TETRA SYSTEM RELEASE 5.5 – 6.5

Installing the TB3

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CASSIDIAN

CASSIDIAN
Metapole
1 boulevard Jean Moulin
CS40001
78996 Elancourt Cedex - FRANCE
Email: PMRsupport@cassidian.com

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DOCUMENT AMENDMENTS			
VERSION	**DATE**	**COMMENTS**	**CHAPTER UPDATED**
08-3	08/2013	Updated for TB3 800 FCC approval.	3.3.1 3.3.3 3.3.8
08-2	05/2013	FCC 1.1310 and Industry Canada RSS-102 Radiofrequency radiation exposure limits added.	3.3
08-1	03/2013	Customer alarms 24-35 (J3) changed to (J8). Information added about TB3 TBCi support for IP transmission.	5.4 Sections 1 , 8.1.1 , 8.2.1 , 8.3 , Tables 33 , 39 , Figure 65
		Instructions added for taking care that the backplane connectors are plugged in the right way.	Sections 8.1.4 , 8.2.4 and Appendix A
07-1	08/2011	TBCi added.	Figures 19 , 20 , 21 , 25 , 27 , 36 , Tables 13 , 33 , Sections 7.1 , 7.1.2
		Corrected cable codes: changed 9726 as 9762	Figures 44 , 59 , 61 , Table 43
		Corrected cable code: changed 9721 as 9761	Table 40
		Minor modifications.	Throughout
07-0	02/2009	Extended TB3 alarms added and illustrations updated to correspond to the current cabinet version.	4,5,6

References

1. TETRA System: Auto-tuned Combiners for TBS, dn00132115
2. TETRA System: Commissioning the TB3, dn04153477
3. TETRA System: FXC E1 and E1/T1 Transmission Unit Description for TETRA, dn05100057
4. TETRA System: Glossary, dn00126469
5. TETRA System: Guidelines for Installing the GPS Unit, dn00126909
6. TETRA System: Guide to TETRA Documentation, dn00126445
7. TETRA System: Installing and Operating the EADS TBS WinMMI, dn00274177
8. TETRA System: Maintenance of TETRA Base Stations, dn00132139

9. TETRA System: TBS Environmental Conditions, dn00132142

10. TETRA System: TB3 Hardware Description, dn04161675

11. TETRA System: TB3 MMI Reference Manual, dn0526038

12. TETRA System: TB3 Product Description, dn04102617

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CHAPTER

1

About this document

The purpose of this document is to give instructions for the installation of the TETRA Base Station TB3 and to ensure that installation is carried out correctly. Descriptions of antenna, power equipment, and other auxiliary system installations are not included in this document.

Cassidian hereby declares that this TB3 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Note

Cabling instructions for the ATC800 4–channel 150 kHz (DA7938) can be found from the document *Auto-tuned Combiners for TBS*, dn00132115.

Note

The TB3 TBCi supports IP transmission from the TETRA System Release 6.5 onwards.

How to use this document

This manual provides the following information:

- Chapter 1 *About this document* (this chapter) introduces the structure of the document.
- Chapter 2 gives an overview of the installation phases and their purpose.
- Chapter 3 lists the preparations of the site and equipment including the safety precautions.
- Chapter 4 gives installation instructions for the cabinets.
- Chapter 5 gives instructions for connecting earthing, power supply, transmission, GPS, customer alarms, customer controls and antenna feeder cables to the cabinet.
- Chapter 6 describes the jumpers of the CSR and TRXSR, as well as PWSR fuses.
- Chapter 7 details the unit installation and jumper settings of the TBC and DRMC.
- Chapter 8 gives instructions for connecting and checking the cabling within the cabinet.

- Chapter 9 describes the completion tasks related to the installation of the TB3.
- Chapter 10 gives an example of an installation check list.
- Appendix A provides instructions for wiring the TB3 backplane to make sure that the connectors are plugged in the right way.

The *Glossary* section explains the central terms and concepts used in this document as well as the abbreviations. The full version of the glossary is provided as a separate document *TETRA System: Glossary*, dn0126469.

We welcome any suggestions for further improvement of this document. Also, should you find any errors or omissions in this document, please forward your comments to your nearest Cassidian representative or to the e-mail address tetra.cudo@cassidian.com.

CHAPTER

2

Installation overview

The purpose of TB3 installation is to:

- Check the delivery.
- Install the TB3 on the site.
- Set the TB3 and the site ready for commissioning.

The TB3 is delivered with plug-in units removed from the subracks. Figure 1 lists the phases of the installation, which are clarified below.

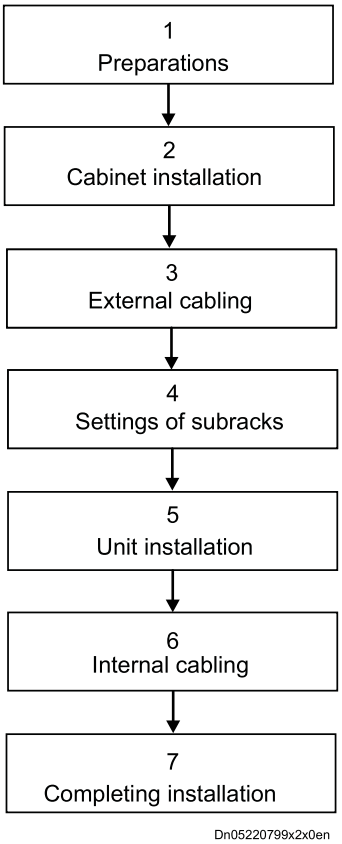

Figure 1 : Installation phases

Preparations

Purpose:

Checking that all the material and documents are available and the work can start. Getting familiar with the Warnings and Cautions sections of this manual.

See Chapter 3 .

Cabinet installation

Purpose:

Unpacking, checking, and installing the TB3.

See Chapter 4 .

External cabling

Purpose:

Connecting earthing, power supply, transmission, GPS, customer alarms, customer controls and antenna feeder cables to the cabinet.

See Chapter 5 .

Settings of subracks

Purpose:

Jumpering the CSR and TRXSR, resetting the PWSR fuses.

See Chapter 6 .

Unit installation

Purpose:

Checking the jumper settings of units and installing the plug-in units to the cabinet.

See Chapter 7 .

Internal cabling

Purpose:

Connecting and checking the cabling within the cabinet.

See Chapter 8 .

Completing the installation

Purpose:

Finishing installation and site-specific documents and cleaning the site.

See Chapter 9 .

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CHAPTER

3

Preparations

3.1 Warnings

This chapter details the recommended safety precautions to be followed when working with the TETRA Base Station TB3.

The safety guidelines are designed in the following way:

- Warnings alert the reader to dangers which may cause physical injury or ill health in any form, potentially including loss of life.
- Cautions are used to denote possible damage to equipment but not dangers to personnel.

Installation, commissioning, integration, and maintenance measures concerning the TB3s may be performed only by properly trained and authorized personnel. The equipment should be installed and located so that only authorized personnel have access to its potentially dangerous parts.

3.1.1 Lethal voltage

Potentially lethal voltages are present within this system. All persons who perform any measures on this equipment must be made aware of this and observe the following precautions to minimize the risk:

To minimize the risk of lethal voltage

1) Before attempting any maintenance work (other than replacing a low voltage plug-in unit in respect of which the person doing the replacement is certain that it can be done without these measures), make sure that all power supply units are completely isolated by setting all the power switches off, including the site mains power switch, disconnecting all relevant connectors and removing all relevant fuses. Do not rely on switches alone to isolate a supply.

2) Make sure that high voltage safety precautions are observed before attempting to work on the system with the power connected.

3) Mains filters (capacitors) are fitted in this system. Potentially lethal voltages can be induced if the equipment is not earthed correctly. Make sure that all earth connections are secure.

The warning label attached to the appropriate parts of the TB3 are shown in the following figure.

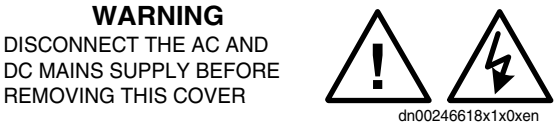

Figure 2 : Warning label

3.2 Toxic hazards

3.2.1 Beryllium oxide

Note

Since TETRA System Release 4.5 the delivered TB3 base stations have not included beryllium oxide.

3.2.2 Toxic fumes

This equipment contains materials, which, in case of combustion, generate the toxic fumes hydrogen fluoride and hydrogen chloride. Precautions must be taken to avoid inhaling the toxic fumes. Dispose of the equipment in a manner appropriate for chemical or special waste according to local regulations.

3.3 Safety distance requirements (compliance boundary)

3.3.1 Public safety at base station installation

To ensure public safety when installing base stations, take into account the following facts. This equipment generates radio frequency energy, which has a thermal effect when absorbed by the human body. For this reason compliance boundaries specific to this equipment have been established. The thermal effect of radio frequency energy can exceed safety levels when a person is inside the established compliance boundaries. By observing the compliance boundary and by ensuring the general public has no access to areas inside the established boundaries, it is ensured that the general public has no exposure to levels in excess of the safety limits.

To ensure installer safety when installing base stations, installation engineers need to be aware of the potential risk of the thermal effects of radio frequency energy and of what precautions to take against undue risk.

When working close to transmitter antennas, the proper safety distances must be observed. The minimum safe distance from an antenna is measured in metres.

WARNING

Do not go any closer to a live antenna than the compliance boundary. The radio frequency energy generated by the antenna poses a serious health risk.

AVERTISSEMENT Ne pas s'approcher d'une antenne active plus près que la limite de conformité. L'énergie radio fréquence générée par l'antenne pose de sérieux risques pour la santé.

When assessing the applicable compliance boundaries, European standards EN 50383, EN 50384, EN 50385 and Council Recommendation 1999/519/EC for occupational and general public electromagnetic exposure limits have been applied (see Section 3.3.6).

Compliance boundaries for the TB3 800 have also been calculated according to FCC 1.1310 and Industry Canada RSS-102 requirements (see Table 3 and Section 3.3.7).

3.3.2 Assessment applying SAR measurements

European standards EN 50383, EN 50384 and EN 50385 do not include specifications for whole body Specific absorption rate (SAR) measurements. Whole body SAR measurements are not required for transmitters that have maximum output power levels too low to result in exposure levels that can reach the whole body SAR compliance limits under any conditions. Whole body SAR exclusion power levels have been based on worst-case assumptions. For details, see the following table.

Table 1 : Whole body SAR exclusion power levels

Exposure category	Maximum output power (rms)
General Public	Max power [W]=general public whole body SAR limit 0.08 [W/kg] 4-year old child mass 12.5 [kg] = 1 W
Occupational	Max power [W]=occupational whole body SAR limit 0.4 [W/kg] 16-year old worker 42 [kg] = 16.8 W

Localized SAR measurement can be used only when:

1. The separation between the phantom and the outer surface of the energy generating element is 40 cm or less.

   and

2. The surface area of the energy generating element is less than 60 cm by 30 cm.

   and

3. The frequency is in the range of 800 to 3000 MHz.

For the reasons mentioned above, SAR measurements are not applicable to TETRA Base Stations.

3.3.3 Assessment of compliance boundary

The compliance boundary is defined as the area around the antenna, shown in the following figure. The centre of the antenna is located at the origo. Distances from the antenna are shown.

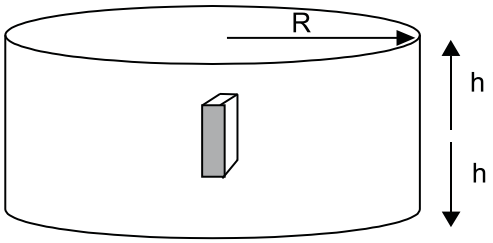

Figure 3 : Area around the antenna

The compliance boundaries for the TETRA Base Stations are given in the following tables for different power levels at the antenna input. The boundaries have been calculated using data from a typical omni antenna with 7.5 dBi gain for the 350 - 470 MHz variants, and with 12 dBi gain for the 806 - 869 MHz variant. Also the typical and worst case power level configurations for general public (GP) and occupational (O) exposure limits are included in the following tables.

Table 2 : Dimensions of compliance boundary in meters (TB3 350, TB3 380, TB3 410, TB3 450)

Power at antenna input (W)	TB3 350, TB3 380, TB3 410, TB3 450			
	R (m)		h (m)	
	GP	O	GP	O
20	2.1	0.9	1.9	1.7
40	3.0	1.3	2.1	1.8
60	3.7	1.6	2.2	1.8
80	4.2	1.9	2.4	1.9
100	4.7	2.1	2.5	1.9
120	5.2	2.3	2.5	2.0

Table 2: Dimensions of compliance boundary in meters (TB3 350, TB3 380, TB3 410, TB3 450) (cont'd.)

Power at antenna input (W)	TB3 350, TB3 380, TB3 410, TB3 450			
	R (m)		h (m)	
	GP	O	GP	O
140	5.6	2.5	2.6	2.0
160	6.0	2.7	2.7	2.0

Table 3 : Dimensions of compliance boundary in meters (TB3 800) according to European, FCC and IC standards

Power at antenna input (W)	TB3 800 European standards				TB3 800 FCC 1.1310 and IC RSS-102			
	R (m)		h (m)		R (m)		h (m)	
	GP	O	GP	O	GP	O	GP	O
20	2.4	1.1	2.4	2.3	2.1	0.9	2.3	2.3
40	3.4	1.5	2.4	2.3	3.0	1.3	2.4	2.3
60	4.2	1.9	2.5	2.3	3.7	1.6	2.5	2.3
80	4.9	2.2	2.5	2.4	4.2	1.9	2.5	2.3
100	5.4	2.4	2.6	2.4	4.7	2.1	2.5	2.3
120	6.0	2.7	2.6	2.4	5.2	2.3	2.6	2.4
140	6.4	2.9	2.6	2.4	5.6	2.5	2.6	2.4
160	6.9	3.1	2.7	2.4	6.0	2.7	2.6	2.4

3.3.4 Typical configuration

The antenna is connected through a connector and cable(s) to the base station as shown in the following figure. A detailed description of the components is given in the tables below.

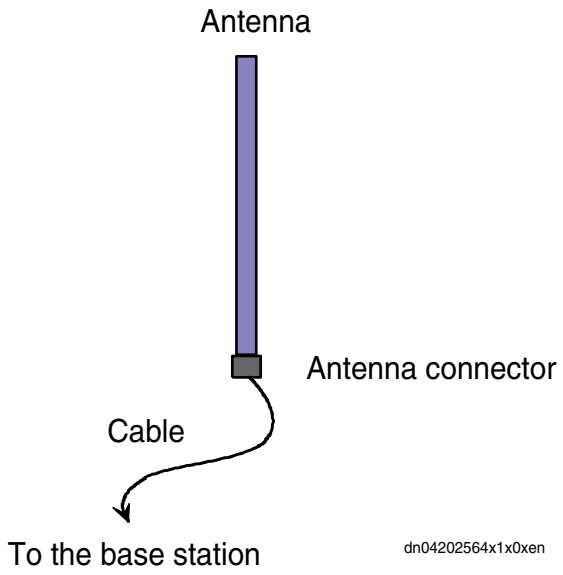

Figure 4 : Antenna connection to the base station

Table 4 : Detailed description of the components

Component	Typical case	Worst case
Power ***(P out)***	25 W	25 W
Total connector loss	0.0 dB	0.0 dB
Total cable loss	1.0 dB	1.0 dB
Total Loss ***(L)*** = Total connector loss + Total cable loss	1.0 dB	1.0 dB
Number of transmitter units ***(N)***	2	8
Power at antenna input = $P_{out} N 10^{\frac{-L}{10}}$	40 W	160 W

Table 5 : Typical antenna specification (TB3 350, TB3 380, TB3 410, TB3 450)

Frequency	350–470 MHz
Gain	7.5 dBi
Pattern	Omni
Electrical downtilt	0 deg
Height/width/depth	3000 / 100 / 100 mm

Table 6 : Typical antenna specification (TB3 800)

Frequency	806–869 MHz
Gain	12 dBi
Pattern	Omni
Electrical downtilt	0 deg
Height/width/depth	4400 / 80 / 80 mm

3.3.5 When using different configurations

Note

In Table 2 , the compliance boundaries are given for different power levels, including the typical and worst case levels. If an exposure limit, antenna, and/or configuration are used which does not correspond to the levels or frequencies given in Table 2 , the compliance boundary must be re-calculated according to EN50383.

The formula for calculating the compliance boundary using the far-field model, which is referenced in EN50383, is given in Section 3.3.8 . This model is applicable for calculating the compliance boundary for the far-field region and over estimates the compliance boundary for the radiating near-field region, but is not applicable for calculating the compliance boundary for the reactive near-field region where the distance from the antenna is less than or equal to λ/4.

3.3.6 Annex A

Council Recommendation 1999/519/EC for occupational and general public electromagnetic exposure limits.

Basic restrictions are given in the following table.

Table 7 : Basic restrictions

Exposure characteristics	Frequency range	Whole body average SAR W kg^{-1}	Localized SAR (head and trunk) W kg^{-1}	Localized SAR (limbs) W kg^{-1}
Occupational exposure	10 MHz –10 GHz	0.4	10	20
General public exposure	10 MHz –10 GHz	0.08	2	4

Note

All SAR values are to be averaged over any period of 6 minutes.

Note

Localized SAR averaging mass is any 10 g of contiguous tissue: the maximum SAR so obtained should be the value used for the estimation of exposure.

Note

Basic restrictions between 10 GHz and 300 GHz are given in power densities.

For occupational exposure it is 50 Wm^{-2} and for general public exposure it is 10 Wm^{-2}.

Reference values are calculated from basic restrictions. The results are given in the following table.

Table 8 : Reference values calculated from basic restrictions

Exposure characteristics	Frequency range	Electric field strength V/m	Equivalent plane wave power density S ($W\ m^{-2}$)
Occupational exposure	10 — 400 MHz 400 — 2000 MHz 2 — 300 GHz	61 $3f^{1/2}$ 137	10 f/40 50
General public exposure	10 — 400 MHz 400 — 2000 MHz 2 — 300 GHz	28 $1.375f^{1/2}$ 61	2 f/200 10

Note

f stands for frequency in MHz.

Note

For frequencies between 100 kHz and 10 GHz, S is to be averaged over any period of 6 minutes.

Note

For frequencies exceeding 10 GHz, S is to be averaged over any period of $68/f^{1.05}$ minutes (f in GHz).

3.3.7 Annex B: FCC 1.1310 and Industry Canada RSS-102 Radiofrequency radiation exposure limits

RF field strength limits for power density are given in the following table.

Table 9 : RF field strenght limits for power density

Exposure characteristics	Frequency range (MHz)	Power density (W/m2)	Averaging time (minutes)
Occupational/ Controlled environment	300 – 1500	f/30	6
General public/ Uncontrolled environment	300 – 1500	f/150	FCC 1.1310: 30 RSS-102: 6

Note

f stands for frequency in MHz.

3.3.8 Annex C: Far-field calculation method

This model is applicable for calculating the compliance boundary for the far-field region and over estimates the compliance boundary for the radiating near-field region, but is not applicable for the calculating the compliance boundary for the reactive near-field region where the distance from the antenna is less than or equal to λ/4. Therefore all the calculations are valid when the compliance boundary is greater or equal to the antenna dimensions plus λ/4.

The compliance boundary in metres, or r_{min}, is calculated according to the following equation:

$$r_{\min} = \sqrt{\frac{N\,10^{(G-L)/10}\,P_{\text{out}}}{4\pi S}}$$

Figure 5 : Formula for calculating compliance boundaries

The formula includes the following factors:

- N - number of transmitter units per one antenna
- G - antenna gain (dBi)
- L - minimum cable loss (dB)
- P_{out} - maximum power of one transmitter unit (W)

- S - power density limit (W/m^2)

In the far-field, the field calculation does not take into account the antenna size, which is assumed to be a point source. Therefore when calculating the compliance boundary, the far-field data, antenna size, and reactive field criteria have to be taken into account.

3.4 Weight and temperature

3.4.1 Cabinet

Care must be taken when handling the cabinets. Install cabinet lifting eyelets and use a mechanical lifting equipment to lift a cabinet.

3.4.2 Plug-in units

Care must be taken when handling heavy plug-in units. These are equipped with warning labels.

WARNING

Do not carry heavy units from the handle. The handle is only for pulling the unit out of the rack.

3.4.3 High temperatures

Care must be taken when touching units as they may reach high temperatures.

3.5 Cautions

3.5.1 Electromagnetic fields

When installing the antennas, the emission of other antennas nearby has to be known beforehand.

3.5.2 Antenna connectors

Do not disconnect the antenna connectors when the TB3 is powered on.

3.5.3 Storage and transportation

During storage and transportation, the units must remain in their original packages in order to:

- avoid mechanical damage
- maintain traceability
- protect the units against static electricity.

3.5.4 Electrostatic discharge protection

An electrostatic sensitive device is an electronic component that may be permanently damaged by electrostatic charges encountered in routine handling, testing, and transportation.

Electrostatic sensitive devices are labelled as follows:

Figure 6 : Sign for electrostatic sensitive devices

Electrostatic discharge is caused by direct contact or an electrostatic field. If a charged body approaches an electrically conducting surface, the acquired potential is discharged. An equalizing current can then flow in the associated circuitry and generate permanently damaging voltages by induction.

CAUTION

Always wear a close-fitting earthing hand strap around your uncovered wrist when handling electrosensitive TB3 units.

The human body should be earthed at the same potential as the component or equipment being handled. The hand strap creates an equipotent electrical connection between the object and the human. There is an earth stud in all TB3 cabinets to which the hand strap must be connected.

3.5.5 Security in installation and maintenance

The instructions in references must be followed when installing this equipment. It may be dangerous to the installation personnel to neglect the instructions.

The instructions in references must be followed when performing any maintenance measures on this equipment. Neglecting the instructions may be dangerous to maintenance personnel.

3.6 Site preparations

The cabinet installation phase requires that the site is properly surveyed and prepared, and all required external services correctly installed. The site survey must identify any special requirements for the installation, such as lifting equipment.

To prepare the site for the cabinet installation

1) Check the accessibility to the cabinet.
2) Inspect the site visually and make sure the following requirements are fulfilled:
   - The site-specific installation instructions are available.
   - The site is prepared according to the instructions.
   - The site survey is completed.
   - The site survey report is available.
   - The site is clean.
3) Verify that all external connections for the cabinet are available:
   - earthing point
   - mains power with correct rating and complying with national requirements (AC or DC power according to the site)
   - transmission interface to the exchange
   - TX and RX antenna cables
   - cable from Global Positioning System (GPS) antenna unit (optional)
   - customer alarm cable (optional).
4) Ensure the cabinet can be installed safely by verifying the following:
   - The lifting and other equipment is available.
   - There is adequate working space.
5) Check that the delivery is complete.

3.7 Tools

The installation personnel must be familiar with the tools listed in the following table and competent in using them.

Table 10 : Installation tools

Tool	Quantity
Roll rule, 3 m	1
Roll rule, 20 m	1
Calliper rule	1
Spirit level, >1 m	1
Felt pen, 1 mm	2
Masking tape, 25 mm	1
Screwdriver set (for slotted 5 and crossrecess PZ1, PZ2) and Torx T10, T20, T30	1
Set of Allen keys (long)	1
Torx T8 50 mm Long Power Bit	1
Open-end or box wrenches 8, 10, 16, and 17	1
Ratchet handle, extension shaft, and socket 19 mm	1
Torque wrench for SMA, N and 7/16 connectors	1
Side-cutting pliers	1
Combined pliers	1
Pointed pliers	1
Stripping pliers for 2.5 and 4 mm^2 wires	1
Plastic mallet	1
Knife	1
Scissors	1
Cable pliers max Cu 50 mm^2	1
Stripping knife	1
Crimping tool for connectors C 16 + 16, C 25 + 25 and C 50 + 50	1
Multimeter (tolerance 0.1 %)	1
(Soldering iron and tin	1)
Crimper for BNC and SMB connectors	1
(Hammer drill, 15 mm bit	1)

The tools in parentheses are not absolutely necessary for a successful installation, but may be needed in some cases.

3.8 Traceability

Units are labelled with permanently attached product identification labels. The labels are designed to be permanent throughout the life span of the TB3. Make sure that the product identification labels are in their places and undamaged.

CHAPTER

4

Cabinet installation

4.1 Space requirements

To ensure that the equipment gets enough cooling air, observe the following minimum clearances around the cabinets:

- 100 mm between the cabinet side panels, back panel and the wall
- 300 mm above the cabinet top
- 650 mm at the cabinet front.

A minimum clearance of 35 mm must be left between the base and the cabinet bottom to ensure adequate air flow.

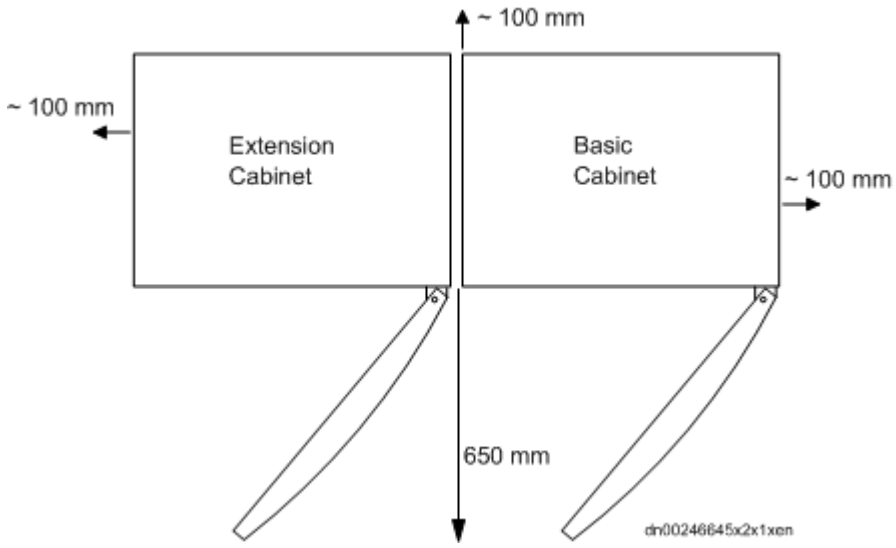

Figure 7 : Cabinet side and rear clearances

The dimensions of the TB3 cabinet are:

- width 600 mm (with extension cabinet 1220 mm)
- height 1615 mm (includes the 35 mm clearance beneath the cabinet bottom)
- depth 530 mm.

The extension cabinet can be placed on either side of the basic cabinet, and the cabinet front door can be installed to open either to the left or to the right.

4.2 Unpacking and checking

CAUTION

Heavy weight. Be careful when lifting the cabinet! The cabinet is delivered with the internal cables, the roof frame, and the door in place.

Eye bolts (M12) can be used for lifting.

To unpack and check the cabinet

1) Open the transportation container.
2) Carefully lift off the container around the cabinet.
3) Carefully lift the cabinet into an upright position using the container bottom.
4) Remove the polystyrene L-shields and the plastic packing.
5) Open the cabinet door and remove the three silica gel bags that have been put into the cabinet to remove moisture.
6) Check the delivery against the packing list.
7) Add the packing list in the Site Folder.
8) Take the type plate sticker from the plastic bag located in the dummy plate set box and attach it on the cabinet according to the following figure.

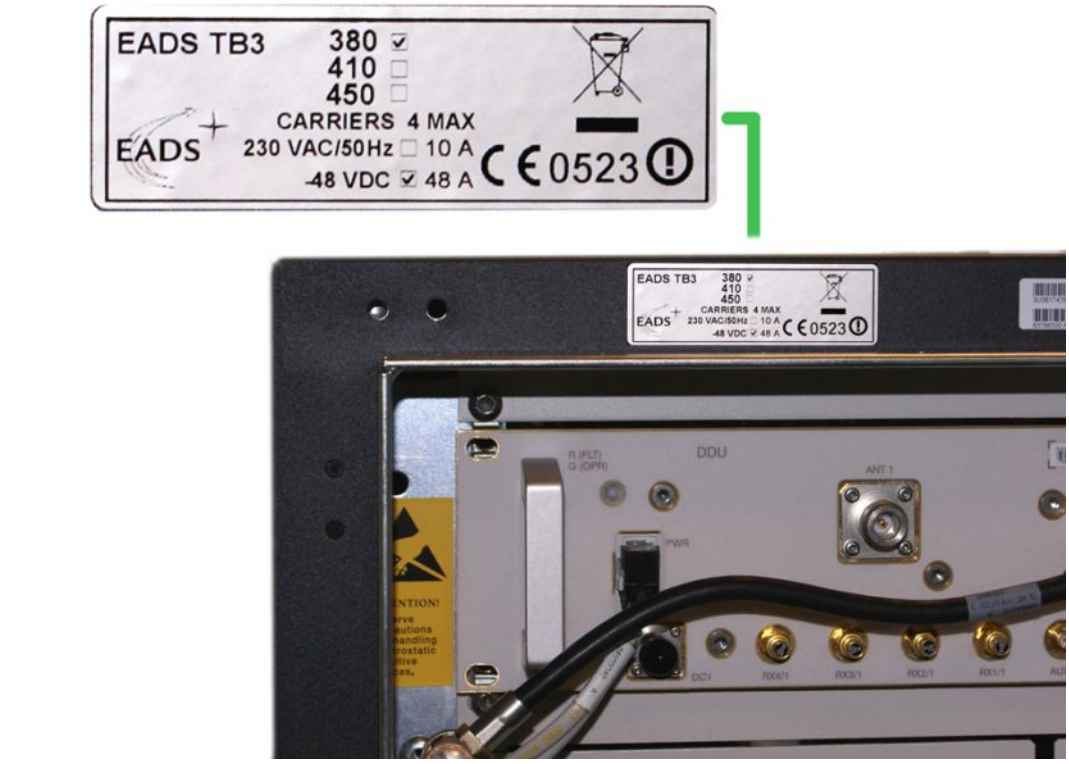

Figure 8 : Placement of the type plate sticker

Note

The SMA terminals in the plastic bag are for terminating the unused outputs in DRMCs and DDUs.

4.3 Installation preparations

This chapter provides instructions for removing the cabinet roof frame, removing the front door, changing the opening direction of the door, and removing the back panel:

- Section 4.3.1 .

  Remove the roof frame if you use lifting eye bolts for lifting.
- Section 4.3.2 .

  Removing the front door is optional.
- Section 4.3.3 .

  Changing the opening direction of the door is optional.
- Section 4.3.4 .

Removing the back panel is necessary only if you bolt the cabinet to the base through the rear bolting holes. The front and middle bolting holes are accessible through the front door.

Note

Opening the door or removing the back panel will cause an alarm in the exchange.

4.3.1 Removing the roof frame

To remove the roof frame

1) Loosen, but do not completely remove, the four roof frame fixing screws.
2) Working from the back of the cabinet, pull the roof frame toward you and lift it off.

Refit the roof frame by reversing the steps above.

4.3.2 Removing the door

Removing the front door is not necessary but it is possible.

CAUTION

Heavy weight. Be careful when lifting the door.

To remove the cabinet front door

1) Open the door to a 90 degree angle.
2) Remove the ground cable from the door fixing point.
3) Loosen the M5 screws of the lower hinge (cabinet side) with an 8 mm wrench.
4) Lift the door off the upper hinge.
5) Lower the door off the lower hinge.

Refit the door by reversing the steps above.

