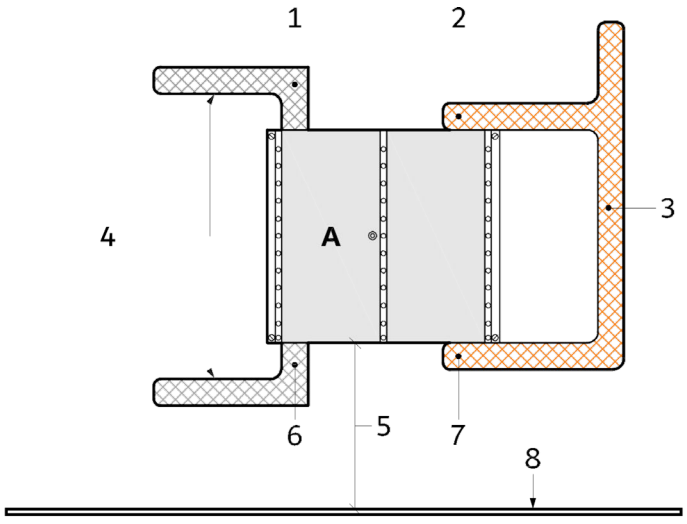
• MTR to each MSR and the RTMR

To enable IBS connectivity within each building, the developer shall provide a pre-terminated cross-connect cabinet installed at each MSR and in the rooftop room. The cross-connect cabinet position, mounting arrangement and cabinet elevation shall conform to Figure G.19 and Figure

G.20. The cabinet shall:

a) have a minimum size of 600 mm (W) × 150 mm (D); and
b) accommodate 24 SC/APC pigtail and adaptors. In addition, the following requirements shall be met.
1) 24-core fibre cables shall be installed from the MTR to each MSR and to the RTMR.
2) 24-core fibre cables shall be terminated inside the MTR rack using 483 mm (19 in), 24-port SC/APC fibre patch panel.
3) 24-core fibre cables shall be terminated inside the cross-connect cabinets in the MSR and rooftop rooms:
i) cores 1 to 12 shall be allocated to connect Etisalat IBS equipment;
ii) cores 13 to 24 shall be allocated to connect du IBS equipment.

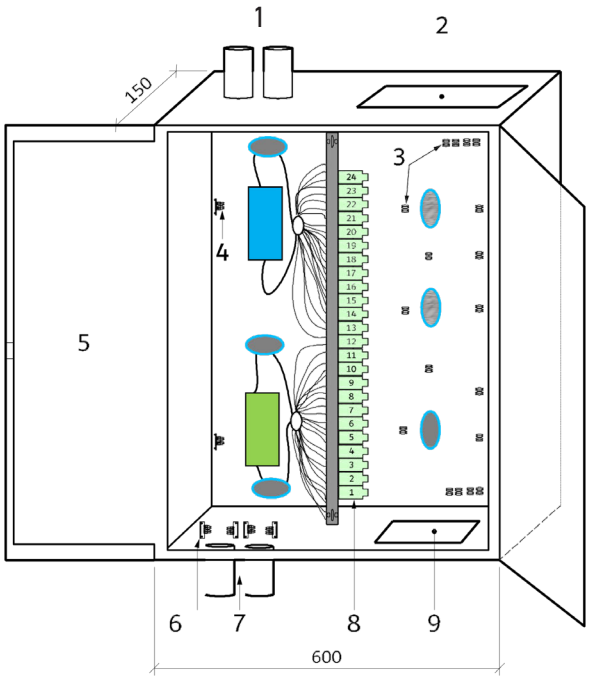
Figure G.19 Cross-connect cabinet mounting detail (inside RTMR)



Key

1 Top cable entry for fibre cables
2 Top entry for fibre patch cords
3 PVC trunking to route fibre patch cords
4 Cable tray
5 1,500 mm from FFL
6 Bottom cable entry for fibre cables
7 Bottom entry for fibre patch cords
8 Finish floor level (FFL)
A Cross connect cabinet

