OPTICAL DISTRIBUTION FRAME ALLOCATION AND LAYOUTS CONFIGURATIONS

(CENTRALIZED SPLITTING ARCHITECTURE)

IMPORTANT:

This technical normative only applies to the "Centralized Splitting Architecture" of UGG.

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INDEX

1. OBJECT

This document aims to define the front view configuration of the Optical Distribution Frames (ODFs) installed in the Points of Presence (POPs) of UGG in the projects done with the "Centralized Splitting Architecture".

1.1 REVISIONS

EDITION	DATE	REVISED SECTIONS	CHANGES	OBSERVATIONS
1st	OCTOBER 2020			
2nd	MARCH 2021	The entire document is revised and modified.	Some sections are reorganized and other are eliminated from the document. The section of the ODFs configuration in active POPs suffer an important change reducing the complexity of the section. 2 Annex are added to the document with 2 examples of ODF configuration in different POPs.	The ODF configuration for the passive POPs is changed, adding 2 reserve position in the upper part of the internal plant vertical, and reducing in 2 positions the reserve for splitters of other operators. The configuration for the ODF installed in active POPs has a big change because of the decision of not use the patch-panel modules in the deployment. This fact simplifies the configuration of the ODFs and it is translated in the document in that there are a reduction of the quantity of sections to explain different cases. In the ODF installed in active POPs, the reserve area for the backhaul network is extended in 2 positions, and the reserve for splitters of other operators is reduced in 2 positions.
3rd	JULY 2023	Chapter 2. Chapter 5.	New subchapter is added (2.2.6) The sub-chapter 5.2.1 is modified	Chapter 2: it is modified to explain a new type of element (CDP: centralized Distribution Point) that has a similar functionality of a passive POP but with reduced capacity. A new sub-chapter 2.2.6 is included to detail the front view configuration of the possible CDPs. Sub-chapter 5.2.1. it is updated to detail the use of the reserved positions for backhaul purposes in the IPV verticals in the aggregation POPs.

EDITION	DATE	REVISED SECTIONS	CHANGES	OBSERVATIONS
4th	DECEMBER 2023	All	New codification of the document	The document is codified with the document code: TEF-NORM-00004. The logo of UGG is updated in the page header. The text explaining the use of the first 4 positions of the IPV in the active POPs is modified lightly (page 35).

2. GENERAL

There are defined various precast shelters for POPs (Points of Presence) with different configurations that must be selected based on the required functionality.

In each POP, differents ODFs (Optical Distribution Frame) configurations are needed, and in this document will be defined the layout and the front view for each one.

In the following image, could be seen different POPs in different situations and with different necesities.
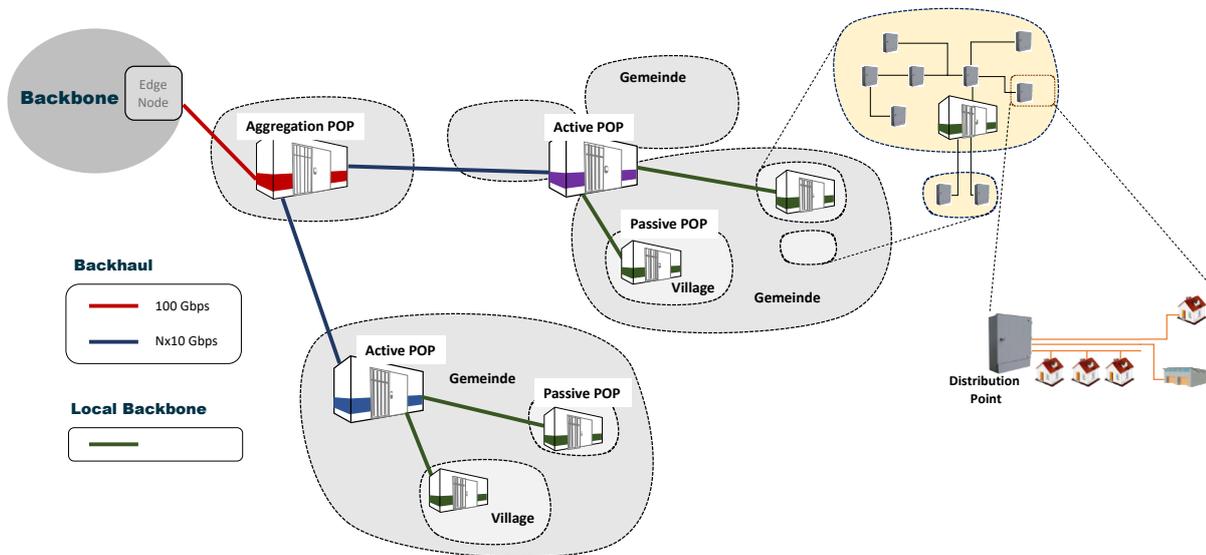
Figure 1. General view of the architecture of the network. Different POPs types and functionalities.

2.1 HIERARCHY OF POPS

There are 3 main types of POP according to its hierarchy in the network:

- **Passive POP:** it is a POP with only passive network equipment installed. A passive POP connects to a single active POP through the so-called local backbone network.

  o **CDP (Centralized Distribution Point)** might be considered hierarchically as a passive POP, but with small capacity and installed in a street cabinet.

- **Active POP:** it is a POP with passive and active network equipment, such as the OLT. Active POPs can be connected to zero, one or several passive POPs depending on the deployment needs. Multiple local backbone networks can potentially end at a single active POP. An active POP connects to a single aggregation POP through the so-called backhaul network.

- **Aggregation POP:** it is a special active POP with an aggregation switch that aggregates the traffic of multiple OLTs from other active POPs (including the OLT located at the aggregation POP itself). Multiple backhaul networks from several active POPs can be connected to a single aggregation POP (see backhaul contribution area of the ODF). An aggregation POP is connected to a single remote node in the backbone through its own backhaul network.

The previous hierarchy follows a logical star topology with three levels, where each active POP is connected directly to an aggregation POP using UGG´s own infrastructure or hiring dark fibers. However, during the planning phase of the deployment could be more efficient to use eventually a physical cascade topology for certain backhaul network segments. For these cases, it is possible to have backhaul contribution areas also in active POPs in order to connect other active POPs.

The following picture represent the situation of an aggregation POP that aggregates 5 remote active POPs (hired fibers are represented with a dashed line) where some of them have backhaul contributions from other active POPs. Please note that passive POPs are not expected to have backhaul contributions from active POPs but can reuse the same civil work if needed.
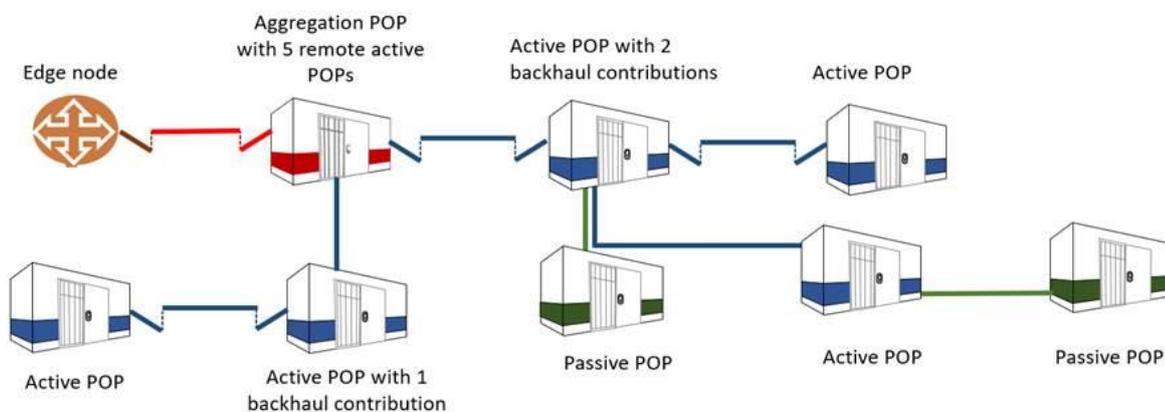
Figure 2. Hierarchy of POPs.

2.2 DIFFERENT TYPES OF POPS

There are defined 6 types of POPs, with different functionalities, sizes and layouts. Three of them are active POPs, with different sizes (small, standard and large), and three are passive POPs (small, standard, and large).

The actives ones, can have different roles, depending on the hierarchy of each POP, if it is working as an agregation active POP for example.

Also a new element has been introduced into the UGG's portfolio: the CDP (Centralized Distribution Point) that has a similar funcionality of a passive POP but with less capacity.

2.2.1 POP TYPE 1 (ACTIVE STANDARD)

The POP type 1 is an active POP, in which both types of equipment active (OLT, switches, routers, etc) and passive (ODF, splitters, etc) are going to be installed.

From this type of POP, different networks can go out, a feeder network to serve DP (Distribution Points) of its influence area or a local backbone network to serve a passive POP that has its own area of influence.

In this type of POP up to 2 ODFs can be installed in a row. Since each ODF has a capacity of 2.688 fibers termination, up to 5.376 fibers could go out (for FTTH access network) from this type of POP.

NOTE: It is possible to finish in the ODF more fibers than the termination capacity mentioned of 2.688 fo, since this is the capacity of one of the verticals of the ODF, and is possible to finish also fibers in the other vertical in some cases: for example to finish fibers backhaul or backhaul contributions from other active POPs (in some cases in which the POPs is an aggregation POP).

NOTE: The optical fibers of the backhaul network must also be finished in the ODFs of the POP, but this fibers will not quit capacity of the ODF, since this fibers will be finished in other vertical of the ODF.

Figure 3. Top view of the POP type 1.

2.2.2   *POP TYPE 2 (ACTIVE LARGE)*

The POP type 2 is an active POP (bigger than the POP type 1), in which both types of equipment active (OLT, switches, routers, etc) and passive (ODF, splitters, etc) are going to be installed.

From this type of POP, different networks can go out, a feeder network to serve DP (Distribution Points) of its influence area or a local backbone network to serve a passive POP that has its own area of influence.

In this type of POP up four ODFs can be installed in 2 rows. Since each ODF has a capacity of 2.688 fibers termination, up to 10.752 fibers could go out (for FTTH access network) from this type of POP.

NOTE: The optical fibers of the backhaul network must also be finished in the ODFs of the POP, but these fibers will not quit capacity of the ODF, since this fibers will be finished in other vertical of the ODF.

Figure 4. Top view of the POP type 2.

2.2.3   POP TYPE 3 (PASSIVE STANDARD)

The POP type 3 is a passive POP in which only passive equipment (ODF, splitters, etc) are going to be installed.

In this type of POP up two ODFs can be installed. Since each ODF has a capacity of 2.688 fibers termination, up to 5.376 fibers could go out (for FTTH access network) from this type of POP.

NOTE: The optical fibers of the local backbone network (to join it with the active POP) must also be finished in the ODFs of the POP, but these fibers will not quit capacity of the ODF, since this fibers will be finished in other vertical of the ODF.
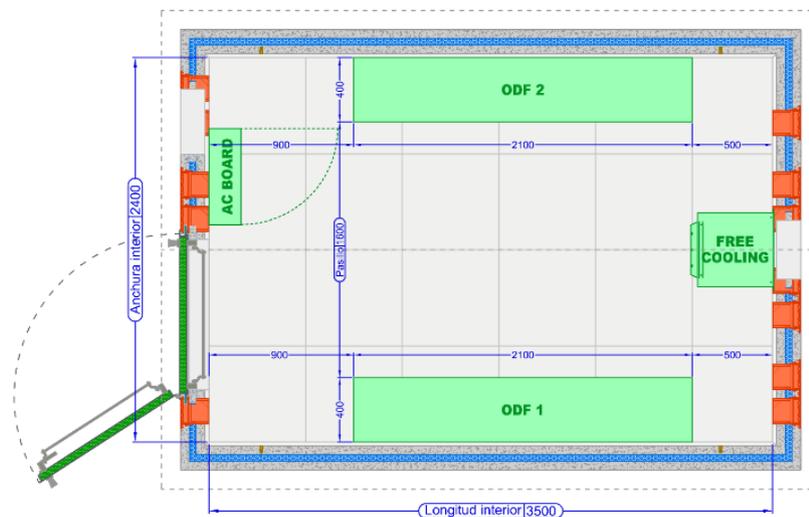
Figure 5. Top view of the POP type 3.

2.2.3.1 POP TYPE 3* (PASSIVE SMALL)

The POP type 3 can also be under-equipped with only one ODF, if necessary. That is, there is no specific type for small passive POP, as it would have the same size as of type 3, but with only one ODF instead of two.

