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CATEGORY 323
TECHNICAL DESCRIPTION

CATEGORY 423
INSTALLATION AND
CONFIGURATION

CATEGORY 523
MAINTENANCE
INFORMATION

CATEGORY 623
PARTS INFORMATION

INDEX

Horizon*macro* indoor

Including:

68P02902W07-B
68P02902W08-B
68P02902W09-B
68P02902W10-B

Service Manual
GSM-205-020

CONTROLLED INTRODUCTION

68P02902W06-B

Horizon*macro* indoor

Service Manual
GSM-205-020

CONTROLLED INTRODUCTION

Horizon*macro* indoor

Including:

68P02902W07-B
68P02902W08-B
68P02902W09-B
68P02902W10-B

Service Manual

CONTROLLED INTRODUCTION

68P02902W06-B

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GSM-205-020

Service Manual
Horizon*macro* indoor

Copyrights, notices and trademarks

Chapter 2

Chapter 3

Chapter 4
Cabinet power supply i

Chapter 5
RF modules i

Issue status of this manual

Introduction

The following shows the issue status of this manual since it was first released.

Version information

The following lists the versions of this manual in order of manual issue:

Manual issue	Date of issue	Remarks
O	3rd Jun 99	Original issue.
A	15th Oct 99	Updated to include details for EGSM900.
B	31st Oct 01	Updated to include details for GSM850 and PCS1900.

Resolution of Service Requests

The following Service Requests are now resolved in this manual:

Service Request	GMR Number	Remarks
N/A	N/A	

General information

Important notice

If this manual was obtained when attending a Motorola training course, it will not be updated or amended by Motorola. It is intended for TRAINING PURPOSES ONLY. If it was supplied under normal operational circumstances, to support a major software release, then corrections will be supplied automatically by Motorola in the form of General Manual Revisions (GMRs).

Purpose

Motorola cellular communications manuals are intended to instruct and assist personnel in the operation, installation and maintenance of the Motorola cellular infrastructure equipment and ancillary devices. It is recommended that all personnel engaged in such activities be properly trained by Motorola.

WARNING	Failure to comply with Motorola's operation, installation and maintenance instructions may, in exceptional circumstances, lead to serious injury or death.

These manuals are not intended to replace the system and equipment training offered by Motorola, although they can be used to supplement and enhance the knowledge gained through such training.

About this manual

The manual contains: technical description of the hardware elements, installation and configuration information, repair procedures and parts lists for the Horizon*macro* indoor equipment in Motorola GSM850, GSM/EGSM900, DCS1800 and PCS1900 systems.

The objectives are to help the reader:

- Gain an overview of the equipment and interconnection of components.
- Understand the function and operation of all components.
- Recognize configurations, and equivalent module functions to M-Cell*6* (an interchangeable previous cabinet).
- Be aware of the **warnings** (potential for harm to people) and **cautions** (potential for harm to equipment) to be observed when working on the equipment.
- Understand how to install and commission the equipment.
- Understand how to inspect, maintain, and repair the equipment.
- Have a clear ready reference for all dedicated information in one manual.

Cross references

Throughout this manual, cross references are made to the chapter numbers and section names. The section name cross references are printed bold in text.

This manual is divided into uniquely identified and numbered chapters that, in turn, are divided into sections. Sections are not numbered, but are individually named at the top of each page, and are listed in the table of contents.

Text conventions

The following conventions are used in the Motorola cellular infrastructure manuals to represent keyboard input text, screen output text and special key sequences.

Input

`Characters typed in at the keyboard are shown like this.`

Output

```
Messages, prompts, file listings, directories, utilities, and
environmental variables that appear on the screen are shown like
this.
```

Special key sequences

Special key sequences are represented as follows:

CTRL–c	Press the Control and c keys at the same time.
ALT–f	Press the Alt and f keys at the same time.
|	Press the pipe symbol key.
CR or **RETURN**	Press the Return (Enter) key. The Return key is identified with the ↵ symbol on both the PC and the Sun keyboards. The keyboard Return key may also be identified with the word Return.

First aid in case of electric shock

Warning

WARNING	**Do not touch the victim with your bare hands** until the electric circuit is broken. **Switch off.** If this is not possible, **protect yourself** with dry insulating material and pull or push the victim clear of the conductor.

Artificial respiration

In the event of an electric shock it may be necessary to carry out artificial respiration. Send for medical assistance immediately.

Burns treatment

If the patient is also suffering from burns, then, without hindrance to artificial respiration, carry out the following:

1. **Do not attempt to remove clothing adhering to the burn.**
2. If help is available, or as soon as artificial respiration is no longer required, cover the wound with a **dry** dressing.
3. Do **not** apply oil or grease in any form.

Reporting safety issues

Introduction

Whenever a safety issue arises, carry out the following procedure in all instances. Ensure that all site personnel are familiar with this procedure.

Procedure

Whenever a safety issue arises:

1. Make the equipment concerned safe, for example, by removing power.
2. Make no further attempt to tamper with the equipment.
3. Report the problem directly to the Customer Network Resolution Centre, Swindon +44 (0)1793 565444 or China +86 10 68437733 (telephone) and follow up with a written report by fax, Swindon +44 (0)1793 430987 or China +86 10 68423633 (fax).
4. Collect evidence from the equipment under the guidance of the Customer Network Resolution Centre.

Warnings and cautions

Introduction

The following describes how warnings and cautions are used in this manual and in all manuals of this Motorola manual set.

Warnings

Definition of Warning

A warning is used to alert the reader to possible hazards that could cause loss of life, physical injury, or ill health. This includes hazards introduced during maintenance, for example, the use of adhesives and solvents, as well as those inherent in the equipment.

Example and format

WARNING	Do not look directly into fibre optic cables or data in/out connectors. Laser radiation can come from either the data in/out connectors or unterminated fibre optic cables connected to data in/out connectors.

Cautions

Definition of Warning

A caution means that there is a possibility of damage to systems, software or individual items of equipment within a system. However, this presents no danger to personnel.

Example and format

CAUTION	Do not use test equipment that is beyond its calibration due date when testing Motorola base stations.

General warnings

Introduction

Observe the following warnings during all phases of operation, installation and maintenance of the equipment described in the Motorola manuals. Failure to comply with these warnings, or with specific warnings elsewhere in the Motorola manuals, violates safety standards of design, manufacture and intended use of the equipment. Motorola assumes no liability for the customer’s failure to comply with these requirements.

Warning labels

Personnel working with or operating Motorola equipment must comply with any warning labels fitted to the equipment. Warning labels must not be removed, painted over or obscured in any way.

Specific warnings

Warnings particularly applicable to the equipment are positioned on the equipment and within the text of this manual. These must be observed by all personnel at all times when working with the equipment, as must any other warnings given in text, on the illustrations and on the equipment.

High voltage

Certain Motorola equipment operates from a dangerous high voltage of 230 V ac single phase or 415 V ac three phase supply which is potentially lethal. Therefore, the areas where the ac supply power is present must not be approached until the warnings and cautions in the text and on the equipment have been complied with.

To achieve isolation of the equipment from the ac supply, the ac input isolator must be set to off and locked.

Within the United Kingdom (UK) regard must be paid to the requirements of the Electricity at Work Regulations 1989. There may also be specific country legislation which need to be complied with, depending on where the equipment is used.

RF radiation

High RF potentials and electromagnetic fields are present in the base station equipment when in operation. Ensure that all transmitters are switched off when any antenna connections have to be changed. Do not key transmitters connected to unterminated cavities or feeders.

Refer to the following standards:

- ANSI IEEE C95.1-1991, *IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*.
- CENELEC 95 ENV 50166-2, *Human Exposure to Electromagnetic Fields High Frequency (10 kHz to 300 GHz)*.

Laser radiation

Do not look directly into fibre optic cables or optical data in/out connectors. Laser radiation can come from either the data in/out connectors or unterminated fibre optic cables connected to data in/out connectors.

Lifting equipment

When dismantling heavy assemblies, or removing or replacing equipment, the competent responsible person must ensure that adequate lifting facilities are available. Where provided, lifting frames must be used for these operations. When equipments have to be manhandled, reference must be made to the Manual Handling of Loads Regulations 1992 (UK) or to the relevant manual handling of loads legislation for the country in which the equipment is used.

Do not ...

... substitute parts or modify equipment.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of equipment. Contact Motorola if in doubt to ensure that safety features are maintained.

Battery supplies

Do not wear earth straps when working with standby battery supplies.

Toxic material

Certain equipment may incorporate components containing the highly toxic material Beryllium or its oxide Beryllia or both. These materials are especially hazardous if:

- Beryllium materials are absorbed into the body tissues through the skin, mouth, or a wound.
- The dust created by breakage of Beryllia is inhaled.
- Toxic fumes are inhaled from Beryllium or Beryllia involved in a fire.

Beryllium warning labels are fitted to equipment incorporating Beryllium or Beryllium Oxide. Observe all safety instructions given on warning labels.

Beryllium Oxide is used within some components as an electrical insulator. Captive within the component it presents no health risk whatsoever. However, if the component should be broken open or burnt, the Beryllium Oxide, in the form of dust or fumes, could be released, with the potential for harm.

Lithium batteries

Lithium batteries, if subjected to mistreatment, may burst and ignite. Defective lithium batteries must not be removed or replaced. Any boards containing defective lithium batteries must be returned to Motorola for repair.

General cautions

Introduction

Observe the following cautions during operation, installation and maintenance of the equipment described in the Motorola manuals. Failure to comply with these cautions or with specific cautions elsewhere in the Motorola manuals may result in damage to the equipment. Motorola assumes no liability for the customer's failure to comply with these requirements.

Caution labels

Personnel working with or operating Motorola equipment must comply with any caution labels fitted to the equipment. Caution labels must not be removed, painted over or obscured in any way.

Specific cautions

Cautions particularly applicable to the equipment are positioned within the text of this manual. These must be observed by all personnel at all times when working with the equipment, as must any other cautions given in text, on the illustrations and on the equipment.

Fibre optics

The bending radius of all fibre optic cables must not be less than 30 mm.

Static discharge

Motorola equipment contains CMOS devices that are vulnerable to static discharge. Although the damage caused by static discharge may not be immediately apparent, CMOS devices may be damaged in the long term due to static discharge caused by mishandling. Wear an approved earth strap when adjusting or handling digital boards.

See **Devices sensitive to static** for further information.

Devices sensitive to static

Introduction

Certain metal oxide semiconductor (MOS) devices embody in their design a thin layer of insulation that is susceptible to damage from electrostatic charge. Such a charge applied to the leads of the device could cause irreparable damage.

These charges can be built up on nylon overalls, by friction, by pushing the hands into high insulation packing material or by use of unearthed soldering irons.

MOS devices are normally despatched from the manufacturers with the leads shorted together, for example, by metal foil eyelets, wire strapping, or by inserting the leads into conductive plastic foam. Provided the leads are shorted it is safe to handle the device.

Special handling techniques

In the event of one of these devices having to be replaced, observe the following precautions when handling the replacement:

- Always wear an earth strap which must be connected to the electrostatic point (ESP) on the equipment.
- Leave the short circuit on the leads until the last moment. It may be necessary to replace the conductive foam by a piece of wire to enable the device to be fitted.
- Do not wear outer clothing made of nylon or similar man made material. A cotton overall is preferable.
- If possible work on an earthed metal surface. Wipe insulated plastic work surfaces with an anti-static cloth before starting the operation.
- All metal tools should be used and when not in use they should be placed on an earthed surface.
- Take care when removing components connected to electrostatic sensitive devices. These components may be providing protection to the device.

When mounted onto printed circuit boards (PCBs), MOS devices are normally less susceptible to electrostatic damage. However PCBs should be handled with care, preferably by their edges and not by their tracks and pins, they should be transferred directly from their packing to the equipment (or the other way around) and never left exposed on the workbench.

Motorola GSM manual set

Introduction

The following manuals provide the information needed to operate, install and maintain the Motorola equipment.

Generic GSM manuals

The following are the generic manuals in the GSM manual set, these manuals are release dependent:

Classification number	Name	Order number
GSM-100-101	System Information: General	68P02901W01
GSM-100-201	Operating Information: GSM System Operation	68P02901W14
GSM-100-202	Operating Information: OMC-R System Administration	68P02901W19
GSM-100-313	Technical Description: OMC-R Database Schema	68P02901W34
GSM-100-320	Technical Description: BSS Implementation	68P02901W36
GSM-100-321	Technical Description: BSS Command Reference	68P02901W23
GSM-100-403	Installation & Configuration: GSM System Configuration	68P02901W17
GSM-100-423	Installation & Configuration: BSS Optimization	68P02901W43
GSM-100-413	Installation & Configuration: OMC-R Clean Install	68P02901W47
GSM-100-501	Maintenance Information: Alarm Handling at the OMC-R	68P02901W26
GSM-100-520	Maintenance Information: BSS Timers	68P02901W58
GSM-100-521	Maintenance Information: Device State Transitions	68P02901W57
GSM-100-523	Maintenance Information: BSS Field Troubleshooting	68P02901W51
GSM-100-503	Maintenance Information: GSM Statistics Application	68P02901W56
GSM-100-721	Software Release Notes: BSS/RXCDR	68P02901W72
GSM-100-712	Software Release Notes: OMC-R System	68P02901W74

Related GSM manuals

The following are related Motorola GSM manuals:

Classification number	Name	Order number
GSM-001-103	System Information: BSS Equipment Planning	68P02900W21
GSM-002-103	System Information: DataGen	68P02900W22
GSM-002-703	Software Release Notes: DataGen	68P02900W76
GSM-005-103	System Information: GSM Advance Operational Impact	68P02900W25
GSM-008-103	System Information: Network Health Analyst	68P02900W36
GSM-008-703	Software Release Notes: Network Health Analyst	68P02900W77
GSM-TOOLS-001	System Information: Cell Optimization (COP)	68P02900W90
GSM-TOOLS-002	System Information: Motorola Analysis and Reporting System (MARS)	68P02900W94
GSM-TOOLS-701	Software Release Notes: Cell Optimization (COP)	68P02900W69
GSM-TOOLS-702	Software Release Notes: Motorola Analysis and Reporting System (MARS)	68P02900W68
GSM-006-202	Operating Information: OMC-R System Administration (OSI)	68P02901W10
GSM-006-413	Installation & Configuration: OSI Clean Install	68P02901W39
GSM-006-712	Software Release Notes: OMC-R OSI System	68P02901W70

Generic GPRS manuals

The following are the generic manuals in the GPRS manual set, these manuals are release dependent:

Classification number	Name	Order number
GPRS-300-101	System Information: GPRS Overview	68P02903W01
GPRS-300-202	Operating Information: OMC-G System Administration	68P02903W03
GPRS-300-222	Operating Information: GSN System Administration	68P02903W37
GPRS-300-313	Technical Description: OMC-G Database Schema	68P02903W46
GPRS-300-321	Technical Description: GSN Command Reference	68P02903W18
GPRS-300-423	Installation & Configuration: GSN Clean Install	68P02903W47
GPRS-300-413	Installation & Configuration: OMC-G Clean Install	68P02903W04
GPRS-300-501	Maintenance Information: Alarm Handling at the OMC-G	68P02903W19
GPRS-300-503	Maintenance Information: GSN Statistics Application	68P02903W20
GPRS-300-722	Software Release Notes: GSN System	68P02903W76
GPRS-300-712	Software Release Notes: OMC-G System	68P02903W70

Related GPRS manuals

The following are related Motorola GPRS manuals:

Classification number	Name	Order number
GPRS-001-103	System Information: GPRS Equipment Planning	68P02903W02
GPRS-005-103	System Information: GSN Advance Operational Impact	68P02903W38

BSS service manuals

The following are the Motorola Base Station service manuals, these manuals are not release dependent. The internal organization and makeup of service manual sets may vary, they may consist of from one to four separate manuals, but they can all be ordered using the overall catalogue number shown below:

Classification number	Name	Order number
GSM-100-020	Service Manual: BTS	68P02901W37
GSM-100-030	Service Manual: BSC/RXCDR	68P02901W38
GSM-105-020	Service Manual: M-Cell*2*	68P02901W75
GSM-106-020	Service Manual: M-Cell*6*	68P02901W85
GSM-201-020	Service Manual: M-Cell*city* and M-Cell*city+*	68P02901W95
GSM-202-020	Service Manual: M-Cell*access*	68P02901W65
GSM-203-020	Service Manual: Horizon*micro*	68P02902W36
GSM-206-020	Service Manual: Horizon*compact*	68P02902W15
GSM-205-020	Service Manual: Horizon*macro* Indoor	68P02902W06
GSM-204-020	Service Manual: Horizon*macro* Outdoor	68P02902W12
GSM-207-020	Service Manual: Horizon*office*	68P02902W46
GSM-209-020	Service Manual: Horizon*micro2* Horizon*compact2*	68P02902W61
GSM-208-020	Service Manual: Horizon*macro* 12 Carrier Outdoor	68P02902W66

GPRS service manuals

The following are the Motorola GPRS service manuals, these manuals include the Packet Control Unit (PCU) service manual which becomes part of the BSS for GPRS:

GPRS-301-020	Service Manual:GPRS Support Nodes (GSN)	68P02903W05
GPRS-302-020	Service Manual: Packet Control Unit (PCU)	68P02903W10

Classification number

The classification number is used to identify the type and level of a manual. For example, manuals with the classification number GSM-100-2xx contain operating information.

Order number

The Motorola 68P order (catalogue) number is used to order manuals.

Ordering manuals

All orders for Motorola manuals must be placed with your Motorola Local Office or Representative. Manuals are ordered using the order (catalogue) number. Motorola manual sets may also be ordered on CD-ROM.

GMR amendment

Introduction to GMRs

Changes to a manual that occur after the printing date are incorporated into the manual using General Manual Revisions (GMRs). GMRs are issued to correct Motorola manuals as and when required. A GMR has the same identity as the target manual. Each GMR is identified by a number in a sequence that starts at 01 for each manual at each issue. GMRs are issued in the form of loose leaf pages, with a pink instruction sheet on the front.

GMR procedure

When a GMR is received, remove and replace pages in this manual, as detailed on the GMR pink instruction sheet.

GMR amendment record

GMR instructions

When a GMR is inserted in this manual, the amendment record below is completed to record the GMR. Retain the pink instruction sheet that accompanies each GMR and insert it in a suitable place in this manual for future reference.

Amendment record

Record the insertion of GMRs in this manual in the following table:

GMR number	Incorporated by (signature)	Date
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		
13		
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16		
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24		
25		

CHAPTER 1
OVERVIEW AND
SPECIFICATIONS

CHAPTER 2
CABINET STRUCTURE

CHAPTER 3
TEMPERATURE CONTROL
SYSTEM

CHAPTER 4
CABINET POWER SUPPLY

CHAPTER 5
RF MODULES

CHAPTER 6
DIGITAL MODULES

MOTOROLA

Category 323

Technical Description (Tech.)

MOTOROLA

Chapter 1

Overview and specifications

Chapter 1
Overview and specifications i

Equipment introduction and manual definition

Overview of Horizon*macro* indoor

The Horizon*macro* indoor is a six carrier base transceiver station (BTS) cabinet, with variants that operate in the following frequency bands: GSM850, GSM/EGSM900, DCS1800, and PCS1900.

Indoor cabinets operate from either –48/60 V dc (positive earth), +27 V dc (negative earth), or wide input, nominal 120/240 V, ac single phase supplies. An optional battery backup system is available for use with the –48/60 V dc BTS, and is described in *Service Manual: Battery Backup System for Horizonmacro Indoor: (GSM-205-023) Order number 68P02900W59* .

Cooling is provided by circulation fans located in the bottom of the unit.

Figure 1-1 shows an external view of a standard cabinet with an optional hood fitted.

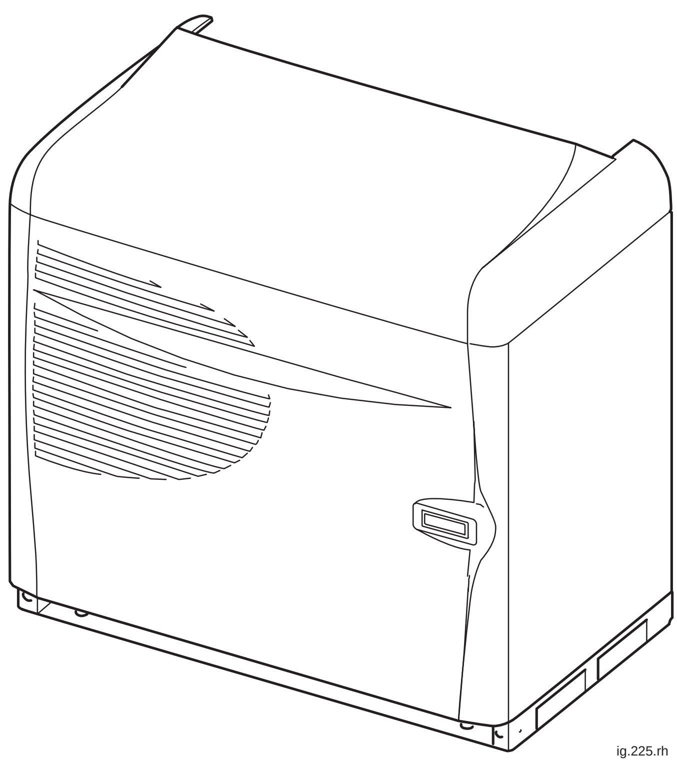


Figure 1-1 Indoor cabinet on plinth with optional hood

Names and acronyms for main cabinet equipment

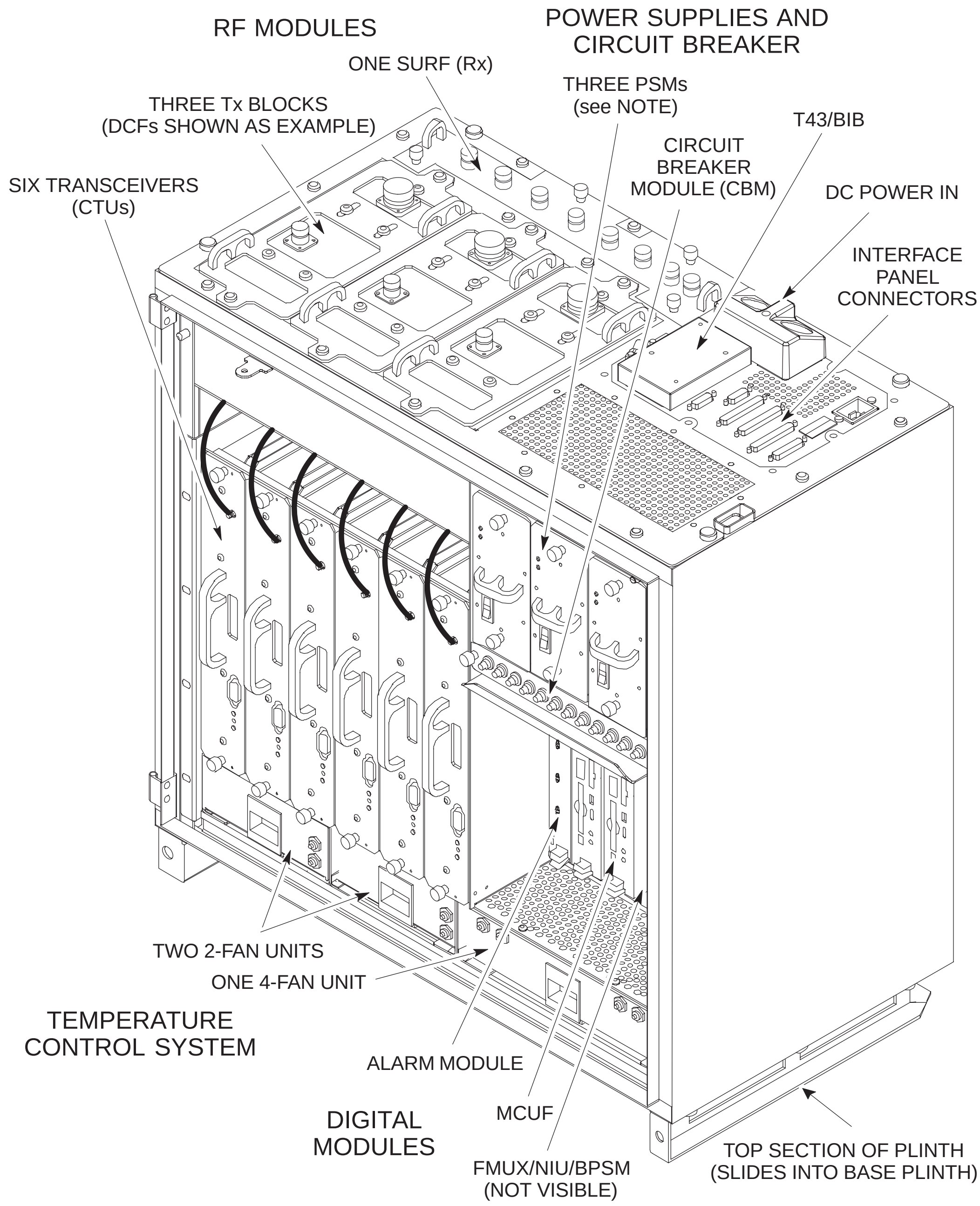
This section is intended to give the reader a basic understanding of how components interconnect.

The BTS cabinet consists of the cabinet frame structure, a main cage and a top panel, and contains the following equipment, as shown in Figure 1-2:

- A digital module shelf, located in the lower right side of the cabinet. This contains master and optional redundant digital modules:
  - Fibre optic multiplexer (FMUX), 1 + 1 redundant (if required).
  - Main control unit with dual FMUX (MCUF), 1 + 1 redundant (if required).
  - Network interface units (NIUs), four in total.
  - An alarm board (no redundancy option).
  - One or two (for redundancy) μBCU power supply modules (BPSMs).
- Up to three power supply modules (PSMs) and one circuit breaker module (CBM) in the upper right portion of the cabinet. The PSMs are load sharing, with the third PSM providing optional redundancy.
- Up to six compact transceiver units (CTUs), located in the left side of the cabinet.
- Fan modules mounted in the bottom of the cabinet, two 2-fan modules and one 4-fan module.
- RF modules, mounted in the top panel, comprising transmit (Tx) blocks, and a receive (Rx) module, the sectorized universal receiver front-end (SURF). The various Tx blocks are listed in **Specifications** in this chapter.
- Interface panel, mounted in the top panel, for power and customer communications connectors.

Cabinet inside view

Figure 1-2 shows the location of components and main headings for detailed information in this technical description category of the manual.



NOTE	Three PSMs = 2 + 1 redundant (if required). An optional hold-up battery module may be installed instead of a redundant PSM.

Figure 1-2 Cabinet with components identified (door and base plinth removed)

Configuration information

Configuration information can be found in *System Information: BSS Equipment Planning: (GSM-001-103) Order number 68P02900W21.*

Finding information in this manual

Each category and chapter has a table of contents (TOC). Headings are designed to convey contents accurately, to enable manual search. The index provides an alternative method of finding subsections of information. This chapter provides a summary of the equipment, to enable readers to understand terminology and thus locate information via the TOCs and index.

The service manual set comprises the four categories below:

- Category 323

  Provides an introduction, specification, and technical description.
- Category 423

  Provides the information for installation and commissioning.
- Category 523

  Provides information on maintenance and repair, with procedures to change Field Replaceable Units (FRUs).
- Category 623

  Provides list of options and spares, with diagrams to illustrate FRUs.

The category 323 technical description is divided into chapters based on functionality as shown in Figure 1-2:

- **Overview and specifications**

  This chapter provides a summary of the equipment to enable the reader to understand terminology, and thus locate information via the TOCs and index.
- **Cabinet structure**, including:

  Interface panel, main cage, door and optional hood.
- **Temperature control system**, including:

  2-fan and 4-fan.
- **Cabinet power supply**, including:

  PSM, BPSM and circuit breaker module.
- **RF modules**, including:

  CTU, SURF, Tx blocks and CCB.
- **Digital modules**, including:

  MCUF, NIU, T43/BIB connections, FMUX and alarm module.

Stacking capability and cabinet view

An optional stacking bracket enables any of the BTS variants to have a second cabinet mounted on top of the first. The stacking bracket also enables an optional Cavity Combining Block (CCB) to be installed in an optional stacking bracket basket. A stacking bracket can be placed on top of the second (stacked) cabinet, as shown in Figure 1-3.

NOTE	CCBs are not currently available for the GSM850 or PCS1900 BTS variants.

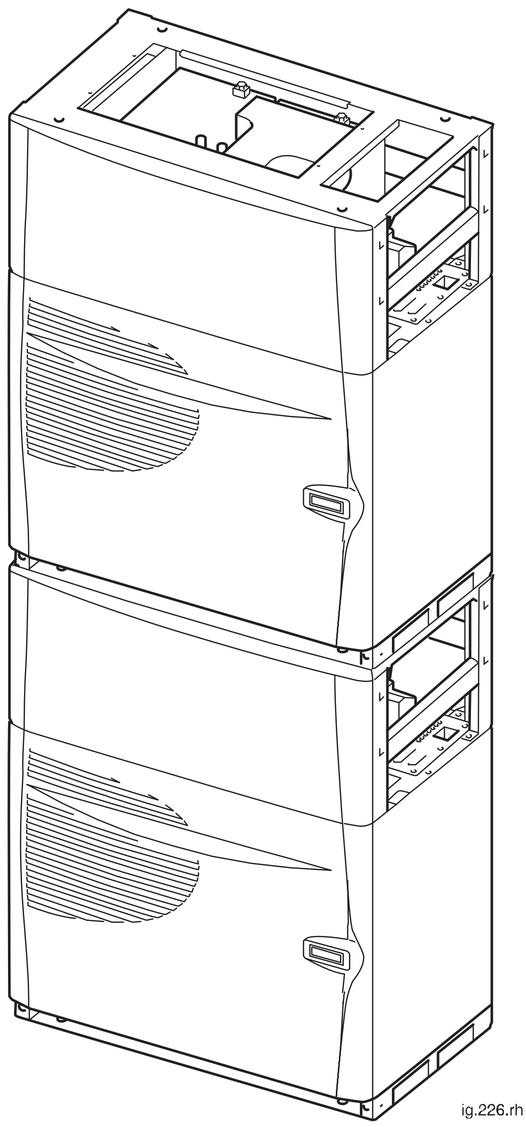


Figure 1-3 View of two cabinets stacked in maximum assembly

Functional diagram of Horizon*macro*

Figure 1-4 shows the functional modules of a Horizon*macro*. For clarity, only one transceiver and one Tx block has been shown.

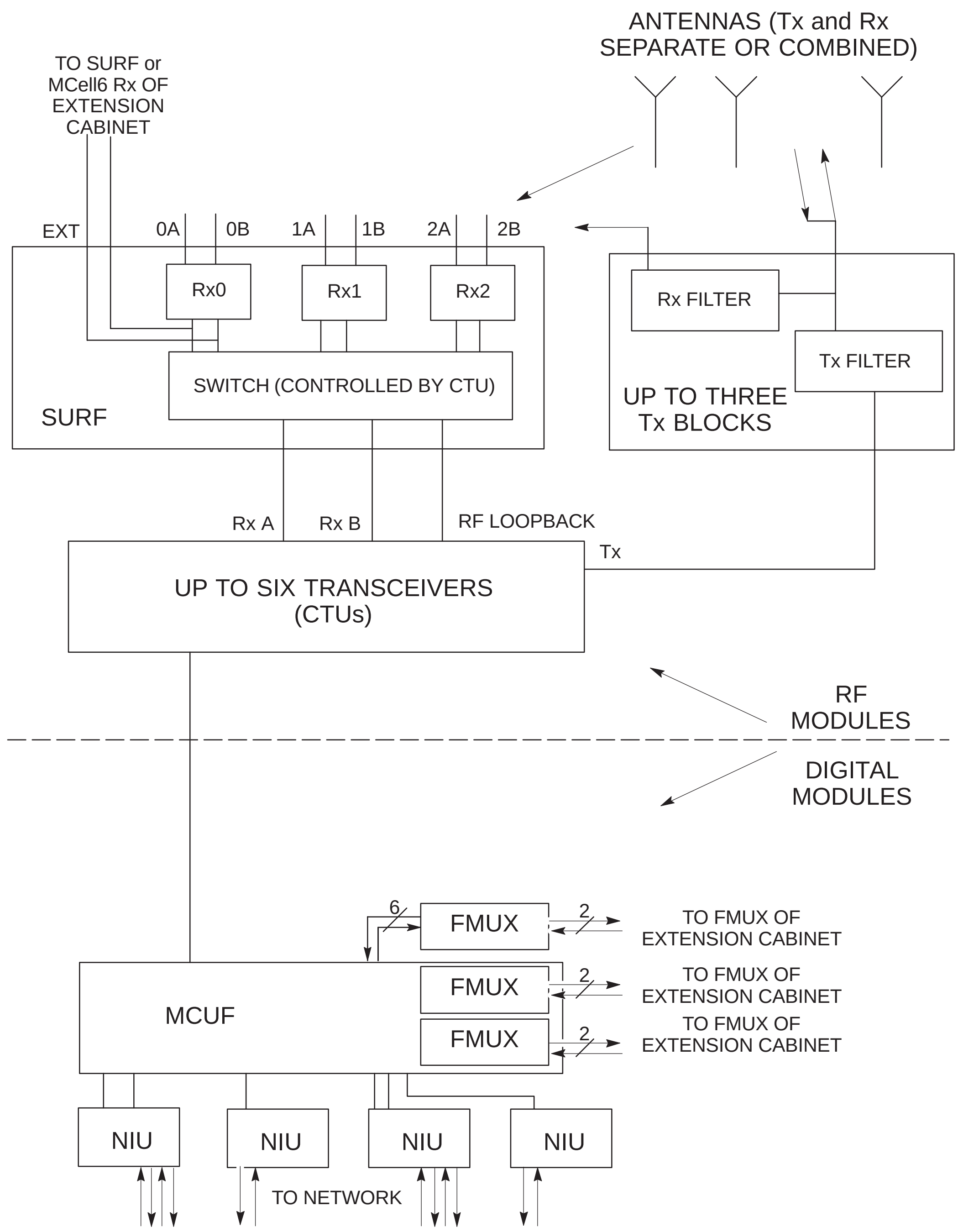


Figure 1-4 Functional diagram of cabinet components

M-Cell*6* comparison with Horizon*macro*

Comparison overview

The Horizon*macro* is a replacement for M-Cell™ *2/6* base stations, and the GSM/EGSM900 and DCS1800 Horizon*macro* variants are directly compatible with M-Cell*6*. For example, a mixture of up to four Horizon*macro* and M-Cell*6* BTSs can be combined to form a single site, with either a Horizon*macro* or an M-Cell*6* being in control of the other units. Since many customers are familiar with M-Cell*6*, and will use Horizon*macro* with M-Cell*6*, equivalent components are described in this section, to assist understanding.

The Horizon*macro* is a single cabinet, using reduced size and higher reliability components. The plinth base fix points are the same as M-Cell*6*, though direct replacement may require repositioning, to allow for adequate cabinet spacing. The Horizon*macro* can have a stacking bracket fitted to enable CCB installation, and/or to enable mounting a second Horizon*macro*.

Horizon*macro* and M-Cell*6* compatibility

A 24-carrier BTS site (in an 8/8/8 configuration) can be achieved by combining four units as shown in Figure 1-5. This is the maximum BTS size. Each unit can be either a Horizon*macro* or an M-Cell*6*. Either a Horizon*macro* or an M-Cell*6* can control the other three units; the MCU of M-Cell*6* and the MCUF of Horizon*macro* being identical in control function.

An MCUF can be fitted into an M-Cell*6* and will then function as an MCU. An MCU cannot be fitted into a Horizon*macro*. Figure 1-5 shows a schematic diagram of the digital connectons in a four cabinet BTS site.

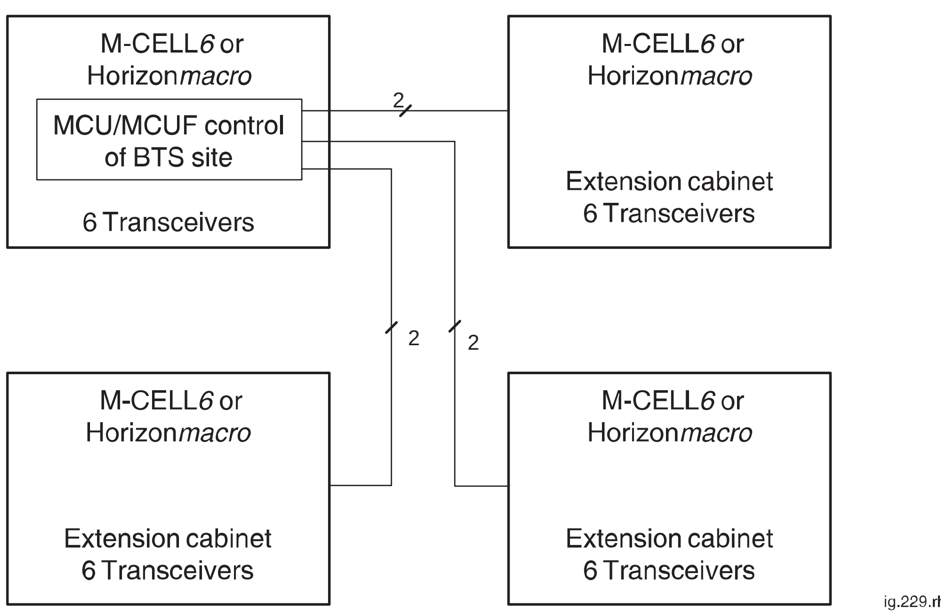


Figure 1-5 Digital connections in maximum BTS site

Comparison of Horizon*macro* and M-Cell*6* connections and modules

Table 1-1 compares the main components of the Horizon*macro*, with equivalent components of M-Cell*6* (the previous generation of equipment).

Table 1-1 Main components of Horizon*macro* and M-Cell*6*

Function	Horizon*macro* component	M-Cell*6* equivalent
Input power conversion units	PSM	PSM (different)
Power to radios and BPSM	Backplane	Cables
Transceiver	CTU	TCU/TCU-B
Main processor board (formerly GPROC, KSW and GCLK boards in BTS4/5/6 (pre-M-Cell) equipment)	MCUF	MCU
Connection radio to MCU	Backplane	FOX
Connection MCU to transceivers in another cabinet	MCUF internal FMUX (two) or external FMUX (one)	FMUX
Rx components and distribution	SURF	DNLB & IADU
Radio to Rx components	SURF Harness	Cables
Tx components	DCF, TDF, DDF, HCU and CCB	CBF, MPDM, HPDM HC and CCB
Links to terrestrial network	NIU	NIU
E1/T1 links	T43/BIB	T43/BIB
Power for digital boards	BPSM	BPSM

Specifications

Overview of specifications

All Horizon*macro* specifications are included in this section.

Software requirements

The GSM/EGSM900 and DCS1800 BTSs require software release GSR4 (or later) in the network.

The GSM850 and PCS1900 BTSs require software release GSR5.1 (or later) in the network.

Approval and safety

Table 1-2 lists the specifications with which the Horizon*macro* indoor complies.

Table 1-2 Horizon*macro* specification compliance

	GSM/EGSM900 & DCS1800	GSM850 & PCS1900
Type approval	ETS 301 502	ETS 301 502
		CFR47 Part 2 CFR47 Part 22 (850 only) CFR47 Part 24 (1900 only)
EMC	EN301 489-8	EN301 489-8
		CFR 47 Part 2 and 15 CFR47 Part 22 (850 only) CFR47 Part 24 (1900 only)
Safety	EN 60215, IEC 60215, EN 60950, IEC 950, CSA 22.2 No. 950, UL 1950	EN 60215, IEC 60215, EN 60950, IEC 950, CSA 22.2 No. 950, UL 1950

Environmental limits

Table 1-3 lists the operating and storage environmental limits.

Table 1-3 Environmental limits

Environment	Temperature	Relative Humidity
Operating	–5 °C to + 45 °C.	5% to 100% relative humidity, not to exceed 0.029 g water / m^3 dry air.
Storage	–45 °C to +70 °C.	8% to 100% relative humidity, not to exceed 0.029 g water / m^3 dry air.

NOTE	This specification is valid up to 3 km altitude, corresponding to an atmospheric pressure range of 648 to 1048 millibars.

Power requirements

Cabinet power supply requirements

Table 1-4 lists the power supply requirements for the different power supply options.

Table 1-4 Main indoor cabinet power supply requirements

Nominal Voltage	Voltage supply range	Current supply maximum
+27 V dc (negative earth)	+20 to +30 V dc	64 A (at nominal voltage)
–48 V dc (positive earth)	–39 to –72 V dc	36 A (at nominal voltage)
120/240 V ac (50 – 60 Hz)	88 to 264	7.5 A (at nominal voltage)

NOTE Voltage transients must be less than 35 V peak amplitude (never below 0 V). Ripple and noise must be less than 200 mV p-p (30 mV rms) over 10 Hz to 14 MHz. Voltage application stabilization must be within the specified range in less than 1 second.

Power consumption

Table 1-5 lists typical and maximum power consumption values

Table 1-5 Power consumption of full cabinet, including digital redundancy

Typical measured consumption	Maximum power consumption
1400 watts	1700 watts

NOTE Maximum power consumption figures are theoretical values derived under extreme conditions and are affected by variables such as temperature, component tolerances, transmission power and supply voltage.
Although these figures must be considered when planning site power requirements, typical measured consumption values will be lower.

Maximum thermal dissipation

Thermal dissipation has to remove the energy of maximum power consumption, less RF power output of the six transceivers.

Maximum power consumption:	1700 W.
Six CTUs at full power at DCF Tx blocks:	
1800 MHz	(6 x 16 = 96) approx. 100 W.
900 MHz	(6 x 20 = 120) 120 W.
Maximum thermal dissipation 1800 MHz:	1700 – 100 = 1600 W.
Maximum thermal dissipation 900 MHz:	1700 – 120 = 1580 W.

NOTE Thermal dissipation figures are not currently available for when 850 MHz or 1900 MHz CTUs are used.

RF power output

Table 1-6 lists the RF power output of the CTU types.

Table 1-6 CTU RF power output at Tx connector

GSM850 and EGSM900	DCS1800 and PCS1900
60 W (47.8 dBm) +/– 1.0 dB	50 W (47.0 dBm) +/–1.0 dB

Table 1-7 lists the expected power output from the various Tx blocks for both types of CTU.

Table 1-7 RF power output at cabinet after Tx blocks

Tx block	GSM850	EGSM900	DCS1800	PCS1900
TDF	40 W (46.0 dBm)		32 W (45.1 dBm)	
DCF	20 W (43.0 dBm)		16 W (42.1 dBm)	
DDF	8.5 W (39.3 dBm)		7 W (38.5 dBm)	
CCB*	n/a	20 W (43.0 dBm)	16 W (42.1 dBm)	n/a

* For a six-channel configuration with minimum cavity separation of 800 kHz.

NOTE CCBs are not currently available for the GSM850 or PCS1900 variants.

Sensitivity

The receive sensitivity of the equipment is shown in Table 1-8.

Table 1-8 Rx sensitivity *

Frequency Band	Without Duplexer	With Duplexer
850 MHz	–107 dBm	–106 dBm
900 MHz	–107 dBm	–106 dBm
1800 MHz	–108.5 dBm	–107.5 dBm
1900 MHz	–107 dBm	–106 dBm
* Guaranteed over all channel types, fading profiles, RF frequencies and operating conditions.		

Battery backup

The Horizon*macro* indoor cabinet has no internal battery backup as standard. An optional hold-up battery module, (sufficient to provide ten seconds of backup power), can be fitted in the PSM shelf, in an empty slot or in place of the redundant PSM. The optional hold-up battery module is described in chapter 4 of this category in **Hold-up battery module**

Additional battery backup capacity can be provided by installation of an optional battery back up system, described in *Service manual: Battery backup system for Horizonmacro indoor; GSM-205-023, 68P02900W59*.

BSC connectivity options

Options exist for E1, T1 and HDSL (star and daisy chain) connection.

Indoor cabinet dimensions

The dimensions of cabinets are shown in Table 1-9.

Table 1-9 Cabinet dimensions

Cabinet type	Height	Width	Depth
Cabinet (without hood)	750 mm	700 mm	430 mm
Cabinet with optional hood	870 mm	700 mm	430 mm
Cabinet with stacking bracket (to hold CCB)	1025 mm	700 mm	430 mm
Two cabinets, with stacking bracket between, and optional hood on top	1900 mm	700 mm	430 mm
Two cabinets, with stacking bracket between, and stacking bracket on top.	2050 mm	700 mm	430 mm

The optional hood allows cables to enter the cabinet from the back and above.

The stacking bracket allows a second cabinet to be stacked on top of the first cabinet. The stacking bracket can also contain a metal basket, in which CCBs are fitted (the only Tx unit that cannot fit in the cabinet itself).

Weights

The maximum weight of the cabinet is shown in Table 1-10.

CAUTION	Consider future expansion. Another cabinet may be added by stacking on top of the existing cabinet. This, if used with stacking units on both, each with CCBs, and associated cables, could result in a total weight of 280 kg. Ensure floor is capable of supporting this weight.

Table 1-10 Main indoor cabinet weights (with six transceivers)

Cabinet with plinth and optional hood	Cabinet with plinth, stacking bracket and CCB
115 kg	130 kg

Torque values

Table 1-11 details torque values used during installation, maintenance and repair procedures.

Table 1-11 Torque values for all cabinet screws/bolts and RF connectors

Size of screw/bolt	M4	M6	M8	M10	SMA	N-type	7/16
Torque value	2.2 Nm	3.4 Nm	5 Nm	10 Nm	1 Nm	3.4 Nm	25 Nm

NOTE	Torque values used with M12 anchor bolts will depend on the anchor bolt manufacturer. Check manufacturer's data for correct values.

Frequency capability

Frequency hopping

The Horizon*macro* supports baseband frequency hopping (BBH) and synthesizer frequency hopping (SFH).

NOTE	Baseband frequency hopping is not supported in the GSM850 and PCS1900 Horizon*macro* variants.

Frequency band characteristics

BTS radio channels (RF carriers) are full duplex (transmit and receive) with the characteristics listed in Table 1-12 for GSM/EGSM900 and DCS1800 BTSs and in Table 1-13 for GSM850 and PCS1900 BTSs.

Table 1-12 Frequency band characteristics – GSM/EGSM900 and DCS1800

	GSM900	EGSM	DCS1800
Transmit frequency band (MHz)	935 to 960	925 to 960	1805 to 1880
Receive frequency band (MHz)	890 to 915	880 to 915	1710 to 1785
Transmit/receive duplex separation (MHz)	45	45	95
Channel width (kHz)	200	200	200
Number of channels	124	174	374
Transmit frequency guard bands (MHz)	935.0 to 935.1 959.9 to 960.0	925.0 to 925.1 959.9 to 960.0	1805.0 to 1805.1 1879.9 to 1880.0
Receive frequency guard bands (MHz)	890.0 to 890.1 914.9 to 915.0	880.0 to 880.1 914.9 to 915.0	1710.0 to 1710.1 1784.9 to 1785.0
Transmit channel centre frequency (MHz)	Even 10ths of a MHz from 935.2 to 959.8	Even 10ths of a MHz from 925.2 to 959.8	Even 10ths of a MHz from 1805.2 to 1879.8
Receive channel centre frequency (MHz)	Even 10ths of a MHz from 890.2 to 914.8	Even 10ths of a MHz from 880.2 to 914.8	Even 10ths of a MHz from 1710.2 to 1784.8

Table 1-13 Frequency band characteristics – GSM850 and PCS1900

	GSM850	**PCS1900**
Transmit frequency band (MHz)	869 to 894	1930 to 1990
Receive frequency band (MHz)	824 to 849	1850 to 1910
Transmit/receive duplex separation (MHz)	45	80
Channel width (kHz)	200	200
Number of channels	124	299
Transmit frequency guard bands (MHz)	869.0 to 869.1 893.9 to 894.0	1930.0 to 1930.1 1989.9 to 1990.0
Receive frequency guard bands (MHz)	824.0 to 824.1 848.9 to 849.0	1850.0 to 1850.1 1909.9 to 1910.0
Transmit channel centre frequency (MHz)	Even 10ths of a MHz from 869.2 to 893.8	Even 10ths of a MHz from 1930.2 to 1989.8
Receive channel centre frequency (MHz)	Even 10ths of a MHz from 824.2 to 848.8	Even 10ths of a MHz from 1850.2 to 1909.8

Structural considerations

Adequate clearance must be provided at the front of the equipment for operation and maintenance purposes. There must be adequate side clearance (50 mm) to enable the door to open beyond 90° (see Figure 1-6). The door can also stop at 95° and 130° , but this is only to protect the door, or give optional additional operator space.

The cabinet ventilation entry can be solely from the bottom front of the cabinet. This allows a cabinet to be placed against a wall. However, if the unit is placed 50 mm from back or side obstructions, such as wall or other cabinets, the ventilation will be improved, and fan noise reduced.

Up to 100 mm rear space may be required for cables if using stacking bracket.

The foundation or structure on which the BTS cabinet is mounted must be of sufficient strength to support a maximum gross weight of 130 kg for a single cabinet or 280 kg for two stacked cabinets.

NOTE	In seismically active areas, Motorola suggest using a qualified structural engineer to assess frame mounting requirements, such as floor construction, mounting anchors, cell site construction and to provide a suitable design for top frame support if a stacked configuration is required.

Layout plan

Figure 1-6 shows the cabinet installation layout plan.

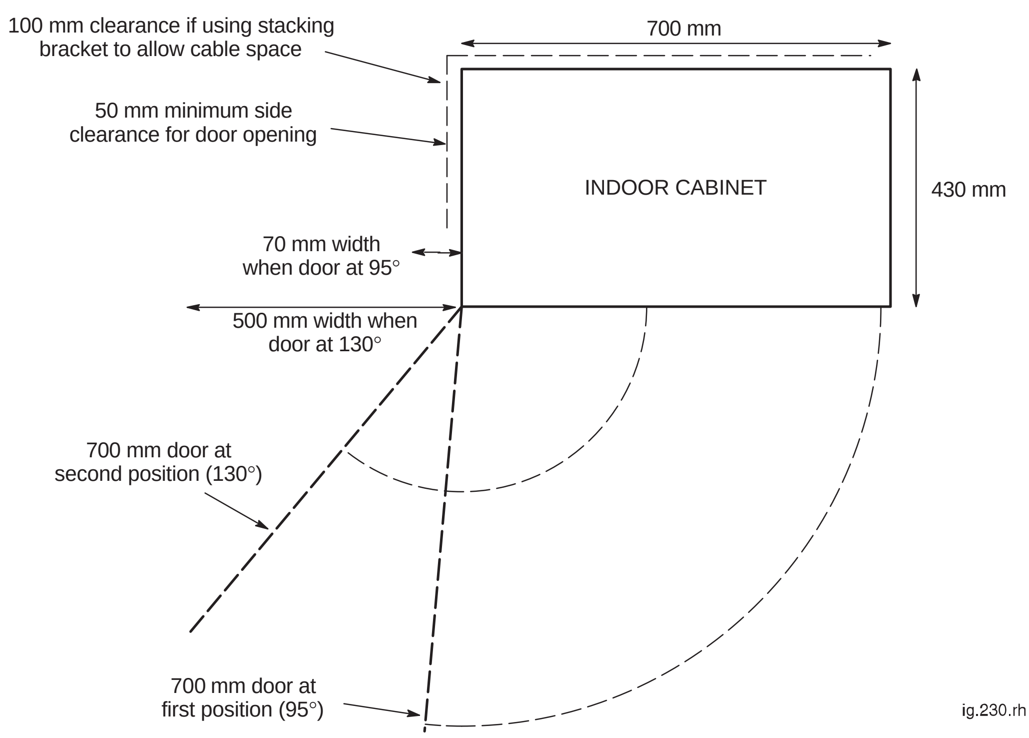


Figure 1-6 Indoor cabinet site layout plan

Chapter 2

Cabinet structure

Chapter 2

Cabinet structure of Horizon*macro* indoor

External cabinet view

Figure 2-1 shows an external view of a closed cabinet with optional hood, and a cabinet with door open and no hood.

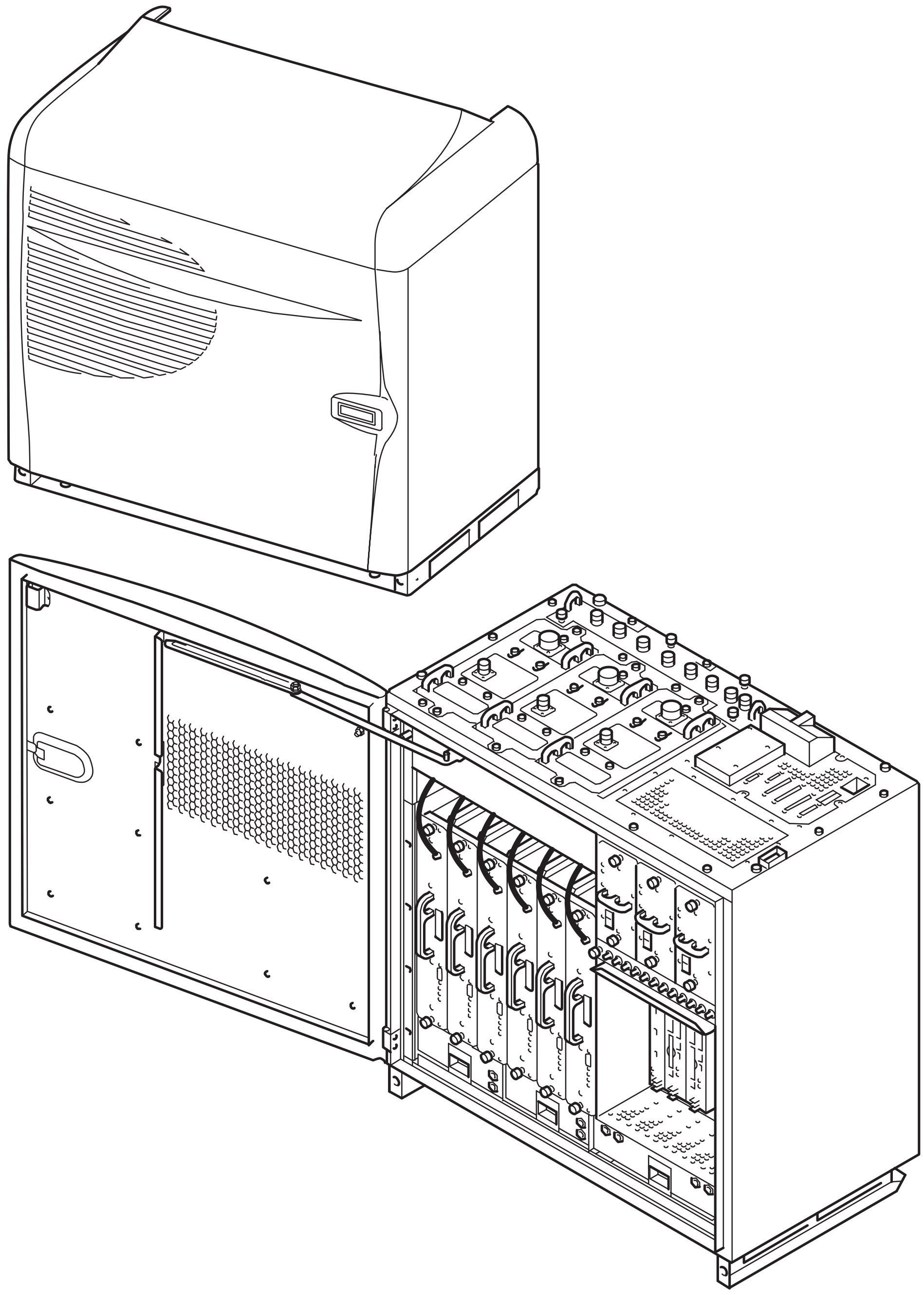


Figure 2-1 Closed cabinet and cabinet with hood removed and door open

Overview of structure description

The equipped cabinet is shown in Figure 2-2. The cabinet, intended for minimum maintenance and maximum ease of module replacement, and has access only from the front and the top.

This chapter describes the cabinet structure and inner connections to assist understanding of the cabinet functions. There should be no need to dismantle the cabinet beyond Field Replaceable Unit (FRU) level.

The cabinet structure components are explained in the following sections:

Empty cabinet and SURF harness

This section describes the empty cabinet and the SURF harness connections between the SURF and the backplane and transceivers.

Top panel

This section describes the bare top panel with all the modules removed.

Cage backplane interface panel harness assembly (CBIA)

This section describes the CBIA. It also describes the backplane connections between all modules, and the harness from the backplane to the interface top panel connectors.

Door and hood

This section describes the structure and function of the door and optional hood.

Stacking bracket and CCB basket

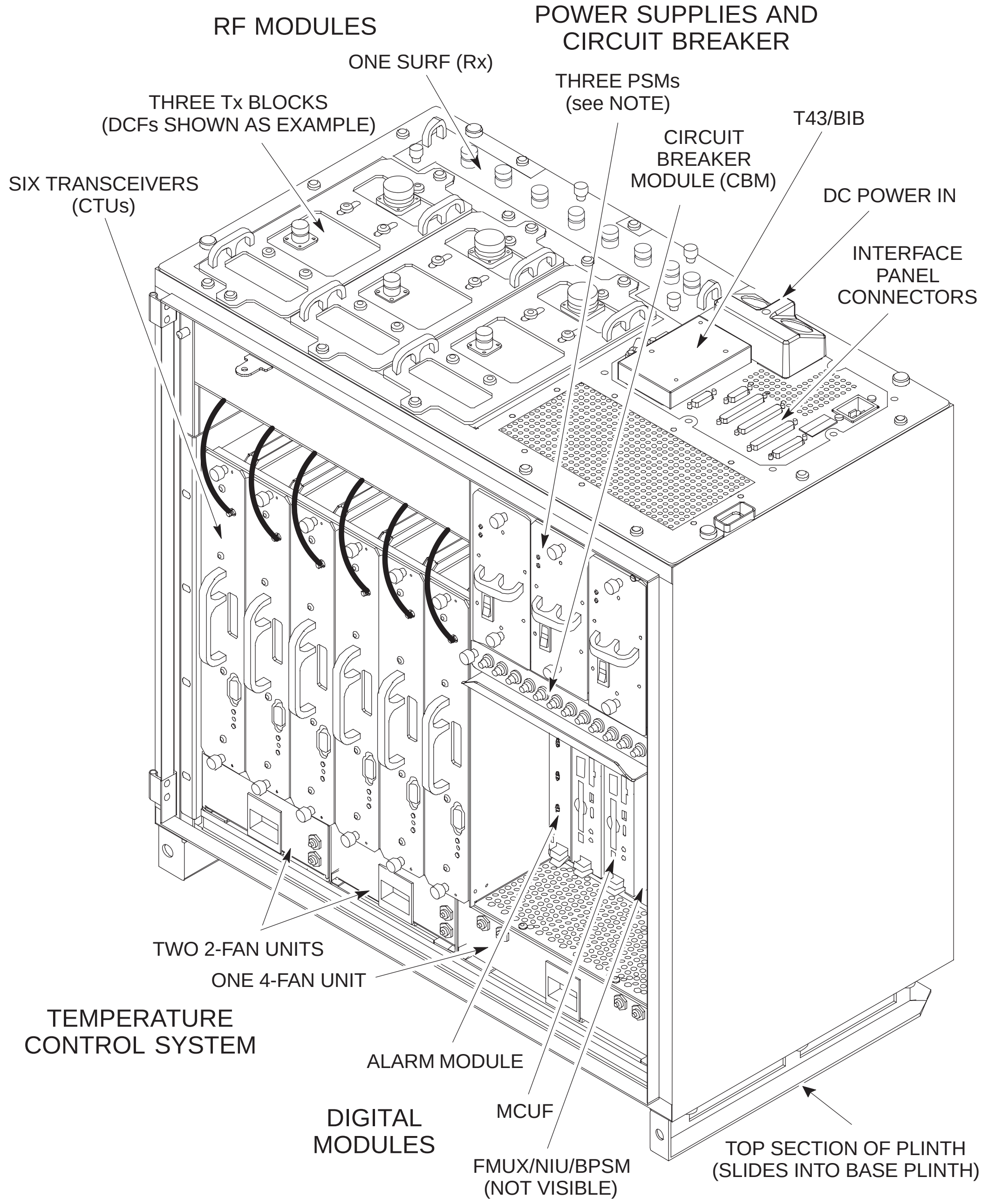
This section describes the stacking bracket. It is used for mounting a second cabinet on top of the first, and/or providing a mounting position for CCBs.

Space required around cabinet

See **Specifications** in Chapter 1.

Filled cabinet view

Figure 2-2 shows a cabinet with maximum number of modules installed. Further information is detailed in the later technical description chapters.



NOTE	Three PSMs = 2 + 1 redundant (if required). An optional hold-up battery module may be installed instead of a redundant PSM.

Figure 2-2 Cabinet, without door or hood, showing main components

Empty cabinet and SURF harness

SURF harness and cabinet attachment

The SURF harness is fitted on the back wall of the cabinet, as shown in Figure 2-3. The chassis of the SURF harness supports the SURF module.

The SURF harness provides:

- Three connectors to the SURF, for RF and power.
- One RF connector to each CTU, consisting of three inputs, one each for RxA, RxB and RF loopback test, as shown in Figure 2-4. The RF connectors are free floating to ensure fitting of CTU modules.
- One connector to the backplane, for power from the PSMs.

Cabinet view with installed SURF harness

Figure 2-3 shows the SURF harness installed in an empty cabinet, with, for clarity, SURF harness cables not shown.

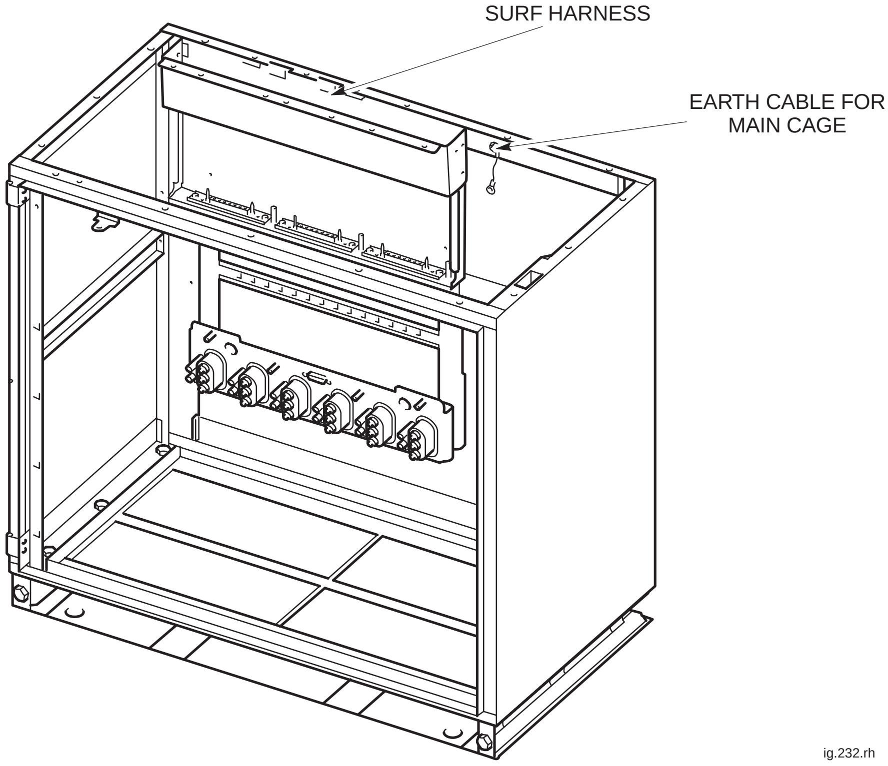


Figure 2-3 SURF harness installed in empty cabinet.

SURF harness view

Figure 2-4 shows the SURF harness with connectors indicated.

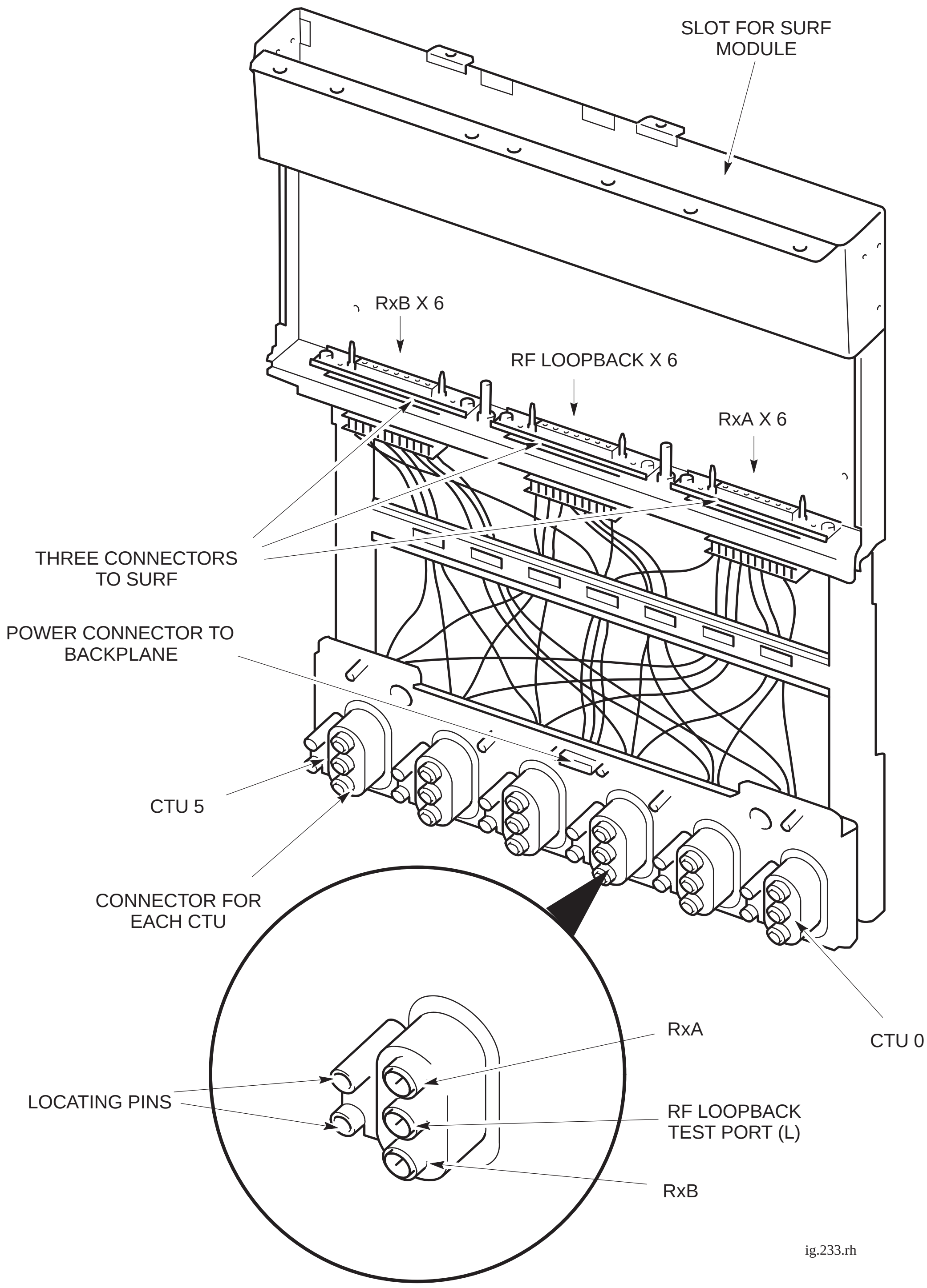


Figure 2-4 SURF harness with connectors indicated

Top panel

Top panel description

The top panel provides:

- A basket to hold up to three Tx blocks. This includes three holes to enable connection of CTU Tx cables to the underside of each Tx block. The holes also allow cooling of the Tx blocks from underneath.
- A slot for insertion of the SURF module.
- A location hole for the interface panel.
- An area for ventilation purposes above the PSMs.
- A cable hole for fibre optic extension cables from the MCUF FMUX to an FMUX of another cabinet.

Top panel view

Figure 2-5 shows a top panel with major features labelled.

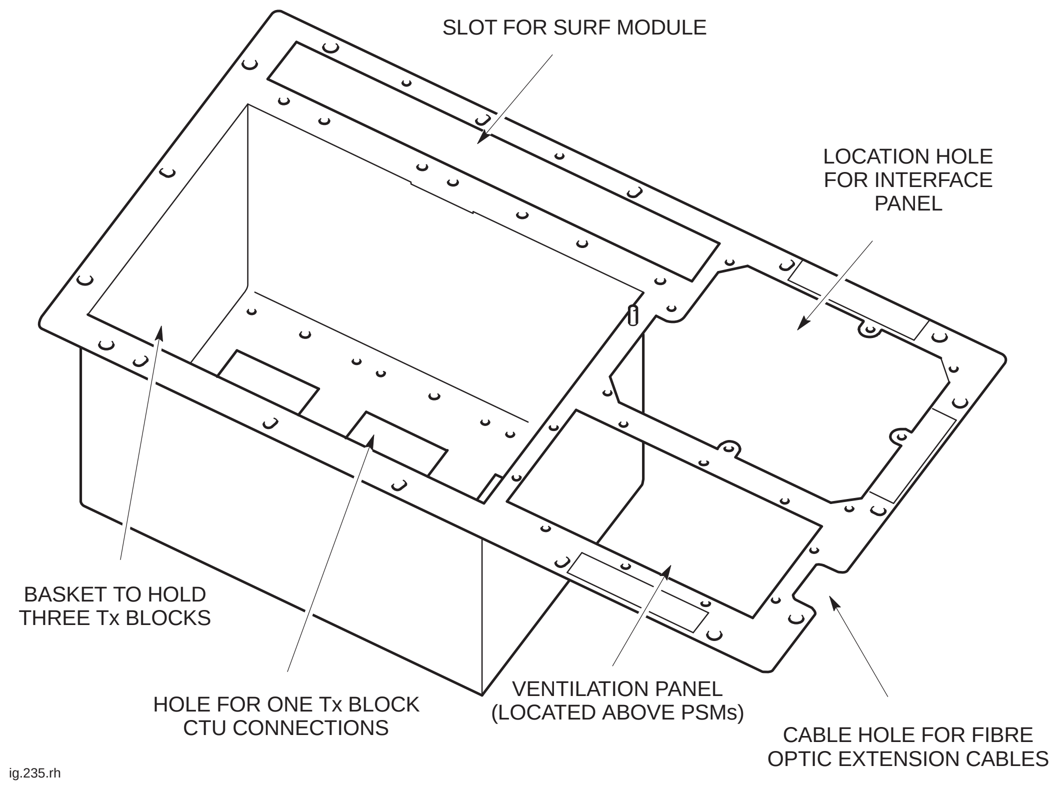


Figure 2-5 Top panel with major features labelled

Cage backplane interface panel harness assembly (CBIA)

CBIA overview

The CBIA provides a platform for module installation and power and digital signal interconnection to cabinet modules. The CBIA consists of:

- The main cage - providing compartments for fans, CTUs, digital modules, BPSMs, PSMs and CBM.
- The backplane - routes power and signals for all cage modules and power to the SURF.
- The harness - links the backplane to the interface panel.
- The interface panel - carries the T43/BIB, the required power and communications connectors.

CBIA and interface panel schematic view

Figure 2-6 shows the CBIA main cage and the interface panel.

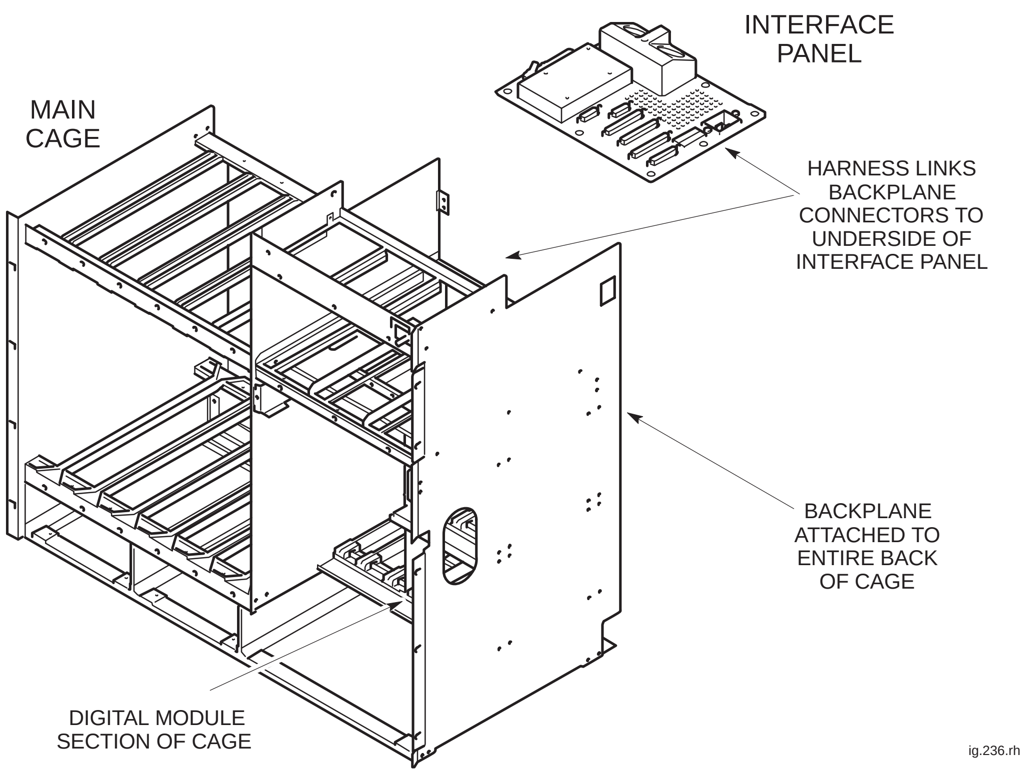


Figure 2-6 View of CBIA cage and the interface panel

Backplane and harness view including door switch and heat sensors

Figure 2-7 shows the CBIA harness linking the interface panel and the backplane at rear of main cage. Each backplane harness connector is identified.

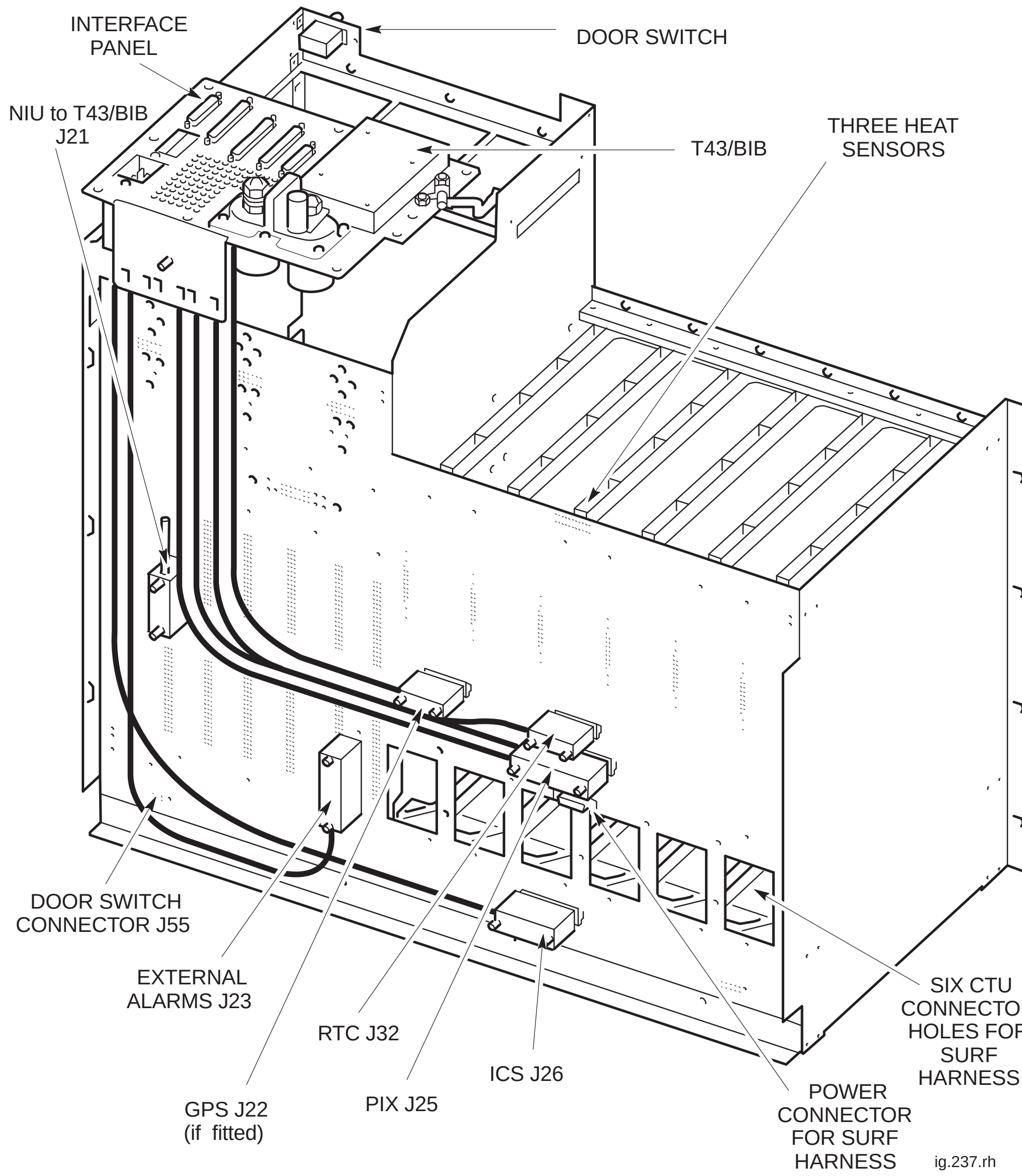


Figure 2-7 Rear view of CBIA showing backplane and harness

CBIA cage function and diagram

The main cage holds modules and supports the backplane. Each compartment has appropriate sliders for insertion of the modules. Figure 2-8 shows the module compartments of the cage.