4.3.3 Changing the opening direction of the door

The cabinet door can be installed to be opened either from the right or the left. Follow the instructions below for changing the opening direction.

To change the opening direction of the door

1) Open the door to a 90 degree angle.

2) Remove the ground cable from the door fixing point.
3) Loosen the M5 screws of the lower hinge (cabinet side) with an 8 mm wrench.
4) Lift the door off the upper hinge.
5) Lower the door off the lower hinge and lay it to one side.
6) Remove the lower hinge.
7) Install the lower hinge as the upper hinge on the other side.
8) Remove the upper hinge.
9) Install the upper hinge as the lower hinge on the other side.

Note

Leave the lower hinge in the upper position and do not tighten the screws yet.

10) Lift the door on the upper hinge.
11) Slide the lower hinge into the lower position and tighten all screws.
12) Re-attach the ground cable to the door fixing.

4.3.4 Removing the back panel

You will need to remove the back panel, if you bolt the cabinet to the base from the rear of the cabinet.

CAUTION

Heavy weight. Be careful when lifting the cabinet back panel.

The back panel is attached to the cabinet with eight Torx screws.

To remove the back panel

1) First remove the roof frame as instructed in Section 4.3.1 .
2) Starting from the bottom, loosen all the Torx screws using the Torx key.
3) Lift the panel and pull it away from the cabinet.

Reinstall the back panel by reversing the steps above.

4.4 Lifting the cabinet

CAUTION

Lift the cabinet without the units installed.

When using a mechanical lifting device, use all four M12 lifting eye bolts for lifting.

Lift the cabinet to its place by crane or some other mechanical lifting method.

To lift the cabinet

1) Remove the cabinet roof frame.
2) Fasten all four M12 lifting bolts to the cabinet top.
3) Attach the lifting ropes to the lifting eye bolts.
4) Lift the cabinet directly upward.
5) Position the cabinet to the correct location.
6) Remove the lifting ropes.

The lifting eye bolts can be left in place or removed for reuse.

4.5 Mounting the cabinet

Although the cabinet can be left standing on its feet, bolting it to the base is recommended. The maximum bolt size is M12. The bolts are included in the delivery.

Note the following caution:

CAUTION

If there is the slightest danger of the cabinet toppling over, as in earthquake areas, the cabinet must be bolted to the base. The cabinet has six bolting points at the cabinet bottom for anchor bolts. The front and middle bolting points are accessible through the front door. For access to the front bolting points, the air deflector must be removed. For access to the mid bolting points, the fan unit cover plate and the fan units must be removed. For access to the rear bolting points, the cabinet back panel must be removed.

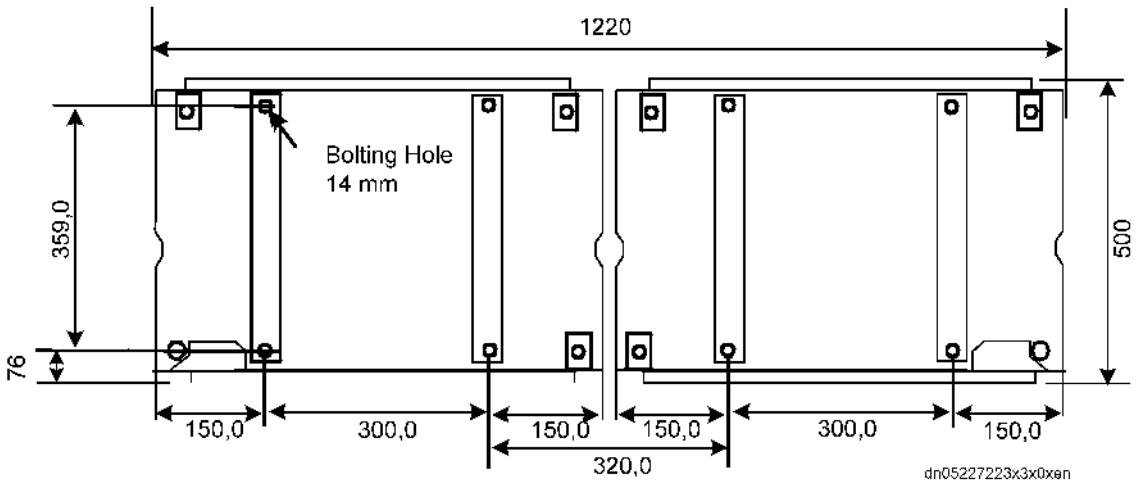

Figure 9 : Basic and Extension cabinet bolting points

A minimum clearance of 35 mm must be left between the base and the cabinet bottom to ensure adequate air flow.

To mount the cabinet to the base

1) If necessary, remove the cabinet door, fan unit cover plate, fan unit, air deflector, and the back panel.
2) Use a spirit level to verify that the cabinet is horizontal. If the cabinet is not horizontal, adjust the cabinet's feet until it is.

To bolt the cabinet to the base

1) Insert at least four anchor bolts in the base.
2) Insert nuts and washers to the bolts and adjust their height so that they are horizontal and on the same level from the base as the cabinet's feet. Check with a spirit level.

   CAUTION

   If you bolt the cabinet to the base, make sure the cabinet rests both on the bolts and the cabinet's feet so that the cabinet bottom is horizontal. Uneven bolting may damage the cabinet.

3) Lift the cabinet in place.
4) Insert nuts and washers to the bolts on the cabinet bottom side and tighten.
5) Adjust the cabinet's feet until the cabinet rests on both the bolts and on the feet.

4.6 Installing the combiner guiding supports

The combiner guiding supports can be installed in several different configurations. The figures on the following pages illustrate the different possible configurations. The meanings of the reference numbers in the figures are explained in the table below.

Table 11 : The meanings of the reference numbers

Ref. number	Object name
2	Dummy plate 0.5 U
3	Dummy plate 1.5 U
4	Dummy plate 1 U
5	2U-front panel
6	Guide support
7	TX screw M6X12
10	dummy plate 3/4 U
11	Dummy plate 2 U

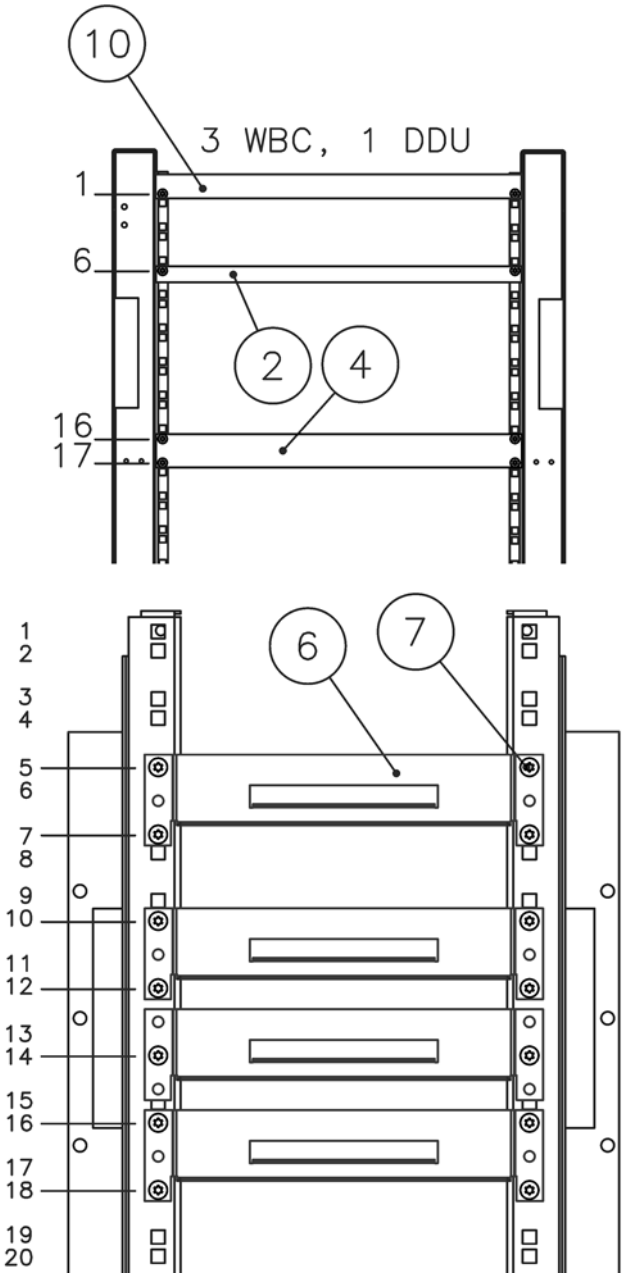

Figure 10 : Dummy plate settings and combiner guiding supports with 3 WBCs and 1 DDU

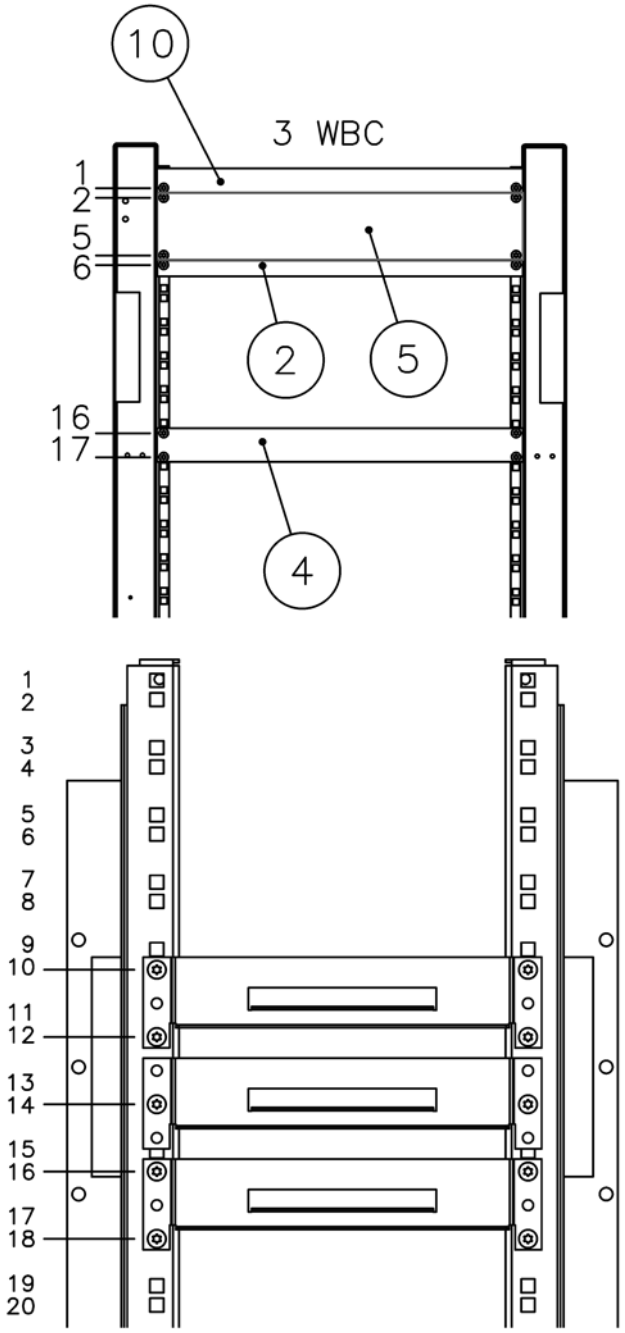

Figure 11 : Dummy plate settings and combiner guiding supports with 3 WBCs

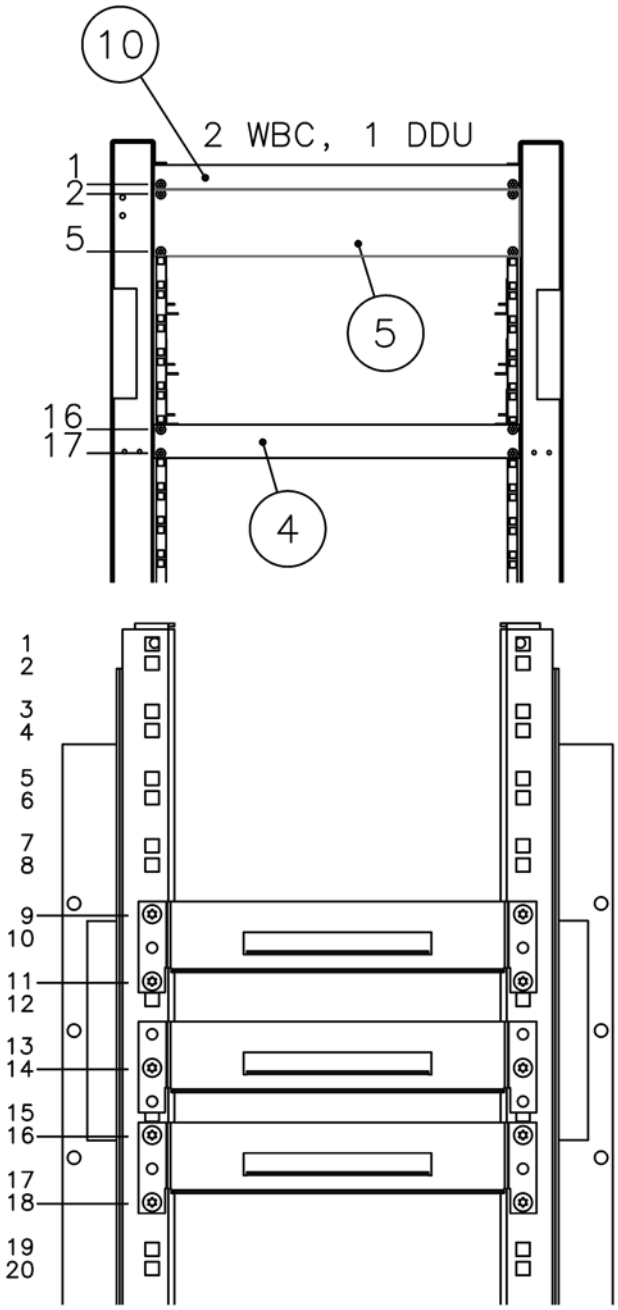

Figure 12 : Dummy plate settings and combiner guiding supports with 2 WBCs and 1 DDU

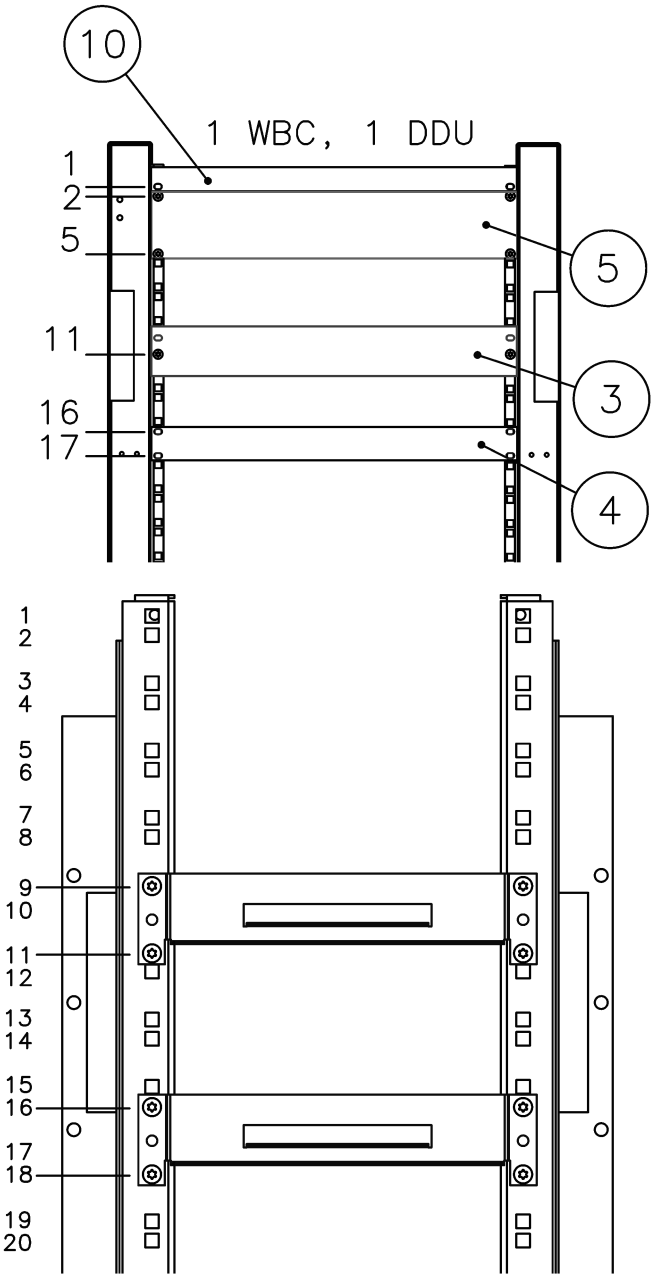

Figure 13 : Dummy plate settings and combiner guiding supports with 1 WBC and 1 DDU

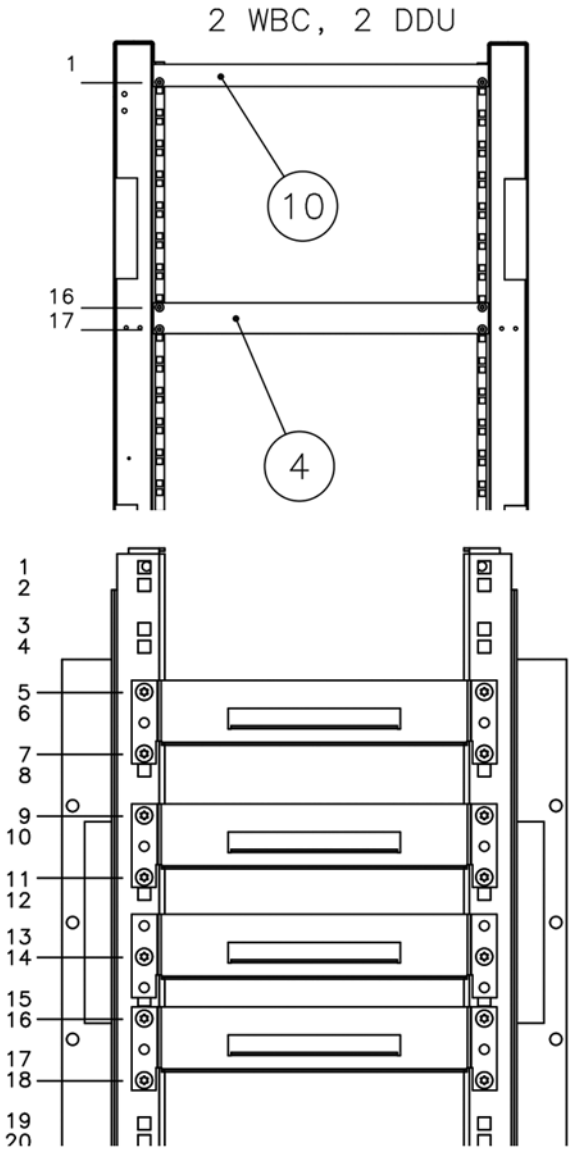

Figure 14 : Dummy plate settings and combiner guiding supports with 2 WBCs and 2 DDUs

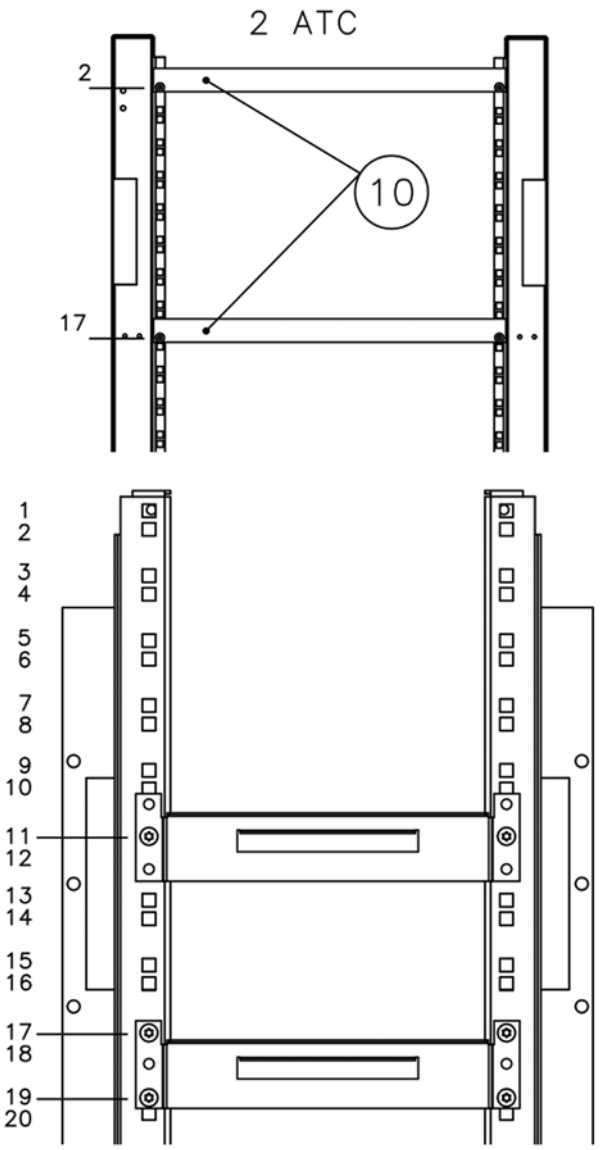

Figure 15 : Dummy plate settings and combiner guiding supports with 2 ATCs

Note

Because the guiding support ’s fixing holes are larger than the diameter of the fixing screws, make sure that you push the upper guiding support as high as it will go before tightening the screws. Similarly, push the lower guiding support as low as it will go. This way you will ensure that there is maximum space between the guiding supports.

4.7 Door lock assembly

A lock can be fitted on the door of the cabinet, but it is not part of the delivery and must be purchased separately. In the following, examples of suitable locking devices are given:

- ASSA ABLOY type 3277C (cylinder) + 434852 (cam)
- SOUTHCO type CM-2–3C101–2SB (cylinder) + CM-C210 (cam).

Note that the bushing required in the lock installation is delivered with the cabinet, in a plastic bag attached to the inner panel of the cabinet door.

The following figure shows the dimensions of the lock assembly.

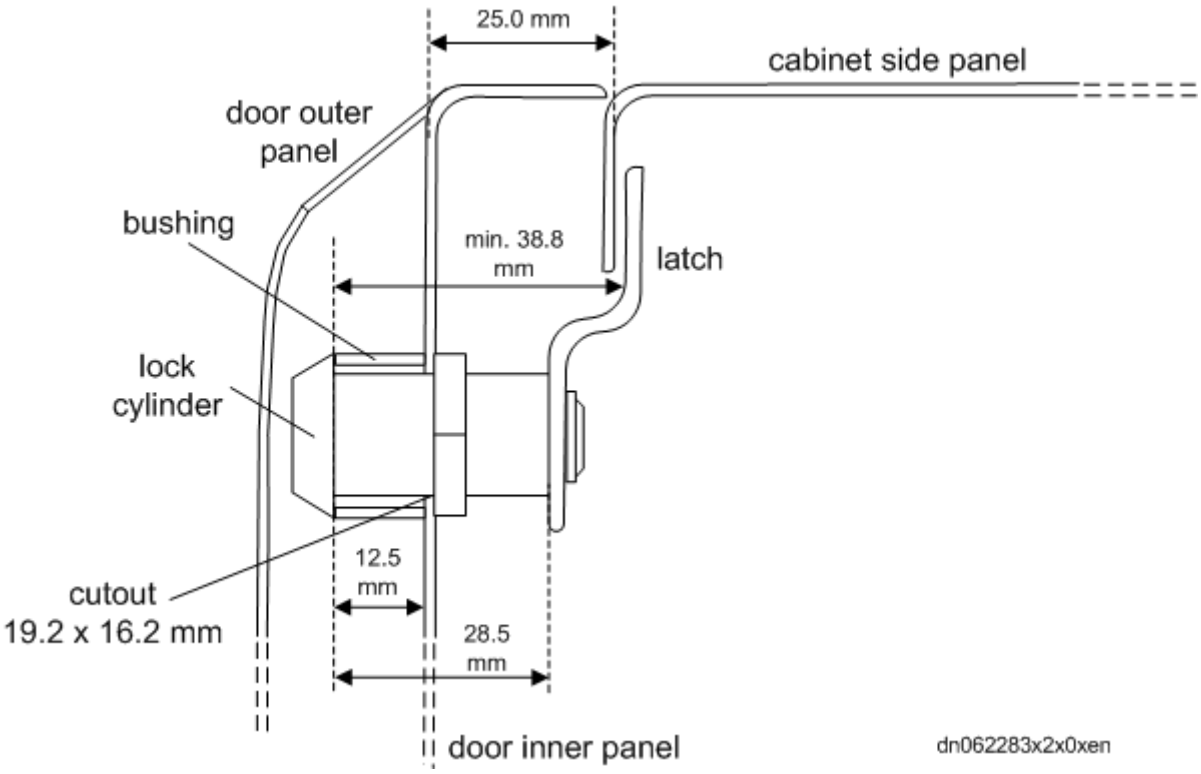

Figure 16 : Dimensions of the lock assembly

4.8 Installing the extension cabinet

The extension cabinet can be installed to either side of the basic cabinet so that the cabinets face in the same direction and there is a 20 mm gap between them. A double cabinet installation consists of the following procedures:

- Preparing the cable openings on opposing sides of the cabinets.

- Joining the cabinets with the EMC clamp round the cable opening and with a spacer.
- Bolting the cabinets to the base when necessary.

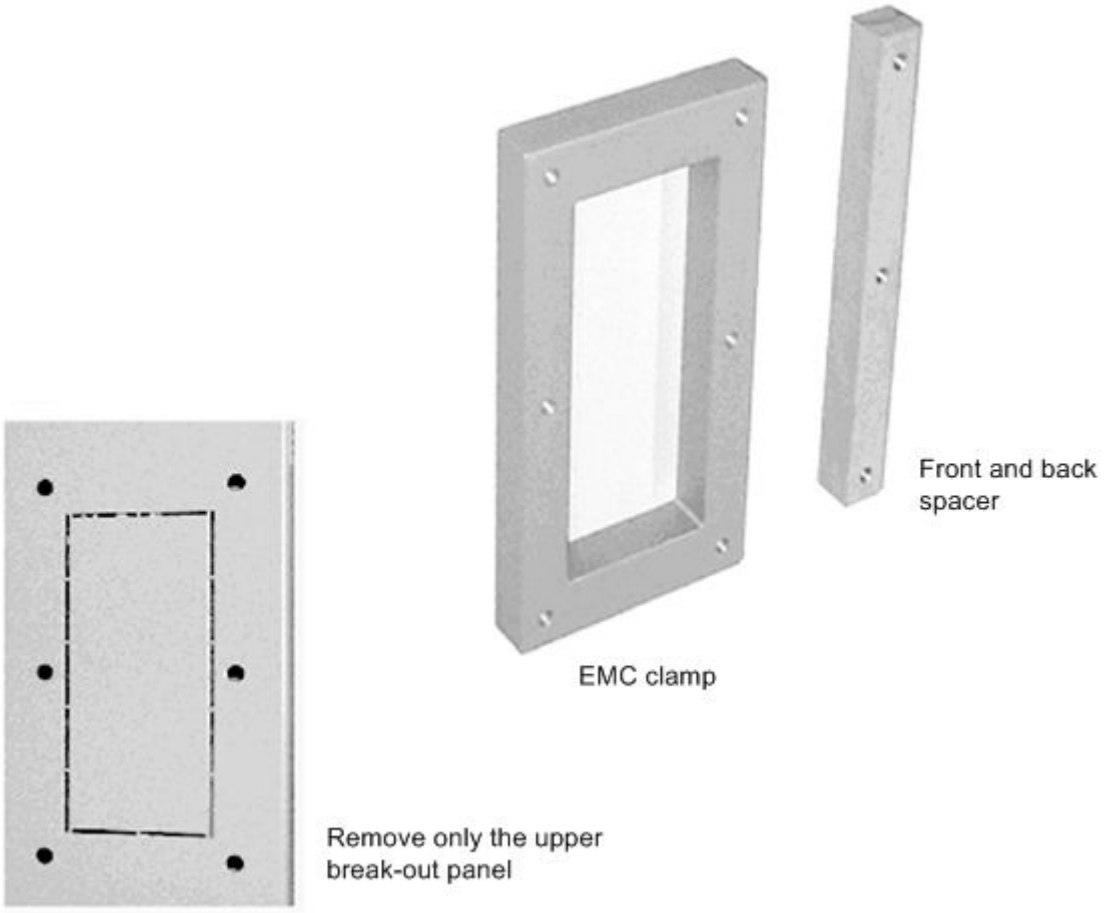

Figure 17 : Break-out panel, EMC clamp, and spacers

4.8.1 Cutting out the break-out panel

CAUTION

Use side cutters for this procedure. Never use a hack saw: the resulting metal dust and fragments would damage the equipment. Be careful when preparing the cable openings. The cut edges of the opening may cause injury.

To cut out the break-out panels

Note

Remove only the upper break-out panel in both cabinets.

1) With side cutters, cut along the perforated line at the top of the basic cabinet side until the break-out panel can be removed.
2) Repeat for the opposing side in the extension cabinet.
3) Clean away possible metal dust and fragments.
4) Paint the cut edges of the cable opening with fast-drying correction paint. Wait until the paint is dry before mounting the EMC clamp.

4.8.2 Joining the cabinets

To join the cabinets

1) The EMC clamp and spacers are fastened to one of the cabinets with M6 and M5 screws and washers. See the following figure.
2) Move the cabinets side by side so the cabinet fronts are flush.
3) The other cabinet is fastened to the clamp and spacers with M6 and M5 screws and washers.
4) Bolt the cabinets to the base when necessary.

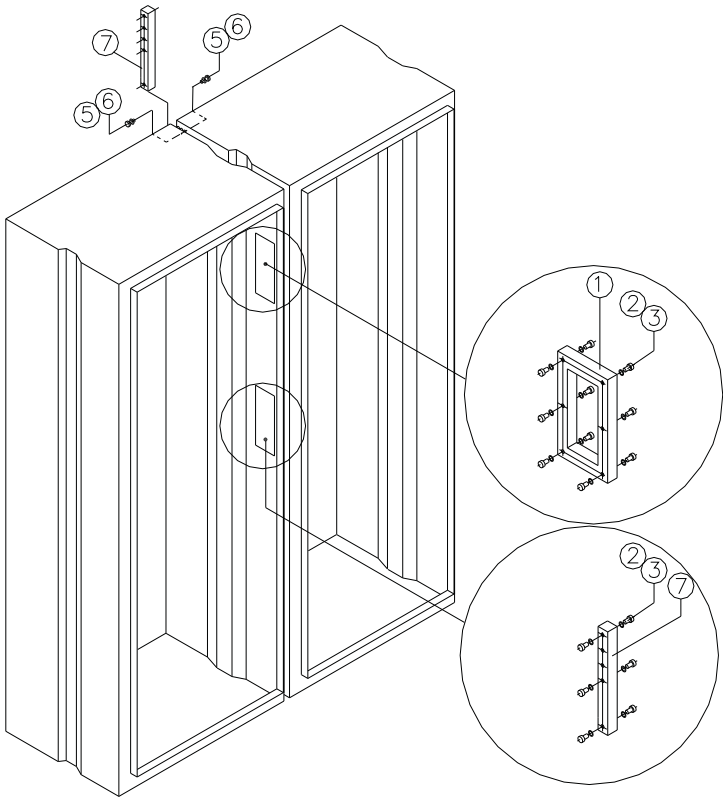

Figure 18 : Joining the cabinets

Table 12 : The meanings of the reference numbers

Ref. number	Object name
1	EMC clamp
2	M6 screw
3	B6 washer
5	M5 screw
6	B5 washer
7	spacer

4.9 Dummy units and panels

To secure proper ventilation, the empty TTRX unit locations must be equipped with the delivered dummy units. All the other empty plug-in unit locations must be fitted with dummy panels.