2.2.4   POP TYPE 4 (PASSIVE LARGE)

The POP type 4 is a passive POP in which only passive equipment (ODF, splitters, etc) are going to be installed.

In this type of POP up four ODFs can be installed in 2 rows. Since each ODF has a capacity of 2.688 fibers termination, up to 10.752 fibers could go out (for FTTH access network) from this type of POP.

NOTE: The optical fibers of the local backbone network (to join it with the active POP) must also be finished in the ODFs of the POP, but these fibers will not quit capacity of the ODF, since this fibers will be finished in other vertical of the ODF.
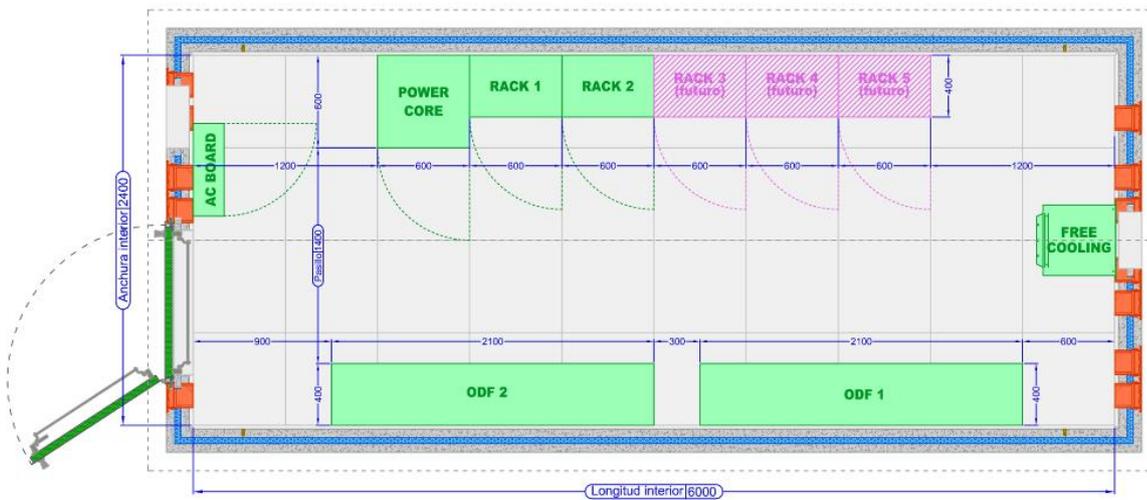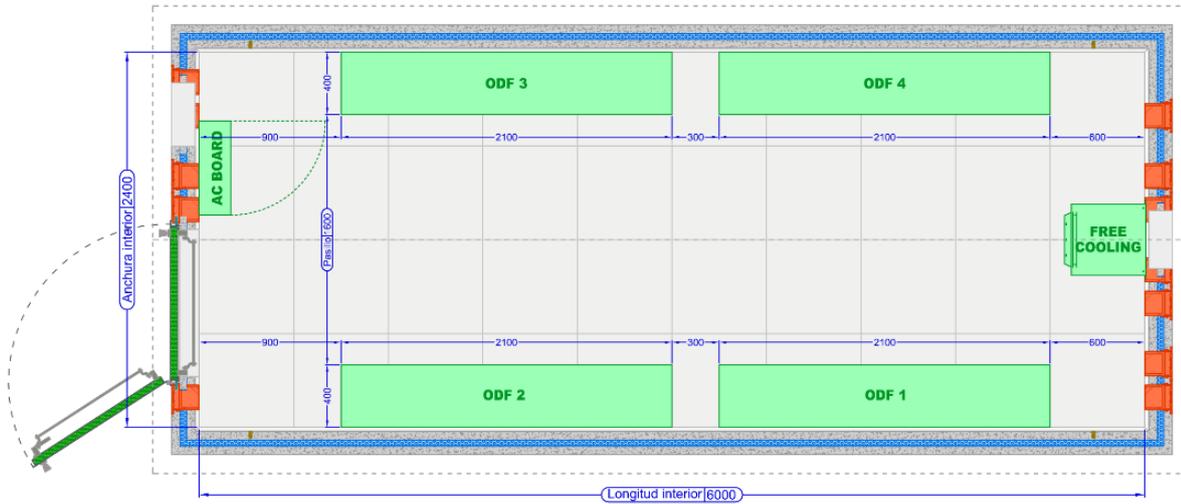
Figure 6. Top view of the POP type 4.

2.2.5 *POP TYPE 5 (ACTIVE SMALL)*

The POP type 5 is an active POP, in which both types of equipment active (OLT, switches, routers, etc) and passive (ODF, splitters, etc) are going to be installed.

In this type of POP only one ODF can be installed, so the maximum capacity of fibers going out this POP is 2688 fo (for FTTH access network).
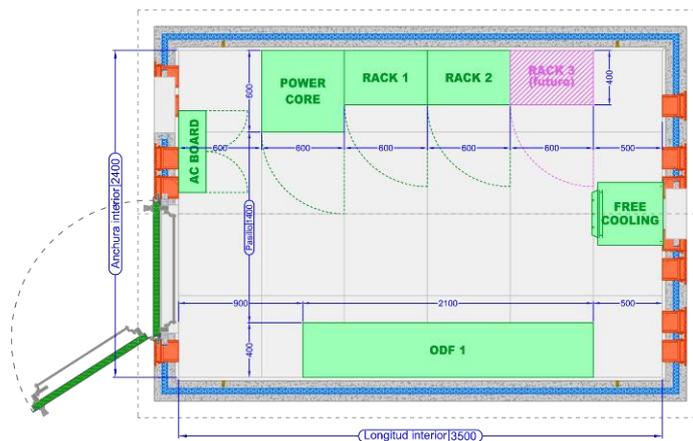
Figure 7. Top view of the POP type 5.

2.2.6 *CDP (CENTRALIZED DISTRIBUTION POINT) CABINET*

The CDP (Centralized Distribution Point) a passive Street Cabinet in which only there are passive equipment (ODF, splitters, etc) installed. The functionality and hierarchy are similar to a passive POP, but this element has less capacity (approximately the half of the capacity of a POP TYPE 3* with reduced capacity)

This element comes from factory with all the components preinstalled and has a capacity of 1152 fiber termination (approximately the half of the capacity of an ODF).

NOTE: The optical fibers of the local backbone network (to join it with the active POP) must also be finished in the ODFs of the CDP, but these fibers will not quit capacity of the ODF, since these fibers will be finished in other vertical of the ODF.
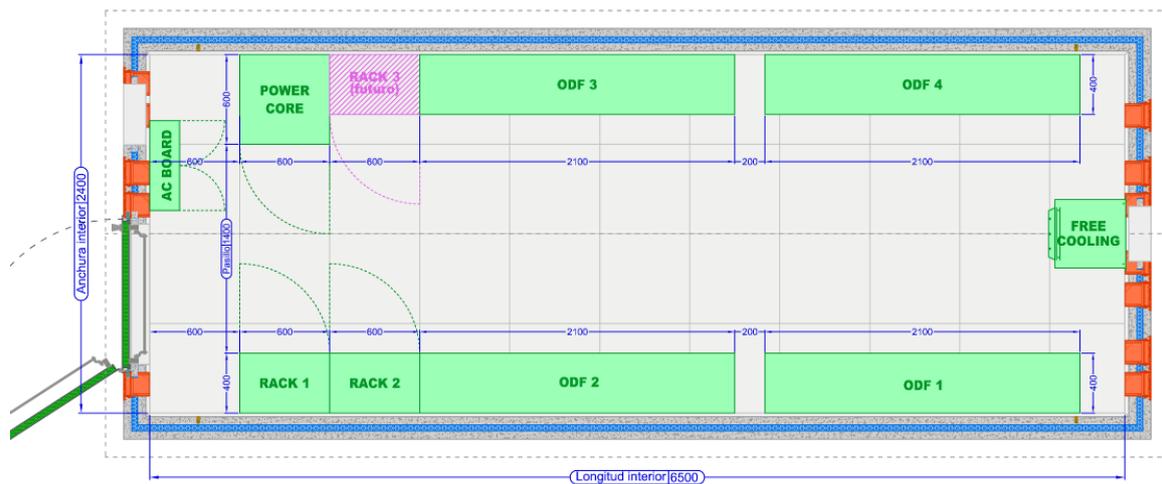

24 pcs
Splice patch shelf for customer connections

2 pcs
Splice patch shelf for Feeder connections

8 pcs
Splitter shelf 1:64
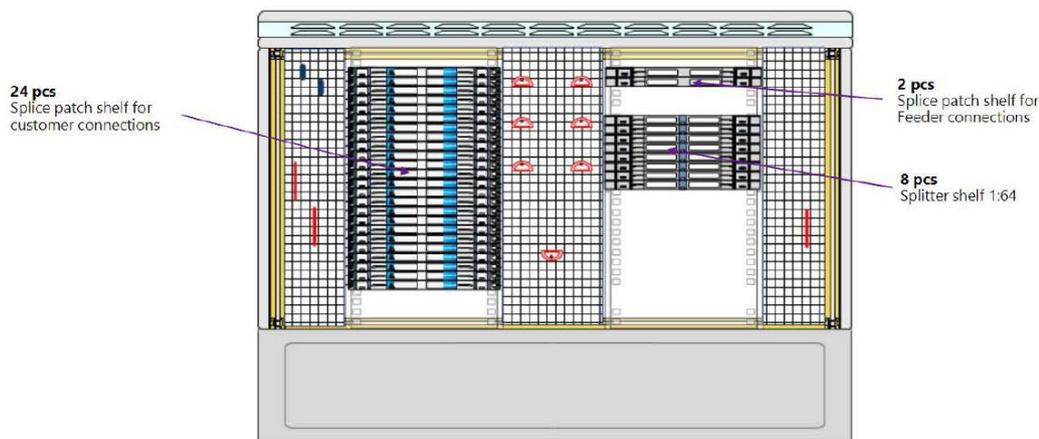
Figure 8. CDP from the manufacturer Commscope
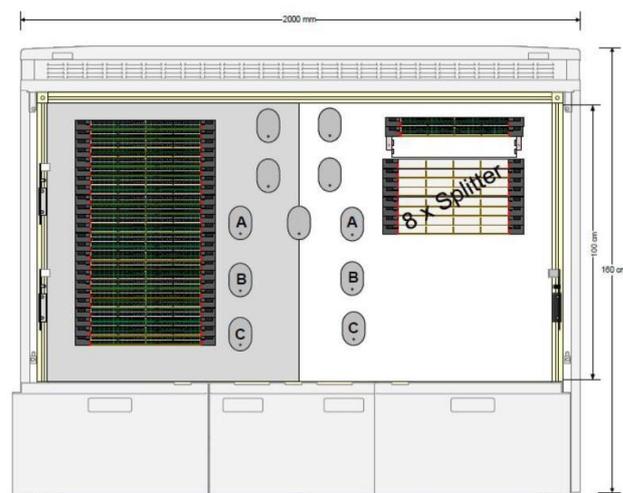
Figure 9. CDP from the manufacturer R&M

3.   OPTICAL DISTRIBUTION FRAMES

3.1   GENERAL DESCRIPTION

The optical distribution frame (ODF) is the point in which UGG will finish all the optical fibers of the outside plant cables of the FTTH network.

The dimensions of the ODF are 2200 x 2100 x 300 mm (height x wide x deep).

The ODFs are fully modular and could be equipped with different modules according to the necessities of each installation.

The maximum capacity of each ODF is 2.688 optical fibers (access network). The ODF is also the point in which the optical splitters needed for a point to multipoint network (GPON, for example) are going to be installed.

The ODF is based in two verticals, one with the prime destination to be used to finish the optical fiber cables of the outside plant (access network), and other vertical to install different components as can be, for example: optical splitters. The cross-connection between both verticals is the base of the functionality of the ODF.

Each vertical has 56 positions to install different modules.

Between both verticals, there are a space for the patch-cord fiber management.

There are two different models of ODF (from different manufacturers: Commscope and Reichle & De-Massari) that could be used in the deployment. Each manufacturer has their own components, and they are not compatibles between them.

The functionality and the capacity of both ODFs are the same. In the following sections a detailed description of each one is made to present the main components.