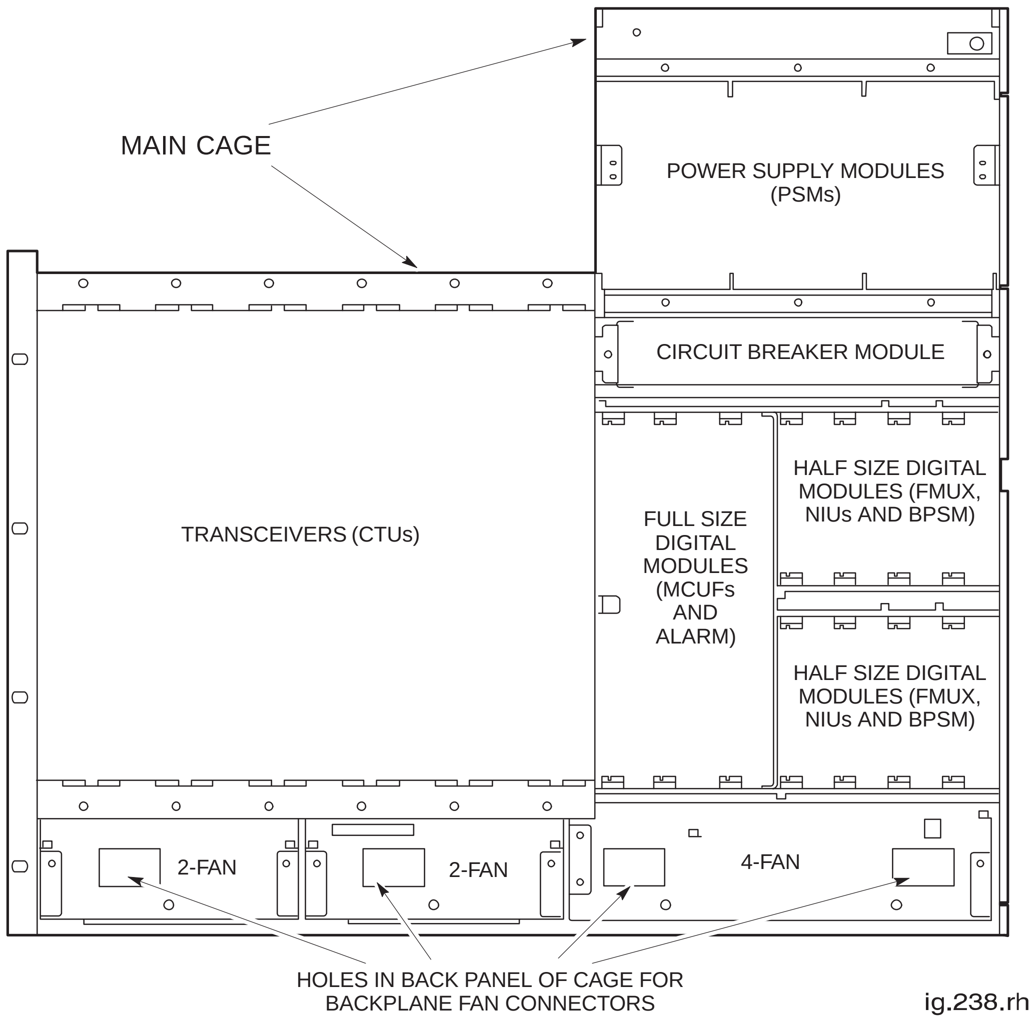


Figure 2-8 Front view of CBIA cage showing where modules fit

CBIA harness function

The harness provides cables to link connectors on the backplane with connectors on the underside of the interface panel.

CBIA backplane function

The cabinet design enables all possible RF and digital module combinations to be served by the same backplane. The only module-to-module cabling required are the Tx cables from the transceivers to the Tx blocks. Any external attachments will also require separate cabling.

The backplane is a multilayered printed circuit board with attached connectors on front and back. The backplane:

- Routes power and digital signals throughout the cabinet.
- Provides connectors for the harness cables linking to the interface panel.
- Provides connectors for plug in modules.
- Provides power to the SURF harness, when the main cage is inserted into the cabinet.
- Provides a connector for the door switch cable.
- Provides connectors for three heat sensors in the main cage above the CTUs.

Attachment of cage to cabinet

The CBIA is fitted to the cabinet at the factory and is not intended to be removed in the course of normal maintenance or FRU replacement procedures.

Interface panel function

The interface panel provides all connection points to:

- The required power sources.
- External alarms (for example battery backup system alarms)
- Connection points to all telecommunications links.

All connectors are linked to the backplane via the CBIA harness. Plastic connector covers, supplied by Motorola, keep unused connectors protected from damage by static or foreign matter and should be retained.

Interface panel diagram

Figure 2-9 shows the locations of the interface panel connectors.

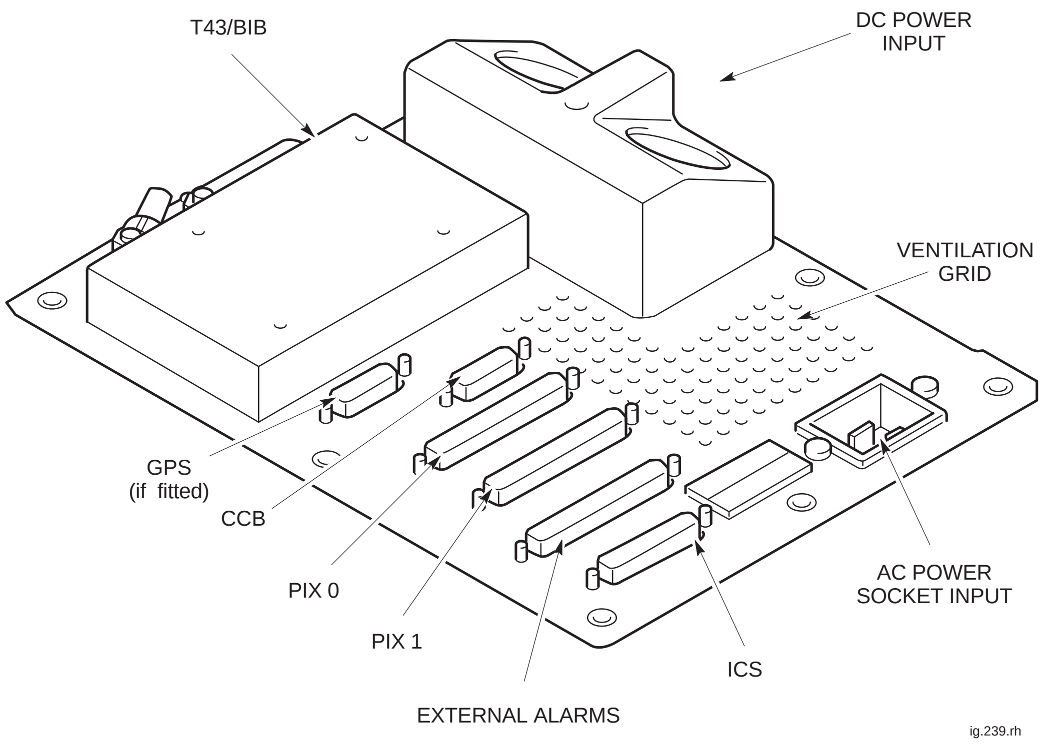


Figure 2-9 Interface panel connector locations

Interface panel pinouts

Interface panel pinouts are detailed in *Installation and Configuration: (GSM-205-423)* **Interface panel cabling** of this service manual.

Cabinet door and optional hood

Door function

The cabinet is fitted with a door and a hood option. The optional hood cannot be fitted in conjuction with a stacking bracket.

The door has the following functions:

- Protects modules from damage.
- Ensures correct air ventilation.
- Provides EMC shielding.

The door has a ventilation grid with internal honeycomb grid, a vertical aluminium air baffle, and a horizontal door stop bracket. The door stop bracket enables the door to open to 95 or 130 degrees.

The lock is a trigger latch, opened (if unlocked) by pressing the middle button. There is also a door alarm bracket, to touch the cabinet door switch.

Door external and internal view

Figure 2-10 shows both sides of the cabinet door.

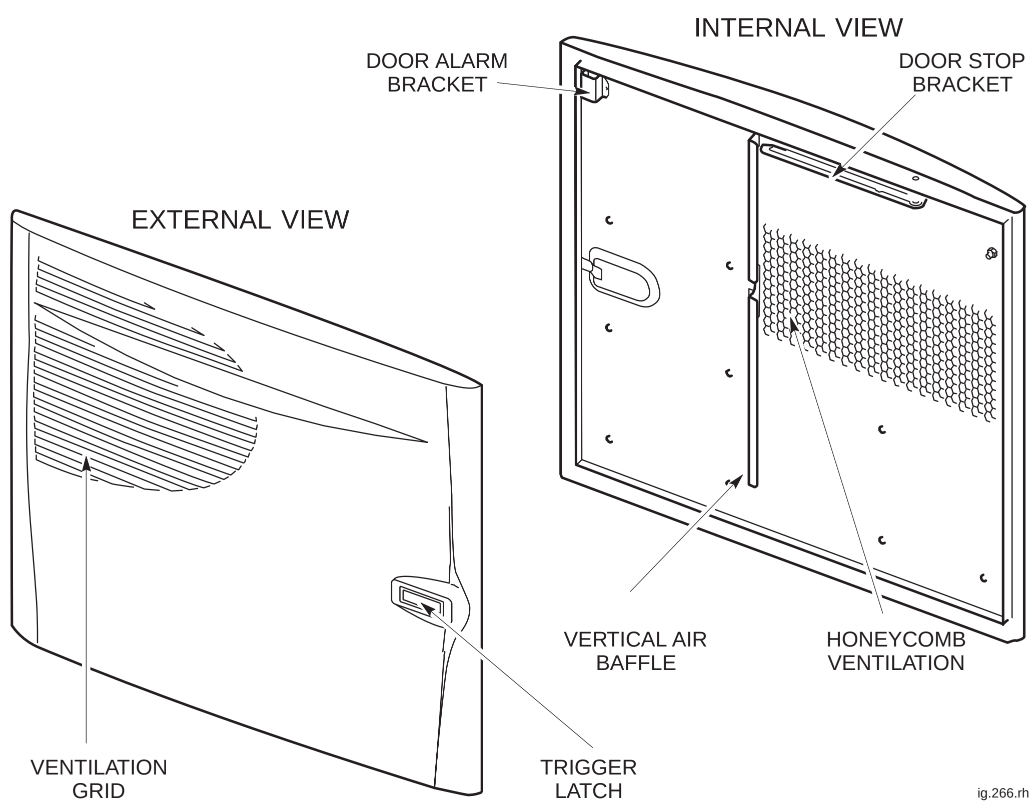


Figure 2-10 External and internal view of cabinet door

Hood function

The optional hood can be fitted to keep unsightly cables and connectors out of view, where this is important.

View of hood

Figure 2-11 shows a top view of the hood.

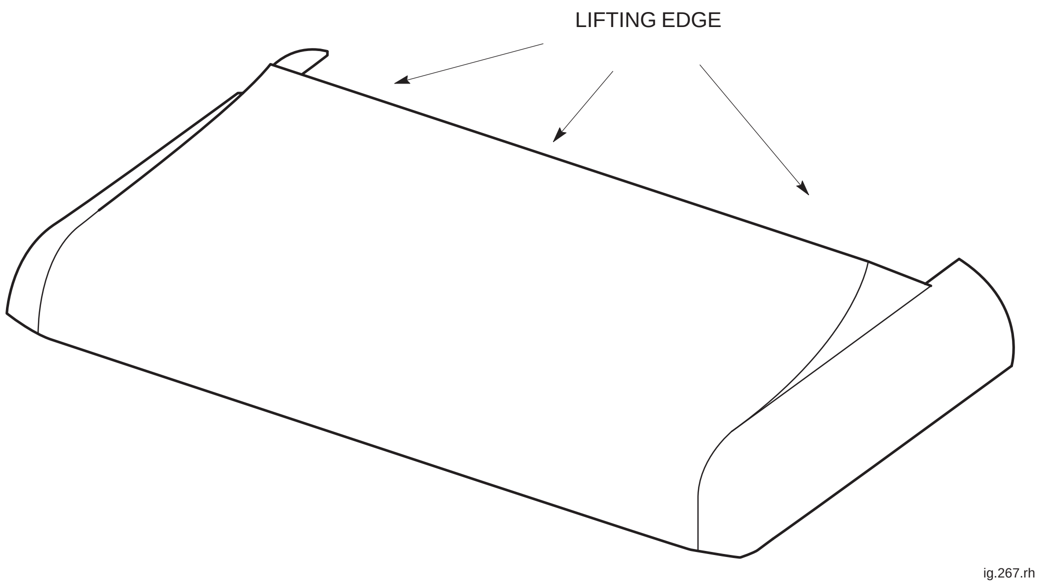


Figure 2-11 View of hood as seen from the front of the cabinet

Securing pins and hood removal

The hood mounts on four pins that screw into the cabinet top panel, replacing existing screws.

The hood can be easily lifted off the cabinet by pulling on the lifting edge at the rear, as shown in Figure 2-11.

Stacking bracket and CCB basket

Stacking bracket function

The stacking bracket has two main functions:

- To enable a second cabinet to be stacked on top of the first cabinet.
- To house CCBs in a dedicated optional CCB basket.

The stacking bracket is fixed to the top of the cabinet by eight M8 screws. If the stacking bracket is replacing an existing hood, then the four hood securing pins must first be removed to accommodate four of the stacking bracket screws. A second cabinet may be attached on top of the stacking bracket by four M10 screws.

Lower cabinet outlet and additional upper cabinet inlet ventilation is provided by the large open sides of the stacking bracket (especially on the right side of the cabinet).

The CCB basket is fitted only if CCBs are required. The CCB basket is removable, to enable access for SURF module replacement.

Stacking bracket diagram

Figure 2-12 shows a view of the stacking bracket with CCB basket installed.

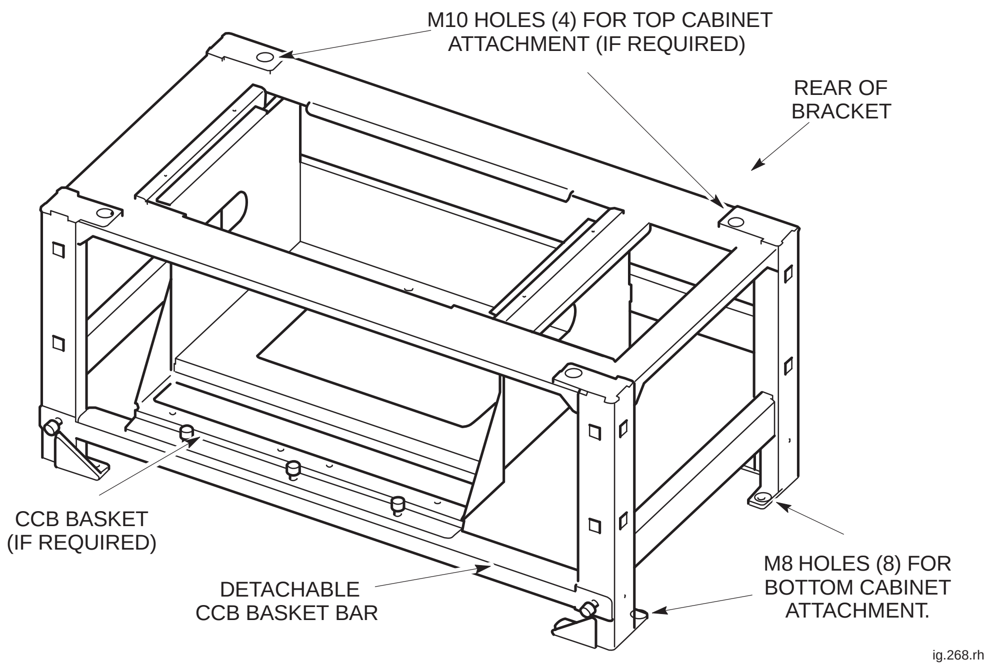


Figure 2-12 View of stacking bracket with CCB basket installed.

Stacking bracket front cover function

The stacking bracket front cover clips onto the front of the stacking bracket and provides the following functions:

- Protection for CCB (if fitted).
- Blanking panel to match appearance of cabinet door.

View of stacked cabinets

Figure 2-13 shows a view of two stacked Horizon*macro* indoor cabinets with front covers attached to the two stacking brackets.

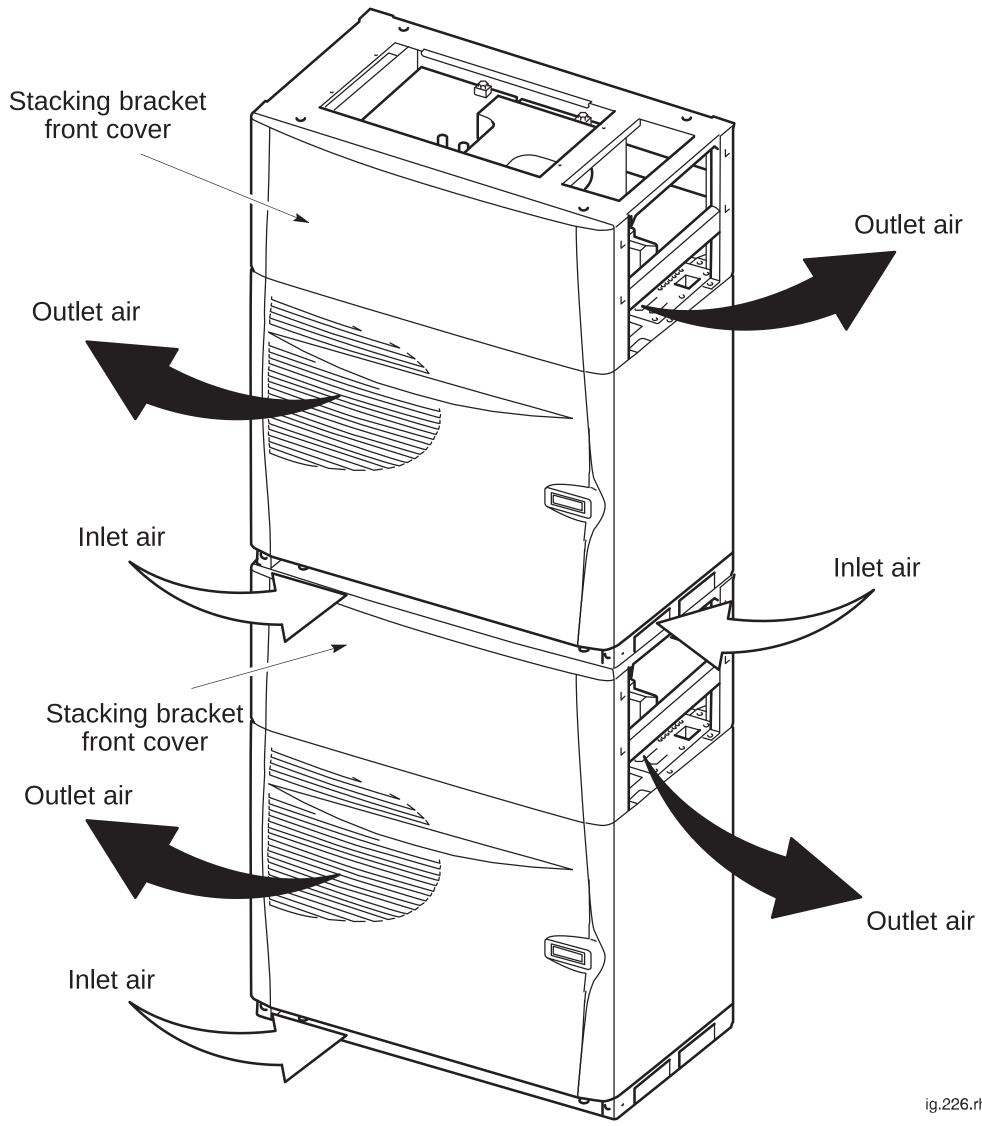


Figure 2-13 View of two stacked Horizon*macro* indoor cabinets, showing stacking bracket front covers

Chapter 3

Temperature control system

Chapter 3

Indoor temperature control system

Temperature control overview

The Horizon*macro* indoor cabinet contains equipment that has to be maintained within the operational temperature range, to ensure correct operation of the equipment and to guard against premature failure of the individual components. The internal temperature is maintained within these limits by internal fans.

Cabinet over temperature control

Under overheat conditions, as the temperature rises above preset levels, temperature sensors located in various areas within the cabinet provide alarms. A further increase in temperature causes dual sensors, set at a higher threshold temperature to initiate PSM and cabinet shutdown. The cabinet is restarted when the sensors are reset by a substantial fall in temperature.

The CTUs have their own shutdown responses to overheating. The CTUs shutdown at 92 °C.

850/900 MHz CTUs also have an internal 4 dB power reduction response to overheating at 85 °C. 1800/1900 MHz CTUs have a 0.6 dB cut back at 70 °C, in addition to the 4 dB power reduction at 85 °C.

The CTU shutdown response to overheating provides a second level of cabinet protection, independent of the cabinet heat sensors.

Temperature sensors

The three cabinet temperature sensors are located above the CTU compartment (see Figure 2-7) and consist of the following:

- One 70 °C sensor provides a cabinet overtemperature alarm when the cabinet temperature exceeds planned level. The alarm is processed by the alarm board and MCUF, and sent on to the OMC-R via the BSC.
- Two 85 °C sensors shut down the PSMs to protect the cabinet equipment from heat damage. Both sensors must detect excess temperature for the shutdown to take place; this reduces the risk of an unnecessary shutdown. No prior notification of shutdown is given to the OMC-R, except for the original 70 °C sensor alarm. This is because the MCUF and CTUs immediately lose power and functionality.

Cabinet restart after shutdown

The cabinet is restarted when the overtemperature condition initiating shutdown has reset. The two 85 °C temperature sensors reset at 55 °C. This re-establishes an earth point for the PSM internal detectors connected to the cabinet heat sensors, which then reactivate the PSM outputs. The MCUF then reboots as in a normal power up.

Fan unit description

Fan unit overview

The indoor cabinet operating temperature is maintained by three sets of fans:

- One 4-fan unit (referred to as FAN0), located in front and beneath the digital module shelf.
- Two identical 2-fan units, (referred to as FAN1 and FAN2), located beneath the CTUs.

Figure 3-1 shows the two types of fan unit:

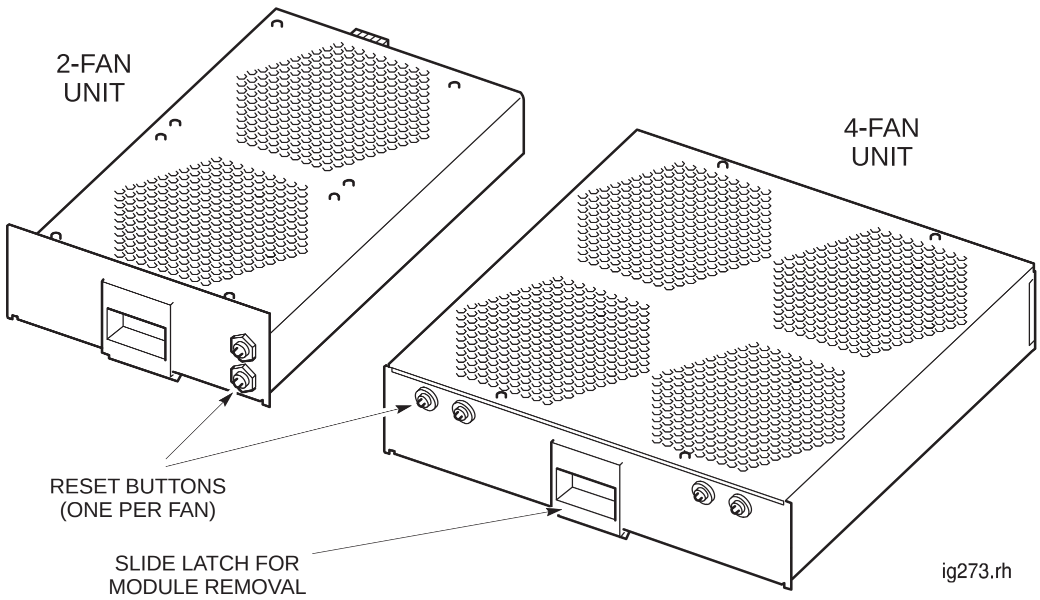


Figure 3-1 View of 2-fan and 4-fan units

Fan operation and reset

The fans draw in air from beneath the cabinet, and the air is expelled through the door and top cabinet vents. The fans run continuously, and respond to temperature changes to ensure adequate flow. The speed of each fan is controlled by a heat sensor mounted on the fan hub.

Each fan has a reset button, for use if a fan has stopped or cannot start. Each reset button is marked **FRONT** or **REAR** to identify the appropriate fan.

Filter option and effect on fans

The filter is an option and not essential in a clean environment. The single filter is mounted under all the fan units. If clogged, fan airflow may be reduced, straining fan motors and increasing fan noise.

Chapter 4

Cabinet power supply

Chapter 4
Cabinet power supply i

Horizon*macro* indoor power supplies

Power supply overview

The horizon*macro* indoor power supplies consist of the following elements:

- The power supply modules (PSM):
  - +27 V dc PSM (negative earth input).
  - –48/60 V dc PSM (positive earth input).
  - 120/240 V ac (nominal) PSM.
- The hold-up battery module.
- The circuit breaker module (CBM).
- The μBCU power supply module (BPSM).

Location of power modules

Figure 4-1 shows the CBIA with the power modules indicated.

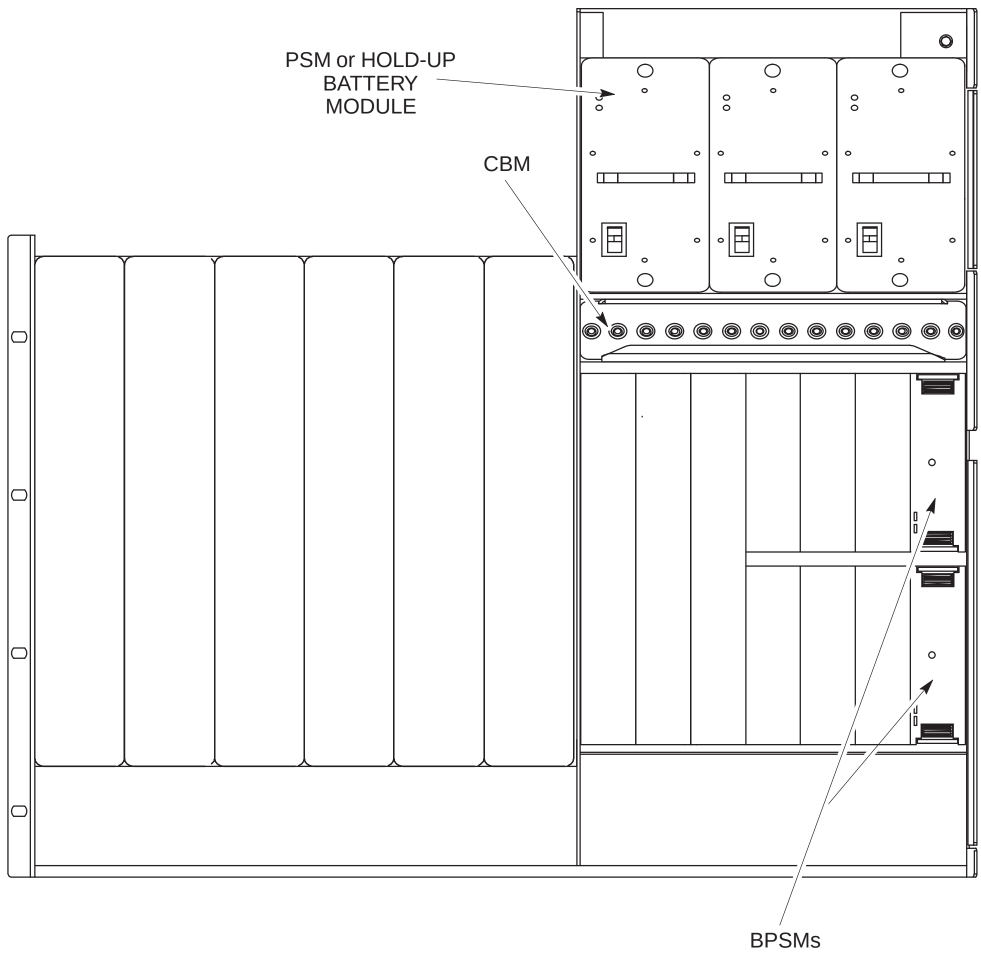


Figure 4-1 Location of power modules

Power supply module (PSM)

Types and overview of PSM

There are two types of dc power supply modules (PSMs):

- Nominal +27 V (negative earth input).
- Nominal –48 V (positive earth input).

There is one type of ac PSM:

- Nominal 120/240 V.

All PSMs have the same external appearance and are located in the same positions. Different types are identified only by front panel labels.

The PSMs are fed from a backplane connector and use pulse width modulation to generate output supply. A front panel switch (shown in Figure 4-2), disables the output, reducing the input current as shown in Table 4-1.

Table 4-1 Input currents for power supply module

Type of PSM	Output voltage full load	Input current full load	Input load when output switch off
+27 V nominal dc	+27 V	32 A	1 A
–48 V nominal dc	+27 V	18 A	0.5 A
120/240 V nominal ac	+27 V	3.75 A	0.1 A

NOTE	There are several manufacturers of the PSMs. Each is fully compatible with the same type of PSM of a different manufacturer.

PSM location and redundancy

The PSMs are located above the digital cage and circuit breaker module. There are three slots, two for maximum cabinet configuration, one for redundancy. Table 4-2 shows the recommended number of PSMs for different operational configurations.

Table 4-2 PSM operational configurations

Number of PSMs fitted	Maximum load capability
1	Complete operation of cabinet for up to three CTUs.
2	Complete operation of cabinet for up to six CTUs.
3	Redundancy and power load sharing (further enhancing reliability by reducing temperature of operation).

PSM module view

Figure 4-2 shows a view of the PSM with LEDs identified.

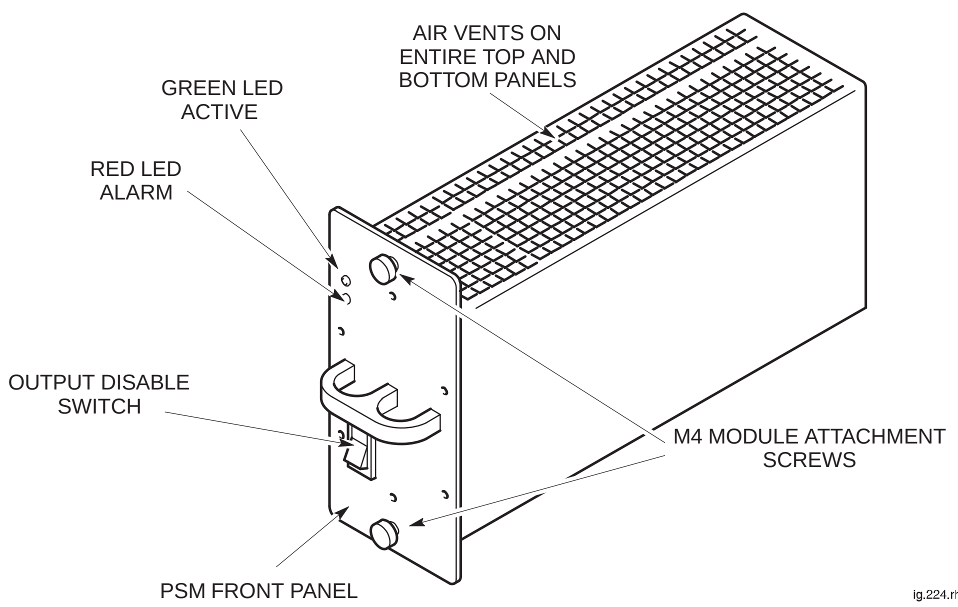


Figure 4-2 View of PSM with LEDs identified

PSM alarms

There are three alarms for each PSM, indicated by LEDs (see Table 4-3):

- Output fail.
- Input fail.
- Overtemperature.

PSM LEDs

The LEDs function with the properties shown in Table 4-3.

Table 4-3 Power supply module LEDs function

Green LED ACTIVE	Red LED ALARM	Indication
OFF	OFF	1. Cabinet power supply off, or 2. Module not connected.
ON	OFF	Normal operation.
OFF	ON	1. Output disable switch off, or 2. Alarm condition with module unable to supply power.
ON	ON	Internal problem (such as over temperature), but still able to maintain supply.

PSM backplane protection

If a power track on the backplane is broken or short-circuited, the PSM detects the fault and shuts down to prevent further damage.

Hold-up battery module

Introduction to hold-up battery module

The optional hold-up battery module provides short term backup power for one ac powered Horizon*macro* indoor BTS cabinet. The hold-up battery module is fitted in the PSM shelf within the CBIA main cage, in any empty slot or in place of the redundant PSM. It connects to the Horizon*macro* indoor BTS through the PSM slot backplane connector.

NOTE	If the hold-up battery module is used in a Horizon*macro* cabinet with more than three radios fitted, power supply redundancy cannot be supported.

Under normal operating conditions the hold-up batteries provide ten seconds of backup power (at 25 °C) for a fully populated (six radio) Horizon*macro* indoor BTS cabinet.

NOTE	Due to the discharge characteristics of the internal batteries, hold-up duration is reduced at temperatures below 25 °C.

Figure 4-3 shows a view of the hold-up battery module, with LEDs identified.

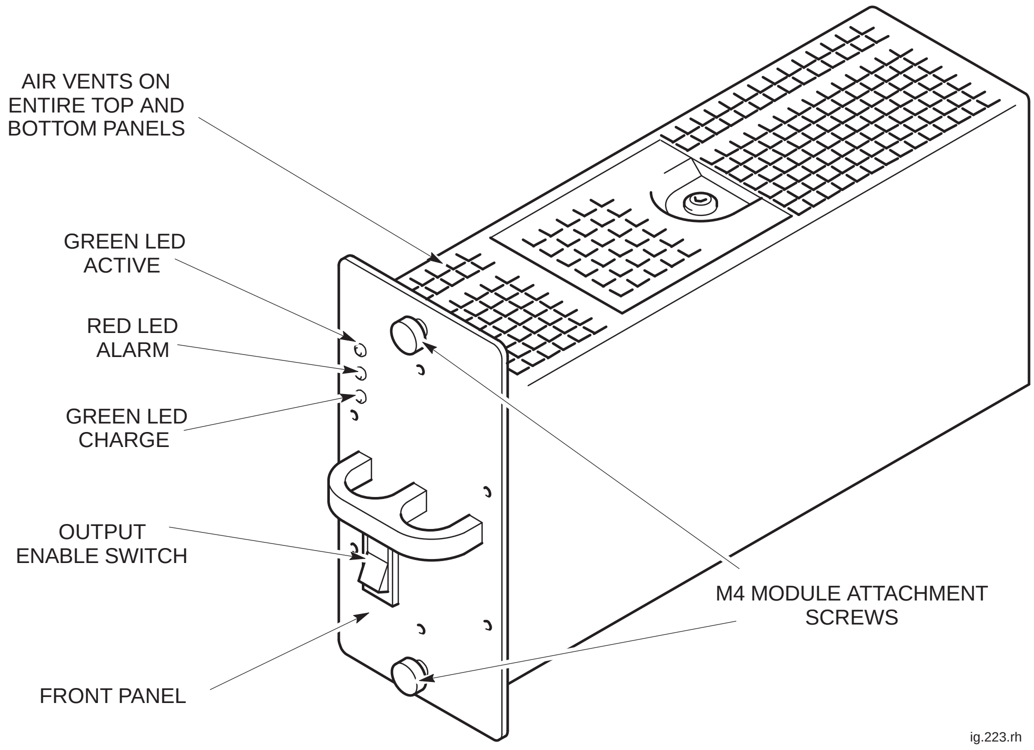


Figure 4-3 View of the hold-up battery module

Specifications

Table 4-4 shows the hold-up battery module specifications.

Table 4-4 Hold-up battery module specifications

Weight	5.9 kg
Environmental limits	–5 to +45 °C (indoor only)
Nominal input voltage and frequency	100 to 240 V ac 50 to 60 Hz
Supply voltage and frequency range	88 to 270 V ac 45 to 66 Hz
Nominal output voltage	24 V dc
Output voltage range	27.5 ± 0.25 V dc (max) 19 ± 0.25 V dc (min)
Maximum output power	1500 watts
Battery capacity	5 Ah
Recharge time	< 2 hours (from LVD level)
Response time (from external supply failure to battery operation)	< 10 msec
Back up switching voltage	88 volts (110 V ac nominal systems) 150 volts (230 V ac nominal systems)
Typical output power duration (six radios)	10 Seconds (@ 25 °C)
Expected battery life (standby)	3 to 5 years
Expected battery life (discharge)	1200 cycles

NOTE	This specification is valid up to 3 km altitude, corresponding to an atmospheric pressure of approximately 70 kPa (648 to 1048 millibars).

Front panel switch and LEDs

Front panel enable switch

The rocker style switch mounted on the front panel is used to enable the output of the hold-up module.

Front panel LED indicators

The front panel LEDs function as follows:

- **ACTIVE** (green).

  Normally lit, this LED indicates that the module is capable of powering cabinets. The **ACTIVE** LED flashes during discharge.

- **ALARM** (red).

  Normally unlit, when lit continuously this LED indicates one or more of the following alarm conditions exists:

  – Battery charger fail.

  – Input voltage drops below 88 V ac (110 V systems) or below 150 V ac (230 V systems).

  – Enable fail, the module is not receiving an enable signal from the Horizon*macro* backplane.

  When the **ALARM** LED is flashing the batteries have failed and are not capable of providing sufficient energy to supply a ten second hold-up.

NOTE	If a battery failure occurs, the batteries may have reached the end of life. The hold-up battery module is disabled and must be returned to Motorola for repair.

- **CHARGE** (green).

  The CHARGE LED is lit while batteries are charging.

Hold-up module batteries

The hold-up module contains two 12 V batteries connected in series to provide a nominal output of 24 V dc, with a capacity of 5 Ah.

Input protection is provided by a 3.15 A fuse mounted on the battery charger PCB, this fuse is not user replaceable. The hold-up module must be returned to Motorola for repair.

Functional description

During normal operation the batteries are charged by an internal battery charger. The charger provides battery temperature compensation to protect the batteries. In the case of external ac power supply failure, the unit automatically switches the BTS to battery operation. The hold-up battery module indicates failure alarms to the OMC-R, through the Horizon*macro* alarm board.

Low voltage disconnect (LVD)

The hold-up battery module has an LVD function to protect the batteries from deep discharge. The battery does not discharge when not in the system or after operation of the low voltage disconnect.

Hold-up battery module functional diagram

Figure 4-4 shows the electrical layout of the hold-up battery module.

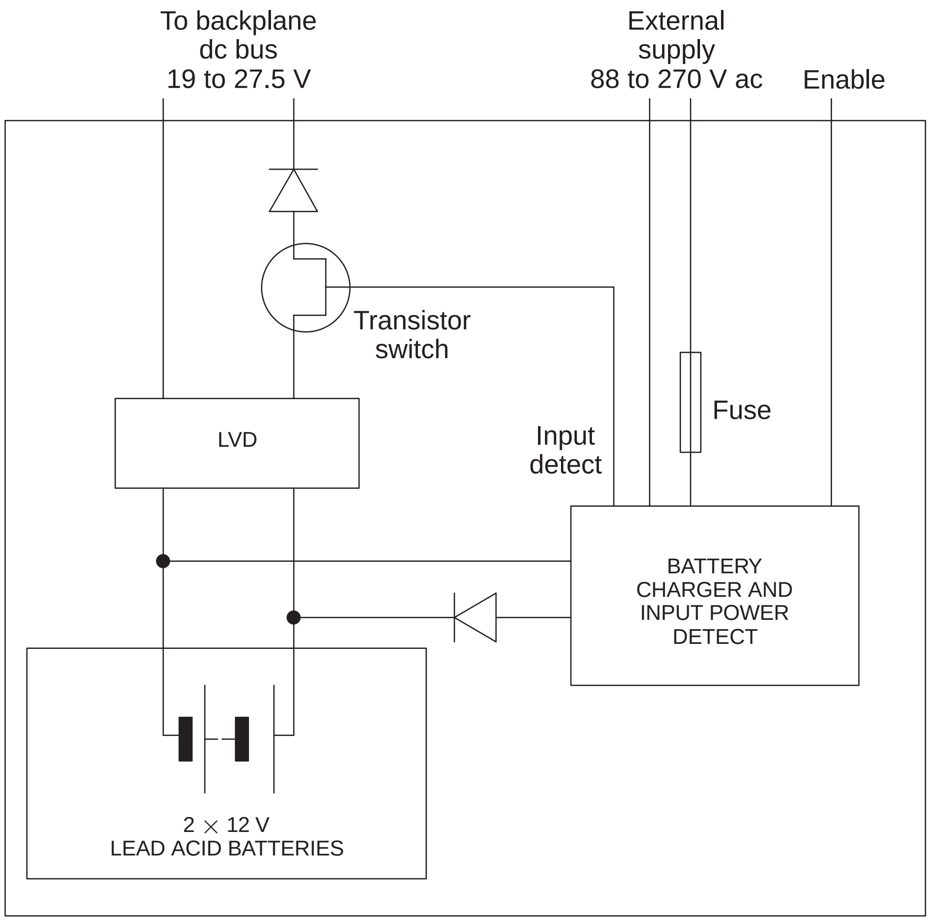


Figure 4-4 Hold-up battery module electrical layout

Alarms

Alarms are generated by the open contacts of de-energized relays within the hold-up battery module, (during normal operation the relays are energized and the contacts closed). The contacts are rated for 1 A at 30 V. The alarms are then passed to the Horizon*macro* alarm board, through the CBIA backplane, for onward transmission to the OMC-R. These alarms are equivalent to the PSM alarms.

The alarm signals generated are:

- Output fail.

  This alarm is triggered if:

  - The enable pin is not correctly plugged into the backplane.
  - The battery charger fails.
  - The front panel enable switch is off.
  - The batteries fail.

NOTE	If a battery failure occurs, the batteries may have reached the end of life. The hold-up battery module is disabled and must be returned to Motorola for repair.

- Input fail.

  This alarm is triggered if the external ac supply voltage drops below:

  - 88 volts (110 V ac nominal systems).
  - 150 volts (230 V ac nominal systems).

- Over temperature.

  This alarm is triggered if the hold-up battery module temperature exceeds 50 °C.

Signals

The following signals interface with the Horizon*macro* backplane:

- Enable.

  The output of the hold-up battery module is inhibited unless the ENABLE signal pin is connected to the output return pin through the Horizon*macro* backplane.

- Hold-up module ID.

  The hold-up module provides a five bit TTL signal to the OMC-R that allows identification of the hold-up module. This signal is available when ac is present and during battery discharge and identifies to the OMC-R the that a battery hold-up module is fitted.

Circuit breaker module (CBM)

CBM overview

The CBM provides circuit protection and manual isolation for all parts of the cabinet, except the PSMs. The CBM is located above the digital module shelf and below the PSMs. The honeycomb casing permits cabinet ventilation through the module.

The CBM is connected to the backplane, providing isolator switches and overload protection for the equipment indicated in Figure 4-5.

View of CBM

Figure 4-5 shows views of the CBM with circuit breaker buttons identified.

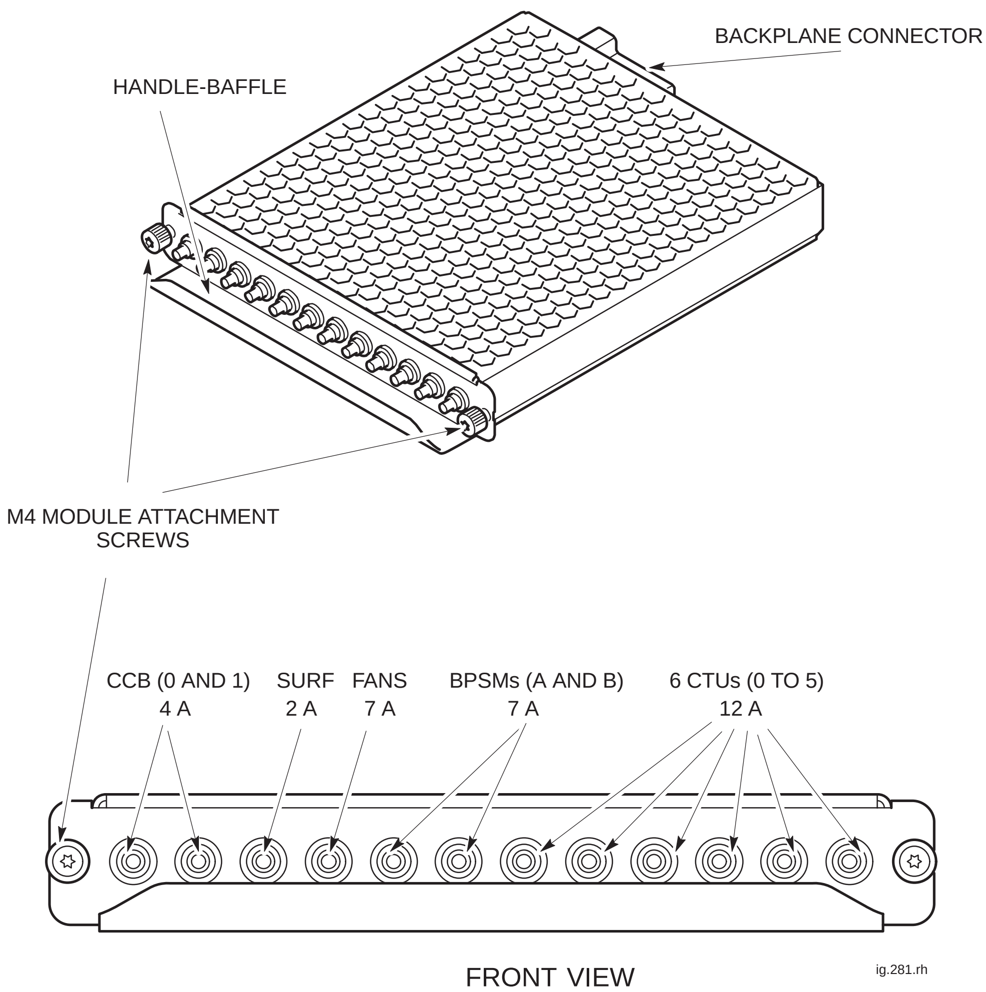


Figure 4-5 Views of CBM with circuit breaker buttons identified

Operation of CBM

Power for each module is supplied via the appropriate circuit breaker switch. Overload of any circuit results in appropriate front panel circuit breaker button tripping to the off (out) position. The button can be pressed to the on (in) position when overload problem has been corrected.

CTUs, BPSMs, CCBs, SURF and fans can be isolated by pressing and releasing the appropriate button to the off (out) position. Power is restored by pushing the appropriate button to the on (in) position.

MicroBCU Power Supply Module (BPSM)

Introduction to BPSM

This section describes the μBCU power supply module (BPSM). The BPSM, located in the digital module shelf of the main cage, supplies regulated dc power to the digital modules.

A single (master) BPSM mounted in the lower half of the digital module shelf can provide sufficient power for:

- One MCUF.
- One FMUX.
- Two NIUs.
- The alarm module.

An optional second BPSM can be fitted in the upper half of the digital module shelf to supply any or all of the following:

- Backup power to the alarm module, which is the only digital module supplied by both BPSMs (for redundancy).
- Optional redundant MCUF and associated FMUX.
- Up to two additional NIUs.

During normal operation, with all the outputs within their regulation limits, a green LED located on the front panel is illuminated. No alarms are generated by the BPSM.

BPSM diagram

Figure 4-6 shows a BPSM.

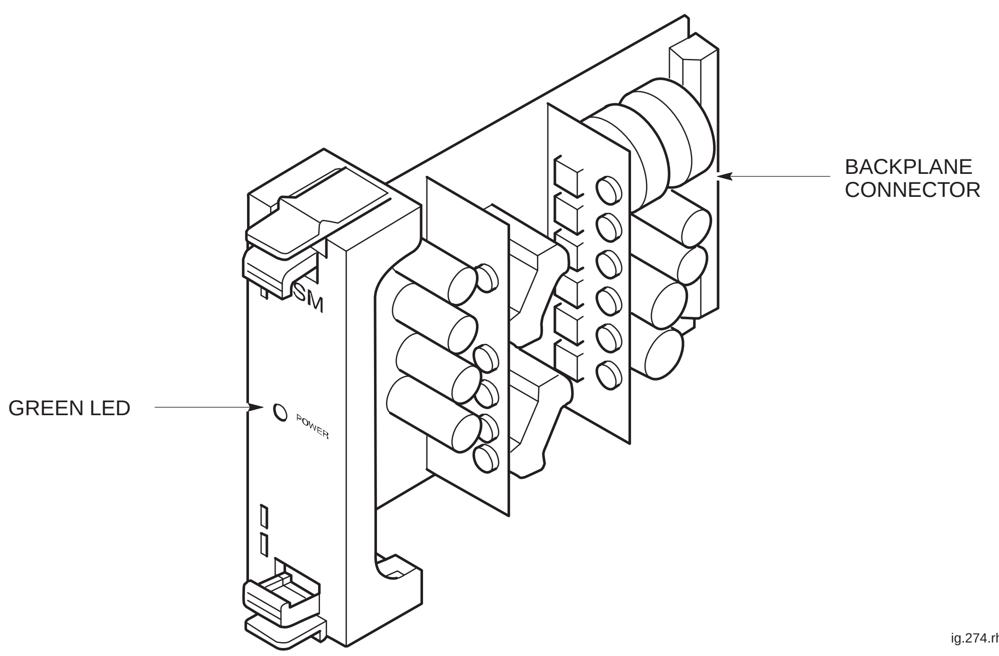


Figure 4-6 BPSM view

Functional description

The BPSM is a switching type dc/dc power converter that converts the cabinet +27 V dc power to the following regulated dc outputs:

- +3.3 V ± 1 % at 10 A (full load current)
- +5 V ± 2 % at 10 A (full load current).
- +12 V ± 5 % at 4 A (full load current).
- –12 V ± 5 % at 2 A (full load current).

Internal BPSM circuits monitor the +3.3 V, +5 V, +12 V and –12 V outputs for the following purposes:

- Output voltage regulation.
- Over-voltage protection - provides shutdown if output voltage exceeds 1.1 to 1.2 times the rated output.
- Over-current protection - maximum output current has the following limits:
  - 1.1 to 1.8 times full load rating of +3.3 V output.
  - 1.1 to 1.8 times full load rating of +5 V output.
  - 1.25 to 2 times full load rating of +12 V and –12 V outputs.

Circuit protection

Additional internal circuitry protects the BPSM:

- Input dc reverse polarity protection, achieved by an input series diode.
- Thermal protection by automatic BPSM shutdown. Normal BPSM operation resumes after BPSM temperature returns to a safe level.
- A 10 Amp fuse is located near the backplane connector.

LED display

An active (Green) LED mounted on the front of the BPSM is on when all output voltages are present and within specified limits. A functional diagram is shown in Figure 4-7.

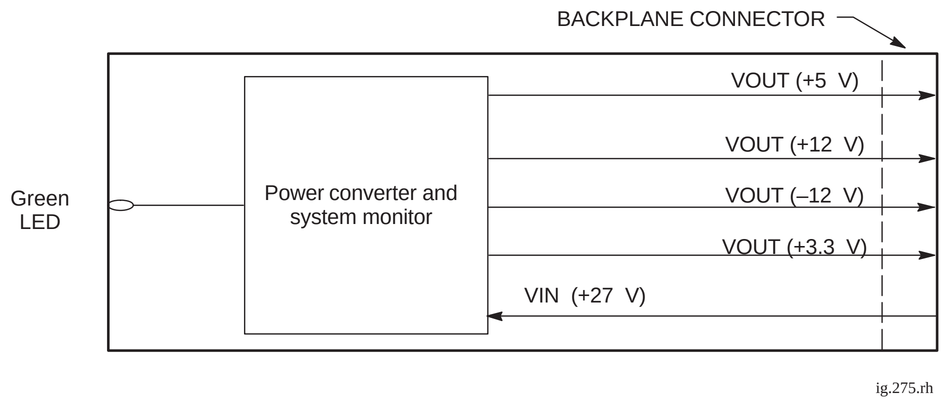


Figure 4-7 Functional diagram of BPSM

MOTOROLA

Chapter 5

RF modules

RF equipment detail

Overview of RF equipment

This chapter describes the functional operation of radio frequency (RF) modules used in the cabinet. All descriptions are presented at a block diagram level.

RF modules described

The following equipment is described:

- Compact Transceiver Unit **(CTU)**.
- Sectorized Universal Receiver Front-end **(SURF)** module (for receive path), both single and dual band variants.
- Several types of transmit block **(Tx block)**. Tx blocks are used for various configurations of transmit path, depending on number of antennas, CTUs and functionality, including potential shared receive path.
- Cavity combining block **CCB**, used to combine three CTU transmit paths in conditions where Synthesizer Frequency Hopping (SFH) is not required. Two CCBs can combine up to six CTU transmit paths on to a single Tx antenna.

RF general information and loopback test function

The following additional information is presented in this chapter:

- General definition of transmit and receive functions in this **RF equipment detail** section.
- An **RF overview and RF test function** description in the next section.
- An explanation of **CTU frequency hopping** in a section immediately after the CTU section.

These descriptions are intended to assist the reader in understanding the information on the RF modules.

RF specifications

All equipment meets or exceeds ETSI regulations. Frequency information is listed in the **Specifications** part of this manual.

Receive RF hardware

Receiver RF hardware consists of the SURF module and optional Tx block receive path, and the receive section of the CTU.

The SURF module provides bandpass filtering and low-noise amplification for up to three sectors, with diversity receive antenna signals, together with switching to CTUs.

CTU Rx role

The CTU provides the following receive functions:

- Receiver tuning (on a timeslot basis) to any receive channel frequency.
- Demodulation and equalization of the receive channel signal.
- Measurement of the received signal strength indication (RSSI) and signal quality.
- Recovery of received data from the demodulated radio channel.
- Channel decoding of the received data and processing of the recovered signal. Traffic data is passed on to the MCUF for routeing to the MSC.
- Digital interface to the SURF module, which controls selection by the SURF switch of the receive signals from the appropriate antenna.
- Comparison and processing of an additional receive path from a second diversity antenna input to compensate for multipath fading and interference.

Transmit (Tx) RF hardware

Transmit RF hardware consists of Tx blocks in appropriate combinations to meet requirements of antenna sharing for the transceivers.

CTU Tx role

The CTU provides the following transmit functions:

- Transmit tuning (on a timeslot basis) for generation of any transmit channel RF frequency.
- Encoding transmit data output.
- Digital modulation of transmit data onto the transmit radio channel signal.
- Final RF power amplification and output power level control of the transmit radio channel RF signal.
- When using a CCB, the output of control data to the CCB.
- Channel encoding of the data to be transmitted, interleaving signal and traffic channel data, as defined by ETSI.

Rx/Tx single antenna duplexing

Duplexers allow a single antenna to be used for both transmit and receive operations. Duplexers exist within several of the transmit blocks. Normally duplexed RF signals are used through one antenna, with a second receive antenna to provide diversity.

CAUTION	If a single antenna (non-diversity) is required, the duplex antenna RF receive cable from the transmit block must be connected to the RxA path at the SURF. Simply switching off diversity at the OMC-R without the correct SURF configuration will cause a loss of reception.

RF overview and RF test function

RF overview

This section explains the RF functional blocks and additional RF loopback test capability.

The terminology, functionality and optional capabilities are set out, as a basis for understanding more detailed descriptions in RF module sections of this chapter.

RF main component explanation

The following description should be read in conjunction with Figure 5-1.

The RF equipment consists of three main blocks:

- The CTU.
- The SURF module.
- The Tx block or alternatively CCBs.

CTU

The CTU can operate at 850 MHz, 900 MHz, 1800 MHz or 1900 MHz, depending on the BTS variant ordered. It can receive two inputs, RxA and RxB, from the SURF. These inputs are converted into digital voice/data. The two Rx signals provide diversity of the Rx function from the MS (uplink).

The CTU also generates a Tx data signal, translated from received digital voice/data, which is transmitted by cable to the Tx block for antenna transmission to the MS (downlink).

The third (middle) port provides an RF loopback test signal capability, for automatic transmission of RF test signals to the SURF.

SURF module

One of six variants of the SURF module can be installed in the Horizon*macro* indoor:

- Single band 850 MHz SURF.
- Single band 900 MHz SURF.
- Dual band 900 MHz SURF.
- Single band 1800 MHz SURF
- Dual band 1800 MHz SURF.
- Single band 1900 MHz SURF.

The single band SURF modules accept up to three pairs of antenna inputs, and the dual band SURF modules accept up to four pairs of antenna inputs. The SURF switches the inputs to the appropriate CTUs under the control of the database via the MCUF. There are two inputs to each CTU for Rx diversity.

The SURF also contains loopback test circuitry, connecting with a test signal from each CTU.

Tx block

There are up to three Tx blocks, each block serving two CTUs.

Tx blocks filter the transmit signal for the required Tx band. Tx blocks also use filters to enable the Rx frequency signal to be passed to the SURF, if one antenna is used for both Tx and Rx signals.

CCBs

Cavity combining blocks (CCBs) are an alternative to Tx blocks. CCBs combine up to three CTU transmit paths. Two CCBs can combine up to six CTU transmit paths. CCBs have no duplexing capability and must be connected to an antenna via an external high power duplexer (HPD). CCBs cannot be used with the GSM850 or PCS1900 BTS variants, or when SFH (see **CTU frequency Hopping**) is required.

RF loopback purpose

The loopback test function is primarily used to identify faults when the RF system has failed. The loopback test function enables a diagnostic capability at the OMC-R, by creating a test signal to identify if the fault is either:

- Software (that the OMC-R can correct).
- Particular hardware (CTU or SURF).

The result is a reduction in site assessment visits, and avoidance of unnecessary visits when hardware is functioning correctly.

NOTE	The RF loopback test feature available on the Horizon*macro*, is not available on previous generations of equipment.

RF loopback hardware

The RF loopback test function is essentially a hardware capability built into the CTU and the SURF. Software instructions activate the test hardware, to route test signals through the RF system.

RF loopback software operation

When installed with suitable software, GSR5 or later, the OMC-R can operate the loopback test functions, and receive the results of the tests.

Functional diagram of RF

Figure 5-1 shows the basic RF and loopback/VSWR test functions. For clarity, only one CTU and one Tx block is shown, and part of the SURF. CCBs could be used instead of Tx blocks.

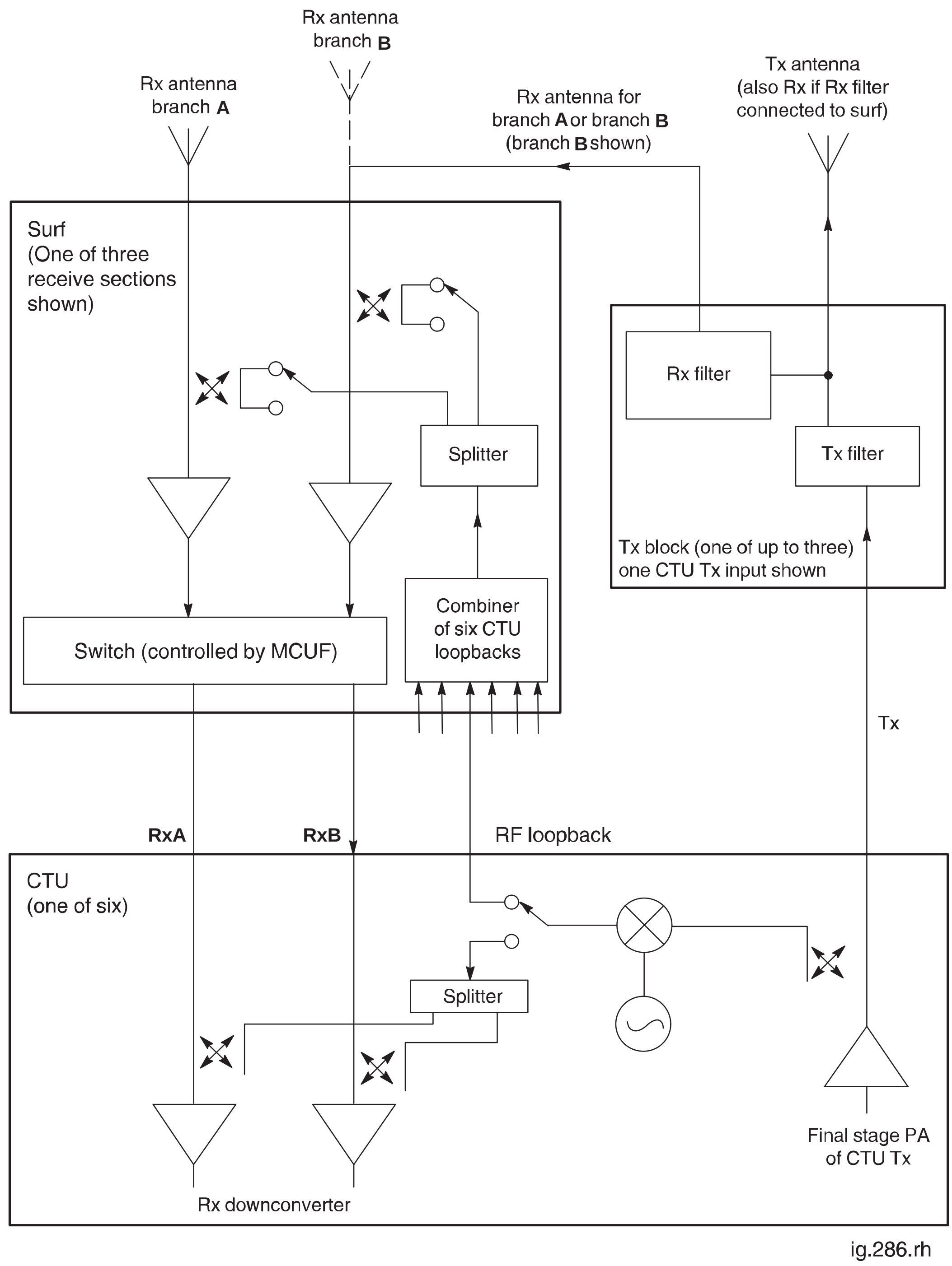


Figure 5-1 RF functional diagram

Description of RF test modes

The following description should be read in conjunction with Figure 5-1.

NOTE	The RF test capability described requires software load GSR5 or later.

The loopback test hardware picks up an attenuated signal by coupled link from the normal CTU transmit signal.

The signal is mixed down to the receive band for testing the Rx functionality of the SURF and CTU. Power to the loopback circuitry is automatically turned off when the radio is in normal operation.

SURF test mode

The loopback signal is injected into the antenna receive path of the SURF by coupled link. This tests the complete SURF and CTU Rx system path.

Test of CTU Rx circuitry

The loopback signal is injected directly internally into the Rx input of the CTU. This tests the receive portion of the CTU.

VSWR test mode

The test signal, at Rx frequency, is injected into the antenna port through coupled link on the SURF. Reflected power is monitored by the receive system to calculate VSWR. Detection of a high VSWR may indicate the presence of a cable or antenna fault.

CTU

Overview of CTU

This section provides the technical description of the compact transceiver unit (CTU).

NOTE	The CTU may be an 850 MHz, 900 MHz, 1800 MHz or a 1900 MHz transceiver, depending on requirements. The functionality of the CTU is the same for all variants.

The CTU:

- Generates the RF frequencies required to perform the transmit and receive functions.
- Contains the digital circuits required for eight timeslots of channel equalization, encoding and decoding, and transceiver control logic.

The CTU provides the air interface between a BSS and MSs, with the following features:

- Capability of diversity reception (input from two antennas) which improves the quality reception in the presence of multipath fading and interference.
- Frequency change on a timeslot basis for frequency hopping and equipment sharing.
- Transmit power control.

CTU Tx RF output specification

For Tx RF output, see *Technical Description: GSM-205-323* **Overview and specifications** .

Location and requirements

The CTU shelf is adjacent to the digital module shelf in the base of the cabinet.

The cabinet can contain six CTUs. A minimum of one CTU must be fitted in each cabinet.

CTU internal boards

The CTU is a single field replaceable unit (FRU), which contains:

- CTU transceiver (XCVR) board.
- Power amplifier (PA) board.
- Power supply unit.

Alarm reporting

The CTU status is displayed by LED indicators on the front panel, as shown in Figure 5-2, and detailed in Table 5-1. Major sub-systems, such as synthesizers and RF amplifiers, are monitored, with alarm signals as necessary.

Table 5-1 CTU front panel status indicators

Indicator LED	When the LED is	Then CTU
RADIO STATUS	OFF	Module off
	Flashing green	Code required or being loaded
	Green	Normal operational mode
	Flashing yellow	Test mode
	Yellow	Radio inhibited
	Red	Alarm condition
Transmit (Tx) STATUS	OFF	Transmitter is off
	Yellow	Transmitter is keyed on
RADIO STATUS AND TRANSMIT (Tx) STATUS	Both LEDs flashing rapidly	Non-volatile memory boot code upgrade (Do not remove power or reset – see CAUTION)

CAUTION	When both LEDs are flashing, the boot code is downloading into non-volatile memory for software upgrade. Power should not be removed, nor the cabinet reset, until downloading has been completed, as this will corrupt the non-volatile memory. If the boot code is corrupted, contact Motorola Customer Network Resolution Centre requesting the boot code restoration procedure and the appropriate boot code file.

View of a CTU

Figure 5-2 shows the CTU with main features identified.

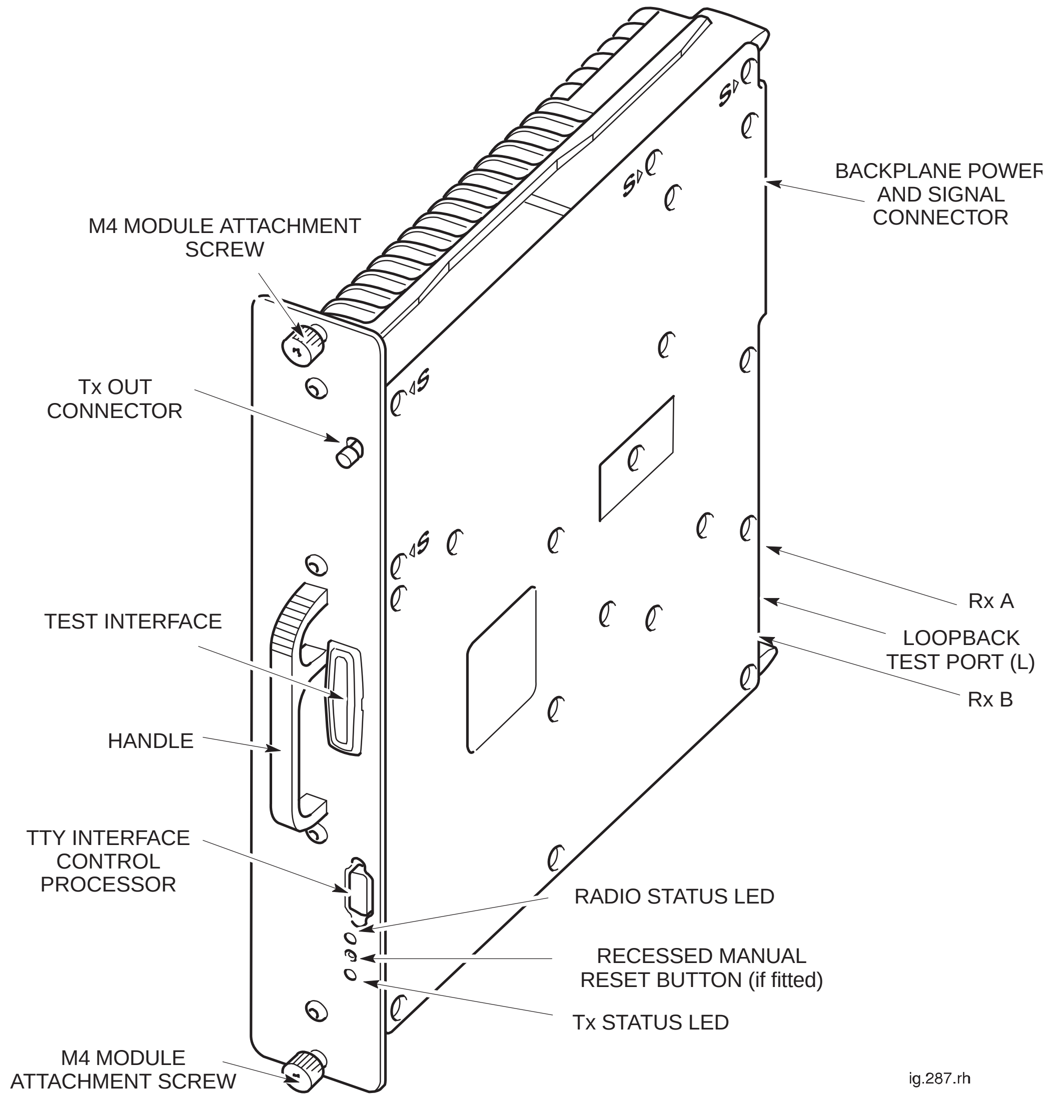


Figure 5-2 View of CTU showing main external features

CTU connectors and reset

The TTY RS-232 serial port has three serial links onto the 9-way connector:

- Radio subsystem (RSS).
- Equalizer and control processor (EQCP).
- Channel coder control processor (CCCP).

A test interface port on the CTU front panel provides access to critical test points for factory alignment and maintenance.

Pressing the reset push button generates a hard reset of the processor, initiating a normal power-up. Later versions of the CTU (mid 2001 onward) have no reset button, reset is acheived by operation of the appproriate CTU circuit breaker on the CBM.

Figure 5-3 shows the front panel and Table 5-2 lists connector functions.

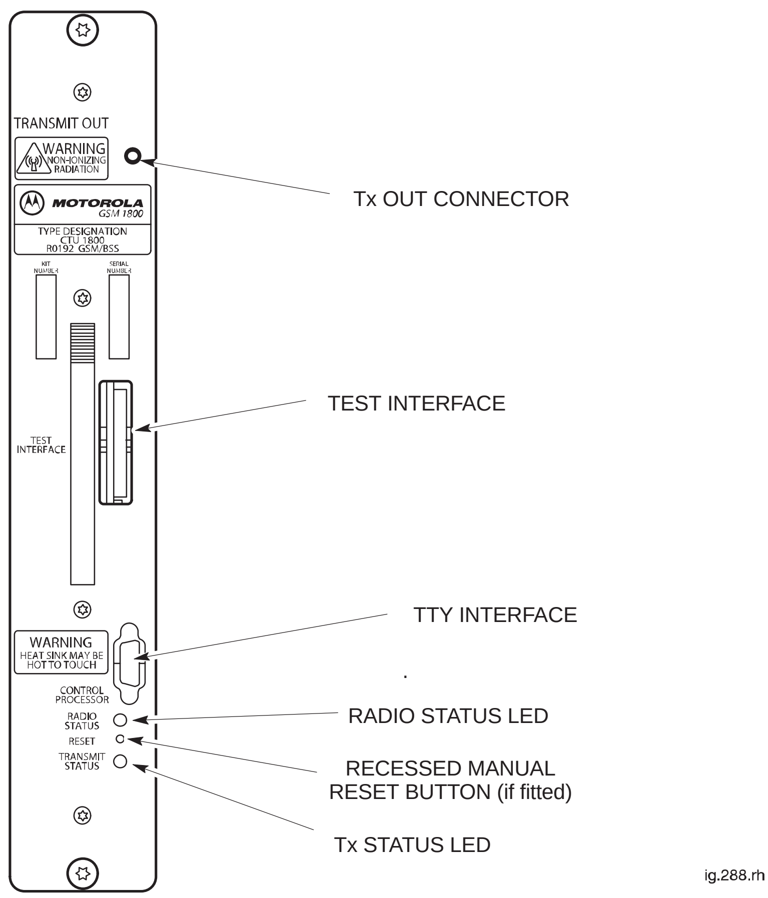


Figure 5-3 CTU front panel

Table 5-2 CTU front panel connectors

Front panel legend	Function	Connection to
TRANSMIT OUT	Transmitter RF output	Tx Block
TTY INTERFACE	Test access to processor	Three RS-232s
TEST INTERFACE	Factory use	Test equipment

CTU input/output diagram

Figure 5-4 shows a block diagram of the CTU with the inputs/outputs annotated.

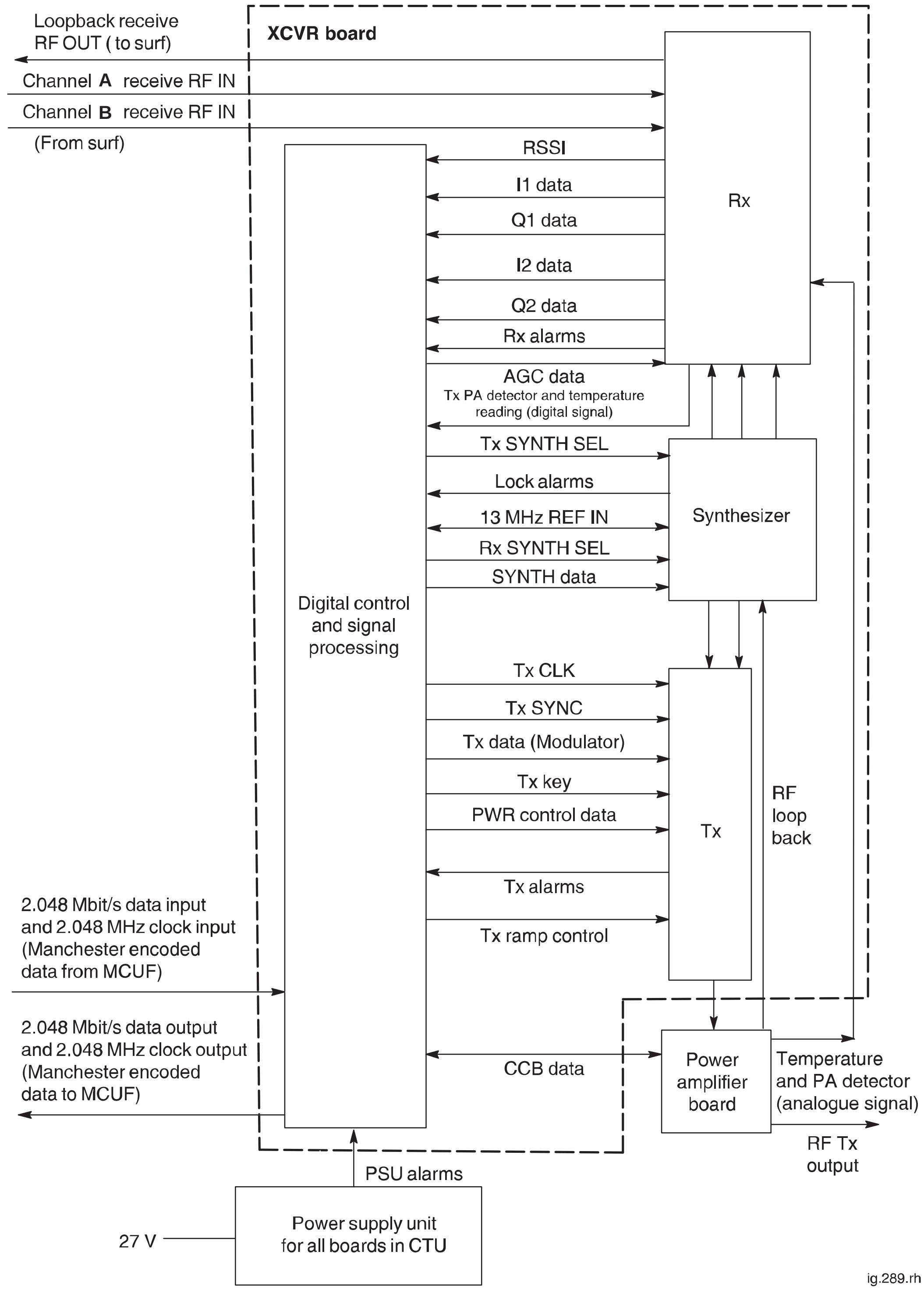


Figure 5-4 CTU block diagram

CTU Tx connector

The CTU Tx connector is a short SMA to SMA link to the base of the appropriate Tx block or feedthrough plate.