Figure G.20 Cross-connect cabinet – elevation layout



1 Cable entry for 24-core fibre cables from MTR
2 Opening for fibre patch cords
3 Velcro
4 Tube holder
5 Door
6 Cable holder
7 Cable entry for 24-core fibre cables from MTR
8 SC/APC pigtails and adapters
9 Opening for fibre patch cords

12 slot splice tray –for Etisalat (cores 1 to 12 of MTR cable)

12 slot splice tray –for du (cores 13 to 24 of MTR cable)

Adaptors and pigtails

Ring to manage fibre patch cords, fibre pigtails and buffer tubes

• Category 6 copper cabling

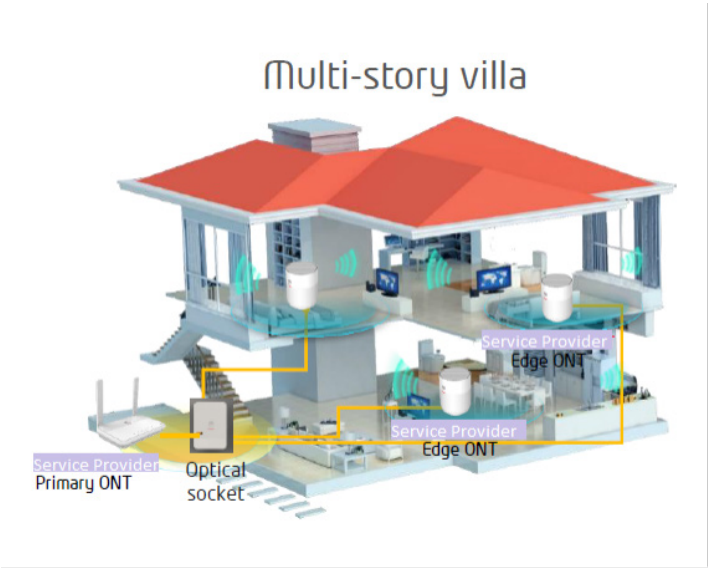
To deliver services from the consolidation cabinets to building outlets, twisted pair copper cables shall be provided. The full design is the responsibility of the developer; however, the following minimum requirements shall be met for the efficient and effective provision of services.

a) The cables shall conform as a minimum to the requirements for category 6 cabling as specified in ISO 11801-1.
b) The wiring shall be a star topology from the consolidation cabinet.
c) Dual RJ45 TOs with spring load sliding shutters shall be provided wherever service is required.
d) Design shall include additional spare TOs to provide service flexibility for tenants.
e) Each socket in the dual RJ45 outlet shall be wired back to the consolidation cabinet with an individual cable.
f) TOs shall not be cascaded or looped.
g) Cable pairs shall not be split between outlets.
h) The permanent link cable length from consolidation cabinet to TO shall not exceed 90 m.
i) Cable lengths shall be de-rated where required due to local temperature conditions and cable specifications to enable end-to-end error-free channel performance up to 1 Gbps for category 6 and 10 Gbps for category 6A.
j) At the consolidation cabinet, copper cables shall be terminated on an RJ45 patch panel and labelled with the socket and outlet served. Terminations shall be to the TIA 568B pair scheme.
k) In each TO, each cable shall be terminated such as to maintain the twists in each pair up to the termination. The termination shall be in accordance with the selected manufacturer's installation instructions.
l) Strain relief shall be provided at the terminated ends of each cable.
m) The components of the system shall all be of the same category (6 or 6A) and type (UTP or STP), and from a single manufacturer, to ensure optimum performance and compatibility.
n) The results from copper cable tests shall be recorded and retained for future reference.