Scheme of the ODF:

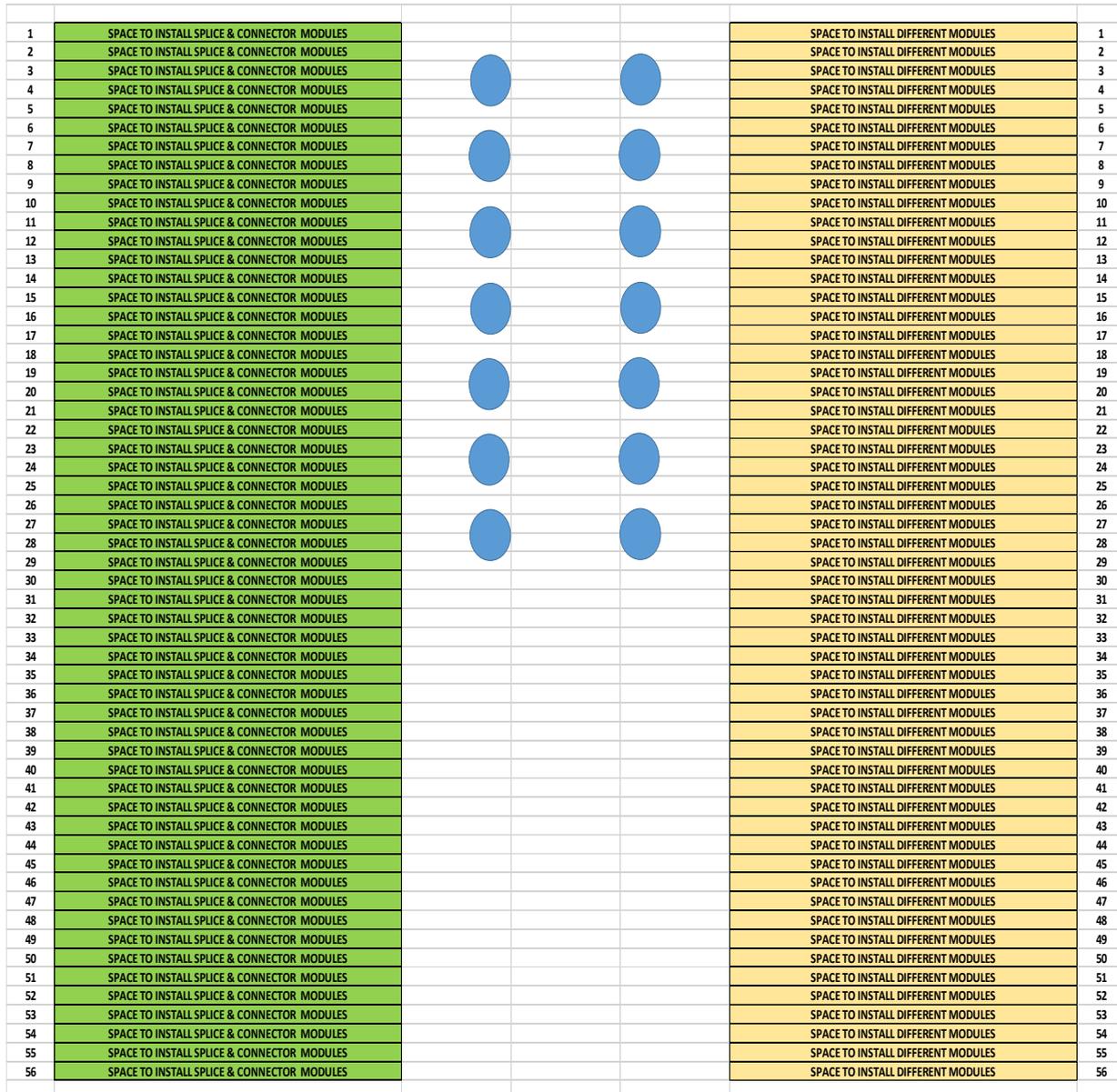| #			#
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2	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	2
3	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	3
4	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	4
5	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	5
6	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	6
7	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	7
8	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	8
9	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	9
10	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	10
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33	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	33
34	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	34
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45	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	45
46	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	46
47	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	47
48	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	48
49	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	49
50	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	50
51	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	51
52	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	52
53	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	53
54	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	54
55	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	55
56	SPACE TO INSTALL SPLICE & CONNECTOR MODULES	SPACE TO INSTALL DIFFERENT MODULES	56

Figure 10. General scheme of the ODF (positions per vertical)

3.1.1 *COMMSCOPE'S ODF*

The ODF that could be used in the deployment from Commscope is the FACT ODF model.

The dimensions of the ODF with 2 verticals installed are 2200mm (H) x 2100mm (W) x 300mm (D). It is formed by two sub-frames of 1050 mm wide each.

There are right-hand and left-hand modules. All the routes for the patching are signalized with colours.

There is no patch-cord movement when accessing the FACT Elements for patching, splicing, maintenance adds, moves or changes or routes.

The next picture shows a front view of the FACT ODF from Commscope:
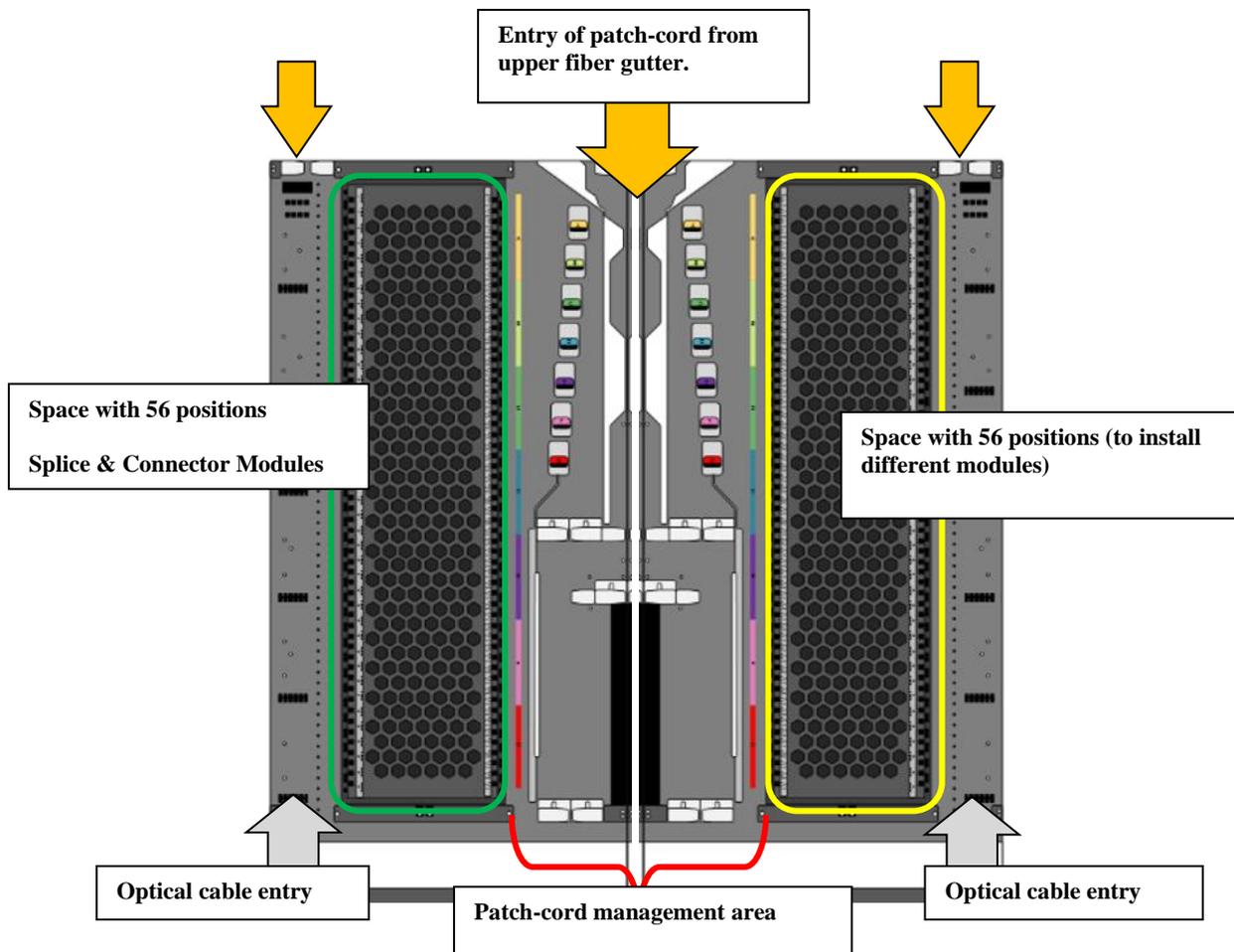
Figure 11. View of the (empty) ODF of Commscope

The frames are empty structures that has the space with the necessary means to fix the different modules.

3.1.1.1 COMMSCOPE'S SPLICE AND CONNECTOR MODULES

Commscope has several splice and connector modules in its FACT catalogue. The smallest module occupies only one position in the ODF frame, and the largest one, occupies 6 positions.

The following splice and connector modules are available for fiber cable termination:

- 48 fo splice and connector module. Occupies one position in the ODF frame.

- 96 fo splice and connector module. Occupies two positions in the ODF frame.

- 144 fo splice and connector module. Occupies three positions in the ODF frame.

- 192 fo splice and connector module. Occupies four positions in the ODF frame.

- 288 fo splice and connector module. Occupies six positions in the ODF frame.

The basic module is the 48 fo capacity one. The other modules with more capacity are formed adding 48 fo splice and connector modules up to the capacity required. The module formed works as one block.

The following image is a real picture of a 96 splice and connector module (formed by 2 sub-modules of 48 fiber capacity).

Figure 12. Picture of a 96 fo splice and connector module

Internally, the module, has 2 trays with space to store the fusion splices and the optical fibers, and the patch panel in which the pigtails are connected. Each tray has a capacity of 24 fibers and connectors.

IMPORTANT: Internally, each module has identified each port from the number 1 to 48.

The modules are prepared to fix to them directly the optical cable using a cable termination unit. In the following picture, could be saw a picture, in which a cable of 288 fo is fixed to the module, and their fiber are distributed between the individual modules.

Figure 13. Picture of a 288 fo splice and connector module

IMPORTANT: It is very important to consider, that all the splice and connector modules from CommScope have hand (left-hand or right-hand), depending in which vertical are going to be installed.

3.1.1.1.1   CABLE TERMINATION UNIT

The splice and connector module require an additional part (Cable Termination Unit - CTU) to fix the cable to the module. This part is needed for each cable that are going to be finished in the ODF. It is possible to install only one CTU in each height of the modules (if the modules include more than one height, is possible to install more than one (one per height)).

NOTE: This part doesn't form part from the splice and connector module and must be ordered apart.

Figure 14. Cable Termination Unit for splice and connector module of Commscope
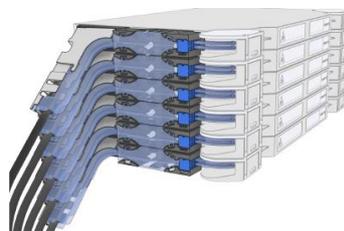
Figure 15. Example of installation of multiple CTU.

Note: it is important to consider that for each type of module, Commscope has a different part number also for the CTU (adapted to guide the loose tubes of the cables to the different sub-modules that has the complete module. That is, that the CTU for a module of 96 fo (formed by 2 sub-modules of 48 fo) is different to the CTU used for a module of 288 fo (formed by 6 sub-modules of 48 fo)

3.1.1.2 COMMSCOPE'S PATCH PANNEL MODULES

CommScope has several types of patch panel module in its FACT catalogue (LC/APC connectors) with different capacities, but for the deployment of UGG only the 48 adapters module is going to be used (if needed).

NOTE: it is possible that this kind of modules are not going to be used at the beginning of the deployment.

The capacity of this module is 48 adapters LC/APC and it only occupies one position in the ODF frame.