NOTE	The Tx cable has a 90° SMA connector at one end and a straight SMA connector at the other end. The 90° end is designed for connection to the Tx port of a CTU.

CTU Rx function

The receiver part of the CTU accepts two amplified and filtered receive antenna signals from the SURF module. These two signals are applied to inputs (branch A and branch B) of the CTU transceiver board. Figure 5-5 shows a CTU receiver functional diagram for one branch.

The input from the SURF module is filtered, amplified and down converted to ensure the signal level and frequency range are correct for the next stage.

RSSI data (applicable only to GPRS and RACH bursts) is used for automatic gain control (AGC) to ensure signal strength is correct for the intermediate frequency (IF) stage.

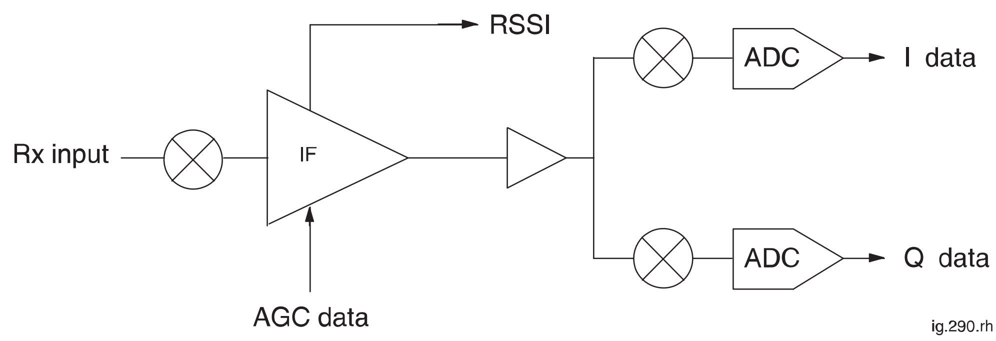


Figure 5-5 CTU receiver functional diagram for one branch

The primary function of the IF is to filter and amplify the incoming signal.

The path is demodulated into quadrature signals and filtered by baseband analogue filters. These signals are then digitized (I1/I2 data and Q1/Q2 data) and made available to the equalizer for the purposes of receive synchronization and data recovery.

CTU Tx function

IQ modulator

Figure 5-6 shows a functional diagram of the IQ modulator. IQ modulator data for eight timeslot channels is applied to the modulator state machine. This data is encoded, serial-to-parallel converted and split into quadrature components. The quadrature components are D/A converted and applied to a quadrature modulator to create a Gaussian minimum shift keyed (GMSK) carrier at an intermediate frequency (IF).

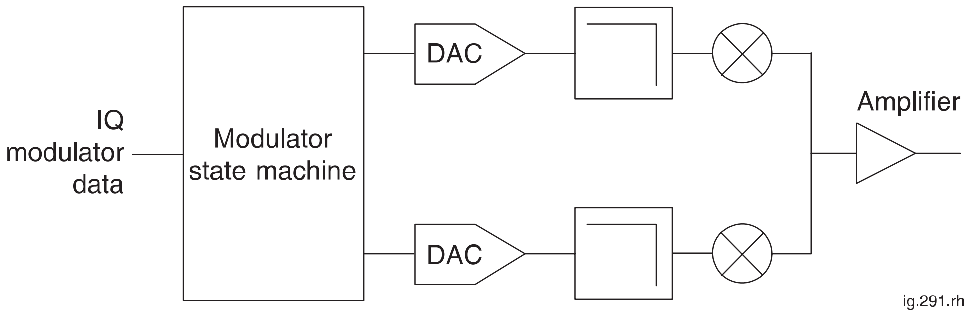


Figure 5-6 IQ modulator functional diagram

IF and exciter stages

Figure 5-7 shows a functional diagram of the IF and exciter stages. The low level modulated carrier is applied to a combination of analogue and digital attenuators for RF power control. The power control data comes from the digital sections of the XCVR. The output of the power control elements is further amplified by an exciter chain to drive the power amplifier.

The GMSK modulated IF is filtered and applied to the input of a controlled gain amplifier for transmitter pulse sloping (ramped). The ramped signal is filtered and then mixed with the main transmitter injection and is upconverted to the final transmit channel frequency.

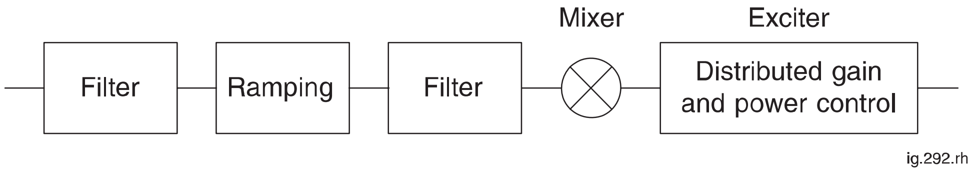


Figure 5-7 IF and exciter functional diagram

Power amplifier board

Figure 5-8 shows a functional diagram of the power amplifier (PA). The PA board provides amplification and a forward power detector. The isolator protects the PA board amplifiers. The detected output is used to adjust the final CTU RF power output level by the digital sections of the XCVR.

The PA board consists of six functional blocks:

- RF power amplifier.
- RF forward power directional coupler.
- RF forward power detector.
- Temperature sensor.
- CCB control.
- RF loopback circuit.

The isolator performs two functions:

- Isolates multiple transmitters to reduce intermodulation distortion.
- Protects the RF power amplifier from possible damage resulting from load mismatches.

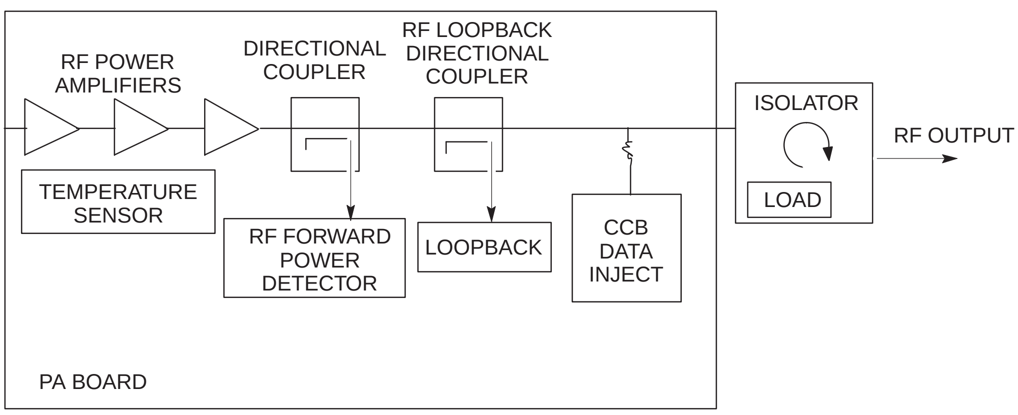


Figure 5-8 Power amplifier board functional diagram

CTU digital processing and control functions

The CTU digital processing and control function provides control and RF processing for that CTU. These functions include:

- 2.048 Mbit/s links which interface with up to two MCUFs for redundancy.
- A software processing platform for the radio sub system (RSS)
- A digital signal processor (DSP) for radio control and channel equalization (EQCP).
- A DSP for channel coding, data routeing, and baseband hopping (CCCP).
- Control of RF systems: diversity receiver, transmitter, and power amplifier.
- Alarm monitoring of internal devices and external cabinet elements.
- Control of external modules including CCBs, and the SURF.
- Maintenance ports for processor TTY, test point sub system, and CTU test connections.

Figure 5-9 shows a CTU digital functional diagram.

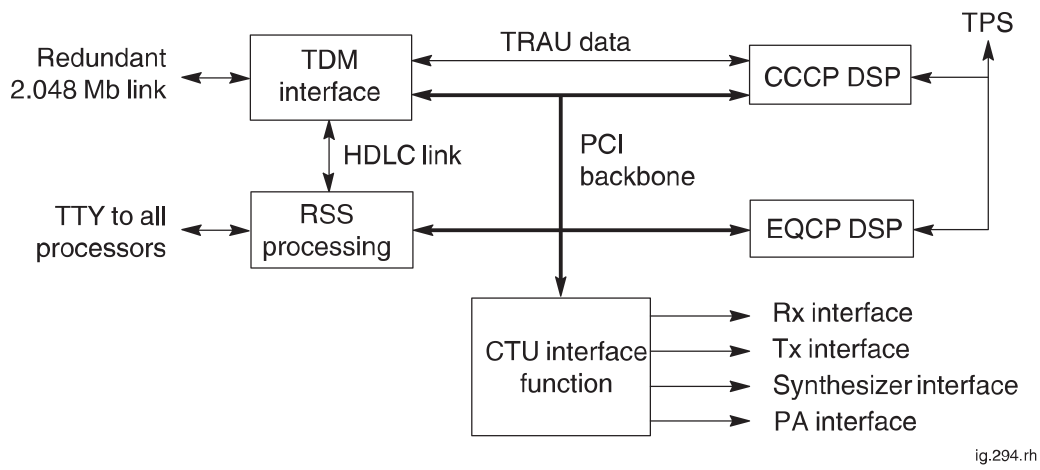


Figure 5-9 CTU digital functional diagram

2 Mbit/s TDM links

The CTU interfaces to the redundant MCUF are by 2.048 Mbit/s links on the backplane (or FMUX modules in extension cabinets). These links are Manchester encoded, thus providing both clock and data in a single connection. The recovered clock provides a frequency reference for the CTU. The Rx and Tx circuitry supports FMUX fibre optic lengths of up to 1 km.

The TDM links are formatted into 32 x 64 kbit/s timeslots to provide:

- Downlink and uplink TRAU speech data.
- Downlink baseband hopping data to be routed to/from other CTUs.
- Cell site air interface synchronization.
- HDLC channel for control information between RSS and MCUF.
- Baseband routeing information to indicate source of downlink baseband hopping data.

RSS processor

The RSS processor function communicates with:

- The MCUF via dedicated 64 kbit/s timeslots in the TDM link.
- The rest of the digital control functions by the peripheral communications interface (PCI) bus.
- A dual port interface for communication with the CCCP.

A TTY interface is also provided for user support.

The RSS processor memory includes flash EPROM and 8 Mbytes of DRAM. Flash EPROM is used for code storage.

EQCP processor

The EQCP processor handles all radio control functions and the channel equalizer function. The EQCP controls the Rx and Tx function via the CTU control function on a per timeslot basis. These EQCP functions include:

- Alarm management.
- Downlink burst building and modulator control.
- Transmitter power control.
- Synthesizer channel control.
- RF frequency hopping.
- Receiver front end and remote tune combiner control.
- Uplink synchronization and equalization.
- Diversity receiver control.
- Receiver automatic gain control (AGC).
- Receive signal strength (RXLEV) calculation.
- Timing advance calculation.
- Support of front panel indicators.

The EQCP communicates with the rest of the digital control functions via the common PCI bus interface. A TTY interface is provided for radio level calibration, system monitoring, and CTU level test.

CCCP processor

The CCCP processor handles all the GSM specified layer 1 channel encoding and decoding functions for speech and control data associated with the air interface. In addition, it manages the routeing of TRAU frames and baseband hopping (BBH) data, via the TDM interface, to and from the MCUF. The CCCP functions include:

- Uplink channel decoding.
- Downlink channel encoding.
- GSM specified encryption algorithms.
- Baseband frequency hopping (not supported in GSM850 or PCS1900 BTS variants).
- TRAU frame collection and synchronization.
- Alarms management.

The CCCP communicates with the rest of the digital control functions via the common PCI bus interface. A dual port RAM (DPR) is also used in the downlink direction for communications from RSS. In addition to the TDM function, a serial link is provided to support uplink and downlink TRAU data.

CTU interface function

The CTU interface function provides the air interface timing and radio control circuitry required for Rx (uplink) and Tx (downlink) control functions. A common PCI bus allows all the processing elements including the RSS processor, EQCP, and CCCP to communicate with the various CTU functions. The CTU interface includes:

- Master GSM air interface timing function.
- Independent Rx gain control interface for each diversity receiver branch.
- Baseband Rx data interface for each diversity receiver branch.
- Receiver front end and CCB control.
- Tx data interface including GMSK modulator which provides baseband data to the transmitter.
- Tx and power amplifier power control interface.
- Rx and Tx frequency synthesizer control which supports RF frequency hopping.
- CTU and cabinet alarm data collection.
- Alarms sampling and multiplexing.

CTU uplink/downlink

Downlink traffic data flow

Downlink TRAU data from the MCUF is received by the TDM function then routed to the CCCP function where it is encoded (cyclic, block, and convolutional), interleaved, and encrypted to GSM recommendations. Signalling messages are also received from the RSS processor and encoded. These traffic and control messages are built into air interface frames and then routed back to the MCUF via the TDM function for baseband hopping. The CCCP calculates a BBH routeing word, which informs the MCUF of the radio link to be the source of its post hopped data. The post hopped data is then once again sent back down to the appropriate CTU where it is received by the TDM function and passed to the EQCP function. The EQCP inserts midamble and guard bits to the data bits and forwards the data on to the modulator for transmission. The EQCP also programs the CTU for the correct RF channel and transmit power level for this transmitted burst.

Uplink traffic data flow

Baseband uplink traffic and control data messages are received by the CTU interface function and sent to the EQCP where they are equalized. The EQCP also calculates timing advance and RXLEV information, which is forwarded to the RSS process. The recovered data bits are forwarded into the CCCP process, where it is de-interleaved, decoded, and decrypted into TRAU frames. Control messages are passed to the RSS function, while TRAU frames are sent to the MCUF via the TDM interface.

CTU frequency hopping

Overview of CTU frequency hopping

The CTU supports two types of frequency hopping, synthesizer frequency hopping (SFH) and baseband frequency hopping (BBH). This section provides an explanation of both types. In either type, the MS switches channels after every transmit/receive (Tx/Rx) burst pair. The difference between SFH and BBH is in the method by which channel switching is achieved at the BTS.

Synthesizer frequency hopping (SFH)

SFH uses the frequency agility of the CTU to change Tx/Rx frequency on any timeslot (TS), without affecting other timeslots.

SFH can only be used with wideband combining.

With SFH, each TS is allocated a number of frequencies (max 64) over which to perform the hopping. When determining the hardware requirement for CTUs using SFH the following rules apply:

- A minimum of two CTUs are required per cell due to BCCH requirements. Timeslot 0 of CTU 0 is used for the BCCH carrier as shown in Figure 5-10. CTU 0 cannot use SFH. Only CTU 1 and additional CTUs can use SFH.
- Hopping through the BCCH carrier (using the BCCH carrier frequency as one of the SFH frequencies) is permitted except for timeslot 0. However, the corresponding timeslot for the BCCH CTU will be switched off for this period.

Figure 5-10 shows the minimum SFH requirement.

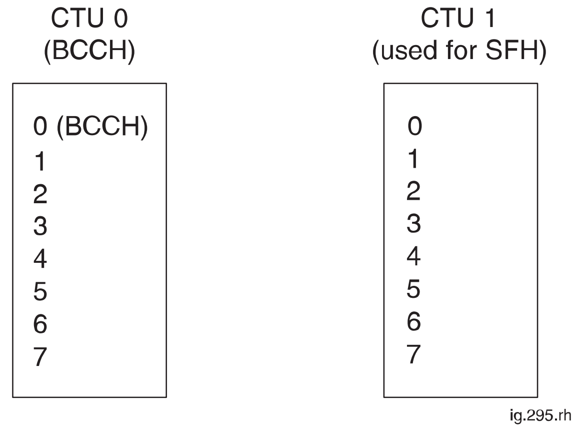


Figure 5-10 Minimum SFH requirement

SFH example not through BCCH

CTU 0

In this example of SFH, CTU 0 provides the BCCH and cannot frequency hop. CTU 0 has to transmit at maximum cell site power to meet the BCCH requirement. Timeslots are used as shown below:

- TS 0 = Combined BCCH TS (BCCH/CCCH/DCCH). Transmitted at maximum cell site power.
- TS 1-7 = Traffic channels, all non-hopping. All traffic channels transmit at maximum cell site power.

CTU 1 and additional CTUs

CTU 1 and any additional CTUs provide SFH traffic channels as shown below:

- TS 0-7 = Frequency hopping traffic channels. The frequency allocated to the BCCH of CTU 0 cannot be used for frequency hopping purposes.

SFH example hopping through BCCH carrier

CTU 0

In this example of SFH, CTU 0 provides the BCCH and cannot frequency hop. CTU 0 has to transmit at maximum cell site power to meet the BCCH requirement. Timeslots are used as shown below:

- TS 0 = Combined BCCH timeslot (BCCH/CCCH/DCCH). Transmitted at maximum cell site power.
- TS 1-7 = Unused timeslots transmitting dummy bursts for BCCH. All channels transmit at maximum cell site power.

CTU 1 and additional CTUs

CTU 1 and any additional CTUs provide SFH traffic channels as shown below:

- TS 0 = Frequency hopping traffic channel, but prevented from using BCCH frequency.
- TS 1-7 =Frequency hopping traffic channels, using all available frequencies, including BCCH.

When the SFH selects the BCCH frequency, the CTU transmits at maximum cell site power and the corresponding TS on CTU 0 is switched off for this period.

Baseband frequency hopping (BBH)

BBH requires all eight timeslots of the CTU Tx (downlink) at the same frequency. In the Rx (uplink) direction, the frequency agility of the CTU is used to change timeslot frequencies on a timeslot basis. The BCCH frequency is always transmitted at maximum cell site power.

BBH can use either Tx blocks or CCB Tx combining equipment. The main reason for using BBH instead of SFH is to enable frequency hopping when using CCBs, because the mechanical tuning of CCBs is too slow for SFH.

The number of CTUs required to support BBH is equal to the number of frequencies used.

NOTE	BBH is not supported on GSM850 or PCS1900 BTSs.

BBH example

In Figure 5-11 MSs A, B and C are using TS 5 of CTUs 0, 1 and 2 respectively.

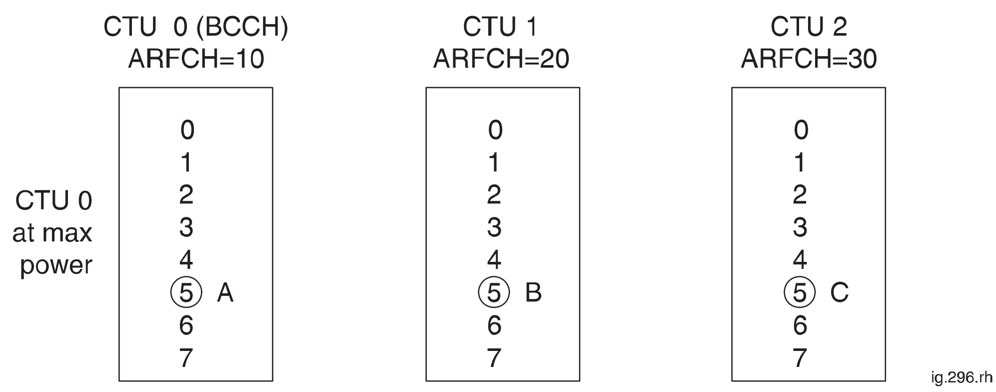


Figure 5-11 Diagram of BBH example using three CTUs

If the MSs are using cyclic hopping across ARFCNs 10, 20, 30 (an example using EGSM900), each MS must transmit a burst of information each TDMA frame (4.615 ms) on a different frequency. The data for the burst is received by each CTU in turn (ARFCN 10, 20, 30), as shown in Table 5-3.

Table 5-3 BBH sequence example (EGSM900)

Burst Sequence Steps	CTU 0		CTU 1		CTU 2	
	Tx	Rx	Tx	Rx	Tx	Rx
1	A_{10}	A_{10}	B_{20}	B_{20}	C_{30}	C_{30}
2	C_{10}	A_{20}	A_{20}	B_{30}	B_{30}	C_{10}
3	B_{10}	A_{30}	C_{20}	B_{10}	A_{30}	C_{20}
4 (same as 1)	A_{10}	A_{10}	B_{20}	B_{20}	C_{30}	C_{30}
5 (same as 2)	C_{10}	A_{20}	A_{20}	B_{30}	B_{30}	C_{10}
6 (same as 3)	B_{10}	A_{30}	C_{20}	B_{10}	A_{30}	C_{20}

In the uplink direction the controlling CTU (for example CTU 0 for MS A in Figure 5-11) tunes TS 5 in accordance with the frequency expected from the MS for that particular burst.

Transmit

The transmit is described by the following, as shown in Figure 5-12:

1. Traffic data from the network is passed through the NIU to the MCUF. Within the MCUF an ASIC switches the data to CTU0 (the dedicated CTU for this particular MS call example).
2. The CTU, having processed the data (channel coding, interleaving, encryption and routeing information) then passes the data back to the ASIC.
3. The ASIC follows the BBH routeing information to direct the data to the next Tx CTU in the sequence of Table 5-3.

NOTE	BBH differs from normal and SFH CTU Tx procedures, in that the data is directed to CTUs in a cyclic sequence at stage 3. Without BBH, stage 3 always routes data to the original CTU.

Figure 5-12 shows a schematic diagram of an example of base band hopping.

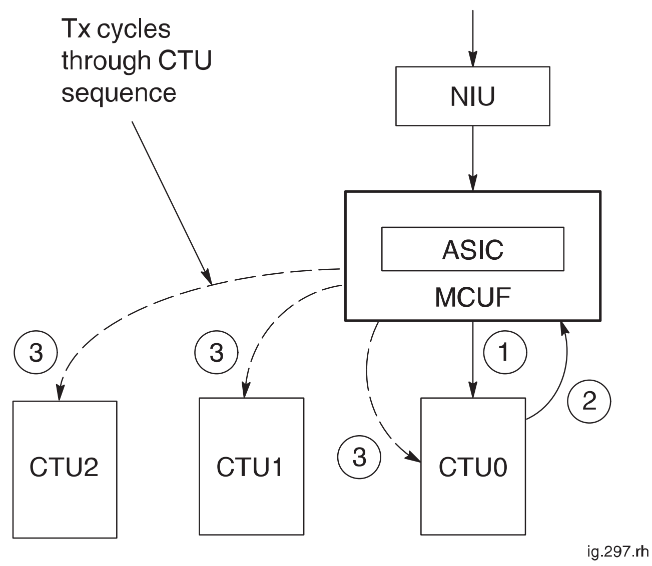


Figure 5-12 Schematic of BBH example

Receive

Data from the MS is received by one CTU allocated to that MS (in this case CTU0). The CTU will synthesize hop to the Rx signal. This ensures that the handover and equalizers within only one CTU will be connected to a particular MS.

SURF module

SURF module overview

The sectorized universal receiver front end (SURF) module is located in a slot at the rear of the cabinet top panel. Three connectors on the underside of the module connect to the SURF harness which provides connectivity to up to six compact transceiver units (CTUs). Antenna connections are located on the top of the unit.

There are six types of SURF module available for the Horizon*macro* indoor BTS, depending on the frequency variant:

- 850 (MHz) single band SURF.
- 900 (MHz) single band SURF.
- 900 (MHz) dual band SURF.
- 1800 (MHz) single band SURF.
- 1800 (MHz) dual band SURF.
- 1900 (MHz) single band SURF.

The single band SURFs contains three amplifier sections for connection to three pairs of receive antenna inputs providing reception at the appropriate frequency.

The 900 dual band SURF contains three amplifier sections for connection to three pairs of antennas providing 900 MHz reception and, being dual band, a further amplifier section for connection to a pair of 1800 MHz receive antennas.

The 1800 dual band SURF similarly contains three amplifier sections for connection to three pairs of antennas providing 1800 MHz reception and a further amplifier section for connection to a pair of 900 MHz receive antennas.

Each amplifier section provides two receive outputs which may be directed to any of the six CTUs, by the switch section. There are three connections to each CTU; RxA, RxB and loopback test (L).

The two receive outputs from amplifier 0 are split and may be used as extensions to other cabinets if required. These act as extended antenna connections from antenna 0. The extension cables are connected to the receive antenna connection ports on the SURF of the extension cabinet (which is able to respond to each amplified signal as if it were a normal antenna input).

Single band SURF module view

Figure 5-13 shows the view of a single band SURF module with features identified.

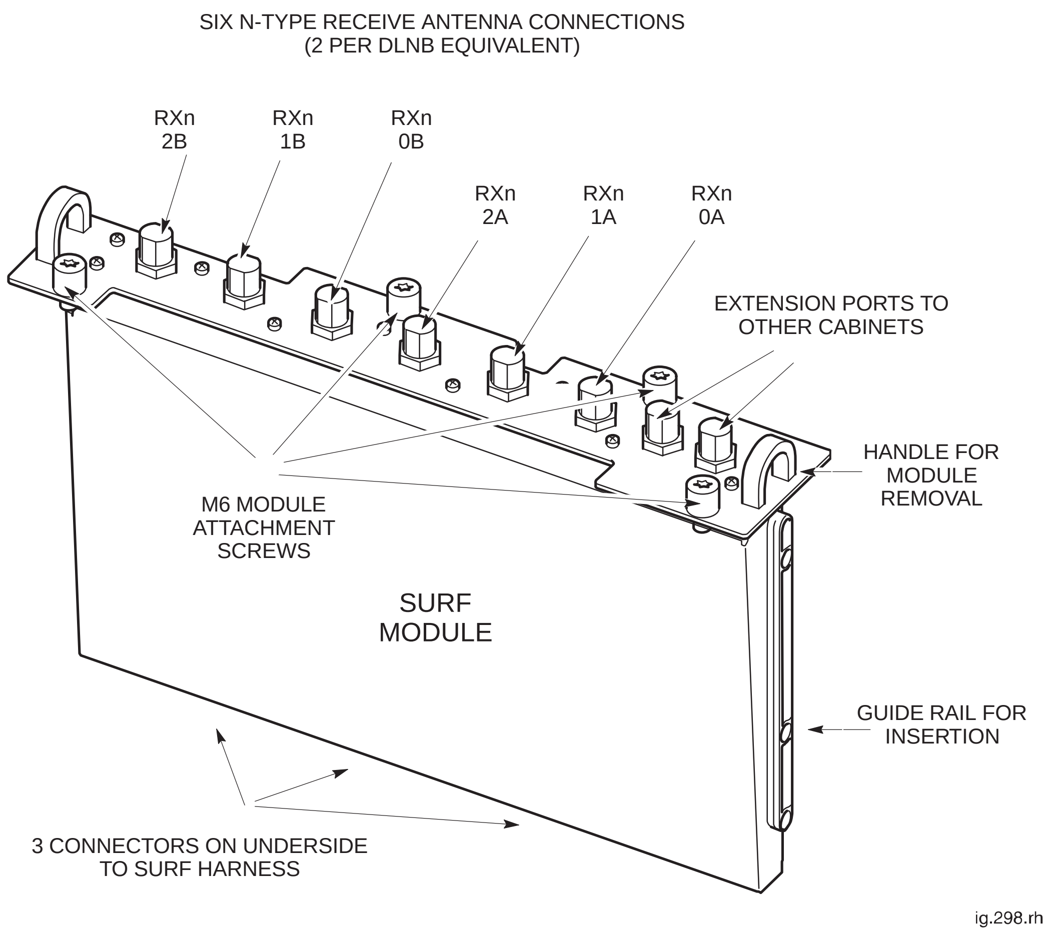


Figure 5-13 View of single band SURF module with features identified

NOTE	Where **RXn** appears in Figure 5-13, the **n** may be 850, 900, 1800 or 1900, depending on the frequency of the SURF module.

Functional description of the single band SURF

The single band SURF provides front end filtering, amplification, and matrix control of the RF receive signal between the antenna and the CTU

The single band SURF functional sections (Figure 5-14) consist of loopback, filtering, amplification, splitting, digital processing and power selection.

Each section is duplicated for the second diversity path except for the digital and dc power section which is shared by the two diversity paths. There are three antenna pair inputs (ANT 0, ANT 1 and ANT 2) for each of the two diversity branches (Branch A and Branch B). There are six outputs to the CTU for each of the two diversity branches as well as one input from the CTU for the loopback (LPBK) signal. There is also an output for an expansion cabinet for ANT 0 on each branch.

The software database must be configured at the OMC-R to accept CTUs of the same frequency as the single band SURF module in the cabinet.

The digital section switch, under the control of the database (signalled through the MCUF and CTUs), routes the six amplifier outputs to the appropriate CTUs. The digital and power supply section is also responsible for loopback switch control, manual overrides, alarms and dc voltages.

The RF loopback test function is described in **RF overview and RF test function** in this chapter.

Single band SURF functional diagram

Figure 5-14 shows a functional diagram of the single band SURF module.

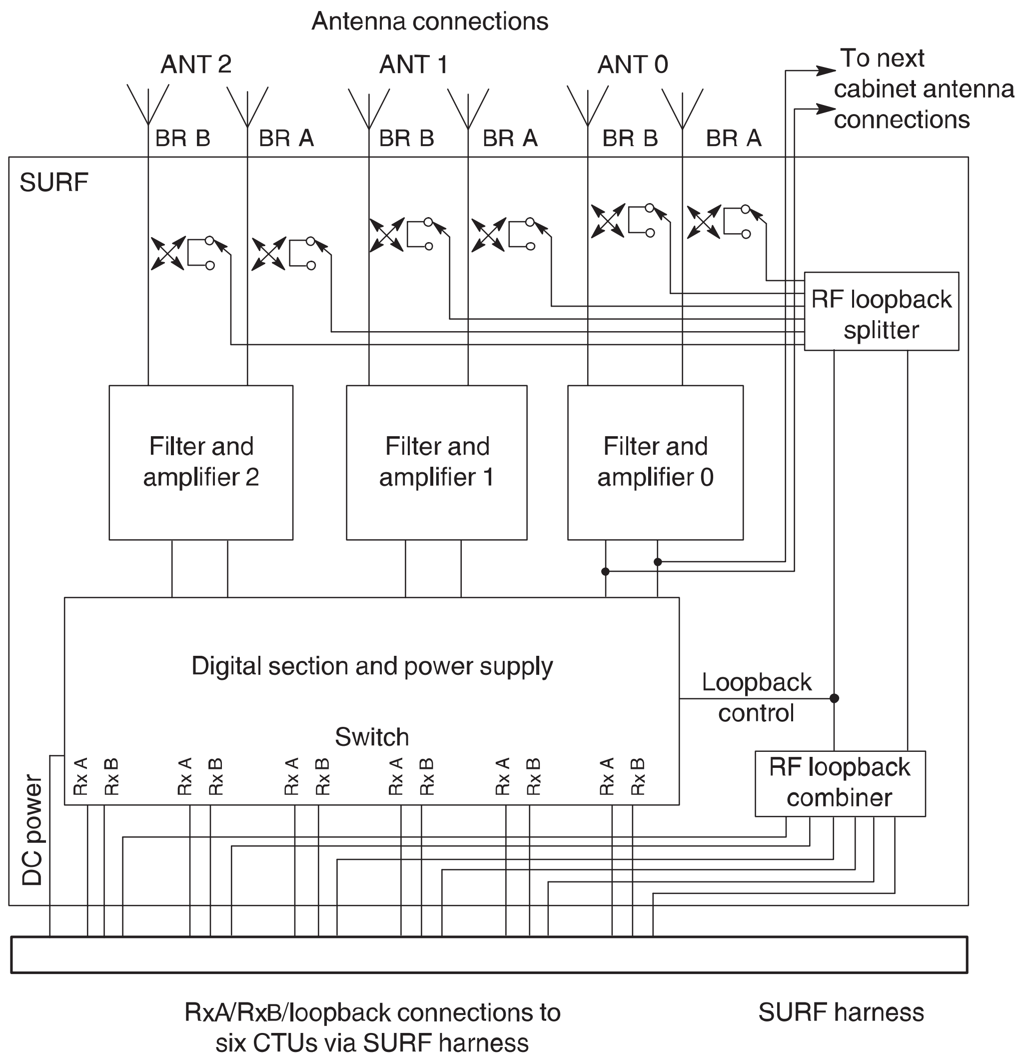


Figure 5-14 Functional diagram of the single band SURF module

Dual band SURF module view

Figure 5-15 shows a view of a dual band SURF module with features identified, both the 900 and 1800 variants are similar in appearance.

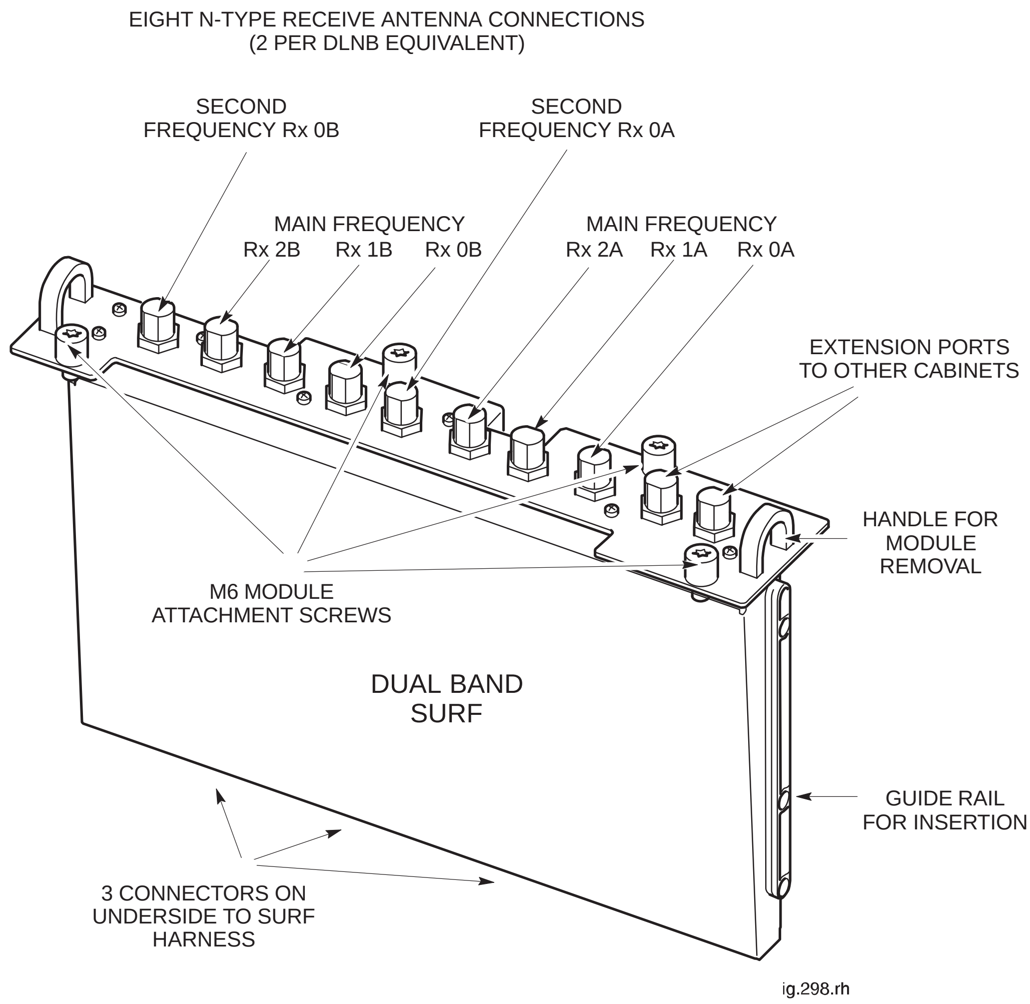


Figure 5-15 View of dual band SURF module with features identified

Functional description of dual band SURF modules

The dual band SURF modules provide front end filtering, amplification, and matrix control of the RF receive signal between the antenna and the CTU. The dual band SURFs each have three antenna pair connections providing main frequency reception, and one antenna pair providing reception on a second frequency. The two types of dual band (DB) SURF enable 900 CTUs to be mixed with 1800 CTUs in any combination, up to the maximum total of six CTUs per cabinet.

The software database must be configured at the OMC-R to accept 1800 CTUs and 900 CTUs in the appropriate cabinet locations.

The dual band SURF functional sections (Figure 5-16) consist of loopback, filtering, amplification, splitting, digital processing and power selection.

Each section is duplicated for the second diversity path except for the digital and dc power section which is shared by the two diversity paths. There are four antenna pair inputs (ANT 0, ANT 1, ANT 2 and ANT DB) for each of the two diversity branches (Branch A and Branch B). There are six outputs to the CTU for each of the two diversity branches as well as one input from the CTU for the loopback (LPBK) signal. There is also an output for an expansion cabinet for ANT 0 on each branch.

Digital codes are transmitted from the 900 CTUs and 1800 CTUs to the digital section. The digital codes are dissimilar in order that 900 or 1800 CTUs can be recognized and appropriate switching can be made to required antenna for transmission and reception.

The digital and power supply section is also responsible for loopback switch control, manual overrides, alarms and dc voltages.

The RF loopback test function is described in **RF overview and RF test function** in this chapter.

Dual band SURF functional diagram

Figure 5-16 shows a functional diagram of the dual band SURF module.

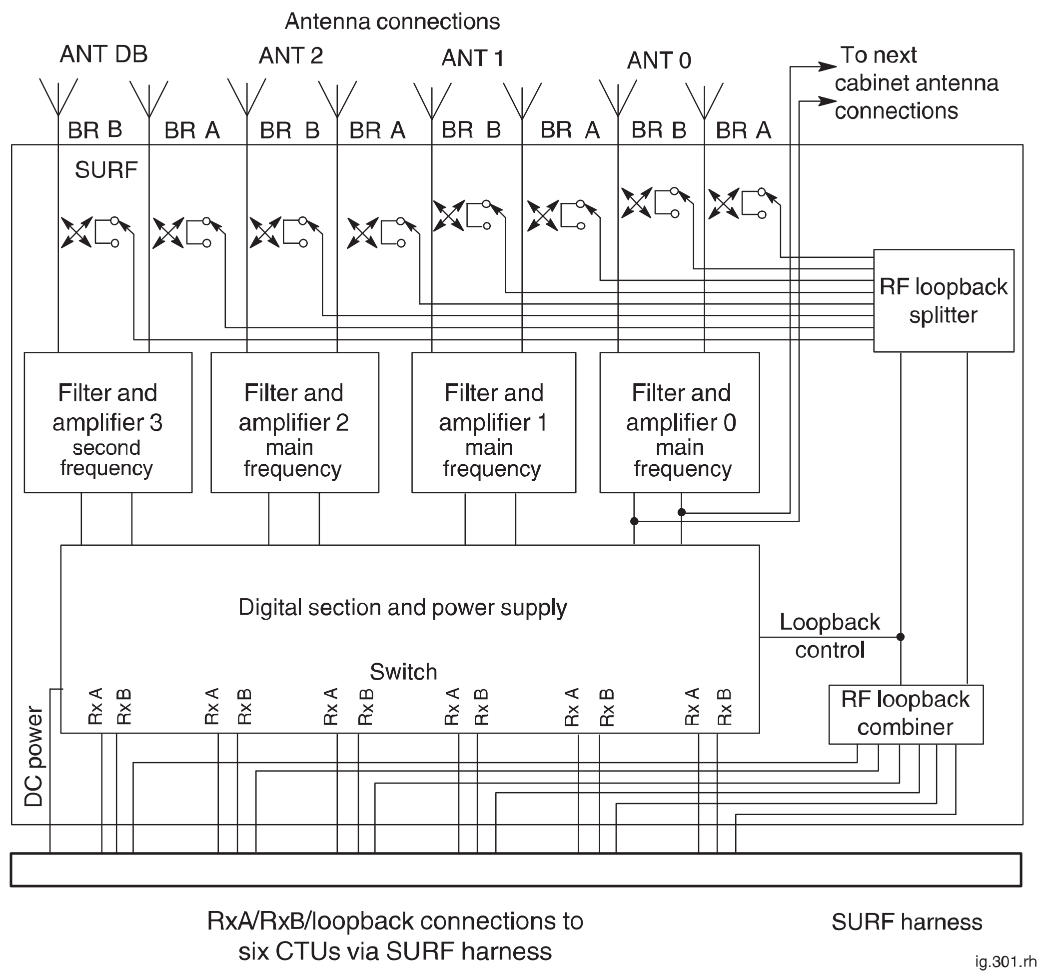


Figure 5-16 Functional diagram of the dual band SURF module

Tx blocks overview

Introduction to transmit blocks

Transmit (Tx) blocks are located in three positions in the basket above the CTUs. There are four types of transmit (Tx) blocks, three of which are available as 850, 900, 1800 or 1900 variants, and one dual band variant (for use with 900 MHz or 1800 MHz BTSs only).

CAUTION	Unused Tx block locations must be covered with a blanking plate for correct air flow and EMC shielding.

- **TDF (850, 900, 1800 or 1900)** = Twin duplexed filter.
- **Dual band TDF (900/1800)** = Dual band twin duplexed filter.
- **DCF (850, 900, 1800 or 1900)** = Duplexed combining bandpass filter.
- **DDF (850, 900, 1800 or 1900)** = Dual-stage duplexed combining filter.

These Tx blocks are cooled by airflow underneath. The DDF has fins, whereas the TDF, dual band TDF and DCF do not.

Three types of plate can be located in the basket, one as blanking plate and two to interface CTU Tx cables:

- **Blanking plate**. This ensures proper air flow and EMI shielding for an unused basket Tx Block location.
- **Feedthrough plate**. This converts two SMA connectors to two N-type connectors, used for connecting Tx cables to CCBs or DDFs.
- **Hybrid combining unit (HCU)**. This combines two SMA connectors to one N-type, enabling two additional CTUs to be connected to a DDF.

One type of Tx unit is installed in the stacking bracket, and is connected to three CTUs:

- **CCB** = Cavity Combining Block.

Two CCBs are required for the six CTUs of a filled cabinet. The CCB has no duplexing capability and, if a single Rx/Tx antenna is used, connection must be via an external high power duplexer.

CCBs are not currently available for use with the 850 MHz or 1900 MHz BTS variants.

Screw retention in Tx block locations

The plates are attached to the base of the top panel basket using six M4 screws.

Tx blocks are attached to the top surface of the top panel using two M6 screws.

To ensure correct EMC shielding and general containment, it is important to ensure that all Tx block/plate screw locations have a screw in place and tightened to correct torque.

View of basket for Tx blocks

Figure 5-17 shows the top panel and basket which holds the Tx blocks.

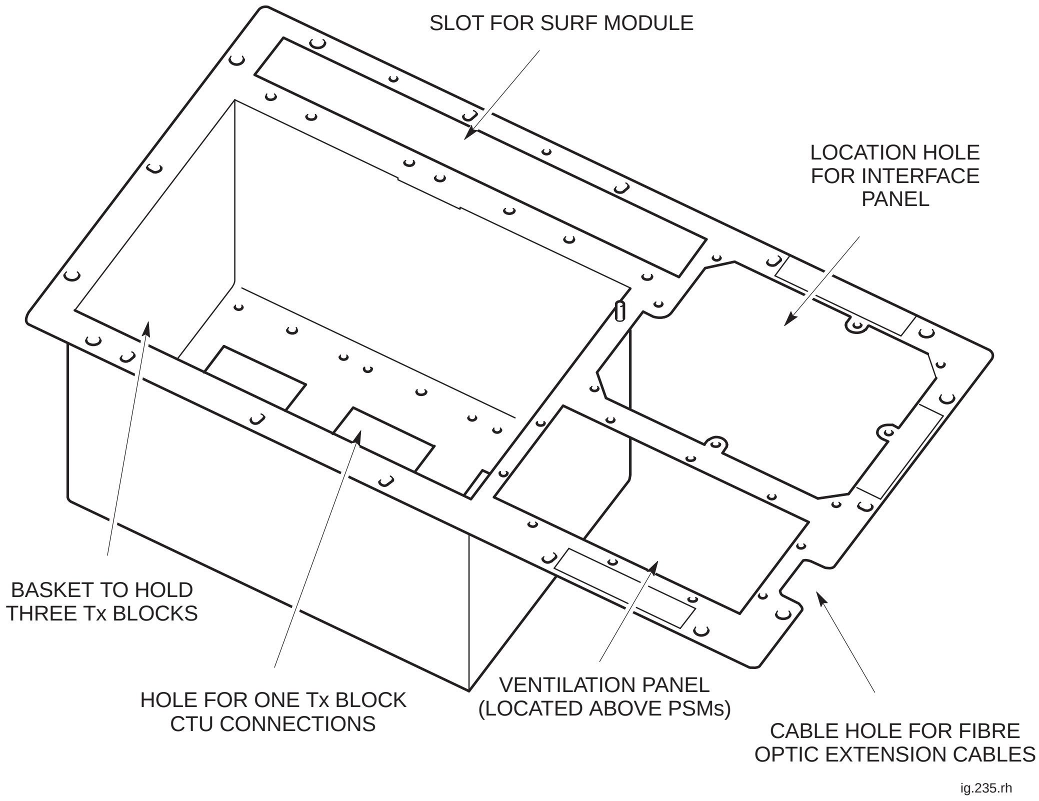


Figure 5-17 View of top panel showing Tx block basket

Transmit block connectors

The transmit block connectors are of the following types:

- SMA connectors for cables to transceivers.
- 7/16 connectors to antennas.
- N-type duplex receive connectors, also used by HCU, CCB inputs and feedthrough plate.

The SMA connectors are underneath the unit (for ease of connection to the CTUs), and the other connectors on top, as shown in Figure 5-18.

NOTE	All unused SMA inputs to DCF, DDF and HCU modules must be fitted with 50 ohm load terminations.

View of Tx block connectors

Figure 5-18 shows a typical Tx block with connector locations.

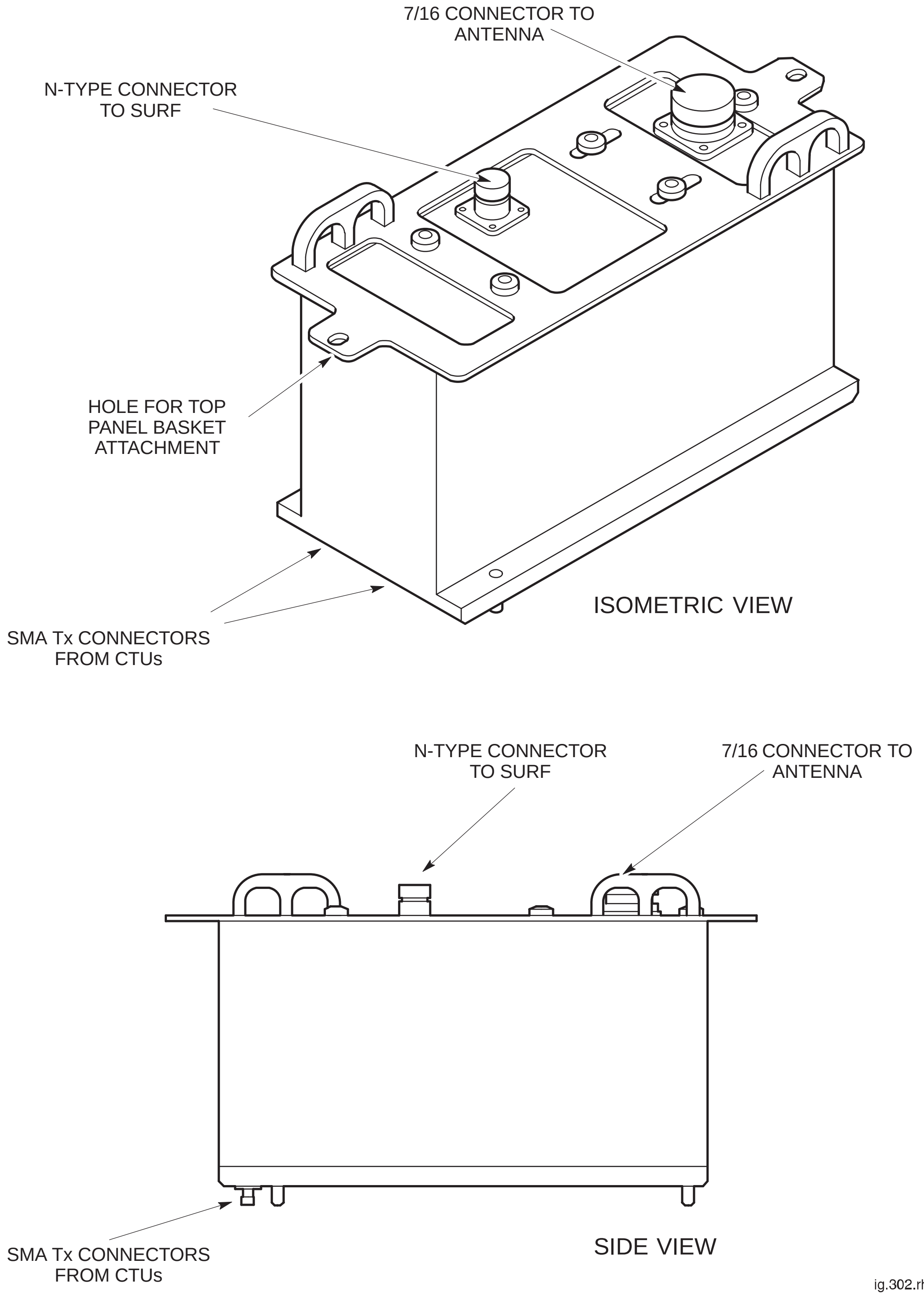


Figure 5-18 Typical Tx block

Blanking plate

Purpose of blanking plate

The blanking plate is fitted in locations where a Tx block is not required. The blanking plate ensures correct air flow through the cabinet.

The plate is attached to the base of the top panel basket using six M4 screws.

NOTE	It is important to ensure that all unused Tx block screw locations have a screw in place and tightened to correct torque (see *Technical Description: GSM-205-323* **Overview and specifications**). This is to ensure maximum quality of EMC and general containment.

View of blanking plate

Figure 5-19 shows a view of the blanking plate.

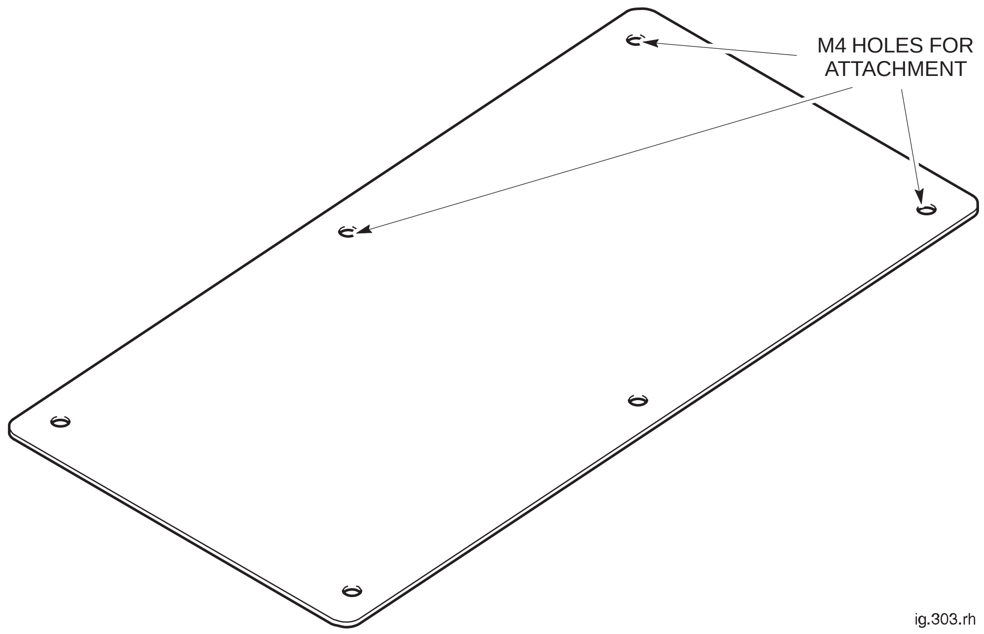


Figure 5-19 View of blanking plate

Feedthrough plate

Purpose of feedthrough plate

The feedthrough plate converts the normal SMA connector from the CTU to an N-type connector. Each feedthrough plate has a pair of these converters, one for each of two CTUs. The top N-type connectors are used to connect with either a CCB, or at the (optional) third Tx port on the top of a DDF Tx block.

The plate is attached to the base of the top panel basket using six M4 screws.

View of feedthrough plate

Figure 5-20 shows a top view of a feedthrough plate.

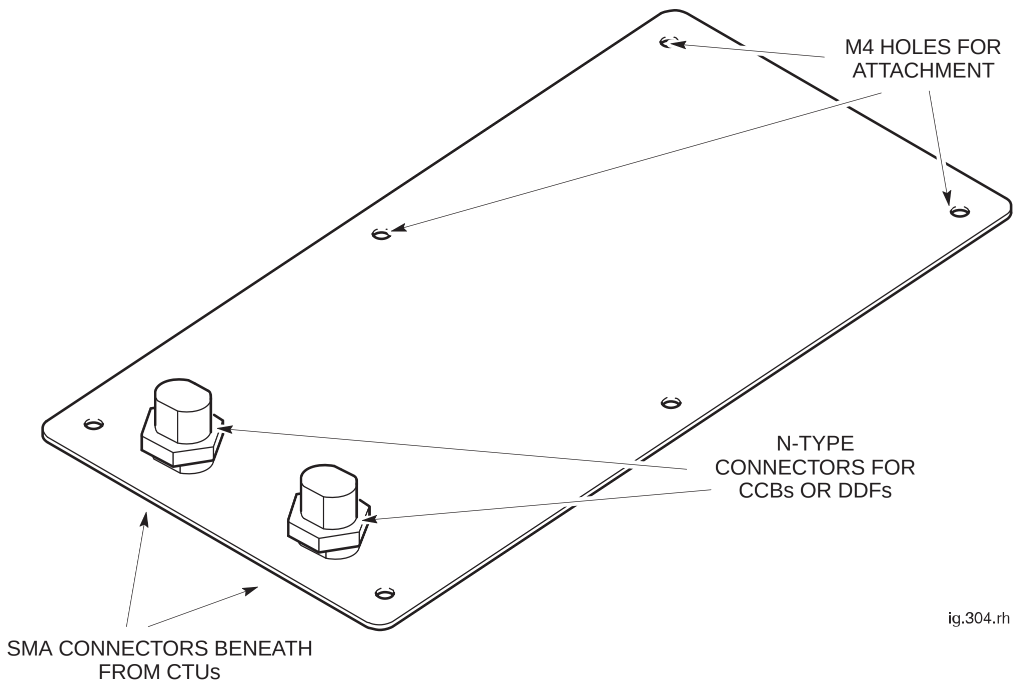


Figure 5-20 View of feedthrough plate

Feedthrough plate connectors

Each feedthrough plate connects to:

- The Tx outputs of two CTUs, using SMA connectors.
- Tx inputs of CCBs, or DDFs, using N-type connectors.

HCU plate

HCU overview

The hybrid combining unit (HCU) combines two CTU Tx outputs.

There are six holes for attachment into the bottom of the Tx block basket.

HCU view

Figure 5-21 shows the HCU plate with connectors identified.

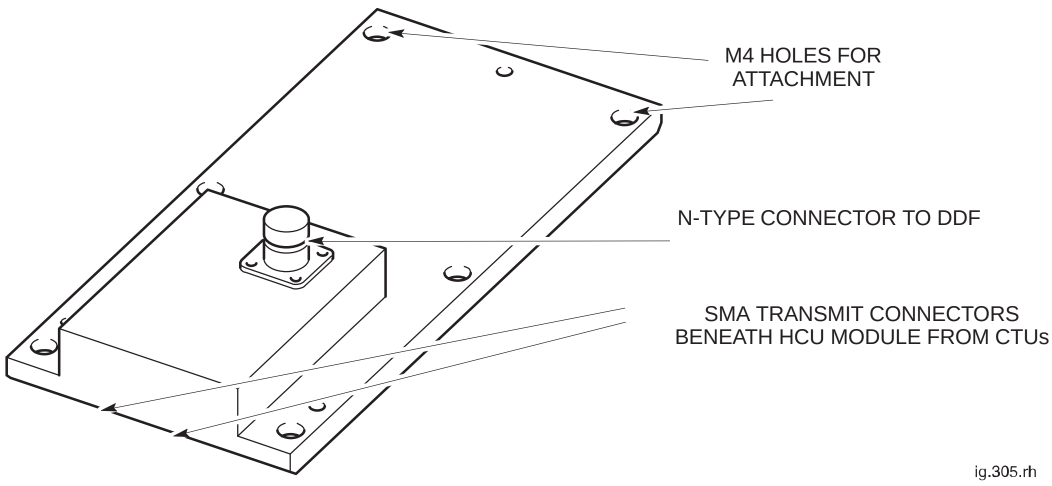


Figure 5-21 HCU plate view showing connectors

HCU functional diagram

Figure 5-22 shows a functional diagram of the HCU.

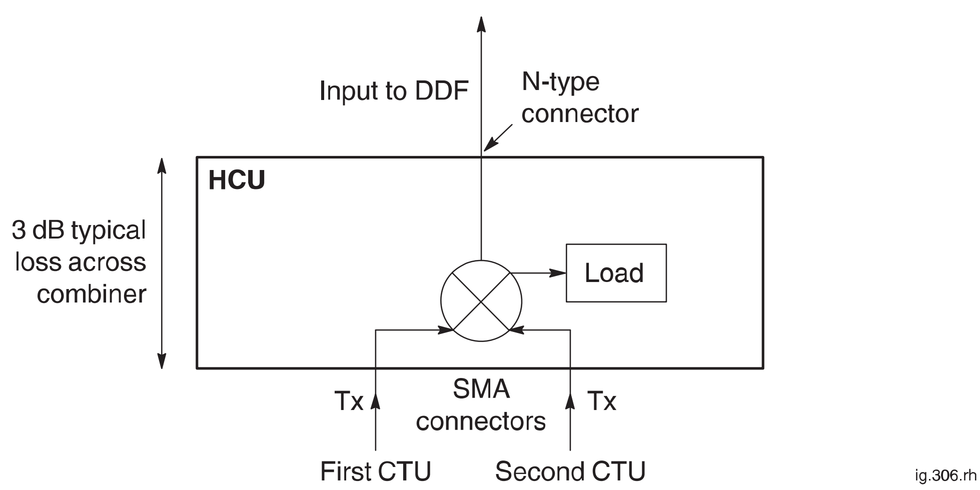


Figure 5-22 HCU functional diagram

HCU connectors

Each HCU connects to:

- The Tx outputs of two CTUs, using SMA connectors.
- A Tx input of a DDF, using an N-type connector.

NOTE	All unused SMA inputs to HCU modules must be fitted with 50 ohm load terminations.

TDF

Overview of TDF

The purpose of the twin duplexed filter (TDF) Tx block is to enable each antenna to serve one CTU for both Tx and Rx.

The TDF has two identical sections, each providing a single path from a CTU to a separate antenna. There is no combining in the TDF.

The TDF is located in the basket above the CTUs, and attached to the top surface of the top panel using two M6 screws.

TDF view

Figure 5-23 shows the TDF Tx block with connectors identified.

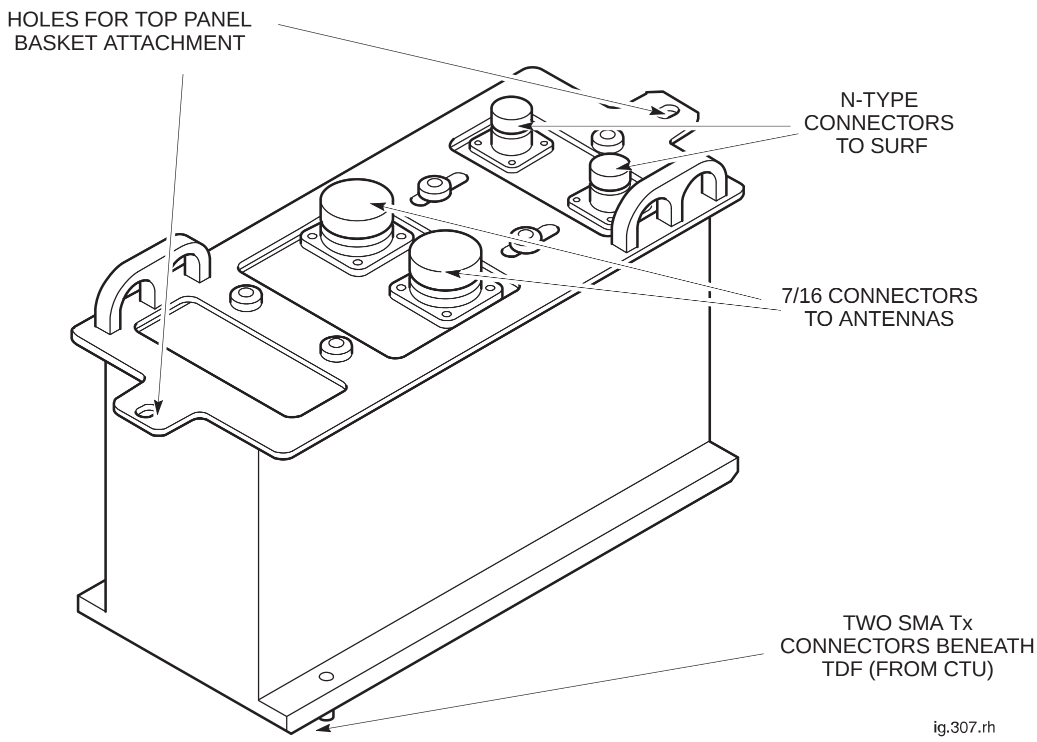


Figure 5-23 View of TDF Tx block with connectors identified

TDF functional diagram

Figure 5-24 shows a functional diagram of the TDF.

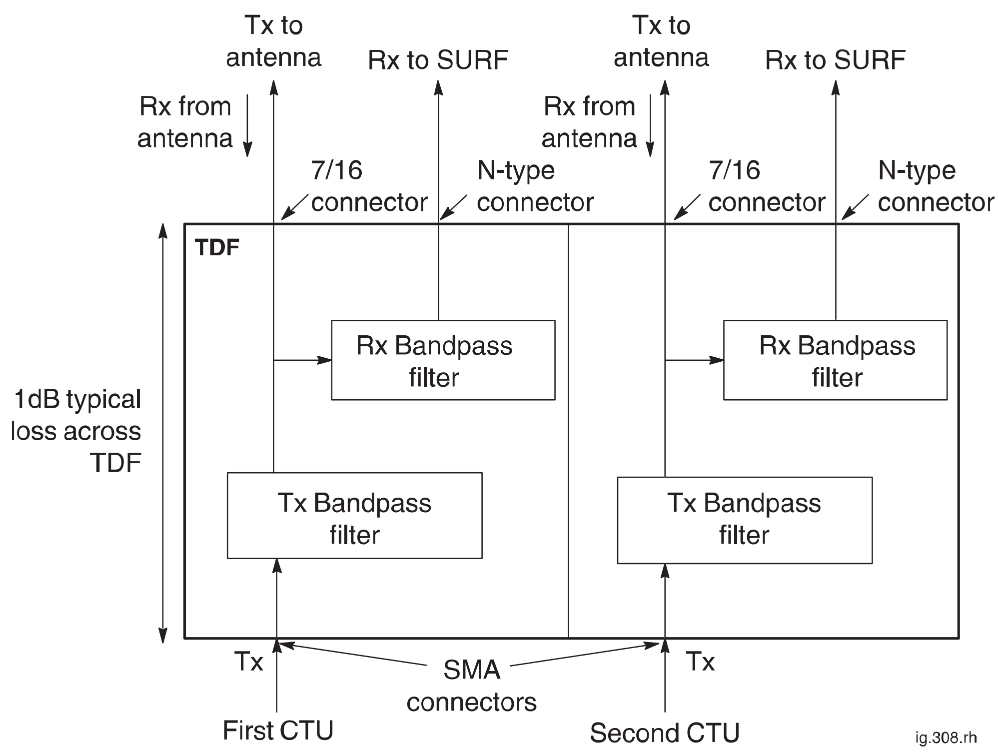


Figure 5-24 TDF functional diagram

TDF connectors

Each TDF connects to:

- The Tx outputs of two CTUs, using SMA connectors. The two connectors are underneath the TDF.
- Two antennas, each for both Rx and Tx, using 7/16 connectors. These connectors are on top of the TDF.
- The SURF, using two N-type connectors. These connectors are on top of the TDF.

Dual band TDF

Overview of Dual band TDF

The purpose of the dual band twin duplexed filter (dual band TDF) Tx block is to enable one 900 MHz antenna to serve one EGSM900 CTU for both Tx and Rx, and an 1800 MHz antenna to serve one DCS1800 CTU for both Tx and Rx.

NOTE	The dual band TDF for the GSM850 and PCS1900 BTS variants is not currently available.

The dual band TDF is essentially a TDF with one section providing a path for 900 MHz signals and another section providing a path for 1800 MHz signals. There is no combining in the dual band TDF.

The dual band TDF is located in the basket above the CTUs, and attached to the top surface of the top panel using two M6 screws.

Dual band TDF view

Figure 5-25 shows the dual band TDF Tx block with connectors identified.

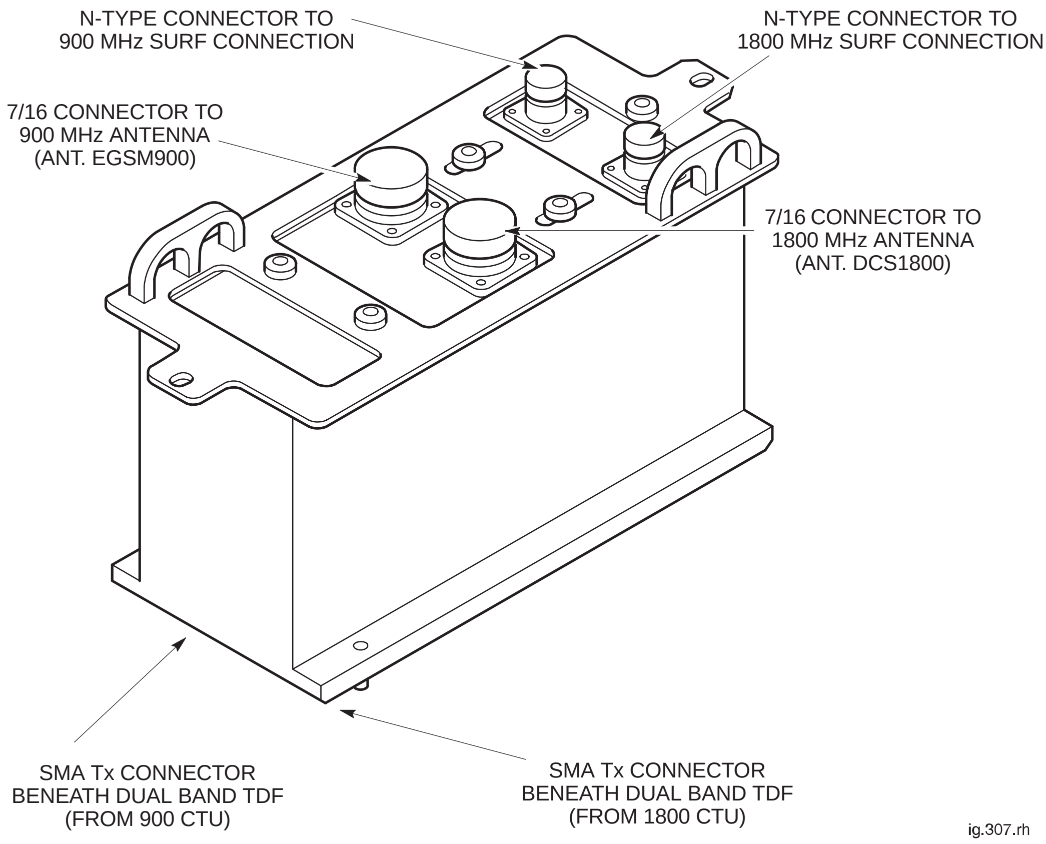


Figure 5-25 View of dual band TDF Tx block with connectors identified

Dual band TDF functional diagram

Figure 5-26 shows a functional diagram of the dual band TDF.

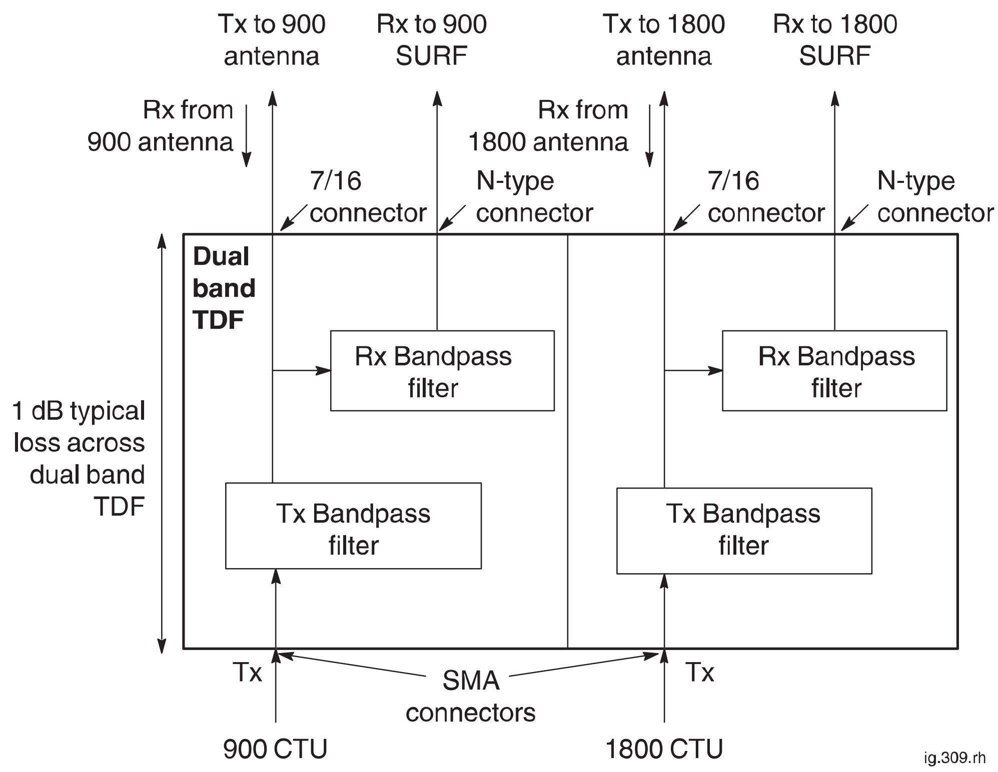


Figure 5-26 Dual band TDF functional diagram

Dual band TDF connectors

Each dual band TDF connects to:

- The Tx output of one 900 CTU and one 1800 CTU, using SMA connectors. The two connectors are underneath the dual band TDF.
- One 900 MHz antenna and one 1800 MHz antenna. Each antenna is used for both Rx and Tx, and each is connected to the dual band TDF using 7/16 connectors. These connectors are on top of the dual band TDF.
- A SURF module with dual band capability. Two N-type connectors, located on top of the dual band TDF, connect one receive path to the SURF's 900 MHz input and one receive path to the SURF's 1800 MHz input.

DCF

DCF overview

The purpose of the duplexed combining bandpass filter (DCF) Tx block is to enable each antenna to serve two CTUs for both Tx and Rx.

The DCF combines two Tx inputs, dissipating half the power within an internal load.

The signal then passes through a bandpass filter and out to the antenna.

A receive bandpass filter passes only the Rx signal to the SURF module.

The DCF is located in the basket above the CTUs, and attached to the top surface of the top panel using two M6 screws.

DCF view

Figure 5-27 shows a DCF with connectors identified.

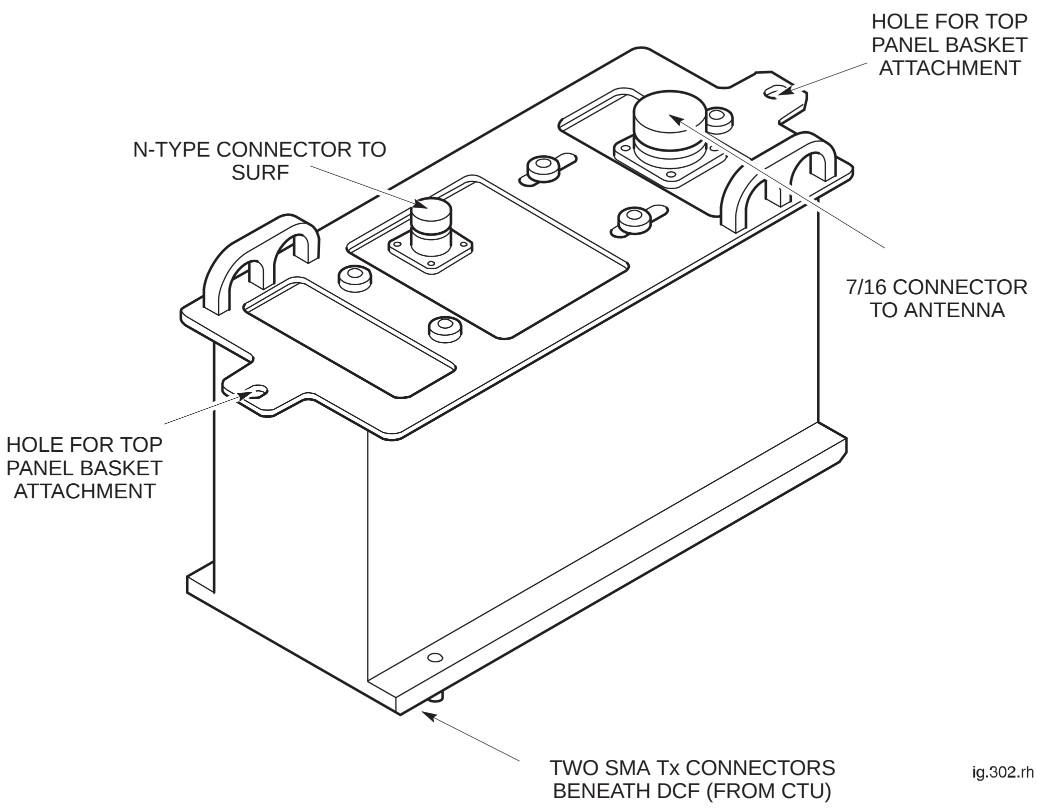


Figure 5-27 DCF Tx block view with connectors identified

DCF functional diagram

Figure 5-28 shows a functional diagram of the DCF.

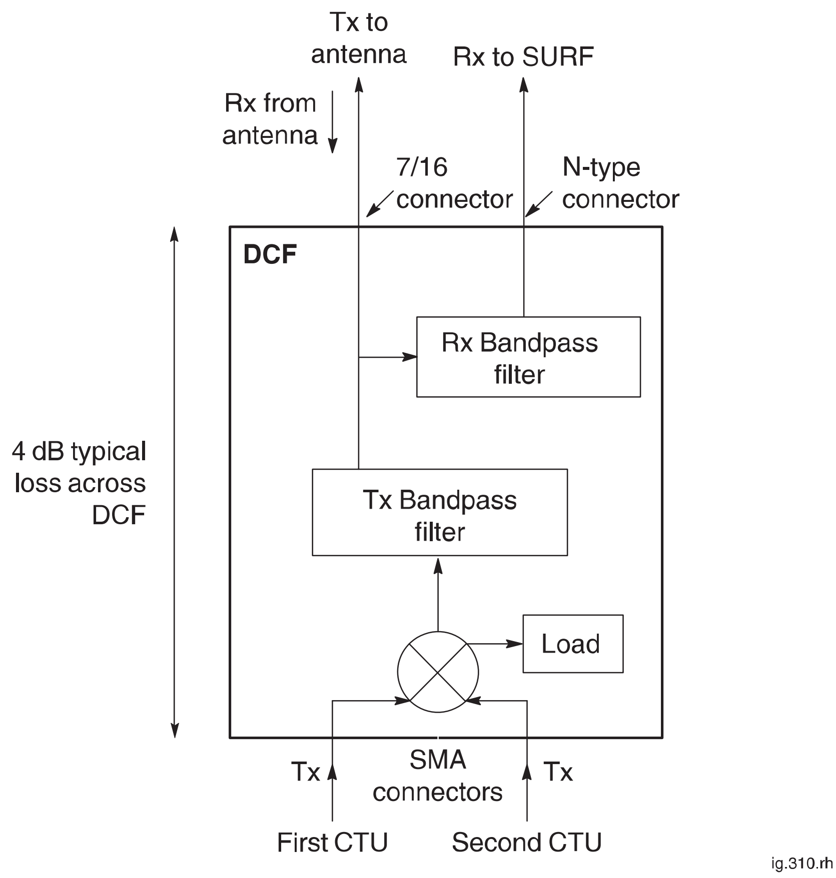


Figure 5-28 Functional diagram of the DCF

DCF connectors

Each DCF connects to:

- The Tx outputs of two CTUs, using SMA connectors. The two connectors are underneath the DCF.
- A single antenna for both Rx and Tx, using a 7/16 connector. This connector is on top of the DCF.
- The SURF, using an N-type connector. This connector is on top of the DCF.