• Extra requirements for Fibre To The Room solution (Optional)

If the building owner would like to support high reliable, large bandwidth bearing capabilities and long-term involution compatibility, the transmission medium is a key factor. Based on the successful experience of fibre deployment in transmission and access network, the industry proposes a new-generation solution based on fibre networking which is called FTTR (fibre-to-the-room). The fibre is characterized by small size, light weight, 30-year ultra-long service life, no electromagnetic interference, and unlimited bandwidth evolution. This feature provides a new option for on-premises networking. Fibre-to-room extends fibre into each room of house which is a further step of FTTH.

The picture bellow shows an overview of the networking of FTTR technology:

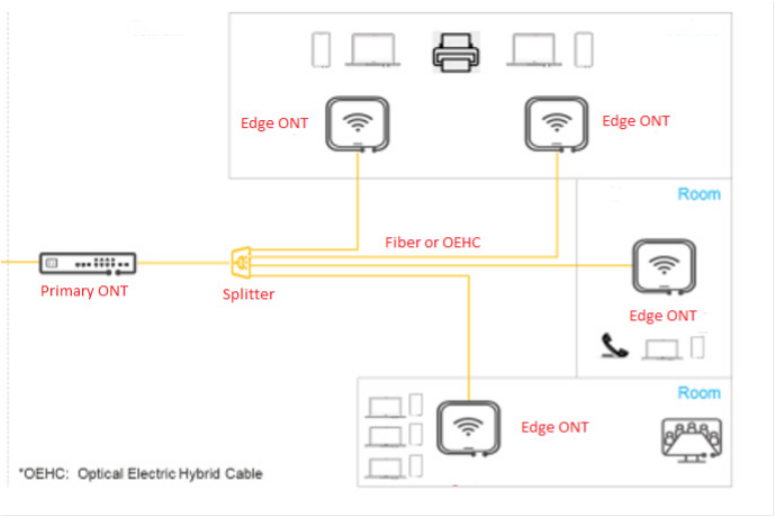


General guidance for on-premises fibre cabling

In addition to copper cabling within the tenant space (e.g. multi-tenanted commercial/retail building, home, unit, flat, apartment, single family home or similar), the building owner to lay fibre cabling from the consolidation cabinet to the access points in each room. Following are some general guidance for residential scenario and business scenario.

a) To provide ultimate experience assurance with ultra-gigabit bandwidth, seamless roaming, quick switching, and long-term evolution compatibility, the fibre should be deployed to each of the room in the unit (Living room, bed room, Study room, etc.)
b) To lay 2-core flat profile LSZH indoor drop fibre cable between the consolidation cabinet and the TO socket can adopt G.657A2 optical fibres according to static bending conditions. The cables are used to connect the Primary ONT and Edge ONT. Drop cables to be terminated on SC/APC ports Fibre Termination Box or Fibre Patch Panel at consolidation cabinet side, and on SC/APC fibre optic wall socket at room side with proper labeling showing TO number. TO should be at 40cm form floor finish nearby power socket. Can be ceiling mounted with dedicated power extension. Note: Owner can use different type of optical fibre called Optical/electrical hybrid fibre cable which is a composite cable that integrates optical fibres and transmission copper lines. It can provide data transmission and remote power supply for devices at the same time. In scenarios where power is not easily available, optical/electrical hybrid fibre cable are required to remotely supply power to the slave FTTR units and transmit data
c) To install splitter (i.e 1 x 4 SC/APC or 1 x 8 SC/APC, etc.) ratio size is equal to number of rooms and shall be fitted inside the consolidation cabinet, supply patch cords and pre- patching the fibre patch cords between splitter to FTB or fibre patch panel
d) The fibre can be laid from the consolidation cabinet to each room through concealed pipe line in the wall. It is suggested to use low smoke and halogen-free pipe line which is environment-friendly material.

e) Consolidation Cabinet Size .....



5.11 Bulk service

The developer is responsible for designing and implementing bulk service infrastructure to support landlord building facility management and security applications, and in specific circumstances tenant business requirements.

NOTE: This kind of service solution is usually applied to projects/buildings having their own IT network (single-tenant) such as hotels, hospitals, schools, universities, banks, airports and other similar establishments.