Note

The dummy units and dummy panels must be installed before the front cabling is done.

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CHAPTER

5

External cabling

5.1 Cabinet top interfaces

Read carefully Section 3.1 of this document before commencing installation of cables.

Use the site-specific *Installation Check List* to record the completion of tasks detailed in this document. An example of the *Installation Check List* can be found at the end of this manual.

The top cabling and connectors consist of the following:

- earthing
- AC/DC power supply terminal blocks (filter module)
- external alarms and controls connectors
- TX and RX antenna connectors
- transmission connectors
- GPS connectors
- Q1 connector
- LMP connector

All external connectors are on the cabinet top. The connector types are detailed in the following figure and in Table 13 .

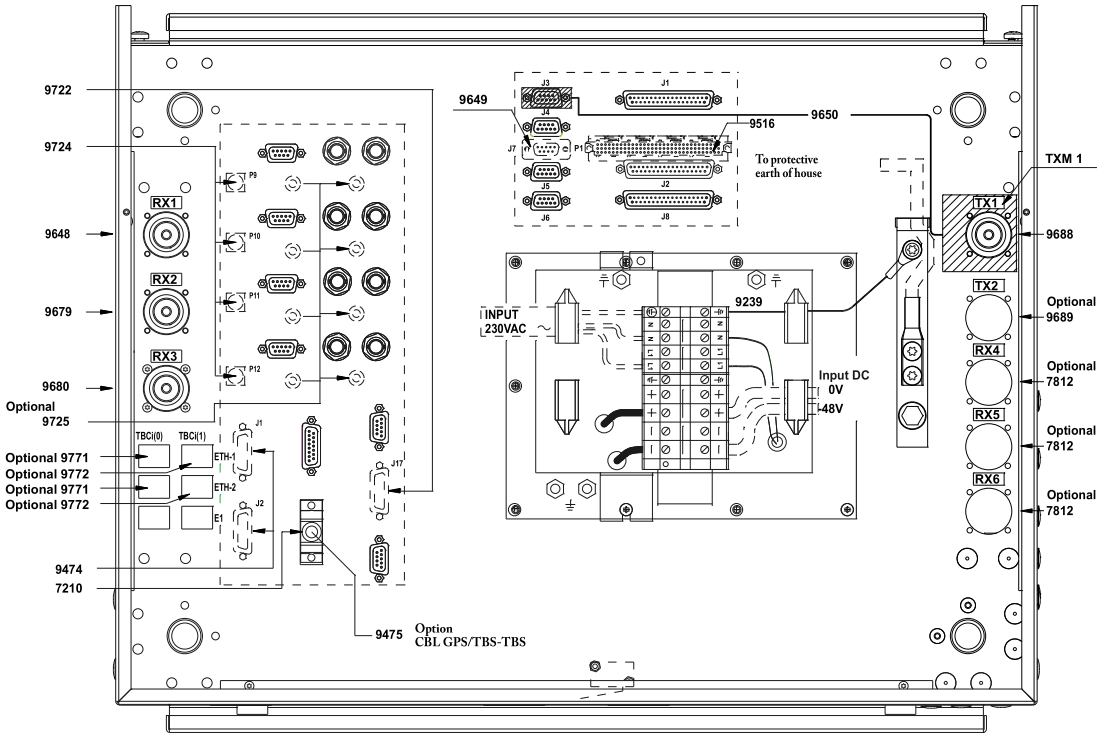


Figure 19 : Basic cabinet top interfaces

The following figure shows a cabinet top with the maximum number (4) of TX antenna monitoring units (TXMs) when two duplexers are used.

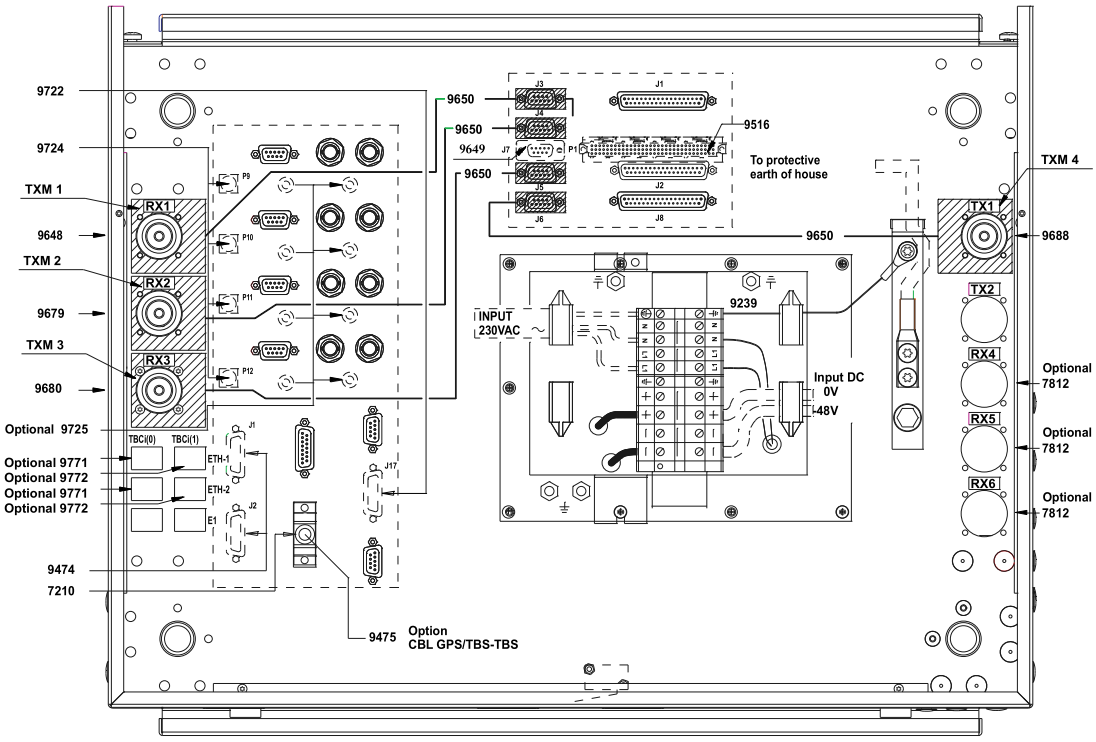


Figure 20 : Cabinet top interfaces when two duplexers are used

The following table presents all the cabinet top connectors including the ones not depicted in Figures 19 and 20 .

Table 13 : Cabinet top connectors

Interface connector name written on the cabinet roof	Interface connector	Connector type
TX1	TX1 antenna connector	7/16 connector, female
TX2	TX2 antenna connector (optional)	7/16 connector, female
RX1	RX1 antenna connector	7/16 connector, female
RX2	RX2 antenna connector	7/16 connector, female
RX3	RX3 antenna connector	7/16 connector, female
RX4	RX4 antenna connector (optional)	7/16 connector, female
RX5	RX5 antenna connector (optional)	7/16 connector, female
RX6	RX6 antenna connector (optional)	7/16 connector, female
75 Ω Rx 75 Ω Tx	E1 75-ohm connectors	BNC connector, female

Table 13: Cabinet top connectors (cont'd.)

Interface connector name written on the cabinet roof	Interface connector	Connector type
100Ω/120Ω	E1/T1 100/120-ohm connectors	9-pin D-type, female
GPS IF1	GPS	15-pin D-type, female
GPS IF2	GPS/TBS-TBS	15-pin D-type, female or 7210 terminator
Customer controls 0–7 and alarms 0–35	Customer Alarms and controls connectors	3 x 37-pin D-type, female
Q1 IF	External Q1	9–pin D-type female
LMP IF	LMP	9–pin D-type female
TXM1	TXM 1	9–pin D-type female
TXM2	TXM 2	9–pin D-type female
TXM3	TXM 3	9–pin D-type female
TXM4	TXM 4	9–pin D-type female
TBCi (0) ETH-1, ETH-2	Ethernet	8/8 RJ45 female
TBCi (1) ETH-1, ETH-2	Ethernet	8/8 RJ45 female

5.2 Extension cabinet interfaces

The top cabling and connectors consist of the following:

- earthing
- AC/DC power supply terminal blocks (filter module)
- TX/RX connectors.

The top interfaces are shown below.

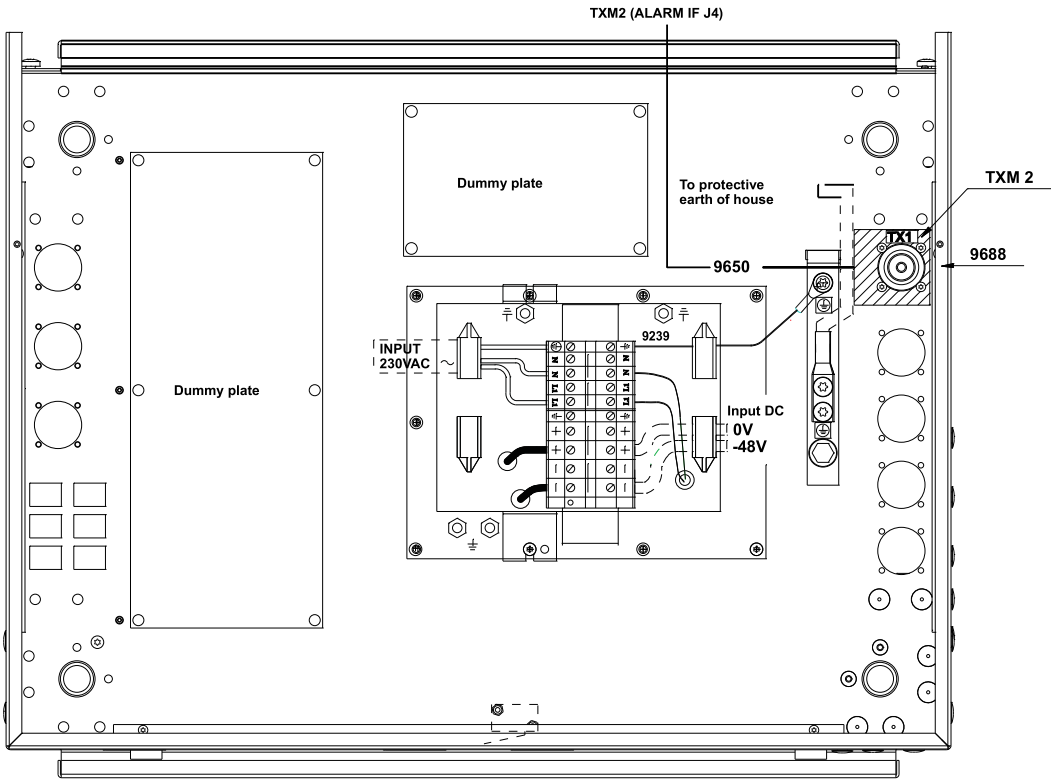


Figure 21 : Extension cabinet top interfaces

5.3 Power supply

WARNING

Mains voltage! Make sure that the site mains power is disconnected before making connections to the cabinet!

The person connecting the power must be authorized to do so as defined in the national legislation.

Note

Remove the cabinet roof frame and the filter module cover and replace them after the interface connections.

There are two alternative power supply units:

- PWR 230AC (AC, 230 V).
- PWR -48VDC (DC, –48 V).

5.3.1 Earthing

Note

Earth the cabinet before making any other connections!

Remove the cabinet roof frame and the filter module cover and replace them after the interface connections.

Check ground potential to earthing busbar between the TBS cabinet and the site earthing busbar.

The cabinet earth connector is a cable shoe with the cable cross-section of 16 mm^2. There is a pre-installed earth cable between the filter module and the earthing busbar on the cabinet top.

To earth the cabinet

1) Check that the pre-installed earth cable between the filter module and the earthing bar on the cabinet top is correctly installed.
2) Strip the main earth cable end for 1 cm.
3) Remove the cable shoe from the earthing bar with a Torx key.
4) Insert the stripped end of the main earthing cable into the cable shoe and crimp with a crimping tool.
5) Replace the cable shoe to the earthing bar of the TBS.
6) Connect the main earthing cable to the protective earth of the site.

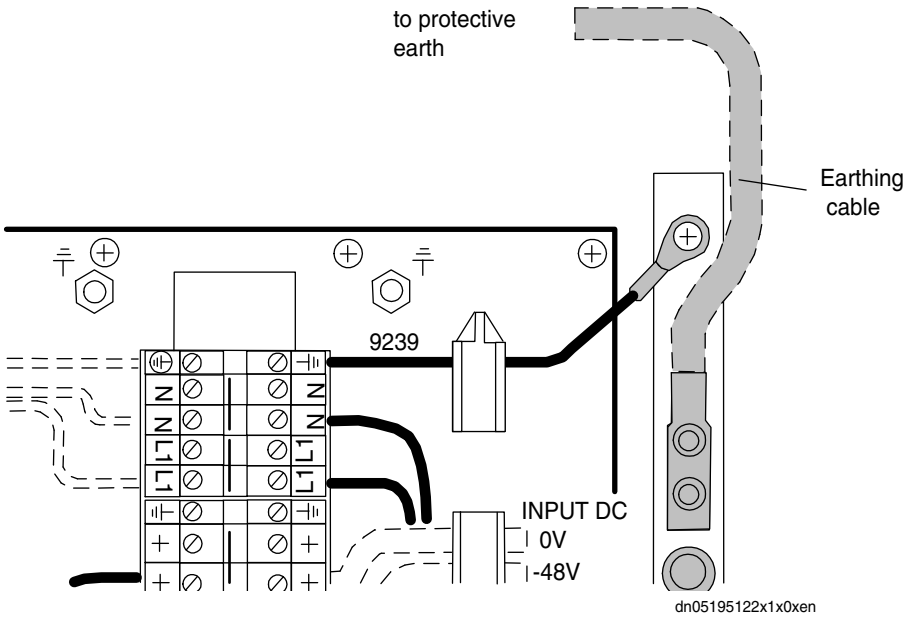


Figure 22 : Earthing cable on cabinet top

5.3.2 Connecting AC power

The maximum cable cross-section that can be connected to the AC terminal block is 6 mm². The minimum cable cross-section is 2.5 mm². Dimension of the cable cross-section must follow the national legislation.

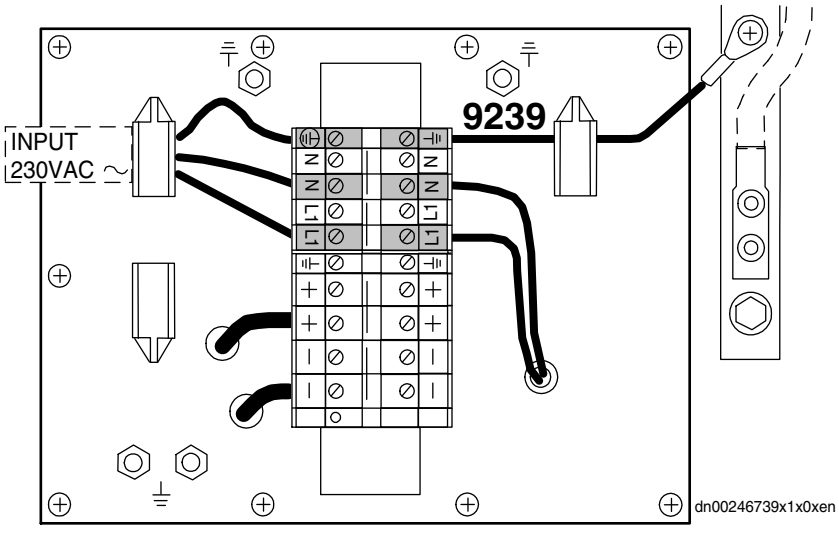


Figure 23 : Connecting AC power supply

To connect the AC power to the cabinet

1) Check that the cabinet is properly earthed.
2) Cut the three wires of the AC power cable so that the earth wire is about 2 cm longer than the other two wires.

   Strip the wires for 1 cm.
3) Insert the earth wire to the earth terminal and secure the wire to the terminal block with a screwdriver.
4) Remove the plastic shields from the [N] and [L1] terminals and loosen the screws of the terminals.
5) Insert the neutral wire to the [N] terminal and secure the wire to the terminal block with a screwdriver.
6) Insert the live wire to the [L1] terminal and secure the wire to the terminal block with a screwdriver.
7) Secure the power cable with the cable clamp.
8) Replace the plastic shields to [N] and [L1] terminals.

5.3.3 DC power supply

Dimension of the cable cross-section must conform to national requirements.

- The maximum cable cross-section that can be connected to the DC terminal block is 25 mm^2.
- The minimum recommended cable cross-section is 16 mm^2.

It is also recommended that future capacity (power consumption growth) is used as a guideline for selecting the cable. Currents up to 50 A should be handled by the DC input cabling. Also cable losses must be taken into account so that the input voltage to the TB3 stays well within specified values. Approximate voltage drop for the first 4.5 m of 16 mm^2 cable with 50 A load is 0.5 V.

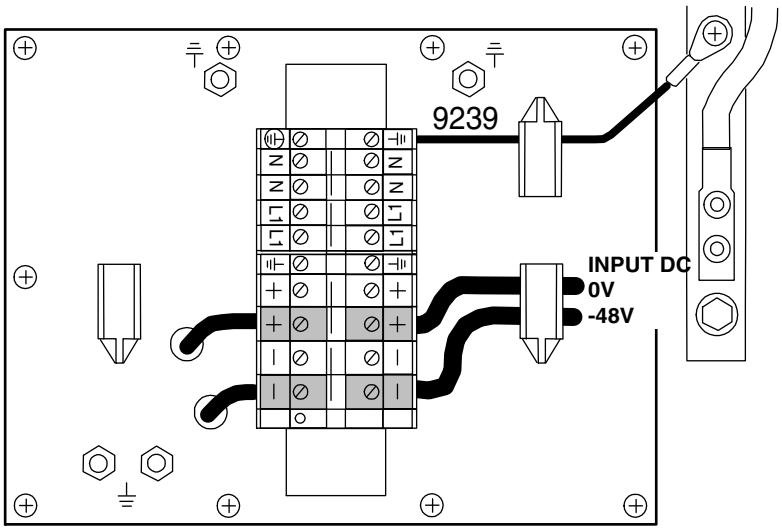


Figure 24 : Connecting DC power supply

To connect the DC power to the cabinet

1) Check that the cabinet is properly earthed.

2) Strip the [+] and [-] wires for 1 cm.

3) Remove the plastic shield from the [+] and [-] terminals and loosen the screws of the terminals.

4) Insert the negative wire to the [-] terminal and secure the wire to the terminal block with a screwdriver.

5) Insert the positive wire to the [+] terminal and secure the wire to the terminal block with a screwdriver.

6) Secure the wires by the cable clamp.

7) Replace the plastic shields to the [-] and [+] terminals.

5.4 Alarm interface (ALIF)

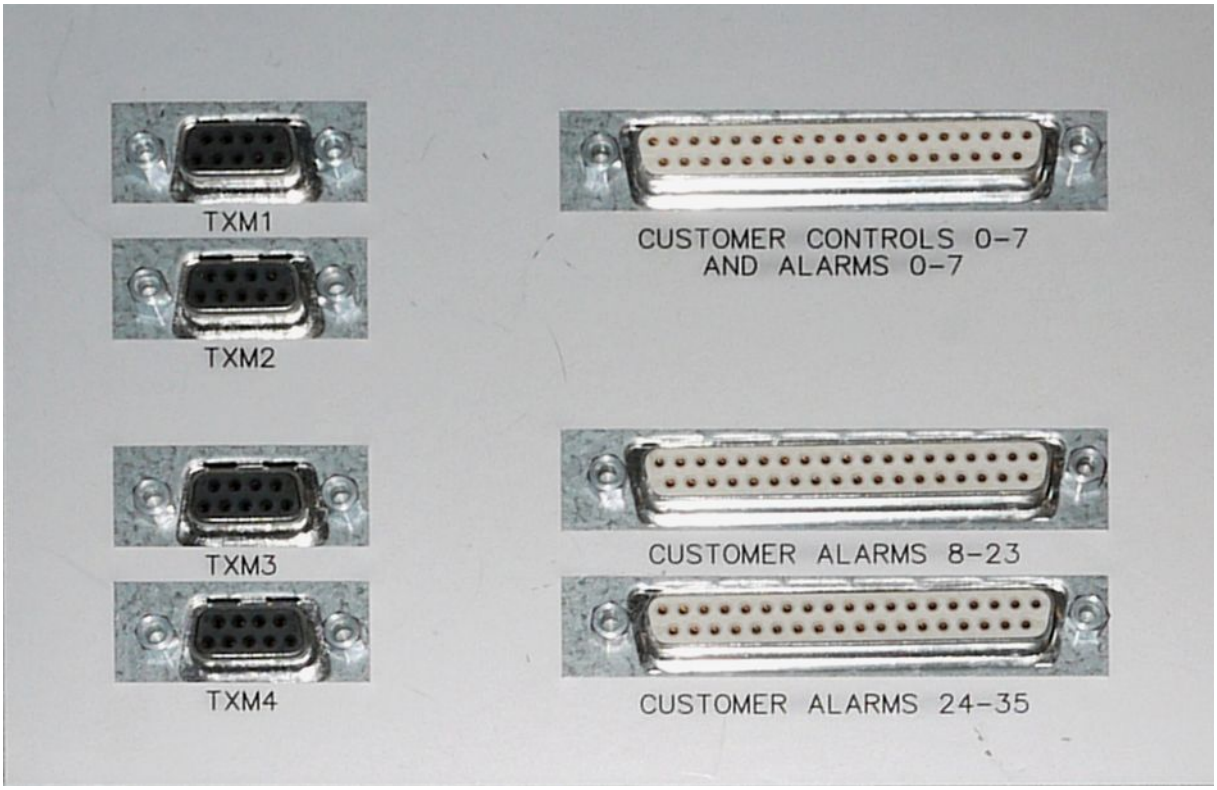


Figure 25 : Alarm interface

The Alarm interface connects customer-specific external alarm inputs and control outputs to the TB3. In addition to the external alarms and controls, the ALIFB provides supply voltage and signal interfaces to the TXM unit. The alarm interface is located on the top of the cabinet.

The Alarm interface has the following external interfaces:

- Customer controls 0–7 and alarms 0–7 (J1): female 37-pin D-connector for external controls and alarm lines.
- Customer alarms 8–23 (J2): female 37-pin D-connector for external alarm lines.
- Customer alarms 24–35 (J8): female 37-pin D-connector for external alarm lines.
- TXM1 (J3), TXM2 (J4), TXM3 (J5), TXM4 (J6): female 9–pole D-connectors for TX antenna line monitoring signal lines and supply voltage.

Table 14 : Customer Controls and Alarms, J1

Pin number	Signal name	Note
01	EXT_CO0	For customer use
02	EXT_CO1	For customer use
03	EXT_CO2	For customer use
04	EXT_CO3	For customer use
05	EXT_CO4	For customer use
06	EXT_CO5	For customer use
07	EXT_CO6	For customer use
08	EXT_CO7	For customer use
09	EXT_AL0	For customer use
10	EXT_AL1	For customer use
11	EXT_AL2	For customer use
12	EXT_AL3	For customer use
13	EXT_AL4	For customer use
14	EXT_AL5	For customer use
15	EXT_AL6	For customer use
16	EXT_AL7	For customer use
17	NC	
18	NC	
19	GND	For customer use
20	GND	For customer use
21	GND	For customer use
22	GND	For customer use
23	GND	For customer use
24	GND	For customer use
25	GND	For customer use
26	GND	For customer use
27	GND	For customer use
28	GND	For customer use
29	GND	For customer use
30	GND	For customer use
31	GND	For customer use

Table 14: Customer Controls and Alarms, J1 (cont'd.)

Pin number	Signal name	Note
32	GND	For customer use
33	GND	For customer use
34	GND	For customer use
35	NC	
36	NC	
37	GND	For customer use

Table 15 : Customer Controls and Alarms, J2

Pin number	Signal name	Note
01	EXT_AL8	For customer use
02	EXT_AL9	For customer use
03	EXT_AL10	For customer use
04	EXT_AL11	For customer use
05	EXT_AL12	For customer use
06	EXT_AL13	For customer use
07	EXT_AL14	For customer use
08	EXT_AL15	For customer use
09	EXT_AL16	For customer use
10	EXT_AL17	For customer use
11	EXT_AL18	For customer use
12	EXT_AL19	For customer use
13	EXT_AL20	For customer use
14	EXT_AL21	For customer use
15	EXT_AL22	For customer use
16	EXT_AL23	For customer use
17	NC	
18	NC	
19	GND	For customer use
20	GND	For customer use
21	GND	For customer use

Table 15: Customer Controls and Alarms, J2 (cont'd.)

Pin number	Signal name	Note
22	GND	For customer use
23	GND	For customer use
24	GND	For customer use
25	GND	For customer use
26	GND	For customer use
27	GND	For customer use
28	GND	For customer use
29	GND	For customer use
30	GND	For customer use
31	GND	For customer use
32	GND	For customer use
33	GND	For customer use
34	GND	For customer use
35	NC	
36	NC	
37	GND	For customer use

Table 16 : Customer Controls and Alarms, J8

Pin number	Signal name	Note
01	EXT_AL24	For customer use
02	EXT_AL25	For customer use
03	EXT_AL26	For customer use
04	EXT_AL27	For customer use
05	EXT_AL28	For customer use
06	EXT_AL29	For customer use
07	EXT_AL30	For customer use
08	EXT_AL31	For customer use
09	EXT_AL32	For customer use
10	EXT_AL33	For customer use
11	EXT_AL34	For customer use

Table 16: Customer Controls and Alarms, J8 (cont'd.)

Pin number	Signal name	Note
12	EXT_AL35	For customer use
13	NC	
14	NC	
15	Test signal	Reserved for testing, leave open
16	Test signal	Reserved for testing, leave open
17	NC	
18	NC	
19	GND	For customer use
20	GND	For customer use
21	GND	For customer use
22	GND	For customer use
23	GND	For customer use
24	GND	For customer use
25	GND	For customer use
26	GND	For customer use
27	GND	For customer use
28	GND	For customer use
29	GND	For customer use
30	GND	For customer use
31	GND	For customer use
32	GND	For customer use
33	GND	For customer use
34	GND	For customer use
35	NC	
36	NC	
37	GND	For customer use

Jumper settings for customer alarms 0-35

Customer alarm signals are divided into ten groups (0-3, 4-7, 8-11, 12-13, 14-17, 18-21, 22-25, 26-29, 30-33, and 34-35). Each of the alarm signal groups, except alarms 12-13, can be provided with either a pull-up or pull-down resistor. Biasing in groups 0-13 is selected by jumpers on the TBC unit (see 7.1). Biasing in groups 14 - 35 are selected by jumpers situated on the underside of the Alarm interface board (see figure 27 and table 16 for instructions). Default jumper settings are marked with bold in table 16.

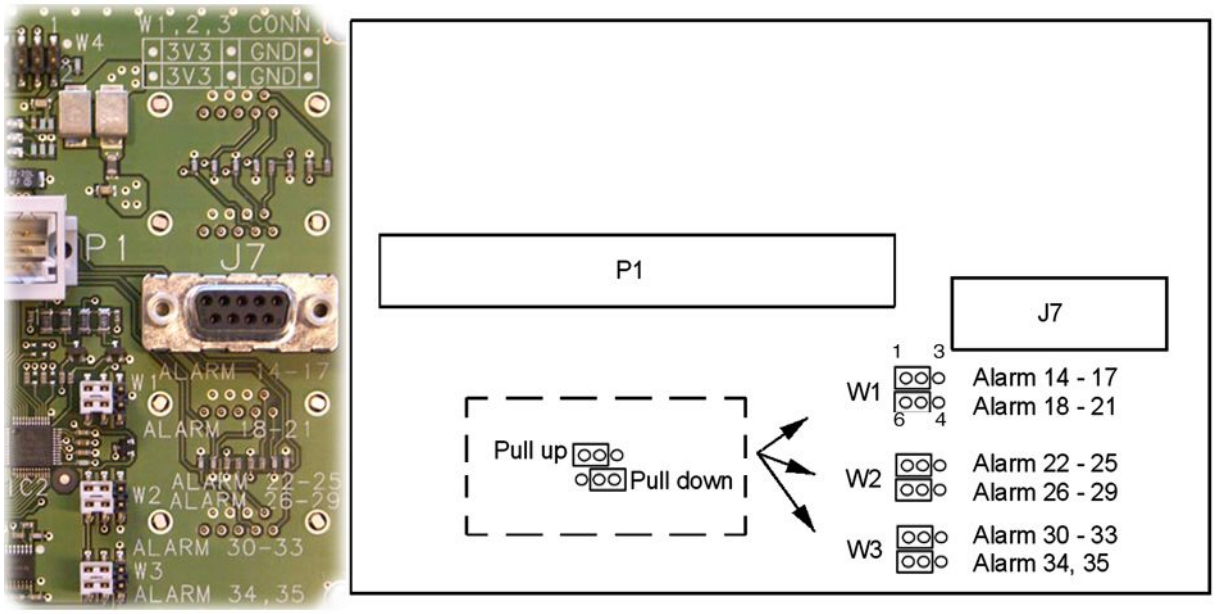


Figure 26 : Alarm interface jumper settings

Table 17 : Jumper settings for Alarm interface

Jumper group	Pins connected	Effect
W1	**1-2** (default)	**biasing EXT_AL14-17 high (+3.3V)**
	2–3	biasing EXT_AL14-17 low (ground)
	5–6 (default)	**biasing EXT_AL18-21 high (+3.3V)**
	4–5	biasing EXT_AL18–21 low (ground)
W2	**1-2** (default)	**biasing EXT_AL22-25 high (+3.3V)**
	2–3	biasing EXT_AL22-25 low (ground)
	5–6 (default)	**biasing EXT_AL26-29 high (+3.3V)**

Table 17: Jumper settings for Alarm interface (cont'd.)

Jumper group	Pins connected	Effect
	4–5	biasing EXT_AL26-29 low (ground)
W3	**1-2** (default)	**biasing EXT_AL30-33 high (+3.3V))**
	2–3	biasing EXT_AL30-33 low (ground)
	5–6 (default)	**biasing EXT_AL34–35 high (+3.3V)**
	4–5	biasing EXT_AL34–35 low (ground)

5.5 Transmission unit (FXC) and transmission unit interface (FXCIF)

The FXC interface is located on the top of the cabinet.

Figure 27 : FXC interface

The FXCIF has the following connectors for external interfaces:

- four female 9 pin D-connectors for balanced 100/120–ohm E1/T1 interfaces 1–4
- eight female BNC connectors for unbalanced 75–ohm E1 interfaces 1–4 (separate TX and RX connectors)
- one female 9 pin D-connector for external Q1 interface
- one female 15 pin D-connector for GPS Antenna unit cable (GPS IF1)
- one female 15 pin D-connector GPS/TBS-TBS cable (GPS IF2)
- one female 9 pin D-connector for optional LMP interface.