NOTE	All unused SMA inputs to DCF modules must be fitted with 50 ohm load terminations.

DDF

Overview of DDF

The dual-stage duplexed combining filter (DDF) differs from the DCF in having a second stage of combining to allow a third CTU Tx input. This third CTU Tx input is connected to either:

- A feedthrough plate connector for a single additional CTU or
- An HCU plate connector for combining two additional CTUs.

The DDF is located in the basket above the CTUs, and attached to the top surface of the top panel using two M6 screws.

DDF view

Figure 5-29 shows a view of the DDF Tx block with connectors identified.

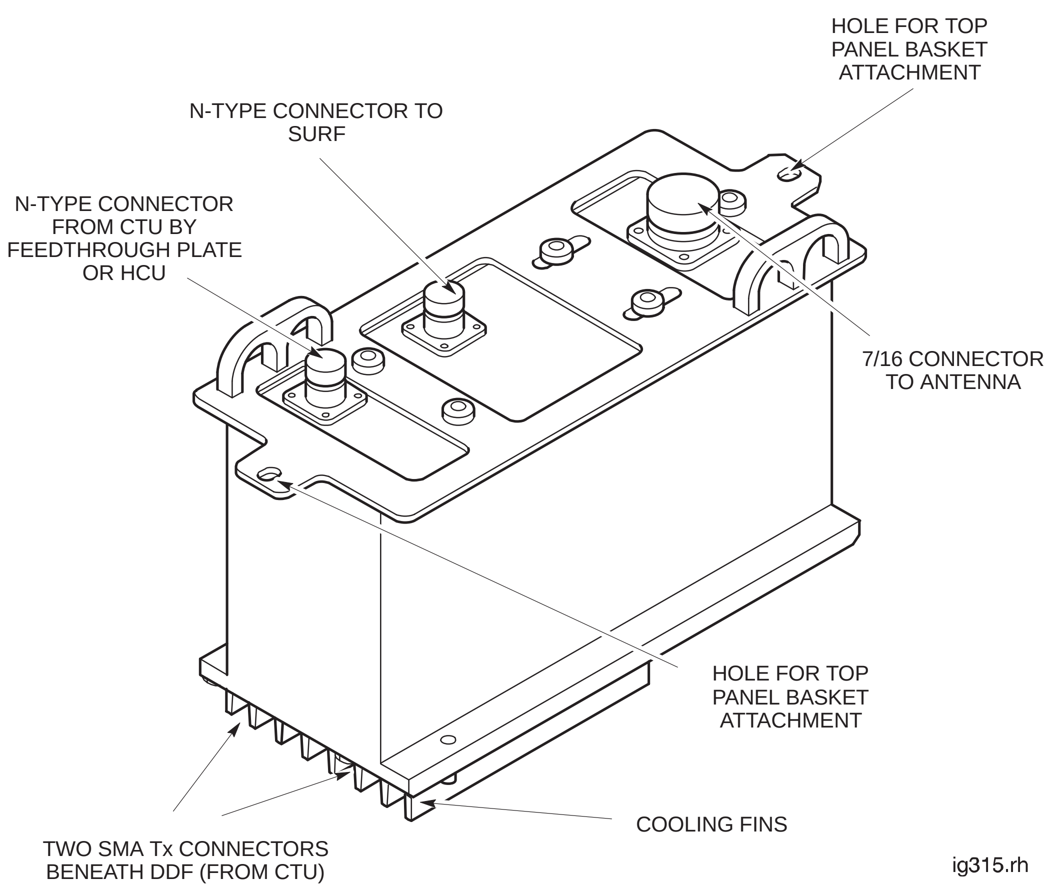


Figure 5-29 DDF Tx block view with connectors identified

DDF functional diagram

Figure 5-30 shows a functional diagram of the DDF.

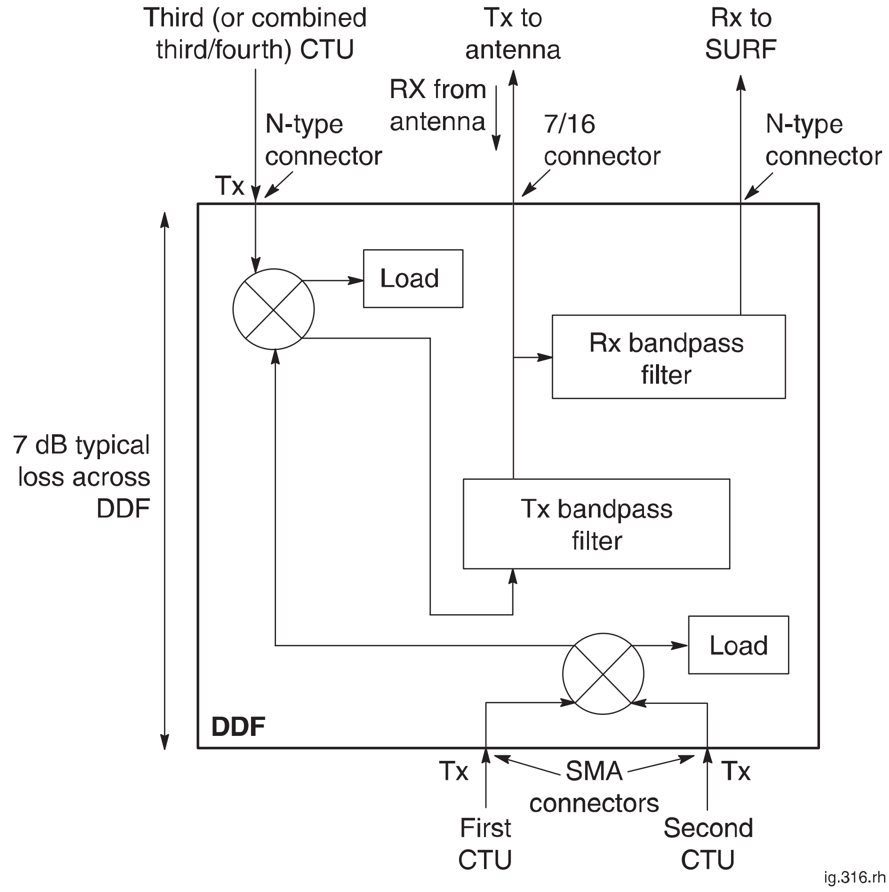


Figure 5-30 Functional diagram of the DDF

DDF connectors

Each DDF connects to:

- The Tx outputs of three or four CTUs, using:
  - Two SMA connectors underneath the DDF.
  - An N-type connector on top of the DDF for connection to a feedthrough plate (for a third CTU) or HCU plate (for combined third/fourth CTUs).
- A single antenna for both Rx and Tx, using a 7/16 connector. This connector is on top of the DDF.
- The SURF, using an N-type connector. This connector is on top of the DDF.

NOTE	All unused SMA inputs to DDF modules must be fitted with 50 ohm load terminations.

CCB

CCB overview

The Cavity Combining Block (CCB) has EGSM900 and DCS1800 variants. A CCB consists of three independently tuneable cavity resonators, one per CTU.

NOTE	CCBs are not currently available for the GSM850 or PCS1900 BTS variants.

The CCBs are fitted in the CCB basket in the stacking bracket. The basket can contain up to two CCBs, one for three CTUs. The two CCBs cannot be in different cabinets because of the short phasing lead connecting the two.

Configurations where five or more carriers per sector are required could utilize CCBs.

The recommended minimum channel spacing between cavities is 800 kHz.

There are two types of CCB:

- Master CCB with Band Pass Filter (BPF) and control board.
- Extension CCB, identical to the master CCB but without the BPF and only having a control board if redundancy is required.

Unlike the Tx blocks, the CCB has no duplexing capability. If a single Rx/Tx antenna is used then connection to the CCB must be via an external high power duplexer.

CCB control board (TCB) and set switch

The CCB control board is also known as the Transmit Antenna Transceiver Interface (TATI) control board (TCB).

The CCB control board controls the interface to the CTU. This allows different vendor CCBs to be installed without requiring amended CTU software.

The address of the control board is set manually using an 8 bit DIL switch, set by Motorola. Data links are automatically set up.

TCB and link redundancy

The redundant TCB has the ability to maintain the separated CCB, if the inter-CCB link fails.

CCB view

NOTE	CCBs may vary slightly, depending on manufacturer and type.

Figure 5-31 shows two EGSM900 CCBs with main and redundant control boards fitted.

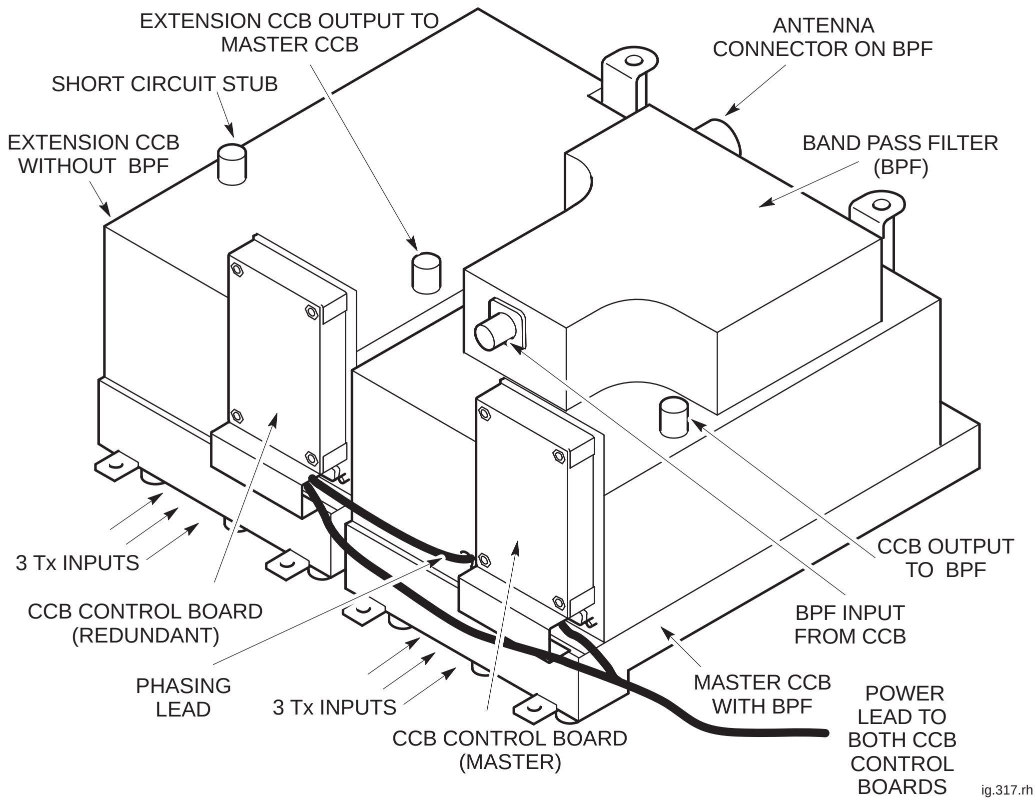


Figure 5-31 EGSM900 CCBs with control boards fitted

Figure 5-32 shows two DCS1800 CCBs with main and redundant control boards fitted.

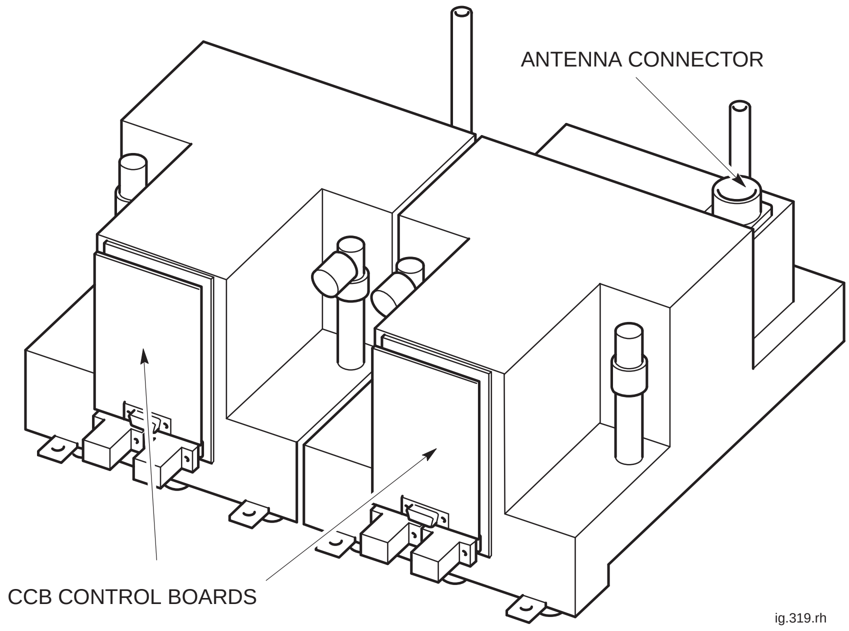


Figure 5-32 DCS1800 CCBs with control boards fitted

CCB configuration

The master CCB has a second output to enable the extension CCB to be connected. The bandpass filter can then serve both CCBs in parallel. Any unused output is terminated with a short circuit stub. The two configurations are shown in Figure 5-33.

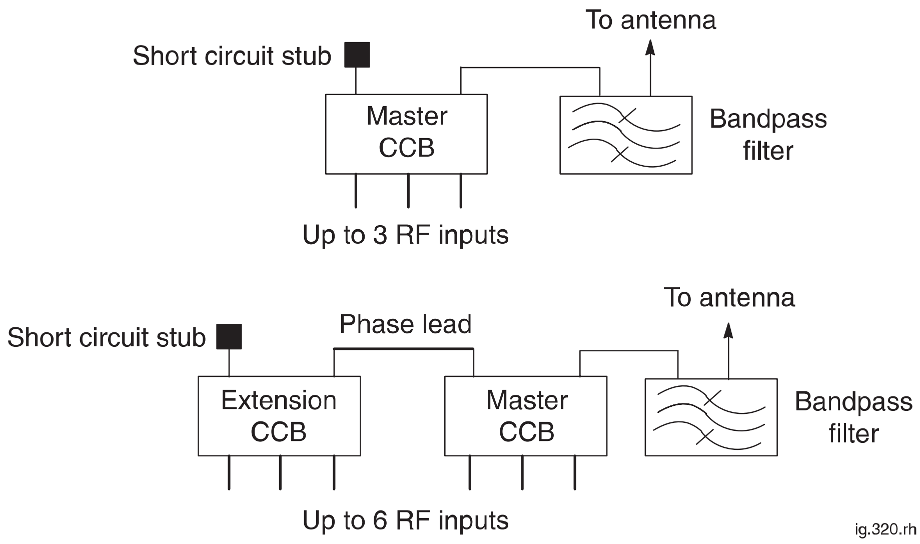


Figure 5-33 CCB configurations

CCB functional description and diagram

The CCB has three independently tuneable cavity resonators, as shown in Figure 5-34. The cavities are narrow band devices which pass transmit signals at the cavity tuned (resonant) frequency. The three cavity outputs are coupled together.

The CCB cavities are tuned by software commands from the CCB control board. Control data is sent from the CTU, via the coaxial cable, to the CCB. This data is separated from the RF signal at the bias tee, and sent to the CCB control board. The CCB control board then sends control signals through the control bus to the motor control of the CCB cavity of the same transceiver.

CCB tuning change	Time taken
One cavity retuned and verified	8 seconds
Three cavities retuned and verified	19 seconds

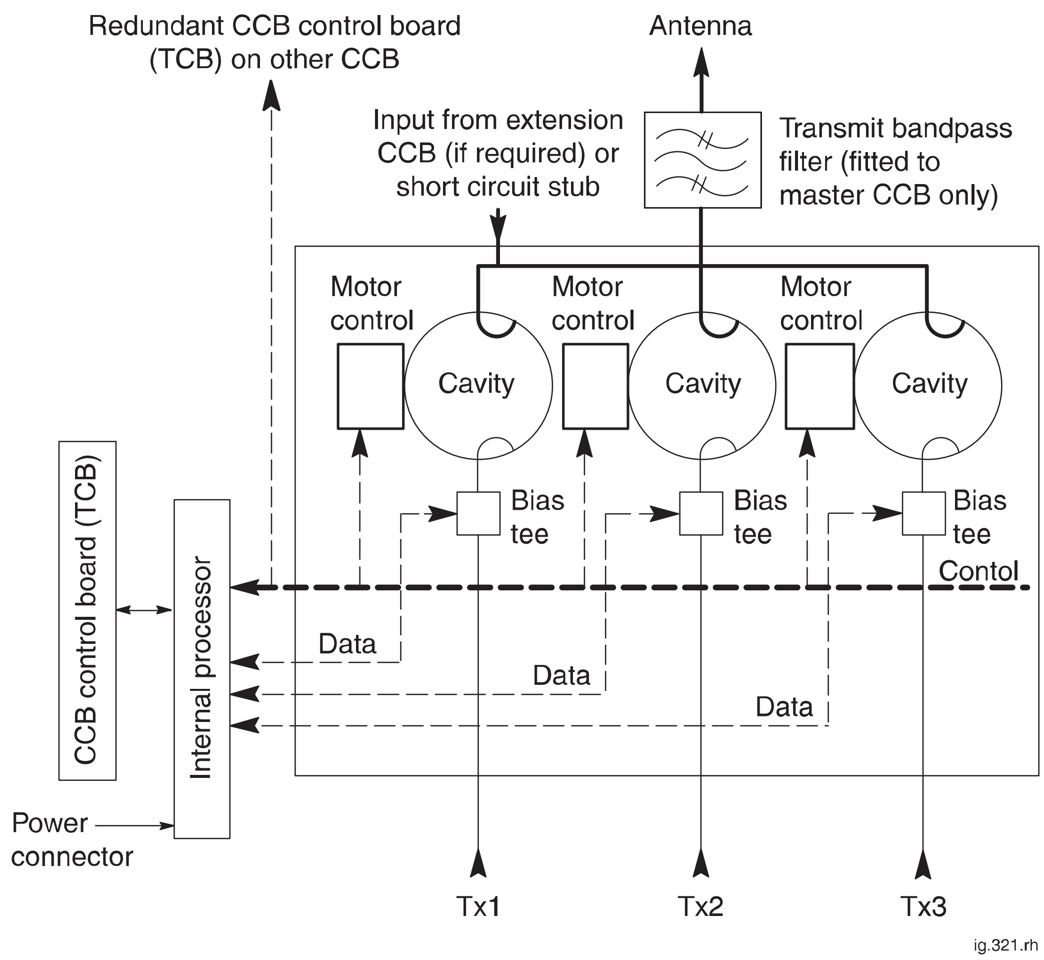


Figure 5-34 Functional diagram of CCB

Chapter 6

Digital modules

Chapter 6

Overview of digital modules

Overview and redundancy

Digital modules provide the Horizon*macro* indoor equivalent of M-Cell*6* micro base control unit (μBCU) functionality. They are located in the bottom right side of the CIBA maincage, and are electronically interconnected through the backplane. Fibre optic connections are at the front of the appropriate modules.

Each digital module is assigned A (master) or B (redundant), with one BPSM (μBCU Power Supply Module) for A and one BPSM for B. The alarm module is not assigned to A or B, as it is supplied by both BPSMs for redundancy.

The master MCUF is assigned to A, and the redundant MCUF to B, each with an associated FMUX.

The four NIUs are used by the operational MCUF, but two NIUs are powered by BPSM A and two NIUs by BPSM B.

All slots are annotated with the legend of the appropriate module and located as shown in Figure 6-1.

Digital module and BPSM locations

Figure 6-1 shows the position of modules within the digital module shelf.

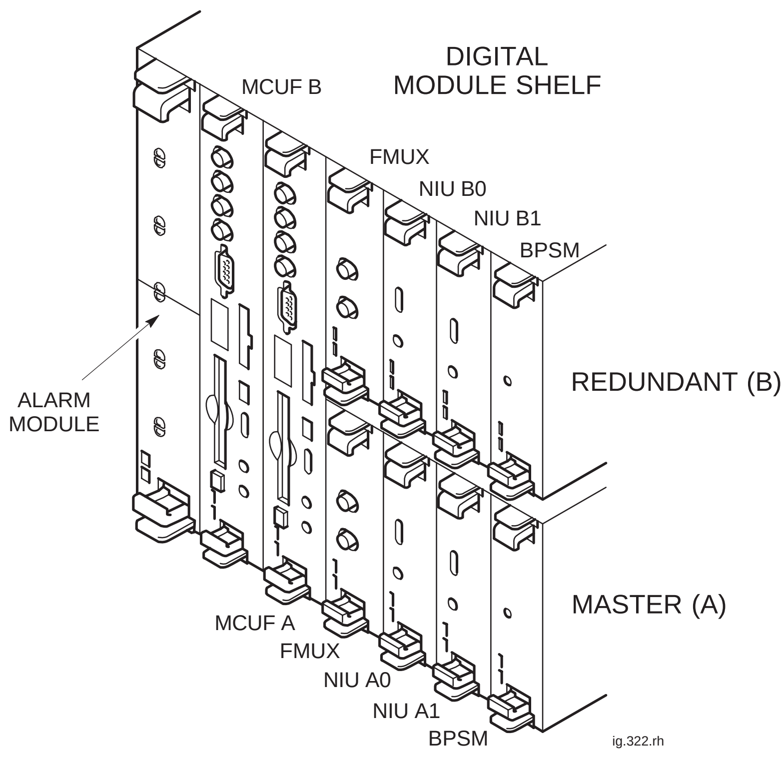


Figure 6-1 Digital and BPSM module locations, including optional redundancy

MCUF and NIU redundancy

The digital module shelf can:

- Support two MCUFs at a BTS site, one master and one slave (for redundancy).
- Enable Master MCUF failure to result in the slave MCUF becoming the master after reset.
- Enable the OMC-R operator to initiate master/slave MCUF swap.
- Configure CTUs by the master MCUF.

All four NIUs operate from the master MCUF, but each pair of NIUs depend on a BPSM for power. All NIUs configure to the master MCUF clock.

NOTE	When fitting a replacement redundant MCUF, care must be taken to ensure firmware compatibility with the master MCUF. Firmware incompatibility may result in a loss of communication between the two MCUFs so that the redundant MCUF is not in a position to take control in the event of a failure of the master MCUF.

Full size and half size modules

Modules are full size and half size, as shown in Table 6-1.

Table 6-1 Full size and half size digital modules

Full size modules	Half size modules
Main Control Unit with dual FMUX (MCUF)	Network interface unit (NIU)
Alarm module	Fibre optic multiplexer (FMUX)
	BPSM (µBCU Power Supply Module)

Digital module and CTU connections

The MCUF is connected to the CTUs in the same cabinet through the backplane. Optional connection to CTUs in up to three additional cabinets (six CTUs per cabinet) is by fibre optic links. FMUXs, two internal to the MCUF and one half size module, convert the electronic data stream into a fibre optic signal. An FMUX module in each extension cabinet converts the fibre optic signal back to electronic data stream, for transmission to CTUs via the backplane.

The NIU modules convert signals for terrestrial E1 or T1 lines.

Diagram of digital module and CTU connections

Figure 6-2 shows a block diagram of the digital module and CTU connections.

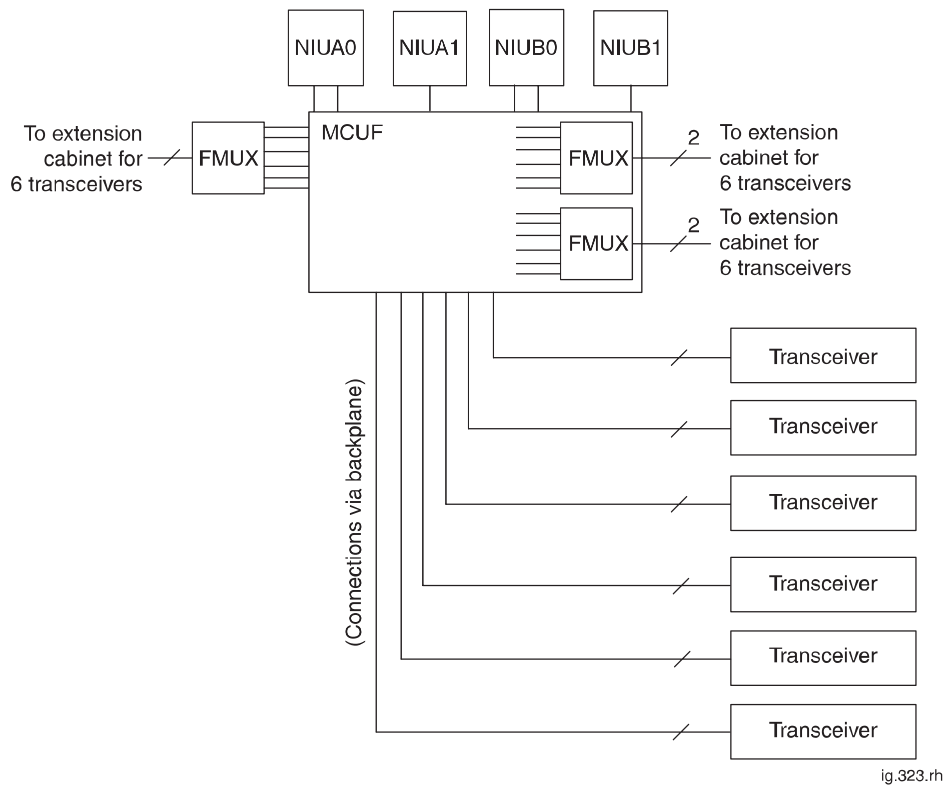


Figure 6-2 Digital module and CTU connections

MCUF

MCUF overview

The main control unit with dual FMUX(MCUF) provides the site processing functions, apart from RF functions of the transceiver. The MCUF also provides switching for up to six network interfaces (via four NIUs) and up to 24 transceivers.

The cabinet may contain up to two MCUF modules, (one master and one for redundancy). Each site and module has an electronic ID for remote identification.

The MCUF provides the following functions:

- Maintenance and operational/control processing.
- Call processing (for example resource management and switching of baseband hopping data).
- Switching of traffic and control information.
- Timing reference and network/BTS master clock synchronization.
- The functionality of two FMUX.
- Support of up to six transceivers via backplane in first cabinet and up to an additional 18 transceivers via FMUX connections to other cabinets.
- Support of up to six E1 or T1 circuits, via NIU modules.
- Support of the CSFP function via the PCMCIA flash memory card.

Capability to replace MCU of M-Cell*6* and M-Cell*2*

The MCUF combines the MCU function of M-Cell*6* with two FMUX modules. If the MCUF is installed in an M-Cell*6* or M-Cell*2* the MCUF automatically reverts to the functionality of an MCU. The internal FMUX devices no longer operate. In M-Cell*2* the reversion to MCU mode includes ability to directly connect to two transceivers by modified use of the front panel FMUX fibre optic connections.

NOTE	This capability to use MCUF in M-Cell*6* and M-Cell*2* is only possible with GSR4 or later.

GPROC TSW and GLCK functions

The MCU section of the MCUF module combines functions of older generation equipment:

- The BTP (Base Transceiver Processor) functions and CSFP (Code Storage Facility Processor) functions (provided PCMCIA card fitted), formerly achieved by generic processor boards (GPROCs).
- The timeslot switch (TSW).
- The generic clock (GCLK).

MCUF module view

Figure 6-3 shows an MCUF module.

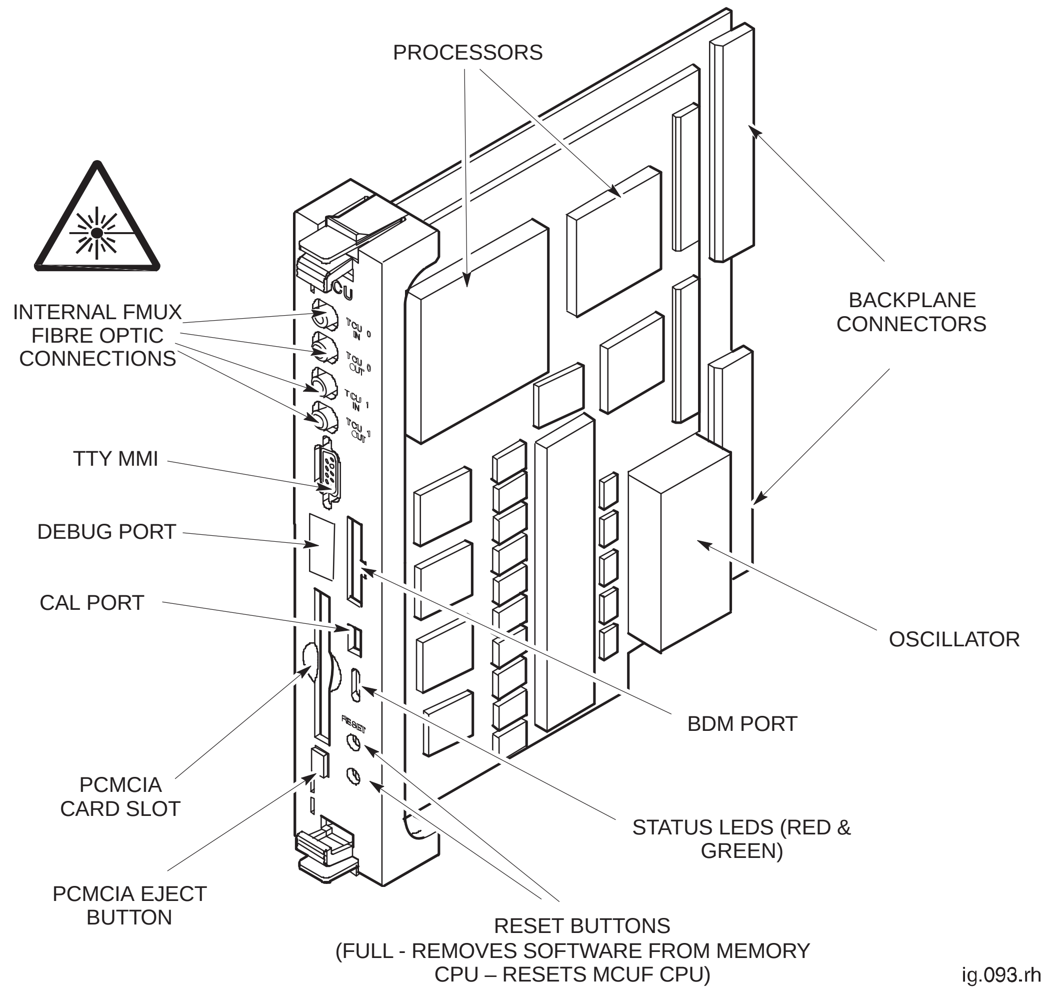


Figure 6-3 View of the MCUF

MCUF functional diagram

Figure 6-4 shows a functional diagram of the MCUF.

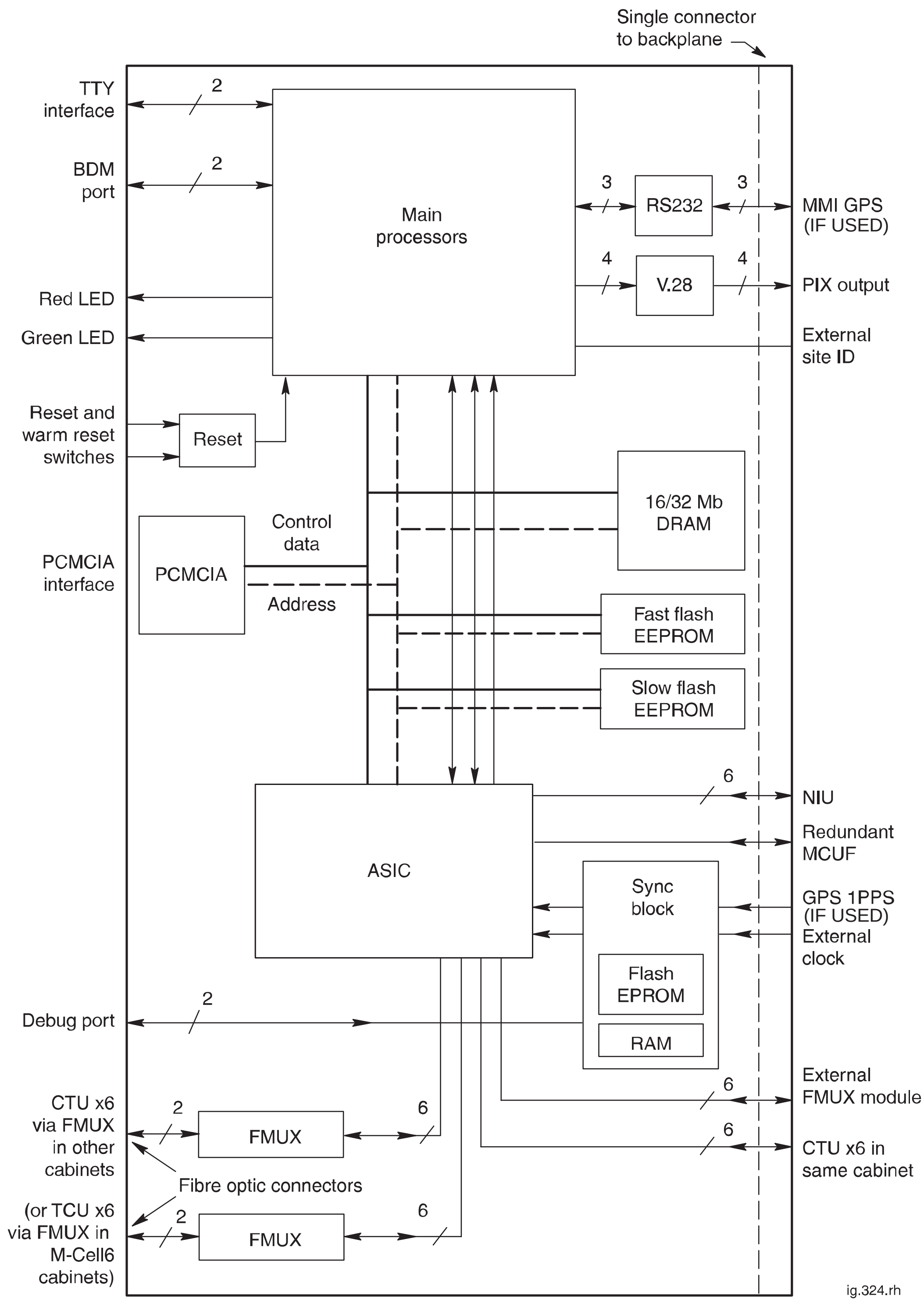


Figure 6-4 Functional diagram of MCUF in MCUF mode

Link to redundant MCUF

The link to the redundant MCUF is similar to a transceiver link, but does not have the BBH capability, or the link delay measurement and compensation facility. The 6.12 s, and 60 ms signals, are inserted into timeslots 8 and 16.

When the MCUF is in slave mode, timeslot and E1/T1 clock information is extracted from the MCUF link and passed to the sync block.

The main processor HDLC link to the redundant MCUF can be routed in any unused timeslot(s) of this link.

The ASIC can switch any timeslot on the redundancy link to any timeslot on any of the other links connected to it such as the transceiver links, network links, redundancy link or processor links.

Front panel interfaces

TTY interface

A standard TTY interface is provided on the front panel, of 9.6 kbit/s (8 bits, no parity, 1 stop bit (8 N 1)). A local maintenance terminal can be attached to this port to use the MMI (Man Machine Interface) of the MCUF.

Debug and BDM ports

Two front panel ports are for Motorola factory and development use only:

- The debug port, consists of a TTY connection to the sync processor to access sync firmware, together with other connections to the ASIC and main processors.
- The Background Debug Mode (BDM) port is used for low level debugging of the main processors.

FMUX fibre optic connections

There are fibre optic connections from the MCUF internal FMUX modules. The fibre optic connectors enable connection to FMUX modules in other cabinets for additional transceivers.

CAL port

The CAL port on the front panel of the MCUF can be used to calibrate the sync block clock via MMI commands. The 8 kHz reference output is used in GCLK calibration procedure (see *Installation & Configuration BSS Optimization (GSM-100-423)*).

PCMCIA interface

The PCMCIA card is located on the front panel of the MCUF, and is used for:

- Code Storage Facility Processor (CSFP) memory.
- Rapid site initialization.

The PCMCIA socket is an industrial standard 68 pin single socket, fitted with an ejector. The PCMCIA interface supports rev 2.1 type I and II cards.

The 20 Mbyte card can be write enabled, for upgrade of site information, or disabled to protect card use for other sites or secure the site code.

Front panel switches and indicators

The front panel of the MCUF module has two reset switches as shown in Figure 6-3:

- FULL is a hard reset (power up - removes software from the memory).
- CPU is a soft reset (this resets the MCUF main processors, but the software remains in RAM).

A hard reset results in the software being reloaded to the DRAM in the same way as normal power up.

NOTE	During the CPU (soft) reset, pressing CPU reset again will perform a hard reset. Pressing the CPU reset button twice thus has the same effect as a hard reset.

The MCUF has two front panel LEDs (one green and one red) as shown in Figure 6-3, with indications as shown in Table 6-2.

CAUTION	When red and green LEDs are flashing, the boot code is downloading into non-volatile memory for software upgrade. Do not remove power or reset the cabinet until downloading has been completed, as this will corrupt the non-volatile memory. If boot code is corrupted, contact the Motorola Customer Network Resolution Centre, requesting the boot code restoration procedure and the appropriate boot code file.

Table 6-2 MCUF front panel LED indication

Red	Green	Status
Off	Off	Board not powered up or in rest cycle
Off	On	Normal operation
On	Off	Fault condition
Flashing	Flashing	Non-volatile memory boot code upgrade (Do not remove power nor reset – see CAUTION)

PIX interfaces

The MCUF provides four PIX outputs on the backplane, driven at V. 28 levels. The four PIX outputs, routed to the cabinet alarm board, enable relay contact control of external customer equipment.

DRAM, flash EPROM and code loading functions

DRAM

The 16 Mbyte DRAM provides operational code and data storage for the main processors. There is also a SIMM socket in the circuit board, enabling the addition of a further 16 Mbytes if required. After software initialization, the DRAM uses ECC protection. Memory protection is provided by the main processors.

Fast flash EPROM

The fast flash 1 Mbyte bank is used for bootcode and executive process code. It has a fast access time (<75 ns), enabling direct execution. The bootcode is factory set, and reprogrammed only in major software upgrades.

Slow flash EPROM

The slow flash 0.5 Mbyte bank is used for non-volatile data storage of diagnostic data and module ID information.

Code loading

The boot and executive code, held in the fast flash EPROM, initiates the MCUF on power up or reset. If a PCMCIA memory card is fitted, operational code may be obtained and copied to the DRAM for execution. If no card or code is available, the operational code is obtained from the BSC.

Before execution, the operational code held in DRAM is checked with code held at the BSC. The BSC downloads any changed code objects to the DRAM.

After successful checking of the DRAM operational code, the code is executed, and the PCMCIA memory card updated with any changed objects.

CSFP code loading

If a PCMCIA memory card is available,then a code storage facility processor (CSFP) function can be supported. A new software load can be downloaded in the background, without any reduction in service, and stored on the PCMCIA card.

Once the complete load has been transferred to the PCMCIA card, a code swap can be initiated. The site is reset and the new software brought into service (<10 minutes). As a precaution, the old version is held on the PCMCIA card to support a roll back to the original version if required.

ASIC functionality

The Application Specific Integrated Circuit (ASIC) provides central switching capabilities for the MCUF. It is capable of supporting up to 24 transceivers, together with up to six network interfaces and two links to the on-board processors, one link to the sync processor and a link to the redundant MCUF. The link to the sync processor is used for code loading purposes only. The ASIC supports baseband hopping across the 24 transceiver links.

The ASIC provides interface features associated with the transceiver links, these include synchronization features to allow for delay in the link to the transceivers, and the necessary framing and encoding to support the link.

All of the serial links into the ASIC are internal lines (I lines), 125 μs framed, with 32 eight bit timeslots per frame.

ASIC transceiver link features

The ASIC interfaces to a maximum of 24 transceiver links. The ASIC can switch any timeslot on any of the transceiver links to any timeslot on other links connected to the ASIC; transceiver links, network links, MCUF redundancy link or processor links.

The ASIC provides the following features associated with the transceiver links:

- Link advance/delay compensation.

  The ASIC will continually measure the round trip delay on each transceiver link to calculate a timing advance for each link. The link advance is applied, and can be adjusted, by the main processor via the processor parallel interface.

- BBH data switching.

  BBH switching is performed automatically on any timeslot configured as BBH data. A single timeslot from the transceiver is selected for BBH routeing information, and defines which transceiver link (0-23) should be used for downlink.

- Timing reference insertion.

  The ASIC receives timing pulses from the sync block and inserts the appropriate bits into the transceiver downlink synchronization and framing timeslots. The sync block will provide a version of the 6.12 s and 60 ms signals that is advanced by 125 μs for this purpose.

- Manchester coding/decoding.

  The transceiver links are all Manchester coded/decoded by the ASIC. This function can be switched on or off (default on) on a per link basis. The disable feature is for applications outside of the MCUF module.

ASIC/network and processor link switching

The ASIC supports a maximum of six network links and two main processor links. The data to/from these links can be switched to/from any timeslot on other links connected to the ASIC.

The two links to the main processor allow it to route HDLC and other links to the appropriate place:

- 24 HDLC timeslots for the BCF RSS channel to each transceiver.
- Four timeslots for NIU control channels (two local, two redundant).
- Sync processor code load channel.
- Two channels for RSL links.
- One HDLC channel occupying up to three timeslots to the redundant MCUF.

Sync block functionality

The sync block is controlled via the parallel interface of the main processors. The sync block is responsible for site synchronization functions. It generates all required local references from a high stability local clock source. This clock source may also be locked to the incoming network clocks.

The sync clock source is in the form of a crystal oscillator (OCXO) which warms up for phase locking in 4 minutes, and achieves frequency stabilization in 15 minutes.

Site frame reference generation and re-timing includes:

- 2.048 MHz - For serial communications.
- 16.384 MHz - For FMUX communications.
- 125 μs - For NIU framing and transceiver framing.
- 60 ms- For transceiver GSM timing.
- 6.12 s - For GSM superframe.

The reference clocks available to the sync block are:

- Six network extracted clocks (E1/T1 source via NIUs). Any of the NIU modules under control of the MCUF can extract a reference clock from an E1/T1 link and pass to the Sync block.
- CAL port. The CAL port can be used to calibrate the sync block clock via MMI commands. The reference output provides a monitoring point.
- Redundant MCUF link.

Phase lock loop (PLL) operating modes

The PLL uses the selected reference signal as the loop reference clock. It includes an OCXO accurate to 0.05 ppm, a phase comparator and a loop filter. The PLL has the following operating modes:

- Warm-up

  The PLL is open loop and using the calibration frequency, but the OCXO is not yet warmed up.

- Set frequency

  The PLL is open loop and using the calibration frequency, and the OCXO is warmed up.

- Fast tune

  Closed loop with wide filter for coarse locking to the reference (extracted from network clock).

- Fine tune

  Closed loop with narrow filter for accurate locking to the reference (extracted from network clock).

When in fine tune closed loop mode, the accuracy is 0.01 ppm.

Sync block code load

The sync block controller has a dedicated 2.048 Mbit/s serial link into the ASIC enabling a 64 kbit/s HDLC channel to the main processors for code loading.

The sync block includes 256 kbytes of flash EPROM used to store:

- Boot code.
- Operational code.

The boot code, which cannot be altered, queries the main processors on the current version of the sync operational code.

If the stored operational code is the correct version, the boot code will move the operational code to RAM and execute the code.

If the query results in the need for new operational code, the sync processor will download the operational code from the main processors via the ASIC to the RAM in the sync block.

After a successful download, the boot code programmes the flash EPROM with the new operational code and runs the operational code in RAM.

GSM counters

The following counters are provided:

- GSM frame incremented every 4.615 ms, range 0 to 1325.
- GSM superframe incremented every 6.12 s, range 0 to 2047.

Integral MCUF FMUX functionality

The equivalent function of two FMUX modules exists integral to the MCUF, enabling two extension cabinets to be connected. To enable total of four cabinets to be joined together as one BTS site, an FMUX module is also required in the master cabinet to connect the third extension cabinet. A single cabinet site has no need for the FMUX functionality, because the MCUF connects with the cabinet CTUs through the backplane.

Each fibre optic multiplexer (FMUX) function multiplexes and demultiplexes six, full duplex, transceiver links to one (TX/Rx) pair of fibre optic cables. This enables up to six transceivers in a single extension cabinet (either Horizon*macro* or M-Cell*6*) to be linked to the master cabinet.

Each FMUX fibre optic link is full duplex 16.384 Mbit/s. The FMUX optical link is capable of driving up to 1 km.

For functional description of FMUX see **FMUX module and FMUX function** in this chapter.

NIU

Overview of NIU

The network interface unit (NIU) module provides two E1 or two T1 termination links to the terrestrial network. The NIU E1/T1 outputs are connected to a T43 or BIB board, depending on the impedance matching requirement of the customer terrestrial circuits.

There are two types of NIU board, one for E1, one for T1. The NIU layout is common to both E1 and T1, the only differences being in the associated crystal oscillators and line matching resistor values.

An on-board NIU control processor provides network interface configuration and supervision, controlled by the MCUF.

NIU locations

The cabinet may contain up to four NIU modules in the digital module shelf, as shown in Figure 6-1. Two NIUs are located in the master (lower) part of the shelf. Two NIUs are in the redundant (upper) part of the shelf, though these upper NIUs are also used for non-redundant purposes.

An NIU in slot A0 supports two E1/T1 links.

An NIU in slot A1 supports one E1/T1 link.

An NIU in slot B0 supports two E1/T1 links.

An NIU in slot B1 supports one E1/T1 link.

NIU command identity number

Each NIU is identified in the database by an identity number, from 0 to 3. Table 6-3 shows the NIU slots and equivalent identity number.

Table 6-3 NIU slot and equivalent command identity

NIU (MSI) identity number used in commands	NIU slot
0	A0
1	B0
2	A1
3	B1

Module view and LEDs

Figure 6-5 shows an NIU module.

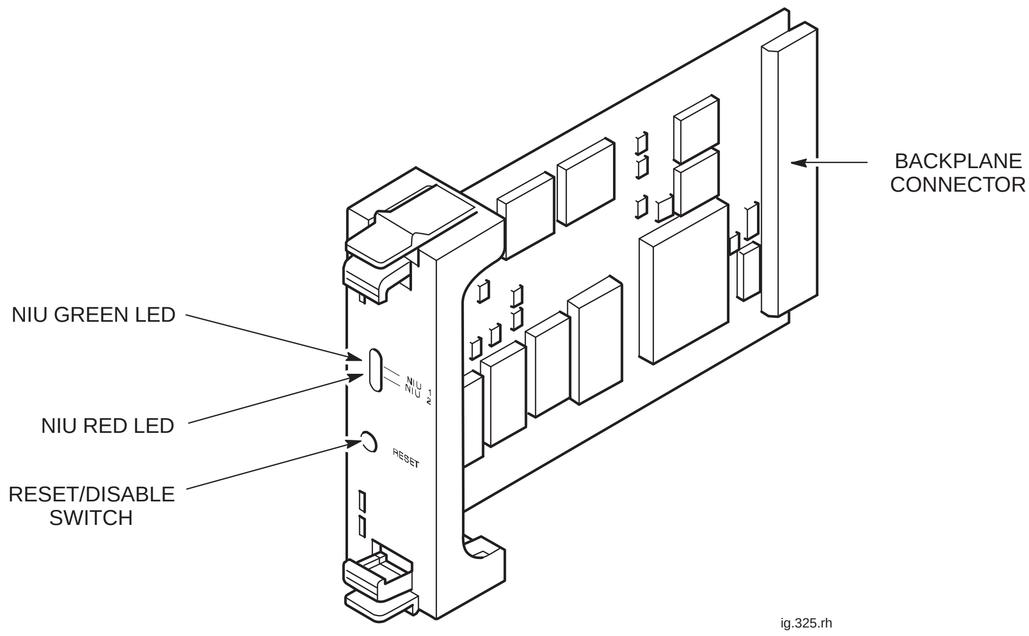


Figure 6-5 View of NIU module

The NIU status is indicated by the two front panel LEDs, one green and one red, controlled by the on-board processor, as shown in Table 6-4.

Table 6-4 NIU LED display

Red LED	Green LED	Status of NIU board
Off	Off	NIU not powered up or in reset cycle.
Off	On	Normal operation.
Flashing	Flashing	NIU undergoing system code download.
On	On	NIU self testing following switch on or reboot. Red LED extinguishes after 20 seconds, or after 50 seconds following a reboot due to code download.

NIU functionality

The NIU provides two E1/T1 interfaces into the network (link 0 and link 1) as well as LAPD encoding/decoding and clock recovery from a selected E1/T1 link. The second E1/T1 interface (link 1) is not used for NIUs placed in positions at A1 and B1, as shown in Figure 6-1.

An NIU control processor provides network interface configuration and supervision, controlled by the MCUF. The NIU control processor maintains two independent control links in the redundant configuration (one to each MCUF), each using timeslot 0 of MCUF link 0.

NIU diagram

Figure 6-6 identifies the functional blocks in the NIU.

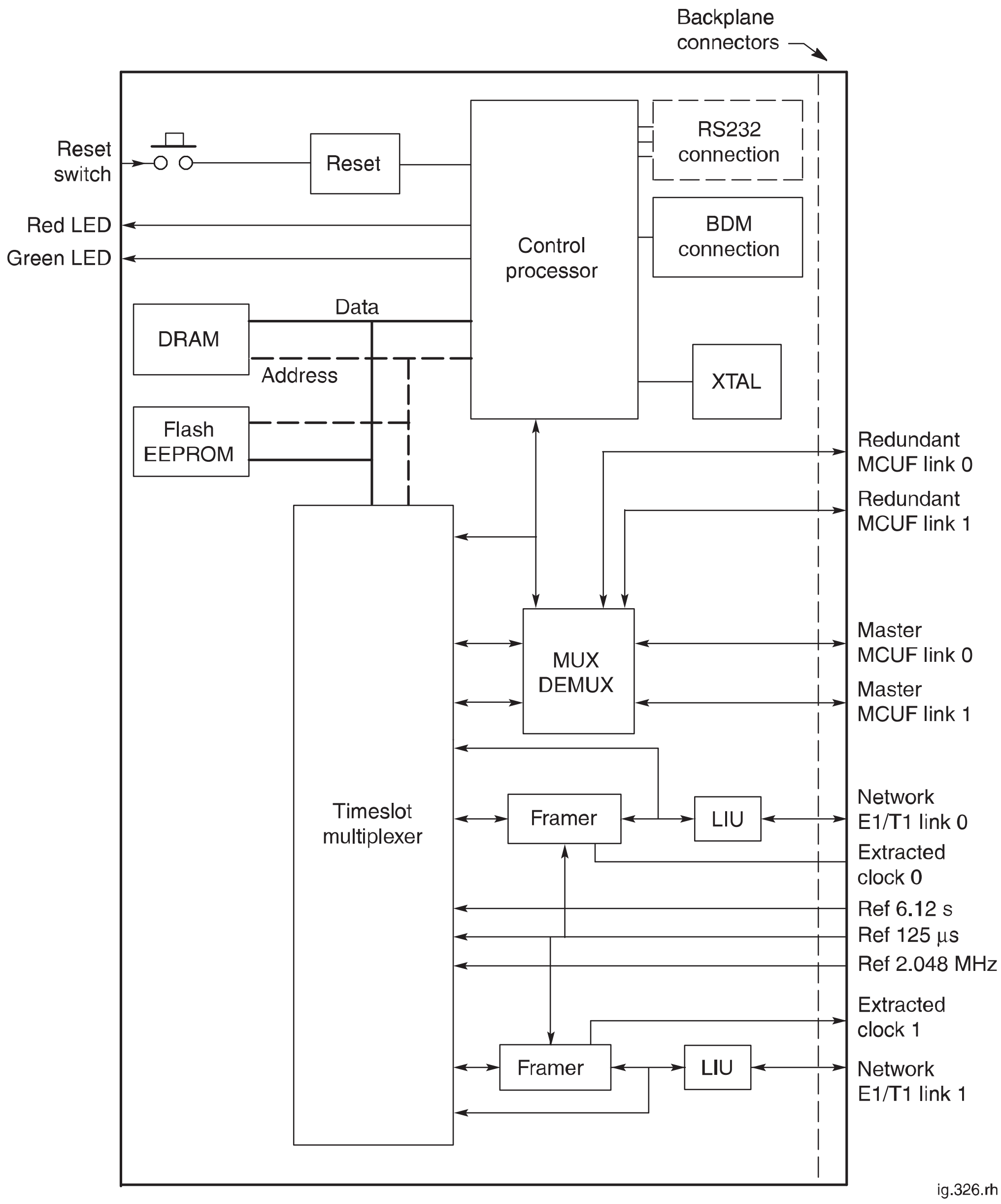


Figure 6-6 Functional diagram of NIU module

Control processor

The control processor interfaces to timeslot 0 of link 0 from each connected MCUF.

The processor uses 512 kbytes of flash EPROM for boot code. operational code storage and module ID. Code is executed directly from the Flash EPROM. The boot code can be overwritten under control of the MCUF, if required.

The processor also has an on-chip 1 Mbyte of DRAM.

TTY ports

The processing section provides two TTY ports for Motorola debugging purposes only.

Resets

The processor is capable of soft resetting itself. The front panel reset causes a hard reset of the entire board. Power-on also resets the processor.

The MCUF is able to reset the NIU via a message on the HDLC link.

NIU/MCUF framing and clocks

The control processor is supplied with a clock from an on-board crystal oscillator, which has an output enable pad for test purposes. The framer devices also have their own crystal oscillators on-board.

The framer devices provide the decoded and jitter attenuated receive data, for passing to the MCUF.

The framer devices also extract a clock signal from an E1/T1 link, which is then passed to the MCUF synchronization circuit. At the MCUF, this signal is used to phase lock a local 16.384 MHz clock signal. Once phase locked, three reference clock signals are provided for NIU use:

- REF 2.048 MHz clock signal.
- REF 6.12 s clock signal.
- REF 125 μs clock signal.

The NIU transmit and receive framing is controlled by this 125 μs reference pulse received from the MCUF.

Distance measurement

The NIU provides the ability to perform network distance delay measurement on either of the two network links. Measurement can only be performed on one link at a time.

Three modes of operation are possible:

- Mode 1. A pattern is transmitted in a selected network timeslot and the corresponding receive timeslot is monitored for its return. The delay is measured to an accuracy of ± 488 ns. The pattern is transmitted on the 6.12 second reference signal.
- Mode 2. The receive link is monitored for the pattern. When received the pattern is transmitted back in the next frame. The time between receipt and transmission of the pattern is measured to an accuracy of ± 488 ns.
- Mode 3. The receive link is monitored for the pattern. When it is detected a strobe is generated for the MCUF sync block.

Radio signalling links (RSLs)

The radio signalling links (RSL) to the BSC from the main processor on the MCUF are 64 kbit/s LAPD links. The LAPD encoding of this RSL data is performed on the NIU by the NIU control processor.

The RSL links between the MCUF and NIU must be sent as follows:

- RSL link 1 is embedded in the NIU control link; that is, it will be in timeslot 0 of link 0 to the NIU. This link is important for initialization.

NOTE	When the NIU is on a network link to a BSC or another BTS, the RSL can be placed on either link on any default timeslot other than zero.

- RSL link 2 is on a different timeslot from that used for the network connection.

The NIU supports a maximum of two RSL links. The RSL links may both be on a single network link or shared between the two network links.

The NIU hardware supports switching for 64 k and 16 k LAPD channels.

T1 NIU need to set link type

T1 NIUs and E1 NIUs cannot be interchanged. A T1 link line consists of 24 timeslots as opposed to 32 timeslots for an E1 link line. A T1 link generates specific T1 alarms, referred to as **Red alarms**. A T1 NIU supports the same MSI type of device transitions as an E1 NIU.

The OMC-R operator should set the link type or it will default the site to an E1 system. In ROM it is set by a ROM-only MMI command. In RAM it is a database parameter set by a **`chg_element`** command.

The RSL default timeslots are the same for a T1 NIU and an E1 NIU. The basic mechanism for communicating and configuring is also the same.

T43/BIB-NIU - E1/T1 mapping

Overview of T43/BIB-NIU connection

The NIU network interface (E1/T1) links connect to a single T43 (CIM) or BIB (BIM) board on top of the cabinet by a single backplane connector and cable.

NIU to T43 mapping and command ID

Only six network interfaces are used, three pairs to the master NIU modules, and three pairs to the redundant NIU modules. Each NIU is identified in the database by an identity number, from 0 to 3, as shown in the final column of Table 6-5.

NOTE	The redundant NIU modules are only redundant in the sense of being supplied by a different BPSM, and can thus continue to operate if the master BPSM fails. All NIUs are available for separate use.

Table 6-5 defines the mapping from the T43/BIB connector to NIU boards.

Table 6-5 T43/BIB connector to NIU boards

T43 network side connector	37-way D-type connections (BIB)	NIU location	NIU identity (MSI) used in commands
J1	1,20	NIU A0 - Tx1	MSI(NIU) 0
J2	2,21	NIU A0 - Rx1	
J7	7,26	NIU A0 - Tx2	MSI(NIU) 0
J8	8,27	NIU A0 - Rx2	
J13	13,32	NIU A1 - Tx1	MSI(NIU) 2
J14	14,33	NIU A1 - Rx1	
J4	4,23	NIU B0 - Tx1	MSI(NIU) 1
J5	5,24	NIU B0 - Rx1	
J10	10,29	NIU B0 - Tx2	MSI(NIU) 1
J11	11,30	NIU B0 - Rx2	
J16	16,35	NIU B1 - Tx1	MSI(NIU) 3
J17	17,36	NIU B1 - Rx1	

Diagram of T43 connection to NIUs

Figure 6-7 shows a diagram of T43 connection to NIUs.

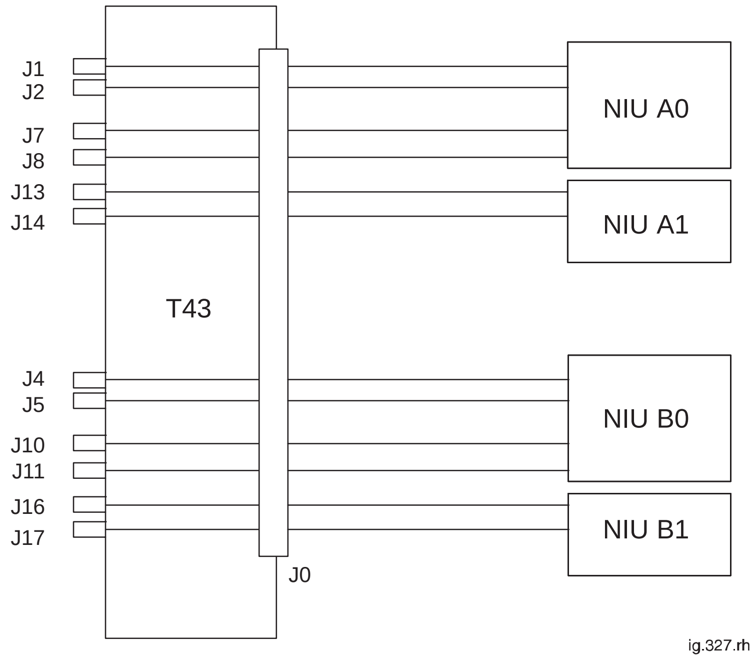


Figure 6-7 Diagram of T43 connection to NIUs

FMUX module

Overview of FMUX module

The fibre optic multiplexer (FMUX) module multiplexes and demultiplexes six, full duplex, transceiver links to one (TX/Rx) pair of fibre optic cables. This enables up to six transceivers in a single extension cabinet (either Horizon*macro* or M-Cell*6*) to be linked to the master cabinet.

The FMUX module has two modes of operation:

- Working in conjunction with the MCUF to multiplex transceiver links to/from a third extension cabinet.
- Operating in the extension cabinet to supply the transceivers in that cabinet.

To enable a total of four cabinets to be joined together as one BTS site, an FMUX module is required in the master cabinet to connect the third extension cabinet. A single cabinet site has no need for an FMUX module, because the MCUF connects with the cabinet CTUs through the backplane.

Two FMUX modules may be fitted in the digital module shelf, one for the master MCUF, and one for the slave. An extension cabinet only requires one FMUX to connect to six transceivers within the cabinet, (plus one for redundancy if required).

Each FMUX fibre optic link is full duplex 16.384 Mbit/s. The FMUX optical link is capable of driving up to 1 km.

FMUX module view

Figure 6-8 shows an FMUX module.

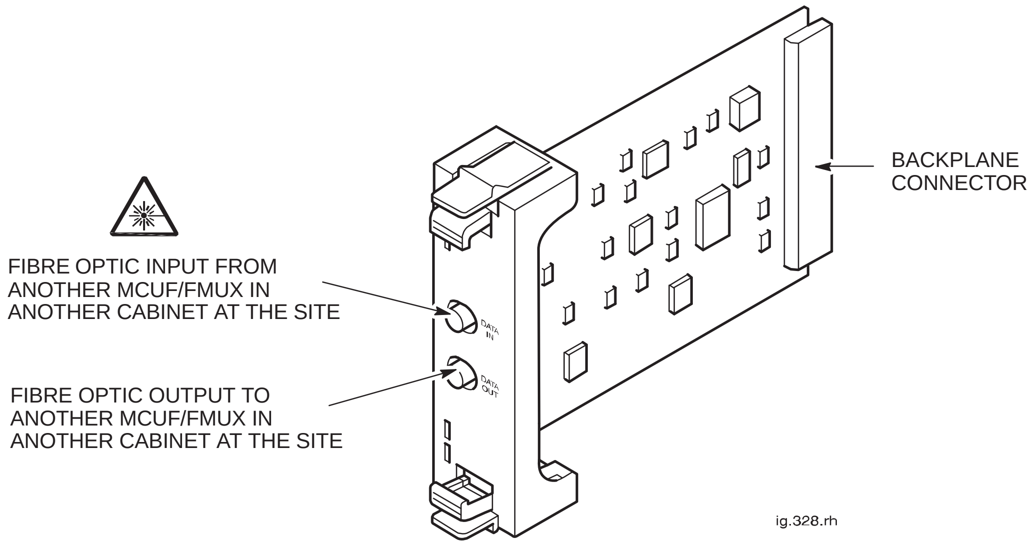


Figure 6-8 View of the FMUX module

FMUX functional diagram

Figure 6-9 shows a block diagram of the FMUX module.

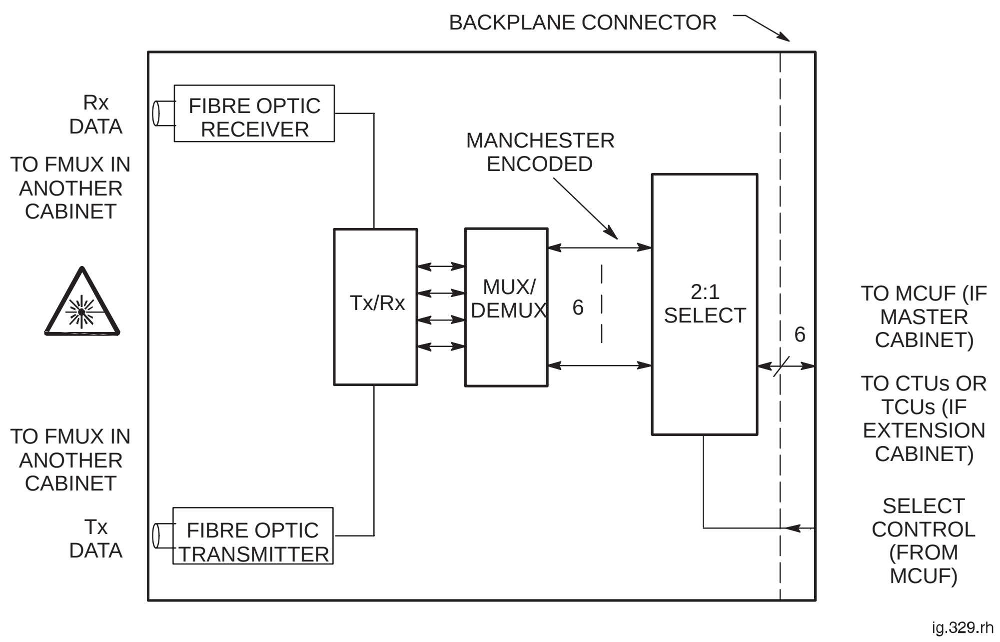


Figure 6-9 Functional diagram of FMUX module

FMUX functional explanation

The MCUF transmits and receives a 2.048 Mbit/s data stream link to each operational transceiver. In the master cabinet this is achieved by the backplane, without using an FMUX.

If the transceiver is in an extension cabinet, the master cabinet FMUX combines the data stream with up to five others (see Figure 6-9), and then converts the electronic signal to fibre optic, for onward transmission to the extension cabinet.

At the extension cabinet, another FMUX converts the fibre optic signal back to electronic form, for transmission to the transceivers.

The data stream return from the extension cabinet is a reverse of the above.

The multiplexer/demultiplexer can support up to six transceiver links. It uses a 16.384 Mbit/s Manchester encoded serial data link organized as 256 x eight bit timeslots in a 125 μs frame. Manchester coding is used to detect errors, indicated at timeslot zero for each transceiver, enabling error correction at the other FMUX.

Alarm module

Alarm module overview

The alarm module is located in the digital module shelf, adjacent to the MCUFs. It provides the cabinet equipment with an external alarm system to report operational status. The alarm module:

- Collects all cabinet alarms (received from the backplane).
- Provides current sensing for 16 customer inputs, referred to as site alarms. These inputs are provided by the PIX connectors PIX0 and PIX1.
- Controls up to four relay driven outputs linked to customer equipment. (Changeover contacts 30 V 1 A maximum). These outputs are provided by the PIX0 connector.
- Transmits alarm information to all CTUs in the same cabinet.

Alarm module view

Figure 6-10 shows an alarm module.

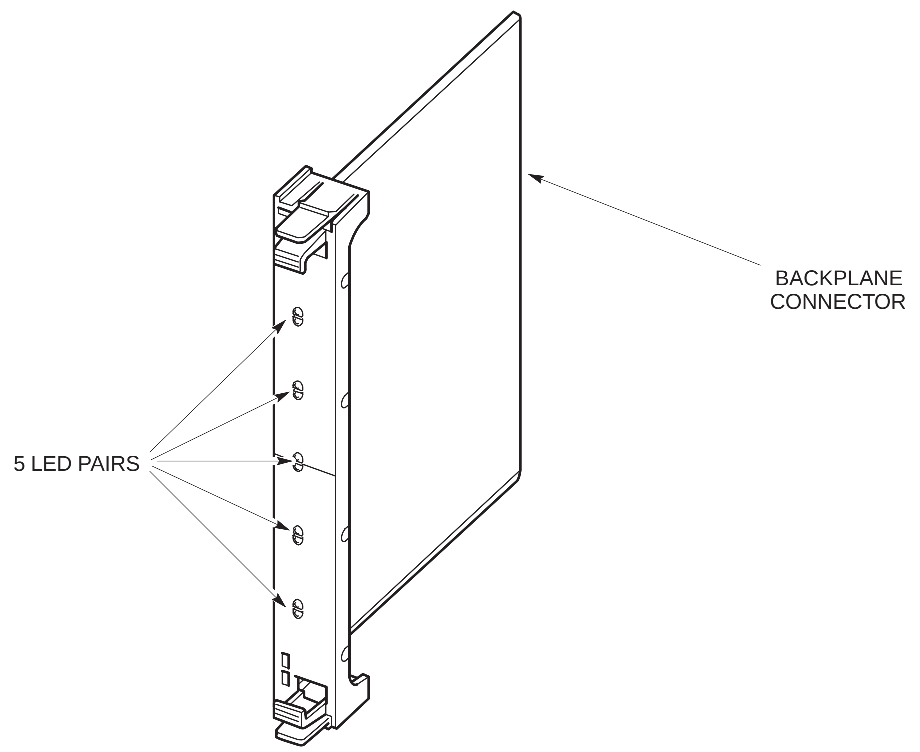


Figure 6-10 Alarm module view

Alarm module functionality

The alarm module receives inputs from:

- The external alarm connector on the interface panel, (from the optional batery backup system BBS).
- Cabinet PSMs (identifying type, manufacturer and slot number).
- Environmental control devices.
- Customer defined alarms.

The alarm board receives these inputs, encodes them, and then passes the code word to all CTUs in the cabinet via the backplane.

Alarm module replacement – effect on alarms

The alarm module can be replaced while the cabinet system is running (hot replacement). This will temporarily interrupt alarms, with the OMC-R receiving an additional **alarm module out of service** alarm, which automatically clears upon correct insertion of the replacement module.

Alarm collection from extension cabinets

Extension cabinet alarms are sent from the extension cabinet alarm module to the extension cabinet CTUs. The CTUs transmit the alarms to the main cabinet, by using the normal FMUX connection, for transmission to the MCUF.

Alarm module display presentation

All alarms LEDs are green or off when equipment is functioning correctly, and red when equipment is faulty. The LED designations are shown in Table 6-6.

NOTE	Only five of the ten front panel LEDs are utilized in the Horizon*macro* indoor equipment. Others are utilized in the Horizon*macro* outdoor.

Table 6-6 Alarm module LEDs

LED location	Light colour states	Equipment monitored by light (Green = OK, Red = FAULT)
1 (top)	Off/Red	Not used in Horizon*macro* indoor.
2	Off/Red	Not used in Horizon*macro* indoor.
3	Off/Red	Door 1 – main cabinet door open alarm.
4	Off/Red	Not used in Horizon*macro* indoor.
5	Off/Red	Low voltage disconnect (LVD) alarm (battery backup option).
6	Green/Red	Fan Tray 0 fully operational (4-fan tray).
7	Green/Red	Fan Tray 1 fully operational (2-fan tray).
8	Green/Red	Fan Tray 2 fully operational (2-fan tray).
9	Off/Red	Not used in Horizon*macro* indoor.
10 (bottom)	Off/Red	Not used in Horizon*macro* indoor.

CHAPTER 1
INTRODUCTION AND SITE PREPARATION

CHAPTER 2
INSTALLATION OF INDOOR CABINET

CHAPTER 3
INTEROPERABLITY

CHAPTER 4
COMMISSIONING OF INDOOR CABINET

CHAPTER 5
DECOMMISSIONING OF CABINET

MOTOROLA

Category 423

Installation & Configuration (Inst.)

Chapter 5
Decommissioning of cabinet i

Chapter 1

Introduction and site preparation

Chapter 1
Introduction and site preparation

Introduction to installation

Manual scope

This category (GSM-205-423) covers installation and commissioning for the cabinet, arranged in the following chapters:

Chapter 1 Introduction and site preparation

General information, **safety instructions** and information about tools needed to install the equipment.

Describes the procedures to be followed for initially preparing the site and installing the necessary ducting and plinths.

Chapter 2 Installation of indoor cabinet

All the procedures necessary to install the cabinet ready for operation and an overview about the different configurations available.

Chapter 3 Interoperability

Describes interoperability between the Horizon*macro* indoor BTS and earlier Motorola BTS products.

Chapter 4 Commissioning of indoor cabinet

All procedures necessary to enable the cabinet to be fully operational.

Chapter 5 Decommissioning of indoor cabinet

All procedures necessary to decommission the cabinet.

NOTE	For hardware optimization and base site integration, refer to *Installation and Configuration: BSS Optimization: (GSM-100-423)*.

Software requirements

The GSM/EGSM900 and DCS1800 BTSs require software release GSR4 (or later) in the network.

The GSM850 and PCS1900 BTSs require software release GSR5.1 (or later) in the network.

Safety instructions

WARNING	This equipment must only be installed by trained personnel.

The following safety instructions must be observed when installing the equipment described in this manual:

- The installation and configuration procedures described in this manual must only be carried out by suitably trained personnel.
- Installation and commissioning must comply with all relevant national and regional regulations.
- The equipment must only be installed in a location to which unauthorized access can be prevented.
- Cabinets must be bolted to the plinth base which must be bolted to the floor.

Horizon*macro* indoor tool list

Overview of tool list

This section lists the recommended tools required for installing, commissioning and maintaining the Horizon*macro* indoor cabinet.

Tool list

Table 1-1 lists the recommended tools for the Horizon*macro* indoor.

Table 1-1 Horizon*macro* indoor tool list

Quantity	Description
1 pair	Safety goggles
1	Hard hat
1	Dust mask
1 pair	Ear defenders
1	Antistatic wrist strap with coiled lead
1	Antistatic mat
1	Marker pen
1	Torch
1	Socket set (A/F/Metric 13 mm or 1/2 sq drive)
1	280 mm insulated adjustable spanner
1 each	Combination spanners A/F: 1/4, 5/16, 3/8, 7/16, 1/2, 9/16, 5/8, 11/16, 7/8, 3/4, 1.
1 each	Combination spanners metric: 8 mm to 25 mm
1	Ratchet ring spanner (15 mm x 13 mm)
1	Torque spanner (12 mm)
1	Torque wrench (1–25 Nm)
1	Torxdriver set (T10 to T30) and Security Torxdriver set (T10 to T30)
1	6 mm torque spanner (for SMA Tx block connectors)
1	Security Allen key set
1	Claw hammer
1	Pipe cutter
1	Junior hacksaw
1	300 mm hacksaw
1 pair	150 mm side cutters
1 pair	150 mm heavy–duty side cutters

Quantity	Description
1 pair	Flush cut wire cutters
1 pair	Light duty cable cutters
1 pair	Cable shears
1	Knife with retractable blade
1 pair	General purpose pliers
1 pair	Snipe nose pliers
1 pair	Industrial scissors
1 pair	GP serrated jaw pliers
1	Set of jeweller's screwdrivers
1	Screwdriver set (including flat and cross-head blades)
1	Isolating transformer (suitable for site use)
1	Piston drill (suitable for drilling concrete and capable of accepting an M20 drill bit)
1	M20 drill bit
1	Drill bit set
1	6 m 240 V extension cable (twin outlet)
1	Soldering iron (dual temperature) with holder
1	Coax cable stripper for 2002 (75 ohm coaxial cable)
1	Hand crimp tool
1	Crimp tool for type 43 connectors
1	BNC crimp tool with inserts
1	Telephone plug crimp tool
1	50 mm crimp tool
1	Cable tie gun
1	1.5 m wooden step ladder
1	Table vice
1	250 mm vice grips
1	7.5 m tape measure
1	300 mm steel rule
1	Spirit level (1 m)
1	Centre punch
1	Pocket scriber
1	250 mm half round file
1 pair	Straight point tweezers
1	Null modem

Quantity	Description
1	RS232 mini tester
1	M to M gender changer

Preparation overview

Overview of site preparation

This section contains:

- Information that should be read for initial planning.
- Information that should be read for safe completion of procedures.
- Pre-installation procedures to be followed to prepare the site before beginning the installation.

Pre-installation procedures

Pre-installation for the cabinet comprises the sections listed in Table 1-2.

Table 1-2 Pre-installation sections in this chapter

Section	Description
Site requirements and considerations	Details mechanical, electrical and structural parameters to be taken into account when selecting a site.
Visiting the site	Defines the site operating procedures.
Preparing the site	Details general site construction parameters.

Site requirements and considerations

Overview of requirements

The base site area, where the equipment is to be installed, must meet :

- Structural requirements including:
  - Space for all conditions, including maintenance, expansion and associated cables.
  - Allowance for cabinet height. including allowance for second cabinet placed on top with stacking bracket.
  - Allowanance for weight, including that for potential additions on expansion.
  - Additional space to allow door to be opened beyond 90 degrees.
- Environmental and power requirements, as defined in manual specifications.

Indoor cabinet dimensions

The dimensions of cabinets are listed in Table 1-3.

Table 1-3 Cabinet dimensions

Cabinet type	Height	Width	Depth
Cabinet (without hood)	750 mm	700 mm	430 mm
Cabinet with optional hood	870 mm	700 mm	430 mm
Cabinet with stacking bracket (to hold CCB)	1025 mm	700 mm	430 mm
Two cabinets, with stacking bracket between, and optional hood on top	1900 mm	700 mm	430 mm
Two cabinets, with stacking bracket between, and stacking bracket on top.	2050 mm	700 mm	430 mm

The optional hood allows cables to enter the cabinet from the back and above.

The stacking bracket allows a second cabinet to be stacked on top of the first cabinet. The stacking bracket can also contain a metal basket, in which CCBs are fitted (the only Tx unit that cannot fit in the cabinet itself).

Cabinet weights

The weights of the fully populated cabinets are listed in Table 1-4.