The client shall have an IT server room and a minimum of one dedicated MTR (Figure G.21) for SP telecom/network equipment installation.

The tenant/client shall provide written requirements during the design stage, confirming the bulk service and explaining the service required to be provided up to the client IT room.

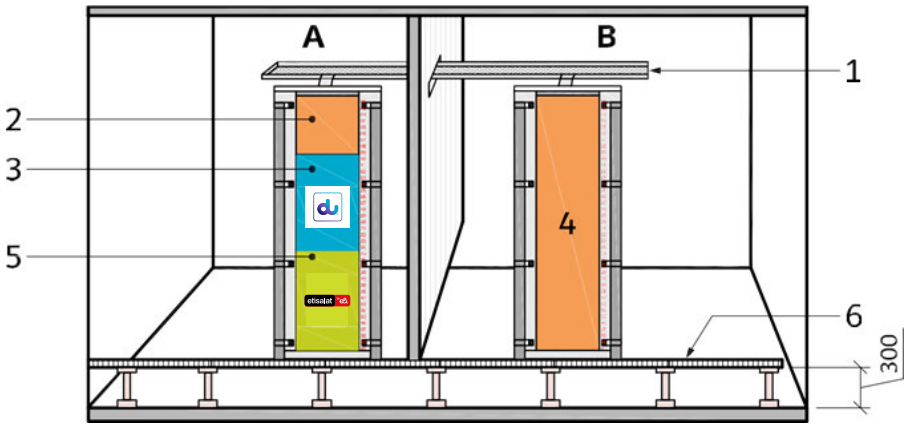
The exact requirements related to telecom cabling and EM requirements shall be determined during the design stage based on the client's service requirements.

For bulk services setup the tenant/client shall:

a) install 483 mm (19 in) 42U free standing rack within the MTR;
b) install and test 12 core fibre cable between MTR and client IT server room, terminating the fibre cables at both ends using 12-port fibre patch panels:
1) cores one to six shall be allocated to connect Etisalat equipment;
2) cores seven to 12 shall be allocated to connect du equipment;
c) install and test 24 category 6A copper cables between the MTR and client IT server room:
1) ports one to 12 shall be allocated to connect Etisalat equipment;
2) ports 13 to 24 shall be allocated to connect du equipment;
d) install main and spare optical splitter(s) and patch panels;
e) install two 12-port SC/APC pre-terminated fibre patch panels to each SP uplink fibre;
f) provide SC/APC adaptors and pigtail for fibre interfaces;
g) extend 300 mm × 50 mm HDRF cable tray from MTR to client IT server room.

The distance between the MTR and client IT server room shall be within 70 m (to remain within the 90 m permanent link distance limitation, while provisioning fixed services over copper cables).

Figure G.21 Bulk service MTR arrangement



Key

1 300 mm × 50 mm cable tray
2 10 U space reserved for OSP link (MMR to building MTR) and ISP link (building MTR to client server room)
3 16 U space reserved for active equipment – du
4 Clients server rack
5 16 U space reserved for active equipment – ETC
6 Raised floor tiles (optional)
A MTR room
B Client server room

5.12 Smart Home System

With availability of wide band internet connectivity all over UAE by licensees, smart home system become reliable solution to provide better quality of life

Smart home system can be used for one of the following aspects or to integrate all aspects:

- Security: to control and monitor access and activities remotely
- Safety: to firefighting system and medical systems
- Energy saving: to automate usages of heating and air condition switching of unused appliances and lights
- Life style improvement: demining lights once TV is on and close curtain to block sun light checking available food items in fridge remotely