Figure 16. Detail of a patch panel module of 48 adapters (empty)
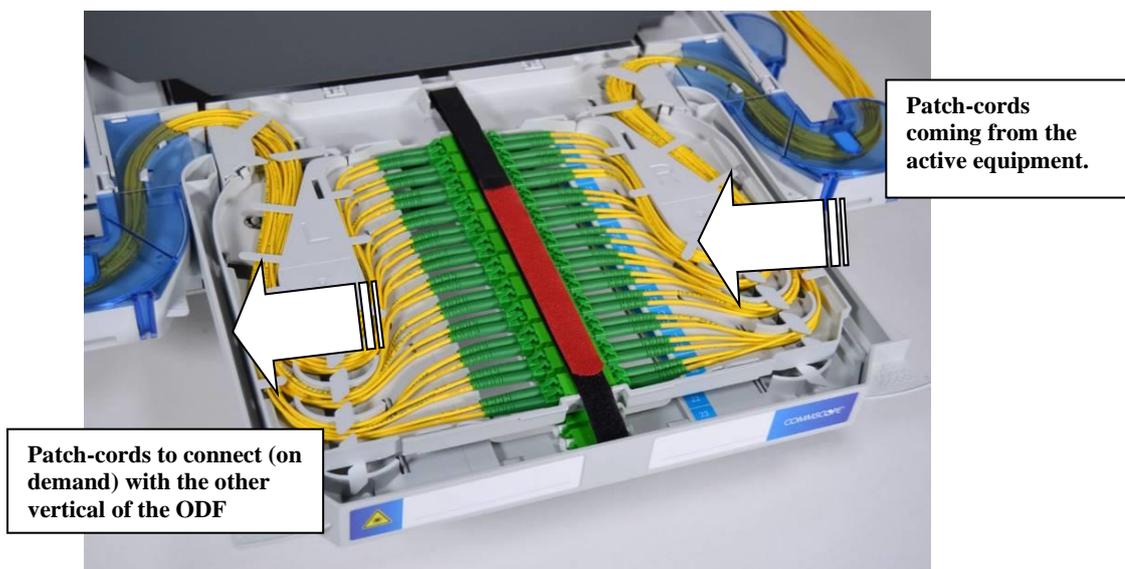
Figure 17. Detail of a patch panel module of 48 adapters (full charge)

This kind of modules have no hand and is valid for installation int both verticals (left or right).

3.1.1.3 COMMSCOPE'S SPLITTER 1:64 MODULE

CommScope has several types of splitters modules in its FACT but for the deployment of UGG only a new one developed for this ad-hoc is going to be used.

The capacity of this module is one splitter 1:64, formed internally by one splitter 1:2 followed by two splitters 1:32.

The 1:2 splitter is attached to one side of the module, and each 1:32 splitters are installed in two independent trays inside the module. The connection between the 1:2 splitter outputs and the 1:32 splitter input, will come already done from the factory.
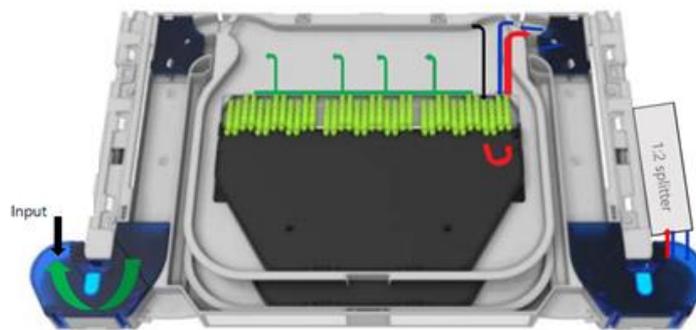
Figure 18. Detail of the 1:64 splitter module configuration

Figure 19. Detail of the 1:64 splitter module (tray open)

This configuration of splitter allows the change of the splitting level of the network to 1:32 easily, retiring the 1:2 splitter if it is needed in the future.

IMPORTANT: It is very important to consider, that this splitter module has hand and that always must be installed in the Internal Plant Vertical of the ODF (the vertical of the right).

3.1.2 *REICHLE AND DE MASSARI'S ODF*

The ODF that could be used in the deployment from Reichle and De Massari (R&M) is the PRIME ODF model.

The dimensions of the ODF with 2 verticals installed are 2200mm (H) x 2100mm (W) x 300mm (D). It is formed by three sub-frames of 900 mm, 300 mm and 900 mm wide each.

There are right-hand and left-hand modules. All the routes for the patching are signalized with letters.

The next picture shows a front view of the PRIME ODF from R&M configured for this deployment:

Figure 20. View of the (empty) ODF of R&M

The frames are empty structures that has the space with the necessary means to fix the different sub-racks in which could be possible to install different modules.

IMPORTANT: The R&M Prime ODF requires an additional element (a sub-rack) to install the different modules in the structure

3.1.2.1 R&M'S SUB-RACK

To install different modules on the Prime ODF of R&M it is necessary to install a sub-rack on it before.

The sub-rack can be fixed directly to the back-panel of the ODF chassis and occupies 4 positions from the 56 positions available on it.

This sub-rack has internally 4 sliding rails on which up to 4 different modules can be installed.

The following picture represent the sub-rack:

Figure 21. Detail of the sub-rack of R&M

3.1.2.2 R&M'S SPLICE AND CONNECTOR MODULE

R&M has several splice and connector modules in its PRIME catalogue. All the models occupy only one position in the ODF frame (only one position inside the sub-rack).

The module that are going to be used in the deployment has a capacity of 48 fibers.

If more fibers are needed to terminate in the ODF, it is possible to achieve adding more modules to the ODF.

The following image is a real picture of a 48 splice and connector module.

Figure 22. Picture of a R&M splice and connector module of 48 fo

Internally, the module, has 2 splice trays with space to store the fusion splices and the optical fibers. Each tray has a capacity of 24 fibers.

In the R&M ODF, the cables are not fixed directly to the splice and connectors modules. It is necessary to fix the cables to the ODF main structure (frame) and make a transition to corrugated tubes to guide the fibers to the splice and connectors modules. For this reason, there is no limit in the fiber count of the cables, since once make the transition it is possible to guide the fibers by distributing them to different modules 48 by 48.

Point to fix the cables.
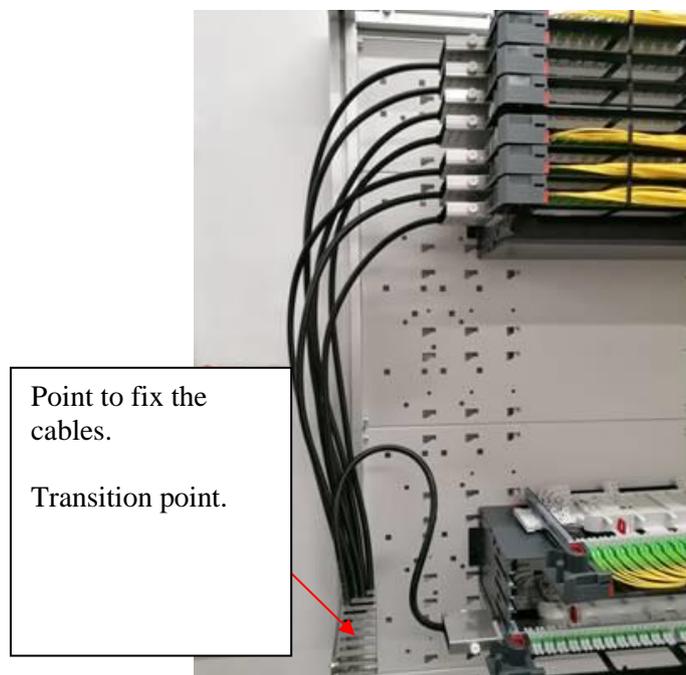
Transition point.

Figure 23. Detail of the transition point for the cable termination

IMPORTANT: It is very important to consider, that all the splice and connector modules from R&M have hand (left-hand or right-hand), depending in which vertical are going to be installed.

3.1.2.3 R&M'S PATCH PANNEL MODULES

If it is needed in the deployment of UGG the patch panel module that is going to be used has a capacity of 48 LC/APC adapters.

NOTE: it is possible that this kind of modules are not going to be used at the beginning of the deployment.

This module only occupies one position on the ODF frame.

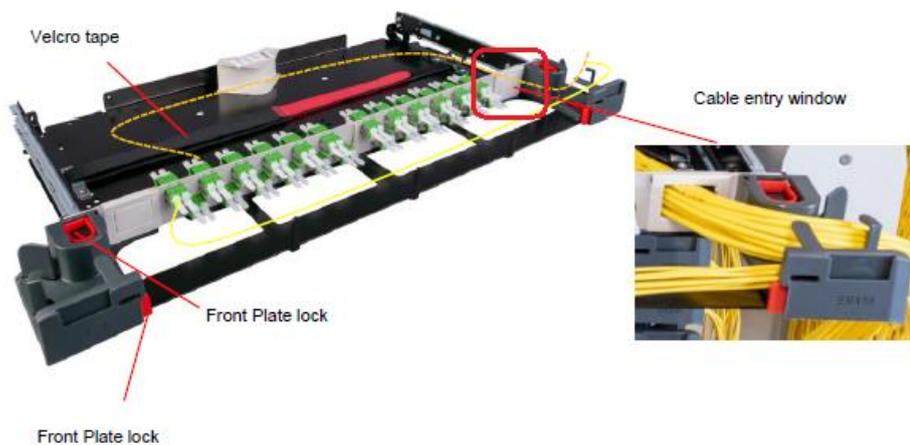**Figure 24. Detail of the patch-panel module of R&M for 48 adapters (empty)**

Figure 25. Detail of the patch-panel module of R&M for 48 adapters (Routing schemes)

This kind of modules have no hand and are valid for installation int both verticals (left or right).

3.1.2.4 R&M'S SPLITTER 1:64 MODULE

R&M has several types of splitters modules in its catalogue but for the deployment of UGG only a new one developed ad-hoc is going to be used.

The module used for this application is a sub-equipped module of 96 connectors, in which internally have been added the splitters needed to have a splitter of 1:64.

Figure 26. Detail of the splitter module of R&M (for splitter 1:64 formed by one splitter 1:2 followed by two splitters 1:32).

The splitter 1:64, is formed internally by one splitter 1:2 followed by two splitters 1:32.

The 1:2 splitter and each 1:32 splitters are installed inside the module and the connection between the 1:2 splitter outputs and the 1:32 splitter input, will come already done from the factory.
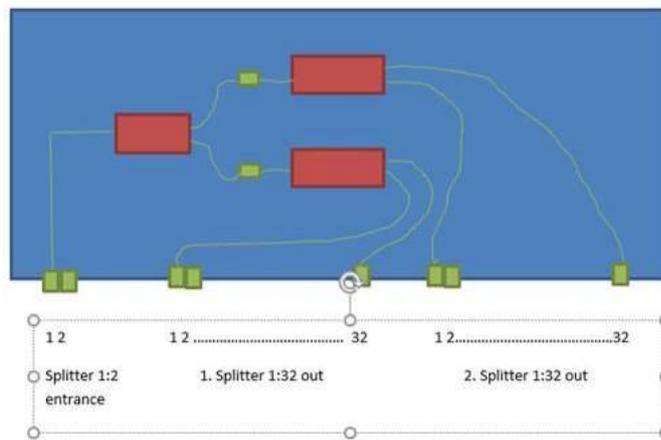
Figure 27. Internal scheme of the 1:64 splitter module

This configuration of splitter allows the change the splitting level of the network to 1:32 easily, retiring the 1:2 splitter if it is needed in the future.

This splitter module has no hand and is possible to install in both verticals. For the deployment of UGG, this module always will be installed in the right vertical of the ODFs.

4.   ODFS CONFIGURATIONS IN PASSIVE POPS

4.1   CONFIGURATION OF THE ODFS

Each ODF has 2 verticals, and each vertical has 56 positions, in which different types of modules can be installed.

The vertical located on the left, will be used to finish the outside plant network (FTTH access side).

The vertical located on the right, will be used for more purposes, but the main functionality is to install splitters, or to finish the local backbone network towards the active POP. This vertical will be called, "internal plant vertical" through the document.

It is possible to install the following different modules:

-    **Splice and connector modules.** This module can be installed in both verticals and it is used to finish optical fiber cables.

-    **Modules with splitters.** This module can be installed only in the "internal" plant vertical. These modules are used to split the signal between N ports, to cover the necessities of point to multipoint technologies (as can be GPON).

4.1.1   *OUTSIDE/EXTERNAL PLANT VERTICAL (FTTH ACCESS NETWORK)*

The left vertical would be used to terminate the FTTH outside/external plant network (optical cables) leaving the POP towards the DPs.

Only "Splice and Connectors" modules would be installed for the termination of the different types of fiber optic cables in this vertical.

Up to 56 modules of 48 fibers could be installed, which would give a maximum capacity of 2.688 fo.

Installation order ➔ The modules will be installed from the top to the bottom as the demand for positions to finish the external plant fibers grows.