CAUTION	Consider future expansion. Another cabinet may be added by stacking on top of the existing cabinet. This, if used with stacking units on both, each with CCBs, and associated cables, could result in a total weight of 280 kg. Ensure floor is capable of supporting this weight.

Table 1-4 Main indoor cabinet weights (with six transceivers)

Cabinet with plinth and hood	Cabinet with plinth, stacking bracket and CCB
115 kg	130 kg

Torque values

Use the torque values listed in Table 1-5 during installation (see **NOTE** for M12).

Table 1-5 Torque values for all cabinet screws/bolts and RF connectors

Size of screw/bolt	M4	M6	M8	M10	SMA	N-type	7/16
Torque value	2.2 Nm	3.4 Nm	5 Nm	10 Nm	1 Nm	3.4 Nm	25 Nm

NOTE	Torque values used with M12 anchor bolts will depend on the anchor bolt manufacturer. Check manufacturers data for correct values.

Power requirements

The power requirements of cabinets depends on the configuration. Indoor cabinets require either ac or a positive or negative earth dc supply.

Power consumption (dc and ac)

Table 1-6 lists typical and maximum power consumption values

Table 1-6 Power consumption of full cabinet, including digital redundancy

Typical measured consumption	Maximum power consumption
1400 watts	1700 watts

NOTE	Maximum power consumption figures are theoretical values derived under extreme conditions and are affected by variables such as temperature, component tolerances, transmission power and supply voltage. although these figures must be considered when planning site power requirements, typical measured consumption values will be lower.

Cabinet power supply requirements

WARNING	All cabinets and supply cables must be protected by a fuse or circuit breaker selected in accordance with national and regional wiring regulations.

Table 1-7 lists the power supply requirements for the different power supply options.

Table 1-7 Main indoor cabinet power supply requirements

Nominal voltage	Voltage supply range	Current supply maximum
+27 V dc (negative earth)	+20 to +30 V dc	64 A (at nominal voltage)
–48 V dc (positive earth)	–39 to –72 V dc	36 A (at nominal voltage)
120/240 V ac (50 – 60 Hz)	88 to 264	7.5 A (at nominal voltage)

NOTE	Voltage transients must be less than 35 V peak amplitude (never below 0 V). Ripple and noise must be less than 200 mV p-p (30 mV rms) over 10 Hz to 14 MHz. Voltage application stabilization must be within the specified range in less than 1 second.

RF output power

Table 1-8 lists the RF power output of the CTU types.

Table 1-8 CTU RF power output at Tx connector

GSM850 and EGSM900	DCS1800 and PCS1900
60 W (47.8 dBm) +/– 1.0 dB	50 W (47.0 dBm) +/–1.0 dB

Table 1-9 lists the expected power output from the various Tx blocks for both types of CTU.

Table 1-9 RF power output at cabinet after Tx blocks

Tx block	GSM850	EGSM900	DCS1800	PCS1900
TDF	40 W (46.0 dBm)		32 W (45.1 dBm)	
DCF	20 W (43.0 dBm)		16 W (42.1 dBm)	
DDF	8.5 W (39.3 dBm)		7 W (38.5 dBm)	
CCB*	n/a	20 W (43.0 dBm)	16 W (42.1 dBm)	n/a

* For a six-channel configuration with minimum cavity separation of 800 kHz.

NOTE	CCBs are not currently available for use with the GSM850 or PCS1900 variants.

Environmental requirements

Table 1-10 lists the operating environmental limits.

Table 1-10 Environmental limits

Environment	Temperature	Relative Humidity
Operating	–5 °C to + 45 °C.	5% to 100% relative humidity, not to exceed 0.029 g water / m^3 dry air.
Storage	–45 °C to +70 °C.	8% to 100% relative humidity, not to exceed 0.029 g water / m^3 dry air.

NOTE	This specification is valid up to 3 km altitude, corresponding to an atmospheric pressure range of 648 to 1048 millibars.

Structural considerations

Adequate clearance must be provided at the front of the equipment for operation and maintenance purposes. There must be adequate side clearance (50 mm) to enable the door to open beyond 90° (see Figure 1-1). The door can also stop at 95° and 130°, but this is only to protect the door, or give optional additional operator space.

The cabinet ventilation entry can be solely from the bottom front of the cabinet. This allows a cabinet to be placed against a wall. However, if the unit is placed 50 mm from back or side obstructions, such as wall or other cabinets, the ventilation will be improved, and fan noise reduced.

Up to 100 mm rear space may be required for cables if using stacking bracket.

The foundation or structure on which the BTS cabinet is mounted must be of sufficient strength to support a maximum gross weight of 130 kg for a single cabinet or 280 kg for two stacked cabinets.

NOTE	In seismically active areas, Motorola suggest using a qualified structural engineer to assess frame mounting requirements, such as floor construction, mounting anchors, cell site construction and to provide a suitable design for top frame support if a stacked configuration is required.

Layout plan

Figure 1-1 shows the cabinet installation layout plan.

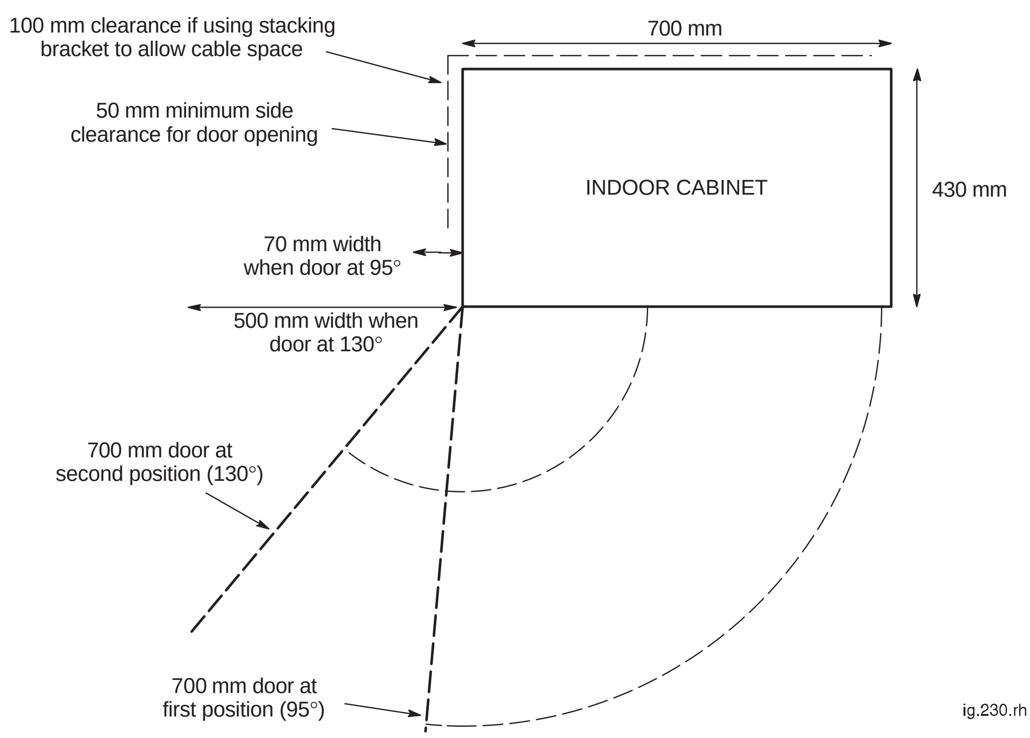


Figure 1-1 Indoor cabinet installation layout plan view

Visiting the site

Site visit instructions

When preparing to do work at a site and upon arrival, follow the instructions provided in this section.

Before leaving for the site

Before leaving for the site:

1. Check that team members have adequate test equipment, tools, and hardware to complete the tasks. Check for any special requirements.
2. Contact the person in charge of the building to advise of the team’s estimated time of arrival and the expected duration of their stay on the site. Usually the logistics will have already been arranged, but it is good practice to check that the information was received.
3. Ensure that the team read the site access details on each visit to a site as local regulations may change.

Arrival at site

When entering any site:

1. Do not enter the site before contacting the communications site manager. Obtain the following information from the building contact:
   – Local regulations.
   – Parking instructions.
   – Waste material removal instructions.
   – Directions to canteen facilities (if available).
2. Enter the site.
3. Check for building alarms, for example, intruder alarms, that may have been activated by entry. If fitted, disable the CO2 gas systems, and any other alarms activated by entry.
4. Read any local instructions provided.

Leaving the site

When leaving a site:

1. Enable the CO2 gas system, if fitted, and any alarms that were disabled.
2. Contact the local site manager to announce the team’s departure.
3. Sign out of the building as necessary

Waste material on site

Clear waste material from the site on completion of the job, unless otherwise indicated by the customer.

WARNING	Do not burn waste material, as packaging might give off toxic gasses.

Rural sites

It is the responsibility of the senior member of the team to ensure that all personnel on site are aware of all applicable national and regional environmental regulations or codes of practice and, especially with respect to water authority sites, any relevant health regulations.

Adhere to these points:

- Guard against all risk of fire.
- Fasten all gates (remember site visits could be traced back if a complaint is made).
- Leave no litter.
- Drive carefully on country roads and observe speed restrictions at all times.
- Keep to the paths/tracks across farm land.

On site safety

All personnel must:

- Ensure that under no circumstances should anyone move cabinets without assistance. Cabinets must be safely positioned at all times.
- Wear supplied safety helmets when antenna or overhead work is in progress, and when local regulations require them.
- Wear supplied safety goggles and dust masks when drilling. This is particularly important when drilling overhead ironwork.
- Wear supplied ear protectors while drilling is in progress.
- Wear approved safety footwear when moving heavy equipment.

Stop any work that you are supervising should any person in your team not be properly protected, or be unaware of safety requirements.

When installing cable ties, even temporarily, cut the excess or tail properly. This is to prevent sharp edges inflicting injury when not cut flush with the locking edge.

Preparing the site

Introduction to site preparation

This section provides a general overview on the preparation of a site, and site requirements. For specific sites, refer to the site-specific documentation.

Base site structure

The base site structure should be designed to meet accepted cellular system specifications. Additionally, the site must meet the environmental and electrical operating criteria.

Site requirements

The customer should provide secure access free from unauthorized personnel, ample protection from fire, and adequate lighting and clearance at the front and rear of the equipment for operation and maintenance. Additionally, four cable ducts with sufficient space for communications cables, mains cables, earth cables, and antenna RF cables should be provided.

Site access

The site access road and equipment receiving area must be constructed of asphalt, concrete, or other suitable load bearing aggregate capable of supporting the transportation vehicle and the cabinet.

NOTE	Ensure the unloading area is clear of standing water, fallen leaves, mud, and building debris.

Cabinet installation layout

The cabinet installation layout plans are provided in the **Site requirements and considerations** section. Figure 1-1 shows the cabinet installation layout plan with dimensions.

Chapter 2

Installation of indoor cabinet

Chapter 2
Installation of indoor cabinet i

Installation overview

Introduction to installation

This chapter provides the information required to install cabinets and their internal and external interfaces.

CAUTION	Ensure that all site associated equipment is completely installed before commissioning the cabinet for operation.

NOTE	Some site equipment may not be produced by Motorola, including battery chargers, power supplies, and antennas. Refer to site-specific documentation and non-Motorola vendor instructions.

Before starting an installation, ensure the site has been prepared according to the description summarized in **Preparation overview** in the Site preparation chapter, and the site-specific documentation.

WARNING	Do **NOT** stack more than two Horizon*macro* indoor cabinets. The floor mounted cabinet **must** be securely bolted to the floor before a second cabinet is stacked on top.

In multiple cabinet sites, up to two Horizon*macro* indoor cabinets may be stacked with another two stacked Horizon*macro* indoor cabinets installed adjacent, to provide the maximum 24 carrier BTS site.

Installation sections

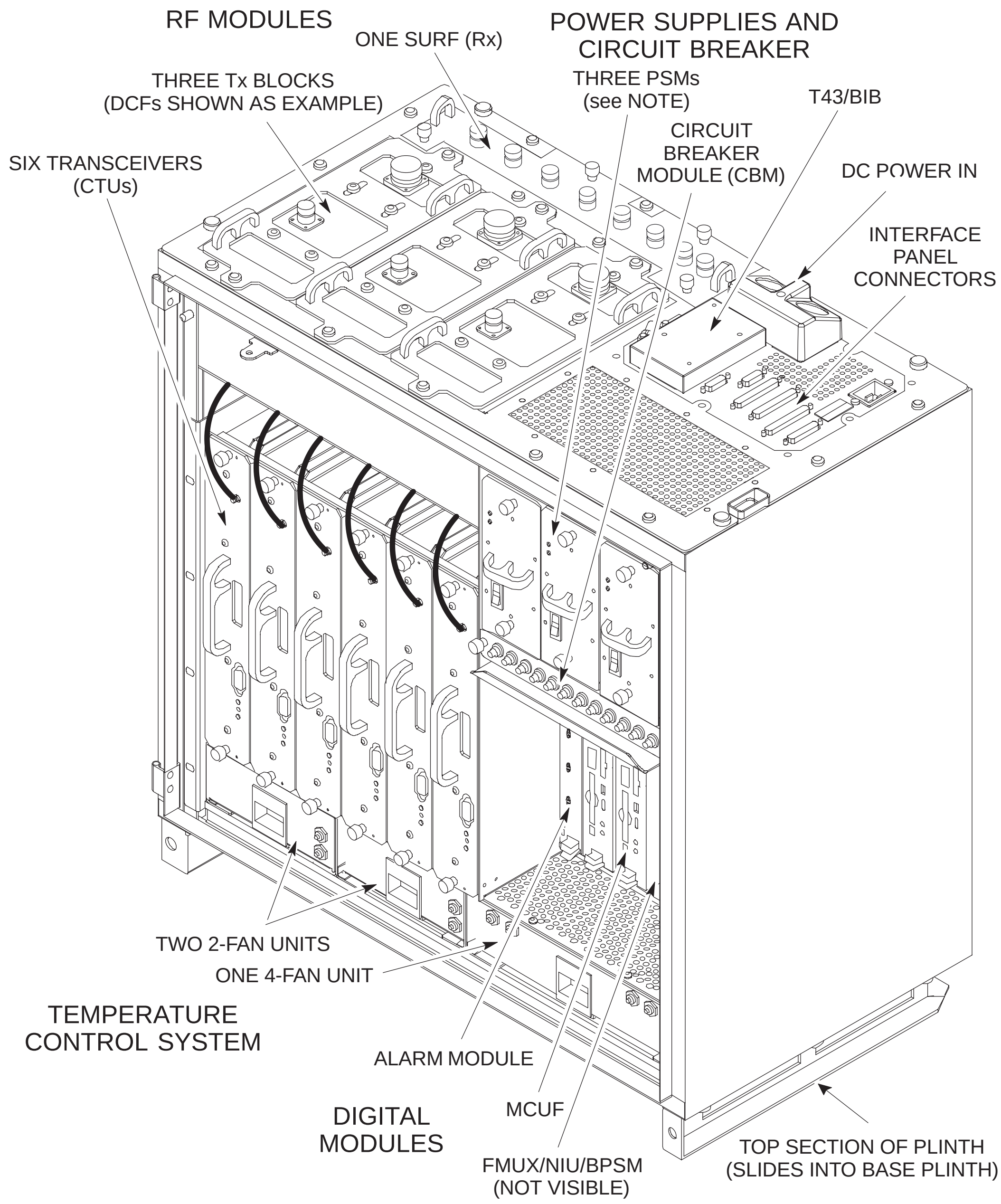
Installing cabinets comprises the sections shown in Table 2-1.

Table 2-1 Installation sections in this chapter

Section	Description
Equipment delivery and unpacking	Information on delivery packaging, and how to unpack the equipment.
Installing cabinet plinth	Details the procedure for fitting the cabinet plinth base.
Fitting cabinet to plinth	Provides procedure for attaching cabinet to prepared plinth.
Hood or stacking bracket fit	Provides procedure for attaching stacking bracket on top of any cabinet.
Fitting cabinet onto stacking bracket	Provides procedure for attaching second cabinet to stacking bracket of first cabinet.
Installing CCBs into stacking bracket	Provides procedure for installing CCBs into stacking bracket of any cabinet.
Earthing and transient protection	Details site earthing procedures and cabinet internal earths.
Connecting antennas and cabinet configurations	Details setting up antenna connections, with additional configuration information to illustrate potential equipment connections.
Interface cabling	Details cabling to the interface panel.
Installing power and earth cabling	Details of power supply earthing requirements.
Connecting input power	Details the correct sequence for power connection.

Cabinet view

Figure 2-1 shows the main components of a fully equipped cabinet.



NOTE	Three PSMs = 2 + 1 redundant (if required). An optional hold-up battery module may be installed instead of a redundant PSM.

Figure 2-1 Cabinet with components identified (door and hood removed)

E1/T1 line testing

If an E1/T1 line has been provided, contact the local MSC and, at the earliest opportunity, arrange to test the line back to the MSC.

Equipment delivery and unpacking

Delivery and packaging overview

Before the cabinet equipment arrives, installation personnel should designate an area at the site where the equipment can be unloaded. This area should also be suitable for unpacking the equipment. Consult with the heavy freight or moving company and the owners of the building (if applicable) to select this area.

CAUTION	The cabinet equipment should be delivered to the site while still contained in its packaging. This is to protect the cabinet in transit and from moisture.

The equipment should be carefully delivered to the site by the freight company, along with the necessary moving dollies and padding. Use the dollies and padding to move the equipment from the unloading area to the installation point.

NOTE	Keep all paperwork attached to packaging, or found inside cabinet.

Packaging crate

The cabinet equipment is shipped in a crate of a similar construction to that shown in Figure 2-2.

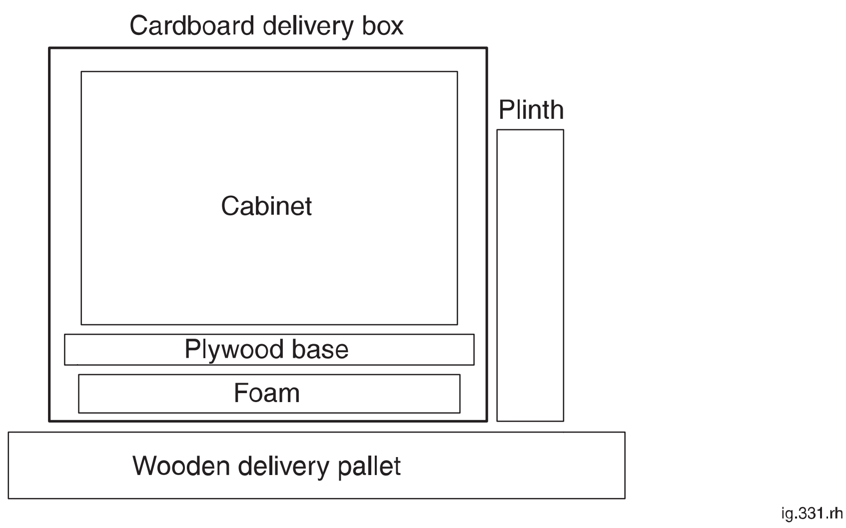


Figure 2-2 Typical shipping crate detail

Equipment module packaging

The equipment modules are supplied already fitted into the cabinet. The only exception to this is the plinth, supplied in a separate package. The plinth is attached to the side of the main package to enable preparation work to proceed, using the plinth, without opening the main cabinet package. This keeps the cabinet protected during initial preparation.

The optional hood is supplied in a separate package.

Unpacking the crate, plinth and cabinet

The following describes the procedure for unpacking the equipment.

NOTE	It is recommended that the installer read through the following procedure before starting to unpack and install the equipment.

Tools

Use the following tools to dismantle the crate and unpack the cabinet.

- Claw hammer (or similar levering device).
- Knife.

Obtaining plinth base

To obtain the plinth:

1. Cut the plastic banding that secures the crate.
2. Remove separate plinth package, and deliver to site for site preparation if required separately.

Delivery and dismantling of shipping crate

To deliver and dismantle the shipping crate:

1. Deliver remaining cabinet equipment to site in its original packaging.

NOTE	The packing material used by Motorola is non-returnable and should be disposed of safely.

2. Lift the lid free of the crate.
3. Lift out cardboard protective pieces.
4. Lift the box over the cabinet.

Removing the cabinet from the crate base

WARNING	The cabinet can weigh up to 130 kg if fully equipped. Handle each cabinet with extreme caution, and in accordance with local health and safety regulations.

To remove the cabinet from the crate base pallet:

CAUTION	Care must be taken to avoid damaging the cabinet in any way, especially by scratching the outer surfaces.

1. Carefully cut open the sealed barrier bag containing the cabinet.
2. Use straps attached to the plywood base holding the cabinet, to lift cabinet over the delivery pallet and foam packing pieces.
3. Remove the desiccant bag from the cabinet.
4. Inspect the equipment immediately for damage. Report the extent of any damage to the transport company.

The cabinet is now unpacked.

Safe disposal of packing material

The packing material used by Motorola is non-returnable and should be disposed of safely.

CTU allotted slot retention

CTUs are supplied already fitted in the cabinet, with Tx cable correctly attached by Motorola. CTUs must remain in the allotted slots for Motorola calibrations to be valid.

Installing cabinet plinth

Overview of foundation and plinth with diagram

An indoor cabinet is supplied with a plinth, into which the cabinet structure is located. This plinth can be used on a smooth, level concrete floor, or other strong supportive construction. In addition the plinth is used in conjunction with the stacking bracket in stacked cabinet configurations. The plinth ensures correct weight distribution, and requires four M12 mounting or anchor bolts to hold it firmly in position.

WARNING	The cabinet must be bolted to the floor using the supplied plinth. This prevents danger from toppling, if a stacking bracket is ever added together with a second cabinet on top. The plinth also reduces fire hazards. **NEVER** install the cabinet without the plinth, and **ALWAYS** bolt the plinth to the floor. Ensure the selected bolts are suitable.

The plinth is first fitted to the floor, then the cabinet is slid into the plinth and bolted to the plinth. Figure 2-3 shows the plinth with locations for both floor attachment and cabinet attachment.

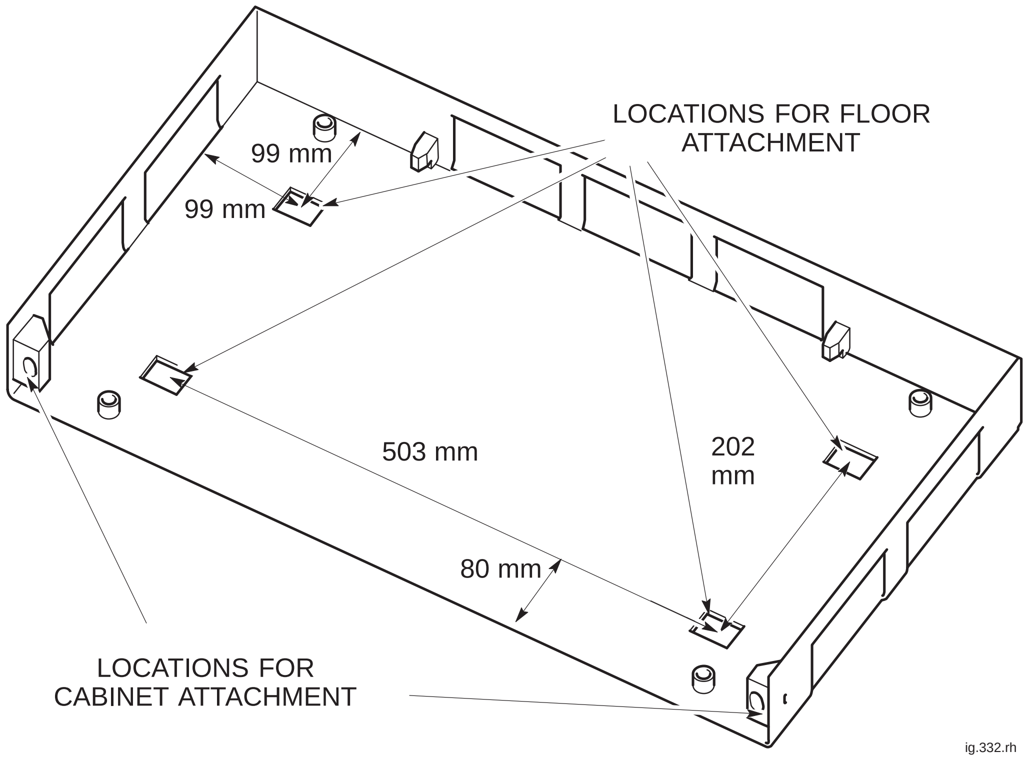


Figure 2-3 Plinth for cabinet installation

Recommended bolt length for concrete floor

The recommended length of the M12 steel anchor bolts is 105 mm minimum. This is to ensure adequate strength if stacked cabinets are installed.

Installing the plinth

If the cabinet is a direct replacement for existing Motorola M-Cell*6*, BTS4 or BTS6 units, the cabinet can be mounted in place using the existing fixing holes. Only use existing holes if sufficient space exists for the new configuration (see **Site requirements and considerations**).

If the installation is new, the concrete floor must be drilled to accept M12 anchor bolts. Washers and bushes are supplied, but the M12 steel bolts are supplied by the customer.

1. Move the cabinet plinth to the selected mounting position. Consider future as well as present space requirements (see **Site requirements and considerations**).
2. Mark the positions of the four mounting holes in the base of the plinth. These are in the form of four square holes in the middle of the plinth.
3. Move the plinth well away from the mounting position.

WARNING	Wear safety glasses and a dust mask when drilling holes.

CAUTION	Drilling concrete flooring produces cement dust, which is harmful to equipment and wiring. Protect the cabinets and any nearby equipment from dust. Use a tarpaulin, cloth, or plastic sheeting to cover exposed equipment. Clean up any accumulated debris from the anchor installation carefully before exposing the equipment. Use drilling equipment suitable for cutting steel reinforced concrete.

4. Drill out the four holes to a depth and clearance for an M12 anchor bolt, using the plinth as a template.
5. Fit the M12 mounting anchors to the holes in the floor.
6. Position the plinth over the mounting anchor holes.
7. Fit the anchor bolts with the supplied bushes and washers, through the plinth floor, to each anchor.
8. Tension up the anchor bolts and then check for alignment and level using a spirit level.
9. When satisfied that the plinth is correctly aligned, torque the bolts to the correct value for M12 bolts (see **Site requirements and considerations** in this chapter).

Fitting cabinet to plinth

Methods of plinth use

There are two methods of using the plinth:

- For floor mounting, with the plinth previously secured firmly to the floor.
- For mounting cabinet on a stacking bracket attached to the top of another cabinet. In this case the plinth is fitted to upper cabinet prior to lifting.

Fitting cabinet to plinth

To fit the cabinet onto the plinth:

1. Remove the two M10 bolts attached to the front of the plinth.

WARNING	Before lifting, ensure that the straps are either side of each cabinet corner.

2. Tilt and slide the cabinet off the plywood base and move to the plinth, using the straps provided.
3. Slide cabinet into the plinth grooves, as shown in Figure 2-4.
4. Fit the two M10 bolts and tighten to correct torque (see *Installation & Configuration: GSM-205-423* **Site requirements and considerations**).

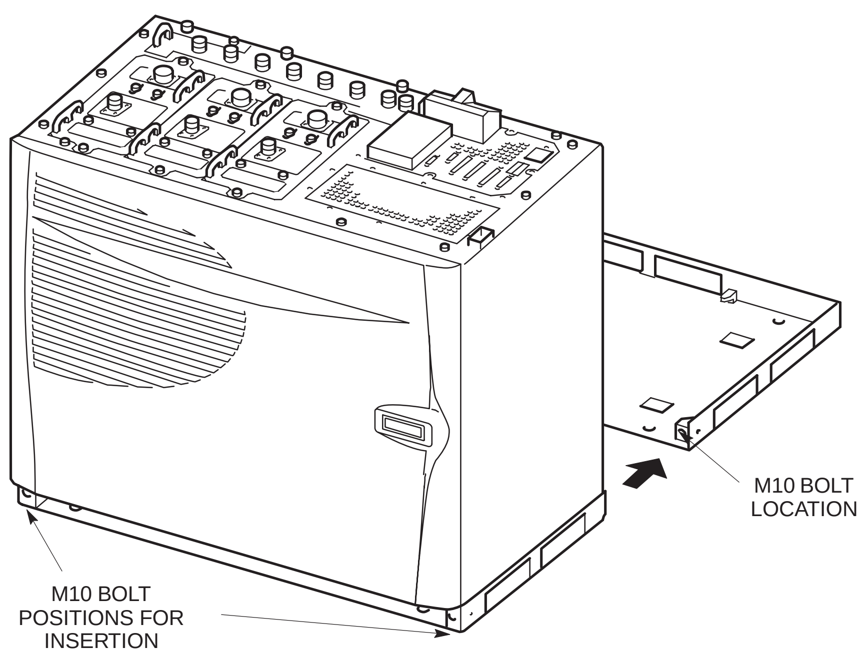


Figure 2-4 Cabinet sliding onto plinth

Hood or stacking bracket fit

Introduction to hood and bracket fit

If required, the optional hood or stacking bracket are fitted at this stage.

To change from an existing hood to a stacking bracket, the pin locations for the hood are used by removing the pins before fitting the stacking bracket screws. Similarly, if replacing a stacking bracket with the optional hood, the appropriate stacking bracket securing screws are replaced with the hood pins (see Figure 2-5).

Diagram of pin location points on cabinet top

Figure 2-5 shows the eight screw positions used by the stacking bracket, including the four positions also used for hood pins.

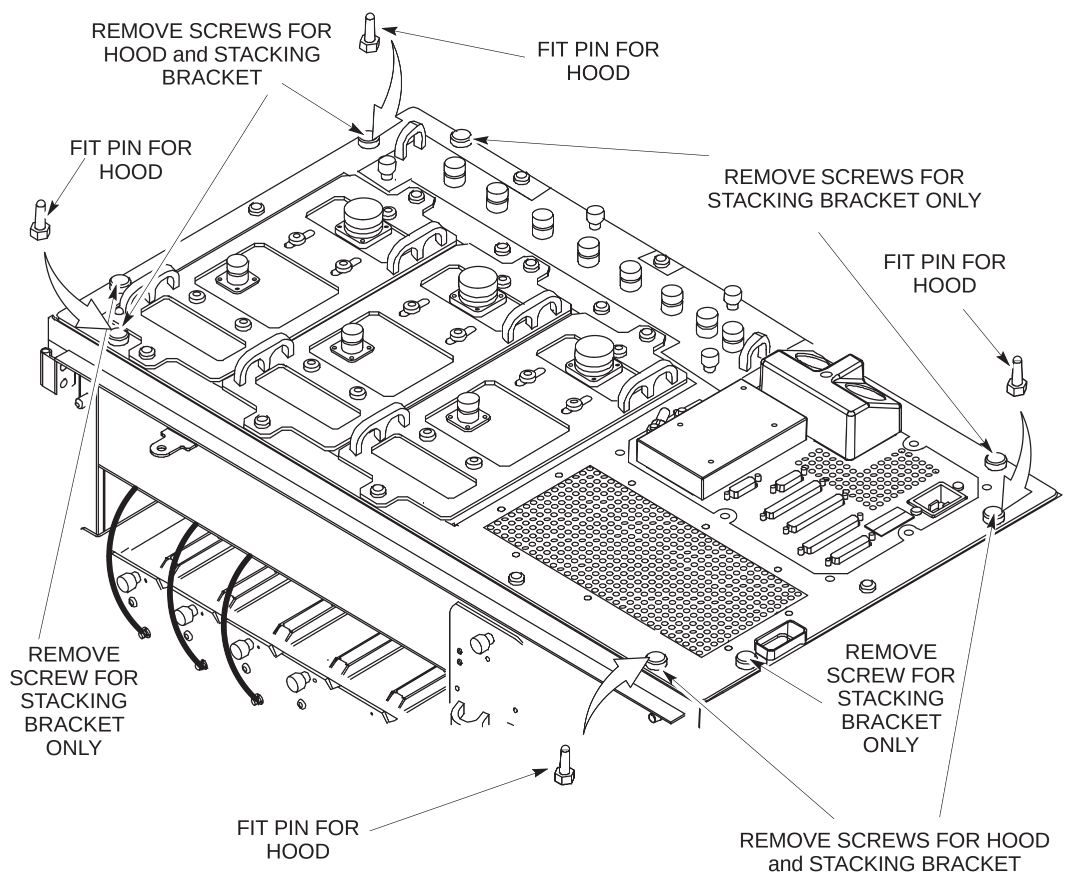


Figure 2-5 Hood pin and stacking bracket screw positions

Fitting the optional hood

The hood is held in place by four pins. To fit the hood:

1. Locate the four top panel M8 screws to be replaced by hood pins, as shown in Figure 2-7, and remove.
2. Screw the four pins into the cabinet top panel. Tighten to correct torque (see *Installation & Configuration: GSM-205-423* **Site requirements and considerations**).
3. Align the hood with the back pins, then lower the hood onto the pins, and press firmly into place.

Figure 2-6 shows a top view of the hood as seen when on the cabinet:

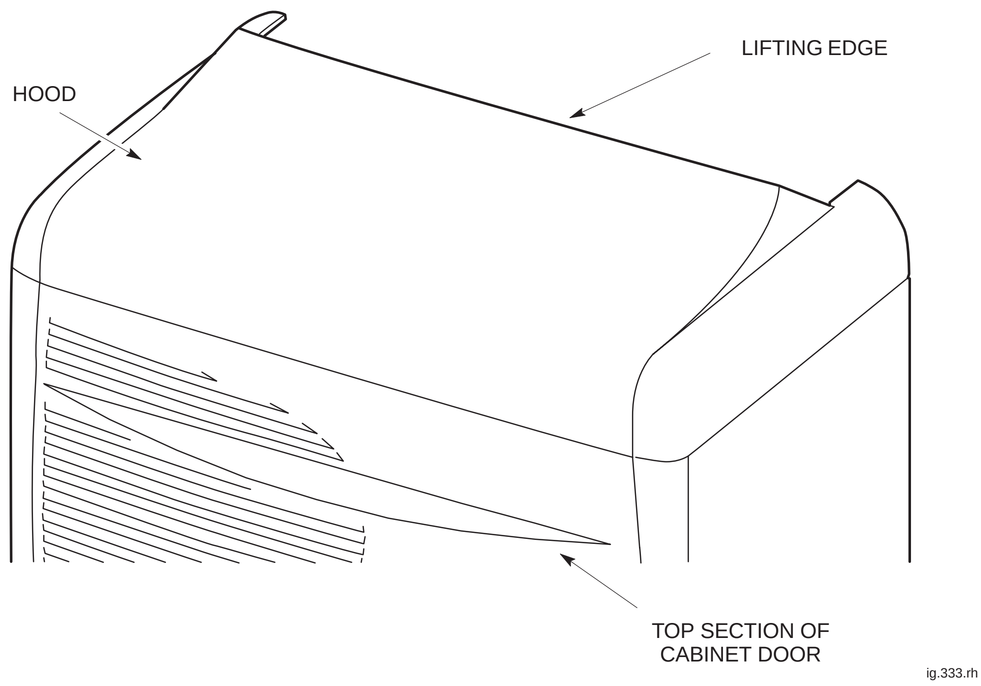


Figure 2-6 Hood view when placed on top of cabinet

Fitting a stacking bracket

To fit a stacking bracket:

1. If an optional hood is fitted:

   a. Lift hood by rear lifting edge, until free of the pins.

   b. Unscrew and remove the four pins from the cabinet. Store the pins with the hood.

2. Remove the eight (or four remaining) M8 screws form the cabinet top panel as shown in Figure 2-7 and retain.

WARNING	The stacking bracket can weigh as much as 15 kg (more if CCBs are contained in the CCB basket). Observe correct lifting precautions when handling the stacking bracket.

3. Align the stacking bracket onto the cabinet, and fit the eight M8 screws. Tighten to correct torque (see *Installation & Configuration: GSM-205-423* **Site requirements and considerations**).

4. Fit the front cover following the procedure detailed in **Fitting the stacking bracket front cover**.

Figure 2-7 shows a stacking bracket fitted with optional CCB basket.

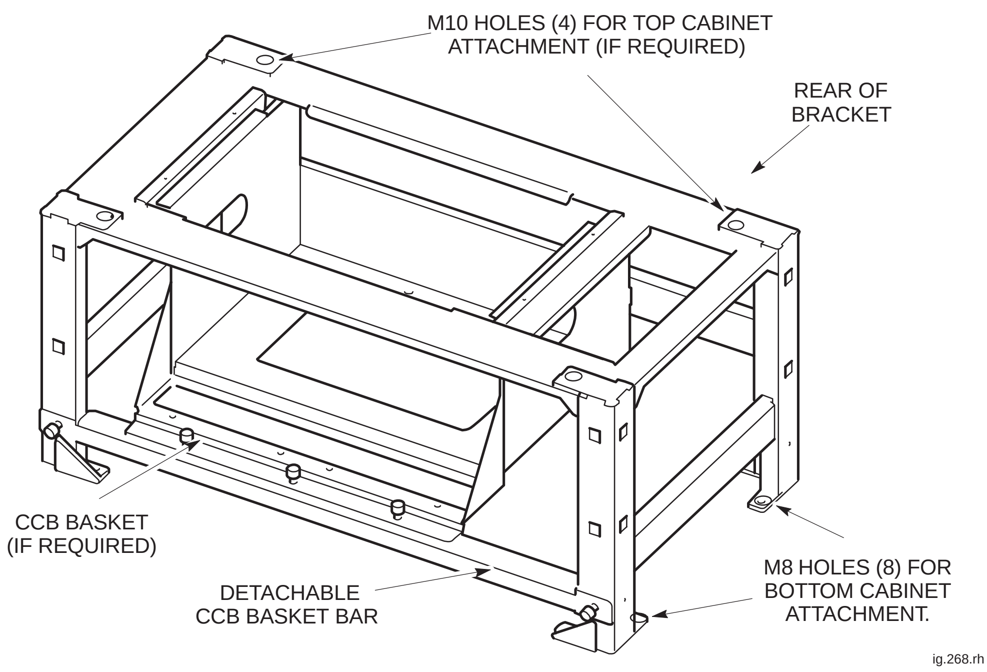


Figure 2-7 View of stacking bracket with optional CCB basket installed

Fitting the stacking bracket front cover

The stacking bracket front cover is attached to the stacking bracket by four locating clips. The procedure to fit the front cover is as follows:

1. Align the four locating clips on the front cover with the four square holes in the front of the stacking bracket. Ensure that the cut out slot on each clip is facing downward.
2. Press the cover against the stacking bracket, so that the cut out slot on each locating clip engages with the bottom edge of each square hole. It may be necessary to gently push in and down to ensure the cut out slots are fully engaged and the cover securely in place.

Figure 2-8 shows the locating points for the stacking bracket front cover.

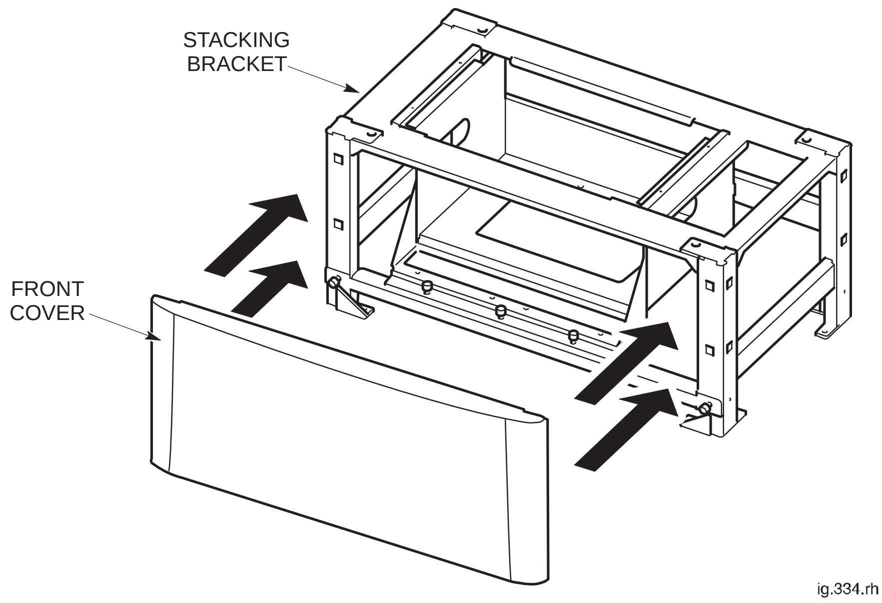


Figure 2-8 Fitting the stacking bracket front cover

Fitting upper cabinet onto stacking bracket

Overview of stacked cabinet fit

WARNING	Do **NOT** stack more than two Horizon*macro* indoor cabinets. The floor mounted cabinet **must** be securely bolted to the floor before a second cabinet is stacked on top.

In multiple cabinet sites, up to two Horizon*macro* indoor cabinets may be stacked with another two stacked Horizon*macro* indoor cabinets installed adjacent, to provide the maximum 24 carrier BTS site.

When a second cabinet is stacked above a floor mounted cabinet, the plinth is used to secure the cabinet to the stacking bracket mounted on the lower cabinet top panel. The plinth is connected to the cabinet prior to lifting onto the stacking bracket.

View of eyebolt positions

Figure 2-9 shows the positions to which eyebolts can be fitted.

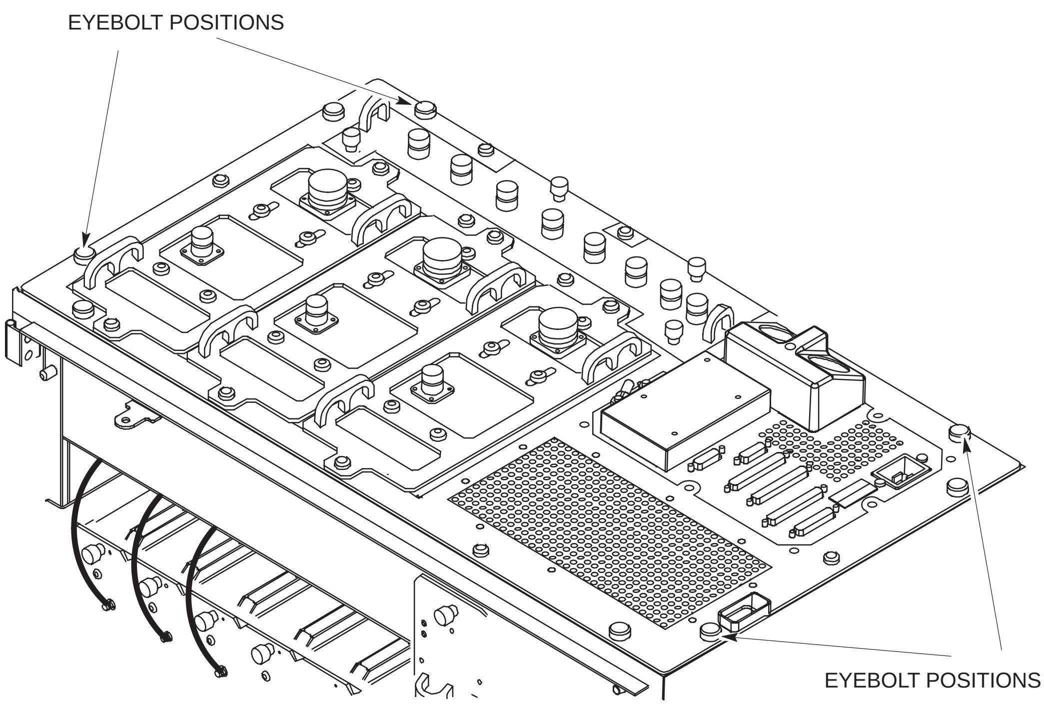


Figure 2-9 Eyebolt positions

Eyebolt positions and safety

There are four eyebolt positions to enable lifting of a second cabinet on top of the first cabinet stacking bracket. Eyebolts are available from Motorola for this purpose (part number 0386436N01 – eyebolt, M8).

WARNING	The cabinet can weigh as much as 130 kg with stacking bracket and CCB. Handle cabinets with extreme caution, and in accordance with any national or regional health and safety regulations. Horizon*macro* cabinets are heavy and should not be installed without the use of lifting equipment unless sufficient personnel are available to ensure that Health and Safety regulations are not breached. Eyebolts used to lift the cabinet must be of the collared type, manufactured to CE conformity, and must have sufficient safe working load to lift the cabinet, in accordance with national or regional health and safety regulations. Eyebolts, must be visually checked for damage before use. If any damage is apparent, DO NOT USE. The eyebolts must not be overtightened; hand tight is sufficient. Motorola recommends the use of slings in conjunction with hydraulic lifting apparatus for moving and positioning Horizon*macro* cabinets. The four screw locations used for hood pins must **NOT** be used for eyebolts. In addition to these points, refer to and comply with any local regulations that govern the use of lifting equipment.

For the subsequent use of eyebolts, there may be local regulations that govern the use of lifting equipment and stipulate a test and/or examination regime. If the eyebolts are to be used, ensure that all such regulations are met.

Eyebolts can be fitted into the four designated cabinet top panel locations, shown in Figure 2-9, after removal of the screws. These locations are identified with an eyebolt symbol and the word **LIFT**. The eyebolt locations are also used for stacking bracket attachment.

Fitting upper cabinet to stacking bracket

This procedure assumes the upper cabinet has been unpacked (see **Equipment delivery and unpacking**).

To install the upper Horizon*macro* indoor cabinet in a stacked configuration:

WARNING	Do **NOT** stack more than two indoor cabinets. The bottom cabinet must be bolted to the floor using the supplied plinth. This prevents danger from toppling in stacked configurations.

1. Ensure the stacking bracket is fitted to the lower cabinet. If not, refer to **Fitting a stacking bracket**.
2. Place the plinth in a convenient position, near to unpacked upper cabinet.
3. Fit the cabinet to unsecured plinth as described in **Fitting cabinet to plinth**.

WARNING	Each cabinet can weigh up to 130 kg if fully equipped. Handle the cabinets with extreme caution, and in accordance with local health and safety regulations. Eyebolts are to be used with lifting equipment. These must be located in the correct position as shown in Figure 2-9. The four screw locations used for hood pins must **NOT** be used for eyebolts. Visually check each eyebolt before inserting. If any damage is apparent, DO NOT USE. The eyebolts must not be over tightened; hand tight is sufficient. **Do not tighten eyebolts with a t-bar or spanner.** Screw the eyebolt fully into the lifting point so that no thread is left exposed.

4. Fit the eyebolts to the locations identified with an eyebolt symbol and the word **LIFT**. hand tighten the eyebolts and, using suitable lifting equipment, lift the cabinet onto the stacking bracket and slide to position.
5. Attach four M10 bolts to the cabinet plinth from underneath the top of the stacking bracket. Tighten to the correct torque (see *Installation & Configuration: GSM-205-423* **Site requirements and considerations**).
6. Install the top stacking bracket to hold the CCBs (see **Fitting a stacking bracket**) or optional hood (see **fitting the optional hood**), if required.

CAUTION	Incorrect airflow may cause internal cabinet temperatures to rise above operational limits. Do not obstruct the honeycomb ventilation panels on the top of the cabinets. Ensure the stacking brackets are clear of obstruction, particularly on the right side.

7. Fit a stacking bracket front cover onto each stacking bracket, using the procedure described in **Fitting the stacking bracket front cover**.

The finished assembly is shown in Figure 2-10.

Completed stacked cabinet assembly

Figure 2-10 shows the maximum stacked assembly, (two cabinets), with stacking brackets, covers and CCBs installed.

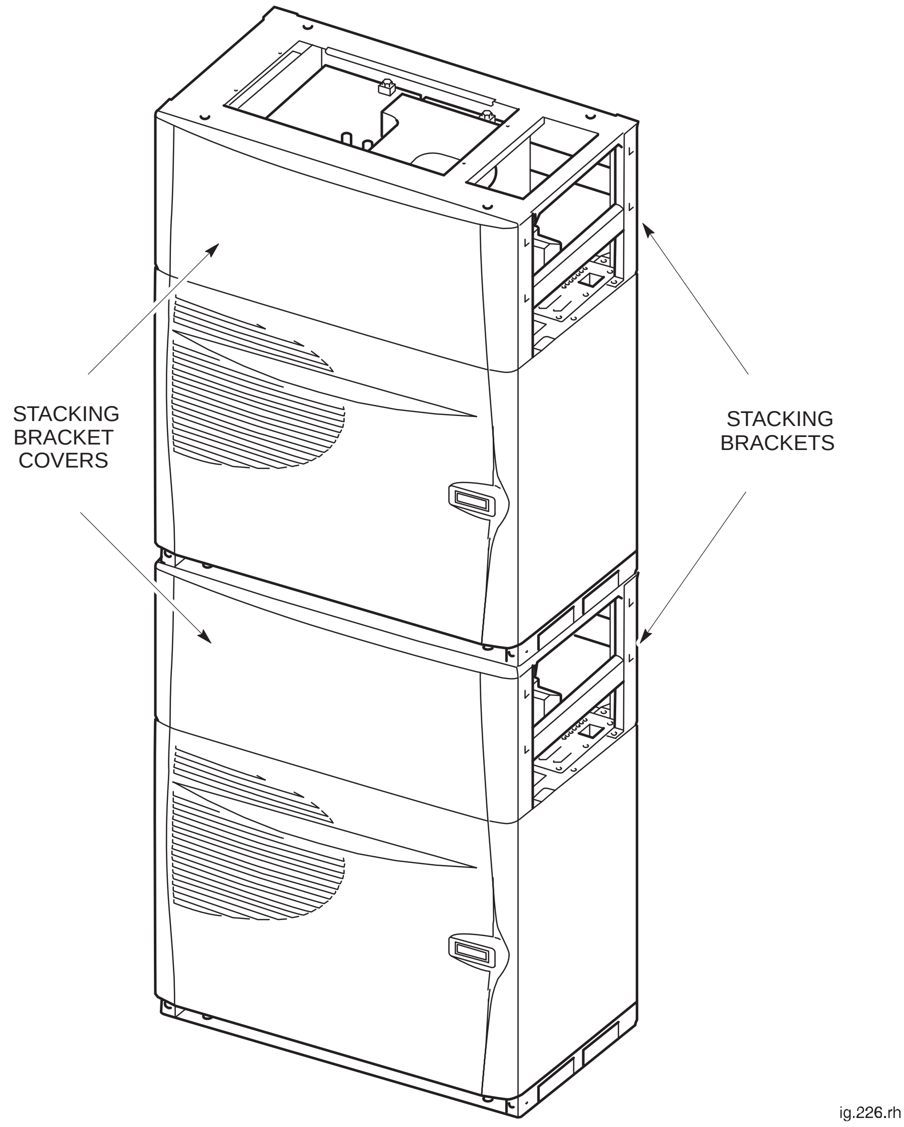


Figure 2-10 View of two cabinets stacked with stacking brackets, covers and CCBs installed

Installing CCBs into stacking bracket

Overview of installing CCBs

A maximum of two CCBs can be fitted into a CCB basket. The CCB basket fits inside a stacking bracket.

NOTE	CCBs are not currently available for use with the GSM850 and PCS1900 BTS variants.

View of DCS1800 CCBs

Figure 2-11 shows two DCS1800 CCBs, with CCB control boards fitted.

NOTE	CCB appearances may vary slightly, depending on type and manufacturer.

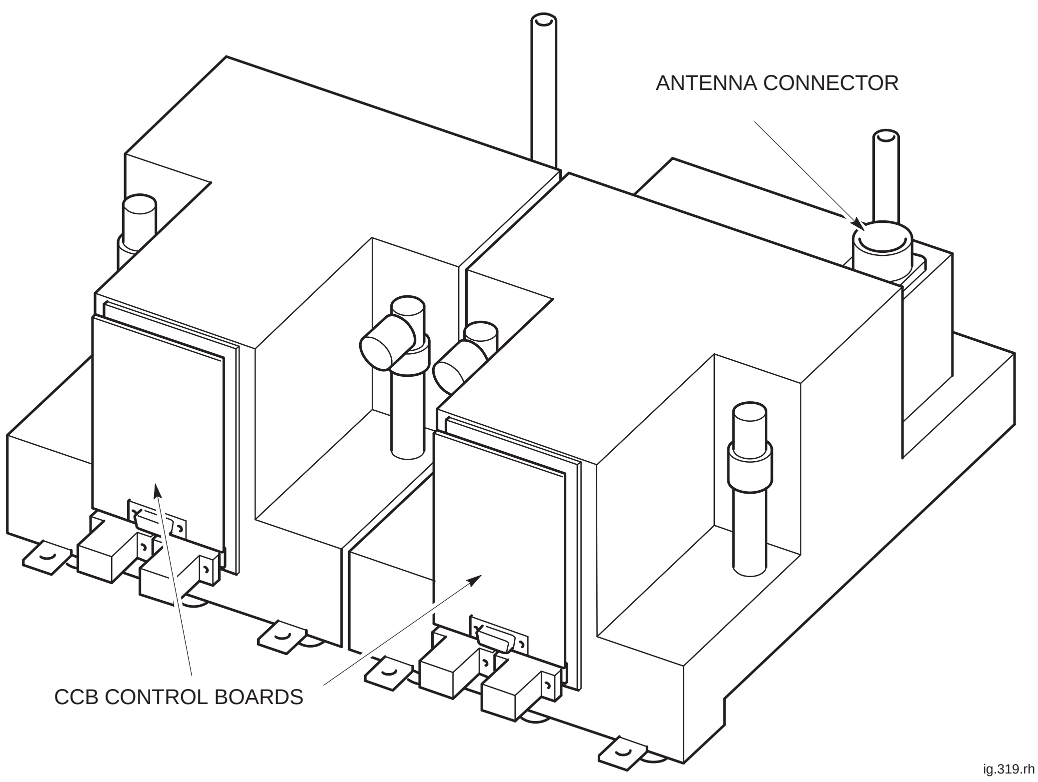


Figure 2-11 Two DCS1800 CCBs with control boards fitted

Installing CCBs

Follow these procedures to install CCBs.

Cabinet preparation

1. Ensure the SMA to N-type feedthrough plates are fitted inside the Tx block basket, with SMA cables installed from CTUs underneath. Ensure the N-type cables are connected to the feedthrough plates and draped over the front of the cabinet.
2. Ensure the stacking bracket is fitted to lower cabinet. If not, refer to **Fitting a stacking bracket**.

Fitting CCBs into basket

1. Place the CCB basket onto a flat surface.
2. Place the CCBs into the basket and secure with four M6 screws on the front and two M8 screws at the back. Tighten to the correct torque (see *Installation & Configuration: GSM-205-423* **Site requirements and considerations**).
3. Insert each CCB control board, then secure the control board cover with four M4 screws. Tighten to the correct torque (see *Installation & Configuration: GSM-205-423* **Site requirements and considerations**).
4. Connect the phasing lead between the CCB control boards.

Fitting basket to stacking bracket

NOTE	Due to space limitations and the need for flexibility, Motorola recommends the use of Superflex jumper cables for antenna connections to the CCBs.

1. Slide the basket part way into the stacking bracket, and connect antennas to the CCBs.
2. Slide the CCB basket fully home.
3. Connect the six N-type to N-type RF cables from the feedthrough plates to the CCB inputs.
4. Attach the CCB basket bar to the sides of the stacking bracket with the two captive screws. The bar is then directly underneath the basket captive screws.
5. Attach the CCB basket bar to the basket with the three captive screws on the basket.
6. Connect the power cable to each CCB from the single connector (marked CCB) on the interface panel, shown in Figure 2-36.
7. Fit the front cover onto the stacking bracket, pushing it in so that it drops into position on the side lugs, as described in **Fitting the stacking bracket front cover**.

The fully installed CCBs are illustrated in Figure 2-10 and Figure 2-12.

CCBs installed without front cover

Figure 2-12 shows two EGSM900 CCBs located in stacking bracket (cabinet not shown).

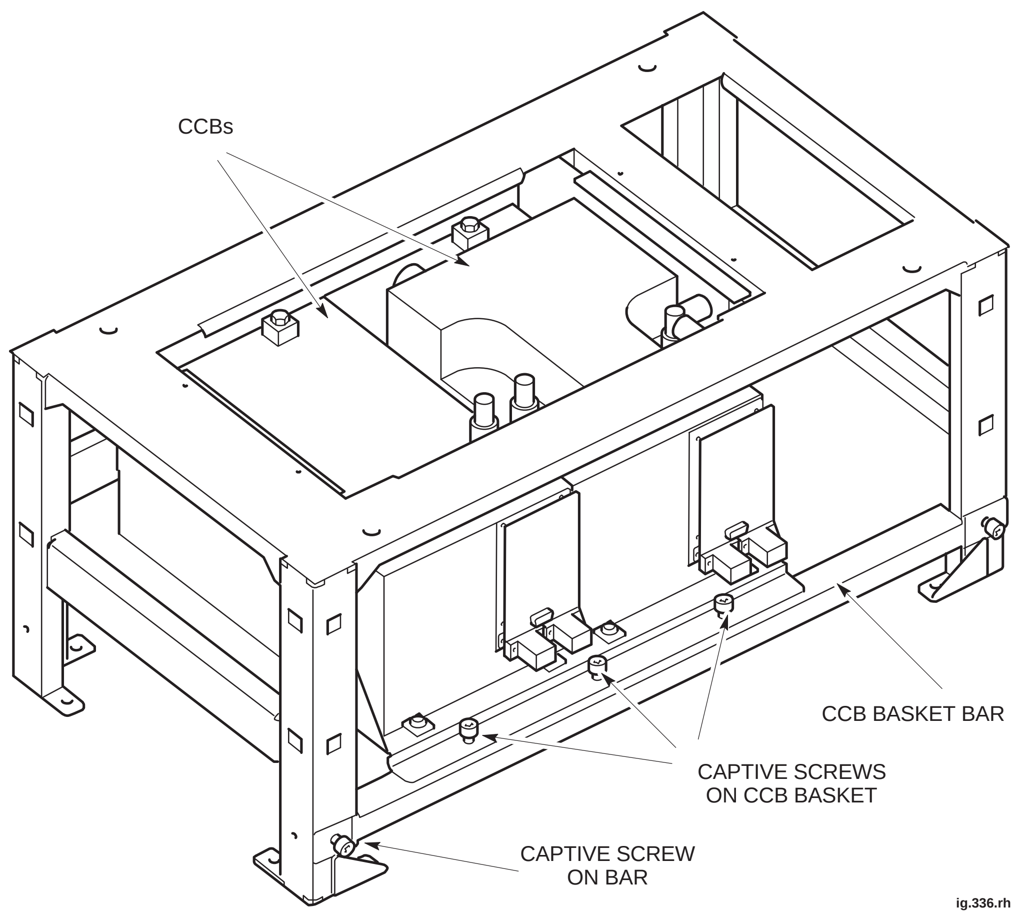


Figure 2-12 CCBs in installed position with CCB basket bar attached

Earthing and transient protection

Site earthing

This manual describes only general procedures for earthing the site. Refer to the *Grounding guidelines for cellular radio installations 68P81150E62*, for detailed earthing information.

WARNING	Each cabinet must be earthed separately and **not** daisy chained together.

- The cell site equipment must be earthed (in the same common earth point as its power source).
- Provision should be made for routeing earthing lines into the site and to the cabinet before beginning the installation of the system cabinets.
- There is an earthing terminal (stud) located on the interconnect panel on top of each cabinet.
- Refer to the site-specific documentation for detailed site earthing information.

Transient and lightning protection

All E1/T1 lines connected to Motorola equipment have secondary transient protection as part of the BIB or T43 board. Ensure the receive and transmit antenna connections to the building are fed through coaxial electromagnetic protection (EMP) devices.

CAUTION	The end user is responsible for transient protection of the E1/T1 lines connected to Motorola equipment.

Connections to RF modules

Overview of RF connections

The components shown in Figure 2-13 provide all the RF connections to the cabinet, and internally within the cabinet. Up to four cabinets can be interconnected to form a single BTS site.

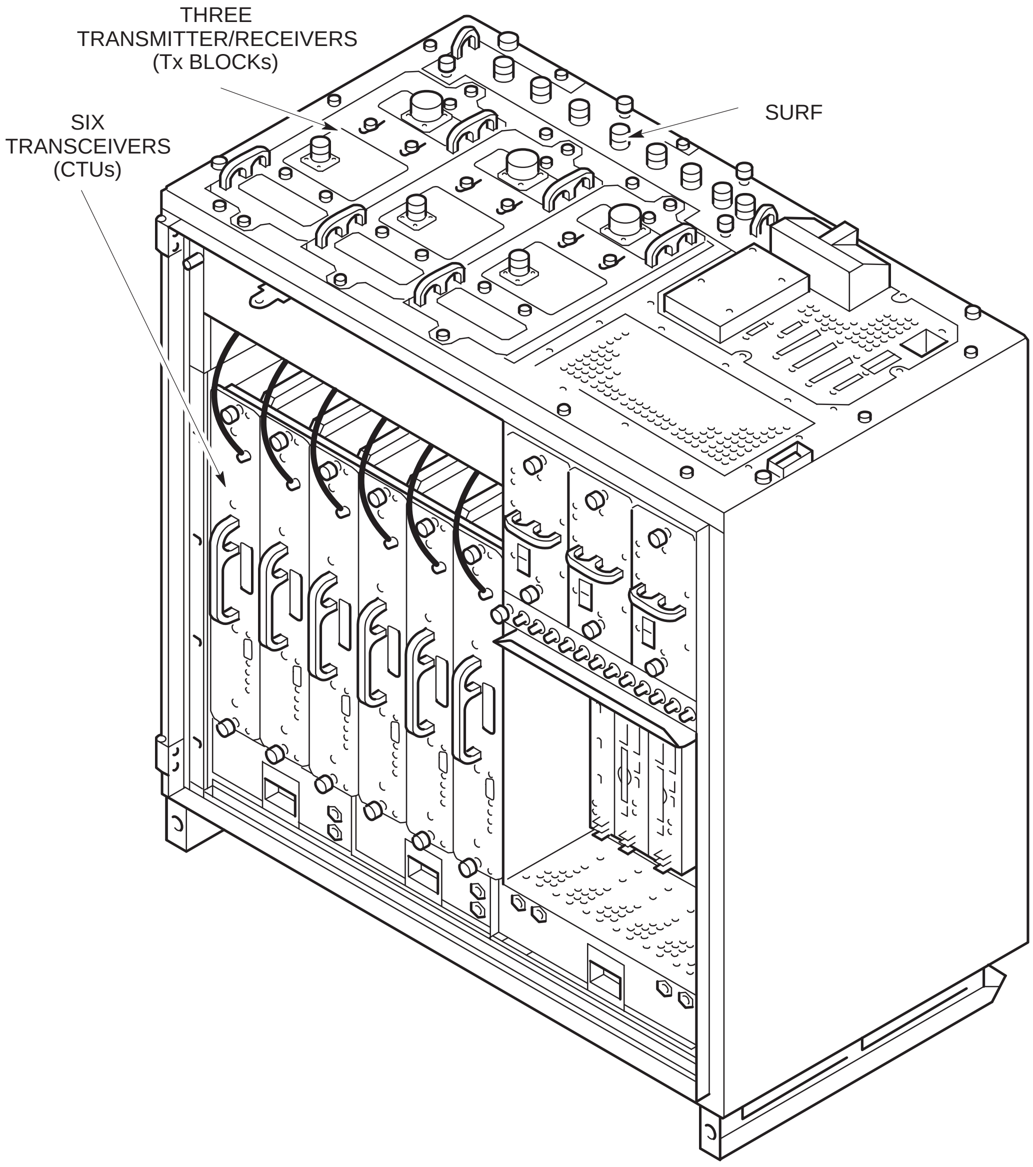


Figure 2-13 Location of RF components

Types of RF connector

Table 2-2 lists the RF module connectors with their destinations.

Table 2-2 RF module connectors and destinations

RF module	Type of connector	Destination
CTU transceiver	SMA	Tx Block (underneath)
Tx Block	SMA	CTU transceiver
	N-type	SURF
	7/16	antenna
SURF	N-type	Rx N-type of Tx Block

SURF/Tx block interconnecting cables

Table 2-3 lists cable types used for SURF/Tx block interconnections.

Table 2-3 SURF/Tx block interconnecting cables

Part number	Description	Use
3086225N01	34.5 cm coaxial cable terminated at either end with straight N-type plugs.	Tx block to SURF
3086225N02	28 cm coaxial cable terminated at one end with a straight N-type plug, and at the other end with a right-angle N-type plug.	Tx block to Tx block
3086225N03	2.25 m coaxial cable terminated at either end with straight N-type plugs.	SURF to SURF
3086225N04	2.25 m coaxial cable terminated at one end with a straight N-type plug, and at the other end with a right-angle N-type plug.	Tx block to Tx block

Unused SMA connections

Ensure that any unused SMA inputs to DCF, DDF or HCU modules are fitted with 50 ohm termination loads.

Torque of RF connectors

CAUTION	Care should be taken when tightening SMA connectors to avoid damage by excess force.

For correct torque of connectors, see *Installation & Configuration: GSM-205-423* **Site requirements and considerations**.

Tx connection to CCB via feedthrough plates

If CCBs are used instead of Tx blocks, the Tx cables are connected through an N-type to SMA feedthrough plate. This plate converts the normal Tx block SMA connector underneath to an N-type connector above.

RF connection principles

The primary receive path is connected to the A branch of the SURF module, either directly or from the Rx connector on the Tx block in non-diversity configurations. The diversity receive path is connected to the B path on the SURF. This is normally duplexed with the transmit signal on a single antenna, and fed to the SURF from the Rx connector on the Tx block. Within any single cabinet the lowest numbered sector is normally connected to amplifier 0 connections, and higher numbered sectors to amplifiers 1 and 2 as appropriate. For example, sector one is connected to SURF connectors 0A and 0B, sector two to 1A and 1B, and sector three to 2A and 2B. However, if a sector is split between two cabinets, the split sector antennas must be connected to amplifier 0, (this is the only path with connection to the extension ports). Extension ports must be connected to the correct branch at the destination cabinet.

The transmit path feeds from the CTUs to the Tx block or feedthrough plate immediately above. Two signals are combined in most Tx blocks. A third signal can be combined using a feedthrough plate and the third input of a DDF. The Tx blocks then duplex the Tx signal with the diversity Rx signal, before feeding to the antenna.

Rx/Tx single antenna duplexing

Duplexers allow a single antenna to be used for both transmit and receive operations. Duplexers exist within several of the transmit blocks. Normally duplexed RF signals are used through one antenna, with a second receive antenna to provide diversity.

CAUTION	If a single antenna (non-diversity) is required, the duplex antenna RF receive cable from the transmit block must be connected to the RxA path at the SURF. Simply switching off diversity at the OMC-R without the correct SURF configuration will cause a loss of reception.

Suggested RF configurations

Overview of configuration diagrams

The following series of RF configuration diagrams show suggested ways of connecting together Horizon*macro* SURF and Tx blocks to meet different operational requirements. The series of diagrams is by no means exhaustive, and numerous alternative configurations may be adopted to achieve the same aim.

Each Horizon*macro* cabinet is represented by a SURF module and three Tx blocks. Interconnecting cables are identified by a label; N01, 2, 3 or 4. Further details of each cable type are shown in Table 2-3. Antenna connecting cables, not supplied as part of the Horizon*macro* equipment, are shown as dotted lines.

With the exception of Figure 2-33 and Figure 2-34, the diagrams are applicable to GSM850, EGSM900, DCS1800 or PCS1900 single band operation, although only the 1800 SURF module is illustrated.

NOTE	Dual band 900 and 1800 SURFs are available, but 850 and 1900 SURFs are only available as single band.

Figure 2-33 shows one way of achieving dual band operation using two Horizon*macro* cabinets. A single band 1800 SURF is installed in one cabinet and a dual band 900 SURF in the other. Figure 2-34 shows another, using one of each type of dual band SURF.

Diversity is assumed in the majority of RF configuration diagrams shown here, Figure 2-15 being the exception. Other non diversity configurations can be derived from this figure by ensuring that the single receive path is always connected to branch A at the SURF module.

Digital connections

Digital connections between cabinets are not shown in the following diagrams. Fibre optic cables used to provide digital connections between cabinets are described in **Connecting fibre optic cables**.

Depopulated site configurations

The purpose of a depopulated site configuration is to allow customers to provide a future expansion capability, at the time of installation. The diagram showing the final target configuration is to be used to connect Tx blocks, SURF and antennas. Depopulated site configurations are supplied with fully equipped RF section to achieve the target configuration, with CTUs only fitted to alternate slots. CTUs are fitted in slots 0, 2 and 4. Unused Tx block SMA connectors must be fitted with 50 ohm terminating loads.

Configuration for omni 1

Figure 2-14 shows a suggested configuration, using one Horizon*macro* cabinet, for omni 1 with twin duplexed filter.

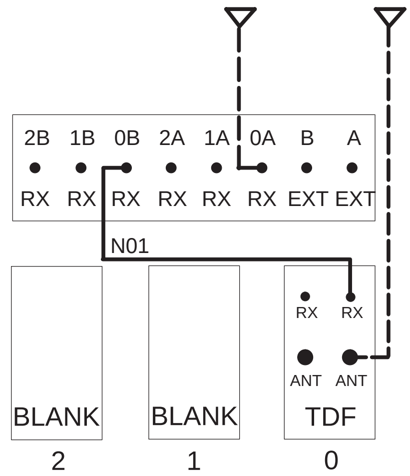


Figure 2-14 Single cabinet omni 1 with TDF

Configuration for omni 1 or 2 (with and without diversity)

Figure 2-15 shows suggested single Horizon*macro* cabinet configurations, with and without diversity, for omni 1 or omni 2 with duplexed combining bandpass filter.

NOTE	If a single antenna (non-diversity) is required, the duplex antenna RF receive cable from the transmit block must be connected to the RxA path at the SURF. Simply switching off diversity at the OMC-R without the correct SURF configuration will cause a loss of reception.

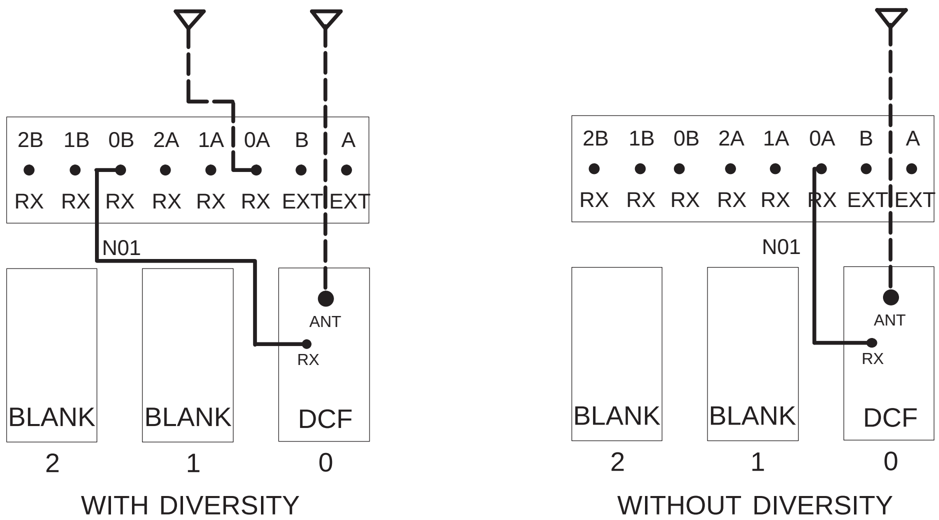


Figure 2-15 Single cabinet omni 1 or 2 with DCF

Unused SMA connectors must be fitted with 50 ohm terminating loads as shown below.

If configured for...	Then 50 ohm load required on unused SMA input to...
omni 1	DCF 0

Configuration for omni 3 or 4

Figure 2-16 shows a suggested configuration, using a single Horizon*macro* cabinet, for omni 3 or omni 4 with duplexed combining bandpass filter.

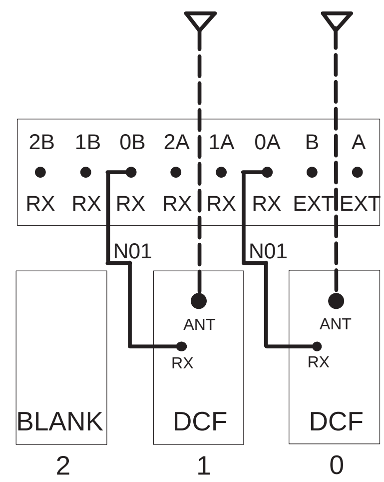


Figure 2-16 Single cabinet omni 3 or 4 with DCF

Unused SMA connectors must be fitted with 50 ohm terminating loads as shown below.

If configured for...	Then 50 ohm load required on unused SMA input to...
omni 3	DCF 1

Configuration for omni 3

Figure 2-17 shows a suggested configuration, using one Horizon*macro* cabinet, for omni 3 with dual stage duplexed combining filter.

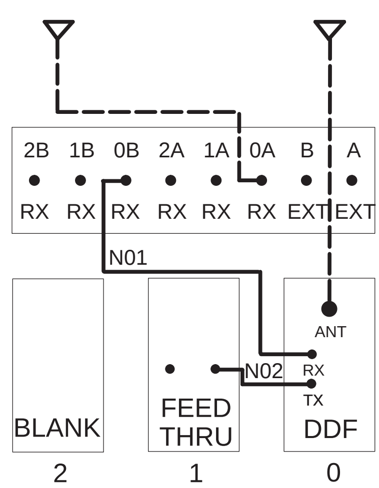


Figure 2-17 Single cabinet omni 3 with DDF

Configuration for omni 4

Figure 2-18 shows a suggested configuration, using a single Horizon*macro* cabinet, for omni 4 with dual stage duplexed combining filter and hybrid combining unit.

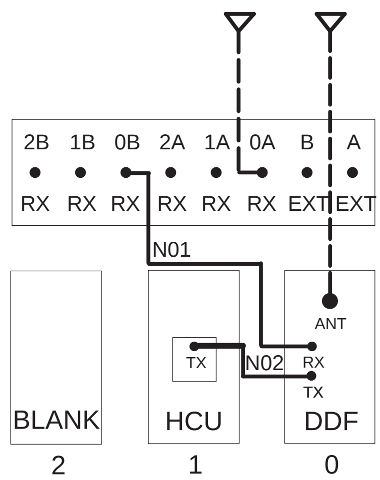


Figure 2-18 Single cabinet omni 4 with DDF and HCU

Configuration for omni 5 or 6

Figure 2-19 shows a suggested configuration, using one Horizon*macro* cabinet, for omni 5 or 6 with dual stage duplexed combining filter and air combining.

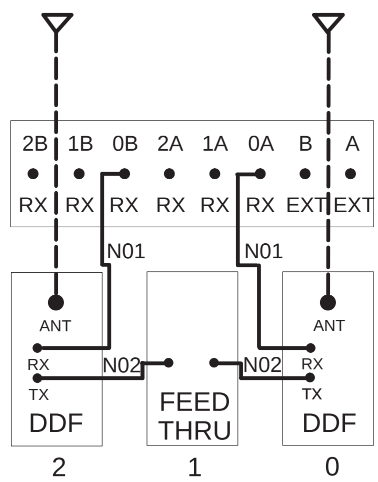


Figure 2-19 Single cabinet omni 5 or 6 with DDF and air combining

Unused SMA connectors must be fitted with 50 ohm terminating loads as shown below.

If configured for...	Then 50 ohm load required on unused SMA input to...
omni 5	DDF 2

Configuration for sector 1/1 or 2/2

Figure 2-20 shows a suggested configuration, using a single Horizon*macro* cabinet, for sector 1/1 or 2/2 with duplexed combining bandpass filter.

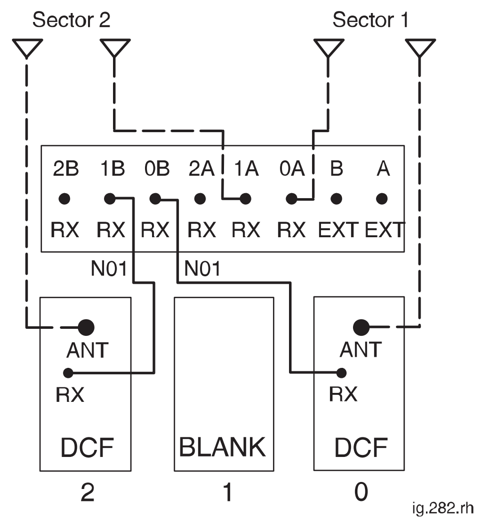


Figure 2-20 Single cabinet sector 1/1 or 2/2 with DCF

Unused SMA connectors must be fitted with 50 ohm terminating loads as shown below.

If configured for...	**Then 50 ohm load required on unused SMA input to...**
sector 1/1	DCF 0 and DCF 2

Configuration for sector 1/1

Figure 2-21 shows a suggested configuration, using one Horizon*macro* cabinet, for sector 1/1 with twin duplexed filter.