5.5.1 Connecting cables to the FXC transmission units

FXC E1/T1

The FXC E1/T1 unit has four 100/120 ohm Tx/Rx connectors (type TQ). See Figure 28 .

For more information on the FXC unit refer to the document *FXC E1 and E1/T1 Transmission Unit Description for TETRA*, dn05100057.

Steps

1) Connect the cables (code 9724) from the FXCIF to the 100/120 ohm Tx/Rx connectors on the FXC E1/T1 front panel.
2) Tighten the connector nut properly. The torque needed is 2 Nm (1.5 ft-lb).
3) Make sure that the cable connector and shrinking sleeve combination is not too long so that the cable has enough space to bend when you close the cabinet door.

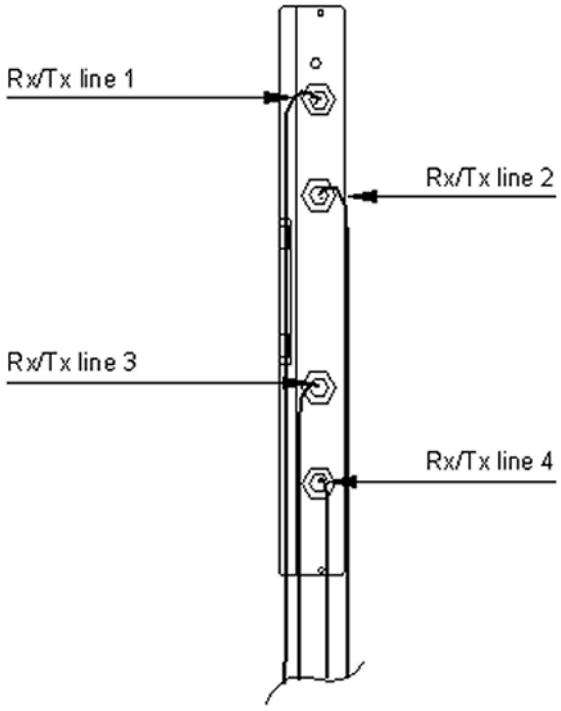


Figure 28 : Cabling of FXC E1/T1 unit

FXC E1

The FXC E1 unit has four pairs of 75 ohm connectors (type BT-43). Each pair forms a transmission interface (IF). The upper connector is always the Tx connector of any given transmission interface. The lower connector is always the Rx connector of any given transmission interface. See Figure 29 .

For more information on the FXC unit refer to *FXC E1 and E1/T1 Transmission Unit Description for TETRA*, dn05100057.

Steps

1) Connect the cable (code 9725) of the received (Rx) signal line from the FXCIF to the 75 ohm Rx connector on the IF1. Note that the cables coded 9710 are supplied with the FXC E1 unit.
2) Connect the cable (code 9725) of the transmitted (Tx) signal from the FXCIF line to the 75 ohm Tx connector on the IF1.
3) Cable the other IFs in the same manner.
4) Make sure that the cable connector and shrinking sleeve combination is not too long so that the cable has enough space to bend when you close the cabinet door.

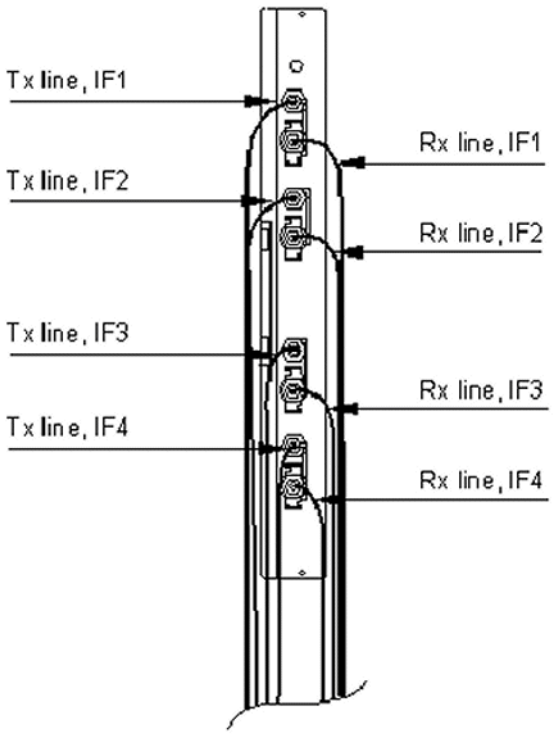


Figure 29 : Cabling of FXC E1 unit

Grounding the Rx connector

The grounding of the FXC E1's Rx connector is implemented with a grounding washer under the Rx connector. It connects the outmost wires of the connector.

To ground the outmost wire of the Rx connector directly, leave the grounding washer in place.

To ground the outmost wire of the Rx connector capacitively, remove the grounding washer. Loosen the connector and pull the grounding washer off. Store it for future use.

Note

The grounding of the RX interface on the FXCIF located on the cabinet top must correspond to the grounding method selected on the RX connectors of the FXC E1 unit. Refer to Section 5.5.4 .

Note

Remember to tighten the connector nuts properly after the grounding bridge has been removed! The torque is 1.5 Nm (1.11 ft-lb).

5.5.2 100/120–ohm E1/T1 interface

The connector type of the four E1/T1 100/120–ohm interfaces use a 9–pin female D-connector.

The pin configuration of the connectors is detailed in the table below.

Table 18 : Pin configuration of the 100/120–ohm E1/T1 interface

Pin number	Description	Signal (n=1–4)
1	Receive E1/T1 line signal	RXBALnA
2	Ground	GND
3	Ground	GND
4	Ground	GND
5	Transmit E1/T1 line signal	TXBALnA
6	Receive E1/T1 line signal	RXBALnB
7	Not connected	
8	Not connected	
9	Transmit E1/T1 line signal	TXBALnB

5.5.3 75–ohm E1 interface

The connector type of the E1 interface is a coaxial female BNC connector. On the FXC interface , these interfaces are:

Table 19 : Receiving signal pin configuration of the 75–ohm E1 interface

Pin number	Description	Signal (n=1–4)
Center contact	Receive E1 Line signal	RXUNBn
Outer contact	Ground	RXGNDn

Table 20 : Transmitting signal pin configuration of the 75–ohm E1 interface

Pin number	Description	Signal (n=1–4)
Center contact	Transmit E1 line signal	TXUNBn
Outer contact	Ground	GND

5.5.4 Grounding the FXC IF

The FXC 75-ohm RX interface is grounded on the FXC IF located on the cabinet top. The connector body is separated from the cabinet earth with capacitors as factory default.

Grounding is changed from capacitance to galvanic by rearranging the order of washers in the 75-ohm RX connector.

Use the settings shown below when the TBSs are connected to different earthing points.

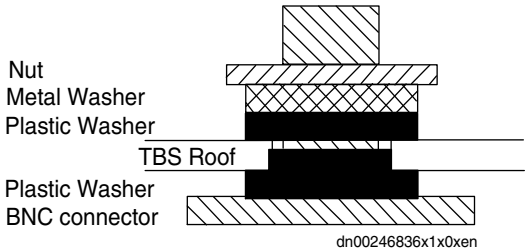


Figure 30 : Capacitance grounding of 75-ohm RX connector on FXCIF

Use the settings shown below when the TBSs are connected to the same earthing point.

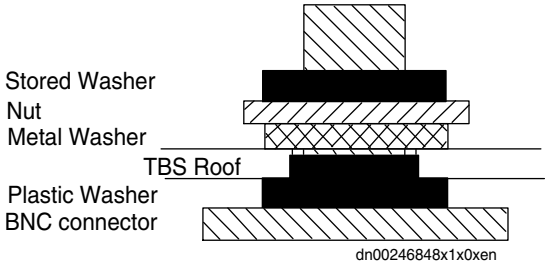


Figure 31 : Galvanic grounding of 75-ohm RX connector on FXCIF

To reconfigure the four washer positions on the FXC IF

1) Unscrew the nut of the RX connector.
2) Remove the metal and plastic washers.
3) Replace the metal washer.
4) Reposition and tighten the nut. Store the plastic washer above the nut.

See also the Topic *Grounding the Rx connector* in Section 5.5.1 .

5.5.5 External Q1 interface on the FXC interface

The connector type of the External Q1 interface on the FXC interface on the cabinet top is a 9–pin female D-connector.

The External Q1 interface can be used for connecting external NSN specific equipment to the TB3. Reserved for future use.

Table 21 : Pin configuration of the external Q1 interface

Pin number	Description	Signal
1	Transmit Q1 interface signal	Q1EXTD_N
2	Not connected	
3	Ground	GND
4	Not connected	
5	Receive Q1 interface signal	Q1EXTU_N
6	Transmit Q1 interface signal	Q1EXTD_P
7	Not connected	
8	Not connected	
9	Receive Q1 interface signal	Q1EXTU_P

5.5.6 Optional LMP interface

The Local Management Port (LMP) interface is an optional interface which enables local management of the FXC unit with the help of element manager software.

Table 22 : Pin configuration of the optional LMP interface

Pin number	Description	Signal
1	Not connected	
2	Receive LMP interface signal	LMP_IN
3	Transmit LMP interface signal	LMP_OUT
4	Not connected	
5	Ground	GND
6	Not connected	
7	Not connected	
8	Not connected	
9	Not connected	

5.5.7 GPS IF connectors

The cable from the GPS antenna unit is connected to the IF1 connector on the FXCIF . If the GPS signal is not taken to another base station rack, the GPS terminator (DA7210) must be connected to connector IF2 for terminating the GPS signal bus. The TBS-TBS cable (code 9475) is necessary if the GPS signal is fed from one TBS (IF2) to the next TBS rack's IF1 connector. The GPS terminator (DA7210) must be connected to connector IF2 of the second rack for terminating the GPS cable.

Table 23 : GPS IF 1 and IF2 pin configurations

Signal / GPS IF1	Pin	Signal / GPS IF2
PWR_GPS1	1	PWR_GPS2
BR1-	2	BR2-
BR1+	3	BR2+
BT1-	4	BT2-
BT1+	5	BT2+
—	6	—

Table 23: GPS IF 1 and IF2 pin configurations (cont'd.)

—	7	—
AT1-	8	AT2-
GND	9	GND
AT1+	10	AT2+
PPS1+	11	PPS2+
PPS1-	12	PPS2-
5V_BIAS1	13	5V_BIAS2
RESET1	14	RESET2
—	15	—

5.6 RF connectors

Note

Tighten the 7/16 connectors to 25 Nm, N connectors to 1.2 Nm and the SMA connectors to 1 Nm torque with a torque spanner.

RF connectors with cavity combiners

The following antenna connections are on the cabinet top:

- 1–2 TX and 1–6 RX antenna connections

The following figures show the default cabling with a fully equipped TB3 with ATC:

- Figure 42
- Figure 43
- Figure 44
- Figure 45
- Figure 46

The number of RX per TTRX can vary between one and six. The number of DRMC units vary between one and three.

RF connectors with duplexer and wideband combiner

The following antenna connections are on the cabinet top:

- 1...4 TX/RX antenna connections

Figure 57 shows front cabling for a 2–carrier TB3 with WBC and DDU with FXC E1 and Figure 43 shows front cabling for a 2–carrier TB3 with WBC and DDU with FXC E1/T1.

Note

Duplexer can be used with or without DRMC.

Note

Do not connect the cables to the SMA-connectors in the DDU, DRMC or DDIV units if the TTRX-end of the cable will remain open. All unused SMA-connectors in the DDU, DRMC or DDIV units must be terminated with a 50 ohm terminator. Terminators are delivered with the cabinet.

CHAPTER

6

Settings of subracks

6.1 Common subrack (CSR) jumpers

The Common Subrack (CSR) has jumpers for the TBS HW configuration, 12.96 MHz system clock termination, and D-bus termination. Note that TBC1 and TBC2 must be identically jumpered. The jumpers are accessible via the subrack front.

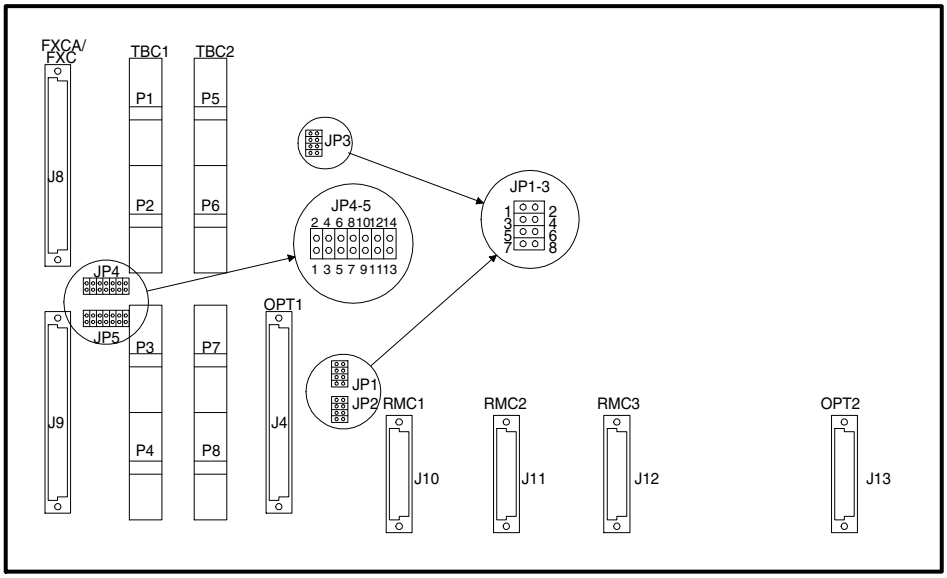


Figure 32 : CSR jumpers

Table 24 : JP1 jumpering in the basic cabinet

Jumper	JP1 usage	
Pin numbers	**Description**	**Setting**
1–2	Not used	Jumper off
3–4	Not used	Jumper off
5–6	Not used	Jumper off
7–8	Not used	Jumper off

Table 25 : JP2 jumpering in the basic cabinet

Jumper	JP2 usage	
Pin numbers	**Description**	**Setting**
1–2	Not used	Jumper off
3–4	Not used	Jumper off
5–6	Not used	Jumper off
7–8	Not used	Jumper off

Table 26 : JP3 jumpering in the basic cabinet

Jumper	JP3 usage in single cabinet configuration	
Pin numbers	**Description**	**Setting**
1–2	12.96 MHz clock termination	Jumper on
3–4	12.96 MHz clock termination	Jumper on
5–6	NC	Jumper off
7–8	NC	Jumper off

Table 27 : JP3 jumpering in the basic cabinet with extension cabinet configuration

Jumper	JP3 usage with extension cabinet configuration	
Pin numbers	**Description**	**Setting**
1–2	12.96 MHz clock termination	Jumper off
3–4	12.96 MHz clock termination	Jumper off

Table 27: JP3 jumpering in the basic cabinet with extension cabinet configuration (cont'd.)

Jumper	JP3 usage with extension cabinet configuration	
Pin numbers	**Description**	**Setting**
5–6	NC	Jumper off
7–8	NC	Jumper off

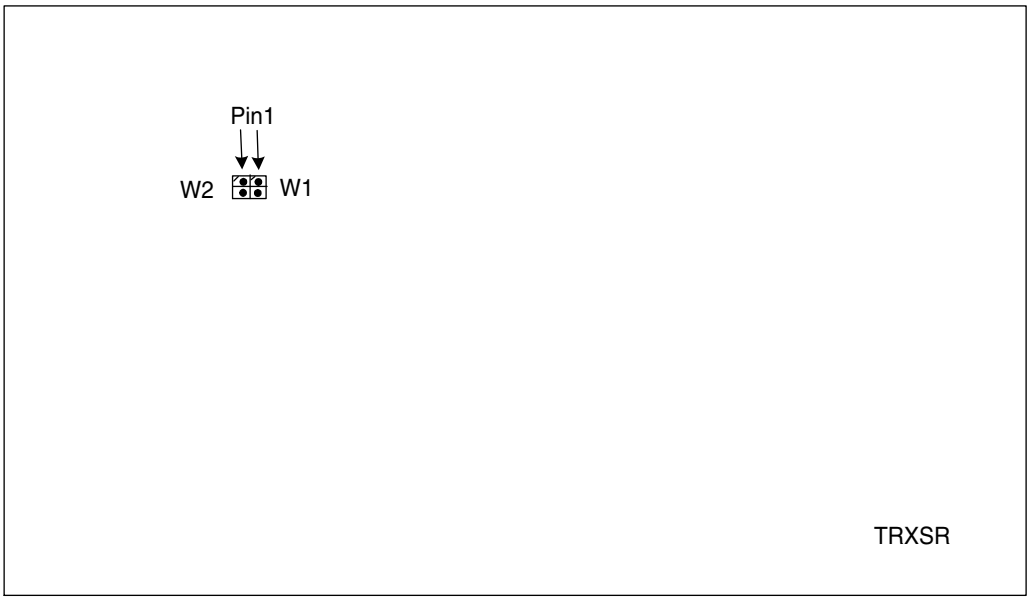
Table 28 : JP4 & JP5 jumpering in the basic cabinet

Jumper	Pins	Description
JP4 JP5	1–2 13–14	SYNC- termination SYNC+ termination
JP4	3–4 5–6	RDAT1+ termination RDAT1– termination
JP4	7–8 9–10	TDAT1+ termination TDAT1– termination
JP4	11–12 13–14	MFCLK+ termination MFCLK– termination
JP5	1–2 3–4	CK2M+ termination CK2M– termination
JP5	5–6 7–8	RDAT2+ termination RDAT2– termination
JP5	9–10 11–12	TDAT2+ termination TDAT2– termination
Setting All pins of both jumpers need to be jumpered (default setting) when an extension cabinet is not used. Remove all jumpers when an extension cabinet is taken into use.		

There is no need to jumper the CSR in the extension cabinet.

6.2 TETRA transceiver subrack (TRXSR) jumpers

The subrack address can be selected by means of jumpers. In the basic subrack, both jumpers are inserted and in the extension subrack ADDR3 jumpered. The subrack jumpers are accessible via the subrack front.



W1/1-W2/1	Address bit ADDR2 of TTRX subrack
W1/2-W2/2	Address bit ADDR3 of TTRX subrack

Jumpers of basic cabinet's TTRX subrack (default):

W1/1-W2/1	jumpered
W1/2-W2/2	jumpered

Jumpers of extension cabinet's (TBS with 8 channels) TTRX subrack:

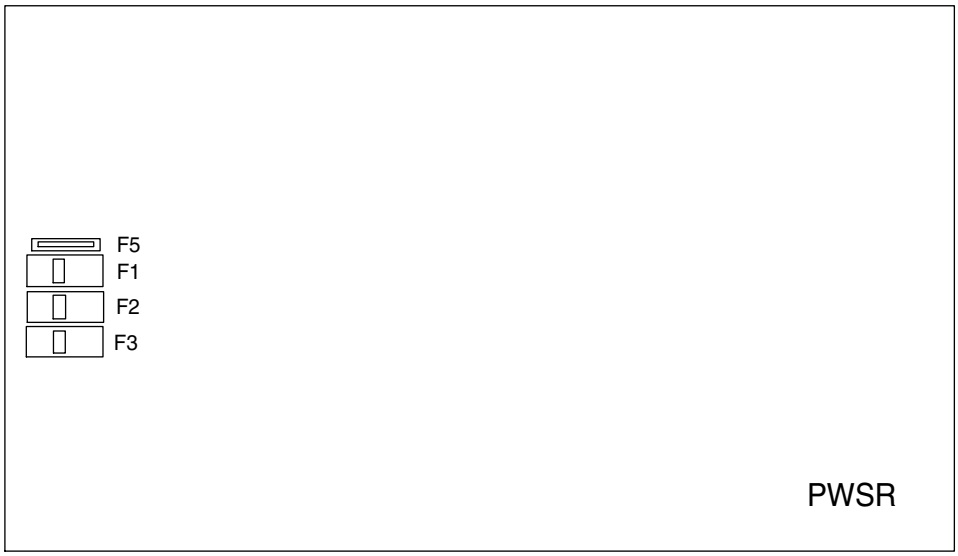
W1/1-W2/1	no jumpers
W1/2-W2/2	jumpered

Figure 33 : TRXSR jumpers

6.3 Power subrack (PWSR) fuses

Reset the fuses by pressing the buttons on the fuses.

The subrack fuses are accessible via the subrack front.



dn05225143x2x0xen

Fuses (reset type):		
F1	+12 V	power supply common subrack
F2	+26 V	power supply to ATC and fans
F3	+26 V	power supply to common subrack
F5	+5 V	power supply to common subrack

Figure 34 : PWSR fuses

CAUTION

Do not reset the fuses with the power turned on.

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CHAPTER

7

Unit installation instructions

General procedures

This chapter gives instructions for installing units in TB3. Unit cabling instructions are in Chapters 5.5.1 and 8. The *Maintenance of TETRA Base Stations, dn00132139* manual also has instructions for working with the units of the TBS. For more instructions how to handle the plug-in units, refer to *Replacing Plug-in Units and Other Hardware Units*, dn98613521.

Always pay attention to the following:

- Read the safety instructions in Chapter 3.
- Wear an antistatic hand strap connected to the ESD stud of the TBS whenever handling electrosensitive units. You can identify the electrosensitive units by the ESD sign on the unit front panel.
- Note that some units (TBC, DRMC) need checking/setting of jumpers.
- Some units like TTRX, DDU, PSU, and combiners are heavy and may have sharp edges.
- Handle units with care and fasten all retaining screws (but do not overtighten) to ensure that the units are well seated in the subracks.
- After installing the units, see that the empty slots have been covered by dummy plates.
- Keep some of packing material in case a unit needs to be replaced e.g. due to transportation damage.

7.1 TBC unit

This section details the installation and jumper settings in the TETRA Base Station Controller unit (TBC). There are two variants of the TBC unit: TBC-U and TBCi.

Note

Only one type of TBC units can be installed in one TB3 at a time: TBC-U or TBCi.

7.1.1 TBC-U

CAUTION

Wear an antistatic hand strap connected to the ESD stud when handling the TBC-U unit. The unit is susceptible to damage caused by static electricity.

Always check the jumper settings before installation and change them if the default settings are inappropriate.

CAUTION

Handle the unit with care. Use the top and bottom handles for lifting and for pushing the unit into the cabinet.

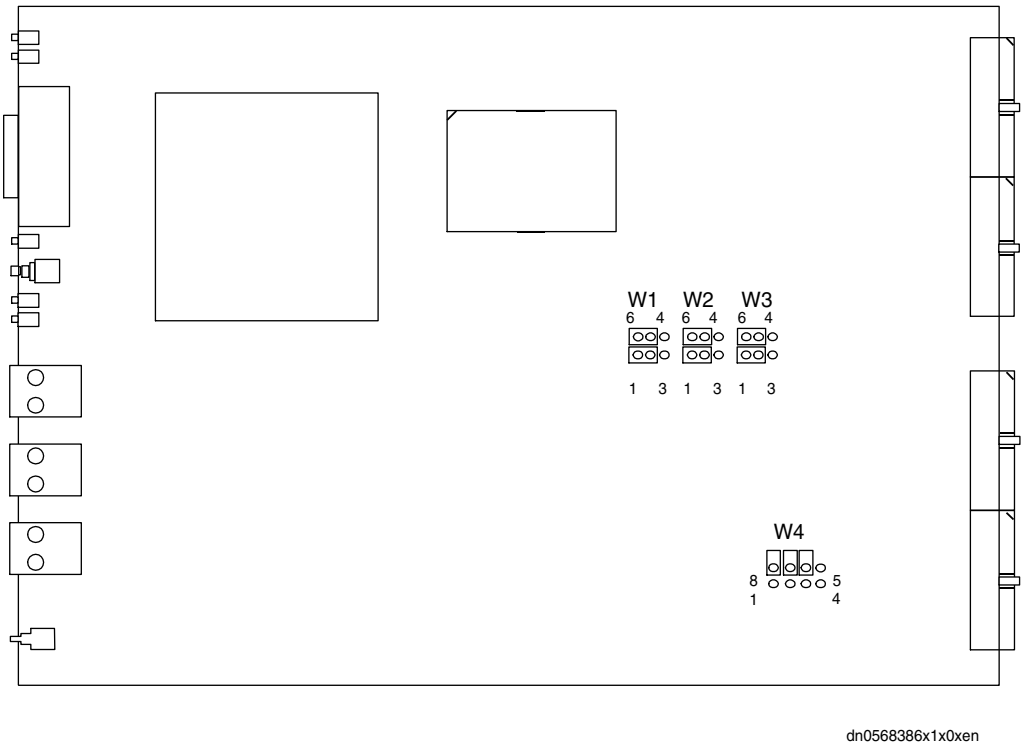

Figure 35 : TBC-U default jumper settings

Note

Use only the mandatory settings for jumpers W2 1–2, 5–6 and W3 1–2 in the table below (internal lines biasing). The remaining EXT_AL lines biasing can be freely selected.

Table 29 : TBC-U jumper settings

Jumper group	Pins connected	Effect
W1	**1-2** (default)	**biasing EXT_AL4-7 high (+5V)**
	2–3	biasing EXT_AL4-7 low (ground)
	5–6 (default)	**biasing EXT_AL0-3 high (+5V)**
	4–5	biasing EXT_AL0-3 low (ground)
W2	**1-2** (mandatory) **See Note above**!	**biasing internal signals for TXM4 and ALIF serial data high (+5V)**
	2–3	biasing internal signals for TXM4 and ALIF serial data low (ground)
	5–6 (mandatory) **See Note above**!	**biasing internal signals for TXM2 and TXM3 high (+5V)**
	4–5	biasing internal signals for TXM2 and TXM3 low (ground)
W3	**1-2** (mandatory) **See Note above**!	**biasing EXT_AL12-13 and internal signals for TXM1 high (+5V)**
	2–3	biasing EXT_AL12-13 and internal signals for TXM1 low (ground)
	5–6 (default)	**biasing EXT_AL8–11 high (+5V)**
	4–5	biasing EXT_AL8–11 low (ground)
W4	1-8	disable redundancy by setting the jumpering on
	2–7	enable boot flash programming by setting the jumpering on
	3–6	disable watchdog by setting the jumpering on
	4–5	NA

7.1.2 TBCi

CAUTION

Wear an antistatic hand strap connected to the ESD stud when handling the TBCi unit. The unit is susceptible to damage caused by static electricity.

Always check the jumper settings before installation and change them if the default settings are inappropriate.

CAUTION

Handle the unit with care. Use the top and bottom handles for lifting and for pushing the unit into the cabinet.

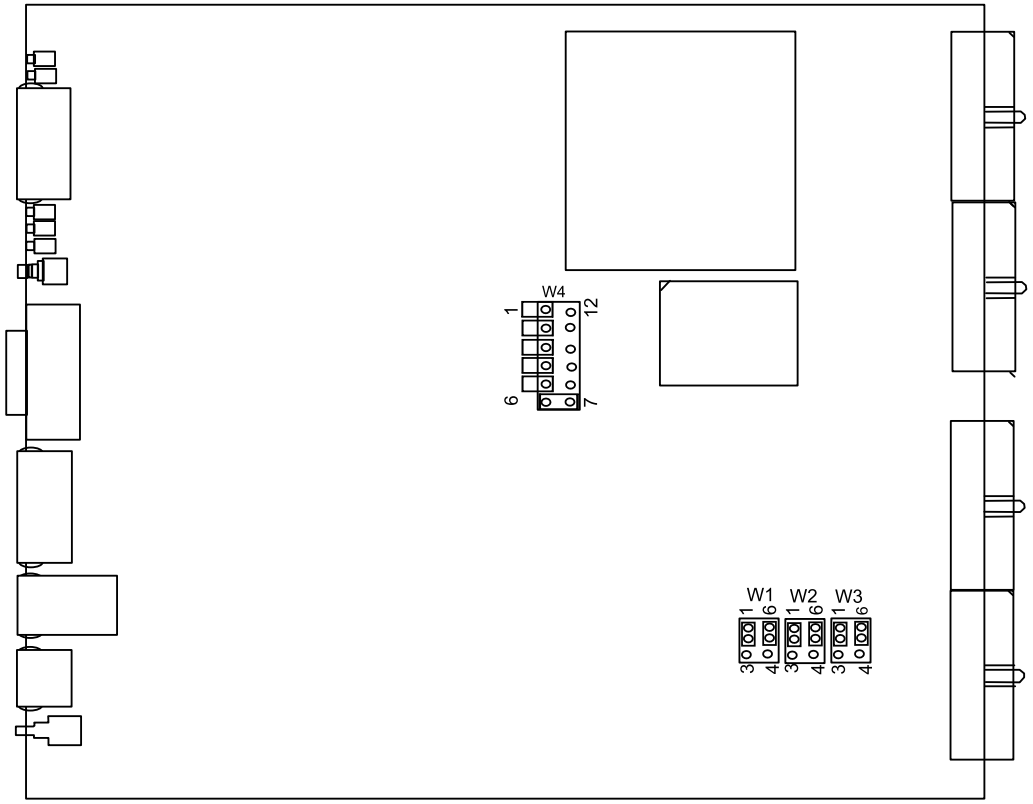

Figure 36 : TBCi default jumper settings

Note

Use only the mandatory settings for jumpers W2 1–2, 5–6 and W3 1–2 in the table below (internal lines biasing). The remaining EXT_AL lines biasing can be freely selected.

Table 30 : TBCi jumper settings

Jumper group	Pins connected	Effect
W1	**1-2** (default)	**biasing EXT_AL4-7 high (+5V)**
	2–3	biasing EXT_AL4-7 low (ground)
	5–6 (default)	**biasing EXT_AL0-3 high (+5V)**
	4–5	biasing EXT_AL0-3 low (ground)
W2	**1-2** (mandatory) **See Note above**!	**biasing internal signals for TXM4 and ALIF serial data high (+5V)**
	2–3	biasing internal signals for TXM4 and ALIF serial data low (ground)
	5–6 (mandatory) **See Note above**!	**biasing internal signals for TXM2 and TXM3 high (+5V)**
	4–5	biasing internal signals for TXM2 and TXM3 low (ground)
W3	**1-2** (mandatory) **See Note above**!	**biasing EXT_AL12-13 and internal signals for TXM1 high (+5V)**
	2–3	biasing EXT_AL12-13 and internal signals for TXM1 low (ground)
	5–6 (default)	**biasing EXT_AL8–11 high (+5V)**
	4–5	biasing EXT_AL8–11 low (ground)
W4	1-12	NA
	2-11	disable redundancy by setting the jumpering on
	3-10	connect SERV to front plate by setting the jumpering on
	4–9	connect Console to front plate by setting the jumpering on
	5–8	disable x86 watchdog by setting the jumpering on
	6–7 (default)	disable PPC watchdog by setting the jumpering on

7.2 DRMC unit jumper settings

In case MHA is used, it is possible to reduce RX path gain in the DRMC by switching the internal 10 dB step-attenuator by the jumper settings at the back side of the DRMC unit. See the following figure.