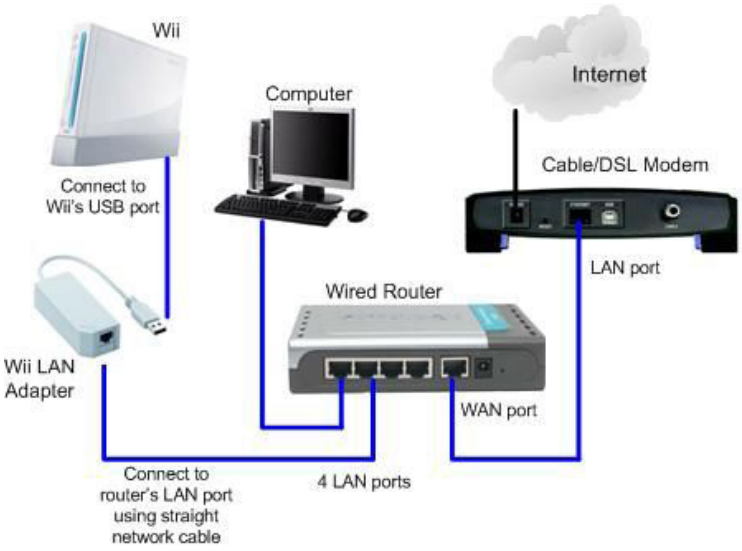
Smart home system components:

Smart home system consists of three major components:

- User interface
- Smart hard ware (sensors, cameras, gateways)
- Platform

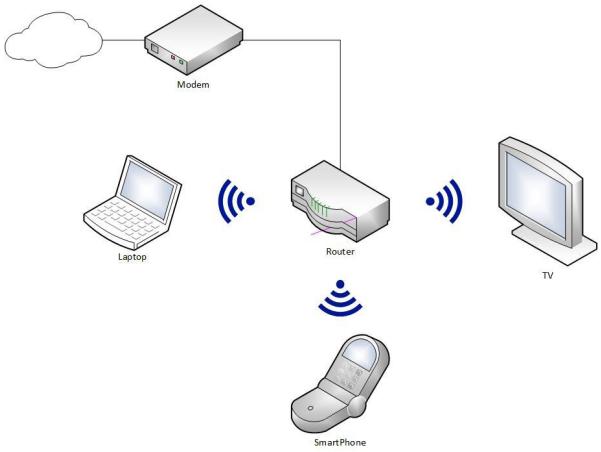
The glue between the three parts which allow all part works to gather is the connectivity which can be wired or wireless
Wired:

CAT6 Ethernet cables where sensors will require battery of power connection
CAT6A power over Ethernet where power and data combined together in over one cable



Wireless:

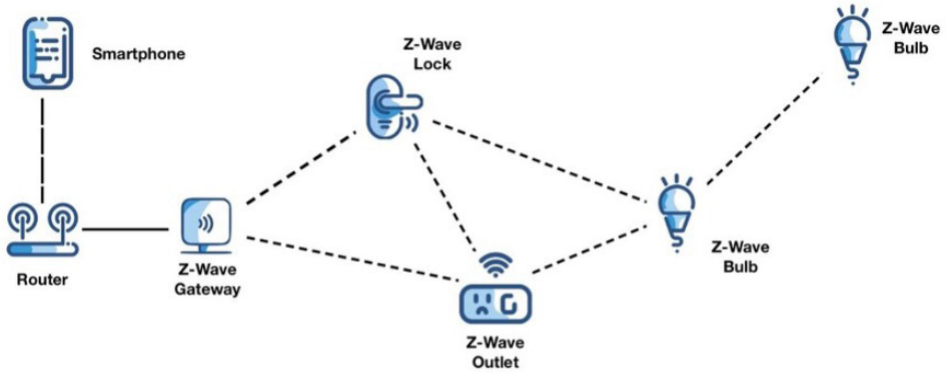
WIFI: all smart home hard ware will connect to the platform through WIFI to the home gateway or
Access point and dully the gateway will connect cameras and sensors back to the platform through internet connection



Zee wave:

Z-Wave is low frequency of 800 to 900 MHz wireless communication protocol used primarily in smart home networks, allowing smart devices to connect and exchange control commands and data with each other.