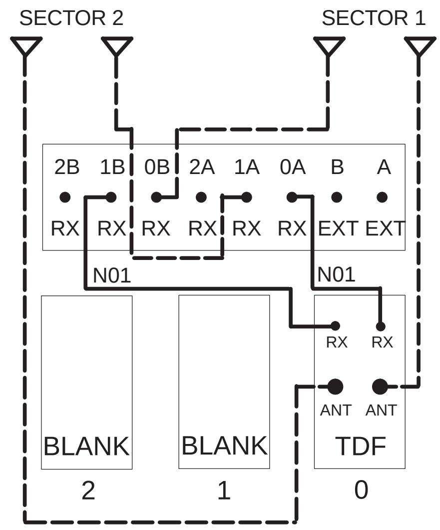


Figure 2-21 Single cabinet sector 1/1 with TDF

Configuration for single cabinet sector 3/3

Figure 2-22 shows a suggested configuration, using one Horizon*macro* cabinet, for sector 3/3 with dual stage duplexed combining filter.

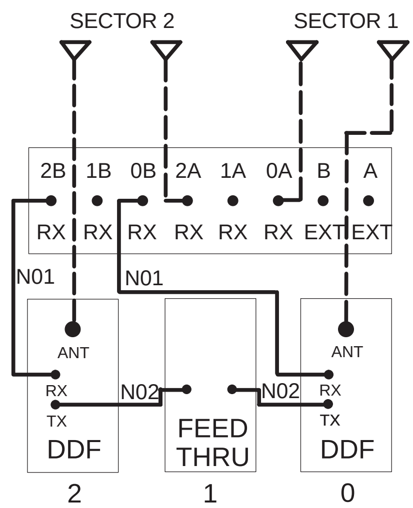


Figure 2-22 Single cabinet sector 3/3 with DDF

Configuration for 2 cabinet sector 3/3

Figure 2-23 shows a suggested configuration, using two Horizon*macro* cabinets, for sector 3/3 with dual stage duplexed combining filter.

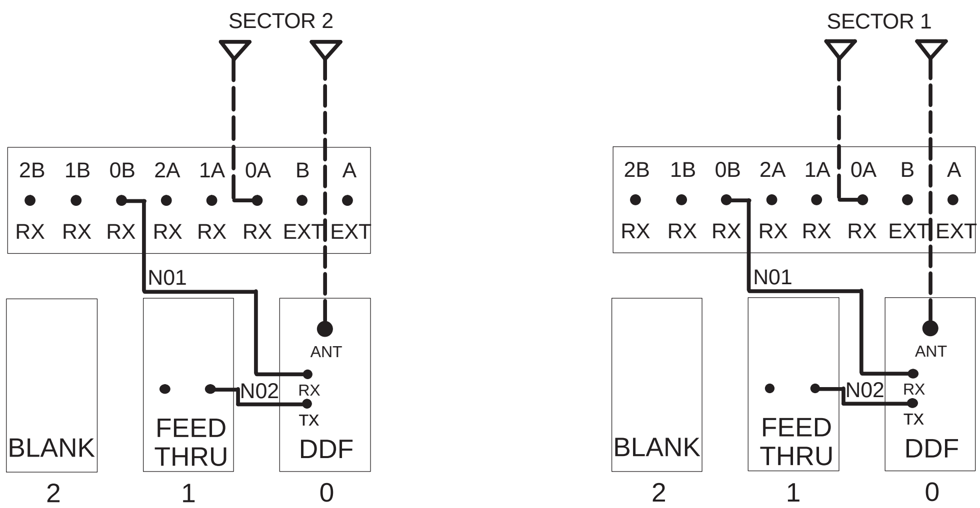


Figure 2-23 Two cabinet sector 3/3 with DDF

Configuration for 2 cabinet sector 4/4

Figure 2-24 shows a suggested configuration, using two Horizon*macro* cabinets, for sector 4/4 with dual stage duplexed combining filter and hybrid combining unit.

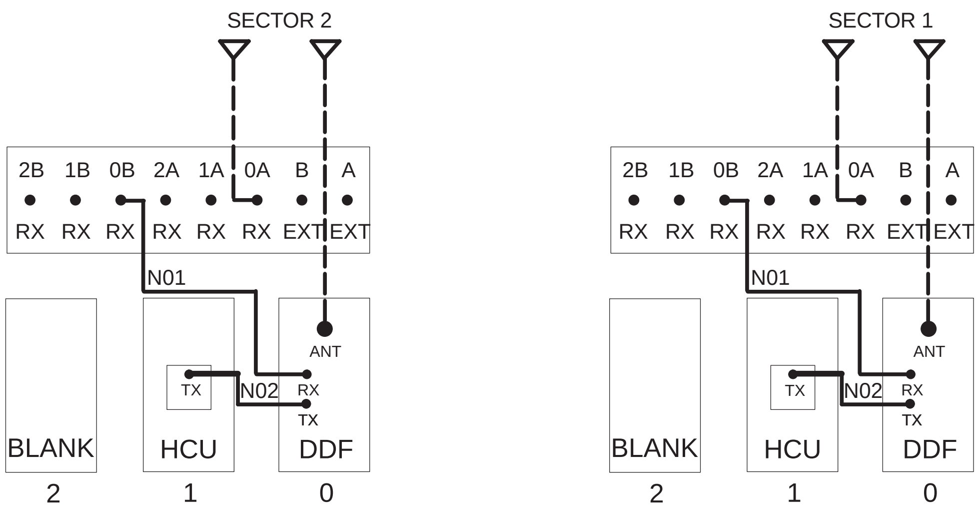


Figure 2-24 Two cabinet sector 4/4 with DDF and HCU

Configuration for 2 cabinet sector 5/5 or 6/6

Figure 2-25 shows a suggested configuration, using two Horizon*macro* cabinets, for sector 5/5 or 6/6 with dual stage duplexed combining filter and air combining.

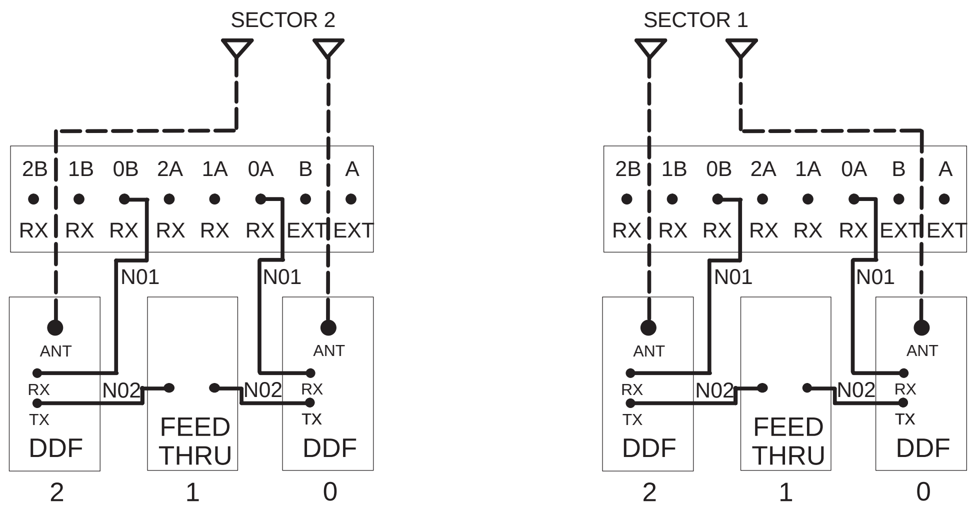


Figure 2-25 Two cabinet sector 5/5 or 6/6 with DDF and air combining

Unused SMA connectors must be fitted with 50 ohm terminating loads as shown below.

If configured for...	Then 50 ohm load required on unused SMA input to...
sector 5/5	both DDF 2 modules

Configuration for single cabinet sector 1/1/1, 1/1/2, 1/2/2 or 2/2/2

Figure 2-26 shows a suggested configuration, using a single Horizon*macro* cabinet, for sector 1/1/1, 1/1/2, 1/2/2 or 2/2/2 with duplexed combining bandpass filter.

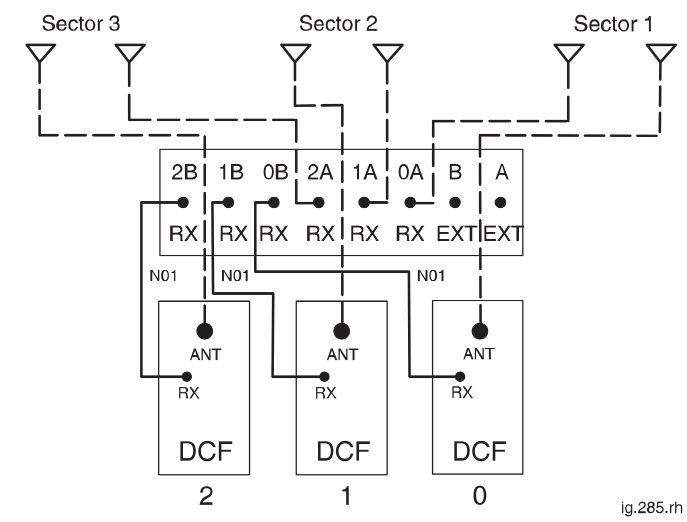


Figure 2-26 Single cabinet sector 1/1/1, 1/1/2, 1/2/2 or 2/2/2 with DCF

Unused SMA connectors must be fitted with 50 ohm terminating loads as shown below.

If configured for...	Then 50 ohm load required on unused SMA input to...
Sector 1/1/1	DCF 0, 1 and 2
Sector 1/1/2	DCF 1 and 2
Sector 1/2/2	DCF 2

Configuration for 2 cabinet sector 2/2/2

Figure 2-27 shows a suggested configuration, using two Horizon*macro* cabinets, for sector 2/2/2 with duplexed combining bandpass filter.

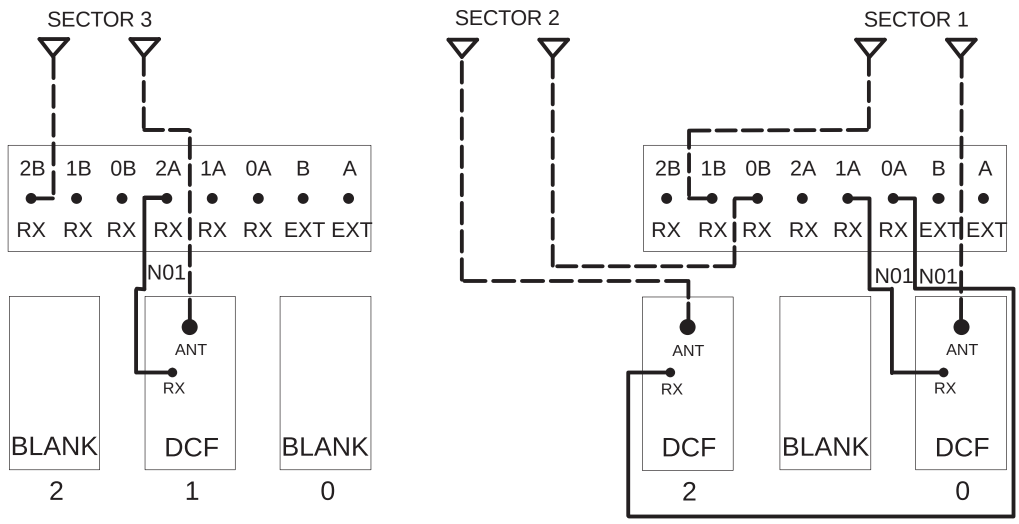


Figure 2-27 Two cabinet sector 2/2/2 with DCF

Configuration for 2 cabinet sector 3/3/3 or 4/4/4

Figure 2-28 shows a suggested configuration, using two Horizon*macro* cabinets, for sector 3/3/3 or sector 4/4/4 with duplexed combining bandpass filter and air combining.

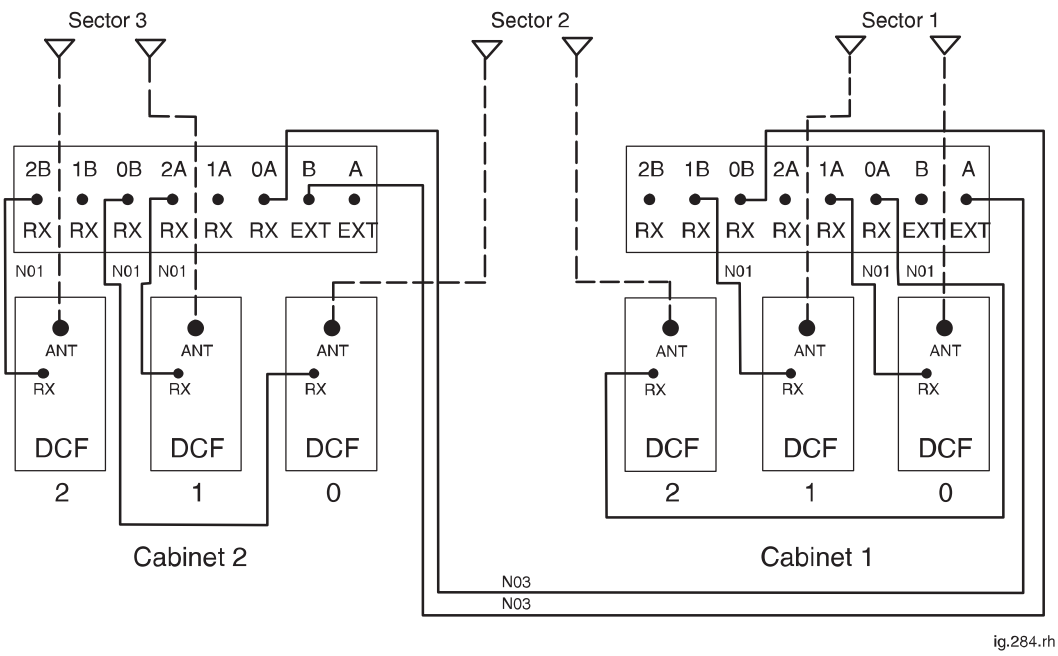


Figure 2-28 Two cabinet sector 3/3/3 or sector 4/4/4 with DCF and air combining

Unused SMA connectors must be fitted with 50 ohm terminating loads as shown below.

If configured for...	Then 50 ohm load required on unused SMA input to...
sector 3/3/3	cabinet 1, DCF 1 cabinet 2, DCF 0 and DCF 2

Configuration for 2 cabinet sector 4/4/4

Figure 2-29 shows a suggested configuration, using two Horizon*macro* cabinets, for sector 4/4/4 with dual stage duplexed combining filter and hybrid combining unit.

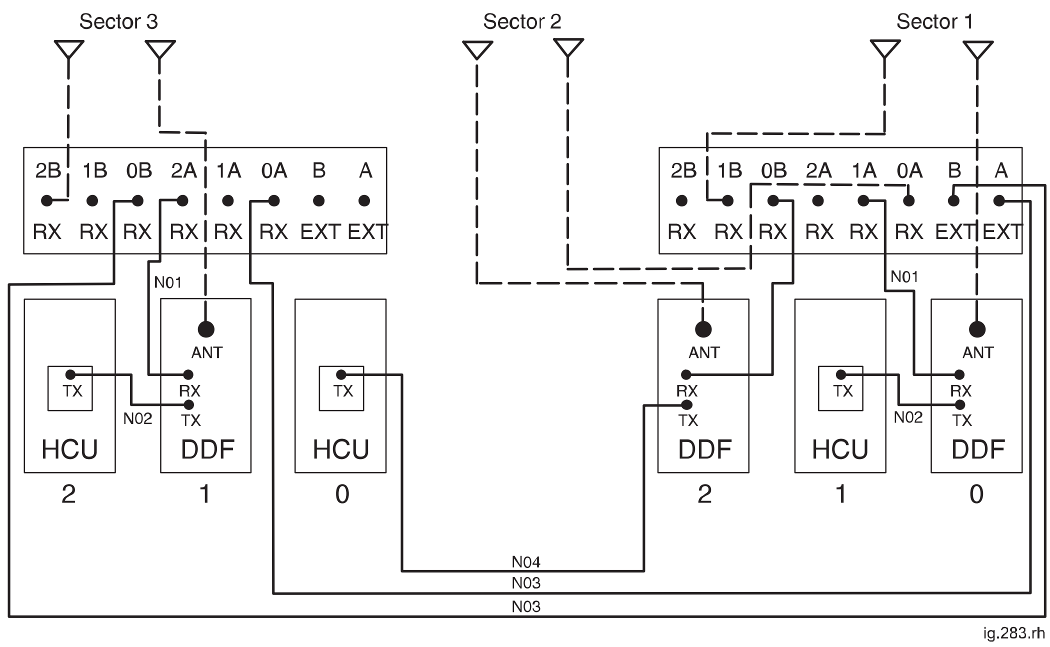


Figure 2-29 Two cabinet sector 4/4/4 with DDF and HCU

Configuration for 3 cabinet sector 4/4/4

Figure 2-30 shows a suggested configuration, using three Horizon*macro* cabinets, for sector 4/4/4 with dual stage duplexed combining filter and hybrid combining unit.

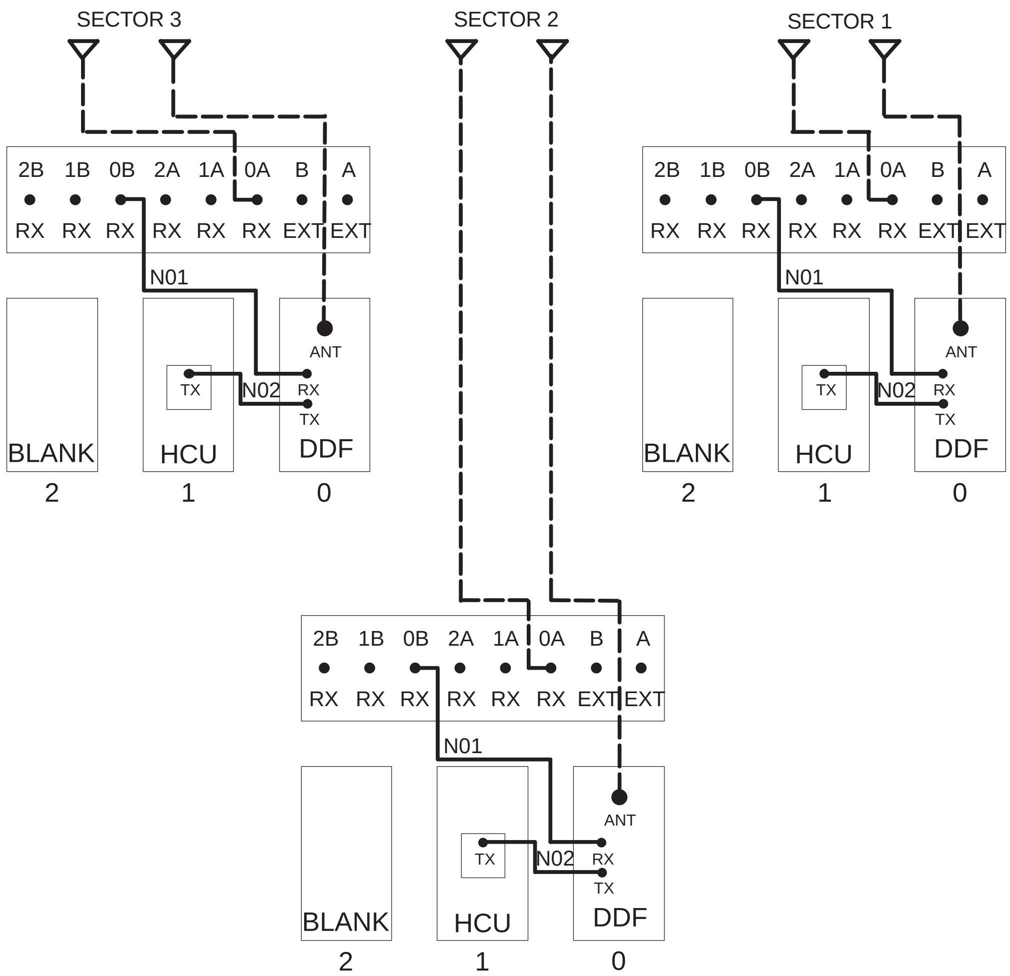


Figure 2-30 Three cabinet sector 4/4/4 with DDF and HCU

Configuration for sector 5/5/5 or 6/6/6

Figure 2-31 shows a suggested configuration, using three Horizon*macro* cabinets, for sector 5/5/5 or sector 6/6/6 with dual stage duplexed combining filter and air combining.

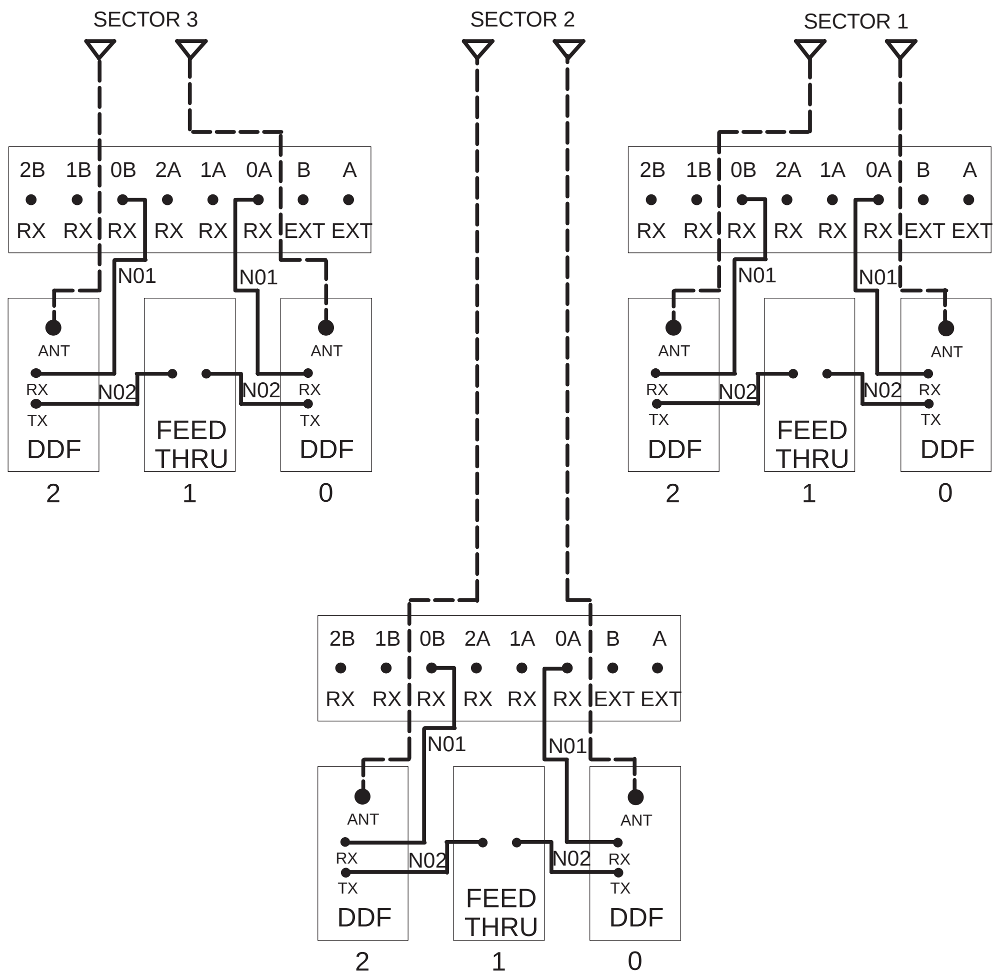


Figure 2-31 Sector 5/5/5 or sector 6/6/6 with DDF and air combining

Unused SMA connectors must be fitted with 50 ohm terminating loads as shown below.

If configured for...	Then 50 ohm load required on unused SMA input to...
sector 5/5/5	all DDF 2 modules

Configuration for sector 8/8/8

Figure 2-32 shows a suggested configuration, using four Horizon*macro* cabinets, for sector 8/8/8 with dual stage duplexed combining filter, hybrid combining unit and air combining.

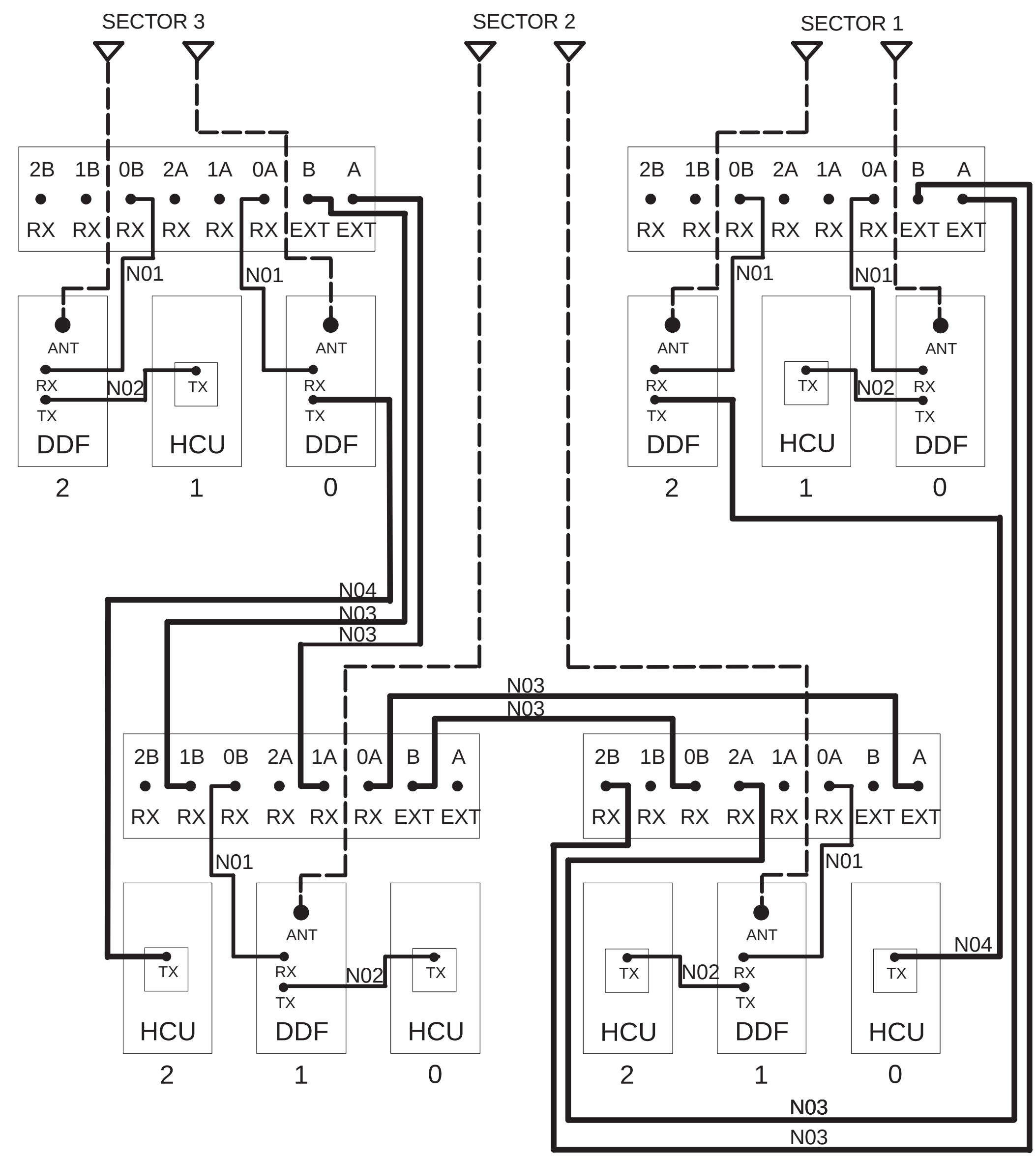


Figure 2-32 Sector 8/8/8 with DDF, HCU and air combining

Configuration for dual band 1/1/1-3/3/3

Figure 2-33 shows a suggested configuration, using two Horizon*macro* cabinets, for dual band sector 1/1/1–3/3/3 operation, where sector 1/1/1 is EGSM900 and sector 3/3/3 is DCS1800. This dual band configuration requires one single band 1800 SURF and one dual band 900 SURF.

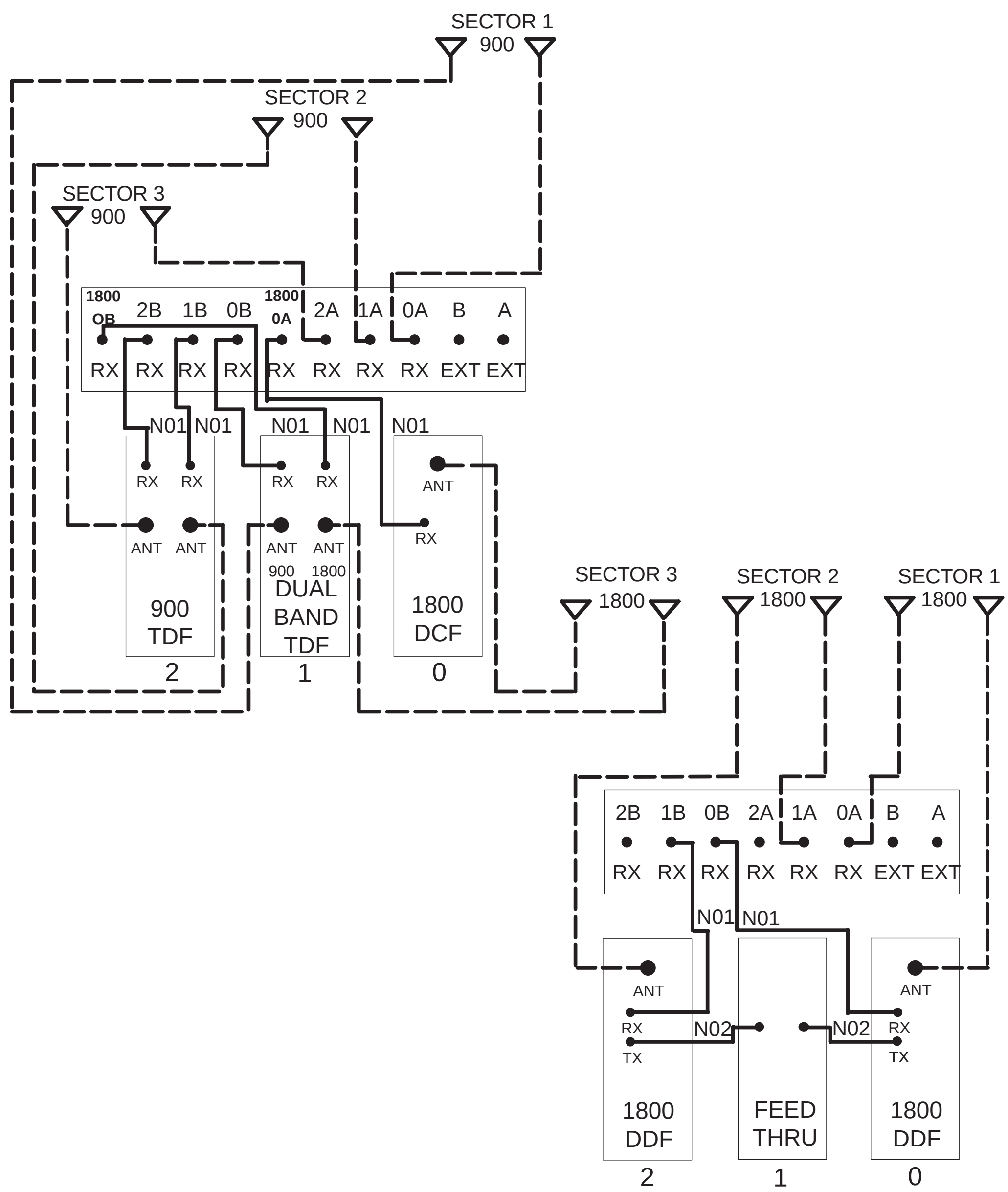


Figure 2-33 Two cabinet dual band sector 1/1/1-3/3/3

Unused SMA connectors must be fitted with 50 ohm terminating loads.

Configuration for dual band 3/3/3-1/1/1

Figure 2-34 shows a suggested configuration, using two Horizon*macro* cabinets, for dual band sector 3/3/3–1/1/1 operation, where sector 3/3/3 is EGSM900 and sector 1/1/1 is DCS1800. This dual band configuration requires one dual band 1800 SURF and one dual band 900 SURF.

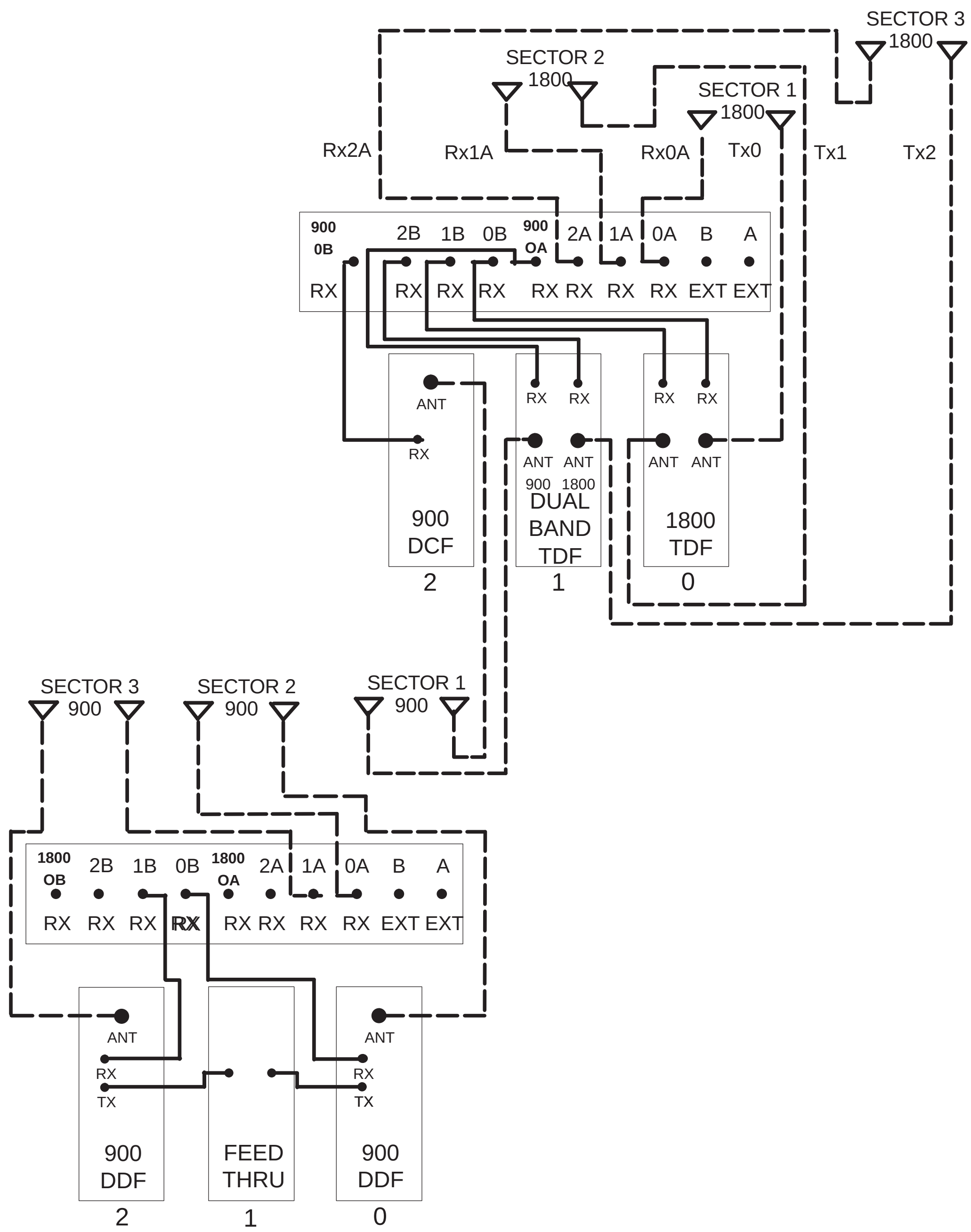


Figure 2-34 Two cabinet dual band sector 3/3/3-1/1/1

Unused SMA connectors must be fitted with 50 ohm terminating loads.

Connecting fibre optic cables

Location of fibre optic connections

WARNING	Do not look directly into a fibre optic cable or the data in/out connectors of the FMUX or MCUF, with or without the use of optical aids. Laser radiation can come from either the data in/out connectors or unterminated fibre optic cables connected to data in/out connectors.

In an installation configuration with more than one Horizon*macro* indoor cabinet, fibre optic connections are used to link the MCUF in the master cabinet to the extension cabinets. A maximum of three extension cabinets can be added to the master cabinet.

Connections from the master cabinet are provided by three fibre optic multiplexers (FMUXs). Two are located integral to the MCUF, and the third is a separate module located in the slot next to the master MCUF. Additional redundant modules may be installed for both MCUF and FMUX modules.

Extension cabinets have only a single FMUX, with optional redundancy, for fibre optic connectivity to the master cabinet.

Tx and Rx data connections to the MCUF and FMUXs are located on the front panel of each module.

Three different types of fibre optic cable, coloured orange and terminated with ST fibre connectors, are available for use. These are described in Table 2-4.

Table 2-4 Extension cabinet fibre optic cables

Order number	Length	Description
SVKN1244	5.6 m long	connects master cabinet to first extension
SVKN1245	7.6 m long	connects master cabinet to second extension
SVKN1246	7.6 m long	connects master cabinet to third extension

Care of fibres

Optical fibre cables contain an inner core, which is a strand of glass coated by a cladding (sometimes in two layers), and an outer protective sheath which provides mechanical protection.

The fibre acts as a light waveguide. In order for the link to work correctly light must be propagated with minimal losses from end-to-end of the fibre. A number of problems can prevent this from happening, resulting in a potentially faulty link. Care must be taken to ensure that the conditions that follow are met.

Minimum bend radius

All optical fibres have a minimum bend radius. This represents the smallest circle that is allowed to be formed from a loop of fibre, that is how tight it can be coiled, looped or bent.

CAUTION	Under no circumstances should fibres be bent tighter than the minimum bend radius.

If fibres are bent tighter than the minimum bend radius then two possible effects can happen:

- Excessive light loss can occur from the outside of the bend, resulting in a loss of performance.
- The fibre can fracture due to microscopic imperfections in the surface. This type of break is invisible externally. If such a break occurs, excessive light loss would be permanent and light would be scattered and reflected from the break in the fibre. Returning the fibre to straight will not help and the whole assembly will require replacement.

For glass fibres (orange or green outer sheath) the long term minimum bend radius is approximately 30 mm.

Figure 2-35 illustrates the minimum bend radius for fibre optic cables.

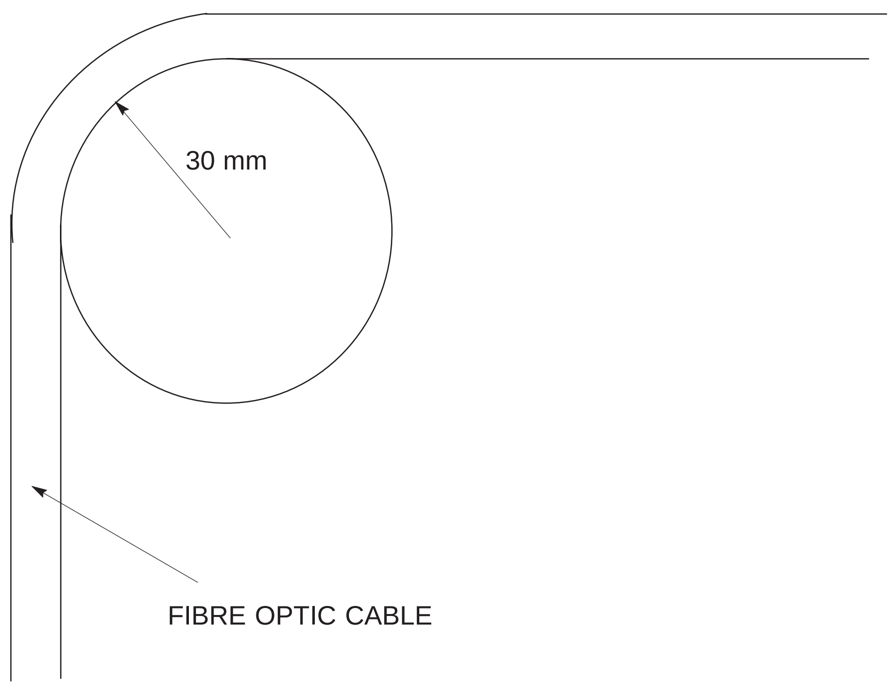


Figure 2-35 Minimum bend radius of 30 mm

If the fibre is under tension (being stretched), the bend radius should be much larger, at least doubled. This is because the tension in the fibre can increase the possibilities of damage.

If in doubt about the radius, the fibre should be allowed to form its natural bend radius by allowing it to bend under gravity only. This natural bend radius is normally greater than 30 mm.

Protecting fibres and connectors

To maintain good light transmission through the fibre optic link it is essential to maintain cleanliness of the connector end surfaces and/or bare fibre ends.

At all times when fibres are not connected into the system, the connector protective caps (normally red) should be fitted and kept in place. This is especially important when routeing fibres during installation.

Cleaning fibres and connectors

Cleanliness of fibre terminations and connectors is essential. If cleaning of contaminated optical components is required, then all areas should be wiped gently with a lint free cloth soaked in a suitable cleaning solution. Care should be taken to ensure the ends of the fibres are not scratched in any way, and are completely dry before reconnection.

Connecting glass fibre cables

Fibre-ST connectors are used to terminate the fibre optic cables. These are push fit and should not be tightened when connecting. Table 2-5 shows the fibre optic interconnections between master and extension cabinets in multiple cabinet sites.

Table 2-5 Fibre optic interconnections

Master cabinet connection	Extension cabinet	FMUX connection
MCUF TCU0 FMUX0 IN	2nd cabinet	DATA OUT
MCUF TCU0 FMUX0 OUT	2nd cabinet	DATA IN
MCUF TCU1 FMUX1 IN	3rd cabinet	DATA OUT
MCUF TCU1 FMUX1 OUT	3rd cabinet	DATA IN
FMUX module DATA IN	4th cabinet	DATA OUT
FMUX module DATA OUT	4th cabinet	DATA IN

Connecting fibre optic cables between cabinets

WARNING	Do not look directly into a fibre optic cable or the data in/out connectors of the FMUX or MCUF, with or without the use of optical aids. Laser radiation can come from either the data in/out connectors or unterminated fibre optic cables connected to data in/out connectors.

To connect fibre optic cables between master and extension cabinets in multiple cabinet sites.

1. Open master and extension cabinet doors and remove hoods, (if fitted).

CAUTION	Under no circumstances should fibres be bent tighter than the minimum bend radius.

2. Route the appropriate length extension cabinet fibre optic cable from the digital module compartment of the master cabinet, through the aperture in the right side of the CBIA cage, to the top section of the cabinet.

CAUTION	Under no circumstances should any tools, such as pliers, be used to connect ST fibre connectors.

3. Connect the push fit ST connector of the fibre optic cables to the appropriate ports on the master MCUF, or master FMUX module, front panel (see Table 2-5).
4. Route the fibre optic cable to the extension cabinet, following existing cable layout as far as possible.
5. Pass the fibre optic cable through the fibre optic cable hole in the cabinet top section to the extension cabinet FMUX.
6. Connect the push fit ST connector of the fibre optic cables to the data ports on the extension cabinet master FMUX front panel.
7. Repeat steps 2 to 6 for digital redundancy MCUF and FMUX, if fitted.
8. Repeat steps 2 to 7 for additional extension cabinets.

Interface panel cabling

Interface panel diagram and pinout overview

All cabinet connectors are located on the interface panel. Each connector is marked with the appropriate label. Power connectors are also located on the interface panel.

An extension cabinet fibre optic cable is not connected to the interface panel, but directly connected to the FMUX digital module in the CBIA cage. The fibre optic cable enters the cabinet through a hole on the top panel in front of the interface panel.

Figure 2-36 shows the locations of all the interface panel connectors.

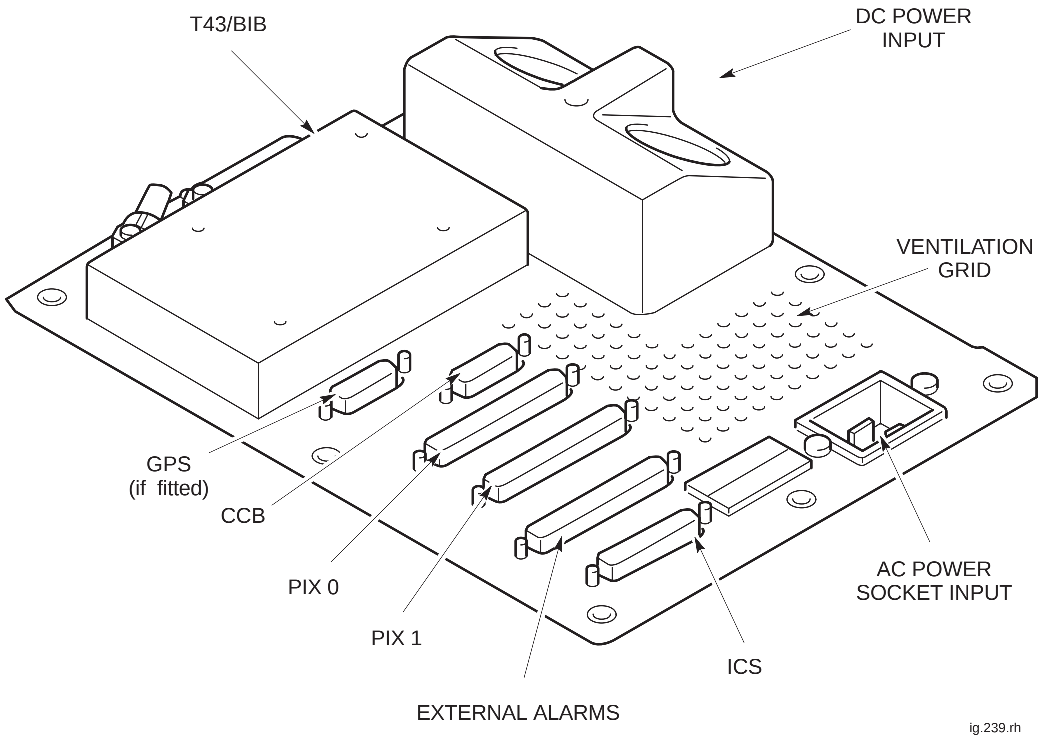


Figure 2-36 Interface panel connector locations

Connector pinout tables

CAUTION	Keep the plastic connector covers, supplied by Motorola, on unused connectors to protect from damage by static or foreign matter.

The following tables list the connector pinouts:

- External alarms see Table 2-6 and accompanying information.
- GPS see Table 2-7.
- CCB see Table 2-8.
- BIB see Table 2-9.
- T43 see Table 2-10.
- PIX0 see Table 2-11.
- PIX1 see Table 2-12.
- ICS see Table 2-13.

NOTE	Some pin connections only refer to indoor or outdoor cabinets.

External alarm connector

The external alarms connector is used by the battery backup system (BBS). When this connector is not in use, a shorting plug, Motorola part number 2886169N01, is inserted. This plug must be removed to allow connection of the alarm cable from the BSS and should be retained for refit during decommissioning of BBS. The external alarm connector carries different alarms in the Horizon*macro* outdoor.

The shorting plug joins pairs of pins as shown in Table 2-6.

Table 2-6 External alarms indoor pin shorts (37-way D-type)

Pin Nos	Pin Nos	Pin Nos	Pin Nos
1 + 2	11	21+22	32
3 +4	12	23+24	33
5+6	13+14	25+26	34
7+8	15+16	27+28	35
9	17+18	29+30	36+37
10	19 +20	31	

GPS connector

Table 2-7 lists the GPS connector pinouts.

NOTE The GPS connector is optional on later BTS cabinets.

Table 2-7 GPS pin connections (15-way D-type)

Pin No	Signal/Description	Pin No	Signal/Description
1	GPS power 1	9	GPS power 2
2	Not connected	10	Not connected
3	chassis earth	11	PPS positive
4	Tx negative	12	PPS negative
5	Tx positive	13	Rx positive
6	Rx negative	14	VPP
7	Earth	15	GPS return 2
8	GPS return 1		

CCB connector

Table 2-8 lists the CCB connector pinouts. This provides a single connector, to provide power for up to two CCBs.

NOTE The CCB connector is not currently used on GSM850 or PCS1900 BTS variants.

Table 2-8 CCB pin connections (15-way D-type)

Pin No	Signal/Description	Pin No	Signal/Description
1	Not connected	9	Not connected
2	Not connected	10	Not connected
3	CCB0 27 V	11	Earth
4	CCB0 27 V	12	Earth
5	Not connected	13	Not connected
6	CCB1 27 V	14	Earth
7	CCB1 27 V	15	Earth
8	Not connected		

BIB (BIM) interconnection

The Balanced-line Interconnect Board (BIB), also known as BIM, provides the line isolation between the E1/T1 circuit lines and the CBIA backplane. The board provides an interface for up to six input and six output balanced 120 ohm lines. 12 transformers are used to provide line isolation while maintaining impedance matching between the E1/T1 circuit lines and the NIU module. Each transformer has a 1:1 turns ratio to match the external and backplane 120 ohm connections.

Connection is made using a 37-pin D-type connector to both the BIB and the external PCM twisted pair circuit lines. Figure 2-37 shows a typical BIB and Table 2-9 lists BIB interconnections:

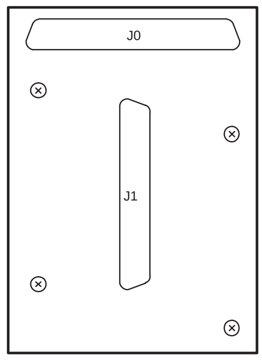


Figure 2-37 Balanced-line interconnect board (BIB)

Table 2-9 BIB interconnections

NIU/ port	Pin no	Equipment/Ext	Pin no	Pin no	Equipment/Ext	Pin no
A0/0	J0-1	Tx1+	J1-1	J0-20	Tx1–	J1-20
	J0-2	Rx1+	J1-2	J0-21	Rx1–	J1-21
B0/0	J0-4	Tx4+	J1-4	J0-23	Tx4–	J1-23
	j0-5	Rx4+	J1-5	J0-24	Rx4–	J1-24
A0/1	J0-7	Tx2+	J1-7	J0-26	Tx2–	J1-26
	J0-8	Rx2+	J1-8	J0-27	Rx2–	J1-27
B0/1	j0-10	Tx5+	J1-10	J0-29	Tx5–	J1-29
	j0-11	Rx5+	J1-11	J0-30	Rx5–	J1-30
A1/0	J0-13	Tx3+	J1-13	J0-32	Tx3–	J1-32
	J0-14	Rx3+	J1-14	J0-33	Rx3–	J1-33
B1/0	J0-16	Tx6+	J1-16	J0-35	Tx6–	J1-35
	J0-17	Rx6+	J1-17	J0-36	Rx6–	J1-36
Connector J0 and J1 pins 3,6,9,12,15,18,19, 22, 25, 28, 31, 34 and 37 are **connected to earth**						

T43 (CIM) interconnection

The Type 43 Interconnect Board (T43), also known as CIM, provides the impedance matching and line isolation between the E1/T1 circuit lines and the CBIA backplane. The board provides an interface for up to six input and six output unbalanced coaxial 75 ohm lines. 12 transformers are used to provide impedance matching and line isolation between the E1/T1 circuit lines and the NIU module. Each transformer has a 1:1.25 turns ratio to match the external 75 ohm and backplane 120 ohm connections.

Connection is made using a 37-pin D-type connector to the interconnect board and twelve type 43 coaxial connectors to the external E1/T1 circuit lines.

Figure 2-38 shows a typical T43, and Table 2-10 lists the T43 interconnections.

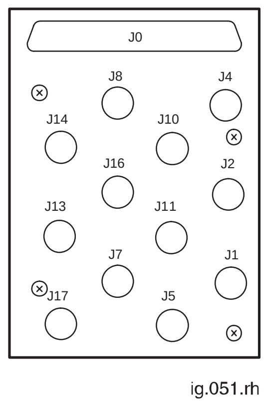


Figure 2-38 Type 43 interconnect board (T43)

Table 2-10 T43 interconnections

NIU/ port	Pin no	Equipment / Ext	Pin no	Pin no	Equipment / Ext	Pin no
A0/0	J0-1	Tx1+	J1 centre	J0-20	Tx1–	J1 shield
	J0-2	Rx1+	J2 centre	J0-21	Rx1–	J2 shield
B0/0	J0-4	Tx4+	J4 centre	J0-23	Tx4–	J4 shield
	j0-5	Rx4+	J5 centre	J0-24	Rx4–	J5 shield
A0/1	J0-7	Tx2+	J7 centre	J0-26	Tx2–	J7 shield
	J0-8	Rx2+	J8 centre	J0-27	Rx2–	J8 shield
B0/1	j0-10	Tx5+	J10 centre	J0-29	Tx5–	J10 shield
	j0-11	Rx5+	J11 centre	J0-30	Rx5–	J11 shield
A1/0	J0-13	Tx3+	J13 centre	J0-32	Tx3–	J13 shield
	J0-14	Rx3+	J14 centre	J0-33	Rx3–	J14 shield
B1/0	J0-16	Tx6+	J16 centre	J0-35	Tx6–	J16 shield
	J0-17	Rx6+	J17 centre	J0-36	Rx6–	J17 shield
Connector J0 pins 3,6,9,12,15,18,19, 22, 25, 28, 31, 34 and 37 are **not used**						

PIX conditions input/output

PIX outputs

PIX outputs comprise 4 relay contacts controlled by the alarm board and MCUF. The relays have multiple contacts, some normally open and some normally closed. The contacts are rated for 1A at 30 V. The contacts may be used for control of external equipment such as fans or audible alarms.

PIX inputs

PIX inputs comprise 16 connections to external sensors. These inputs report alarms to the BSC, via the alarm board and MCUF, which forwards the alarms to the OMC-R. The end-user supplies the external sensors. Each sensor connects across an opto-coupled pair of PIX inputs (eight per PIX connector).

All sensors **must** be dry-contact type with the following specification:

- 5 kohms or greater across sense inputs for logic 1 (PIX opto-coupler **off**).
- 500 ohms or less across sense inputs for logic 0 (PIX opto-coupler **on**).

Table 2-11 shows PIX0 connections and Table 2-12 shows PIX1 connections.

Table 2-11 PIX0 pin connections (37-way D-type)

Pin No	Signal/Description	Pin No	Signal/Description
1	Site input Ext 1–1	19	Not connected
2	Site input Ext 2–1	20	Site input Ext 1–2
3	Site input Ext 3–1	21	Site input Ext 2–2
4	Site input Ext 4–1	22	Site input Ext 3–2
5	Site input Ext 5–1	23	Site input Ext 4–2
6	Site input Ext 6–1	24	Site input Ext 5–2
7	Site input Ext 7–1	25	Site input Ext 6–2
8	Site input Ext 8–1	26	Site input Ext 7–2
9	Not connected	27	Site input Ext 8–2
10	Not connected	28	spare
11	Site output relay 1 – NO	29	Site output relay 1 – NC
12	Site output relay 2 – NO	30	Site output relay 1 – COM
13	Site output relay 2 – NC	31	Site output relay 2 – COM
14	Site output relay 3 – NO	32	Site output relay 3 – NC
15	Site output relay 4 – NO	33	Site output relay 3 – COM
16	Site output relay 4 – NC	34	Site output relay 4 – COM
17	Not connected	35	Not connected
18	Not connected	36/37	Not connected

Pin No	Signal/Description	Pin No	Signal/Description
1	Site input Ext 9–1	19	Not connected
2	Site input Ext 10–1	20	Site input Ext 9–2
3	Site input Ext 11–1	21	Site input Ext 10–2
4	Site input Ext 12–1	22	Site input Ext 11–2
5	Site input Ext 13–1	23	Site input Ext 12–2
6	Site input Ext 14–1	24	Site input Ext 13–2
7	Site input Ext 15–1	25	Site input Ext 14–2
8	Site input Ext 16–1	26	Site input Ext 15–2
9	Not connected	27	Site input Ext 16–2
Pins 10 to 18 not connected		Pins 28 to 37 not connected	

Table 2-12 PIX1 pin connections (37-way D-type)

ICS connector

Table 2-13 lists the Integrated Cell Site (ICS) connector pinouts. This is a future feature.

Table 2-13 ICS pin connections (25-way D-type)

Pin No	Signal/Description	Pin No	Signal/Description
1	ICS0 TTY earth	10	ICS3 TTY earth
2	ICS0 TTY Rx	11	ICS3 TTY Rx
3	ICS0 TTY Tx	12	ICS3 TTY Tx
4	ICS1 TTY earth	13	ICS4 TTY earth
5	ICS1 TTY Rx	14	ICS4 TTY Rx
6	ICS1 TTY Tx	15	ICS4 TTY Tx
7	ICS2 TTY earth	16	ICS5 TTY earth
8	ICS2 TTY Rx	17	ICS5 TTY Rx
9	ICS2 TTY Tx	18	ICS5 TTY Tx
Pins 19 to 25 not connected			

Installing and connecting power and earth cabling

Overview of power and earth cabling

This section describes the procedure for connecting power and earth cabling to the cabinet.

WARNING	Use the earth stud, located on the interface panel on the top of the cabinet, to earth the cabinet. Do not daisy chain cabinet earths together. Cabinets must be earthed with a conductor capable of carrying the full fault current of the overcurrent protection device. Do not make input power connections at the main power source at this time. **Connecting input power** is the final installation procedure in this chapter.

Power specifications can be found in Chapter 2 **Site requirements and considerations**.

Cable routeing

CAUTION	Ensure that covers are fitted to any unused connectors on the cabinet interconnect panel; the covers protect the connectors from damage by static electricity or foreign matter. Do not make dc input power connections at the main dc power source at this time. The external converter supplying power to the cabinet must have double or reinforced insulation between its primary and secondary circuits. The external converter that supplies power to the cabinet must meet safety standard EN 60950.

An adequate means should be provided for routeing cables from the main power source to the equipment, such as a cable trough or conduit.

NOTE	The current-carrying capacity of a cable for continuous service is affected by all of the following factors (reference IEC 364): – Ambient temperature. – Grouping. – Partial or total enclosure in thermal insulating material. – Frequency (ac only).

Cabinet and ESP earthing points

The main earth connection point is on the top interface panel, with a 10 mm M6 threaded stud, adjacent to the dc input. This connection is for protective earthing and functional earthing of the cabinet.

Additional internal earths are:

- Door to cabinet frame.
- Main cage to interface panel above PSM.
- Tx block top panel to interface panel, near dc input.
- AC input connector to interface panel at rear of panel.
- Enclosure to interface panel, at rear near dc input.

An earthing wrist strap must be worn when handling electronic modules, including the MCUF, FMUX, NIU, alarm module, CTU, and SURF. An ESP earthing connection point is provided above the leftmost PSM.

Power supply cable colour coding

CAUTION	Ensure correct PSMs are fitted to match the supply source voltage.

+27 V dc cabinets

To connect a +27 V dc (negative earth) cabinet to the main dc power source. Observe the following rules:

- The **27 volt** (+ve) power cable is **red**.
- The **0 volt** (–ve) cable is **black**.

–48/60 V dc cabinets

To connect a –48/60 V dc (positive earth) cabinet to the main dc power source, Motorola recommends using a 35 sq. mm dc input power cable with a maximum length of 24 m. Observe the following rules:

- The **–48/60 volt** (–ve) power cable is **blue**.
- The **0 volt** (+ve) cable is **black**.

+ 27 V dc connection procedure

To connect dc power cables to a + 27 V dc cabinet:

WARNING	Each cabinet must be earthed separately and **not** daisy chained together.

1. Route the earth wire from the building master earth and connect to the earth stud on top of the cabinet. Tighten to correct torque (see *Installation & Configuration: GSM-205-423* **Site requirements and considerations**).

WARNING	Do not make input power connections at the main power source at this time. **Connecting input power** is the final installation procedure in this chapter.

2. Thread the cone-shaped plastic covers onto the cables before connection.
3. Connect the black 0 volt (–ve) dc power cable to the cabinet dc power connector assembly **0 V** terminal, and route to the main dc power source.
4. Connect the red 27 volt (+ ve) dc power cable to the cabinet dc power connector assembly **V IN** terminal, and route to the main dc power source.
5. Tighten the dc power connections (nuts on studs with star washers) to correct torque as in step 1.

The + 27 volt dc power cable connection procedure is now complete.

– 48/60 V dc connection procedure

To connect dc power cables to a –48/60 V dc cabinet:

WARNING	Each cabinet must be earthed separately and **not** daisy chained together.

1. Route the earth wire from the building master earth and connect to the earth stud on top of the cabinet. Tighten to the correct torque (see *Installation & Configuration: GSM-205-423* **Site requirements and considerations**).

WARNING	Do not make input power connections at the main power source at this time. **Connecting input power** is the final installation procedure in this chapter.

2. Thread the cone-shaped plastic covers onto the cables before connection.
3. Connect the black 0 volt (+ve) dc power cable to the cabinet dc power connector assembly **0 V** terminal, and route to the main dc power source
4. Connect the blue –48/60 volt (–ve) dc power cable to the cabinet dc power connector assembly **V IN** terminal, and route to the main dc power source.
5. Tighten the dc power terminal connections (nuts on studs with star washers) to correct torque as in step 1.

The –48/60 volt dc power cable connection procedure is now complete.

Cabinet ac install

WARNING	For connection to ac supply, use correct socket type, protective device and appropriately rated cable, selected in accordance with National and regional wiring regulations.

The 230 volt ac input is via a recessed plug connector, rated at 20 amps, into which an ac supply cable terminated with a standard type IEC320 socket may be connected.

AC input connection

Figure 2-39 shows the ac input connection located on the interface panel. The live, neutral and earth connections are clearly marked.

WARNING	If assembling a cable and socket for connection to this ac input, ensure live, neutral and earth connections within the socket match equivalent plug connections. That is, live connects to live, neutral to neutral and earth to earth.

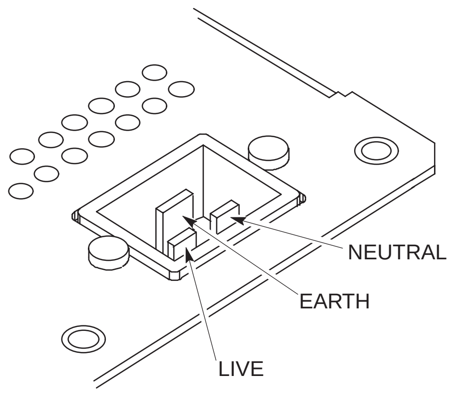


Figure 2-39 View of ac input recessed plug connector

WARNING	Do not make ac input power connections at the main power source at this time. **Connecting input power** is the final installation procedure in this chapter.

Connecting input power

Pre-connection checks

At this point in the installation, ensure that:

- The cabinet is not already connected to the main ac or dc power source.
- The cabinet is connected to the ac or dc power cabling.

Connecting dc power

To connect dc power to a cabinet:

WARNING	Do not wear an anti static wrist strap while servicing the power supplies or power distribution cabling, as serious personal injury can result. The external converter supplying the cabinet must have double or reinforced insulation between its primary and secondary circuits, and must conform to Safety Standard EN 60950.

CAUTION	Perform any adjustments recommended by the manufacturer on the main power supply equipment before connecting dc power cables to the main dc power source. Input to the base station must remain between 20 V and 30 V under all load conditions for normal +27 V dc operation. Input to the base station must remain between –40 V and –60 V dc for –48 V dc operation.

1. Turn off the main dc power supply.
2. Use a digital voltmeter to ensure that power is not present.
3. Route and secure the dc power and earth cables to the building ac power supply from the cabinet.
4. Connect the earth wire to the building master earth.
5. Connect the 0 volt lead of the input dc power cable to the 0 volt terminal of the main dc power supply. See **Installing and connecting power and earth cabling**.
6. Connect the V IN lead of the input dc power cable to the V IN (+ 27 or –48/60 volt, as appropriate for cabinet PSM type) terminal of the main dc power supply. See **Installing and connecting power and earth cabling**.
7. Tighten connections to correct torque (see **Site specific or electricity supply company documentation**).

Connecting ac power

WARNING	Ensure the ac power supply input has been safely isolated, so that there is no risk of power being applied to the cable during this procedure. The source should be isolated and locked, and warning label attached.

To connect ac power to a cabinet:

1. Isolate the ac power source and lock the isolator switch.

WARNING	Do not make input power connections at the main power source at this time. Connecting to ac power source is the final step in this procedure.

2. Route and secure the power cable from the building ac power supply to the cabinet, near the interface panel.
3. Insert the ac power connector into the ac power socket on the cabinet.
4. Connect the ac power cable to the building power supply socket.

Ensure that all correct **Request for connection** and **Completion and inspection form** certificates have been sent to the local electricity supply board.

Installing a hold-up battery module

Introduction to hold-up module installation

The hold-up battery module is an optional item fitted in the PSM shelf within the CBIA main cage, in any empty slot or in place of the redundant PSM. It may be installed at the same time as the Horizon*macro* BTS or retrospectively. There is no requirement to take the BTS out of service to retrofit the hold-up battery module.

Installing a hold-up battery module

WARNING	The batteries are capable of supplying high short circuit currents and as such present a high energy hazard.

To install a hold-up battery module:

1. Check that the hold-up battery module enable switch is set to **O** (off).
2. Cut the cable tie that secures the jumper lead to the isolation connection access hatch. Open the access hatch by turning the fastener a quarter turn anticlockwise and lifting.
3. Fit the jumper lead between the battery spade terminals as shown in Figure 2-40. Close the access hatch and turn the fastener a quarter turn clockwise to secure.
4. Set switch of the redundant PSM, (if fitted) to OUTPUT DISABLE. The **ACTIVE** LED (green) will extinguish. The **ALARM** LED (red) will light, or if already lit due to alarm state, will stay on.
5. Remove redundant PSM or blanking assembly from the spare slot, by unscrewing attachment screws with a torxdriver.

WARNING	The hold-up battery module weighs 5.9 kg. Handle with care.

6. Insert hold-up battery module in spare slot.
7. Ensure hold-up battery module is firmly in position and tighten both module attachment screws using a torxdriver. Tighten to a torque of 2.2 Nm.
8. Set the hold-up battery module enable switch to **I** (on). Check that the **CHARGE** LED (green) is lit.

NOTE	The **ACTIVE** LED (green) will not light until 1.5 to 2 hours after installation. The **ALARM** LED (red) may also be lit if the initial battery voltage is below 19 V dc (+/–0.25 V).

Hold-up battery module view

Figure 2-40 shows the hold-up battery module with the battery isolation jumper connection shown in detail.

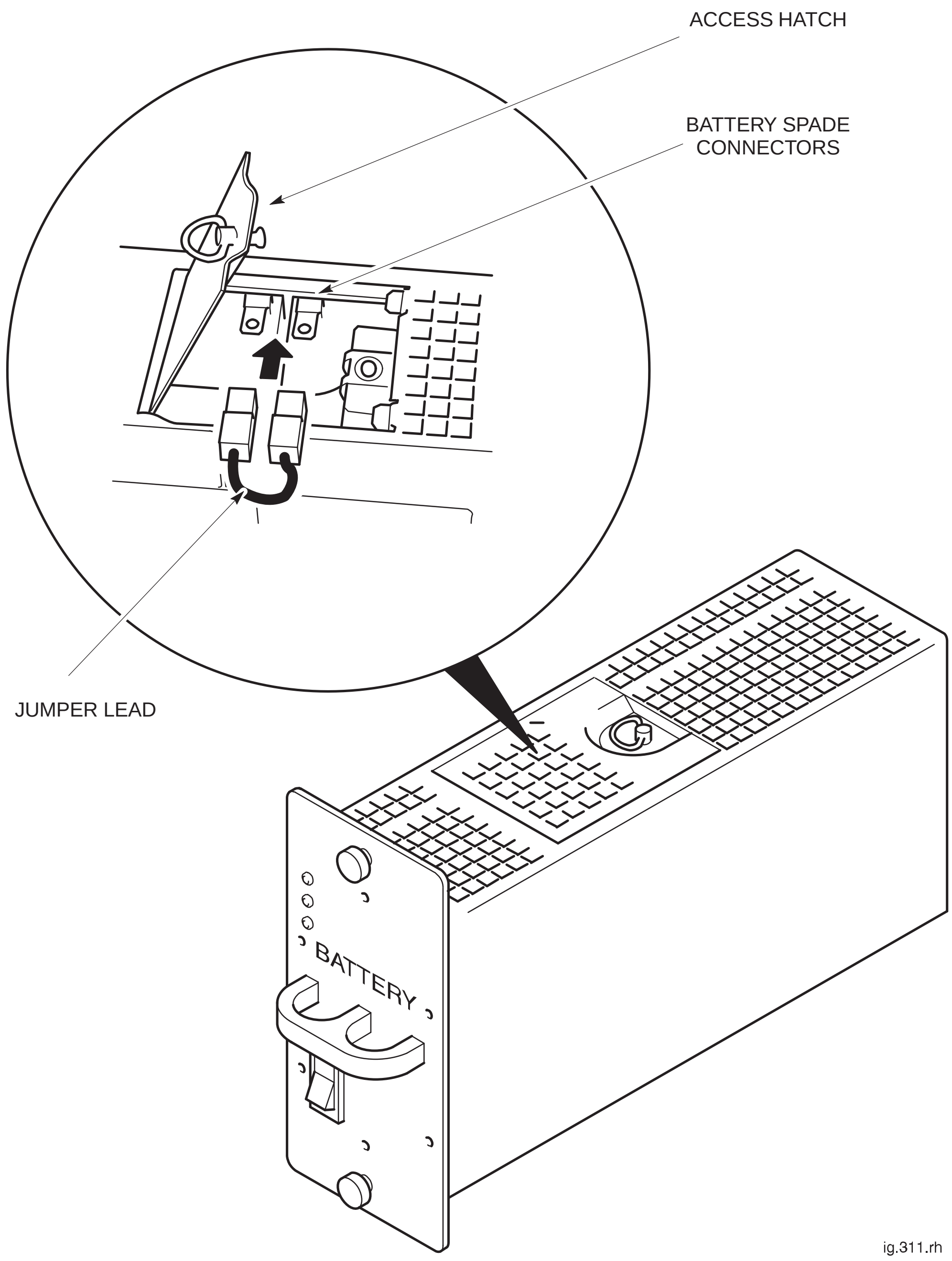


Figure 2-40 Connecting battery isolation jumper lead

Chapter 3

Interoperability between different Motorola BTSs

Chapter 3
Interoperability between different Motorola BTSs i

Introduction to interoperability

Mixed product sites

This chapter describes how the Horizon*macro* indoor can be used in conjunction with other Motorola BTS products.

Different Motorola product types can be collocated at the same physical site without restriction, provided they are configured as logically separate installations, and in accordance with the normal product engineering rules.

When mixed product types are installed at the same logical site, a number of technical issues arise that restrict the hardware that can be configured, and the way it is interfaced. This chapter explains which product types can be mixed in this way, and how they are interfaced.

NOTE	This chapter only applies to the Horizon*macro* GSM/EGSM900 and DCS1800 BTS variants. GSM850 and PCS1900 Horizon*macro* BTS variants cannot be mixed with other Motorola BTS types.

Architectural constraints

To enable different product types to be used at the same logical site, one product type is chosen as master, which is connected to the extender equipment so that the two product types can function as a single, logical BTS. This approach is viable when the product types to be interfaced have similar architectures.

Motorola BTS product types that can be interfaced for collocation at a single logical site are therefore restricted to those shown in Table 3-1 below.

Table 3-1 BTS compatibility for collocation at a single logical site

Master	**Extender**			
	InCell	M-Cell*2*	M-Cell*6*	Horizon*macro*
InCell	Discontinued	No	No	No
M-Cell*2*	No	Yes*	Yes*	No
M-Cell*6*	No	No	Yes*	Yes
Horizon*macro*	No	No	Yes*	Yes

* Check for availability before ordering

Indoor and outdoor cabinets can be mixed, but different mechanical arrangements may be required for routeing the inter-cabinet cabling.

BTS architectures and interoperability

M-Cell*6* and Horizon*macro* architectures

Figure 3-1 represents the high level architecture of the M-Cell*6* and Horizon*macro* BTSs. Both systems provide an optical interface for connection to remote transceivers, which in a normal installation would be used to connect to transceivers of the same product type.

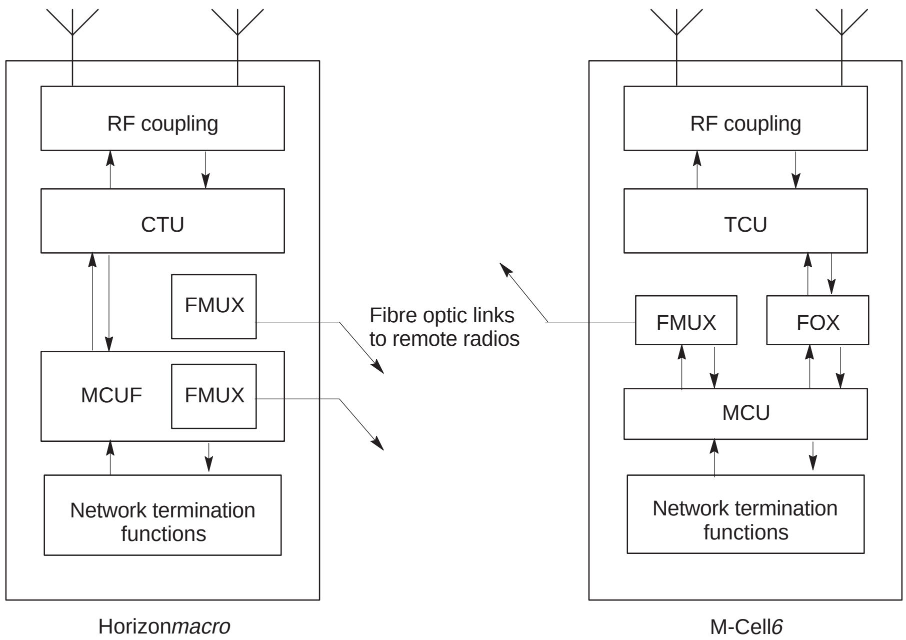


Figure 3-1 High level architecture of M-Cell*6* and Horizon*macro* BTSs

However, since the optical interface is identical for both products, it can be used to link an M-Cell*6* to Horizon*macro* transceivers, or a Horizon*macro* to M-Cell*6* transceivers. The principle is shown in Figure 3-2.

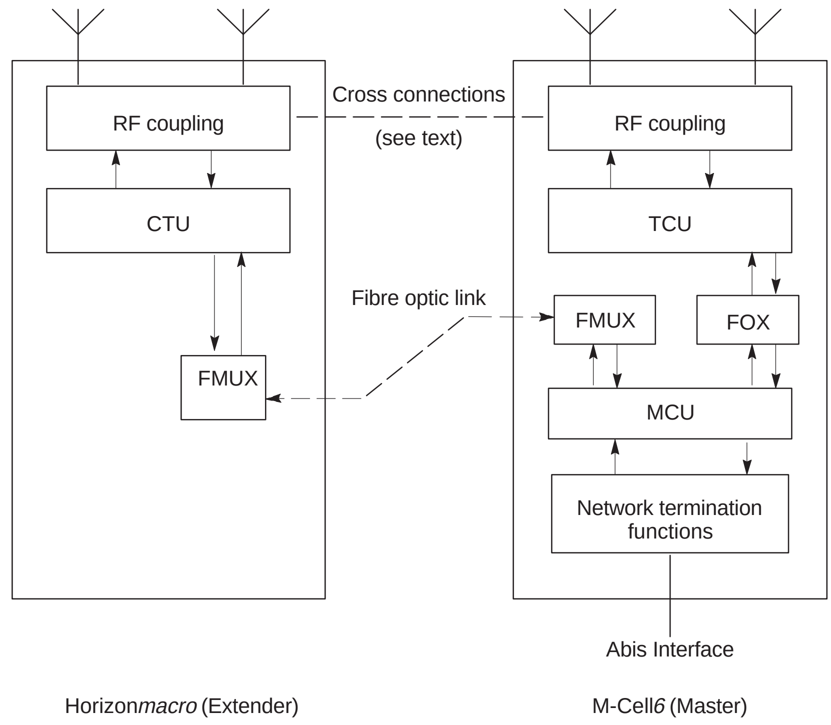


Figure 3-2 Example of interfacing different products at a single logical site

When two product types are interfaced in this way, the control function for the entire BTS is implemented by the master product. In Figure 3-2, this is the M-Cell*6*. In practice, either BTS can be configured as master according to the needs of the network concerned.