4.1.2   *INTERNAL PLANT VERTICAL*

The right vertical would be equipped with different types of modules (splice and connectors modules or splitter modules), and for each type of module or functionality some positions must be defined in order to have a similar front view for all the ODFs.

4.1.2.1 *SPACES DISTRIBUTION IN THE INTERNAL PLANT VERTICAL*

The first 4 positions of the vertical will be reserved for future upgrades or different functionalities that could arise.

The next 8 positions are reserved for the terminations of the local backbone network (the fibers that comes from the main POP). These fibers will be terminated into "splice and connector" modules. With these 8 positions, up to 384 fiber optics could be finished.

The installation of this modules will be made from the top to the bottom.

The next 22 positions are reserved for the installation of splitters of UGG. **Note:** Each module allows the installation of 1 splitter 1:64, therefore those 22 positions would allow to illuminate up to 1.408 fo.

Finally, the 22 end positions of the vertical would be reserved for the installation of different splitter modules of other operators. Up to 22 splitters 1:64 could be installed (that could illuminate up to 1.408 fo). **Note:** These positions would be shared among the other different operators.

In summary, the distribution and reserve of positions in the internal plant vertical would be as follows:

- Positions 1 to 4 are reserved for future upgrades.
- Positions 5 to 12 are reserved for the termination of link fibers between POPs (up to 384 fo).
- Positions between 13 and 35 are reserved for the installation of splitter of UGG.
- Positions between 36 and 56 are reserved for the installation of other operators' splitters.

4.1.3 *FRONT-VIEW CONFIGURATION OF EACH ODF IN PASSIVE POPS*

The following image shows the front view of all the ODFs installed in all the passive POPs.
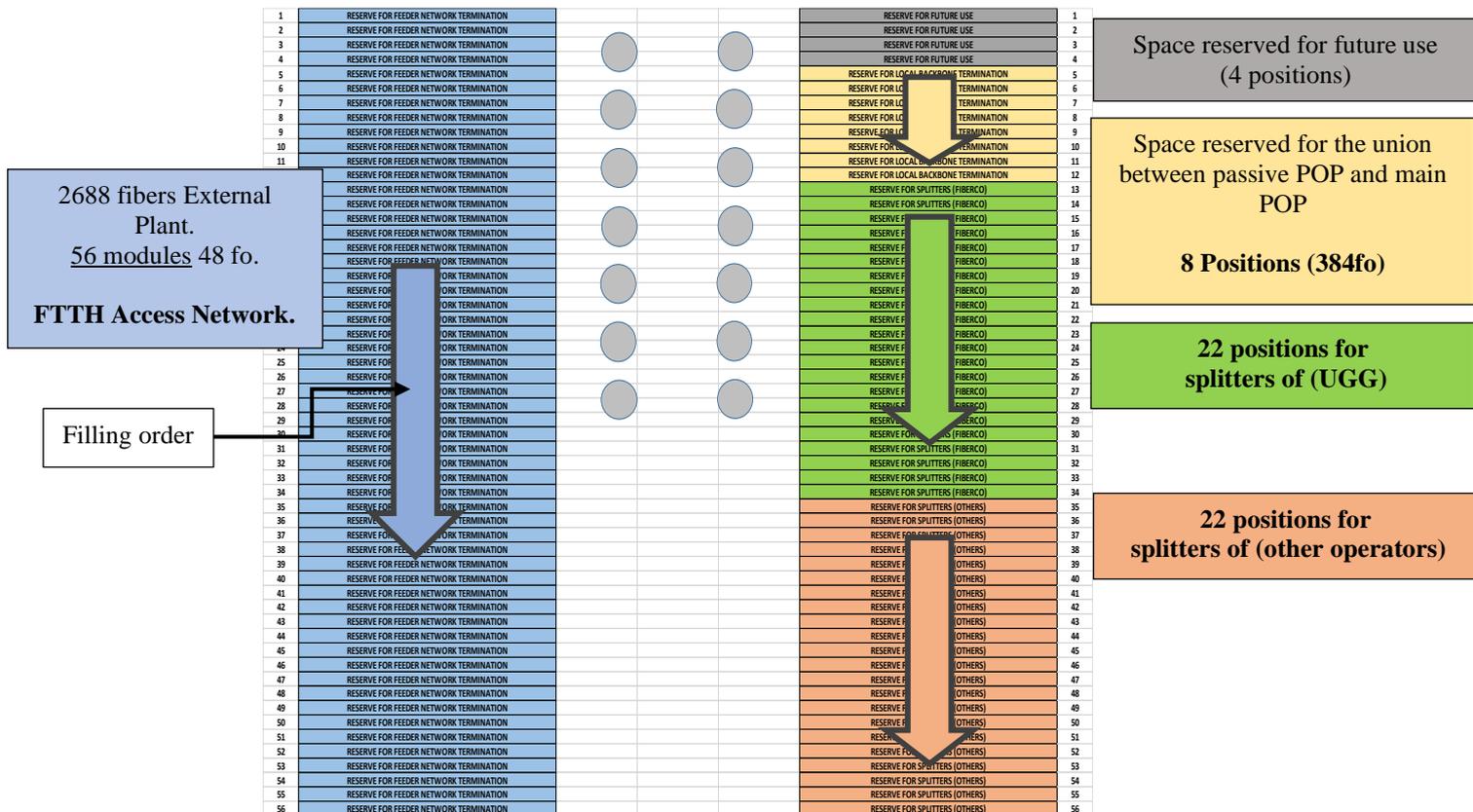
NOTE: The arrows mark the installation order of the modules.

Figure 28. Front view configuration for ODFs in passive POPs.

Other considerations:

- All the ODFs must be loaded in a balanced way, distributing the fibers coming from the Distribution Points (DPs) between different ODFs.
- All the splitters must be distributed between the different ODF according to the number of potential subscribers that depends from each ODF.
- If there is only one cable of Local Backbone coming out of a passive POP, it is finished in the first ODF.
- If there are multiple (Local Backbone) cables coming out of a passive POP, they are finished into different ODFs in a balanced way.

4.2   CONFIGURATION OF ODFS (POP TYPE 3)

Two independent ODF units (one on each wall (2 rows)) would be installed, giving the POP a total fiber termination capacity of 5.376 fo (FTTH access network).

Each ODF would have two verticals identical to those shown in the previous section (same configuration on both verticals: outside/external plant and internal plant).

The two ODF are expected to grow in a manner that is accompanied and balanced.

IMPORTANT: It is very important to note that although both ODF share location, **they should be treated (if it is possible) as separate elements in all their configuration and their links to the main POP.** Each ODF must have a separate and dedicated link to the main POP finished in its internal plant vertical.

Moreover, the inventory rules will take into consideration the fact that every ODF is independent and that the allocation of used positions is carried out in a balanced way.

4.2.1 FRONT VIEW CONFIGURATIONS FOR ODFS IN POP TYPE 3 (PASSIVE POP WITH UP TO 5376 FO):

4.2.1.1 ROW 1 – POP TYPE 3 - FRONT VIEW

The following image shows the front view of the ODF installed in the ROW 1 of the passive POP 3 (passive POP).
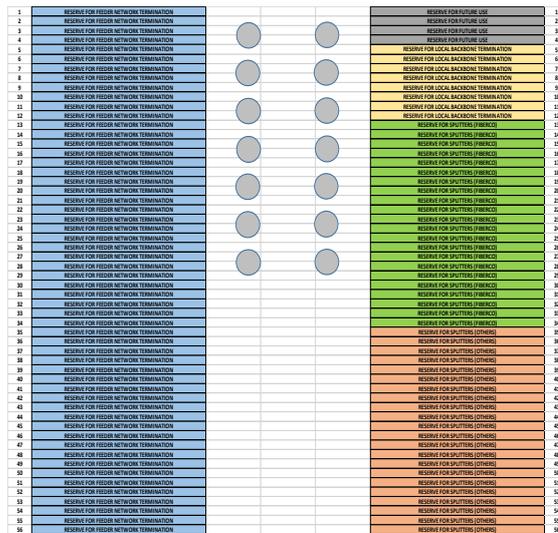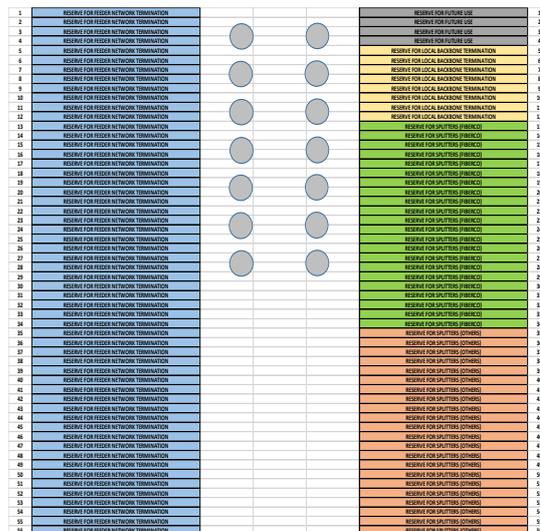

Figure 29. Front view of the row 1 of the POP type 3

4.2.1.2 ROW 2 – POP TYPE 3 - FRONT VIEW

The following image shows the front view of the ODF installed in the ROW 2 of the passive POP 3 (passive POP).

Figure 30. Front view of the row 2 of the POP type 3.

4.3 ODFS CONFIGURATIONS IN PASSIVE POPS (TYPE 4 POP)

In this type of POP, up to 4 ODF could be installed, in two rows formed by 2 ODFs each one.

Each ODF has the same configuration as the one defined in the previous section for the POP type 3.

4.3.1 FRONT VIEW CONFIGURATION OF THE ODFS (POP TYPE 4)

4.3.1.1 ROW 1- POP TYPE 4 - FRONT VIEW

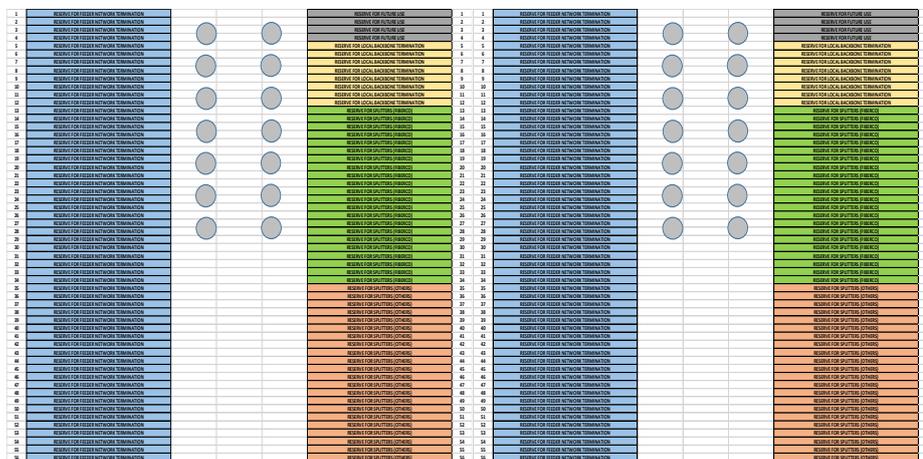On each wall of the POP would have 2 ODFs with the same configuration as shown in the following image:

Figure 31. Front view of the row 1 of the POP type 4.

4.3.1.2 ROW 2 – POP TYPE 4 - FRONT VIEW

On each wall of the POP would have 2 ODFs with the same configuration as shown in the following image:
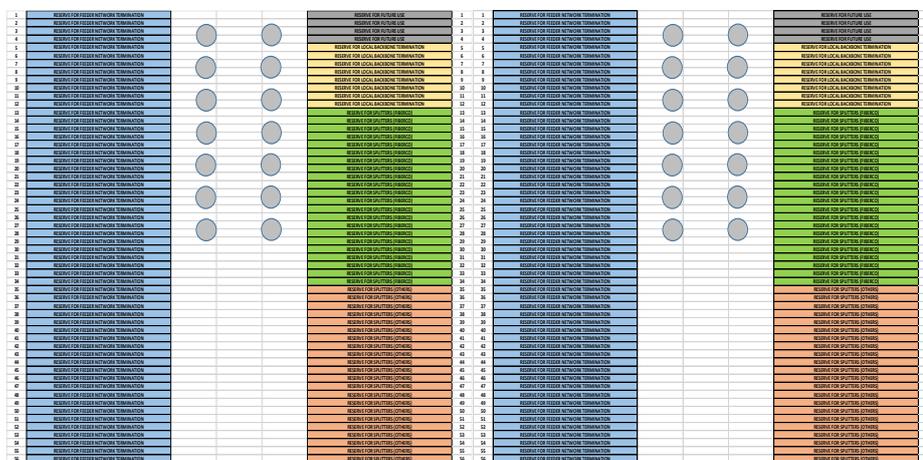

Figure 32. Front view of the row 2 of the POP type 4.