The high penetration and almost no interference connectivity and the communication between sensors allow robust and relabel censoring system



The above is showing that it is recommended to select the smart home system in advanced during the design stage of the project in order to check all available solutions and to reduce the cost of the suitable system .

Keep in mind home designer should consider that smart home could affect the decoration lighting features and furniture selection .

Selecting the smart home system during final stages of construction will make the system like last moment stick item not in harmony with rest of project items and for sure installed system will have lower functionality and higher cost .

5.13 Labelling scheme

• General

The installed system shall be in administered accordance with ISO/IEC 14763-1.

All sections of the installation shall be provided with suitable identification labels to indicate clearly the location and purpose of each item or cable.

Instructions and "Optical Fibre Caution" notices shall also be provided. All labels shall be in both English and Arabic. The letter sizes shall be selected to suit individual applications.

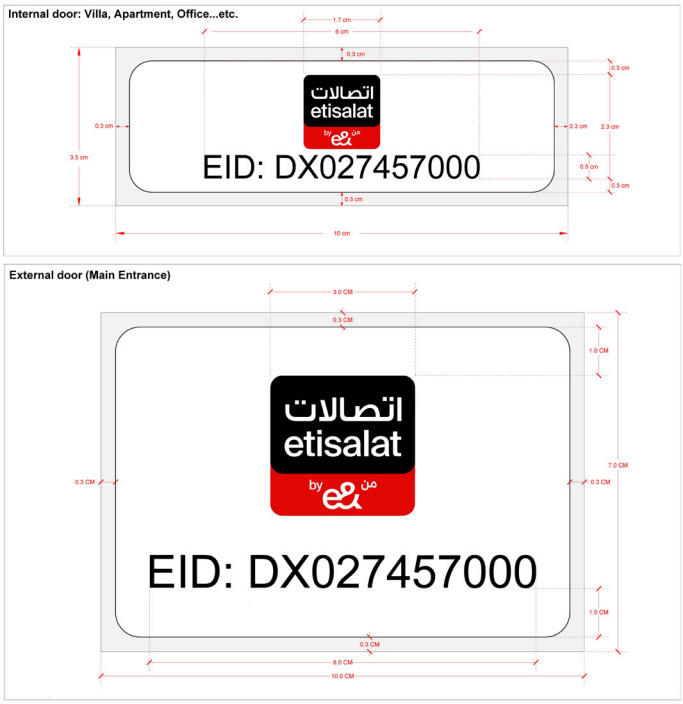
• SP GAID and EID identification plate for each unit/tenant

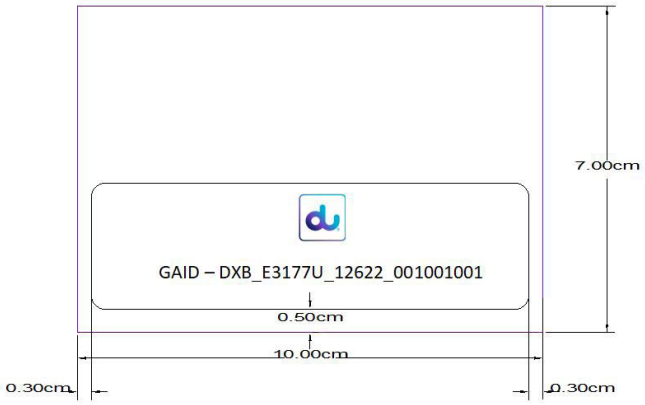
The SP identification plate (see Figure G.22) shall be installed at the door entrance of the residential/commercial units. The identification plate shall be made of plastic or light metal with the alphanumeric characters (GAID or EID) engraved on it.

The GAID and EID reference number details shall be made available to the developer during the inspection stage.

- Component and location labelling

Figure G.22 Example EID and GAID identification plate with labelling details (cm)





• Component and location labelling

When labelling telecom cabling and equipment, common suffixes and designations shall be used in label text as detailed in Table G.14 to Table G.16.