Example mixed site

A multi-cabinet mixed site can typically be achieved in several ways. Figure 3-3 shows the alternatives layouts for a four cabinet mixed BTS site

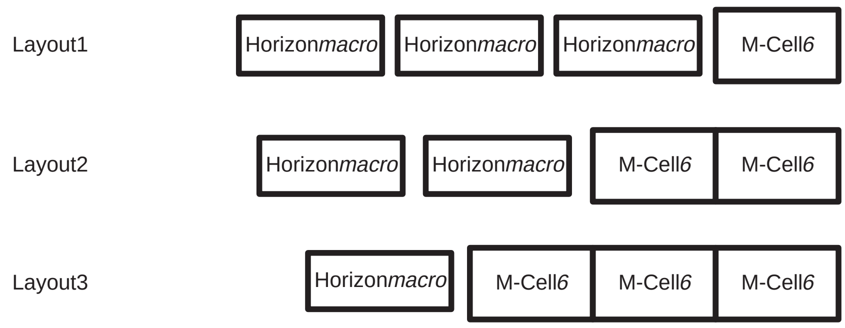


Figure 3-3 Example of alternative layouts for a 4-cabinet mixed BTS site

Technical issues

When mixing different BTS types, the interface may be required to resolve some or all of the following issues, depending on the site configuration:

- The interface must deliver both Rx and Rx_{div} (receive diversity) signals to each transceiver.
- The interface must not change the uplink (receive) signal level delivered to any transceiver.
- The interface must ensure that in the mixed BTS configuration, RF combiners remain correctly loaded.

Receive path

When a cell is wholly configured within one cabinet, there is no requirement to connect the uplink or downlink RF signals between the master and extender cabinets. The only interface between the cabinets in this type of mixed BTS configuration is therefore at digital level, between FMUXs via the fibre optic link.

When a cell is split between two cabinets, the uplink signals must be connected between the cabinets since both Rx and Rx_{div} signals are required at each transceiver. In this situation the downlink signal may or may not require connection between cabinets, depending on the site configuration. The uplink connectivity requirements are shown in Figure 3-4 (DCS1800) and Figure 3-5 (GSM900).

DCS1800

Refer to Figure 3-4. In the Horizon*macro* cabinet, low noise amplification in the SURF module first boosts the Rx signal by +13 dB. Separate Rx outputs from the SURF are then discretely routed to relevant transceivers in the master cabinet, and to the LNA in the extender cabinet. Since the LNA boosts the Rx signal by a further +13 dB, a 13 dB attenuator is placed in the signal path to offset this additional signal gain, which would otherwise result in signal levels outside the permitted range for the transceivers.

The Rx_{div} signal is similarly given a +13 dB boost by the LNA in the extender cabinet. Separate Rx_{div} outputs from the LNA are then discretely routed to relevant receivers in the extender cabinet, and to the SURF module in the master cabinet. Since the SURF provides a further +13 dB boost, a 13 dB attenuator is again placed in the signal path to offset this additional gain.

In this way, the arrangement shown in Figure 3-4 delivers Rx and Rx_{div} signals to the uplink path in both cabinets, at the required signal level.

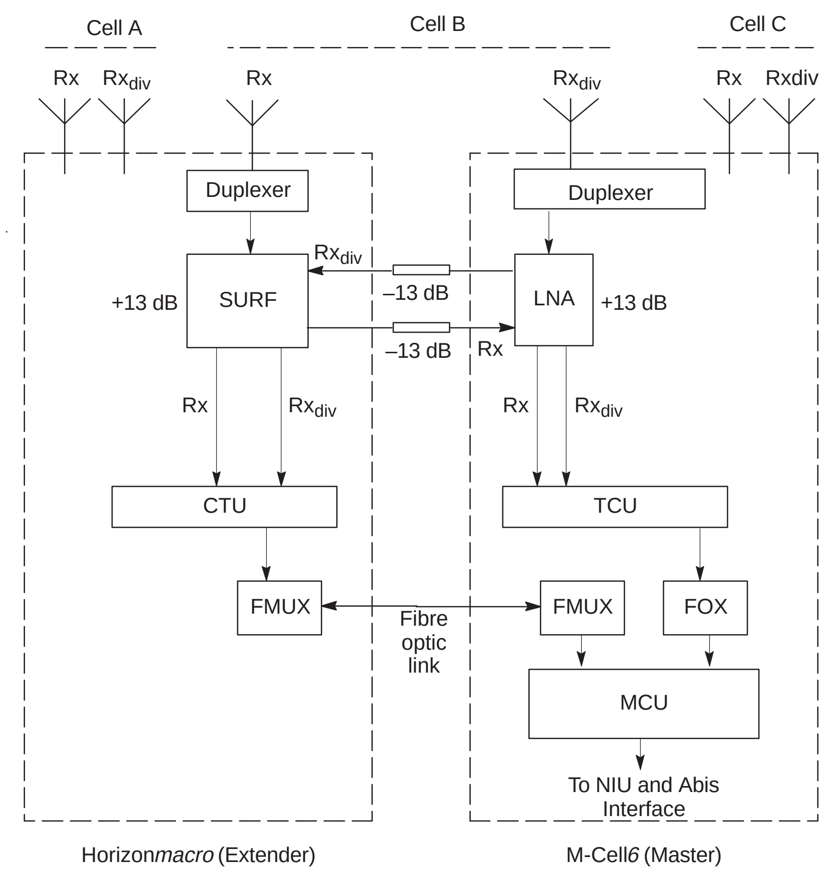


Figure 3-4 Functional overview of the receive path for a DCS1800 split cell configuration

GSM900

Refer to Figure 3-5. In GSM900 products, RF gain for the IADU and SURF is configurable. A split cell configuration is therefore dealt with in the same way as that described for DCS1800, except that the 13 dB attennuators are not required. Instead, the required signal level is maintained by using appropriate gain settings for the IADU and SURF.

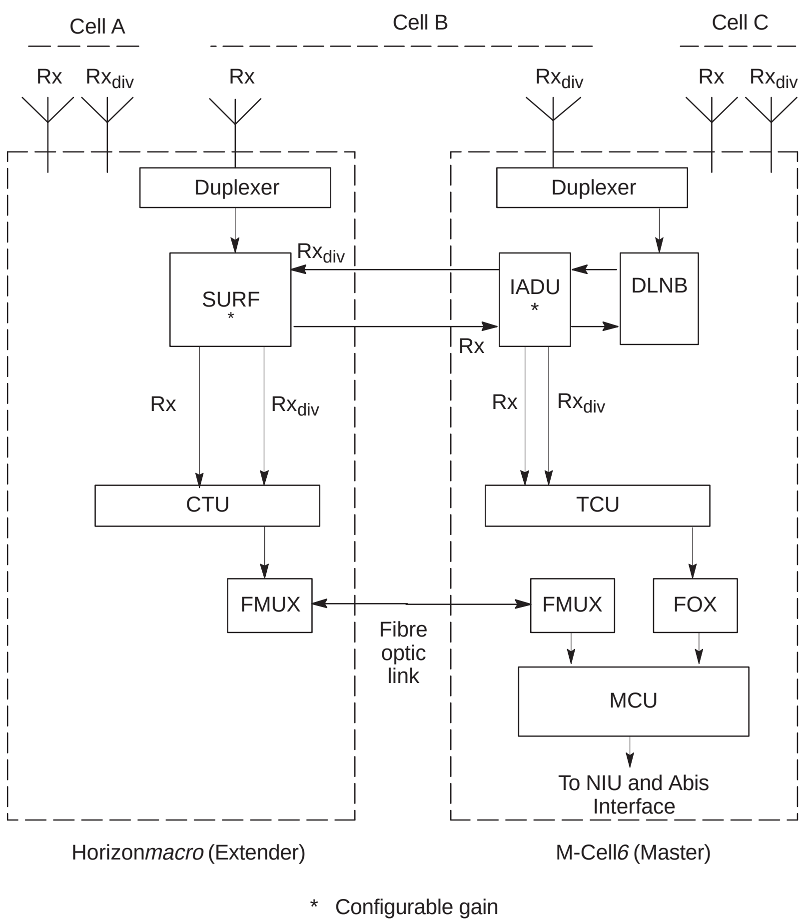


Figure 3-5 Functional overview of the receive path for a GSM900 split cell configuration

Transmit path

M-Cell*6* combining

When configuring the downlink paths for a cell using three carriers or more, it may be necessary to provide additional external RF load(s) for the combiners. This is illustrated by Figure 3-6, which shows a typical M-Cell*6* combining arrangement for a 4-carrier cell.

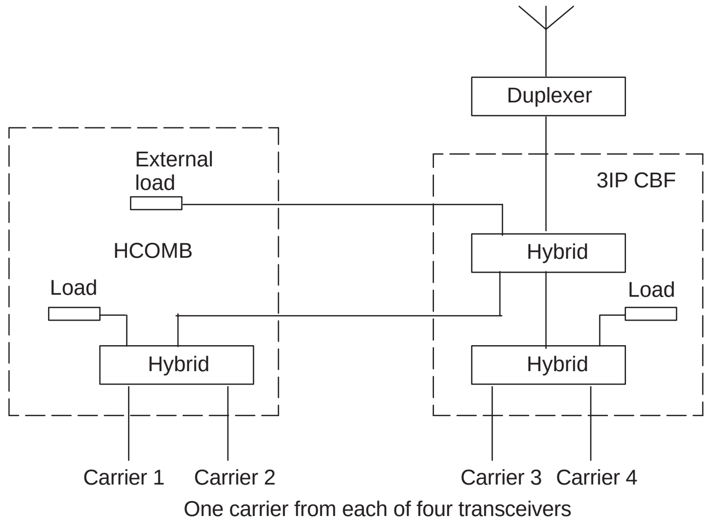


Figure 3-6 Typical M-Cell*6* arrangement for combining four carriers

Carriers 1 and 2 are combined in a hybrid combiner (HCOMB) module. The output from this module provides one of the three inputs to the 3IP CBF. The HCOMB is equipped with an internal RF load, and is therefore self–contained. The 3IP CBF requires one RF load for each of the two hybrids it contains, but is equipped with only a single internal RF load. An additional load is therefore provided for this purpose on the HCOMB casing.

Horizon*macro* combining

A similar arrangement is used in the Horizon*macro*, which uses a Hybrid Combiner Unit (HCU) and Dual stage Duplexed combining Filter (DDF), as shown in Figure 3-7. The DDF has three input ports together with two internal RF loads, and therefore does not require the addition of any external load.

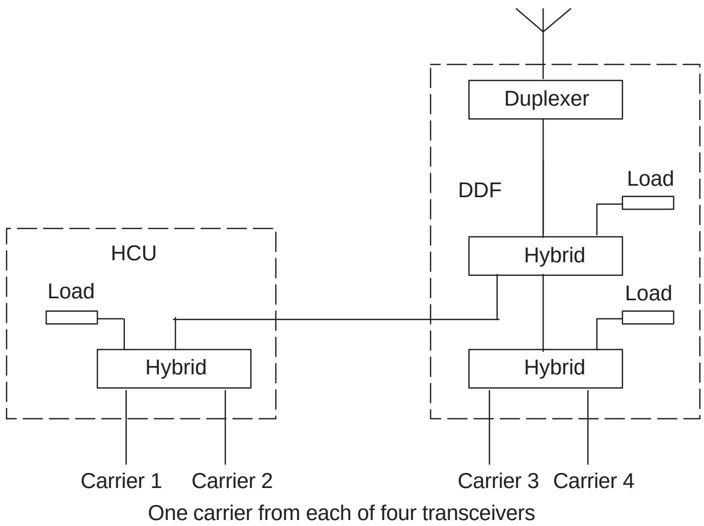


Figure 3-7 Typical Horizon*macro* arrangement for combining four carriers

Mixed equipment combining

When the two different product types are interfaced, a situation can arise where a 3IP CBF is connected to an HCU, as shown in Figure 3-8. In this configuration it is therefore necessary to provide an additional external RF load for this 3IP CBF. The example in Figure 3-8 shows downlink connections for a 4/4/4 configuration using mixed BTS types.

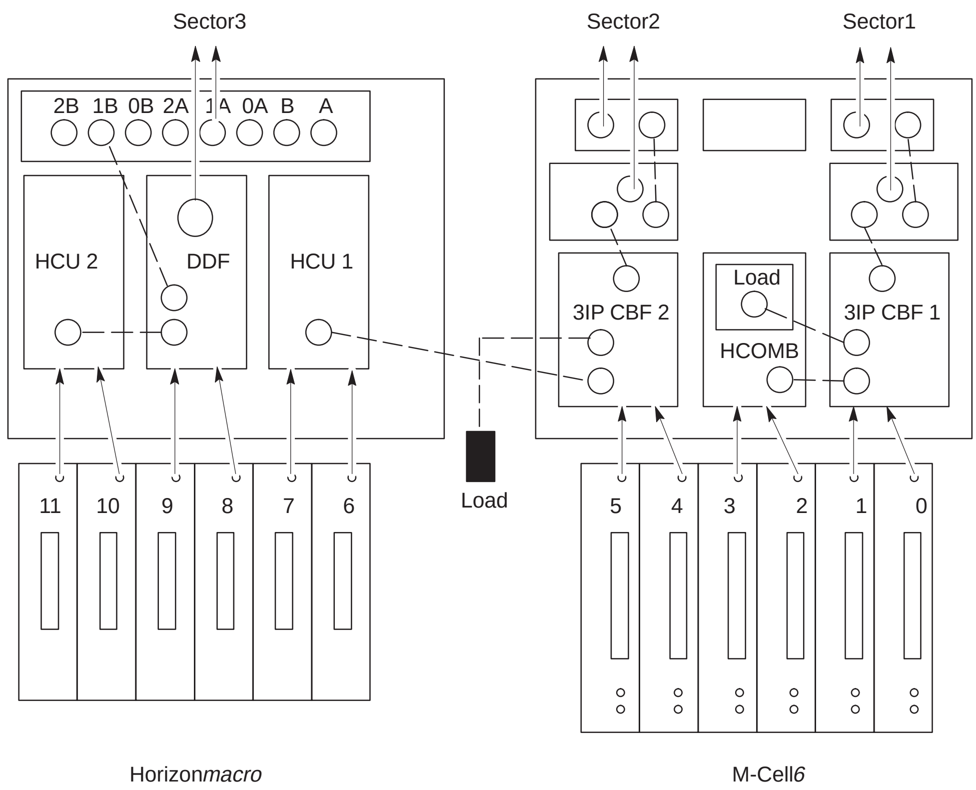


Figure 3-8 Downlink configuration for a 4/4/4 mixed cabinet installation

Inputs for the DDF are carriers 8 and 9, together with the output of HCU2. The DDF contains two RF loads and is therefore self-contained. Inputs to 3IP CBF1 are carriers 0 and 1, together with the combined output of HCOMB. 3IP CBF1 contains a single load and is therefore connected to the external load mounted on HCOMB. Inputs for 3IP CBF2 are carriers 4 and 5, together with the output of HCU1, from the master cabinet. 3IP CBF2 contains a single load and therefore requires the addition of an external 50 ohm load, as shown.

M-Cell*6* and Horizon*macro* hardware equivalents

Table 3-2 shows the RF hardware equivalents for the Horizon*macro* and M-Cell*6* BTSs.

Table 3-2 RF hardware equivalents for Horizon*macro*/M-Cell*6*

Horizon*macro* 900/1800	**M-Cell 900**	**M-Cell 1800**
DCF	CBF + duplexer	Hybrid + duplexer
DDF	3- input CBF* + duplexer	2 x hybrid + dup/BPF
HCU	Hybrid	Hybrid
Feedthrough plate	Non-hybrid	(no equivalent)
TDF	TBF + duplexer	2 x dup/BPF
CCB master	CCB master	CCB master
CCB extender	CCB extender	CCB extender
SURF	3 x DLNB + IADU	3 x LNA
Split Sector Cable	Rx Extender	(no equivalent)

* 3-input CBF contains only one internal 50 ohm load.

Further configuration information

Provided the functional guidelines described in this chapter are followed, the steps involved in upgrading an existing site with mixed equipment are essentially the same as with a conventional upgrade:

- Determine the number of additional carriers required in the upgraded site.
- Based on the required site configuration (for example, 4/4/4), use the functional guidelines provided in this chapter to decide the most effective hardware configuration for the additional cabinet(s).
- Special upgrade kits are available for specified configurations.
- Configuration diagrams and product ordering help are available from the Motorola local office.

Example configurations

Configuration diagrams provided by the Motorola local office show top of rack cable and antenna connections for mixed product configurations, together with details of external RF loads required. Figure 3-9, Figure 3-10 and Figure 3-11 are examples of the type of diagram that can be provided.

GSM900 2/2/2 configuration using two cabinets

In this configuration, there are no split cells, and therefore no uplink/downlink connections between the cabinets. The CBFs are 2-input devices, consequently no external RF loads are required.

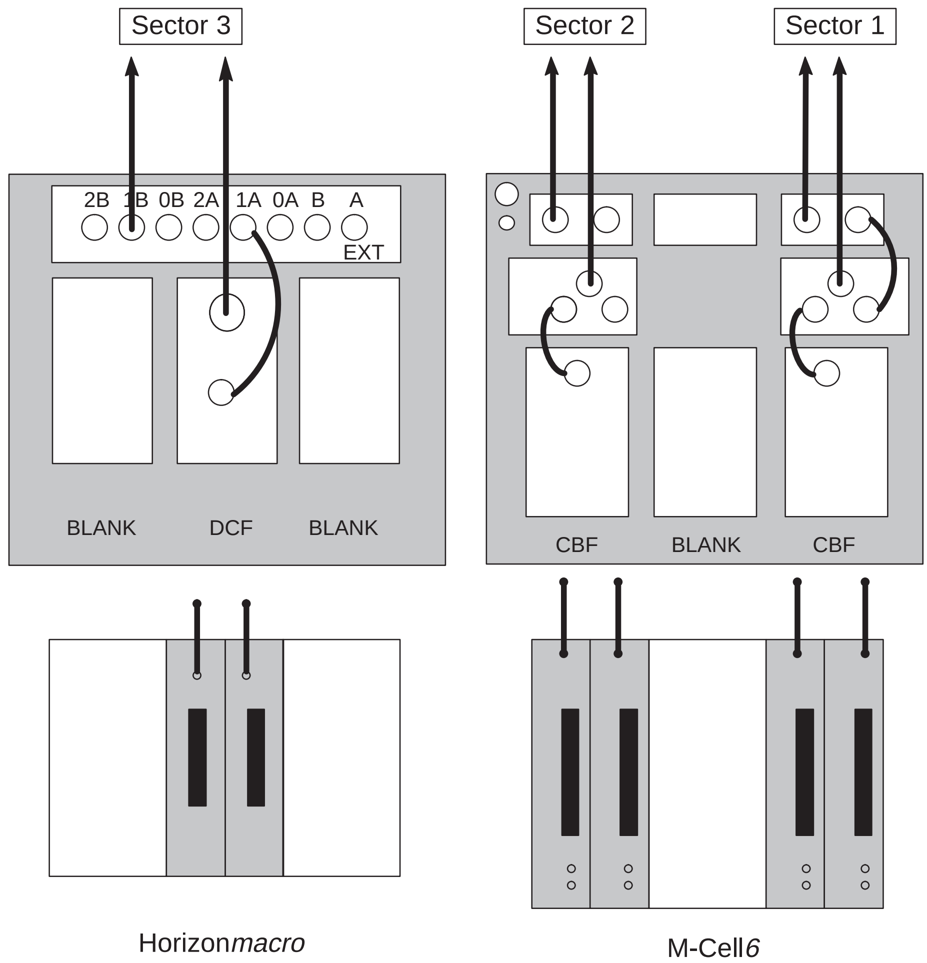


Figure 3-9 GSM900 mixed Horizon*macro* / M-Cell*6* 2/2/2 configuration using two cabinets

GSM900 5/5 configuration using two cabinets

In this configuration, there are no split cells, and therefore no uplink or downlink connections between the cabinets. In the M-Cell*6* cabinet, both 3IP CBFs are configured with external loads provided by the NON HYB. In the Horizon*macro,* one DDF has two direct RF inputs, plus a third input via the FEEDTHRU. The second DDF has two RF inputs, one direct and one via the FEEDTHRU. This arrangement facilitates using the transceivers in sequence. The two 50 ohm loads are required to terminate the unused DDF/3IP CBF input ports.

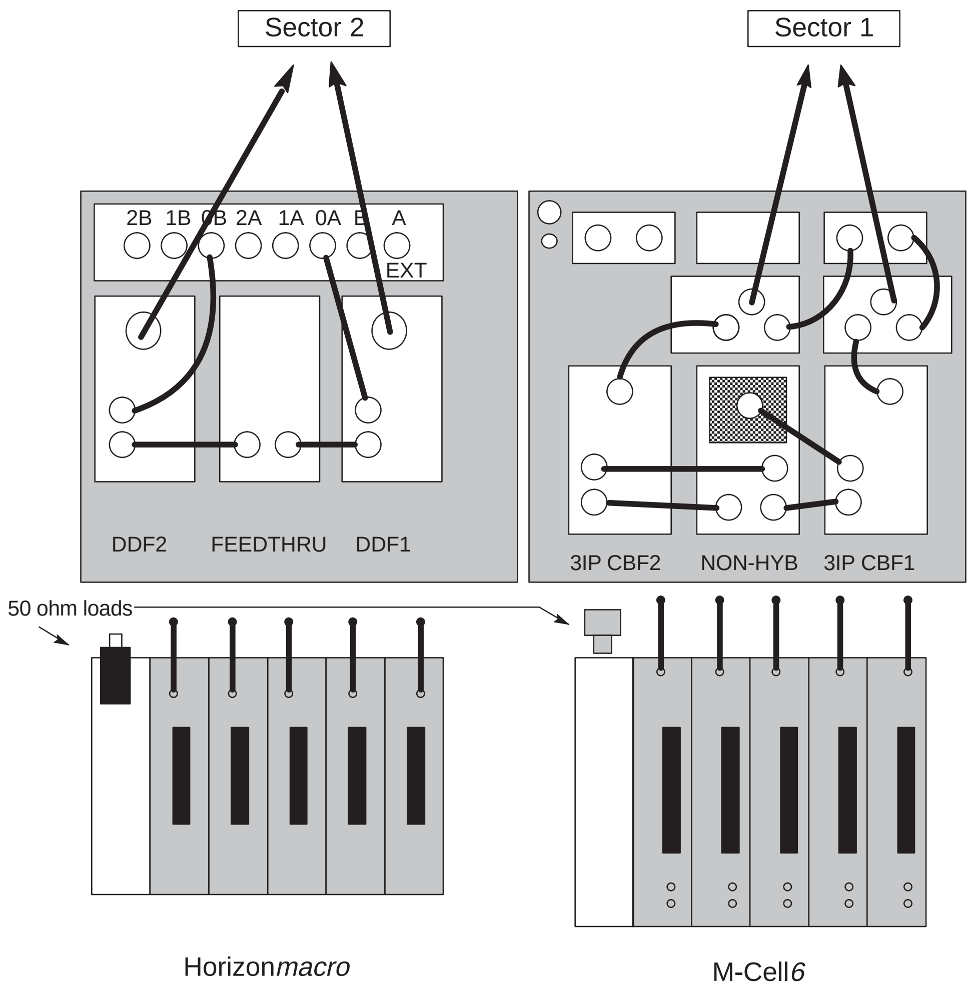


Figure 3-10 GSM900 mixed Horizon*macro* / M-Cell*6* 5/5 configuration using two cabinets

DCS1800 4/4/4 configuration using two cabinets

In this configuration, sector 2 is split between the cabinets. The uplink Rx and Rx_{div} signals for sector 2 are therefore connected between the BTS types to ensure the availability of both signals in both cabinets. In the M-Cell*6* cabinet, 2-input hybrids are used for combining, each configured with a discrete external load.

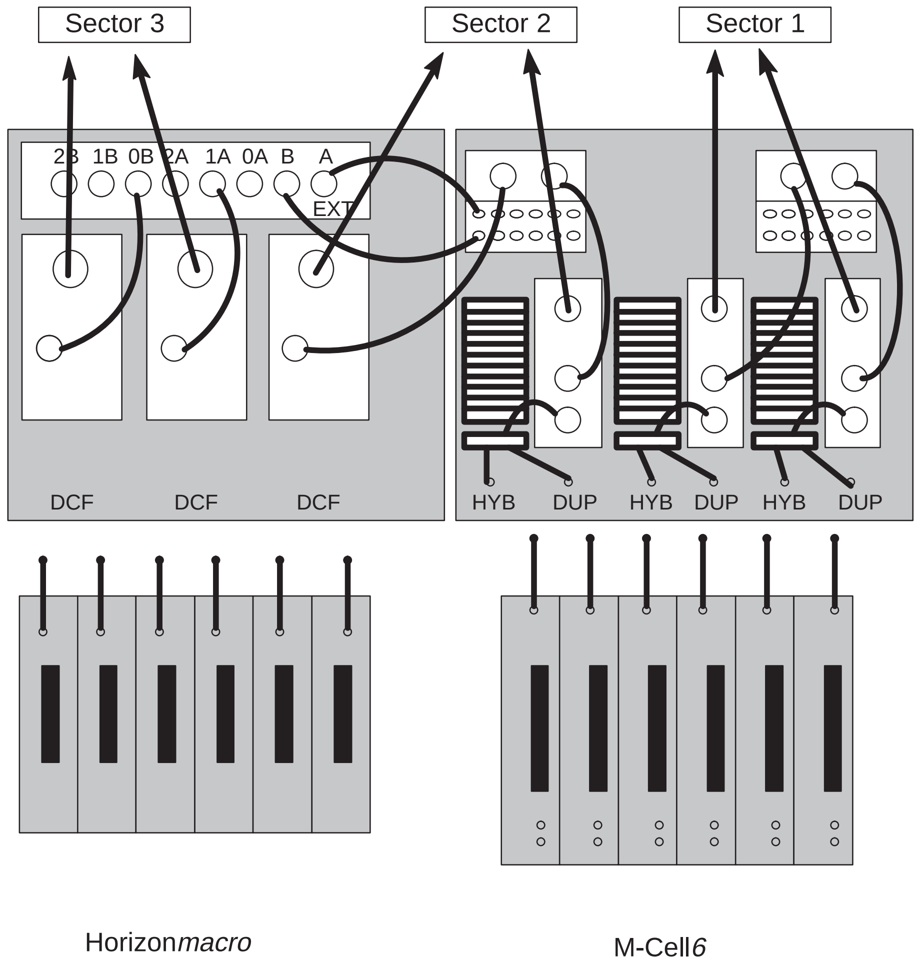


Figure 3-11 DCS1800 Mixed Horizon*macro* / M-Cell*6* 4/4/4 configuration using two cabinets

Special hardware

A range of cables is available for uplink, downlink and fibre optic connections, together with the uplink attenuators described earlier. Contact the Motorola local office for further details.

In addition, the mounting plate and snap-in multi cable gland shown in Figure 3-12 are required when expanding M-Cell*6* outdoor sites with Horizonmacro cabinets. In this type of configuration, the Horizon*macro* equipment is located to the left of the M-Cell*6* cabinets.

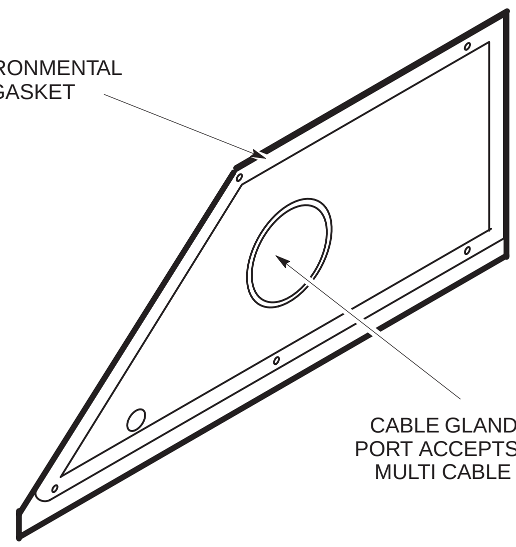


Figure 3-12 Special cable gland plate required for mixed M-Cell*6* and Horizon*macro* installations

The mounting plate is located as shown in Figure 3-13 in place of the original blanking plate fitted to the M-Cell*6*.

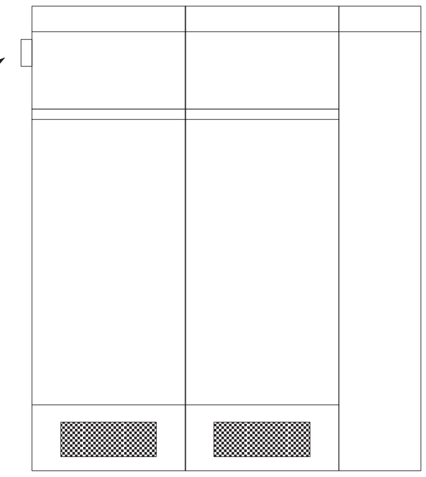


Figure 3-13 Location of the snap-in multi cable gland and mounting plate in the M-Cell*6*

MOTOROLA

Chapter 4

Commissioning of indoor cabinet

Chapter 4
Commissioning of indoor cabinet i

Commissioning overview and test equipment

Overview of commissioning

This chapter provides information required for the commissioning of cabinets and their internal and external interfaces.

NOTE	Some equipment at the site may not be produced by Motorola, including battery chargers, power supplies, and antennas. Refer to site-specific documentation and the non-Motorola vendor instructions.

All site preparation and equipment installation in the previous chapters must be completed before commissioning. Commissioning consists of the following:

- Pre-power up checks.
- Powering up the cabinet.
- Optimization procedures as detailed in *Installation and Configuration: BSS Optimization (GSM-100-423)*.

PC to MCUF cable pin connections

Figure 4-1 shows the pin connections for the PC to MCUF test cable. These are standard null modem pin connections. There is also a TTY adapter, to attach to the cable, for CTU use, Motorola part number 58C86540N01.

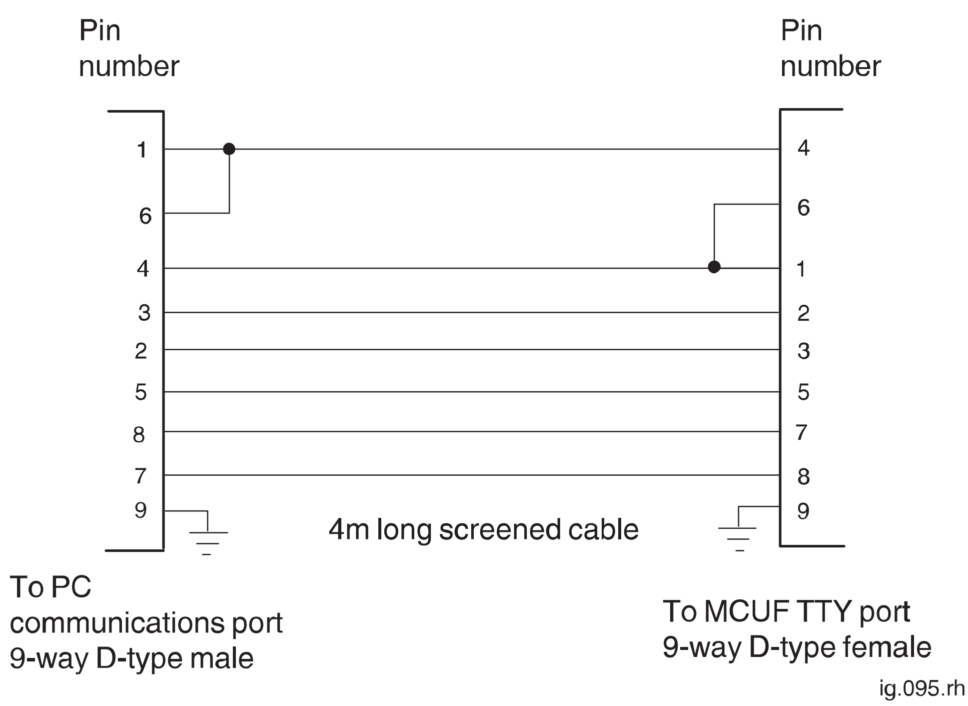


Figure 4-1 9-way to 9-way PC to MCUF cable pin connections

Test equipment

Table 4-1 provides details of the test equipment required to perform the commissioning procedures in this chapter.

Table 4-1 Test equipment required for commissioning

Quantity	Description	Comments
1	IBM compatible portable Personal Computer (PC) (486 DX2 or DX4 minimum)	The minimum requirements are: TFT colour screen. 170 Mbyte hard drive (minimum). Minimum 4 Mbyte RAM or recommended 8 Mbyte. 3.5 inch floppy drive. Serial port. CD-ROM drive (recommended) PCMCIA (Type 2) compatible slot. Windows (3.1 running in 386 enhanced mode minimum) loaded and running. Battery power.
1	Commercial terminal emulator software	PC PLUS or similar software (suitable for PC being used)
1	Digital multimeter (must be sensitive enough to measure 0.05 ohms)	Hewlett Packard E2378A or equivalent
1	ESD protection kit	
1	9-way male D-type to 9-way female D-type adaptor	For PC to MCUF Pin connections shown in Figure 4-1.
1	PAT tester	Insulation and earth tester

Pre-power up checks

Overview of pre-power up checks

WARNING	Before powering up the equipment, the power system checks provided in this section must be performed.

This section contains procedures for testing the power system prior to applying power to the cabinet.

WARNING	230 V is present within the cabinet, when the cabinet is directly connected to an ac supply. Earth straps are not to be worn during the commissioning of the ac and dc power system, and watches and other jewellery should be removed. Only insulated tools should be used.

CAUTION	This equipment contains CMOS devices and is vulnerable to static discharge. Although the damage may not be immediately apparent, CMOS devices may be damaged in the long term due to mishandling causing barrier breakdown. The approved earth strap (high impedance) must be worn at all times when adjusting or handling the processor cards (but see WARNING above, regarding use of earth straps). If the cabinet door is kept open for long periods of time during commissioning, an alternative method of cooling must be provided to avoid damage to the equipment through overheating.

Visual inspection

Inspect the installation for damage in accordance with BS 7671 (16th Edition <Section 712>) or the IEC 364 equivalent.

WARNING	If damage is discovered during the visual inspection, the commissioning must not proceed further until the damage has been inspected and rectified by the manufacturers or their representatives.

Cabinet exterior

Examine the exterior of the cabinets for structural, paint or mechanical damage and report any damage to Motorola.

Cabinet interior

Examine the interior of the cabinet for structural, paint or mechanical damage and report any damage to Motorola.

Power equipment

Examine the power equipment for mechanical damage and report any damage to Motorola.

Request for power supply connection

Ensure that all correct **Request for connection** and **Completion and inspection form** certificates have been sent to the local electricity supplier.

NOTE	Samples of a typical **Request for connection** and a **Completion and inspection form** are shown in **Sample form 1** and **Sample form 2** at the end of this chapter.

Earth continuity check

Ensure an earth continuity check has been performed on appropriate equipment if required. Use the digital multimeter to check that the resistance of the test equipment leads is less than 0.05 ohms.

Main equipment earths

Connect the PAT tester to the earth terminal and to the following earth points:

- Antenna feeders.
- AC supply input earth.
  - The local electricity board termination point.
  - AC distribution board.
  - AC supply isolator.

NOTE	The switched isolator will not be connected to earth if it is a double insulated device and will therefore not require testing.

- Battery box chassis.
- Cabinet chassis (all cabinets).
- +27 V power supply unit chassis.
- Rack members.

Check that the measured resistance is less than 0.1 ohms with the tester connected to a conductive surface (bare metal) at extreme ends of the earth cables.

On completion of each earth check apply conductive non-oxidizing grease to the earth connections on the earth busbar.

AC power system insulation check

Ensure an insulation check has been performed on all ac power cables which supply the site up to the ac input to the Cabinet. Testing must be carried out in accordance with the BS 7671 (16th Edition <section 713-04–01 to 713-04-06>) or IEC 364 equivalent, at the voltage levels shown in Table 4-2, using an approved insulation tester. Check that the resistance at each point is as shown in Table 4-2.

Table 4-2 BS7671 (16th edition) Table 71A (part of)

Parameter	AC test voltage (volts)	Minimum insulation (megohms)
Up to and including 500 V	500	0.5

When the test has been completed, sign the completion and inspection certificate, a sample of which may be found in **Sample form 2**.

Powering up the cabinet

Power up overview

This procedure assumes all previous procedures have been completed.

CAUTION	Ensure correct PSMs are fitted to match the supply source voltage. Ensure that there is no blockage to ventilation at the base of the cabinet.

Power up procedure without code load

The following procedure should be carried out to power up the cabinet, with no code load. This proves the cabinet hardware is capable of operation. The procedure for cabinet code load is described in the next section.

Relevant components are shown in Figure 4-2.

WARNING	Earth straps are not to be worn during the commissioning of the power system, and watches and other jewellery should be removed. Only insulated tools should be used. The power source must be supplied to the cabinet via a suitable over-current protective device and be isolated from the BTS cabinet.

Procedure to prepare cabinet for power up without code load

To prepare the cabinet prior to power up:

1. Ensure the power source isolator is switched off.
2. Disconnect all E1/T1 lines from the BTS.
3. If fitted, remove the optional PCMCIA card from the MCUF slot.
4. Set the switch of each PSM to the OUTPUT DISABLE position.
5. Press and release all push on/push off circuit breaker buttons to the **out** (off) position.

Power up of cabinet without code load

To power up the cabinet:

1. Switch on the external power supply to the cabinet.
2. Turn each PSM switch to the OUTPUT ENABLE position; check that each PSM has the active (green) LED on and the alarm (red) LED off.
3. Press the CBM circuit breaker button marked **FANS**. Check that each fan module is operating correctly. Activate any fan not started by the restart button (marked either **FRONT** or **REAR**) on the fan module.
4. Press the CBM circuit breaker button marked **SURF**, and if CCBs are fitted, press the circuit breaker buttons marked **CCB0** and **CCB1**.
5. Press the CBM circuit breaker button marked **BPSM A** and (if redundant BPSM fitted) **BPSM B**. Check all associated digital module LEDs operate correctly; green LEDs lit on BPSM, NIU and MCUF, and red LEDs off on NIU and MCUF.

NOTE	Both red and green LEDs are initially lit on the NIU while the unit conducts a self test. After approximately 20 seconds, the red LED will extinguish, indicating normal condition.

6. Press the appropriate CBM circuit breaker buttons for the CTUs fitted, and check that the RADIO STATUS LED for each CTU flashes green.
7. Close the door to ensure correct ventilation.

This completes the power up of the cabinet.

Power down of cabinet

If the cabinet is not required to remain powered up, power down the cabinet as follows:

1. Press all circuit breaker buttons to the **out** (off) position.
2. Switch each PSM to the OUTPUT DISABLE position.
3. Switch off the external power supply to the cabinet.

This completes the power down of the cabinet.

Power up procedure with code load

The following procedure should be carried out to power up the cabinet, with code load. The code will be provided either direct from the BSC from E1 line or from a PCMCIA card installed in the PCMCIA socket of the master MCUF.

Relevant components are shown in Figure 4-2.

CAUTION	This procedure should be carried out only by experienced field engineers.

Procedure to prepare cabinet for power up with code load

To prepare the cabinet prior to power up, proceed as follows:

1. Ensure E1 connection to BSC is made.
2. Insert (optional) PCMCIA card in MCUF PCMCIA socket.
3. Connect the 9 to 9-way cable from the PC serial A port to MCUF TTY port.
4. At the PC start the terminal emulator program.
5. Change to Level 3 and at the MMI-RAM> prompt type:

   `CTRL N`
6. Set the switch of each PSM to the OUTPUT DISABLE position.
7. Press and release all push on/push off circuit breaker buttons to the **out** (off) position.

Power up of cabinet with code load

To power up the cabinet, proceed as follows:

CAUTION	When the two LEDs of the CTU or the MCUF are flashing, the boot code is downloading into non-volatile memory for software upgrade. Power should not be removed, nor the cabinet reset, until downloading has been completed, as this will corrupt the non-volatile memory. If boot code is corrupted, contact the Motorola Customer Network Resolution Centre and request the boot code restoration procedure and the appropriate boot code file.

1. Switch on the external power supply to the cabinet.
2. Turn each PSM switch to the OUTPUT ENABLE position; check that each PSM has the active (green) LED on and the alarm (red) LED off.
3. Press the CBM circuit breaker button marked **FANS**. Check that each fan module is operating correctly. Activate any fan not started by the restart button (marked either **FRONT** or **REAR**) on the fan module.
4. Press the CBM circuit breaker button marked **SURF**, and if CCBs are fitted, press the circuit breaker buttons marked **CCB0** and **CCB1**.

5. Press the CBM circuit breaker button marked **BPSM A** and (if redundant BPSM fitted) **BPSM B**. Check all associated digital module LEDs operate correctly; green LEDs lit on BPSM, NIU and MCUF, and red LEDs off on NIU and MCUF.

   MCUF initialization will commence at power up. A connection to the BSC will be established and code download will take place. After download the site will be initialized.

NOTE	The NIU module will initially show both red and green LEDs lit while the unit conducts a self test. When rebooting due to a code download, the red LED extinguishes after approximately 50 seconds.

CAUTION	If the code is a different version, the non-volatile memory will be upgraded at this point. Both LEDs will be flashing, and a warning message will appear on the PC terminal. Do not power down or reset the cabinet as this will corrupt the non-volatile memory. If this happens, contact Motorola Customer Network Resolution Centre and request the boot code restoration procedure and the appropriate boot code file.

6. Press the CBM circuit breaker buttons for the appropriate CTUs fitted, and check that the RADIO STATUS LED for each CTU flashes green.

   At this point, after the MCUF has initialized, the CTUs will download code from the MCUF.

CAUTION	If the code is a different version, the non-volatile memory will be upgraded at this point. Both LEDs will be flashing. Do not power down or reset the cabinet as this will corrupt the non-volatile memory. If this happens, contact Motorola Customer Network Resolution Centre and request the boot code restoration procedure and the appropriate boot code file.

7. Once fully initialized, all CTUs should have RADIO STATUS LED solid green, and TRANSMIT STATUS LED either off or solid yellow.
8. Disconnect the 9 to 9-way cable from the MCUF TTY port.
9. Close the door to ensure correct ventilation.

This completes the power up of the cabinet.

Installation and configuration

Consult *Installation and Configuration: BSS Optimization (GSM-100-423 68P02901W43)* for further procedures associated with ensuring a new site is fully operational and optimized.

Cabinet and CBM views

Figure 4-2 shows the cabinet components and enlarged view of CBM showing circuit breaker buttons.

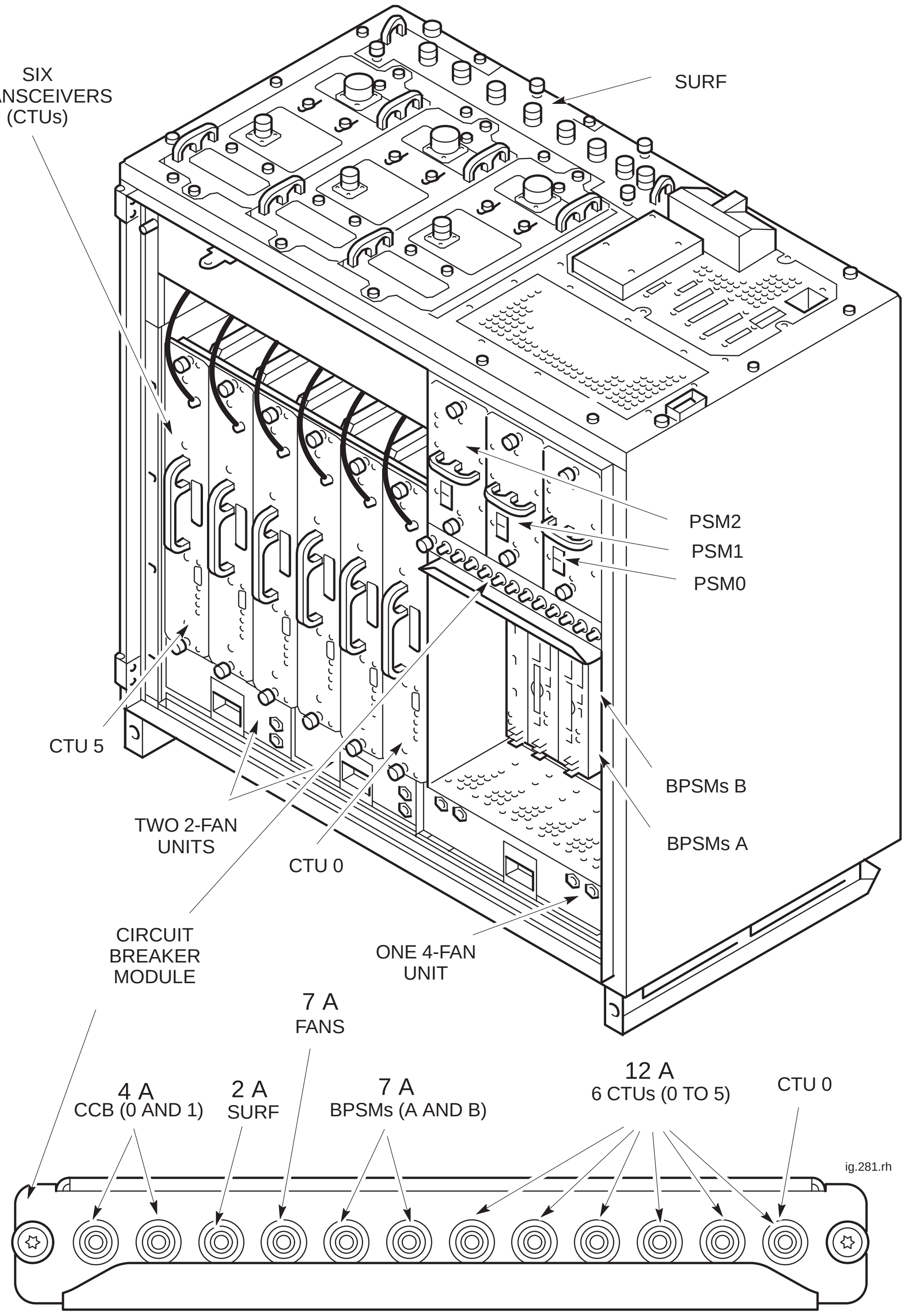


Figure 4-2 Diagram of cabinet with expanded view of CBM

Sample form 1: Request for connection

XXXXXXXXXX ELECTRIC

REQUEST FOR A CONNECTION OF A

CUSTOMER'S INSTALLATION

The electrical installation at the following address will be ready for connection
on (date) ....

NOTE : At least 4 full working days' notice is required.

Address ....

.... Telephone No. ....

DETAILS OF INSTALLATION

The installation to be connected is :
tick as appropriate

A completely new installation ☐ An alteration ☐ A rewire ☐

TYPE OF EQUIPMENT **CONNECTED LOAD (kW)**

Cooker
Water heater
Storage radiators
Other *list below*

METHOD OF EARTHING *tick as appropriate*

PME ☐
Cable Sheath ☐
RCD ☐
Other ☐ Give Details

NO OF PHASES

1 ☐
3 ☐
Other ☐ Give Details

DECLARATION

The electrical installation, summarised above, complies with the current edition of the Regulations for Electrical Installations published by the Institution of Electrical Engineers and is now ready for connection to xxxxxxxxx Electric's supply network.
It is understood that xxxxxxxxxx Electric will carry out tests, required by law, prior to connection, but these tests will NOT confirm that the installation complies with the IEE Wiring Regulations, NOR will its connection imply that it is approved by xxxxxxxxxx Electric in any way.

Electrical Installer's Name ....

Address ....

.... Telephone No. ....

Signed .... Date ....

PARTICULARS OF THE INSTALLATION

(Delete or complete items as appropriate)

Type of Installation — New/alteration/addition/to existing installation

Type of earthing (312–03): (Indicate in the box) — TN–C ☐ TN–S ☐ TN–C–S ☐ TT ☐ IT ☐

Earth Electrode — Resistance . . . . ohms

Method of Measurement . . . .

Type (542–02–01) and Location . . . .

Characteristics of the supply at the origin of the installation (313–01):

Nominal voltage . . . . volts
Frequency . . . . Hz . . . . . . Number of phases . . . .

	ascertained by enquiry	determined by calculation	measured
Prospective short–circuit current . . . . kA			
Earth fault loop impedance (Z_e) . . . . ohms			

Maximum demand . . . . A per phase

Overcurrent protective device – Type BS . . . . Rating . . . . A

Main switch or circuit–breaker (460–01–02): Type BS . . . . Rating . . . . A No of poles . . . . .

(if an r.c.d., rated residual operating current I . . . . mA.)

Method of protection against indirect contact:

1. Earthed equipotential bonding and automatic disconnection of supply ☐

or

2. Other ☐ (Describe) . . . .

Main equipotential bonding conductors (413–02–01/02, 547–02–01): Size . . . . mm^2

schedule of Test Results: Continuation . . . . pages

Details of departures (if any) from the Wiring Regulations (120–04, 120–05) . . . .

Comments on existing installation, where applicable (743–01–01): . . . .

Sample form 2: Completion and inspection form

FORMS OF COMPLETION AND INSPECTION CERTIFICATE

(as prescribed in the IEE Regulations for Electrical Installations)

DETAILS OF THE INSTALLATION

Client:

Address: (1.) (see Notes overleaf)

DESIGN

I/We being the person(s) responsible (as indicated by my/our signatures below) for the Design of the electrical installation, particulars of which are described on Page 3 of this form CERTIFY that the said work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with the Regulations for Electrical Installations published by the Institution of Electrical Engineers, 16th Edition, amended to (3.) (date . . . .) except for the departures, if any, stated in this Certificate.

The extent of liability of the signatory is limited to the work described above as the subject of this Certificate.

For the DESIGN of the installation:

Name (In block Letters): Position:

for and on behalf of:

Address:

(2.) Signature: (3.) Date

CONSTRUCTION

I / We being the person(s) responsible (as indicated by my/our signatures below) for the Construction of the electrical installation, particulars of which are described on Page 3 of this form CERTIFY that the said work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with the Regulations for Electrical Installations published by the Institution of Electrical Engineers, 16th Edition, amended to (3.) (date . . . .) except for the departures, if any, stated in this Certificate.

The extent of liability of the signatory is limited to the work described above as the subject of this Certificate.

For the CONSTRUCTION of the installation:

Name (In block Letters): Position:

for and on behalf of:

Address:

(2.) Signature: (3.) Date

INSPECTION AND TEST

I / We being the person(s) responsible (as indicated by my / our signatures below) for the Inspection and Test of the electrical installation, particulars of which are described on Page 3 of this form CERTIFY that the said work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with the Regulations for Electrical Installations published by the Institution of Electrical Engineers, 16th Edition, amended to (3.) (date . . . .) except for the departures, if any, stated in this Certificate.

The extent of liability of the signatory is limited to the work described above as the subject of this Certificate.

For the INSPECTION AND TEST of the installation:

Name (In block Letters): Position:

for and on behalf of:

Address:

I RECOMMEND that this installation be further inspected and tested after an interval of not more than . . . . years (5.)

(2.) Signature: (3.) Date

(6) page 1 of . . . . pages

1. This document is intended for the initial certification of a new installation or of an alteration or addition to an existing installation and of an inspection.

2. The signatures appended are those of the persons authorised by the companies executing the work of design, construction and inspection and testing respectively. A signatory authorised to certify more than one category of work shall sign in each of the appropriate places.

3. Dates to be inserted.

4. Where particulars of the installation recorded herein constitute a sufficient schedule for the purpose of Regulation 514–09–01 further drawings / schedules need not be provided. For other installations the additional drawings/schedules listed below apply.

5. Insert here the time interval recommended between periodic inspections. Regard should be paid to relevant National or Local legislation and reference should be made to chapter 13.

6. The page numbers of each sheet should be indicated together with the total number of sheets involved.

(4) Schedule of additional records.

(6) page 2 of . . . . pages

MOTOROLA

Chapter 5

Decommissioning of cabinet

Chapter 5
Decommissioning of cabinet i

Decommissioning Horizon*macro* indoor

Introduction to decommission procedures

This chapter describes how to decommission a Horizon*macro* indoor cabinet. To decommission equipment not supplied by Motorola, for example E1/T1 links, power supplies and antennas, refer to the vendor instructions.

WARNING	Hazardous voltages in excess of 240 V ac may exist inside a Horizon*macro* indoor cabinet. Use extreme caution when working on a Horizon*macro* Indoor cabinet with power applied. Remove all rings, watches and other jewellery. In a stacked cabinet configuration, check that the bottom cabinet is bolted to the floor using the supplied plinth. IF NOT, this presents a danger of toppling that the decommissioning personnel must take into account.

Before cabinet decommission

Read all the earlier chapters of this installation section, before attempting to decommission a Horizon*macro* indoor cabinet.

To decommission using checklist

The following procedure should be recorded by use of the checklist, to check that each action has been completed. Photocopy the checklist as often as required; do not write on the original manual copy.

Initial decommission checks

When starting to decommission a Horizon*macro* indoor cabinet:

- Contact the OMC-R and ensure the cabinet is taken out of service.
- Open the cabinet door and power down the cabinet, as described in **Powering down the cabinet** in this section.
- Ensure that NO power is connected to the enclosure.
- Ensue that sufficient packing cartons are available to pack the decommissioned equipment.
- Ensure any unused items, such as hood pins, have been retrieved from storage elsewhere.

Powering down the cabinet

To power down the cabinet:

1. Press and release all circuit breaker buttons to the **out** (off) position.
2. Switch each PSM to the OUTPUT DISABLE position.
3. Switch off the external power supply to the cabinet.

Disconnection of cabinet cables

Follow this procedure to disconnect a Horizon*macro* indoor cabinet cables for decommissioning:

WARNING	Untidy disconnected cables can create a trip hazard to personnel using the site.

Checking and disconnecting from power source

To disconnect power supply cables:

1. Check the cabinet for signs of damage.
2. Ensure that power is NOT present at the cabinet.
3. Disconnect the ac or dc input power cables, from the power source.
4. Disconnect the ac or dc input power cables, from the cabinet.
5. Stow disconnected cables safely.
6. If the power cable is not to be used again for other equipment, dispose of safely.

Disconnecting all remaining external cables

To disconnect remaining cables:

1. Disconnect all cabling from interface panel.
2. Disconnect all RF cables to antennas or other cabinets.
3. Disconnect fibre optic cables between main cabinet and any extension cabinets.
4. Disconnect the earth cable.
5. Stow disconnected cables safely.
6. If the cables are not to be used again for other equipment, dispose of safely.

Eyebolt positions and safety

There are four eyebolt positions to enable lifting of a second cabinet from the top of the first cabinet stacking bracket. Eyebolts are available from Motorola for this purpose (part number 0386436N01 – Eyebolt, M8).

WARNING	The cabinet can weigh as much as 130 kg with stacking bracket and CCB. Handle cabinets with extreme caution, and in accordance with any national or regional health and safety regulations. Horizon*macro* cabinets are heavy and should not be installed without the use of lifting equipment unless sufficient personnel are available to ensure that Health and Safety regulations are not breached. Eyebolts used to lift the cabinet must be of the collared type, manufactured to CE conformity, and must have sufficient safe working load to lift the cabinet, in accordance with national or regional health and safety regulations. Motorola recommends the use of slings in conjunction with hydraulic lifting apparatus for moving and positioning Horizon*macro* cabinets. The four screw locations used for hood pins must **NOT** be used for eyebolts. In addition to these points, refer to and comply with any local regulations that govern the use of lifting equipment.

For the subsequent use of eyebolts, there may be local regulations that govern the use of lifting equipment and stipulate a test and/or examination regime. If the eyebolts are to be used, ensure that all such regulations are met.

Eyebolts can be fitted into the four designated cabinet top panel locations, shown in Figure 5-1, after removal of the screws. These locations are identified with an eyebolt symbol and the word **LIFT**. The eyebolt locations are also used for stacking bracket attachment.

Removing upper cabinet in stacked configuration

WARNING	Check that the bottom cabinet is bolted to the floor using the supplied plinth. IF NOT, this presents a danger of toppling that the decommissioning personnel must take into account.

To remove the upper cabinet in a stacked configuration:

1. If CCBs are fitted to upper cabinet, remove as described in **Removing CCBs** in this section.
2. If stacking bracket is fitted to upper cabinet, remove as described in **Removing a stacking bracket** in this section.

WARNING	The cabinet can weigh up to 130 kg if fully equipped. Handle each cabinet with extreme caution and in accordance with local health and safety regulations. Eyebolts are to be used with lifting equipment, and these must be located in the correct position as shown in Figure 5-1. The four screw locations used for hood pins must **NOT** be used for eyebolts. Before attempting to insert the eyebolts, visually check each one for damage. If any damage is apparent, DO NOT USE. The eyebolts must not be over tightened; hand tight is sufficient. **Do not tighten eyebolts with a t-bar or spanner.** Screw the eyebolt fully into the lifting point so that no thread is left exposed.

3. Fit eyebolts to the locations, identified with an eyebolt symbol and the word **LIFT**. Attach eyebolts to suitable lifting equipment.
4. Remove the four bolts holding upper cabinet plinth to stacking bracket.
5. Lift upper cabinet, complete with plinth, off stacking bracket, and lower to floor.
6. Remove the two M10 bolts securing plinth to cabinet, and slide apart.
7. Pack upper cabinet and plinth in separate containers, for storage, transport or safe disposal.

View of eyebolt positions

Figure 5-1 shows the positions to which eyebolts can be fitted.

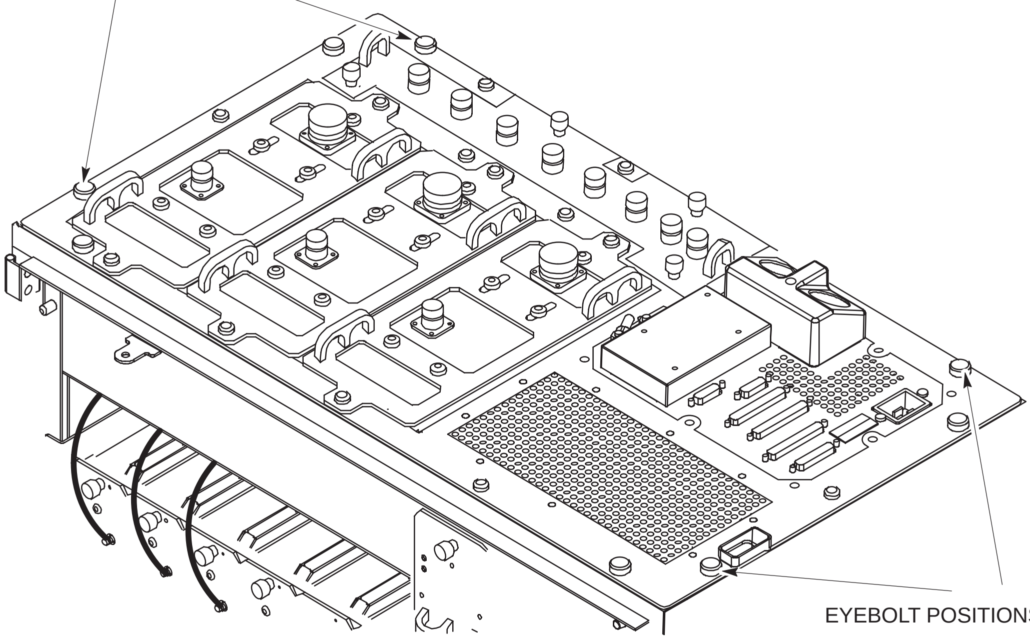


Figure 5-1 Eye bolt positions

Removing CCBs

The removal off CCBs is accomplished in two stages:

- Removing the CCB basket from the stacking bracket.
- Separating CCBs from CCB basket.

Removing CCB basket from stacking bracket

To remove the CCB basket:

1. Remove the stacking bracket front cover by applying gentle pressure to the outer edges, while easing the cover up and pulling it away from the bracket.

Figure 5-2 in **Removing a stacking bracket** shows how to remove the stacking bracket front cover.

2. Disconnect the power cable to each CCB from the single connector (marked CCB) on the interface panel.
3. Loosen the three captive screws attaching CCB basket bar to basket and the two captive screws securing CCB basket bar to the sides of the stacking bracket. Remove the bar
4. Disconnect the six N-type to N-type RF cables from the CCB inputs and the feedthrough plates.
5. Slide basket part way out of the stacking bracket, and disconnect antennas to CCBs.
6. Remove the CCB basket, complete with CCBs, from the stacking bracket.

Separating CCBs from CCB basket

To separate the CCBs from the CCB basket:

1. Place the CCB basket, complete with CCBs, onto a flat surface.
2. Disconnect and remove the phasing lead between CCB control boards.
3. Remove the four M4 screws securing each control board cover, and remove the CCB control boards.
4. Remove the six screws securing each CCB to the basket, (four M6 screws on the front and two M8 screws at the back).
5. Remove the CCBs from the basket
6. Place the CCBs, control boards and associated cables in box for storage, transport or safe disposal and retain the CCB basket to be packaged with stacking bracket.

Removing a stacking bracket

To remove a stacking bracket:

1. Remove the stacking bracket front cover by applying gentle pressure to the outer edges, while easing the cover up and pulling it away from the bracket.

   Figure 5-2 shows how to remove the stacking bracket front cover.

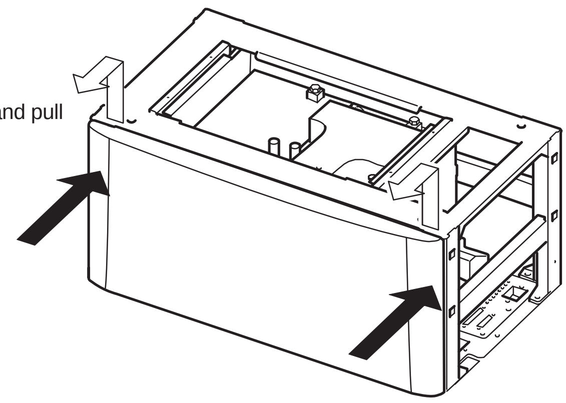


Figure 5-2 Removing the stacking bracket front cover

2. Loosen and remove the eight M8 screws holding the stacking bracket to the cabinet top, and retain.

WARNING	The stacking bracket can weigh as much as 15 kg (more if CCB is contained in CCB basket). Observe the correct lifting precautions when handling the stacking bracket.

3. Lift the stacking bracket off the cabinet.
4. Fit eight previously removed M8 screws to correct cabinet screw points (see Figure 2-5). Tighten to correct torque (see *Installation & Configuration: GSM-205-423* **Site requirements and considerations**).
5. Place the stacking bracket, with CCB basket (if previously removed), in a box for storage, transport or safe disposal.

If the upper cabinet only is being decommissioned and an optional hood is required after stacking bracket removal refer to *Installation & Configuration: GSM-205-423* **Fitting the optional hood**.

Removing floor mounted cabinet

WARNING	The cabinet can weigh up to 130 kg if fully equipped. Handle each cabinet with extreme caution, and in accordance with local health and safety regulations. Horizon*macro* cabinets are heavy and should not be installed without the use of lifting equipment unless sufficient personnel are available to ensure that Health and Safety regulations are not breached.

To remove a floor mounted cabinet for decommissioning:

1. Unscrew the two front bolts holding the cabinet to the plinth.
2. Slide the cabinet out of the plinth.
3. Unscrew the plinth anchor bolts and lift the plinth from the floor.
4. Carefully pack all bolts, washers and other removed items.
5. Pack the cabinet and plinth in separate containers, for storage, transport or safe disposal.

Returning equipment to Motorola

If sending equipment back to Motorola, seal the shipping containers and return, as advised, by the Motorola in-country project manager.

Horizon*macro* indoor decommission checklist

Copy this sheet and fill in the checklist in Table 5-1.

NAME____DA TE__________

SIGNATURE ___________________________________

SITE NAME ___________________________________

EQUIPMENT TYPE ______________________________

NATIONAL ID ______________________________

Table 5-1 Checklist of completed decommissioning steps

ACTION	Yes	No	N/A
Horizon*macro* Indoor cabinet taken out of service by the OMC-R			
Packing material (including polythene bag) on site			
Is cabinet damaged? If yes, detail in comments box			
Hood (if fitted) removed and packed			
Power cable disconnected			
Interface panel cables disconnected			
RF cables disconnected			
Extension cabinet fibre optic cables disconnected			
Earth cable disconnected			
CCBs (if fitted) removed and packed			
Stacking bracket (if fitted) removed and packed			
Cabinet removed from plinth and packed			
Plinth removed from floor and packed			
All loose cables stowed and secured			

COMMENTS

CHAPTER 1
ROUTINE MAINTENANCE

CHAPTER 2
FRU REPLACEMENT
PROCEDURES

Category 523

Maintenance Information (Maint.)

Chapter 1

Routine maintenance

Routine maintenance overview

In this chapter

This chapter contains the procedures for the routine maintenance of a Horizon*macro* Indoor base transceiver station (BTS).

NOTE	Since a Horizon*macro* BTS operates as part of a network, the procedures in this chapter must be performed in conjunction with the relevant network procedures in the associated OMC-R manuals. Before attempting any work on the cabinet, contact should be made with the OMC-R to advise on proposed activity.

Safety

WARNING	Potentially lethal voltages and high energy sources are present in the cabinet when the external ac mains isolator switch is set to the **on** position and/or batteries are connected. Remove rings, watches and jewellery before starting these procedures, and exercise extreme caution when working on the equipment. Maintenance procedures on this equipment must only be carried out by suitably qualified personnel.

Safety features are built into the equipment to protect against the potentially lethal hazards that exist. All statements regarding safety within these routine maintenance procedures must be adhered to when working on the equipment.

Reporting faulty devices

During routine maintenance and FRU replacement procedures, it may be possible to identify signs of damage that might indicate a problem that could repeat, cause additional damage, or be a symptom of a failure elsewhere. Analysis of the problem may identify the fault and make corrective action possible.

Whenever a safety issue arises:

- Inform the OMC-R that an equipment safety problem has been identified.
- Make the equipment concerned safe, for example, by removing power.
- Make no further attempt to tamper with the equipment..
- Report the problem directly to GSM Customer Network Resolution Centre +44 (0)1793 565444 (telephone) and follow up with a written report by fax +44 (0)1793 430987 (fax).
- Collect evidence from the equipment under the guidance of the Customer Network Resolution Centre.
- Seek local office advice.

Routine maintenance intervals

Routine maintenance for Horizon*macro* indoor installations is recommended at the intervals shown in Table 1-1:

Table 1-1 Routine maintenance schedule

6 months	12 months	24 months
Ensure that cabinet air inlets, exhaust grilles and filter (if fitted) are not blocked.	Annual check of the installation.	Inspect general mechanical condition of the cabinet.
	Check normal operation, including fans. Also cable integrity and state of all connections.	Inspect locks, handles, and hinges of door. Lubricate if required.

These procedures are described in subsequent sections of this chapter, one to cover 6 monthly, one 12 monthly, and one 24 monthly.

Cleaning agents

The following is a list of cleaning and lubricant materials required for routine maintenance:

- Dustpan
- Soft brush
- Vacuum cleaner.
- Mild detergent
- De-ionized water.
- Soft cloth.
- Lubricant (WD40 or equivalent).
- Light grease (TBI or equivalent).

Tools

The only tools required are torque spanners, torque wrenches, and torxdrivers, as listed in *Installation and Configuration: GSM-205-423* **Horizon*macro* indoor tool kit**.

Assumptions – door, hood, and stacking bracket

Any requirement to open a door, or remove any hood (if fitted), is assumed in all procedures. Shutting the door, or replacing the optional hood is also assumed at the end of any procedure. SURF module and Tx block replacement may be carried out with the stacking bracket in place, but the CCB basket must be removed (if fitted), see *Maintenance Information: GSM-205-523* **Replacing a CCB** .

Door operation

The door lock is a trigger latch. To operate the door:

1. Insert the correct key into the lock and turn.
2. Press middle square panel by the lock to release the lock.
3. Open door to 95° locking position.

CAUTION	Avoid damaging honeycomb door vent.

NOTE	If the equipment is active, a door open alarm will be signalled to the OMC-R.

4. To open door to 130°, lift up the middle of the slide arm.
5. To close, lift up the middle of the slide arm, close the door firmly, and lock.

Hood removal and refitting

The optional hood is held in place by four pins. Remove by lifting the hood rear edge until free of the pins, then lift off.

To fit the optional hood, align the hood to the back pins, lower hood onto the pins, and press down firmly.

Stacking bracket removal

The stacking bracket is held by eight M8 screws (including four locations which can be alternatively used for pins by hood option). To remove or replace a stacking bracket see *Maintenance Information: GSM-205-523* **Replacing a stacking bracket**.

Stacking bracket front cover removal and fit

The stacking bracket front cover is attached to the stacking bracket by four locating clips.

To remove a stacking bracket refer to Figure 1-1 and then remove the stacking bracket front cover by applying gentle pressure to the outer edges, while easing the cover up and pulling it away from the bracket.

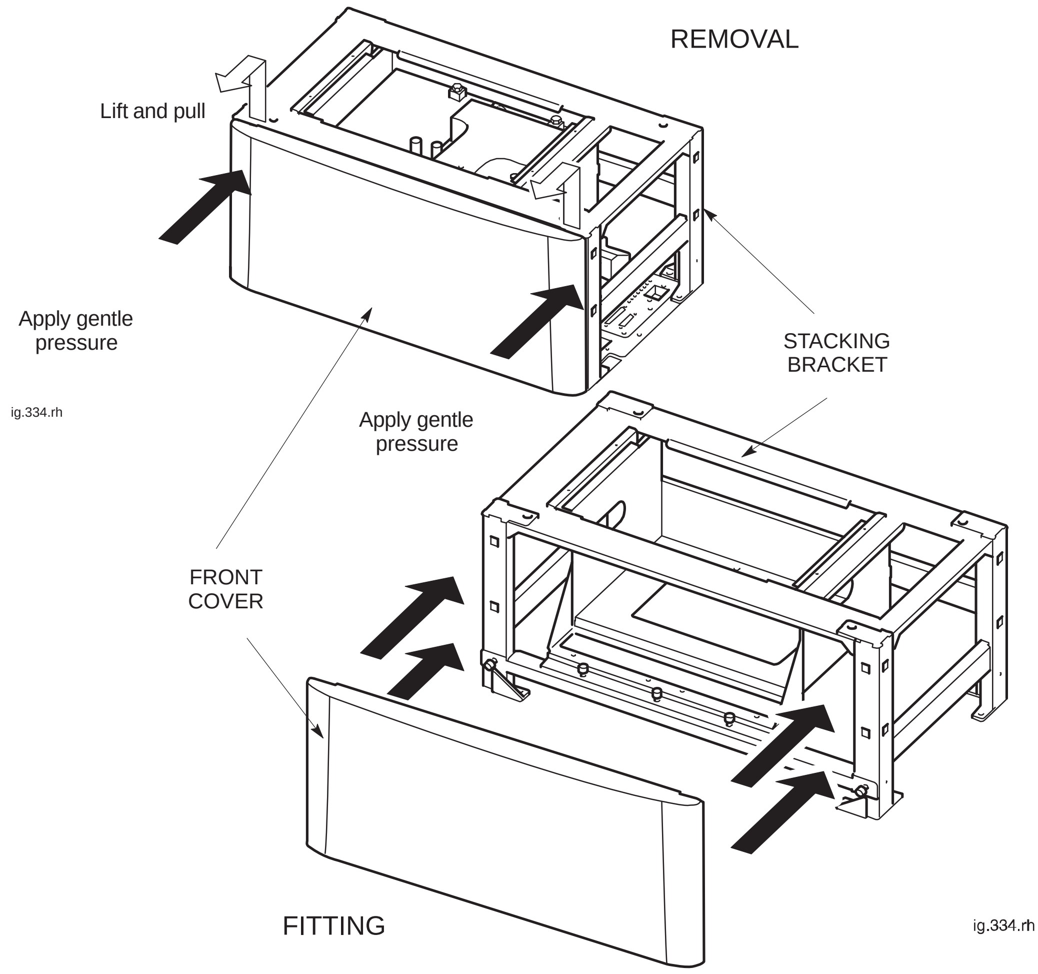


Figure 1-1 Removing and fitting the stacking bracket front cover

To fit the front cover:

1. Align the four locating clips on the front cover with the four square holes in the front of the stacking bracket. Ensure that the cut out slot on each clip is facing downward.
2. Press the cover against the stacking bracket, so that the cut out slot on each locating clip engages with the bottom edge of each square hole. It may be necessary to gently push in and down to ensure the cut out slots are fully engaged and the cover securely in place.

6-monthly maintenance procedures

Type of procedures

The 6-monthly maintenance procedures involve the following:

- Cleaning air inlets and exhaust grilles.
- Examining and, if necessary, replacing the optional air filter.

WARNING	Potentially lethal voltages and high energy sources are present in the cabinet when the external ac mains isolator switch is set to the **on** position and/or batteries are connected. Remove rings, watches and jewellery before starting these procedures, and exercise extreme caution when working on the equipment.

Cleaning inlets and exhaust grilles

CAUTION	If the cabinet is operational, this maintenance procedure should be completed without delay, in order to minimize duration of air cooling disruption.

Inlets are along the back, sides and front at the base of the cabinet. Air is expelled through the door vent and through the top panel beneath hood or stacking bracket.

The following procedure should be followed to clean inlets and exhaust grilles:

- Use vacuum cleaner or brush to ensure bottom inlets are clear of debris.
- Open door and clean aluminium door vent, taking care to avoid damage.

Replacing the air filter

Air filters are an option and not essential in a clean environment. The single filter is mounted under all the fan units. If clogged, fan airflow may be reduced, straining fan motors and increasing noise.

- If a filter is fitted, remove two front M6 screws to allow filter holding plate to drop down. Remove filter, examine and, if dirty, replace with a new filter.
- Replace filter (original or new) then lift up holding plate and secure with the two M6 screws. Tighten to correct torque (see *Technical Description: GSM-205-323* **Overview and specifications**).
- Close and secure the door.

12-monthly maintenance procedures

Summary of 12-monthly procedures

The 12-monthly maintenance procedures involve the following:

- 6-monthly procedures.
- Checking and cleaning fans.
- Checking normal operation.
- Annual check of the installation.

WARNING	Potentially lethal voltages and high energy sources are present in the cabinet when the ac mains isolator switch is set to the **on** position and/or batteries are connected. Remove rings, watches and jewellery before starting these procedures, and exercise extreme caution when working on the equipment.

Checking and cleaning fans

CAUTION	If the cabinet is operational, this maintenance procedure should be completed without delay, in order to minimize duration of air cooling disruption.

There are three cabinet fan modules, one 4-fan unit and two identical 2-fan units. Table 1-2 shows the three fan positions.

Table 1-2 Fan positions

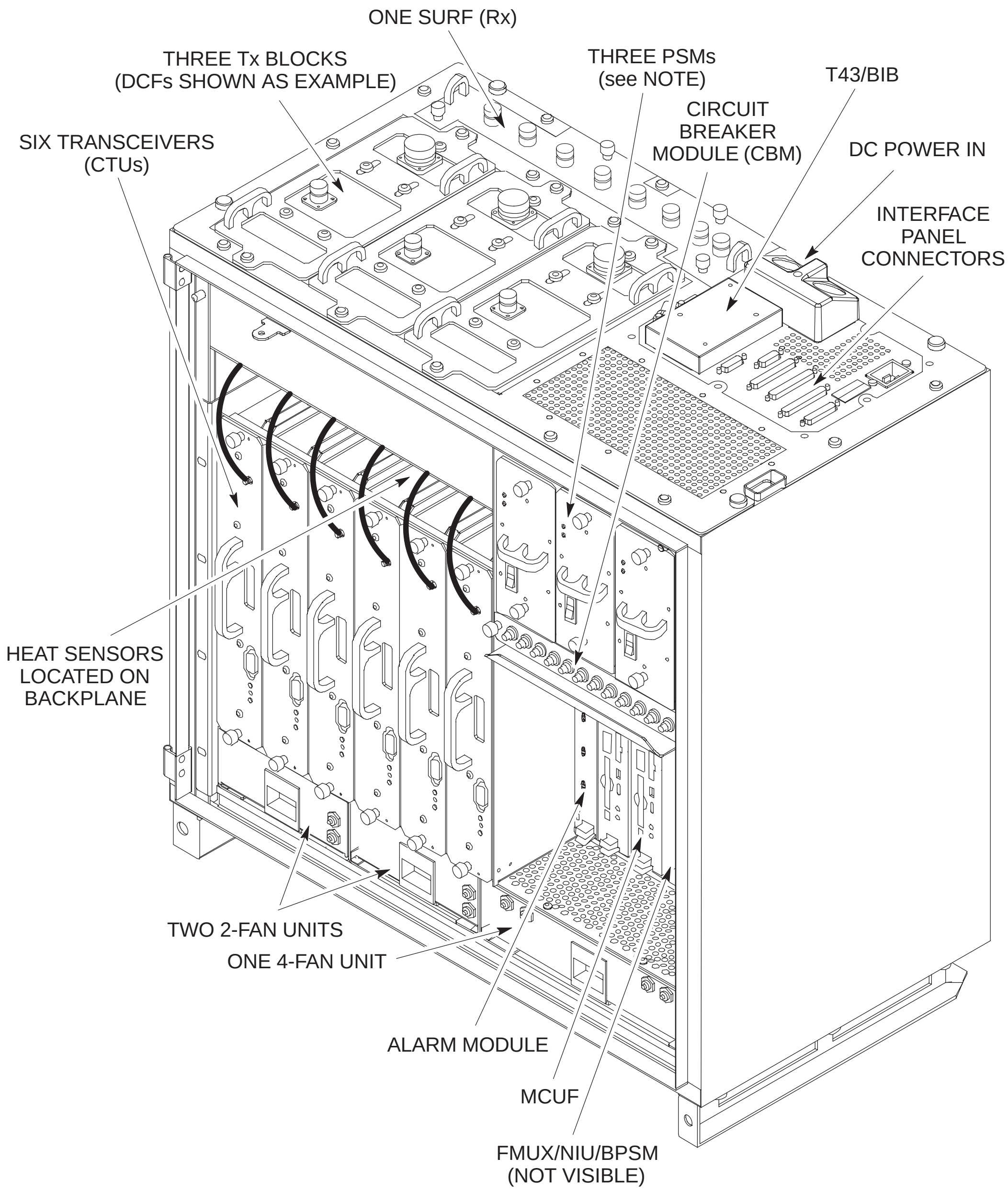
Fan reference	Type of module	Cabinet position
0	4-fan unit	Right side, beneath digital cage.
1	2-fan unit	Middle, beneath CTUs.
2	2-fan unit	Left side, beneath CTUs.