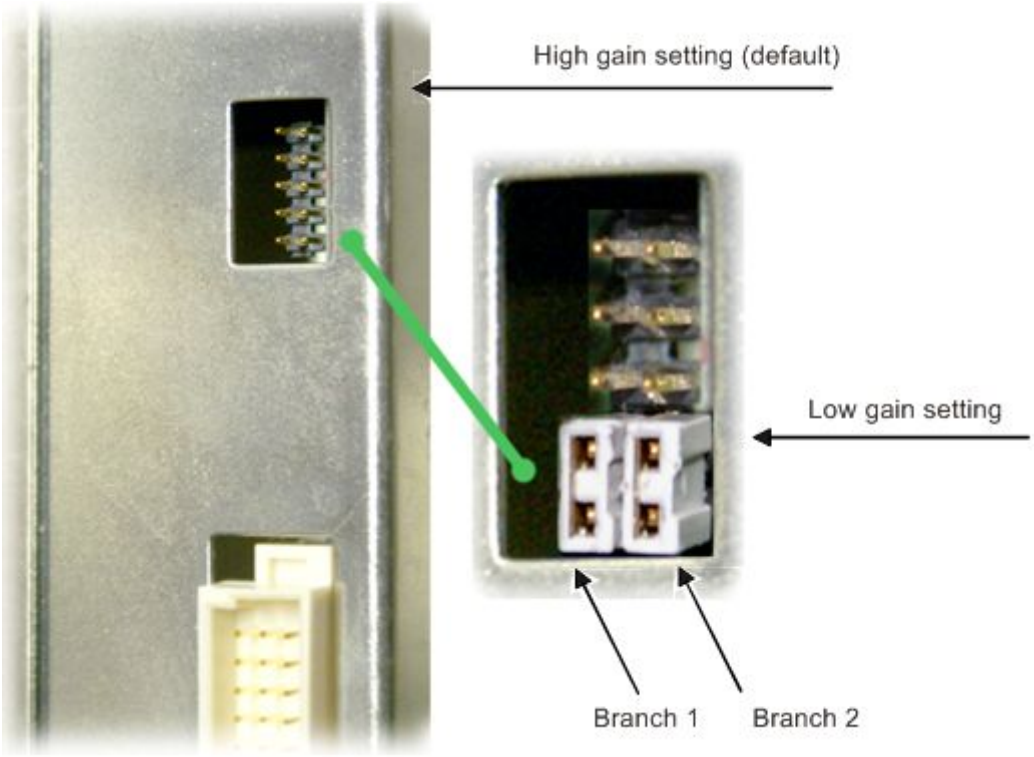

Figure 37 : DRMC jumper settings high/low gain

When the jumpers are not installed (default setting), both DRMC branches are in a high gain mode. When the jumper is installed, the branch in question is switched to low gain mode.

7.3 ATC installation

Before the installation

Before you start the actual installation, do the following:

1. Remove the combiner from the packing.
2. Check that the combiner has not been damaged during transportation.

   If the combiner is damaged, return it for repair and file a claim report.

CAUTION

Check the cable labels and possible site specific instructions to ensure correct cable connections.

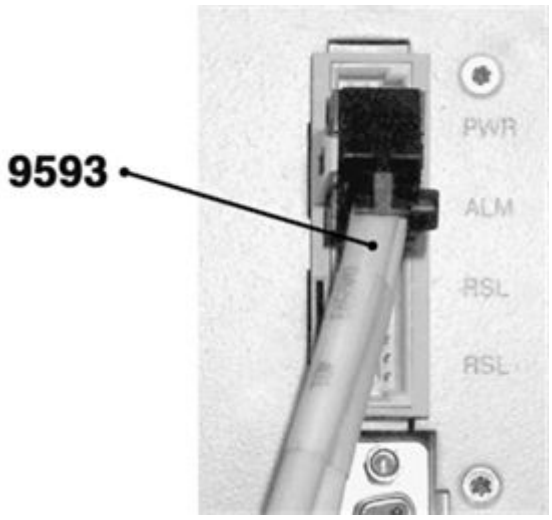

Figure 38 : Cabling to Euroconnector

CAUTION

Connecting the alarm and pwr cable incorrectly may damage the combiner.

To install the combiner

Note

It is not recommended to install ATC 380 units from different vendors in the same cabinet. If you need to do it, install the unit from Combilent (with heatsinks on the front panel) below the unit from Kathrein to ensure proper air flow to the heatsinks on the front.

1) Slide the combiner into the base station rack.
2) Using the four rack screws, fix the combiner to the rack.
3) Remove the protective caps from the connectors.
4) Connect the following cables to the combiner:
    - Base station interface cable
    - Antenna cable
    - TX cable No. 1
    - TX cable No. 2

The combiner is now ready for use.

When the power supply of the base station is turned on, the combiner turns on automatically. The green LED (marked OPR) on the front panel lights up, indicating that the combiner receives DC power and is operative.

As a first action it is recommended that you park the cavities: press the RESET button on the front panel.

The yellow LED (marked ALM) and the green LED will both light up, indicating that the cavities are parked and that the DC power is on.

7.3.1 Troubleshooting

See the document *Auto-tuned Combiners for TBS, dn00132115*.

7.4 WBC and DDU installation

Before the installation

Before you start the actual installation, do the following:

1. Remove the combiner and duplexer from their packings.
2. Check that the combiner and duplexer have not been damaged during transport.

   If either of them is damaged, return it for repair and file a claim report.

CAUTION

Check the cable labels and possible site specific instructions to ensure correct cable connections. Connect the 9593 combiner cables so that when one DDU is used, the cable marked CB1 is connected to it. If two DDUs are used, connect the cable marked CB1 to DDU1 (lower) and cable marked CB2 to DDU2 (upper).

CAUTION

Connecting the alarm and power cable incorrectly may damage the DDU.

WARNING

Heavy weight. Be careful when handling the DDU.

To install the combiner and DDU

1) Slide the combiner and DDU (by supporting it from the bottom) into the base station rack.

2) Using the four rack screws, fix the combiner and DDU to the rack.

3) Remove the protective caps from the connectors.

4) Connect the following cables to the combiner:

- TX cable No 1.
- TX cable No 2.
- WBC-DDU cable(s) 1...2.
- Base station interface cable (cable marked CB1 to DDU1).
- DDU-TTRX RX cable(s) 1...8. (Connect only those cables that will be used and terminate all unused SMA-ports in the DDU with a 50 ohm terminator.)
- Antenna cable(s) 1...2.

The combiner and DDU are now ready for use.

When the power supply of the base station is turned on, the DDU turns on automatically. The green LED (marked OPR) on the front panel lights up, indicating that the DDU receives DC power and is operative.

Note

Unused DDU outputs need to be terminated.

If you are using 3–4 carriers with a single antenna, connect the WBC units using the inbuilt cables in the WBC units. To make the connection, do the following (see Figure 39):

1. Open the HYB IN1 (inbuilt) cable from the Isolator 1 OUT connector in the WBC3 and connect it to the HYB OUT1 connector in the WBC1.
2. Open the HYB IN2 (inbuilt) cable from the Isolator 2 OUT connector in the WBC3 and connect it to the HYB OUT2 connector in the WBC2.

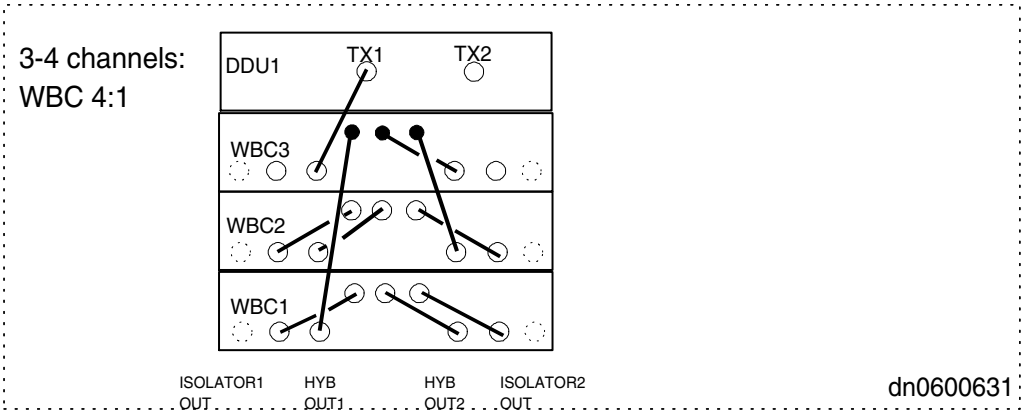

Figure 39 : 3–4 carriers with one antenna

See Section 8.2.5 for information how to add more channels.

7.4.1 Troubleshooting

The following table shows the fault indications for DDU380 and DDU385.

Table 31 : Fault indications for DDU380 and DDU385

Fault indication	Possible causes	Recovery
The LED is OFF	The power supply may not be properly connected.	Connect the power supply properly.
	The fuse inside the DDU may be blown.	Return the DDU for repair.
The LED is red	Failure in the LNA in one or both halves of the DDU.	Return the DDU for repair.
TBC reports both MHA1 and MHA2 alarms	Wrong HW configuration at TBC.	Check that MHAs have not been configured in TBC if they are not used.

7.5 TX antenna monitoring unit (TXM)

TXM(s) are used for monitoring TX antenna line condition. Basic cabinet supports the use of four TXMs mounted on the base station's TX-connector(s) located on the roof of the base station cabinet(s). The antenna line is monitored by measuring its forward and reverse power with directional coupler and detector circuit. Detector circuit is a true-RMS type and has linear-in-dB response. The unit generates two analog output signals: one for forward power (FWD) and another for reverse power (REV).

The TXM has two frequency variants:

- 336-470 MHz variant for TB3 350, TB3 380, TB3 410 and TB3 450
- 851-869 MHz variant for TB3 800

See the following figure to see the TXM and its connectors.

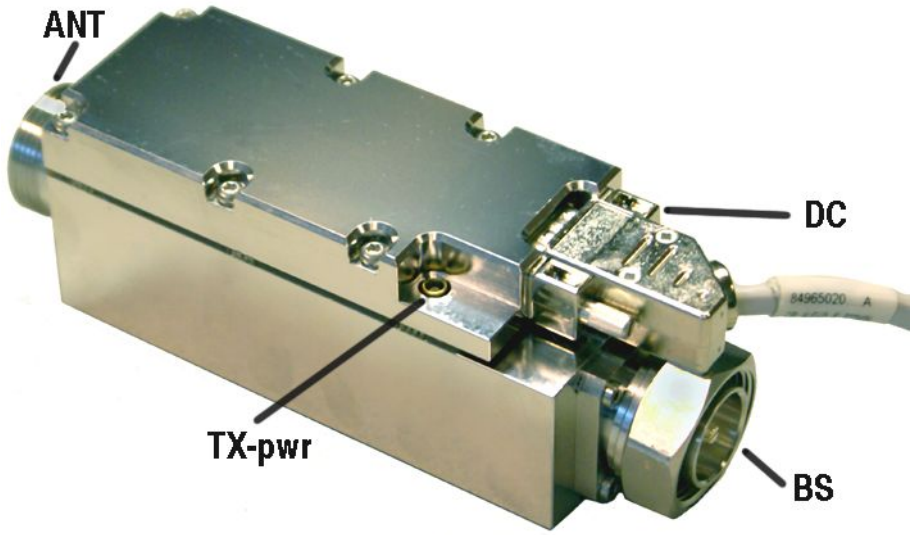

Figure 40 : TX-antenna monitoring unit (TXM)

Table 32 : TXM connectors

BS connector	7/16 male Used for mounting TXM(s) on the base station's antenna connector(s) located on the roof of the base station cabinet.
ANT connector	7/16 female Used for connecting the TB3 antenna cable to the TXM(s).
DC connector	Female 9-pin sub D-connector Cable 9650 to Alarm interface (ALIFB)
TX-PWR connector	MCX female Normally unconnected. Can be used for online monitoring purpose.

See Figures 19 and 20 .

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CHAPTER

8

Internal cabling

The cabinets are delivered with preinstalled internal cabling. Normally only external and unit front panel cables need to be connected.

Every cable carries a label which gives you the four-digit cable code, the 3rd–6th in the number sequence of the label (in the following Figure 41 , for example, the cable code is *9688*).

Figure 41 : Cable code label

Note

Read carefully Section 3.1 of this document before commencing installation of cables.

Use the site-specific *Installation Check List* to record the completion of tasks detailed in this document. An example of the *Installation Check List* can be found at the end of this manual.

CAUTION

Take care not to bend cables unnecessarily. Check also that there is enough room for closing the cabinet door. Improper handling may affect RF characteristics and damage connectors.

8.1 Cavity combiners

CAUTION

Take care not to bend combiner RF cables unnecessarily. Check also that there is enough room for closing the cabinet door. Improper handling may affect RF characteristics and damage connectors.

CAUTION

Check the cable labels and possible site specific instructions to ensure correct cable connections.

8.1.1 Cabinet front cabling (4-carrier TB3 with ATC)

Refer to possible site-specific instructions for cabling. The cable codes and quantity may differ from the following figure.

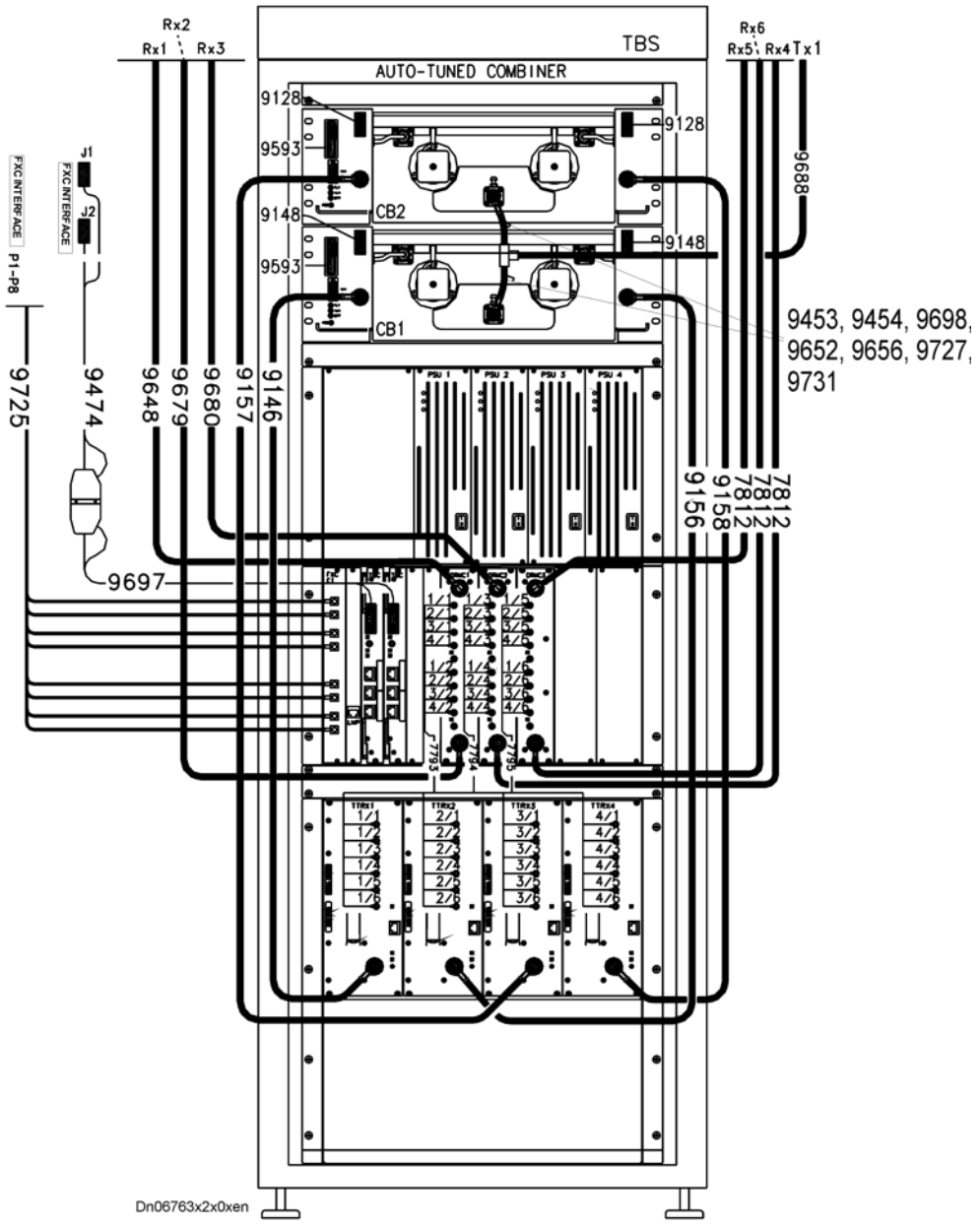

Figure 42 : Front cabling for a 4-carrier TB3 with ATC (FXC E1)

Note

Cables 9128 and 9148 are not used with ATC 380 and ATC 800.

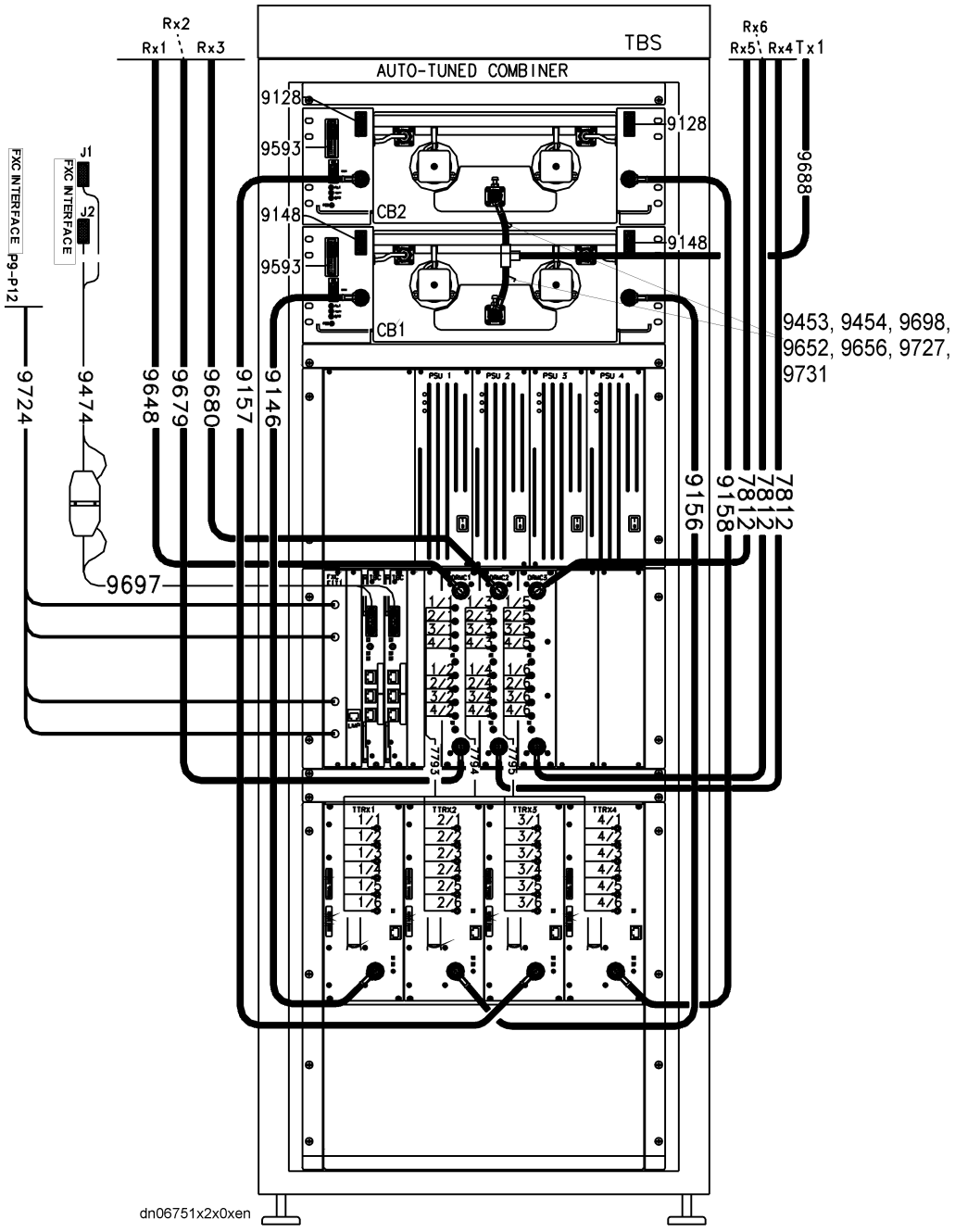

Figure 43 : Front cabling for a 4-carrier TB3 with ATC (FXC E1/T1)

Note

In the case of IP transmission, refer to Section 8.3 .

Table 33 : Front cable codes and routing with ATC 350, ATC 380, ATC 410, ATC 450 or ATC 800

Cable code	Quantity	From	To
9128[1)]	1 set	Combiner 2	Rear CSR P16
9148[1)]	1 set	Combiner 1	Rear CSR P16
9593	1 set	CSR P14 / PWSR P9	Combiner 1 and 2 system connector
9727 (ATC 350)	2	Combiner 1	Combiner 2
9652 or 9656 (ATC 380)	2	Combiner 1	Combiner 2
9453 or 9454 (ATC 410)	2	Combiner 1	Combiner 2
9698 (ATC 450)	2	Combiner 1	Combiner 2
9731 (ATC 800)	2	Combiner 1	Combiner 2
9688	1	Combiner 1	TX ant. conn.
9146	1	TTRX1	Combiner 1
9156	1	TTRX2	Combiner 1
9157	1	TTRX3	Combiner 2
9158	1	TTRX4	Combiner 2
9648	1	RX1 ant. conn.	DRMC1 / ANT1
9679	1	RX2 ant. conn.	DRMC1 / ANT2
9680	1	RX3 ant. conn.	DRMC2 / ANT1
7812	3	RX4 ant. conn. RX5 ant. conn. RX6 ant. conn.	DRMC2 / ANT2 DRMC3 / ANT1 DRMC3 / ANT2
7793	1 set	DRMC1	TTRX 1–4 / RX1 & RX2
7794	1 set	DRMC2	TTRX 1–4 / RX3 & RX4
7795	1 set	DRMC3	TTRX 1–4 / RX5 & RX6
9697	1	TBC 1&2	Cable 9474
9474	1	TBC • to TBC 1 if one TBC is used • to cable 9697 if two TBCs are used	FXC IF J1 & J2

Table 33: Front cable codes and routing with ATC 350, ATC 380, ATC 410, ATC 450 or ATC 800 (cont'd.)

Cable code	Quantity	From	To
9723[2)]	1	FXCA X5	LMP Panel
9724	1 set	FXC E1/T1	FCX IF P9–12
9725	1 set (optional)	FXC E1	FXC IF P1–8
9771[3)]	2	TBCi 1/ETH1, ETH2	TBCi (0)/ETH-1, ETH-2
9772[3)]	2	TBCi 2/ETH1, ETH2	TBCi (1)/ETH-1, ETH-2

[1)] Not used with ATC 380 and ATC 800.
[2)] Internal cable
[3)] Optional. Ethernet cables 9771 and 9772 are only used with TBCi for IP transmission. See Section 8.3 .

Refer to *TB3 Hardware Description*, dn04161675, for more information.

8.1.2 Cabinet rear cabling (4-carrier TB3 with ATC)

CAUTION

Take care not to bend combiner RF cables unnecessarily. Check also that there is enough room for closing the cabinet door. Improper handling may affect RF characteristics and damage connectors.

CAUTION

Check the cable labels and possible site specific instructions to ensure correct cable connections.

Refer to possible site specific instructions for cabling. The cabling and quantity of cables may differ from the following figure.

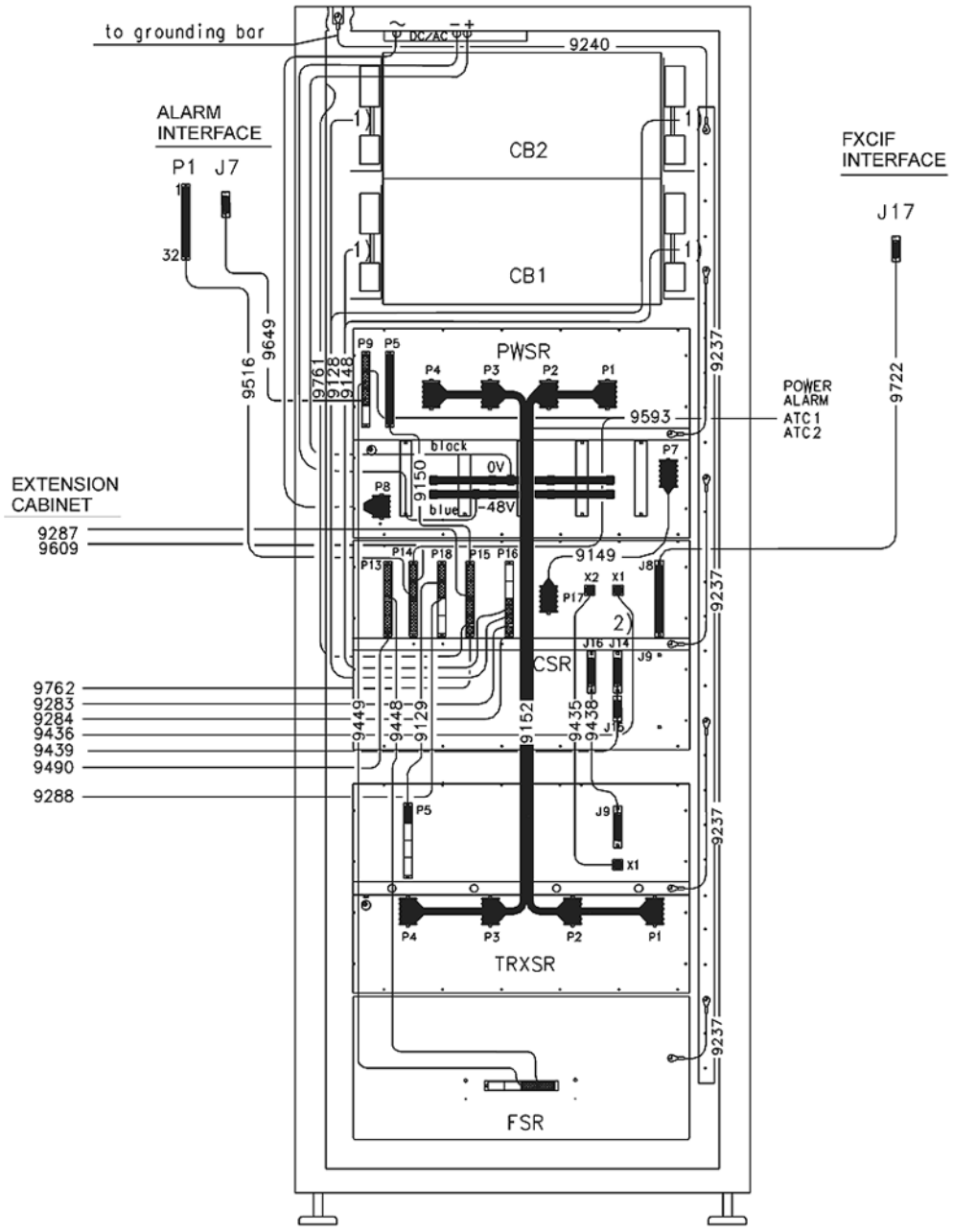

Figure 44 : Rear cabling

Table 34 : Rear cable codes

Cable code	Quantity	From	To
9152	1 set	PWSR P1...P4	TRXSR P1...P4
9149	1	PWSR P7	CSR P17
9150	1	PWSR P5	CSR P15 1st half
9593	1 set	PWSR P9 CSR P14	ATC1 / DDU1 ATC2 / DDU2
9649	1	PWSR P9	ALIF J7
9449	1	PWSR P9	FSR
9448	1	CSR P13 1st half	FSR
9129	1	CSR P18 1st quarter	TRXSR P5 1st quarter
9128	1 set	CSR P16 6th /8	(to front, see Table 10) Combiner 2
9148	1 set	CSR P16 5th /8	(to front, see Table 10) Combiner 1
9435	1	CSR X2	TRXSR X1
9438	1	CSR J16	TRXSR J9
9722	1	CSR J8	Roof, FXC IF J17
9516	1	CSR P14, 2nd half	Roof, Alarm IF P1
9237	3	Subrack gnd	Rack gnd
9761	1	CSR P15, 7th /8	Door and rear panel alarm switches
9240	1	Rack gnd	Gnd bar on cabinet top
Pwr wiring, AC/DC	1	Cabinet top	PWSR P8 / LC-filter

Refer to *TB3 Hardware Description*, dn04161675, chapter 12, for more information.

8.1.3 Extension cabinet front cabling

Refer to possible site specific instructions for cabling. The cable codes and quantity may differ from the following figure.

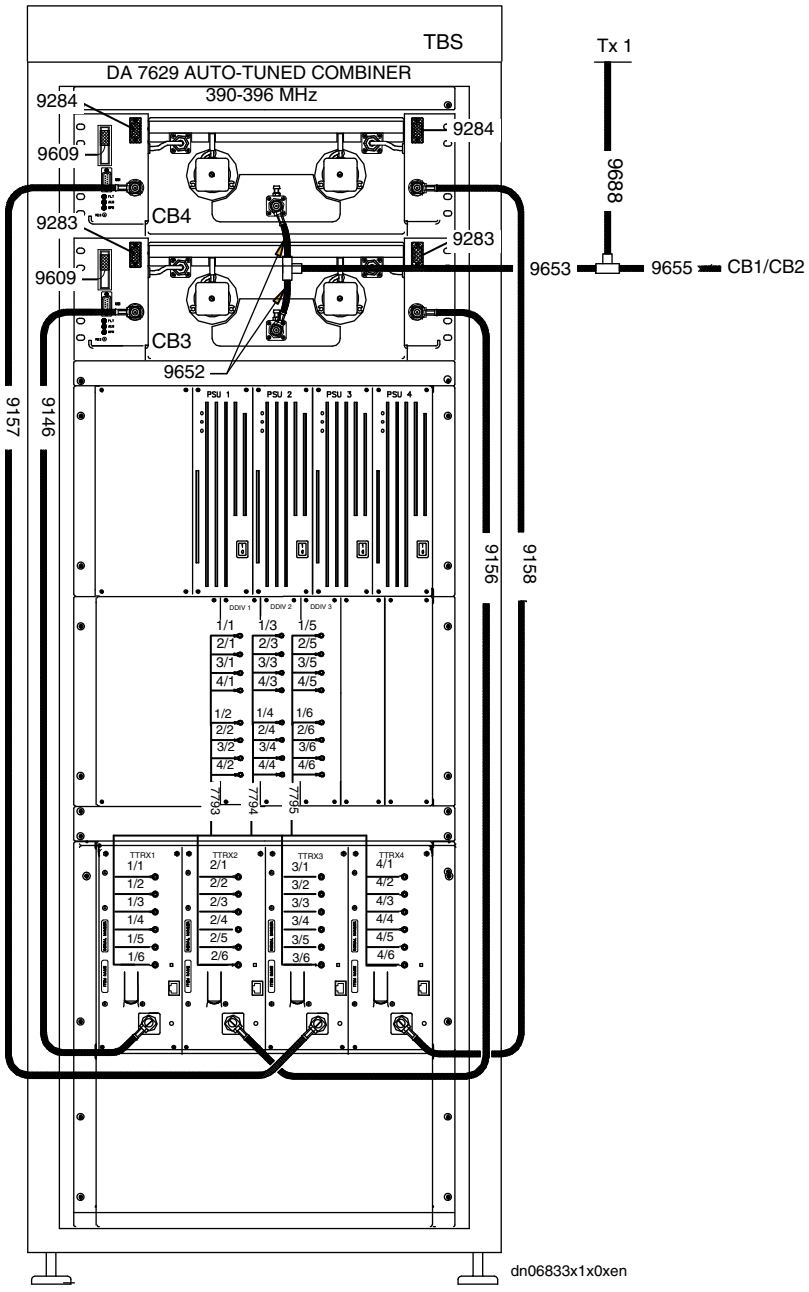

Figure 45 : Front cabling of extension cabinet (example for 390–396 MHz range)

Note

Cables 9283 and 9284 are not used with ATC 380 and ATC 800.