Table G.14 Labelling designations

Location	Labelling designation
Apartment	ACP
BMS Room	BMS
Equipment rack	RCK
Floor	FL
Floor telecom room	FTR
Main telecom room	MTR
Offices	OCP
Reception	REP
Retail shop	RCP

Table G.15 Labelling scheme for SM fibre cables MTR/FTR to tenant unit

MTR/FTR side Floor (Fxx) – Location + number – core number (Cxx)	Tenant side MTR/FTR number – core number
Example for floor 01 apartment 04 FL01-ACP04-C01 FL01-ACP04-C02 FL01-ACP04-C03 FL01-ACP04-C04	MTR01-C01 MTR01-C02 MTR01-C03 MTR01-C04 or FTR01-C01 FTR01-C02 FTR01-C03 FTR01-C04
Example for floor 01 office 10 FL01-OCP10-C01 FL01-OCP10-C02 FL01-OCP10-C03 FL01-OCP10-C04	
Example for ground floor reception FL00-REP-C01 FL00-REP-C02 FL00-REP-C03 FL00-REP-C04	
Example for ground floor retail unit 25 FL00-RCP25-C01 FL00-RCP25-C02 FL00-RCP25-C03 FL00-RCP25-C04	
Example for ground floor reception FL00-REP-C01 FL00-REP-C02 FL00-REP-C03 FL00-REP-C04	

Table G.16 Labelling scheme for equipment

Label type	Format	Example
Labelling of cabinet inside apartment, office, reception or retail shop	"Floor number/name" – "Location + Number"	FL01-ACP12
Labelling of fibre cable after terminating inside fibre ODF or patch panel	"Floor number/name" – "Location + Number" – "ODF core number"	FL01-ACP12-ODF C1, C2, C3, C4
Labelling for 4-core fibre terminal box (always terminate pigtail one to core one of the SM fibre cable)	Rack number-ODF number-ODF row/ slot number-core numbers	RK2-ODF1-S1-C1, C2, C3, C4

The labelling scheme for 2-core adapters inside the fibre terminal box shall follow Figure G.23 depending upon the orientation of the adaptor.

Figure G.23 Labelling scheme for 2-core adapter inside the fibre terminal box

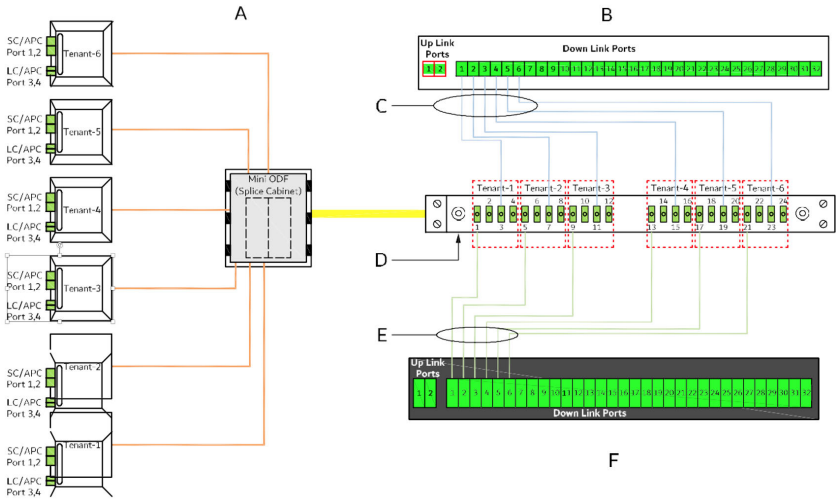
a) Vertical orientation b) Horizontal orientation

5.14 SLD and connectivity/wiring detail

The single line diagram (SLD) detail and full as-built documentation for the installation shall be posted inside the MTR to trace end-to-end SP connectivity.

Example SLDs are shown in Figure G.24 and Figure G.25.