4.4 ODF CONFIGURATIONS IN CDP

The CDP is a cabinet that comes with all the equipment preinstalled from factory. There are defined 2 possible configurations with different capacities: at 100% or at 75%.

The following image shows the front view of the ODF installed in CDP (at 100%):
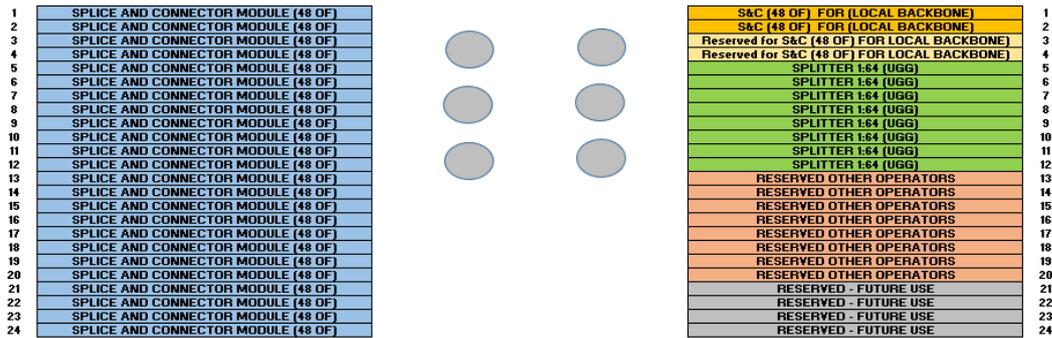

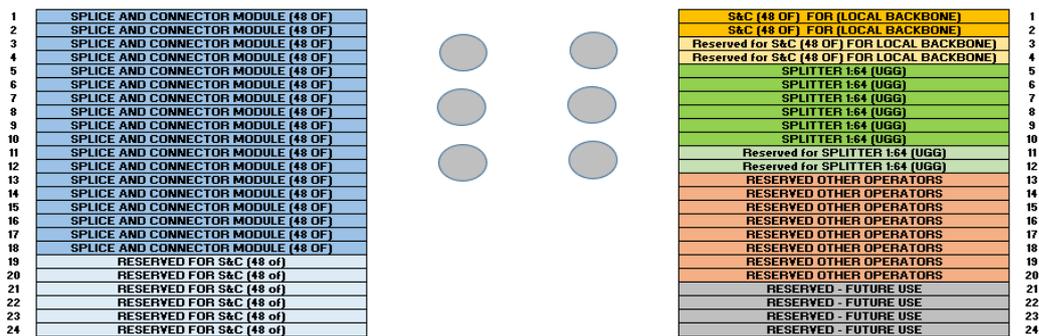**Figure 33. Front view configuration of the ODF of the CDP (100%)**

Figure 34. Front view configuration of the ODF of the CDP (75%)

5. ODFS CONFIGURATIONS IN ACTIVE POPS

The left vertical would be used to terminate the FTTH external plant network leaving the POP towards the DPs or to others Passive POPs that depends from the POP. Only "splice and connectors" modules would be installed for the termination of the fiber optic cables in this vertical.

The vertical located on the right, will be the "internal plant", and mainly will be filled with optical splitters to serve the direct influence area of the ODF. Nevertheless, in some ODFs in this vertical will be finished the fibers of the backhaul network or the backhaul contributions coming from other active POPs (if the ODF is in an aggregation POP).

So, in the ODFs is possible to install the following modules:

- **Splice and connector modules.** This module can be installed in both verticals and it is used to finish optical fiber cables.

- **Modules with splitters.** This module can be installed only in the "internal" plant vertical. These modules are used to split the signal between N ports, to cover the necessities of point to multipoint technologies (as can be GPON).

5.1 OUTSIDE/EXTERNAL PLANT VERTICAL

In the active POPs, the Outside/External plant vertical of the ODFs, can have a little difference in some cases, depending on if the ODF has only to manage fibers of its own direct influence area, or if it has to manage also fibers coming from other passive POPs.

The outside plant vertical must be divided in two different zones: one zone to finish the fibers of the direct area of influence, and other zone to finish the fibers of the contributions of passive POPs).

For the direct area of influence contributions: The modules will be installed from top to bottom as the demand for positions to finish the external plant fibers grows.

For the passive POPs contributions, the modules will be installed bottom up, also, in separated areas (for each passive POP), as this demand grows.

NOTE: If there are several contributions from different passive POPs, and in the active POP there are more than one ODF, the different contributions of the local backbone must be distributed in different ODFs, in order to balance the load. Nevertheless, the local backbone of one passive POP (even if this local backbone is formed by more than one cable) must be finished always in the same ODF in the active POP.

This distribution of spaces must be planned during the phase of network design and must consider a position reservation for each part of the network according to the final capacity required for each one.

It is important to determinate the final position reservation for the direct area of influence and for each passive POP contribution, because the final position for each one, is the beginning and the limit of the next contribution.

IMPORTANT NOTE: it is not possible to fix a (general) position for each purpose inside the Outside/External plant vertical, since these positions will depend of each project, and the casuistic that can be found in the field is very high.

In the following image, an example of an outside plant vertical shared between the direct influence area and several "local backbone" contributions can be see:
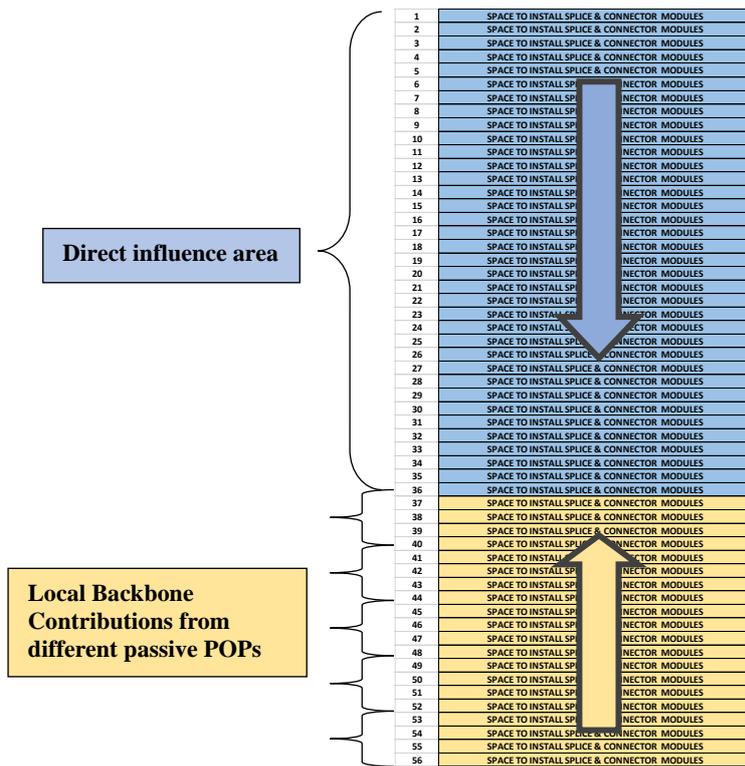

Figure 35. Outside Plant Vertical of the ODF with positions shared for its direct influence area and the local backbone.

5.2   INTERNAL PLANT VERTICAL

The right vertical (used for the internal plant) would be equipped with different types of modules (splice and connectors modules, splitter modules, etc). Each type of module could be installed only in some positions of the ODF in order to keep a similar front view in all the ODFs.

5.2.1   *SPACES DISTRIBUTION IN THE INTERNAL PLANT VERTICAL*

The first 4 positions of the vertical will be reserved to finish the backhaul network (if it is necessary), backhauls contributions from other active POPs or for different functionalities that could arise. The fibers of the backhaul cables will be finished in "splice and connectors" modules, which will be located at the top positions of the vertical. The filling order of those positions will be from top to bottom.

NOTE: if the ODF doesn't have the necessity to finish the backhaul, these 4 positions are reserved for other uses or future upgrades.

The next 8 positions are reserved for other uses or future upgrades.

The following 22 positions will be reserved for the installation of UGG splitter modules (it would allow the installation of up to 22 splitters 1:64 (to illuminate up to 1.408 fo)).

The last 22 positions of the vertical would be reserved for the installation of the splitters of other operators (up to 22 splitters 1:64 could be installed (to be able to illuminate up to 1.408 fo). **Note:** These positions would be shared between different operators.

In summary, the distribution and reserve of positions in the internal plant vertical would be as follows:

- Positions 1 to 4 are reserved for the termination of backhaul fibers and backhaul contributions (if it is and aggregation active POP) **Note:** If there is not backhaul necessities also these positions will be reserved for other uses.

    In case of aggregation active POPs, the use of these 4 positions will be as follow:

    o IPV1 module position 1: for connections with SWD.

    o IPV1 module position 2: for intra-cluster switches connections: subtended or redundancy links (this is for redundant links with other L2AGG switches in the same cluster, if needed).

    o IPV2 (+3 & 4 in case of type 2) module position 1: for backhaul inter-cluster links with L2AGG switches of different clusters, must be balanced between next available ODF racks (this is for redundant links with other switches in different clusters, if needed).

    o Remaining IPV's module positions in sequence order: for downlinking the OLTs hanging from this L2AGG switch.

There will not be blank spaces. The allocation will be in a priority order according to the planned connections.

- Positions 5 through 12 are reserved for other uses or future upgrades.
- Positions between 13 and 34 are reserved for the installation of splitters of UGG.
- Positions between 35 and 56 are reserved for the installation of other operators' splitters.

5.3 FRONT VIEW CONFIGURATION OF THE ODFS IN ACTIVE POPS

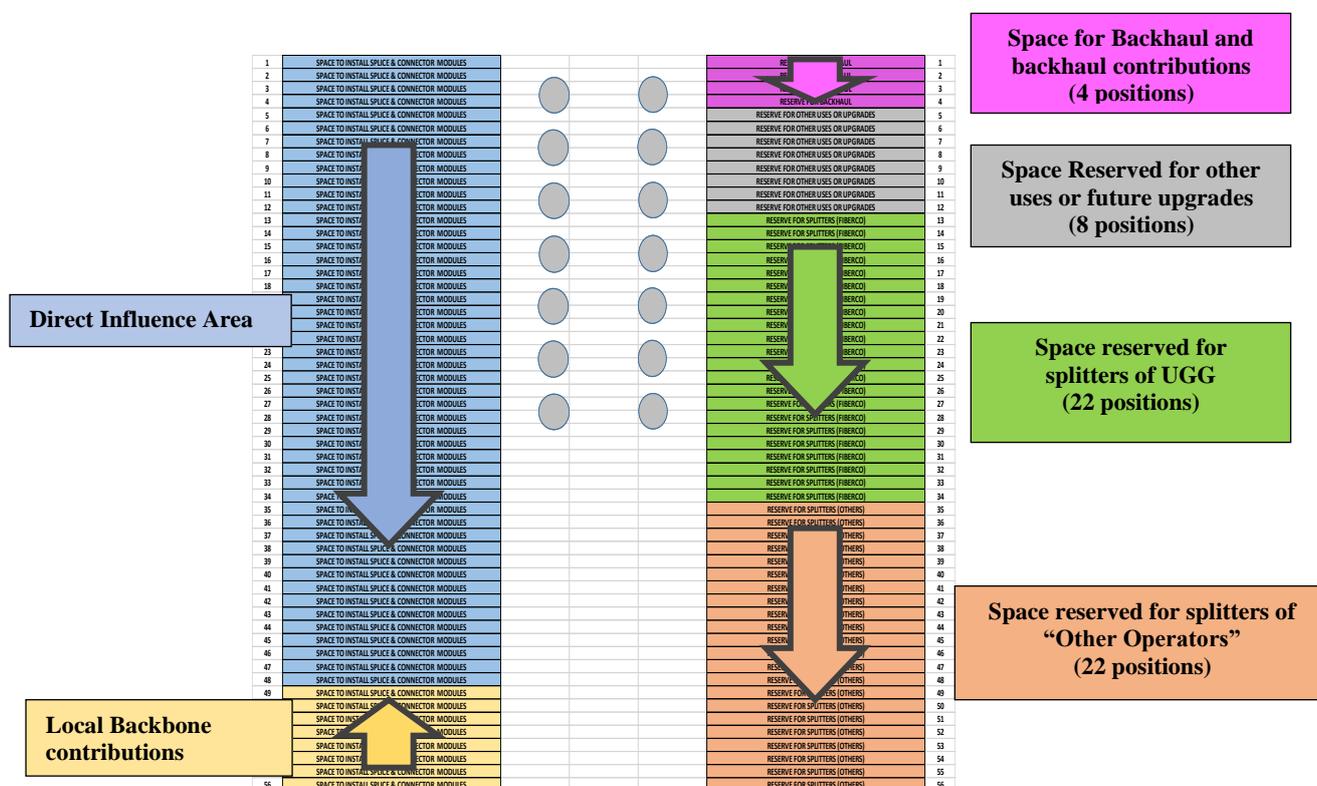The front view configuration for the ODFs installed in an active POP could be as follow:

Figure 36. Front view <u>example</u> of the ODF in an active POP.