Table 35 : Front cable codes and routing, Extension cabinet

Cable code	Quantity	From	To
9146	1	TTRX1	Combiner 3
9156	1	TTRX2	Combiner 3
9157	1	TTRX3	Combiner 4
9158	1	TTRX4	Combiner 4
7793	1 set	DDIV1	TTRX1–4 / RX1 & RX2
7794	1 set	DDIV2	TTRX1–4 / RX3 & RX4
7795	1 set	DDIV3	TTRX1–4 / RX5 & RX6

Refer to *TB3 Hardware Description*, dn04161675, for more information.

8.1.4 Extension cabinet rear cabling

CAUTION

When wiring the TB3 backplane, it is adviced to take special care that the connectors are plugged in the right way. For more information, see Appendix A in this document and Chapter *Internal cabling* in *TBS Hardware Description*, dn04161675.

Refer to possible site-specific cabling instructions. The cables may differ from the following figure.

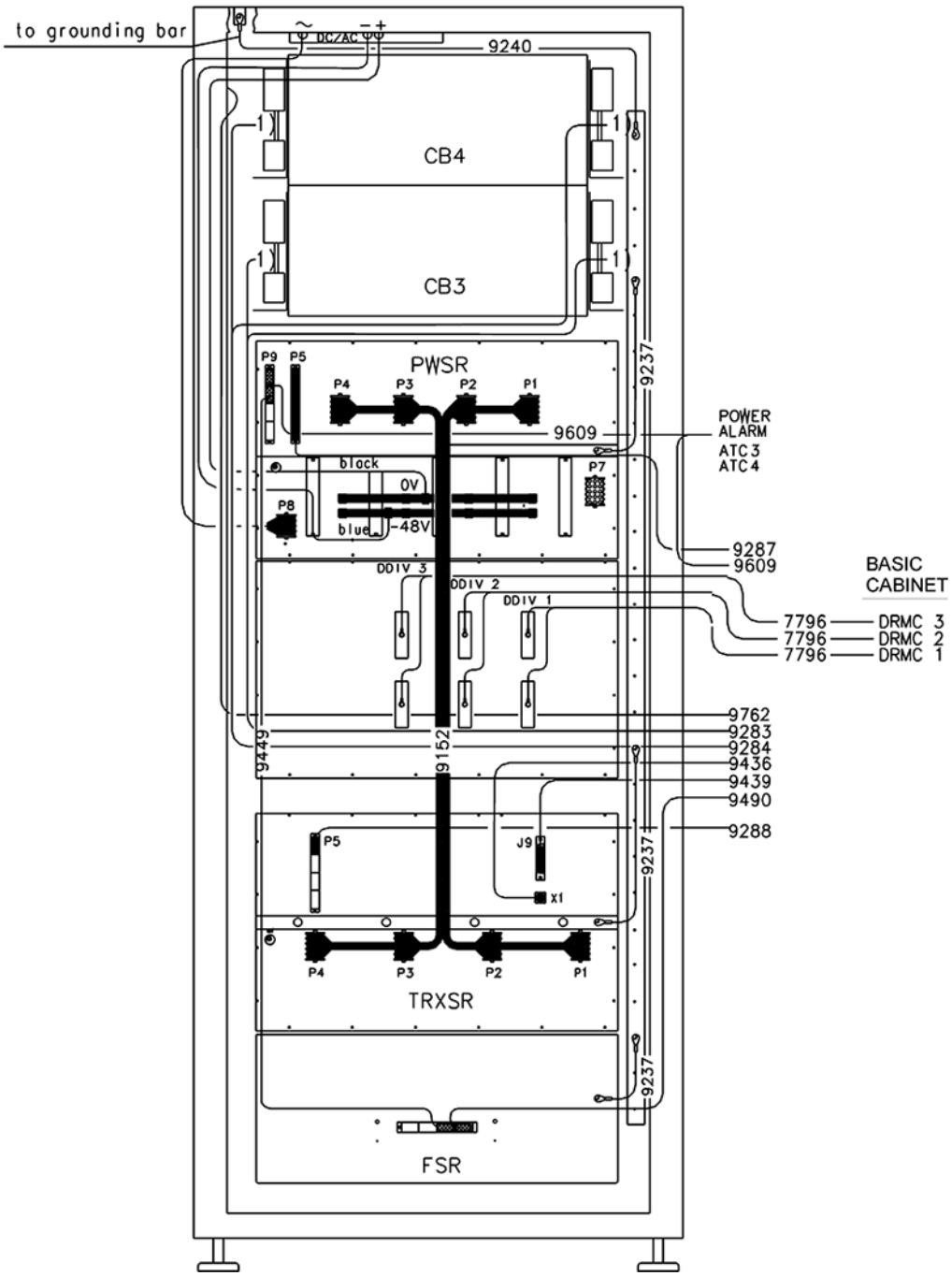

Figure 46 : Extension cabinet rear cabling

Table 36 : Rear cable codes for Extension cabinet

Cable code	Quantity	From	To
9152	1 set	PWSR P1...P4	TRXSR P1...P4
9449	1	PWSR P9	FSR
9237	2	Subrack gnd.	Rack gnd.
9240	1	Rack gnd.	Gnd bar on cabinet top
Pwr. wiring, AC/DC		Cabinet top	PWSR P8 / LC-filter

Refer to *TB3 Hardware Description*, dn04161675, for more information. See also Appendix A .

Table 37 : Cables between Basic and Extension cabinets in ATC cases

Cable code	Quantity	From (Ext. cabinet)	To (Basic cabinet)
9609	1 set	ATC 3 &4 / PWSR P9 1st/4	CSR P14 2nd/4
9287	1	PWSR P5	CSR P15 3rd/4
9762	1	Door alarm switch	CSR P15 8th/8
9283[1)]	1 set	Combiner 3	CSR P16 7th/8
9284[1)]	1 set	Combiner 4	CSR P16 8th/8
9436	1	TRXSR X1	CSR X1
9439	1	TRXSR J9	CSR J14
9490	1	FSR Fan4 1st/4	CSR P13 2nd/2
9288	1	TRXSR P5 1st/4	CSR P18 2nd/4
7796	3	DDIV1 DDIV2 DDIV3	DRMC1 / AUX1, AUX2 DRMC2 / AUX1, AUX2 DRMC3 / AUX1, AUX2
TX RF-cabling		Combiner 3 & 4	Combiner 1 & 2
[1)] Not used with ATC 380 and ATC 800.			

Refer to *TB3 Hardware Description*, dn04161675, for more information. See also Appendix A .

8.1.5 Cabling for alternative cavity combiner types

Cabling for the alternative combiner types is shown in the following figures.

CAUTION

Take care not to bend combiner RF cables unnecessarily. Check also that there is enough room for closing the cabinet door. Improper handling may affect RF characteristics and damage connectors.

CAUTION

Check the cable labels and possible site specific instructions to ensure correct cable connections.

Refer to the document *TB3 Hardware Description*, dn04161675, for more information.

Table 38 : Cavity combiner types, sub-bands and cables

Combiner type	ID	Sub-band	Cables
ATC 350 See Figures 47 , 48 and 49	7971	360–370 MHz	A= 9727 B= 9728 C= 9729 D= 3730
Cavity combiner 380 See Figures 50 , 51 , 52 and 53	7004	390-400 MHz	S= 7096 L= 7097
ATC 380 See Figures 47 , 48 and 49	7629	390-396 MHz	A= 9652 B= 9653 C= 9654 D= 9655
ATC 380 See Figures 47 , 48 and 49	7629	395-400 MHz	A= 9656 B= 9657 C= 9658 D= 9659
Cavity combiner 410 See Figures 54 , 55 and 56	7065	420-430 MHz	A= 7102 B= 7103 C= 7104
ATC 410 See Figures 47 , 48 and 49	7141	420-426 MHz	A= 9453 B= 9457 C= 9461 D= 9465
ATC 410 See Figures 47 , 48 and 49	7141	425-431 MHz	A= 9454 B= 9458 C= 9462 D= 9466
ATC 450 See Figures 47 , 48 and 49	7835	460-466 MHz	A= 9698 B= 9699 C= 9700 D= 9701

Table 38: Cavity combiner types, sub-bands and cables (cont'd.)

Combiner type	ID	Sub-band	Cables
ATC 800 (300 kHz) See Figures 47 , 48 and 49	7996	851–865 MHz	A= 9731 B= 9732 C= 9733 D= 9734
ATC 800 (300 kHz) See Figures 47 , 48 and 49	7996	855–869 MHz	A= 9731 B= 9736 C= 9737 D= 9738
ATC 800 (150 kHz) See Figures 47 , 48 and 49	7997	851–865 MHz	A= 9731 B= 9732 C= 9733 D= 9734
ATC 800 (150 kHz) See Figures 47 , 48 and 49	7997	855–869 MHz	A= 9731 B= 9736 C= 9737 D= 9738

Note

ATC 800 A-cable 9731 is matched for the whole 851 to 869 MHz bandwidth.

8.1.5.1 Auto-tuned cavity combiners

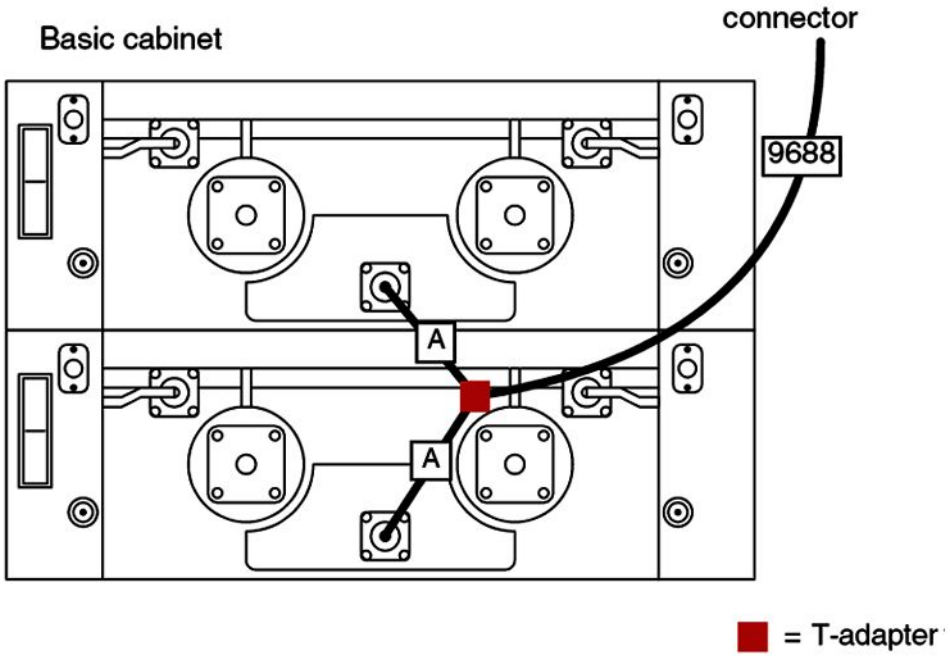

Figure 47 : RF cabling between Auto-tuned cavity combiners and TX-antenna connector: 4-carrier configuration

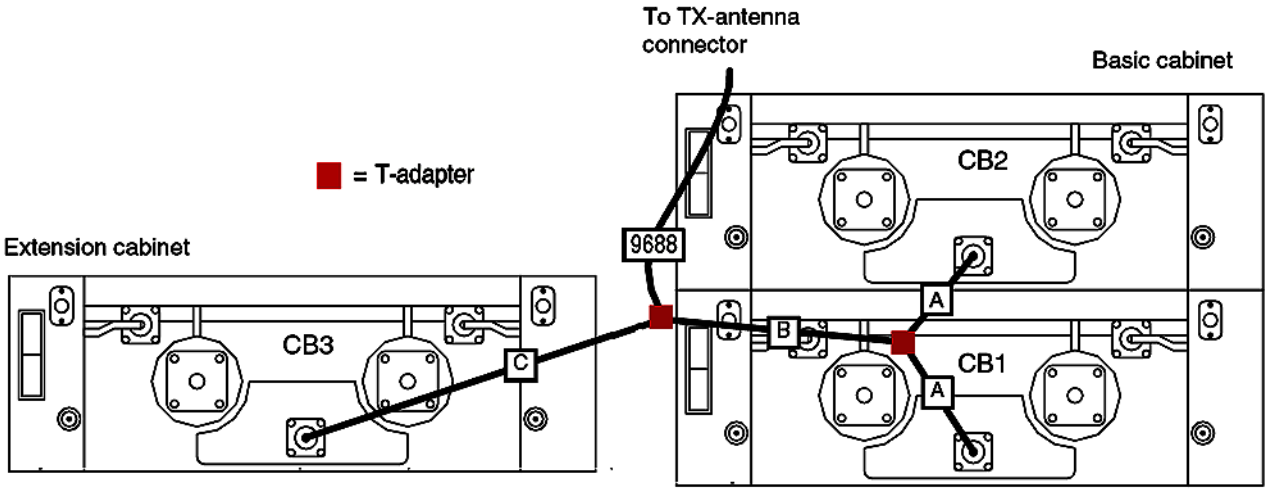

Figure 48 : RF cabling between Auto-tuned cavity combiners and TX-antenna connector: 6-carrier configuration

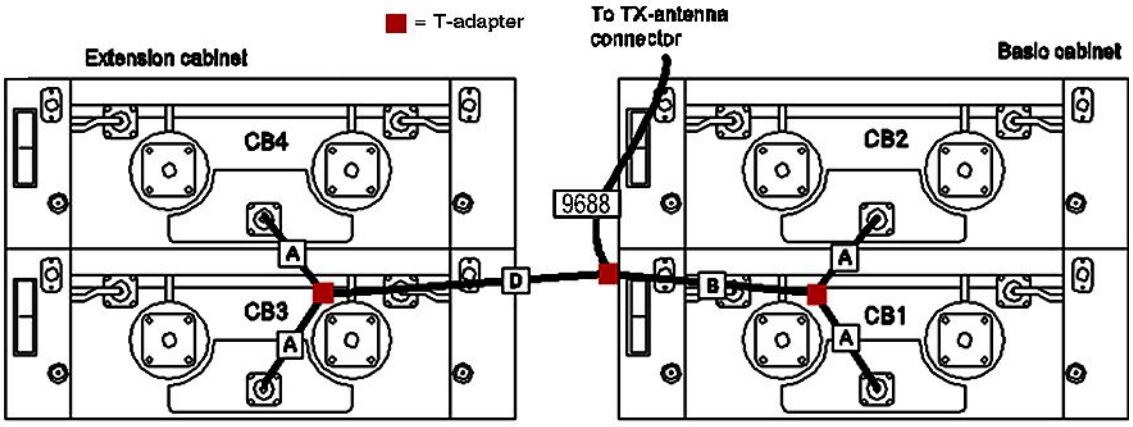

Figure 49 : RF cabling between Auto-tuned cavity combiners and TX-antenna connector: 8-carrier configuration

8.1.5.2 380 MHz manually tuned cavity combiner (DA 7004)

Note

When using 380 MHz manual combiners, the combiner closest to the antenna should use the lowest frequencies, the next nearest combiner should use the second lowest frequencies, and so on. Within each combiner, there is no significance in which cavity input the lower of the two frequencies is. The frequency order is especially important for 5 to 8 channel systems, where it makes a big difference on insertion loss and output return loss.

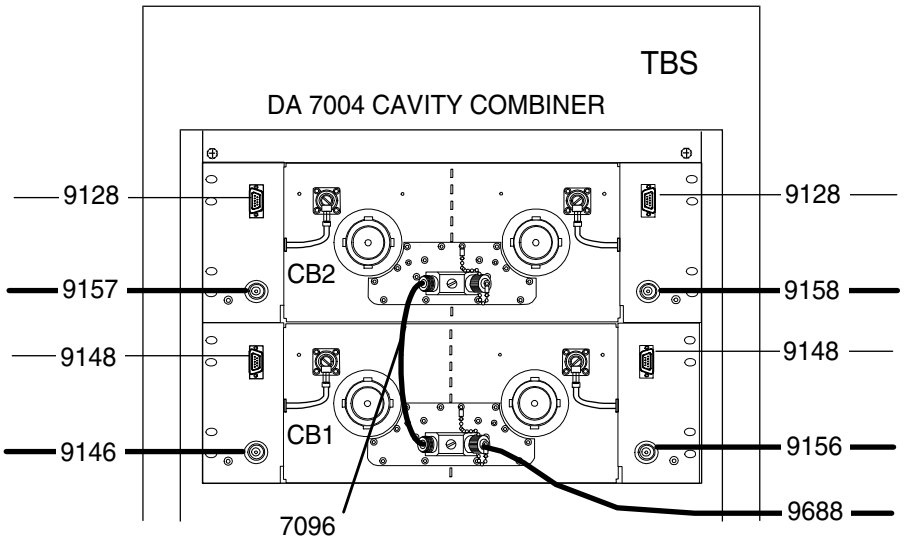

Figure 50 : 380 MHz manually tuned cavity combiner cables

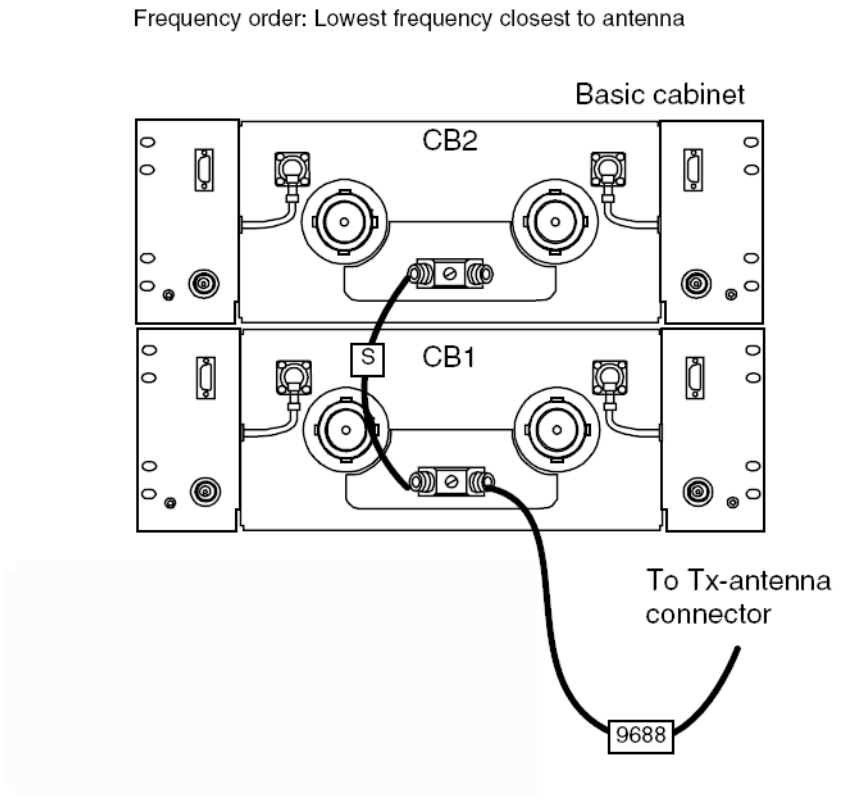

Figure 51 : RF cabling between manually tuned CB 380 and TX-antenna connector: 4-carrier configuration

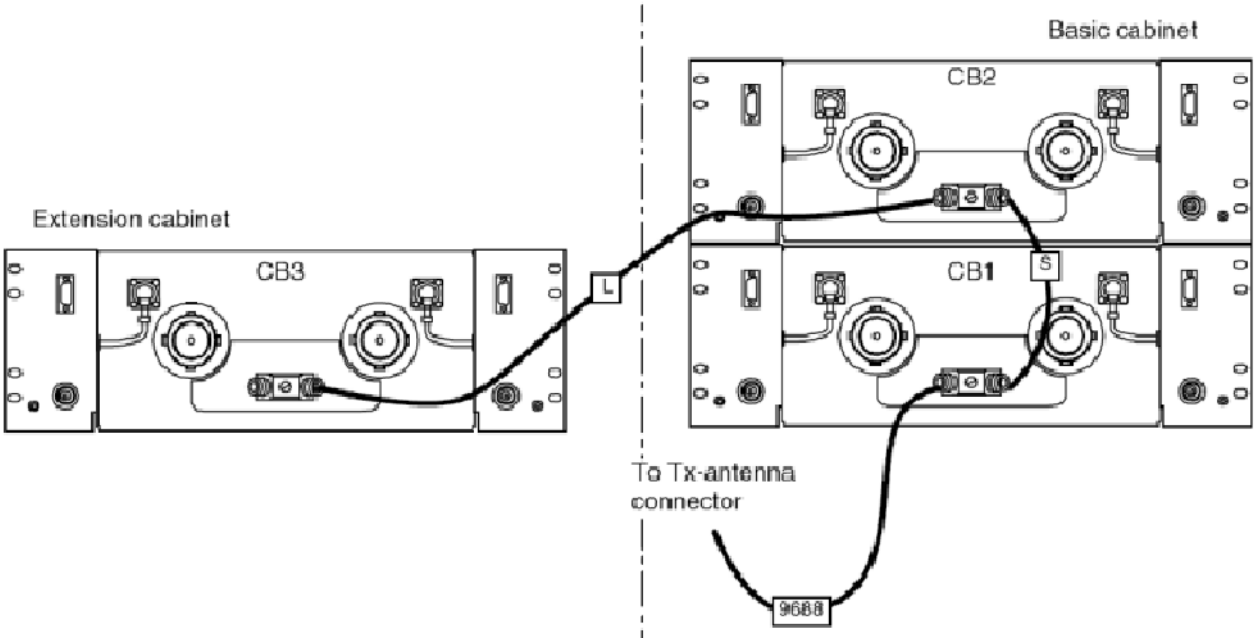

Figure 52 : RF cabling between manually tuned CB 380 and TX-antenna connector: 6-carrier configuration

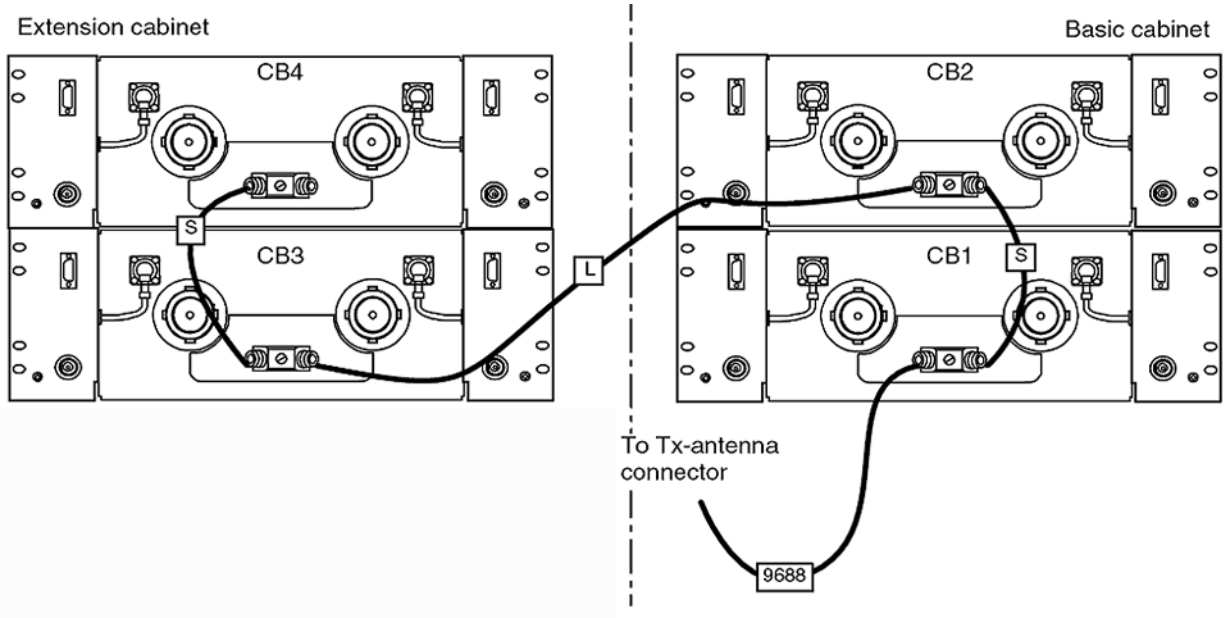

Figure 53 : RF cabling between manually tuned CB 380 and TX-antenna connector: 8-carrier configuration

8.1.5.3 410 MHz manually tuned cavity combiner (DA 7065)

Note

In 2 and 4 ch configurations the frequency order is free.

In 6 and 8 ch configurations frequencies of CBs 3 and 4 (or CBs nearest to antenna) are to be higher than frequencies of CBs 1 and 2 (or CBs farthest to antenna).

Cables B and C can be reversed respecting the frequency order: Combiners connected to cable C shall have higher frequencies that combiners connected to cable B.

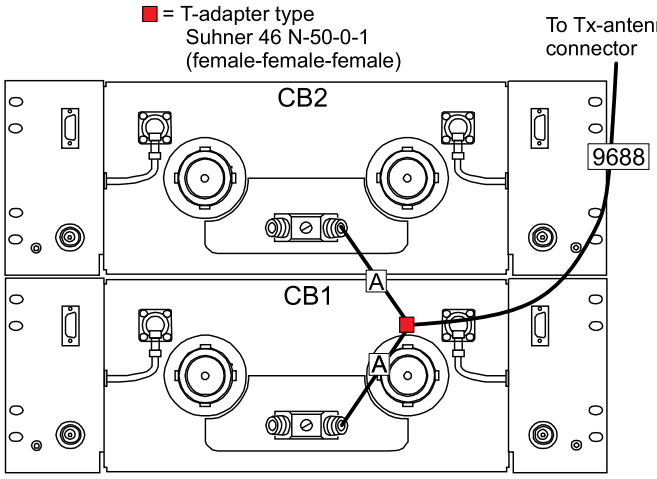

Figure 54 : RF cabling between manually tuned CB 410 and TX-antenna connector: 4-carrier configuration

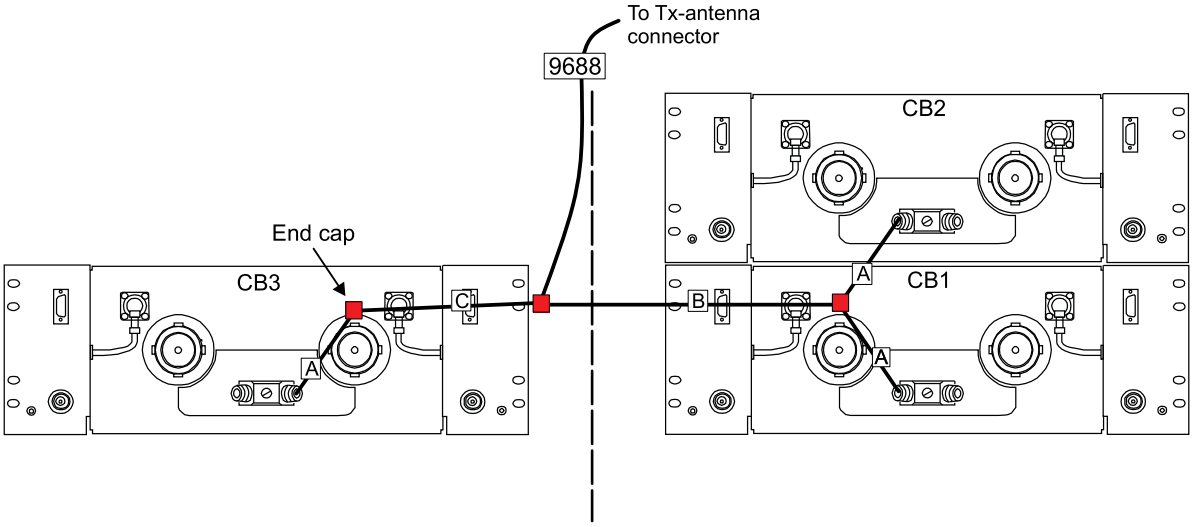

Figure 55 : RF cabling between manually tuned CB 410 and TX-antenna connector: 6-carrier configuration

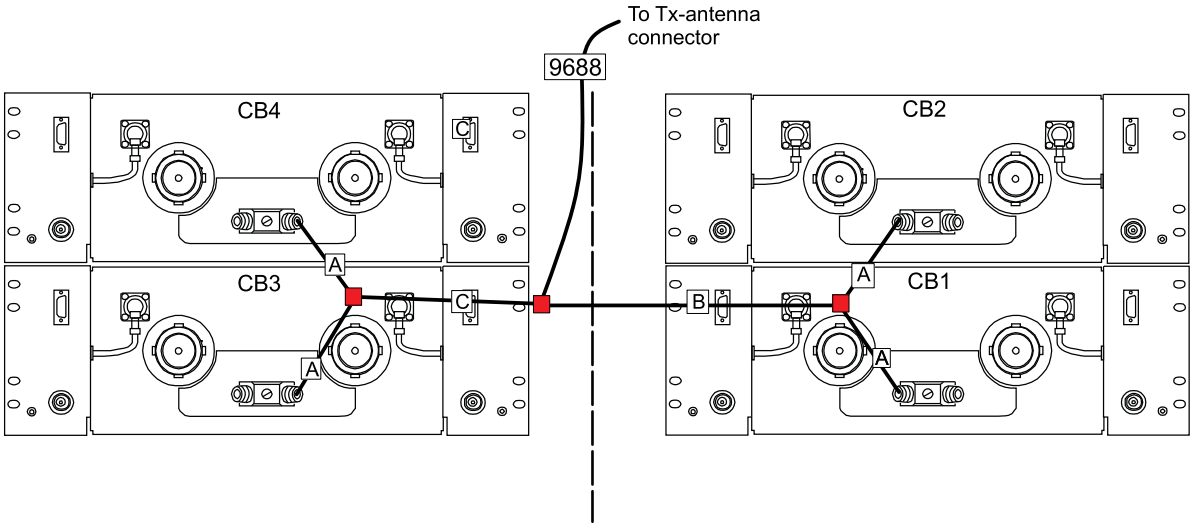

Figure 56 : RF cabling between manually tuned CB 410 and TX-antenna connector: 8-carrier configuration

8.2 Wideband combiner (WBC) and dual duplexer (DDU)

CAUTION

Take care not to bend combiner RF cables unnecessarily. Check also that there is enough room for closing the cabinet door. Improper handling may affect RF characteristics and damage connectors.

CAUTION

Check the cable labels and possible site specific instructions to ensure correct cable connections.

8.2.1 Cabinet front cabling (2-carrier TB3 with WBC)

Refer to possible site-specific instructions for cabling. The cable codes and quantity may differ from the following figures.