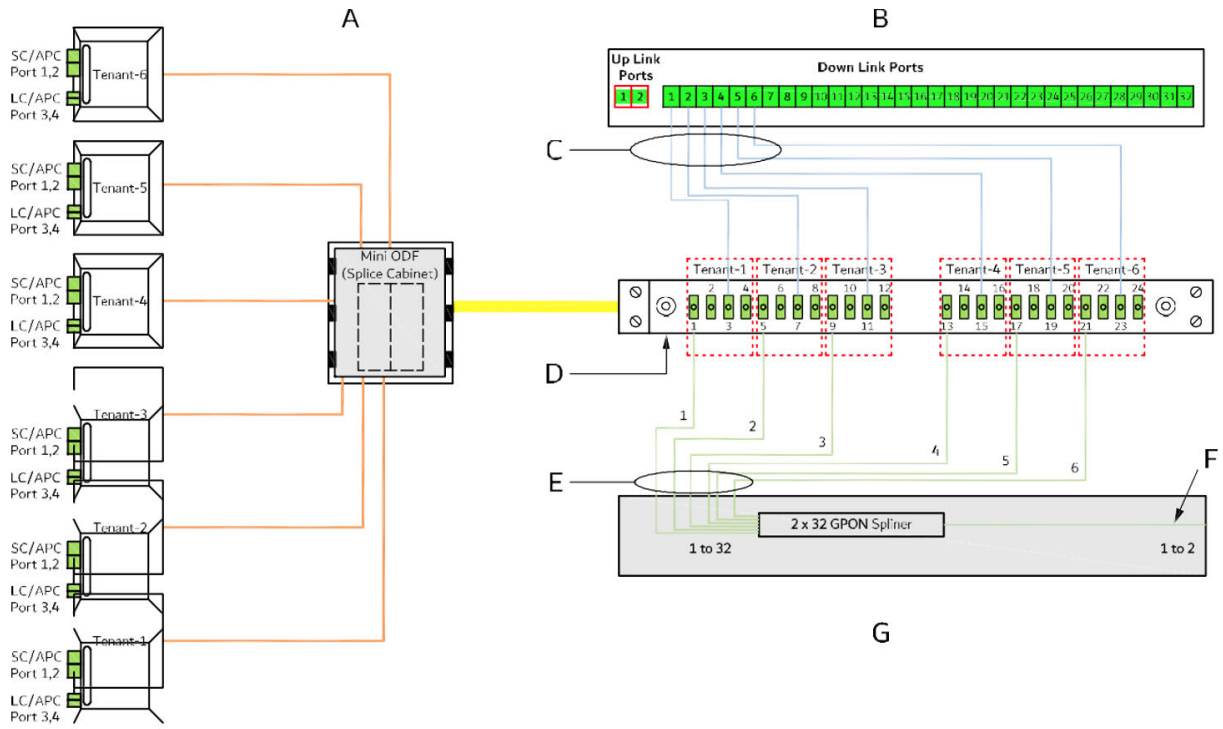
Figure G.24 Example SLD for a building with more than 256 units



Key

A Core assignment SLD – with SC/APC fibre patch panel
B 2 × 32 LC/APC splitter for du
C Simplex fibre patch cords – (LC/APC to SC/APC)
D 24 port SC/APC fibre patch panel
E Simplex fibre patch cords – (SC/APC to SC/APC)
F 2 × 32 SC/APC splitter for Etisalat (for buildings with more than 256 units)
Tight buffer or micro modules LSZH indoor multicore fibre cable
4-core flat profile LSZH indoor drop fibre cable

Figure G.25 Example SLD for a building with less than 256 units



Key

A Core assignment SLD – with SC/APC fibre patch panel
B 2 × 32 LC/APC splitter for du
C Simplex fibre patch cords – (LC/APC to SC/APC)
D 24 port SC/APC fibre patch panel
E Fibre pigtail (SC/APC)
F Uplink cable
G Splice tray with 2 × 32 patch free splitter for Etisalat
Tight buffer or micro modules LSZH indoor multicore fibre cable

4-core flat profile LSZH indoor drop fibre cable

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