IMPORTANT NOTE: The outside plant vertical is shared to finish the fibers of the direct influence area and the local backbone contributions coming from passive pops. If there are not local backbone contributions, all the area could be used for direct influence area.

The position distribution of the internal plant is fixed independently if there backhaul modules are needed or not. That means that the first splitter of UGG will be installed always in the same position (position 13).

NOTE: The arrows mark the installation order.

Other considerations:

- All the ODFs must be loaded in a balanced way, distributing the fibers coming from the Distribution Points (DPs) between different ODFs.
- All the splitters must be distributed between the different ODF according to the number of potential subscribers that depends from each ODF.
- If there are several contributions of local backbone coming from different passive POPs, the load must be distributed in a balanced way between ODFs. The local backbone of one specific passive POP should be finished complete in only one ODF in the active POP (even if the local backbone of this connection is formed by several cables).
- The backhaul network, must be finished in the ODF 1. If there are several backhaul contributions (in the case of aggregation POPs), the first ODF will be loaded until its limit, before to distribute between different ODFs.

5.4   FRONT VIEW CONFIGURATION (POP TYPE 5)

The POP type 5 (active standard) has only 1 ODF installed. The ODF will have the same configuration was presented in the previous section **for all** the ODFs in active POPs.
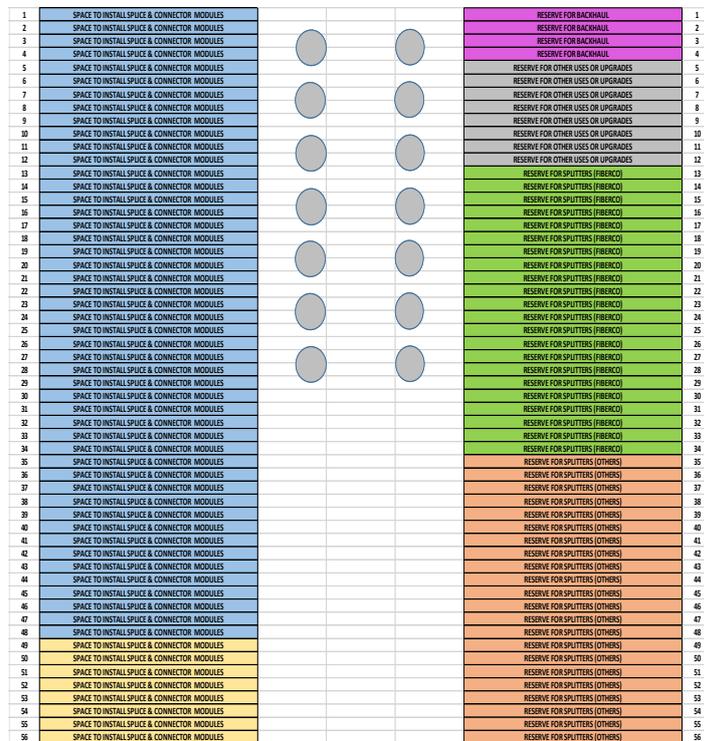

Figure 37. Front view example of the ODF of the POP Type 5

The outside plant vertical of the ODF, could have different configuration if there is not needed to finish local backbone contributions. If the POP has only direct influence area, all the space of the vertical (the 56 positions) could be used to serve the direct influence area.

The internal plant vertical configuration is basically always the same but could be equipped with less or more equipment for example in the backhaul reserve part depending on the necessity to finish back-haul fibers and backhaul contribution that the POP could have.

5.5   FRONT VIEW CONFIGURATION (POP TYPE 1)

The POP type 1 (active standard) has 2 ODF installed in a row.

All the ODFs installed in the POP will have the same configuration layout (no the same equipment), but the same space reserves and uses.

The outside plant vertical of the ODFs, could have different configuration if there is not needed to finish local backbone contributions in all the ODFs of the POP.

It is recommended to balance all the Local Backbone contributions between ODFs (not compulsory).

The internal plant vertical configuration is basically always the same, but if it possible that one of the ODF, the positions reserved to finish backhaul network and the contributions of back haul could be empty.

5.5.1   *ROW 1 – POP TYPE 1 - FRONT VIEW*

The front view of the row for the active pop type 1) could be as the following example:
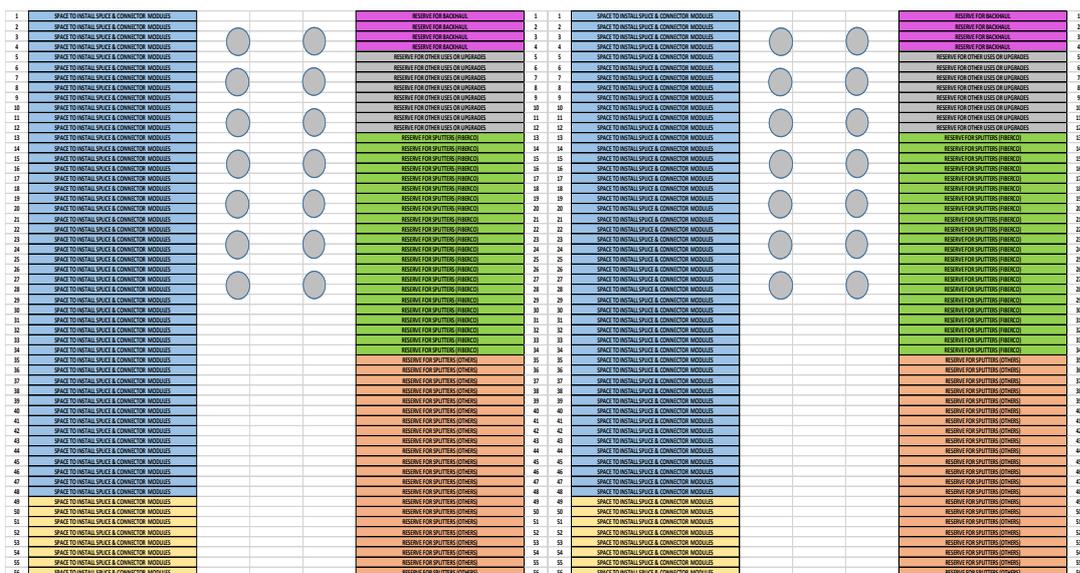

Figure 38. Front view _example_ of the ROW1 of the POP type 1.

5.6 FRONT VIEW CONFIGURATION (POP TYPE 2)

The POP type 2 (active standard) has up to 4 ODFs installed in 2 rows. All the ODFs will have the same configuration.

As in the other cases, the outside plant configuration of all the ODFs could have different configuration if there is not needed to finish local backbone contributions in some of the ODFs. The local backbone contributions (if there are more than one) could be distributed between different ODFs in order to have similar charges of the ODFs.

The internal plant configuration, is basically the same for all the ODFs, but as in other cases commented before, it is possible that some of the ODF will have the backhaul positions empty if there is not a necessity to finish to finish backhaul contributions in all the ODFs.

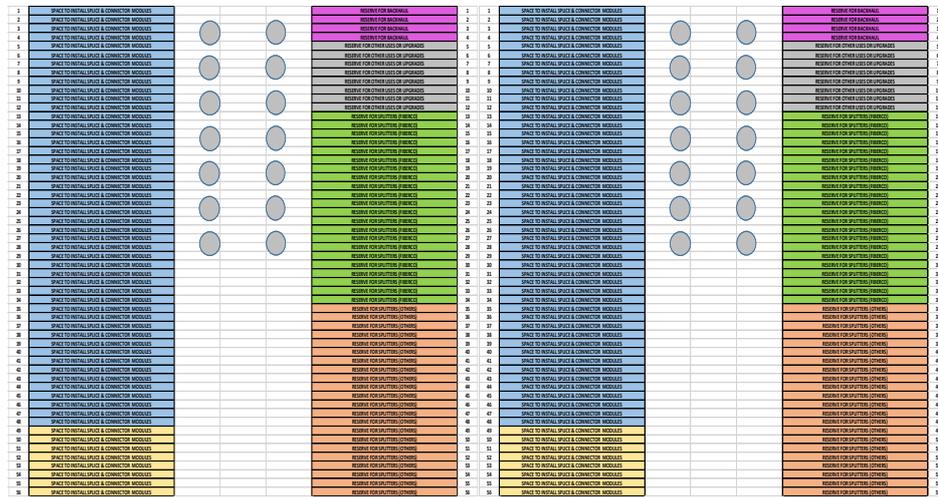### 5.6.1 *ROW 1 – POP TYPE 2 (DIRECT AREA ONLY) - FRONT VIEW*

Figure 39. Front view of the ROW1 of the POP type 2.

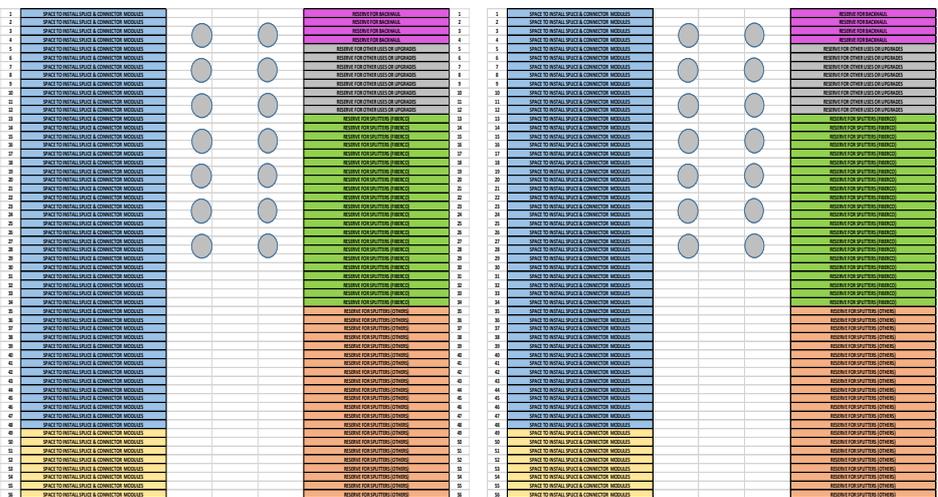### 5.6.2 *ROW 2 – POP TYPE 2 (DIRECT AREA ONLY) - FRONT VIEW*

**Figure 40. Front view example of the ROW2 of the POP type 2.**

6. ANNEX1: EXAMPLE OF CONFIGURATION OF AN ACTIVE POP (AGGREGATION POP) WITH PASSIVE POPS DEPENDENCIES

The following example is the front view configuration of an active POP type 2 (Large), with 4 ODFs (2 ROWs with 2 ODFs each one).

The active and aggregation POP of this example is sited in Regis-Breitingen, and the 2 passive POPs that depends from it are sited in Ramsdorf and Deutzen.