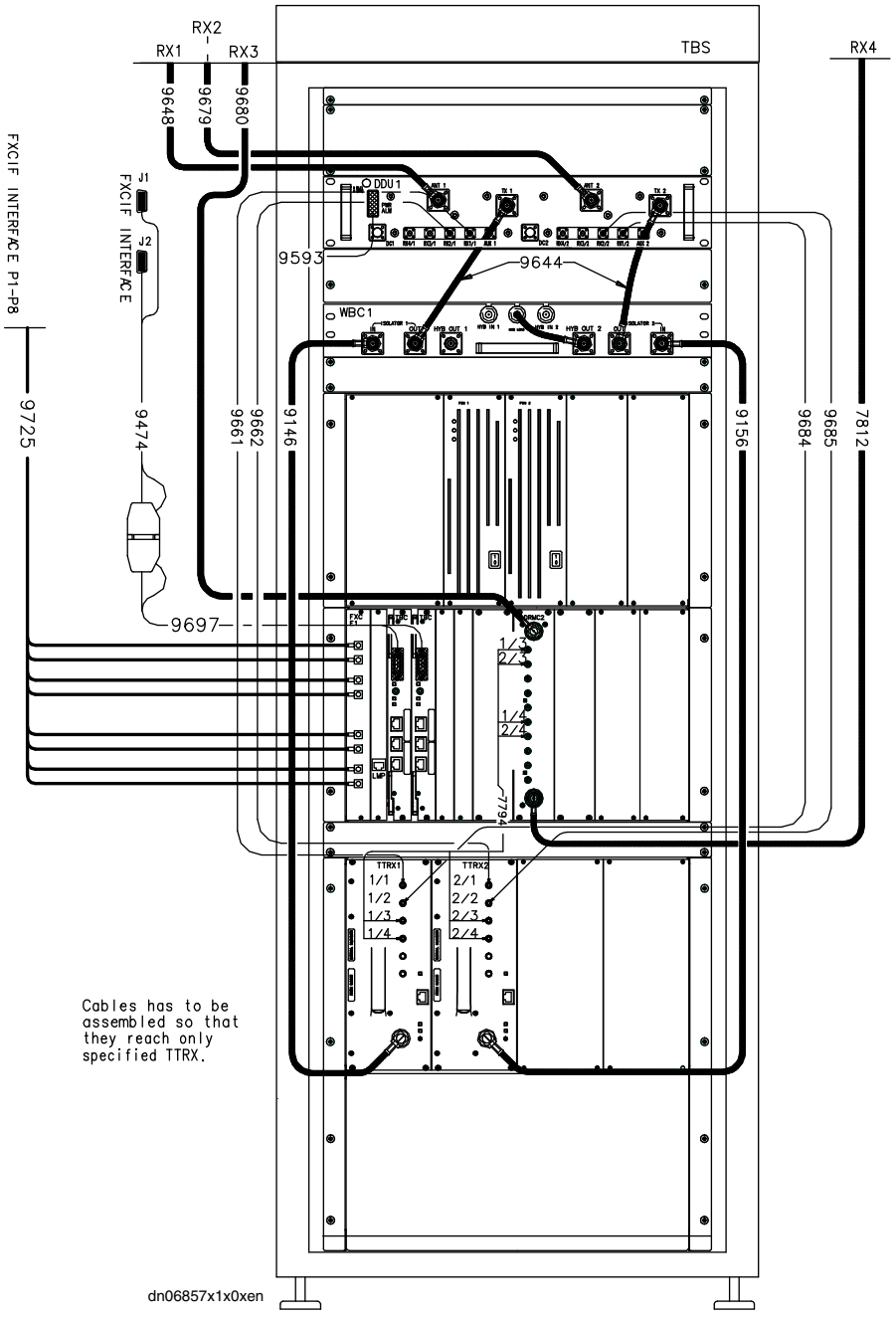

Figure 57 : Cabinet front cabling for 2-carrier TB3 with WBC (FXC E1)

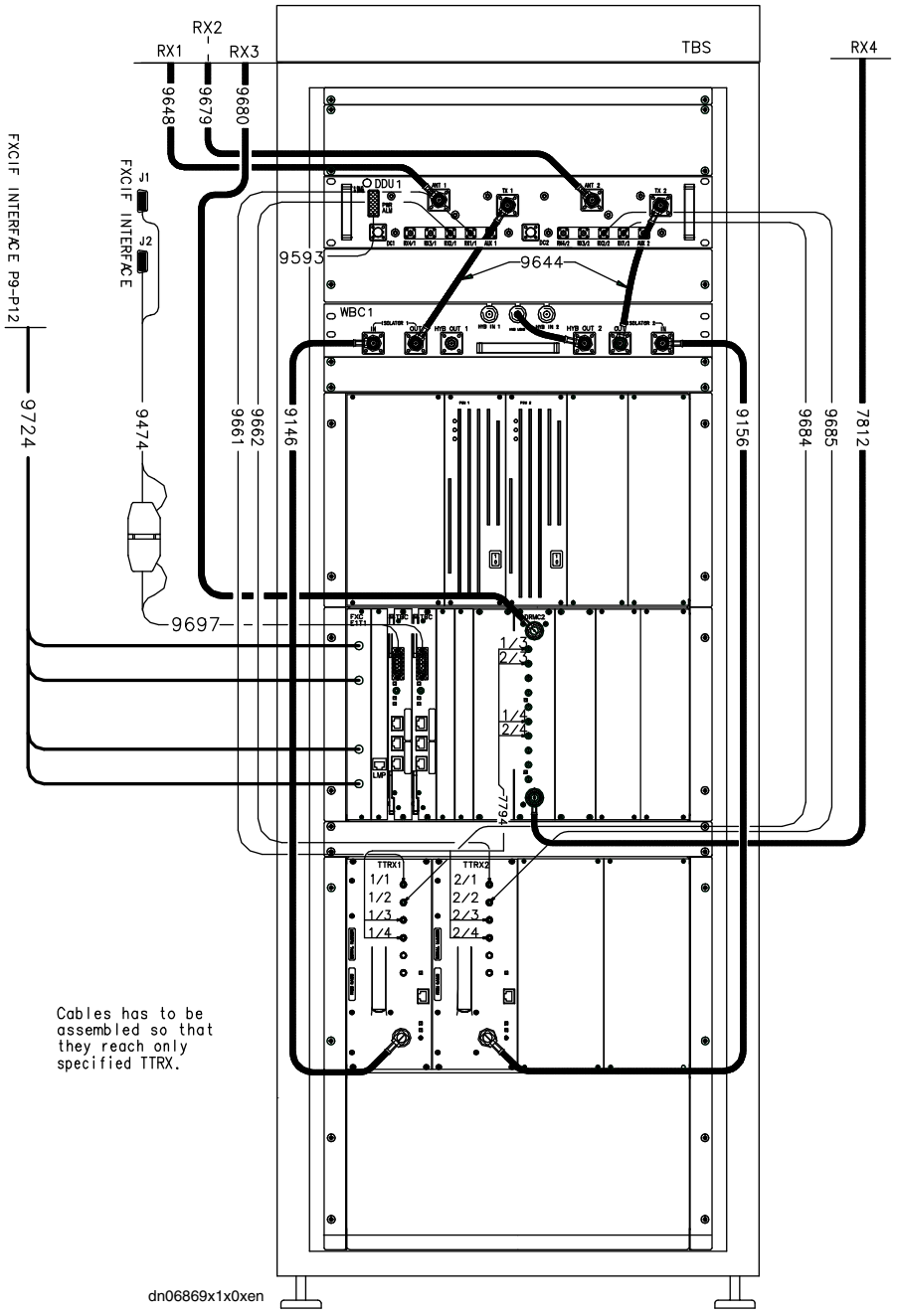

Figure 58 : Cabinet front cabling for 2-carrier TB3 with WBC (FXC E1/T1)

Note

In the case of IP transmission, refer to Section 8.3 .

Table 39 : Front cable codes and routing with WBC

Cable code	Quantity	From	To
9146	1	TTRX1 / TX	WBC1 / Isolator 1 IN
9156	1	TTRX2 / TX	WBC1 / Isolator 2 IN
9644	2	WBC1/Isolator 1 OUT WBC1/Isolator 2 OUT	DDU1 / TX1 DDU1 / TX2
9593	1 set	Rear CSR P14/ PWSR P9	DDU1 and 2 system connector
9648	1	RX1 ant. conn.	DDU1 / ANT1
9679	1	RX2 ant. conn.	DDU1 / ANT2
9680	1	RX3 ant. conn.	DRMC2 / ANT1
7812	1	RX4 ant. conn.	DRMC2 / ANT2
9661	1	DDU1 / RX1/1	TTRX1 / RX1
9662	1	DDU1 / RX2/1	TTRX2 / RX1
9684	1	DDU1 / RX1/2	TTRX1 / RX2
9685	1	DDU1 / RX2/2	TTRX2 / RX2
9697	1	TBC 1&2	Cable 9474
9474	1	TBC • to TBC 1 if one TBC is used • to cable 9697 if two TBCs are used	FXC IF J1 & J2
7794	1 set	DRMC2	TTRX1–2 / RX3 & RX4
9723[1)]	1	FXCA X5	LMP Panel
9724	1 set	FXC E1/T1	FCX IF P9–12
9725	1 set (optional)	FXC E1	FXC IF P1–8
9771[2)]	2	TBCi 1/ETH1, ETH2	TBCi (0)/ETH-1, ETH-2
9772[2)]	2	TBCi 2/ETH1, ETH2	TBCi (1)/ETH-1, ETH-2

[1)] Internal cable
[2)] Optional. Ethernet cables 9771 and 9772 are only used with TBCi for IP transmission. See Section 8.3 .

Refer to *TB3 Hardware Description*, dn04161675, for more information.

8.2.2 Rear cabling (WBC)

Refer to possible site-specific instructions for cabling. The cable codes and quantity may differ from the following figure.

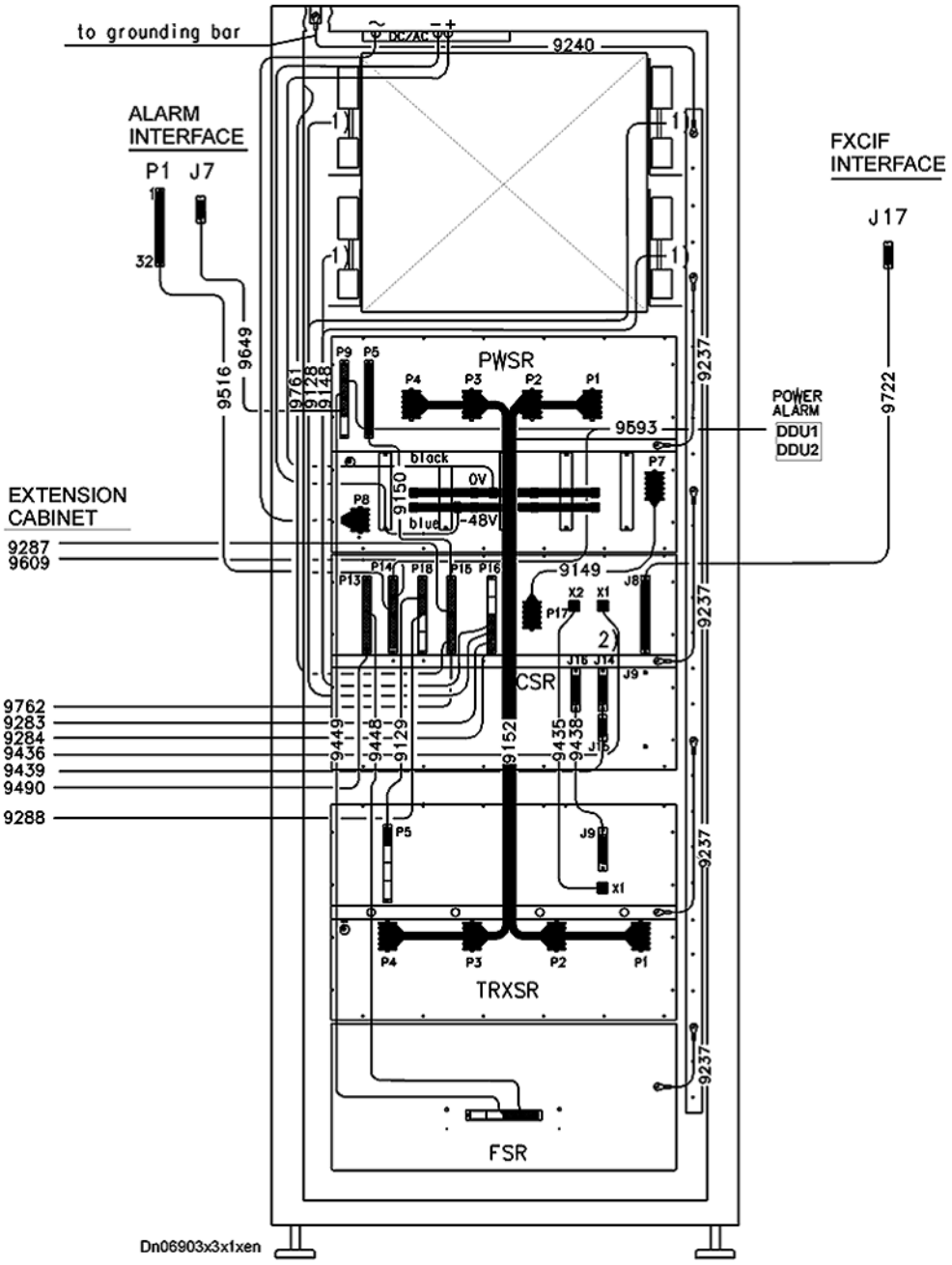

Figure 59 : Rear cabling (WBC)

Table 40 : Rear cable codes

Cable code	Quantity	From	To
9152	1 set	PWSR P1...P4	TRXSR P1...P4
9149	1	PWSR P7	CSR P17
9150	1	PWSR P5	CSR P15 1st half
9593	1 set	PWSR P9 CSR P14	DDU1 DDU2
9649	1	PWSR P9 3rd/4	ALIF J7
9449	1	PWSR P9 2nd/4	FSR 2nd/4
9448	1	CSR P13 1st half	FSR 1st/4
9129	1	CSR P18 1st quarter	TRXSR P5 1st quarter
9128	1 set	CSR P16 6th /8	(not in use)
9148	1 set	CSR P16 5th /8	(not in use)
9435	1	CSR X2	TRXSR X1
9438	1	CSR J16	TRXSR J9
9722	1	CSR J8	Roof, FXC IF J17
9516	1	CSR P14, 2nd half	Roof, Alarm IF P1
9237	4	Subrack gnd	Rack gnd
9761	1	CSR P15, 7th /8	Door alarm switch
9240	1	Rack gnd	Gnd bar on cabinet top
Pwr. wiring, AC/DC	1	Cabinet top	PWSR P8 / LC-filter

Refer to *TETRA System: TB3 Hardware Description*, dn04161675 for more information and for the extension cabinet combiner cabling.

8.2.3 Extension cabinet front cabling (WBC)

Refer to possible site-specific instructions for cabling. The cable codes and quantity may differ from the following figure.

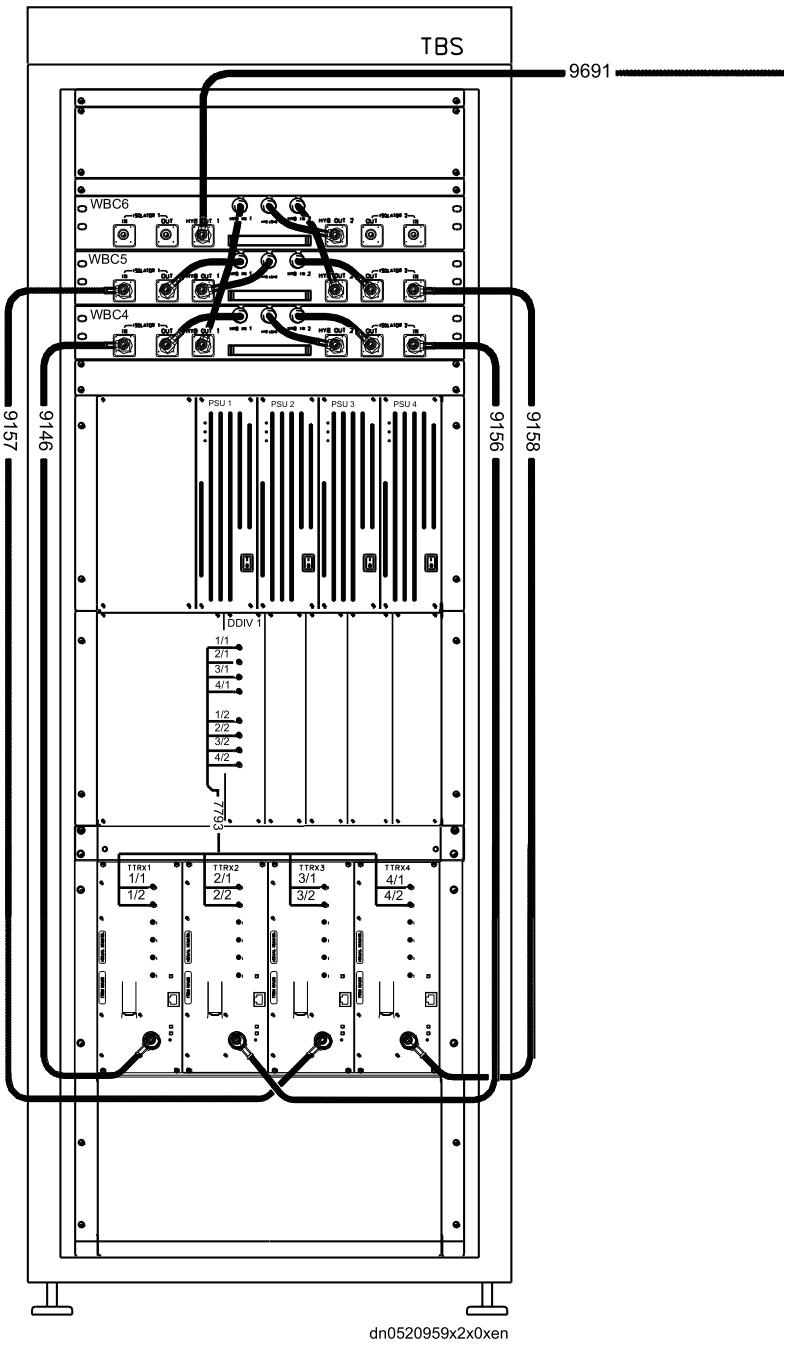

Figure 60 : Extension cabinet front cabling (WBC), one DDIV

Table 41 : Front cable codes, Extension cabinet (WBC)

Cable code	Quantity	From	To
9146	1	TTRX1 / TX	WBC4 / Isolator 1 IN
9156	1	TTRX2 / TX	WBC4 / Isolator 2 IN
9157	1	TTRX3 / TX	WBC5 / Isolator 1 IN
9158	1	TTRX4 / TX	WBC5 / Isolator 2 IN
7793	1 set	DDIV1	TTRX1–4 / RX1 & RX2
9691	1	WBC6 / HYB OUT 1	DDU1 / TX2

8.2.4 Extension cabinet rear cabling (WBC)

CAUTION

When wiring the TB3 backplane, it is adviced to take special care that the connectors are plugged in the right way. For more information, see Appendix A .

Refer to possible site-specific instructions for cabling.

The cable codes and quantity may differ from the following figure.

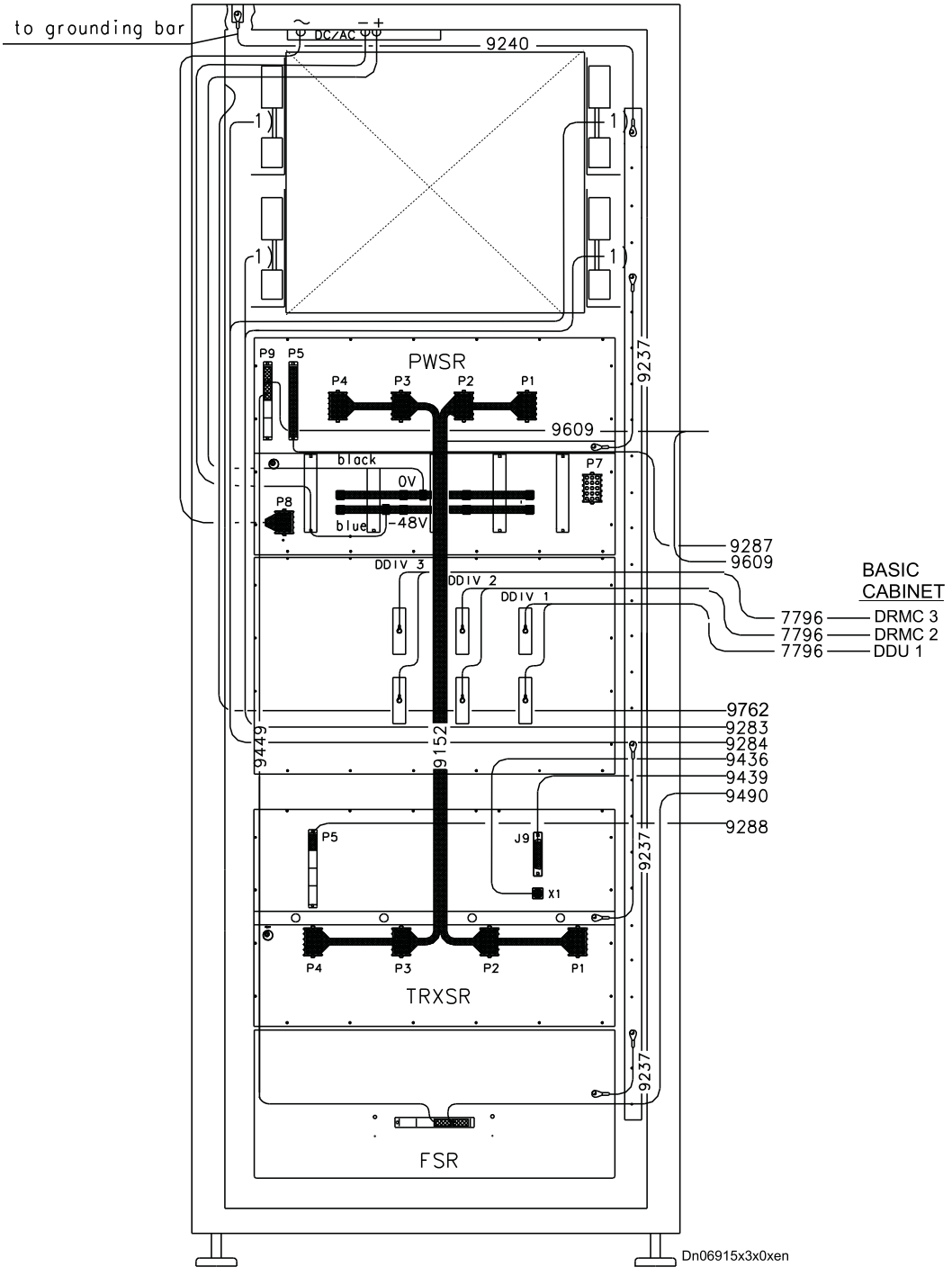

Figure 61 : Extension cabinet rear cabling (WBC), three DDIVs

Table 42 : Rear cable codes, Extension cabinet (WBC)

Cable code	Quantity	From	To
9152	1 set	PWSR P1...P4	TRXSR P1...P4
9449	1	PWSR P9	FSR
9237	3	Subrack gnd	Rack gnd
9240	1	Rack gnd	Gnd bar on cabinet top
Pwr. wiring, AC/DC		Cabinet top	PWSR P8 / LC-filter

The following table shows the cables between extension and basic cabinets in WBC cases.

Table 43 : Cables between Extension and Basic cabinets in WBC cases

Cable code	Quantity	From (Extension cabinet)	To (Basic cabinet)	Note!
9609	1 set	(ATC 3 & 4 / PWSR P9)	CSR P14 2nd/4	Not in use
9287	1	PWSR P5	CSR P15 3rd/4	
9762	1	Door alarm switch	CSR P15 8th/8	
9283	1 set	(Combiner 3)	CSR P16 7th/8	Not in use
9284	1 set	(Combiner 4)	CSR P16 8th/8	Not in use
9436	1	TRXSR X1	CSR X1	
9439	1	TRXSR J9	CSR J14	
9490	1	FSR Fan4 1st/4	CSR P13 2nd/2	
9288	1	TRXSR P5	CSR P18 2nd/4	
9691	1	WBC6 / HYBOUT1	DDU1 / TX2	
7796	1 set	DDIV1 DDIV1 DDIV2 DDIV2 DDIV3 DDIV3	DDU1 / AUX1 DDU1 / AUX2 DRMC2 / AUX1 DRMC2 / AUX2 DRMC3 / AUX1 DRMC3 / AUX2	

Refer to *TB3 Hardware Description*, dn04161675, for more information. See also Appendix A .

8.2.5 Cabling for alternative configurations

8.2.5.1 Radio frequency (RF) cabling

Connect the RF cables according to configuration. See the following figures.

CAUTION

Install the cables carefully. Check especially that the extension cabinet cables will not be sharply bent near the connectors when the cabinet doors are closed. Improper handling will damage the cables.