The following image shows the architecture and the POPs dependence:
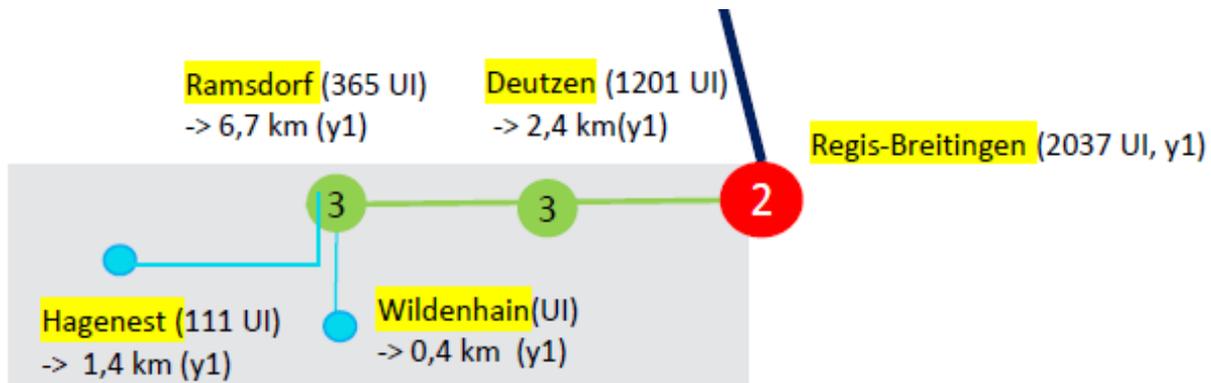
Note: in the picture is not show the active pops that also depends from Regis-Breitingen.

In this case, the POP is an active POP with the functionality of aggregation POP, that means that it has to aggregate the traffic of other active POPs that depends from it.

Regis-Breitingen serves a direct influence area with 56 DP (Distribution Points). This is translated in the necessity to finish 56 cables of 96 fo, in the different ODFs of the POP. Since the POP, has 4 ODFs and the load must be balance between different ODFs, each ODF will have the "splice and connector" modules to finish the fibers of 14 DPs.

Also, Regis-Breitingen serves the passive POPs of Ramsdorf and Deutzen. For this necessity, it is needed to finish the local backbone networks coming from these 2 POPs in the Outside Plant Vertical of some ODFs in Regis-Breitingen. The contribution of Ramsdorf and Deutzen could be finished in different ODFs.

Regis-Breitingen has 2037 home passes, and this number will determine the number of splitters that will be installed in the POP to have the possibility to connect the customers. The splitters must be distributed in a balanced way in the Internal Plant Vertical of all the ODFs installed in the POP. **Note:** for this POP, are needed 14 splitters 1:64, but in the POP are going to be installed 16 (to have all the ODFs with the same load and to avoid splitter expansion in the future).

To connect the POP with the backhaul network, it is needed to finish the fibers of the backhaul network in one of the ODFs of the POP. For this purpose, the first position of the ODF1 will be used. Also, this POP is an aggregation POP, so needs to finish also the backhaul contributions of other 2 active POPs that depends from it. For that, the position 2 and 3 of the ODF1 will be used (these contributions are not needed to distribute between verticals).

For this case, the front view configuration of the ODFs can be seen in the following pictures:

The ROW 1:
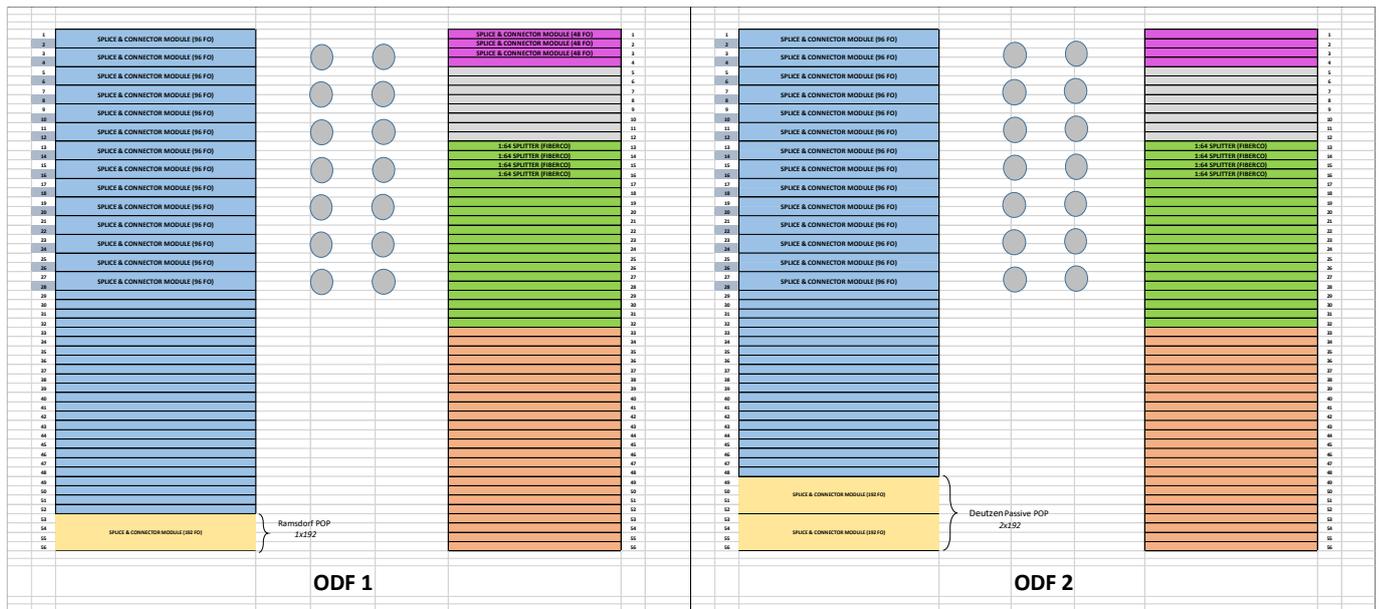
ODF 1 — Ramsdorf POP 1x192

ODF 2 — Deutzen Passive POP 2x192

The ROW 2:

ODF 3

ODF 4
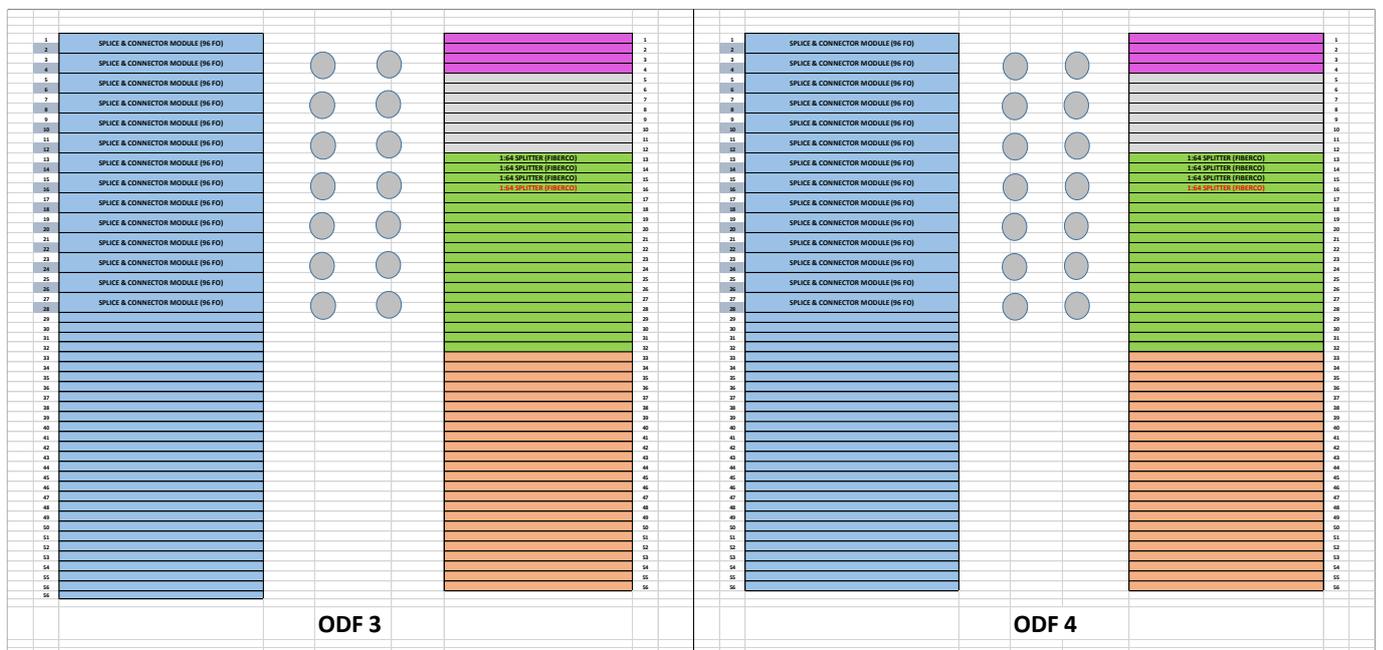
NOTE: The positions with letters are occupied with modules, and the others are empty.

7. ANNEX2: EXAMPLE OF CONFIGURATION OF A PASSIVE POP

The following example is the front view configuration of a passive POP type 3*, with only 1 ODF installed.
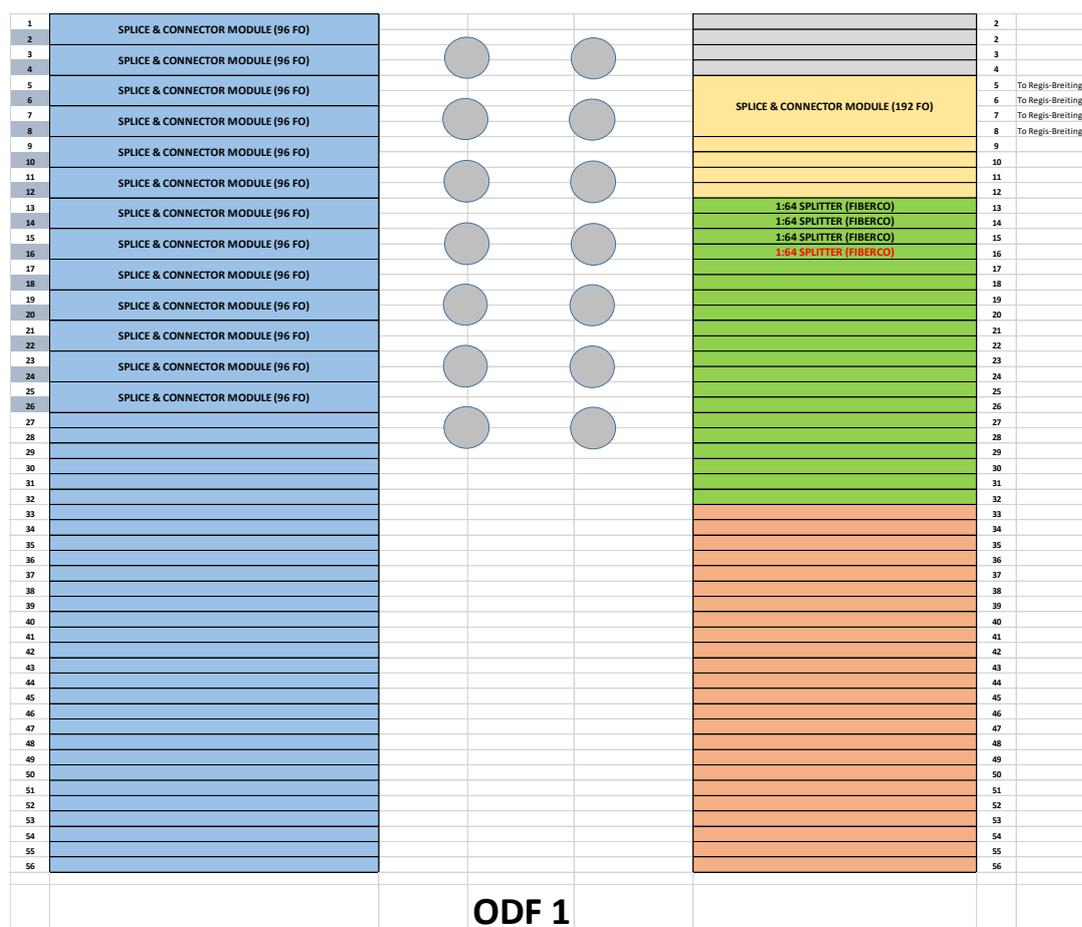
The passive POP of this example is sited in Ramsdorf and depends from the active POP of Regis-Breitingen shown in the Annex 1.

In this case, the Outside Plant Vertical is used to serve the area of influence of the POP only.

The internal plant vertical is used to install splitter modules to serve the area of influence with the % penetration estimated by UGG and to install "splice and connector" modules to finish the local backbone network that join this passive POP with Regis-Breitingen.

NOTE: for this POP only 3 splitters are needed but is going to be installed one more (red letters in the front view) to avoid future expansion of splitters of the ODF.

The local backbone that joins with the active POP is made with a 192 fo optical cable.

ODF 1

NOTE: The positions with letters are occupied with modules, and the others are empty.