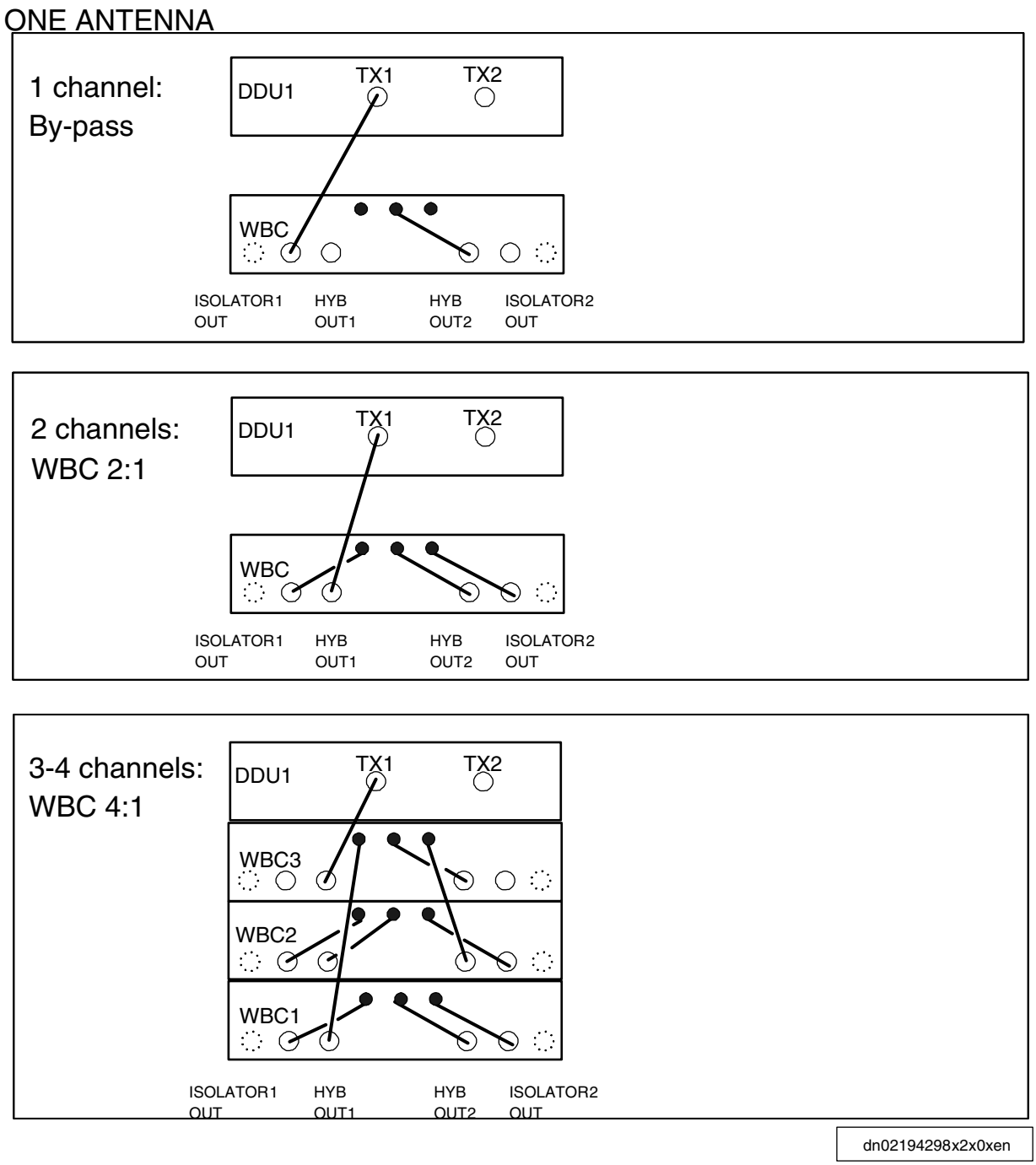

Figure 62 : WBC configurations, one antenna

2 ANTENNAS

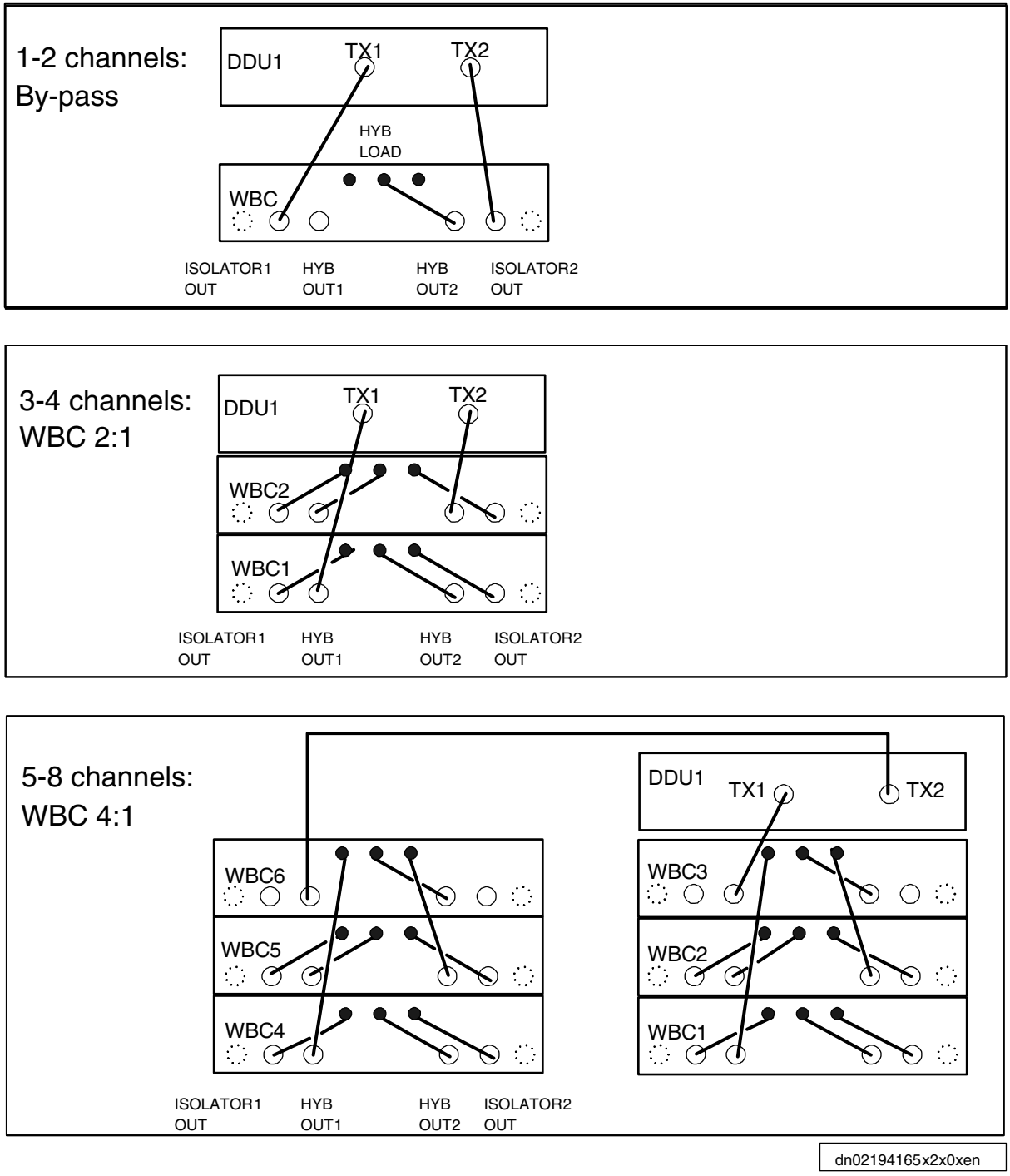

Figure 63 : WBC configurations, 2 antennas

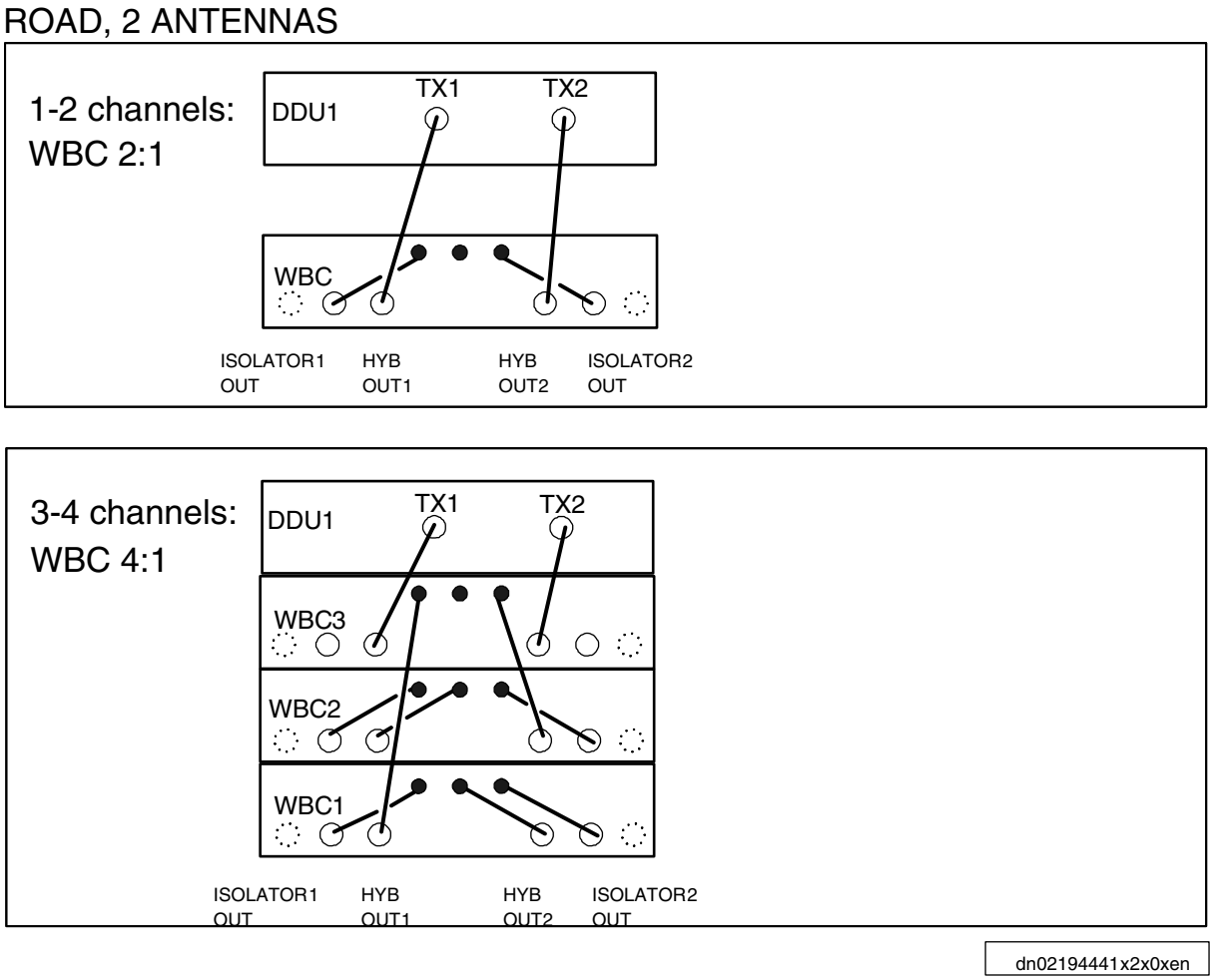

Figure 64 : WBC configurations, road

8.3 IP transmission cabling

IP transmission with the TBCi is optional. It is an alternative to E1 transmission.

Note

The TB3 can only be used for one type of transmission at a time.

In the case of IP transmission, ethernet cables 9771 and 9772 are used. Two or four cables are required, depending on whether a redundant TBCi is used. The cables need to be ordered separately with the following product codes:

- DA9771: IP cables for TBCi
- DA9772: IP cables for the redundant TBCi

Figure 65 shows the optional IP transmission cabling connections between the TBCi cards to the basic-cabinet top-plate interfaces.

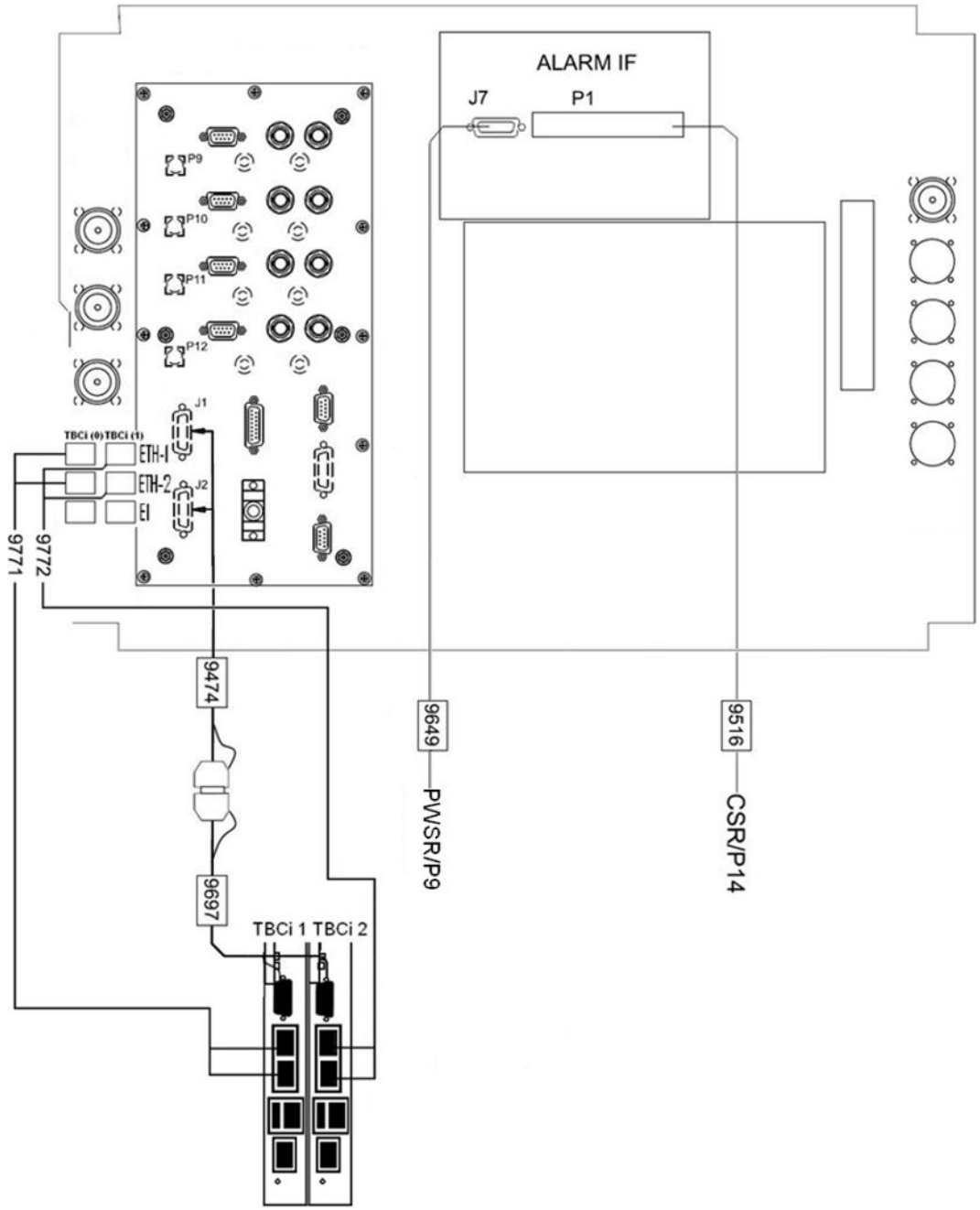

Figure 65 : Cabling between TBCi and basic-cabinet top-plate interfaces (IP transmission)

Further information

For information on how to replace TBC-U with the TBCi plug-in unit, see *Maintenance of TETRA Base Stations, dn00132139*.

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CHAPTER

9

Completing the installation

This chapter details the completion tasks related to the installation of the TB3.

When the installation is completed, the equipment and the site must be brought in a suitable state for commissioning and the paper work must be completed and filed.

When commissioning the TB3, the system will be powered up to make sure that the TB3 is in a suitable configuration for the commissioning procedure.

9.1 Power-up test

Note

The power-up test should be made only in case that the installation is immediately followed by commissioning.

CAUTION

Do not turn power on before proper TX antenna (or dummy load) connections are made. The TB3 may turn the transmitter on, if the TB3 has earlier been configured to operate in the fallback mode.

To power up the TB3

1) Remove the cabinet roof frame.
2) Remove the filter module cover.
3) Check that the installation is carried out according to the *Installation Check List*.
4) Check that the cabinet is correctly earthed.
5) Check that there is incoming mains power supply available.
6) Check that the antenna feeders are connected and earthed correctly.

7) Check the voltages:

Measure the input AC voltage at the AC Terminal Block pins on top of the cabinet. The input AC voltage (nominal 230 VAC at 50 Hz) must be within specifications.

or

Measure the input DC voltage at the DC Terminal Block pins on top of the cabinet. The input DC voltage (nominal -48 V DC) must be within specifications.

8) Replace the filter module cover.

9) Replace the cabinet roof frame.

10) Turn on the power supply unit(s).

11) Check the plug-in unit LEDs:

As the TB3 has not yet been correctly configured, some alarms will be generated. All units should, however, have some LED on. If no LEDs are turned on, there is a power failure.

12) Check that the fan units start operating.

If the fan units do not start operating, check from the TBC that they are configured correctly. For detailed instructions, see the *TB3 MMI Reference Manual*, dn0526038.

13) Switch off the power supply unit(s).

14) Attach the *Installation Check List* to the Site Folder.

15) Close and lock the TB3.

16) Clean the site.

CHAPTER

10

Installation check list

Note

This is an example of an installation check list. The actual check lists are site-specific and differ from the one presented here.

Table 44 : PREPARATIONS

Task/Related documents	Completed
General overview of the TB3 installation. See 2	
Make sure you understand the procedure from the beginning to the end of the installation.	
Check the availability of tools. See 3.7	
Make sure you are familiar with the warnings and precautions. See 3 3	
Check the position of the rack: • is the place safe • is there any risk of broken pipes or other liquids damaging the batteries	
Check the availability of documents. See References.	
Check the number of cases against the packing list. Record shortcomings. The floors must be protected with cardboard to prevent damages. See the *packing list*.	
Inspect transport damages and record them.	

Table 44: PREPARATIONS (cont'd.)

Task/Related documents	Completed
Check the conformance of the room against the installation floor plan drawing. Record the differences. See 4 See the *site-specific documentation* (Equipment layout).	
Construct and mark out the positions of the rack and other equipment on the floor. See 4 See the *site-specific documentation* (Equipment layout).	
Check the routes for external cabling and install cable ladders. Record the differences to drawings. See the 5 See the *site-specific documentation* (Equipment layout).	
Clean the room. Correct the installation floor plan. See the *site-specific documentation* (Equipment layout).	
Check that the temperature of the equipment room is within the limits allowed by the system. See instructions for engineering and ordering. See also the document *TBS Environmental Conditions*.	

Table 45 : CABINET INSTALLATION

Task/Related documents	Completed
Check the minimum clearances around the cabinets. Use the site-specific documentation and Section 4.1	
Unpack and check the cabinet.	
Remove the roof frame and the back panel and lift the cabinet.	
Check that the cable connectors at the cabinet rear side are properly connected. See *TB3 Hardware Description*, chapter 12.	
If needed, remove the door according to the instructions in Section 4.3.2	
Adjust the rack feet to the initial height and position. Place the rack according to the floor markings.	
Install the back panel (if removed). See 4.3.4	
Mount the cabinet.	
Install the cabinet door lock (optional).	
Attach the type plate to the cabinet. See Figure 9.	

Table 46 : EXTERNAL CABLING

Task/Related documents	Completed
Check the connection between the rectifier plus terminal and main earthing busbar. Applicable only for DC power supply. See 5.3	
Check that the main fuses are correctly dimensioned. See *instructions for engineering and ordering*.	
Connect and mark the main AC or DC supply wires according to the installation instructions. See 5.3 See *the site-specific documentation* (Power supply).	
Earth the TB3 according to the installation instructions to the main earthing busbar. See 5.3 See *instructions for engineering and ordering*. See the *site-specific documentation* (Earth cabling).	
Prepare and install the PCM cables to proper length and connect them. See 5.5.1 See the *site-specific documentation* (PCM cabling).	
Connect the GPS cable.	
Prepare and install the external alarm and control cables to proper length and connect them. See 5.4 See the *site-specific documentation* (Alarm cabling).	
Connect the antenna feeder cables.	
In case the TB3 is used for IP transmission, install the ethernet cables. See Section 8.3 . See the *site-specific documentation* (IP transmission cabling).	

Table 47 : UNIT INSTALLATION AND SETTINGS

Task/Related documents	Completed
Use a wrist strap connected to main earth and be extremely careful when handling the plug-in units. See 3	
Check the jumper positions. Record and correct the differences to the equipment list. See 6 and 7 See *the site-specific documentation* (Equipment list).	

Table 47: UNIT INSTALLATION AND SETTINGS (cont'd.)

Task/Related documents	Completed
Insert the plug-in units in the subracks after checking the identification labels. See 7 and *Replacing Plug-in Units and Other Hardware Units* documents. See *the site-specific documentation* (Equipment list).	
Install the power supply units. See 7	

Table 48 : INTERNAL CABLING

Task/Related documents	Completed
Check the internal cabling and verify it against the newest installation instruction available. Record the differences if needed. See 8 See the *site-specific documentation* (Interconnection cables list).	

Table 49 : COMPLETING THE INSTALLATION

Task/Related documents	Completed
Switch the power supply unit(s) on. Check from the LEDs that the unit(s) receive power. See 9	
Check the power-up test. See 9 .	
Fit and install the door (if removed). Change the opening direction, if needed. See 4.3.2	
Measure the supply voltage coming to the rack (-48 V) from the terminal blocks of the rack. See 5 **Voltage: _____**	
If commissioning is not performed at the same time with installation, switch the power supply units off.	
Install the filter module cover.	
Install the top cover plate. See 4.3.1	
Remove all temporary markings.	
Make the additional markings on site. See 9 .	

Table 49: COMPLETING THE INSTALLATION (cont'd.)

Task/Related documents	Completed
Check the corrections in the drawings used during the installation. See the *site-specific documentation* (Equipment list) (Equipment layout).	
Clean the installation site.	
Fill in the *Installation Certificate of Completion*.	

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APPENDIX

A

TB3 backplane wiring

When wiring the TB3 cabinet backplane, it is adviced to take special care that the connectors are plugged in the right way.

CAUTION

If the backplane connectors are plugged in the wrong way, there is a risk of damaging TB3 modules (e.g. TTRX) by a reverse cable connection, because there is no mechanical stop at the connector to prevent this.

The following figures illustrate which way the backplane connectors must be plugged in.

Figure 66 : Basic cabinet, common subrack, connectors for P15, P16, P18 and X1, X2

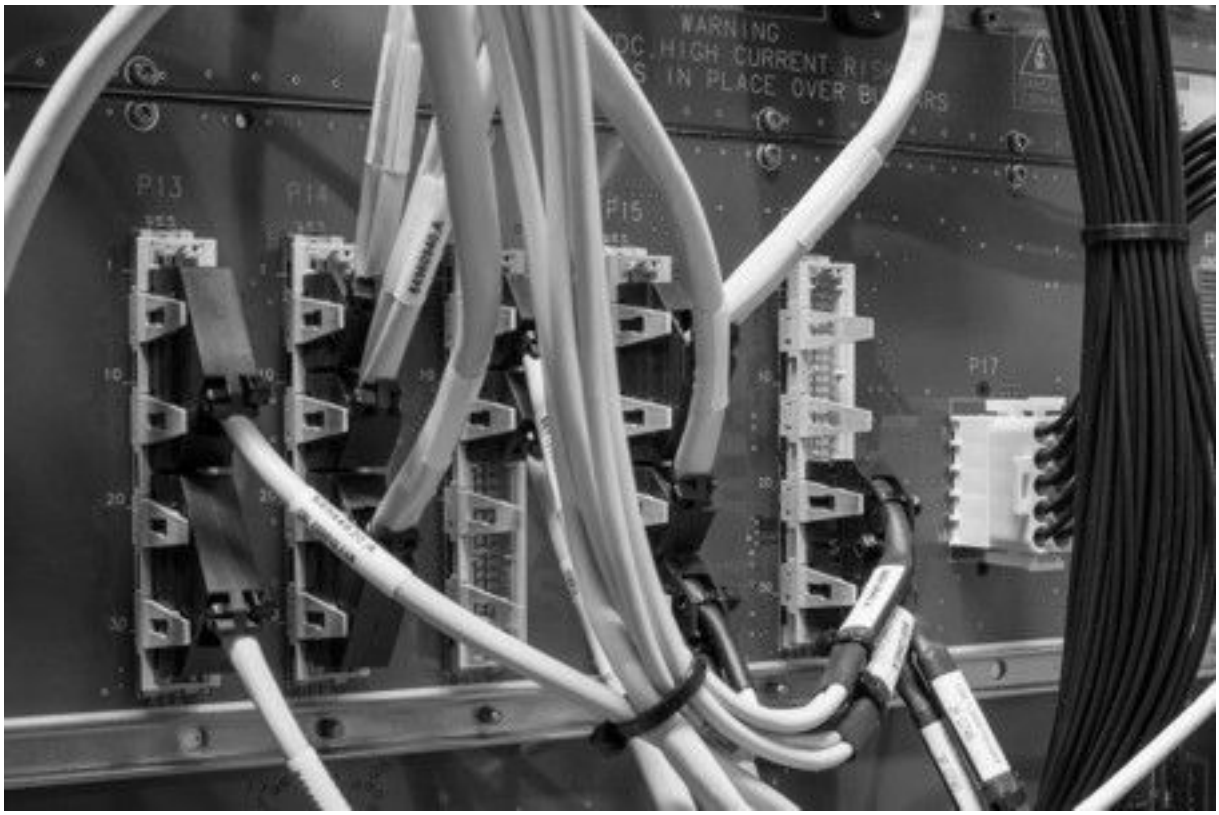

Figure 67 : Basic cabinet, common subrack, connectors for P13 and P14

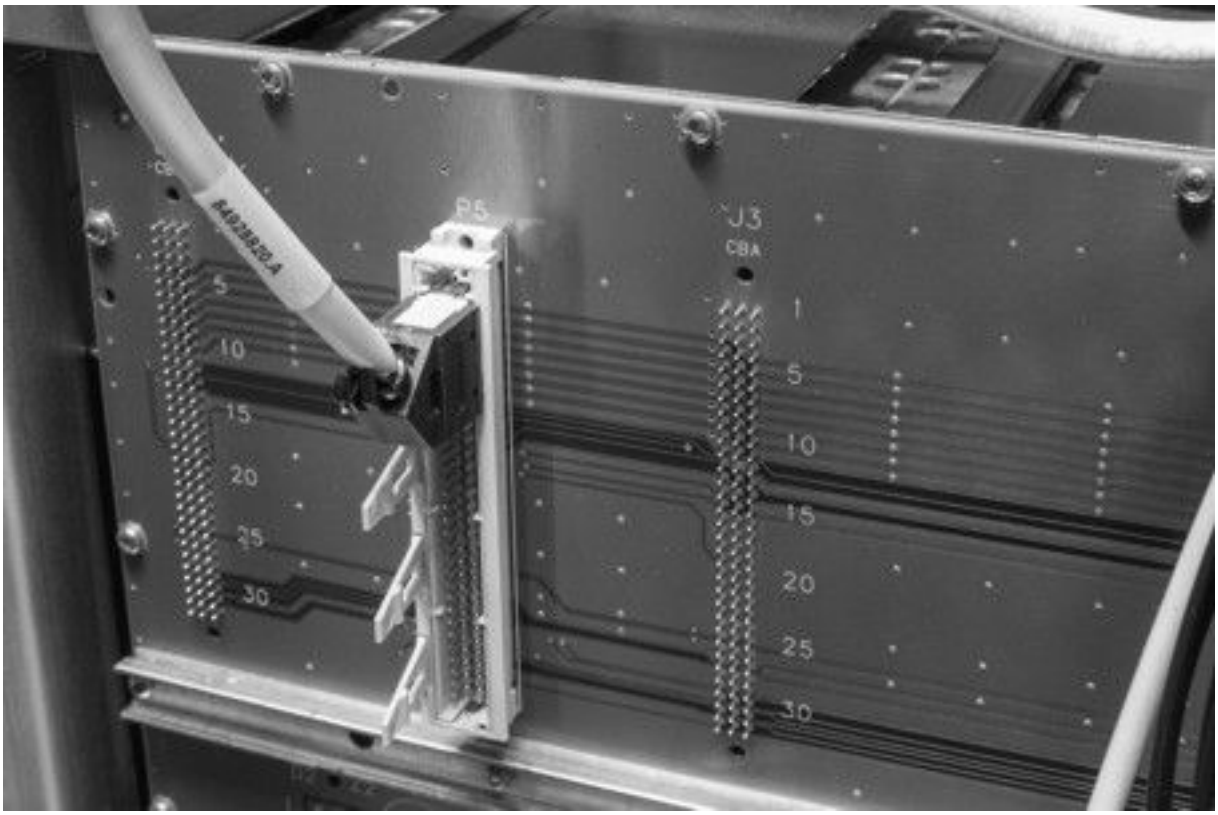

Figure 68 : Basic or extension cabinet, TTRX subrack, connector for P5: cable pointing up

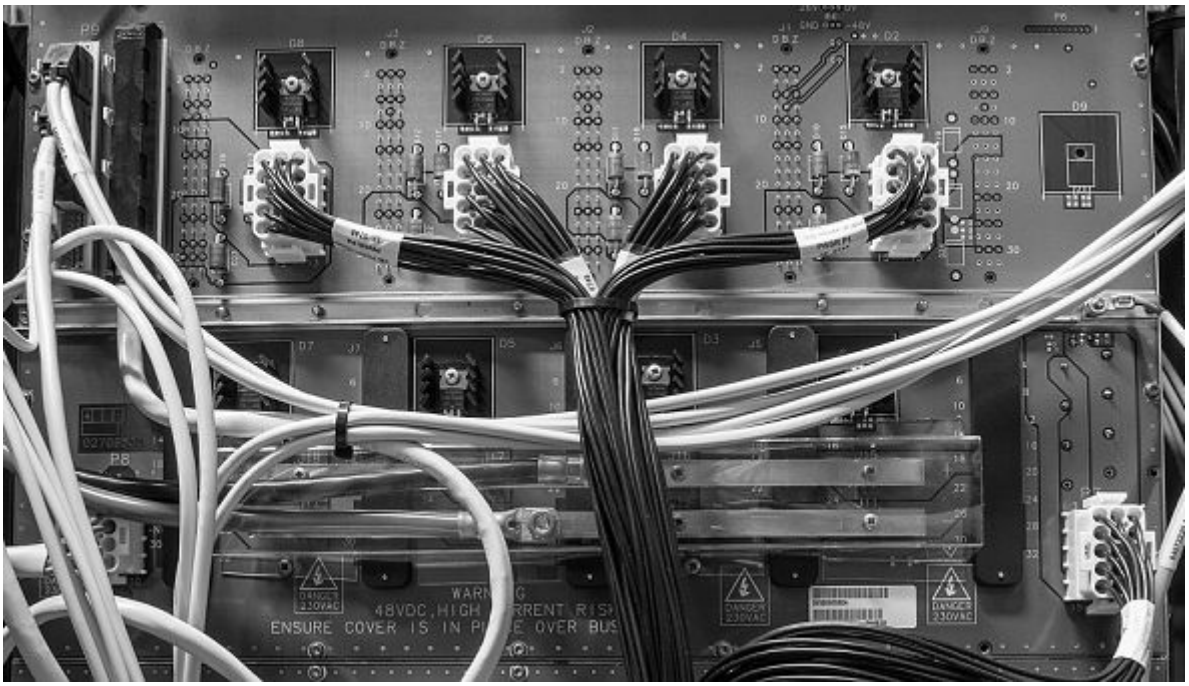

Figure 69 : Basic cabinet, power subrack, connectors for P9

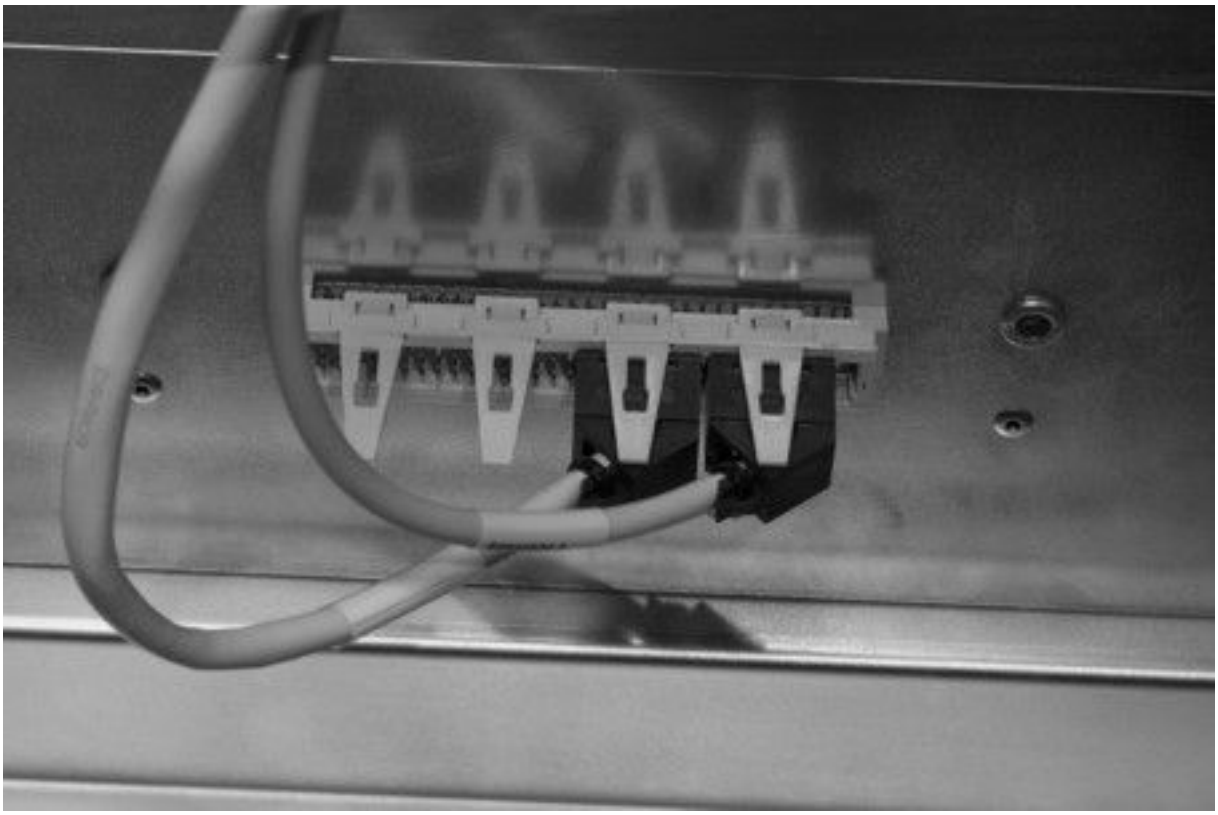

Figure 70 : Basic and extension cabinets, connectors for fans: cables pointing left

Glossary

The meanings of the terms and acronyms used in this document are explained below.

For further information on TETRA definitions, terms and concepts and the meaning of all acronyms and abbreviations used in TETRA System customer documentation, see document *TETRA System, Glossary* (DN00126469).

Term / acronym	Meaning
ALIF	Alarm Interface
ATC	Auto-tuned Combiner
CSR	Common subrack
D-BUS	Internal control/data bus of TBS
DDIV	Dual Divider unit (used in extension cabinet only)
DDU	Dual Duplexer
DRMC	Dual Receiver Multicoupler
EMC	Electromagnetic compatibility
ESD	Electrostatic Discharge
FSR	Fan subrack
FXC	Flexible Cross Connect
FXC IF	FXC interface
GPS	Global Positioning System
LED	Light Emitting Diode
LMP	Local Management Port
MHA	Masthead Amplifier
MMI	Man Machine Interface
PCM	Pulse code modulation
PWSR	Power subrack
Q1–BUS	O&M connection to transmission equipment
RF	Radio Frequency
SAR	Specific Absorption Rate
TB3	Third generation TETRA Base Station
TB3 350	TETRA Base Station, 350–368 MHz

Term / acronym	Meaning
TB3 380	TETRA Base Station, 380–400 MHz
TB3 410	TETRA Base Station, 410–430 MHz
TB3 450	TETRA Base Station, 450–470 MHz
TB3 800	TETRA Base Station, 806–869 MHz
TBC	TETRA Base Station Controller. Two product variants exist: TBC-U and TBCi.
TBCi	TETRA Base Station Controller HW (IP or E1 transmission)
TBC-U	TETRA Base Station Controller HW (E1 transmission)
TBS	TETRA Base Station
TRXSR	Transceiver subrack
TTRX	TETRA Transceiver
TXM	TX antenna monitoring unit
WBC	Wideband Combiner

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C

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E

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G

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