The fans can be checked and cleaned by the following procedure:

- Remove the fan module by lifting the central slide latch and pulling out.
- Use a brush and vacuum cleaner to remove any dust and dirt on the module.
- Refit fan and check operation. Any fan not operating should be started by using the appropriate RESET button.
- Observe the fans through the grilles to ensure correct operation. Listen for excessive noise. If there is excessive noise, identify fan and replace fan module (see *Maintenance Information: GSM-205-523* **Replacing a fan module**.

Cabinet modules in operational positions

Figure 1-2 shows the cabinet modules, (door and optional hood omitted for clarity).



NOTE	An optional hold-up battery module may be installed instead of a redundant PSM.

Figure 1-2 Cabinet modules with door and hood removed

Checking normal operation

Check normal operation by visual inspection in the following procedure:

1. Inspect the inside of the cabinet and note any signs of physical damage, overheating, loose connections, or badly fitting components. Take appropriate action to correct the damage, and inform the OMC-R.
2. Ensure that the LEDs on modules shown in Table 1-3 are lit, this indicates correct functioning of the cabinet. If any red LEDs are lit, other than the door alarm (alarm 3 on the alarm module), inform the OMC-R.

Table 1-3 Normal LED indication of cabinet modules

Equipment with LEDs	Colour of LEDs lit
CTUs in locations 0 to 5	Tx status (ORANGE) or Operational status (GREEN).
PSMs in locations 0 to 2	Top LED (GREEN).
Digital modules (NIU, MCUF, FMUX, BPSM)	GREEN.
Alarm module	6, 7, 8 GREEN (fans) 3 RED (as door is open)

Annual check of the installation

NOTE	Refer to *Installation and Configuration: (GSM-205-423)* to carry out the following procedures.

It is recommended the following be performed annually:

- Power down cabinet.
- Earth continuity check.
- Power system insulation check.
- Check of electricity company connection.
- Pre-power up check of supply and earth connection security and condition.
- Power up of cabinet.

Log the maintenance activity.

After procedures have been completed, restore the cabinet to operational state and notify the OMC-R of base station availability.

24-monthly maintenance procedures

Summary of 24-monthly procedures

WARNING	Potentially lethal voltages and high energy sources are present in the cabinet when the ac mains isolator switch is set to the **on** position and/or batteries are connected. Remove rings, watches and jewellery before starting these procedures, and exercise extreme caution when working on the equipment.

The 24-monthly maintenance procedures involve the following:

- 6-monthly procedures.
- 12-monthly procedures.
- Mechanical inspection of cabinet, including inspection and lubrication of locks and hinges.

Mechanical inspection of cabinet, locks and hinges

The following must be performed every 24 months.

Inspecting the cabinet exterior

NOTE	Use a step ladder or platform for access to a stacked cabinet unit, where necessary.

To inspect the cabinet exterior:

- Check exterior panels and hood/stacking bracket for dents and structural damage.
- Check cabinet top connections for signs of overheating and security of attachment.

Inspecting the door

To inspect the door:

- Check cabinet door for distortion, security and correct operation.
- Check hinges for damage, security and correct operation. Carefully lubricate the hinges. Ensure that all door seals are wiped clean of the lubricant.
- Check earth connection for damage and security.
- Check door lock mechanism and inspect for ease of operation. Lubricate the mechanism with light grease. Ensure that lubricated surfaces are grit-free.

Inspecting the cabinet interior

To inspect the cabinet interior:

- Check all rack equipment for security of attachment, especially PSM, CBM and CTU attachment screws using a torxdriver. Tighten to correct torque (see *Technical Description: GSM-205-323* **Overview and specifications**).
- Carry out a visual check of all wiring for signs of overheating and security of attachment.

WARNING	Do not overstress the earth connections as this may damage the connector and reduce the protective function.

- Check the earth connections for corrosion and tightness using a torque spanner. Tighten to correct torque (see *Technical Description: GSM-205-323* **Overview and specifications**).

Chapter 2

FRU replacement procedures

Chapter 2

Overview of replacement procedures

Field Replaceable Units (FRUs)

WARNING	Potentially lethal voltages and high energy sources are present in the cabinet when the external isolator switch is set to the **on** position and/or batteries are connected. Remove rings, watches and jewellery before starting these procedures, and exercise extreme caution when working on the equipment. Maintenance procedures on this equipment must only be carried out by suitably qualified personnel.

This chapter provides information on replacement of field replaceable units (FRUs). Only components classed as FRUs are detailed in this chapter.

Any requirement to open or close a door, or remove and replace the optional hood, is assumed in procedures. Shutting the door, or replacing the hood is assumed at the end of any procedure. SURF module and Tx block replacement may be carried out with the stacking bracket in place, but the CCB basket (if fitted) must be removed, (see **Replacing a CCB**). For door opening, or hood or stacking bracket removal, see **Routine maintenance overview**.

Where customers wish to perform a minor repair on an FRU, in order to save the cost of full replacement, they should consult Motorola for more detailed procedures or replacement components (see **Additional replacement parts**).

FRU list

The following is a list of FRUs used in this equipment:

- Door.
- Heat sensor modules.
- Hood.
- Stacking bracket.
- Fan units.
- Circuit breaker module (CBM).
- Power supply module (PSM).
- Hold-up battery module.
- CTU.
- Tx blocks, including feedthrough plate.
- SURF module.
- CCBs (installed in stacking bracket basket as CCB FRU).
- Digital modules (MCUFs, NIUs, FMUXs, alarm board and BPSMs).

Torque values

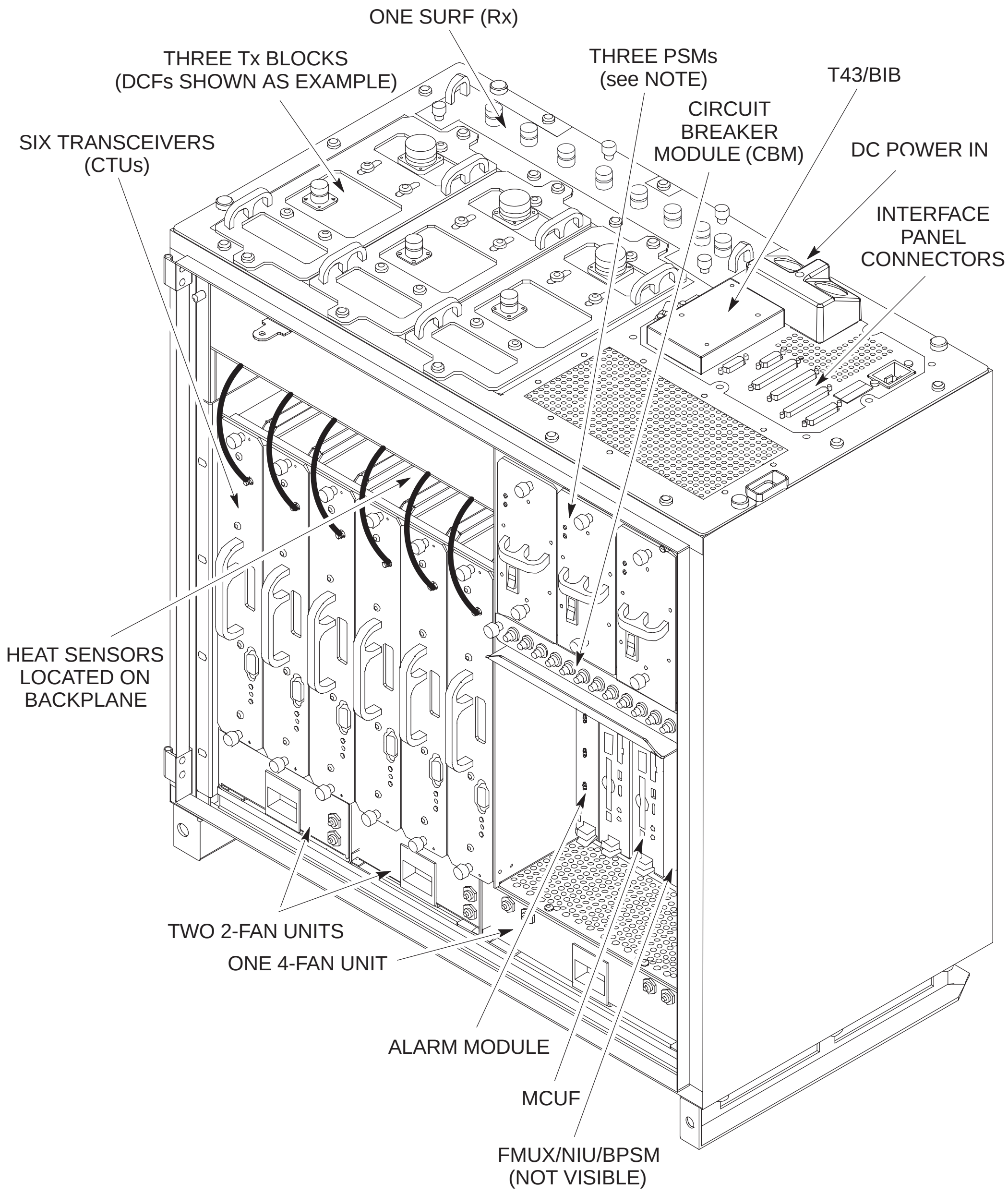
Table 2-1 details torque values used during repair procedures.

Table 2-1 Torque values for all cabinet screws/bolts and RF connectors

Size of screw/bolt	**M4**	**M6**	**M8**	**M10**	**SMA**	**N-type**	**7/16**
Torque value	2.2 Nm	3.4 Nm	5 Nm	10 Nm	1 Nm	3.4 Nm	25 Nm

FRU locations within cabinet

Figure 2-1 shows a cabinet with FRUs identified. Door, optional hood, stacking bracket and CCBs are shown in the relevant FRU sections.



NOTE	An optional hold-up battery module may be installed instead of a redundant PSM.

Figure 2-1 Cabinet, without door or hood, showing FRU components

Additional replacement parts

Policy on non-FRU parts

Non-FRU parts are:

- Items unlikely to fail, but replacement of which is essential if failure occurs.

or

- Subsections of FRUs, where local conditions may make it more economical to repair the FRU.

CAUTION	Only qualified personnel should attempt non-FRU replacement, in order to minimize risk of equipment damage. For example, the CBIA main cage requires care in removal and installation, and Individual fans require care in ensuring correct direction of airflow.

List of non-FRU parts

Non-FRU parts include the following:

- Door lock.
- Individual fans within a fan module.
- Any part of the CBIA: main cage, harness, door sensor, interface panel, or backplane.

Procedure for replacing non-FRU parts

Customers requiring non-FRU replacement should:

1. Contact the local Motorola office for availability.
2. Seek Motorola advice for fitting non-FRU parts.

CBIA attachment screws

The CBIA is attached to the cabinet by screws which should not be loosened:

- Seven M4 screws to SURF harness (two guide pins lock cage into position).
- Four M6 (left side) and five M6 (right side) screws at cabinet front.
- Eight M6 T30 screws for interface panel attachment to top panel.

Replacing a door

Introduction to door replacement

The door is essential to the correct operation of the ventilation system. The door also provides protection to equipment inside. For these reasons, the replacement procedure should be completed in one session, and the cabinet then secured.

Views of door

Figure 2-2 shows an inside and outside view of the door.

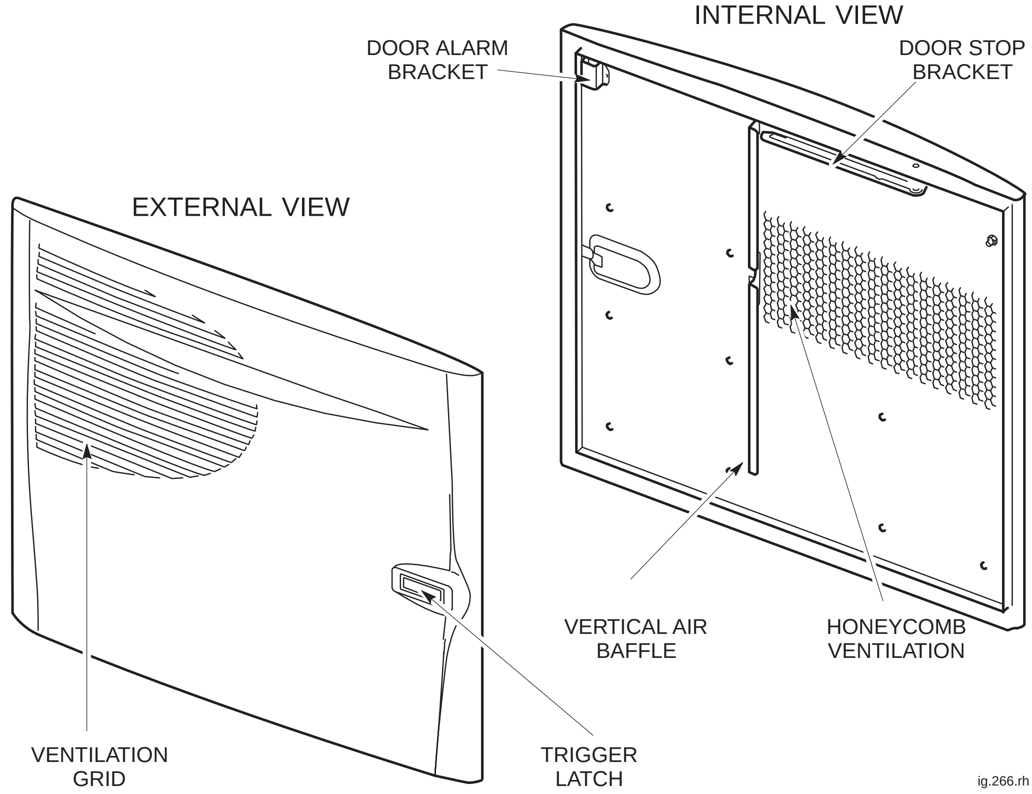


Figure 2-2 Inside and outside views of door

Replacement of door

Removing a faulty door

To remove a door, open and:

1. At the cabinet, unscrew M6 nut, holding the door earth cable to the cabinet. Retain nut for re-use.
2. Unscrew M6 holding screw on slide arm several turns, then unhook slide arm from the cabinet attachment point by lifting up.
3. Move door to about 90° and lift door off hinges.

Fitting a replacement door

CAUTION	Avoid damaging the honeycomb door vent.

To install a replacement door:

1. Hold door at about 90° and lift onto door hinges.
2. Attach the door earth cable to the cabinet by using the M6 nut. Tighten to the correct torque (see **Overview of replacement procedures**).
3. Place the slide arm onto the cabinet attachment holding point and apply several turns of the M6 holding screw.

Replacing a cabinet heat sensor

Overview of heat sensors

Heat sensors plug into the backplane from the front above the CTUs. Each one can be separately detached, and a replacement inserted. CTUs are removed to gain access for this procedure.

There is one 70 °C sensor and two 85 °C sensors. Each sensor is marked with the appropriate temperature.

Procedure for heat sensor replacement

To replace heat sensors:

WARNING	Before disconnecting RF cables, ensure that the RF power is **OFF** by turning cabinet PSMs off. If RF power is **ON** when cables are disconnected, severe burns may result.

1. Remove the CTUs (see **Replacing a CTU**).
2. Identify the faulty heat sensor.
3. Remove the faulty heat sensor by pulling.
4. Install the replacement heat sensor by pushing firmly into place.
5. Install the CTUs (see **Replacing a CTU**).

The heat sensors should now be operational.

Replacing a hood

Introduction to hood replacement

This procedure assumes an optional hood is already fitted, with hood pins located in the correct cabinet locations. If the hood is to replace a stacking bracket, refer to the appropriate procedures in this chapter **Replacing a stacking bracket** and *Installation and Configuration: (GSM number)* Chapter 2, **Hood or stacking bracket fit**.

View of hood

Figure 2-3 shows a top view of the hood.

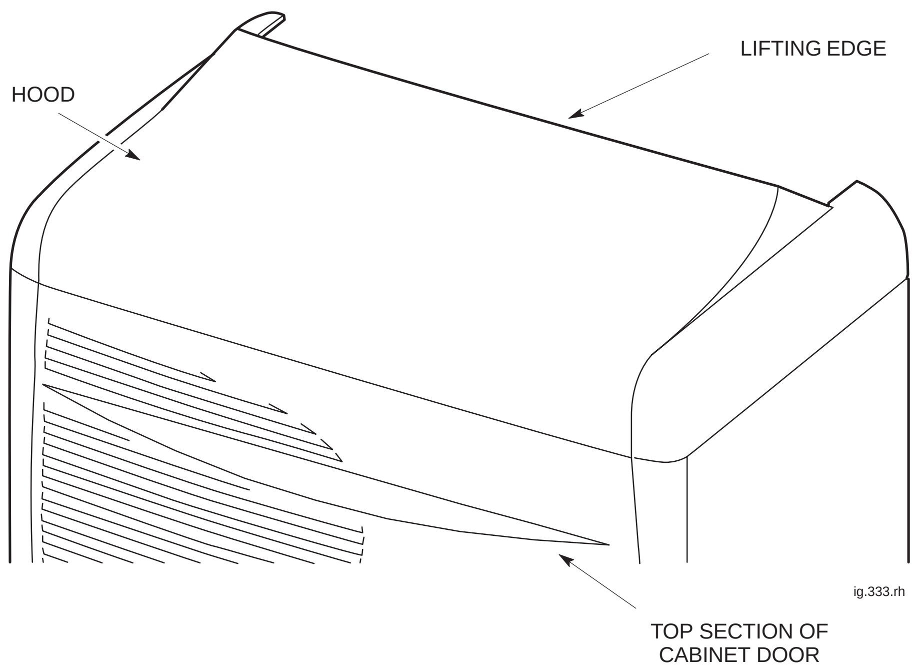


Figure 2-3 Hood view when placed on top of cabinet

Replacing the hood

The hood is held in place by four pins. Remove the faulty hood by lifting the edge, until free of the pins.

To fit the replacement hood, first align the hood to the back pins, then lower the hood onto the pins and press firmly into place.

Replacing a stacking bracket

View of stacking bracket

Figure 2-4 shows a stacking bracket with optional CCB basket.

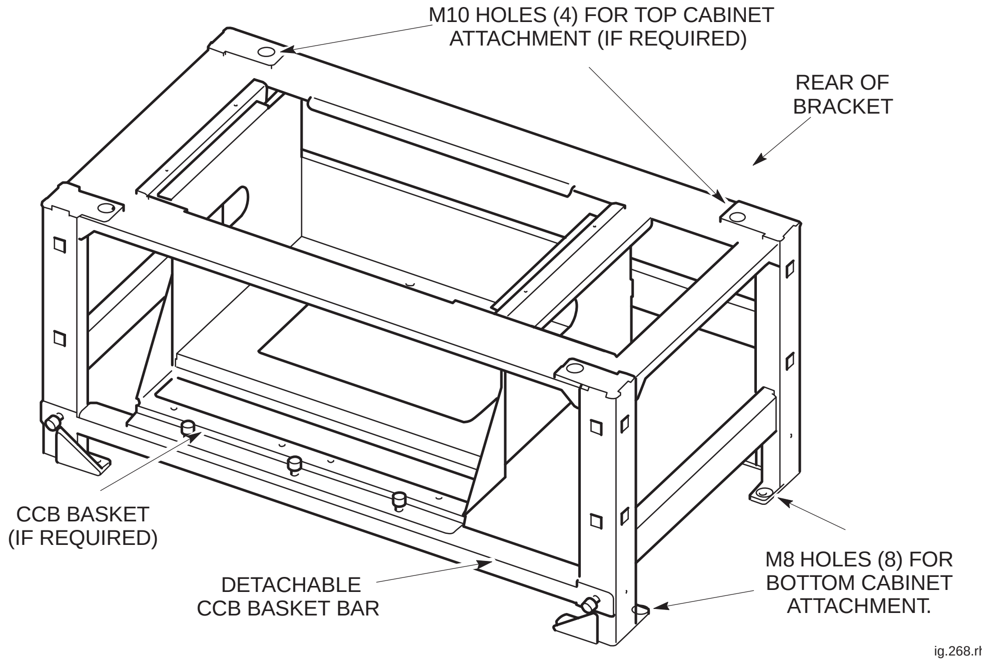


Figure 2-4 Stacking bracket view with optional CCB basket

Procedure to replace a stacking bracket

Replace the stacking bracket as follows:

1. Remove the front cover by pulling away.

WARNING	The cabinet can weigh as much as 115 kg with the hood fitted. Observe correct lifting precautions.

2. If an upper cabinet is fitted on top of stacking bracket, decommission the cabinet as described in *Installation and Configuration: (GSM-205-423)* Chapter 4 **Decommissioning Horizon*macro* indoor**.
3. If a CCB is fitted, remove it (see **Replacing a CCB**).
4. Loosen and remove the eight M8 screws holding the faulty bracket.

WARNING	The stacking bracket can weigh as much as 15 kg (more if CCB is contained in CCB basket). Observe the correct lifting precautions.

5. Lift the faulty stacking bracket off the cabinet.
6. Align the replacement stacking bracket onto the cabinet, and fit the eight M8 screws. Tighten to correct torque (see **Overview of replacement procedures**).
7. Install and commission any upper cabinet removed in step 2 as described in *Installation and Configuration: (GSM-205-423)* Chapter 2 and Chapter 3.
8. Refit the front cover by attaching to side lugs and pushing into position.

Replacing a fan module

Introduction to fan replacement

The fan modules can be replaced while the cabinet is operational, but be aware that airflow is reduced while fans are out of service, and while door is open. This will raise equipment temperature, and could shut down the cabinet by triggering the heat sensors.

View of fan modules

Figure 2-5 shows a view of the two types of fan module fitted in a Horizon*macro* cabinet, with reset buttons indicated.

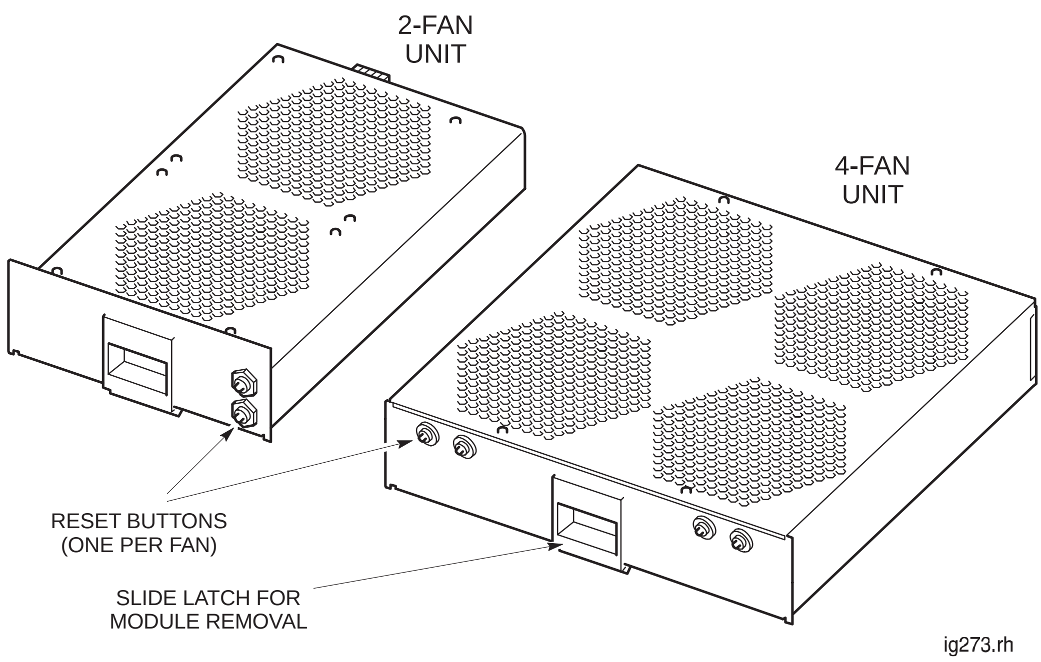


Figure 2-5 View of fan modules

Identifying fan module

There are three cabinet fan modules, one 4-fan unit and two identical 2-fan modules. Table 2-2 shows the three fan positions.

Table 2-2 Fan positions

Fan reference	Type of module	Cabinet position
0	4-fan unit	Right side, underneath digital cage.
1	2-fan unit	Middle, beneath CTUs.
2	2-fan unit	Left side, beneath CTUs.

Replacing fan modules

CAUTION	If the cabinet is operational, this replacement procedure should be completed without delay to minimize the duration of air cooling disruption.

To replace the fan:

1. Lift the central slide latch.
2. Pull out the fan module.
3. Insert the replacement module firmly in place, ensuring the slide latch has engaged.
4. Ensure all fans are operating. Any fan not operating should be started by using the appropriate RESET button.

Replacing a circuit breaker module (CBM)

Preconditions for CBM replacement

The CBM controls power for the whole of the cabinet, apart from the PSMs. Consequently, the replacement of a CBM can only take place after the cabinet has been taken out of service and isolated, in agreement with the OMC-R.

Views of CBM

Figure 2-6 shows views of the CBM with circuit breaker buttons identified.

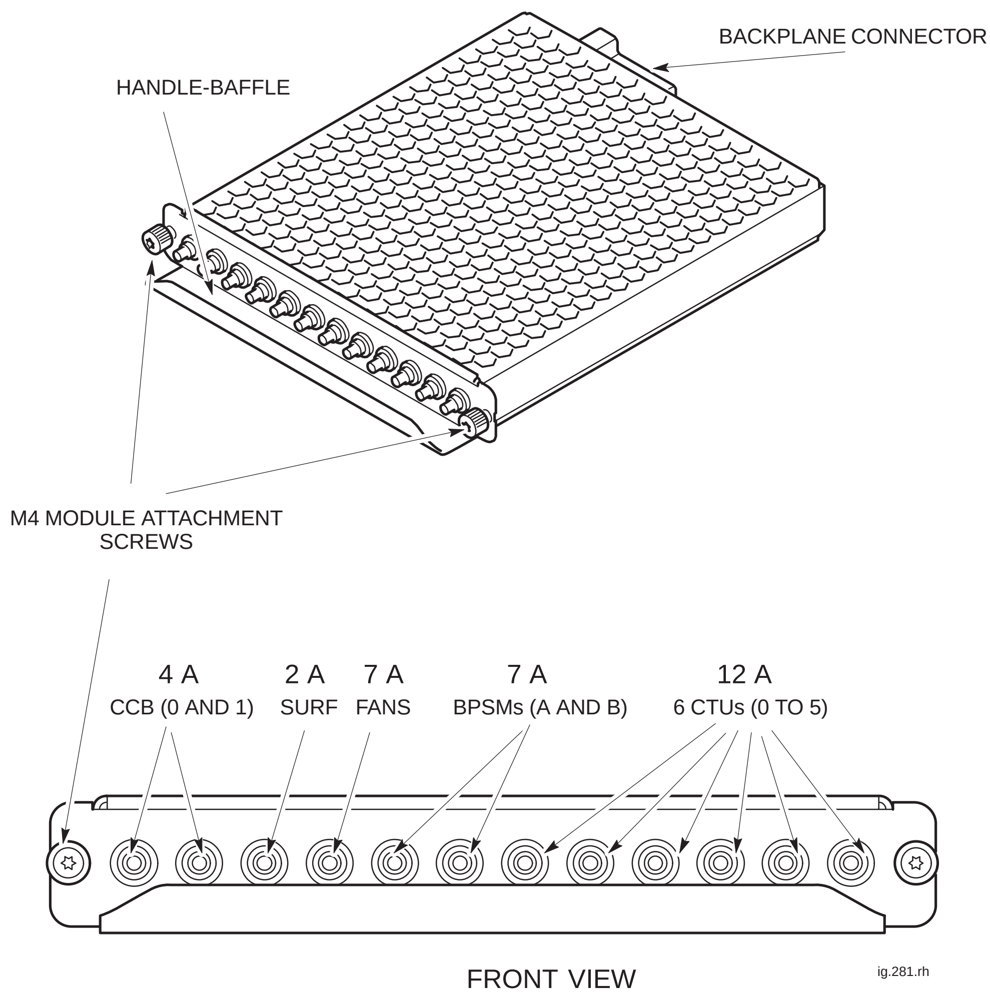


Figure 2-6 Views of CBM with circuit breaker buttons identified

Replacing a CBM

To replace a CBM:

1. Verify that the power source isolator is switched to OFF, and locked (if possible).
2. Set the switch of each PSM to the OUTPUT DISABLE position.
3. Unscrew both CBM module attachment screws (shown in Figure 2-6), using a torxdriver.
4. Pull out module, using handle-baffle.
5. Press and release all push on/push off circuit breaker buttons of the new CBM module into the **out** (off) position.
6. Insert the replacement module and press firmly into place.
7. Tighten both module attachment screws to correct torque (see **Overview of replacement procedures**), using an M4 Torx driver.

To restore power to the cabinet:

1. Switch on the external power supply to the cabinet.
2. Turn each PSM switch to the OUTPUT ENABLE position. Check that each PSM has the ACTIVE (green) light on and the ALARM (red) light off.
3. Press the CBM isolator marked **FANS**. Check that each fan, eight in total, is operating correctly. Any fan not started may be activated by the reset button (marked either **FRONT** or **REAR**) on the appropriate fan unit.
4. Press the CBM circuit breaker button marked **BPSM A** and (if redundant BPSM fitted) **BPSM B**. Check all associated digital module indicators operate correctly.
5. Press the CBM circuit breaker button marked **SURF**, and if CCBs fitted the circuit breaker buttons marked **CCB0** and **CCB1**.
6. Press the appropriate CBM circuit breaker buttons for the CTUs fitted, and check that the LEDs for each CTU indicate correct operation.
7. Close the door to ensure correct ventilation.

This completes the CBM replacement and power up sequence for a cabinet.

Replacing a power supply module (PSM)

Introduction to PSM replacement

There are three slots for PSMs. A single PSM can power a cabinet containing up to three CTUs therefore, a cabinet populated with six CTUs only requires two PSMs to be fully operational. The third slot can be used for an additional power supply to provide redundancy, or for the hold-up battery unit. A replacement PSM can be inserted into a vacant slot without powering down, thereby avoiding any need to take the cabinet out of service.

Preconditions for PSM replacement

Replacement PSM must be of appropriate type for the cabinet (+ 27 V dc, –48/60 V dc, or 100/240 V ac).

CAUTION	Replacement PSM must have the correct input voltage rating for the cabinet.

View of PSM

Figure 2-7 shows a view of the PSM with key features identified.

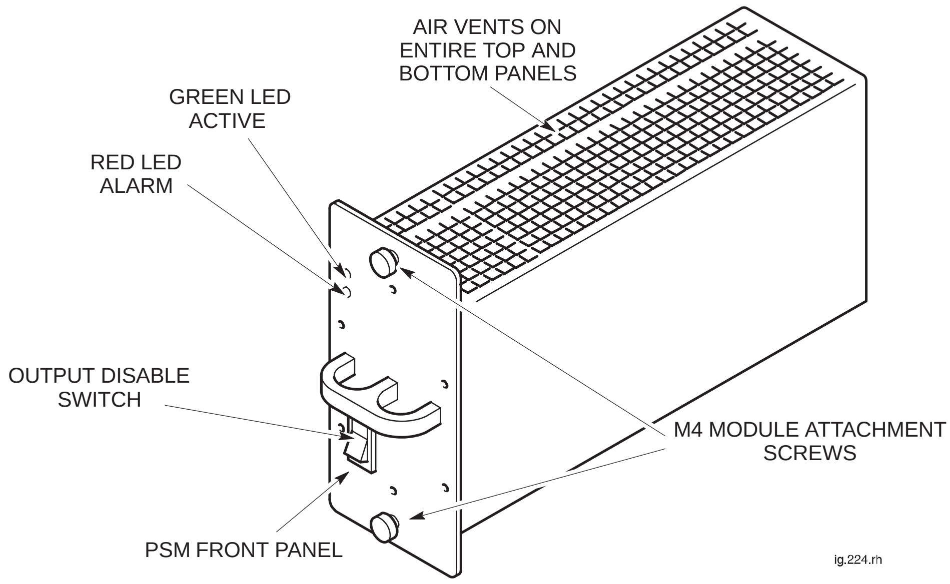


Figure 2-7 View of PSM with key features identified

NOTE	There are several manufacturers of the PSMs. All PSMs of the same type are fully compatible with each other, regardless of manufacturer.

Replacing a non-redundant PSM

The following procedure should be followed if there are one or two PSMs fitted in the cabinet. To replace a non-redundant PSM:

1. Set the switch of the replacement PSM to OUTPUT DISABLE.
2. Remove the blanking assembly of spare slot, if fitted, by unscrewing the attachment screws with a torxdriver.
3. Remove the hold-up battery module, if fitted, as described in **Replacing a hold-up battery module**.
4. Insert the replacement PSM in resulting or spare slot, and tighten both module attachment screws to the correct torque (see **Overview of replacement procedures**), using a torxdriver.
5. Set the replacement PSM switch to OUTPUT ENABLE. Check that the **ACTIVE** LED (green) is lit.
6. Set switch of faulty PSM to OUTPUT DISABLE. The **ACTIVE** LED will extinguish (the **ACTIVE** LED may already be off if a fault has resulted in output failure of that PSM). The **ALARM** LED (red) will light, or if already lit due to alarm state, will stay on.
7. Unscrew the faulty PSM module attachment screws using an M4 torxdriver, and remove the module. The **ALARM** LED will extinguish.
8. If removed in step 3, refit hold-up battery module as described in **Replacing a hold-up battery module**.
9. Fit the cover plate in the vacated PSM position, if required, by tightening the attachment screws to the correct torque with a torxdriver, as stated in step 4.

Replacing a redundant PSM

The following procedure should be followed if there are three PSMs fitted. To replace a redundant PSM:

1. Set the switch of replacement PSM to OUTPUT DISABLE.
2. Set switch of faulty PSM to OUTPUT DISABLE. The **ACTIVE** (green) LED will extinguish (the **ACTIVE** LED may already be off, if a fault has resulted in output failure of that PSM). The **ALARM** LED (red) will light, or if already lit due to alarm state, will stay on.
3. Unscrew the module attachment screws by M4 torxdriver, and remove the module. The **ALARM** LED will extinguish.
4. Insert the replacement PSM, and tighten both module attachment screws to the correct torque (see **Overview of replacement procedures**), using a torxdriver
5. Set switch to OUTPUT ENABLE. Check the **ACTIVE** LED is lit.

Replacing a hold-up battery module

To Replace a hold-up battery module

WARNING	The batteries are capable of supplying high short circuit currents and as such provides a high energy hazard.

To replace a hold-up battery module:

1. Verify that the enable switch of the replacement hold-up battery module is set to **O**.
2. Cut the cable tie that secures the jumper lead to the isolation connection access hatch. Open the access hatch by turning the fastener a quarter turn anticlockwise and lifting.
3. Fit the jumper lead between the battery spade terminals as shown in Figure 2-8. Close the access hatch and turn the fastener a quarter turn clockwise to secure.
4. Set the enable switch of the faulty hold-up battery module to **O** (off). The **ACTIVE** LED (green) will extinguish (the green LED may already be off, if a fault has resulted in output failure). The **ALARM** LED (red) will light, or if already lit due to alarm state, will stay on.

WARNING	The hold-up battery module weighs 5.9 kg. Handle with care.

5. Unscrew the module attachment screws using a torxdriver, and remove the module. The red LED will go off.
6. Insert the replacement hold-up battery module.
7. Ensure the replacement hold-up battery module is firmly in position and tighten both module attachment screws using a torxdriver. Tighten to a torque of 2.2 Nm.
8. Set the hold-up battery module enable switch to **I** (on). Check that the **CHARGE** LED (green) is lit.

NOTE	The **ACTIVE** LED (green) will not light until 1.5 to 2 hours after installation. The **ALARM** LED (red) may also be lit if the initial battery voltage is below 19 V dc (+/–0.25 V).

9. Remove the battery isolation jumper lead from the faulty hold-up battery module and secure it to the outside of the access hatch before transportation.

Figure 2-8 shows the battery hold-up with the battery isolation jumper connection shown in detail.

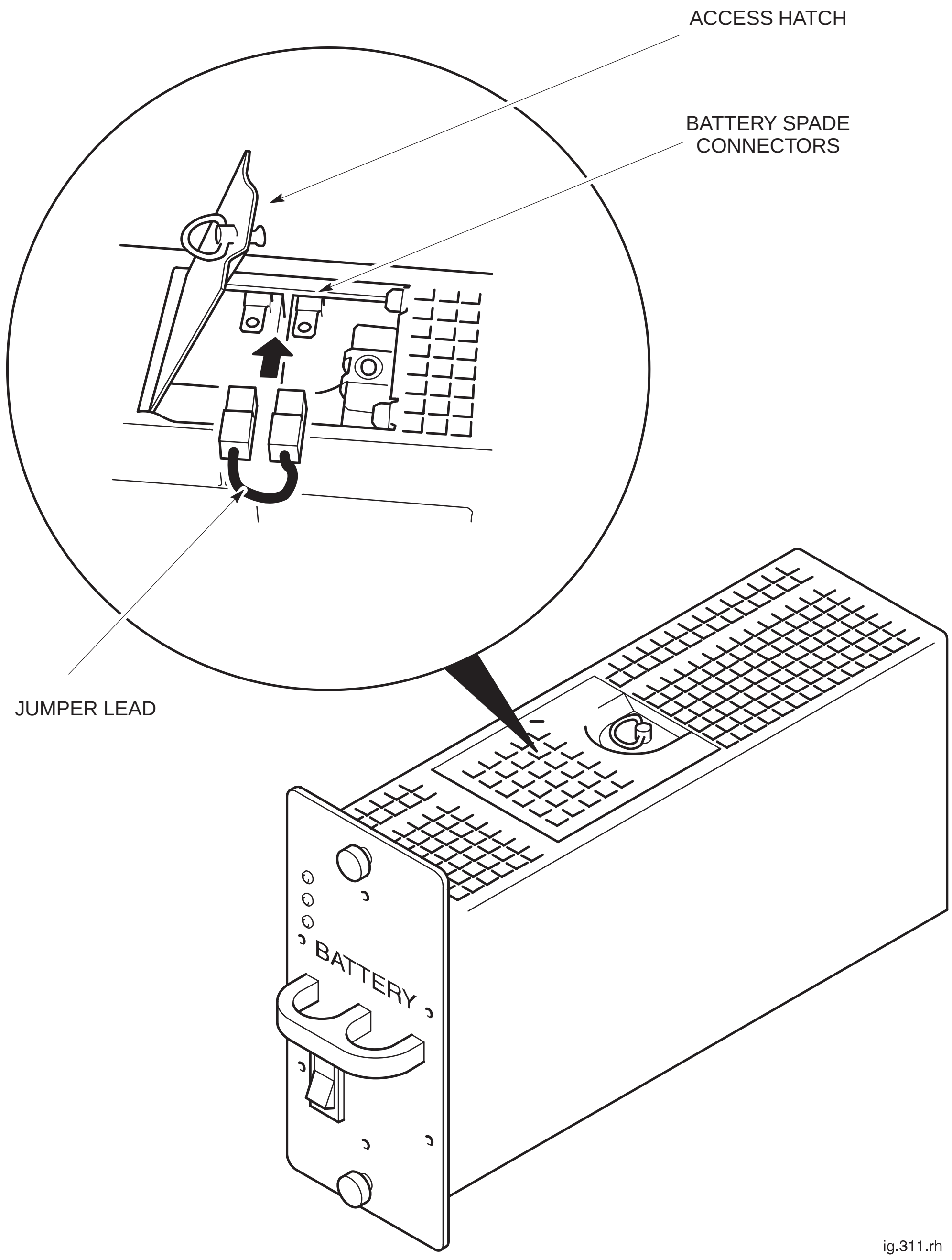


Figure 2-8 Connecting battery isolation jumper lead

Replacing a CTU

Preconditions for CTU replacement

There are up to six CTUs in a cabinet. Replacing a CTU requires removal of RF transmitter power for that CTU; it is therefore advisable to perform this procedure during periods of low traffic. The OMC-R should be notified of imminent repair activity.

NOTE	The CTU replacement procedure is the same for all CTUs, regardless of frequency rating.

View of CTU

Figure 2-9 shows a view of a CTU with key features identified.

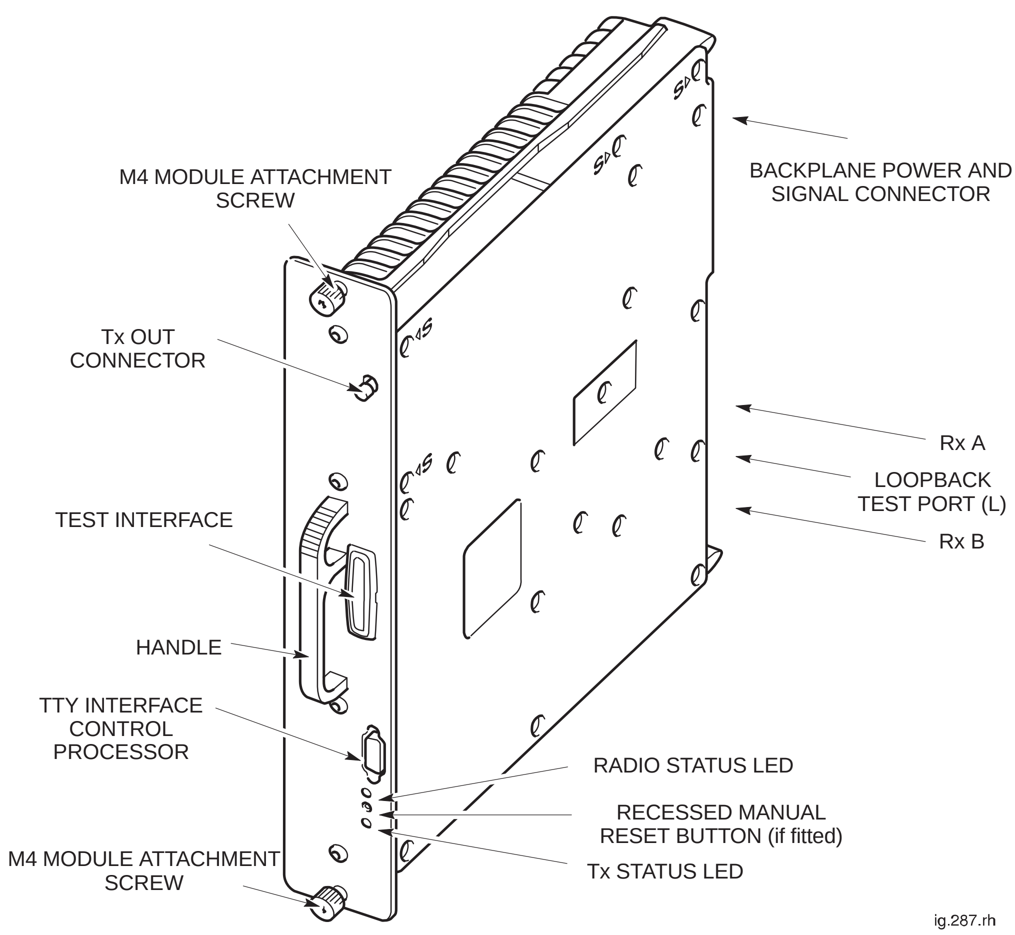


Figure 2-9 CTU view with key features

Replacement procedure for CTU

CAUTION	An earthing wrist strap must be worn when handling CTUs. An ESP earthing connection point is provided above the leftmost PSM.

Removing a faulty CTU

To remove a CTU:

1. Locate the CTU to be replaced. CTUs are sequentially numbered, with CTU 0 on the right, and CTU 5 on the left, as shown in Figure 2-1.
2. Disable the CTU transmit RF power by using the **`shutdown_device`** command at the OMC-R or from a PC connected to the MCUF.

NOTE	Refer to *Technical Description: BSS Command Reference (GSM-100-321)* for information on usage and specific commands.

3. When the CTU has been shutdown, check the Tx STATUS LED (solid yellow) is extinguished.
4. Press and release the appropriate CTU circuit breaker button on the CBM to the out (off) position. Ensure the RADIO STATUS LED is extinguished.

WARNING	Ensure that RF power is OFF, before disconnecting RF cables. Severe burns may result if RF power is ON when cables are disconnected.

5. Unscrew the coaxial cable from the Tx OUT SMA connector at the top of the CTU front panel.
6. Unscrew the two CTU attachment screws using M4 Torx driver.

WARNING	The CTU weighs 5 kg. Handle with care.

CAUTION	Take care to avoid damage of CTU rear connectors when handling outside of the cabinet.

7. Withdraw the CTU using the handle. Support the unit from underneath as it slides out.

Fitting replacement CTU

To fit a replacement CTU:

1. Ensure that the correct CTU push-on/push-off circuit breaker button on the CBM has been pressed to the out (off) position.
2. Ensure that the transmit RF power of the correct CTU has been locked using the `shutdown_device` command at the OMC-R or from a PC connected to the MCUF.
3. Insert replacement CTU module, taking care to locate the module on the guide rails. Press firmly into place.
4. Tighten both module attachment screws to the correct torque (see **Overview of replacement procedures**), using an M4 Torx driver.
5. Attach coax cable to appropriate Tx block or feedthrough plate for the CTU. Tighten to correct torque (see **Overview of replacement procedures**).

NOTE	The Tx cable has a 90° SMA connector at one end, and a straight SMA connector at the other end. The 90° end is designed for connection to the Tx port of a CTU.

6. Screw the coaxial cable onto the Tx OUT SMA connector at the top of the CTU front panel. Tighten to correct torque (see **Overview of replacement procedures**).
7. Press and release the appropriate CTU circuit breaker button on the CBM. The RADIO STATUS LED will flash green for about two minutes, and then remain lit.

CAUTION	If both RADIO STATUS and Tx STATUS LEDs are flashing, the bootcode is downloading into non-volatile memory for software upgrade. Power should not be removed, nor the cabinet reset, until downloading has been completed, as this will corrupt the non-volatile memory. If bootcode is corrupted, contact Motorola Customer Network Resolution Centre requesting the bootcode restoration procedure and the appropriate bootcode file.

8. Enable the CTU transmit RF power by using the `ins_device` command at the OMC-R or from a PC connected to the MCUF. The Tx STATUS LED (yellow) will be lit if the CTU is transmitting.
9. Notify the OMC-R of base station availability and log the maintenance activity.

Replacing a SURF module

Preconditions for SURF replacement

The cabinet only has one SURF module, either a dual band or a single band SURF. Consequently, the replacement of a SURF module can only take place after the cabinet has been taken out of service, in agreement with the OMC-R.

If a stacking bracket is fitted with a CCB basket, the CCB basket has to be removed in order to gain access to the SURF module. To remove CCB basket see **Replacing a CCB**.

CAUTION	An earthing wrist strap must be worn when handling SURF modules. An ESP earthing connection point is provided above the leftmost PSM.

View of the SURF

Figure 2-10 shows a single band SURF module. Where **RXn** appears in Figure 2-10, the **n** may be 850, 900, 1800 or 1900, depending on the frequency of the SURF module.

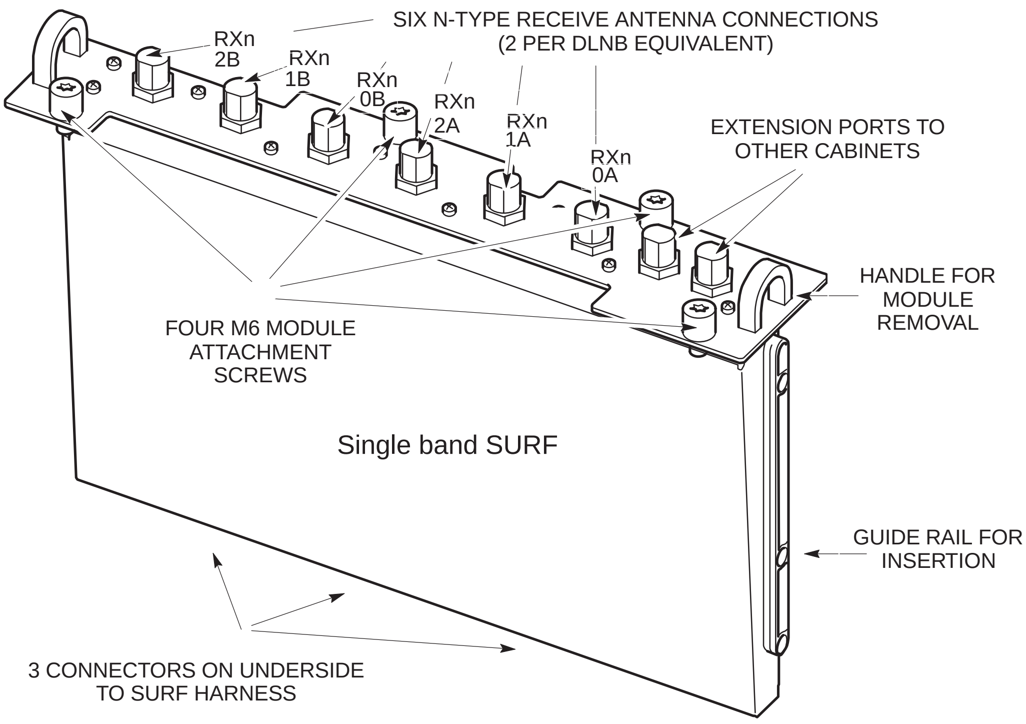


Figure 2-10 View of a single band SURF module

NOTE	The dual band SURF replacement procedure is almost identical, with the addition of the extra two second frequency antenna connections.

Replacing a SURF module

Removing a faulty SURF module

To remove a SURF:

NOTE	The procedure for replacing a faulty SURF module is the same for both single and dual band SURF variants.

1. Note the RF cable connections to the SURF module to enable correct reconnection to the replacement module.

WARNING	Before disconnecting RF cables, ensure that RF power is OFF. If RF power is ON when cables are disconnected, severe burns may result.

2. Disable all CTU transmit RF power by using the **`shutdown_device`** command at the OMC-R or from a PC connected to the MCUF.

NOTE	Refer to *Technical Description: BSS Command Reference (GSM-100-321)* for information on usage and specific device codes.

3. When all CTUs have been shutdown, check that the Tx STATUS LED (yellow) is extinguished.
4. Press and release the CTU circuit breaker buttons on the CBM to the out (off) position. Ensure each RADIO STATUS LED is extinguished.
5. Press and release the SURF circuit breaker button on the CBM to the out (off) position.
6. Disconnect the coaxial RF cables by carefully unscrewing and pulling them out of the module sockets. Note the positions for correct replacement.
7. Using a torxdriver, unscrew the four M6 torx captive screws holding the SURF module to the top of the cabinet.
8. Using the handles, lift the SURF block from the slot.

Fitting a replacement SURF module

To fit a replacement SURF:

1. Transfer the protective caps on the RF connectors from the replacement module to the faulty module.
2. Insert the replacement SURF module firmly into place. Take care to avoid trapping cables as the module is seated.
3. Tighten the four captive M6 torx screws to correct torque (see **Overview of replacement procedures**).
4. Reconnect the coaxial RF cables to the positions noted in the removal procedure. Tighten to correct torque (see **Overview of replacement procedures**).
5. Reset the SURF circuit breaker button on the CBM.
6. Reset the CTU circuit breaker buttons on the CBM. Each RADIO STATUS LED will flash green for about two minutes, and then remain lit.
7. Enable the CTU transmit RF power by using the **`ins_device`** command at the OMC-R or from a PC connected to the MCUF. The Tx STATUS LED (yellow) will be lit if the CTU is transmitting.
8. Notify the OMC-R of base station availability and log the maintenance activity.

The SURF module replacement is now complete.

Replacing a Tx block, HCU or plate

Introduction to Tx block replacement

WARNING	Ensure that RF power is OFF, before disconnecting RF cables. Severe burns may result if RF power is ON when RF cables are disconnected.

CAUTION	An earthing wrist strap must be worn when handling Tx blocks. An ESP earthing connection point is provided above the leftmost PSM.

There are three slots for Tx blocks in the top panel basket of a cabinet, above the CTUs. There are four types of Tx block; DCF, TDF, DDF and HCU.

Replacing a Tx block requires removal of RF transmitter power for the CTU(s) that connect with the faulty Tx block. It is therefore advisable to perform this procedure during periods of low traffic. The OMC-R should be notified of imminent repair activity.

If a stacking bracket is fitted, the CCB basket has to be removed in order to gain access to the Tx block modules (see **Replacing a CCB**).

It is important to ensure that all unused Tx Block M6 screw locations have a screw in place and tightened to correct torque (see **Overview of replacement procedures**). This is to ensure maximum quality of EMC and general containment.

Views of typical Tx block

Figure 2-11 shows a typical Tx block module used in the Horizon*macro* indoor cabinet.

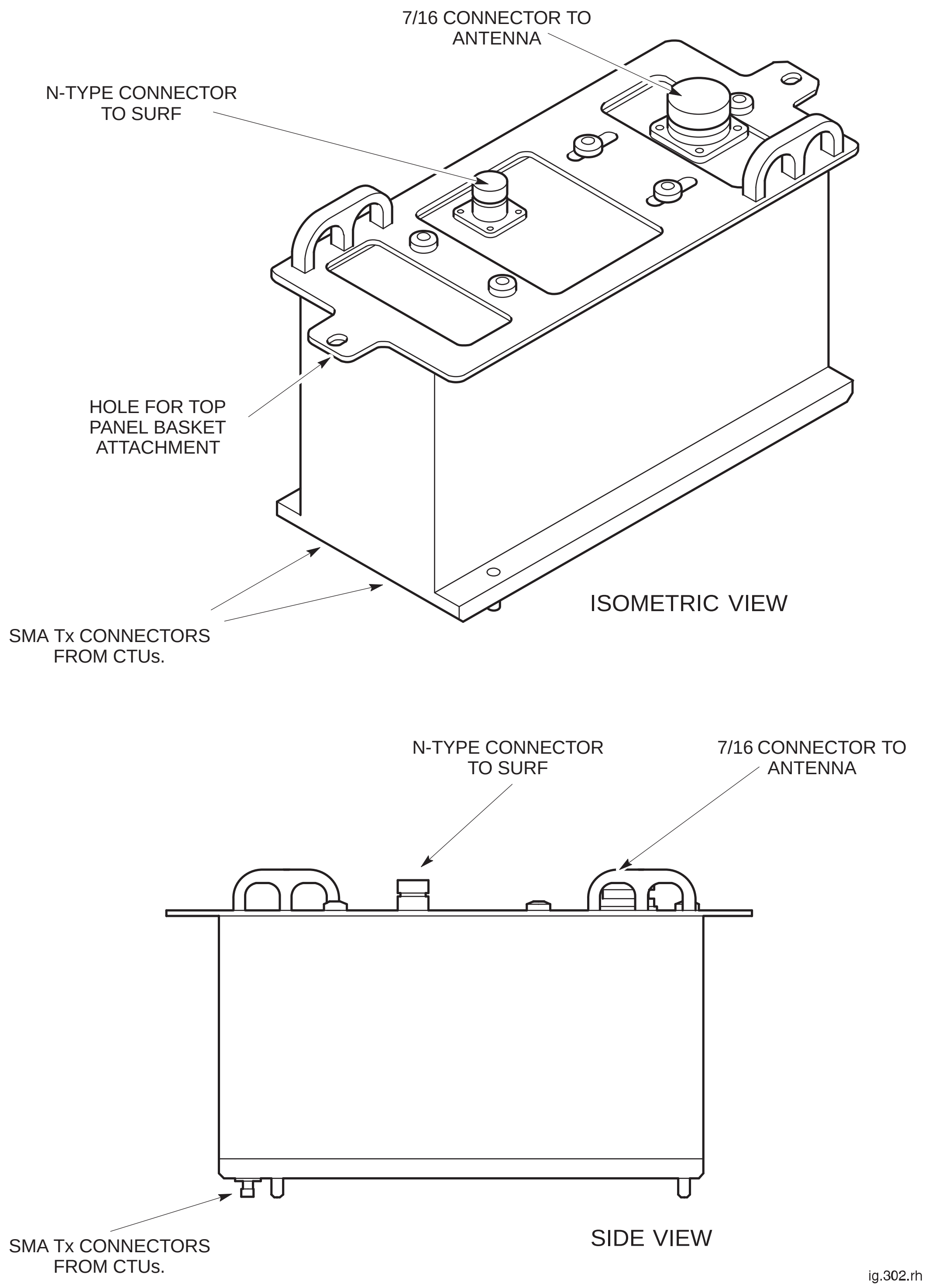


Figure 2-11 Views of typical Tx block

Replacing a Tx block

Removing a faulty Tx block

To remove a Tx block:

1. Locate the faulty Tx block, and note the RF cable connections to enable correct reconnection to the replacement module.

WARNING	Ensure that **all** CTUs associated with the faulty Tx block are identified (for example inputs to an HCU or feedthrough plate connected to a DDF).

2. Identify the CTUs that make Tx connections to the underside of the faulty Tx block (plus any CTUs connected to the third Tx connector on top of a DDF). See Table 2-3.

Table 2-3 Connectors for each type of Tx block module

Tx block	SMA from transceiver TX	7/16 Rx/Tx to antenna	N-type Rx to SURF
DCF	2 (beneath Tx block)	1	1
TDF (including dual band)	2 (beneath Tx block)	2	2
DDF	3 (2 beneath Tx block) (1 on top of Tx block from HCU)	1	1
HCU	2	0	1 to next Tx block

3. Disable each CTU transmit RF power by using the **shutdown_device** command at the OMC-R or from a PC connected to the MCUF. Refer to *Technical Description: BSS Command Reference (GSM–100–321)* for information on usage and specific device codes.
4. When each CTU has been shutdown, check that the Tx status LED (yellow) is extinguished.
5. Press and release each CTU circuit breaker button on the CBM to the out (off) position. Ensure each RADIO STATUS LED is extinguished.

WARNING	Ensure that RF power is OFF, before disconnecting RF cables. Severe burns may result if RF power is ON when RF cables are disconnected.

6. Disconnect all coaxial RF cables by carefully unscrewing and pulling them out of the Tx block sockets. Note the positions for correct replacement.
7. Using a Torx driver, unscrew and retain the two M6 torx screws holding the Tx block to the top of the cabinet.

WARNING	Tx blocks can weigh as much as 5 kg. Handle with care.

8. Using the handles, lift the Tx block from the basket.

Fitting a replacement Tx block

To install a replacement Tx block:

1. Transfer the protective caps on the RF connectors from the replacement Tx block to the faulty Tx block.
2. Carefully insert the replacement Tx block into its basket location on the top panel, adjusting alignment for retaining screws. Take care to avoid trapping cables as the Tx block is seated.
3. Fit the two M6 torx screws to hold the Tx block to the top of the cabinet. Tighten to correct torque (see **Overview of replacement procedures**).
4. Reconnect the coaxial RF cables to the positions noted in the removal procedure. Tighten to correct torque (see **Overview of replacement procedures**).

NOTE	Ensure all unused SMA inputs to DCF, DDF and HCU modules are fitted with 50 ohm load terminations.

5. Reset the appropriate CTU circuit breaker buttons on the CBM. Each RADIO STATUS LED will flash green for about two minutes, and then remain lit.
6. Enable the CTU transmit RF power by using the `ins_device` command at the OMC-R or from a PC connected to the MCUF. The Tx STATUS LED (yellow) will be lit if the CTU is transmitting.
7. Notify the OMC-R of base station availability and log the maintenance activity.

Blanking plate, feedthrough plate or HCU replacement

The procedure for plates is the same as for Tx blocks, but the plates are held by six M4 screws in the base of the Tx block basket. The two M6 Tx block screw locations are not used for plate attachment.

CAUTION	Unused Tx block locations must be covered with a blanking plate, with all screws fitted and tightened to the correct torque (see **Overview of replacement procedures**) to ensure correct airflow and EMC shielding.

Replacing a CCB

Overview of CCB replacement

CCBs, or their associated CCB control boards, can be individually replaced. It is assumed that the OMC-R has identified which item requires replacement. CCB block 0 is the right most block looking from the front, as shown in Figure 2-12, and is the main CCB, with master CCB control board. CCB block 1 is the extension CCB, with an optional redundant CCB control board.

The replacement of CCBs can only take place after the cabinet has been taken out of service, in agreement with the OMC-R.

View of CCBs in stacking bracket

Figure 2-12 shows the CCBs located in stacking bracket (cabinet not shown).

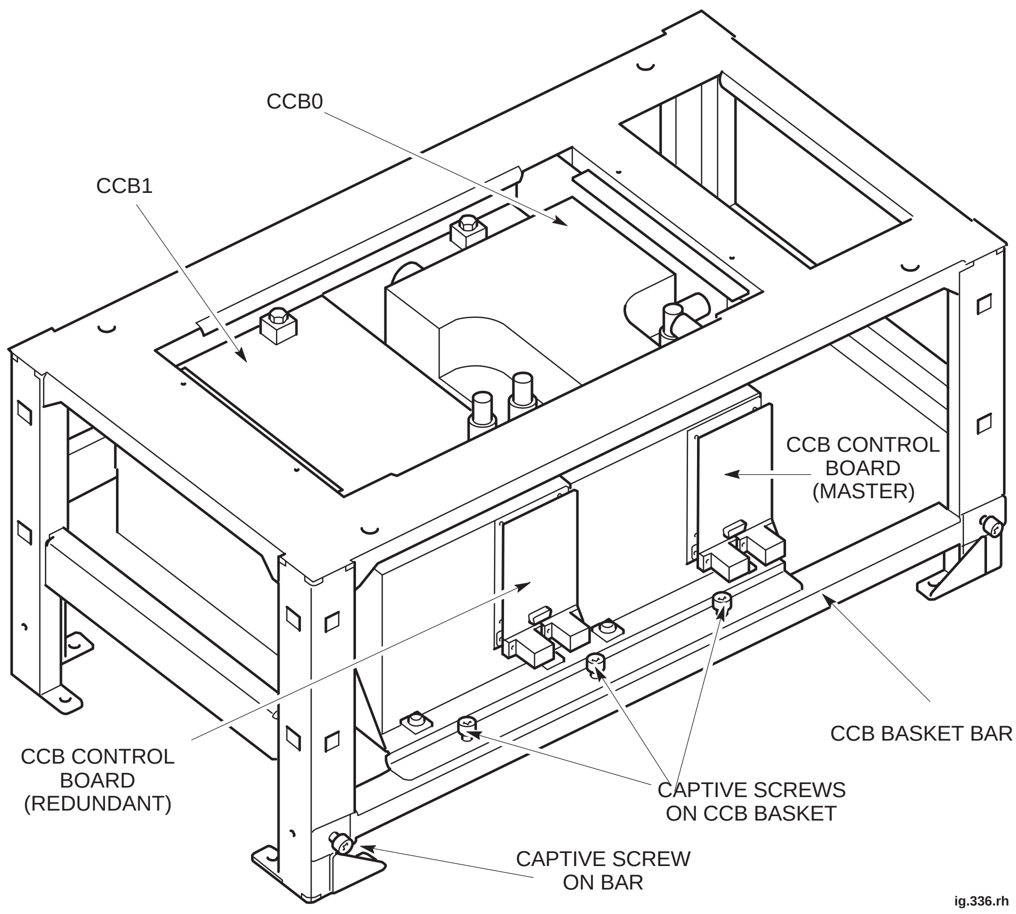


Figure 2-12 CCBs in installed position with CCB basket bar attached

Removing CCBs and CCB control boards

WARNING	Before disconnecting RF cables, ensure that the RF power is **OFF** by turning cabinet PSMs off. If RF power is **ON** when cables are disconnected, severe burns may result.

The removal off CCBs is accomplished in two stages:

- Removing the CCB basket from the stacking bracket.
- Separating CCBs from CCB basket.

Removing the CCB basket from the stacking bracket

To remove the CCB basket:

1. Close cabinet down by turning off PSMs.
2. Remove the stacking bracket front cover by applying gentle pressure to the outer edges, while easing the cover up and pulling it away from the bracket.
3. Disconnect power cable from each CCB and from single connector (marked CCB) on Interface panel.

CAUTION	Do not detach CCB basket bar unless basket is to be immediately removed.

4. Loosen the three captive screws attaching CCB basket bar to basket and the two captive screws securing CCB basket bar to the sides of the stacking bracket. Remove the bar
5. Disconnect the six N-type to N-type RF cables from the CCB inputs, and leave draped over the front of the cabinet. Note the locations for correct replacement.
6. Slide basket part way out of the stacking bracket, and disconnect antennas to CCBs.
7. Remove the CCB basket, complete with CCBs, from stacking bracket.

Separating CCBs from the CCB basket

To separate CCBs from CCB basket:

1. Place the CCB basket, complete with CCBs, onto a flat surface.
2. Disconnect and remove the phasing lead between CCB control boards.
3. Remove the four M4 screws securing each control board cover, and remove the CCB control boards.
4. Remove the six screws securing each CCB to the basket, (four M6 screws on the front and two M8 screws at the back).
5. Remove the CCBs from the basket

The CCBs have now been removed, ready for replacement CCBs.

Fitting replacement CCBs and CCB control boards

Follow these procedures to fit replacement CCBs.

Fitting CCBs into the basket

1. Place CCB basket onto flat surface.
2. Place the CCBs into the basket and secure with four M6 screws on the front and two M8 screws at the back. Tighten to correct torque (see **Overview of replacement procedures**).
3. Insert each CCB control board, then securing cover with four M4 screws. Tighten to correct torque (see **Overview of replacement procedures**).
4. Connect phasing lead between CCB control boards.

Fitting the basket to the stacking bracket

1. Ensure N-type cables are connected to the feedthrough plates and draped over the front of the cabinet.
2. Slide the basket part way into the stacking bracket, and connect antennas to the CCBs.
3. Slide the CCB basket fully home.
4. Connect the six N-type to N-type RF cables from the feedthrough plates to the CCB inputs. Connect to the positions noted in the removal procedure.
5. Attach the CCB basket bar to the sides of the stacking bracket using the two captive screws. The bar is then directly underneath the basket captive screws.
6. Attach the CCB basket bar to the basket with the three captive screws on the basket.
7. Connect the power cable to each CCB from the single connector (marked CCB) on the Interface panel.
8. Refit the front cover onto the stacking bracket, pushing it in so that it can drop into position on the side lugs.

The CCBs are now replaced and ready for power up of the cabinet.

Digital module replacement (MCUF, NIU, FMUX, BPSM, Alarm)

Introduction to digital module replacement

CAUTION	MCUF removal during flash memory programming may result in bootcode corruption. This is only repairable by returning the MCUF to Motorola. For this reason, the MCUF should not be removed while the code load is taking place, indicated by a flashing LED.

A faulty master MCUF, FMUX or BPSM will cause a redundant module (if fitted) to take over until the faulty module is replaced. Faulty MCUF, FMUX and BPSM modules can be hot swapped without harm to the module or effect on normal operation, provided the equivalent redundant module has taken over.

Removal of a faulty digital module that has not had its function taken over by a redundant module, and is still partially functional, will affect service. Inform the OMC-R before replacing out such modules.

Diagram of digital modules

Figure 2-13 shows the location of modules within the digital module shelf.

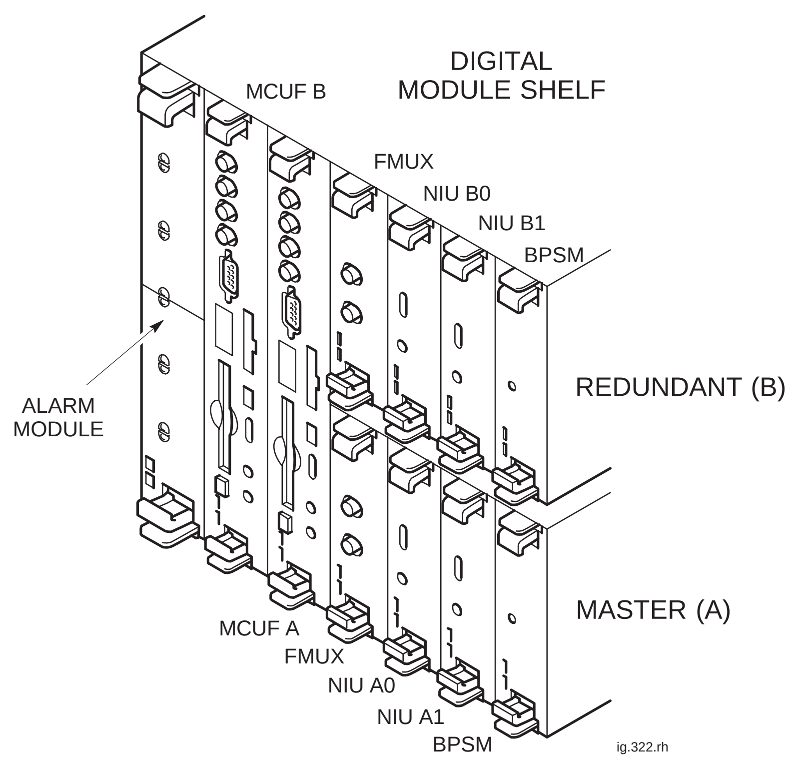


Figure 2-13 Digital and BPSM module locations, including optional redundancy

Replacing digital modules

Removing a faulty digital module

To remove a digital module:

WARNING	There is a possibility of laser radiation when fibre optic cables are disconnected. Do not look directly into cables with or without the use of any optical aids. Radiation can come from either the data in/out connectors or unterminated fibre optic cables connected to data in/out connectors.

CAUTION	An earthing wrist strap must be worn when handling digital modules. An ESP earthing connection point is provided above the leftmost PSM.

1. If the faulty digital module is still partially functional, due to no redundancy option, inform the OMC-R before proceeding.
2. Locate the faulty module, as shown in Figure 2-13.
3. Note location of any fibre optic cable connections to the module, (MCUF or FMUX modules only), to enable correct reconnection to the replacement module.
4. Disconnect each fibre optic cable by gently pushing the knurled connector in and rotating it through a quarter-turn anticlockwise to disengage, then withdraw the cable carefully.

NOTE	It is advisable to protect the tips of the fibre optic cables with a protective cover and secure the cables to one side.

5. Unseat the module by gripping the upper and lower pair of ejectors between the thumb and first finger of each hand, then gently squeeze and pull on the ejectors until the module unclips at the top and bottom of the front panel and unplugs from the rear connector.
6. Carefully slide the module from its location and place it in an anti-static storage container.

Fitting replacement digital module

To install a replacement digital module:

1. Remove the replacement module from the antistatic storage container. In the case of the NIU, ensure it is of the correct type (E1 or T1).
2. Slide the module into the guide rails and push firmly into place. The ejectors will audibly click into place as confirmation of correct insertion.
3. Connect any fibre optic cables by inserting the connector and rotating a quarter-turn clockwise to engage.

NOTE	Ensure fibre optic cables are correctly connected to the locations noted during module removal.

4. Ensure appropriate LEDs indicate correct operation.

CAUTION	When the two LEDs of the MCUF, are flashing, the boot code is downloading into non-volatile memory for software upgrade. Power should not be removed, nor the cabinet reset, until downloading has been completed, as this will corrupt the non-volatile memory. If the boot code is corrupted, contact Motorola Customer Network Resolution Centre requesting the boot code restoration procedure and the appropriate boot code file.

NOTE	Following an NIU switch on or reboot, both red and green LEDs are initially lit. After approximately 20 seconds, the red LED will extinguish, indicating normal condition. This waiting period may be extended to 50 seconds after rebooting due to a code download.

5. When fitting a redundant MCUF refer to **Redundant MCUF firmware compatibility** for details of further checks required.
6. Notify the OMC-R of base station availability and log the maintenance activity.

Redundant MCUF firmware compatibility

Overview of MCUF firmware compatibility

In many installations a redundant MCUF is fitted and configured to assume control in the event of a failure of the master MCUF. Under normal circumstances, the redundant MCUF accepts code downloads from the master MCUF and so remains updated and available for use.

If the redundant MCUF is replaced with a module containing firmware which is incompatible with the master MCUF firmware, then the communicating link between MCUFs will not be established. The redundant MCUF will therefore not be updated and will not be available to take over when required.

Checking MCUF firmware compatibility

To check firmware compatibility between MCUFs, check the state of the base transceiver processor (BTP) within each MCUF as follows:

1. Connect a PC to the TTY connection on the master MCUF.
2. At the CUST MMI prompt, enter:

   `state <site #> btp * *`

Where **<site #>** is the site number.

The status of both BTPs will be displayed as follows:

```
BTP 0 0 0     B–U   NO REASON
BTP 1 0 0     E–U   NO REASON
```

or,

```
BTP 0 0 0     B–U   NO REASON
BTP 1 0 0     D–U   No Redundant Link
```

If `No Redundant Link` is indicated then the master MCUF is not in communication with the redundant MCUF and firmware incompatibility may be assumed. Refer to **Updating redundant MCUF firmware**.

Updating redundant MCUF firmware

The following procedure to update firmware in the redundant MCUF requires a PCMCIA card containing current network configuration data. The procedure assumes that the PCMCIA card is already in the master MCUF.

NOTE	No call processing can take place during the MCUF firmware update process. The entire process should take approximately one hour.

Site preparation

To prepare for the firmware update the site must first be taken out-of-service as follows:

1. Connect a PC to the TTY connection on the master MCUF.
2. At the CUST MMI prompt, disable all CTUs in turn by typing:

   `shutdown_device <site #> dri * * * <seconds>`

   Where **<site #>** is the site number, *** * *** is the DRI identifier and **<seconds>** is the time delay before shutdown occurs.
3. Confirm this action by observing each CTU Tx status LED, which should extinguish shortly after issuing the shutdown command.
4. Disconnect the 2.048 Mbit/s link

Redundant MCUF firmware update procedure

The following procedure describes how to update redundant MCUF firmware by placing the redundant MCUF into the master position and downloading code from a PCMCIA card.

1. Remove the uploaded PCMCIA card from the master MCUF, and ensure that write protect is switched to OFF.
2. Remove both MCUFs. Insert the PCMCIA card into the original redundant MCUF then insert this MCUF into the master position.
3. Connect a PC to the TTY connection on the MCUF front panel.
4. At the MMI-ROM prompt, type:

   `burn`

   This will flash object 8, the MCUF boot object, from the PCMCIA card onto the MCUF card. The flash download takes approximately 30 seconds, then the MCUF will reset.
5. At the MMI ROM prompt, type:

   `set_site <site #>`

   Where **<site #>** is the site number.

   The MCUF now carries out a system initialization using data from the PCMCIA card. After a short wait the screen displays:

   ```
   Initialization complete. All commands accepted.
   ```

   The MCUF firmware update is complete and both MCUFs now hold identical firmware. The MCUF originally removed from the master position may now be used in the redundant position.
6. Insert the original master MCUF into the redundant position.

   The redundant MCUF now requires a 15 minute sync warm up period, followed by a further delay of four minutes while the two MCUFs achieve phase lock. Once phase lock is achieved the master MCUF immediately begins codeloading to the redundant MCUF. Codeloading takes a further 15 minutes.

   The process is complete when the following message is displayed on screen:

   ```
   Redundant MSW is INS
   <*><*><*> NEW STANDBY Switch CONFIGURED <*><*><*>
   ```

7. To confirm correct MCUF status, at the CUST MMI prompt, enter:

   `state <site #> btp * *`

   Where **<site #>** is the site number.

   The status of both BTPs will be displayed as follows:

   ```
   BTP 0 0 0      B–U   NO REASON
   BTP 1 0 0      E–U   NO REASON
   ```

   Where `B–U` is busy unlocked (master) and `E-U` is enabled unlocked (redundant).

8. Reconnect the 2.048 Mbit/s link.

NOTE	There is no need to unlock the CTUs as these are automatically unlocked during the initialization procedure.

NOTE	If a PCMCIA card is not available then the firmware in the redundant MCUF may be updated by removing the master MCUF and placing the redundant MCUF in the master position. Code download from the BSC will ensure the newly installed MCUF is fully updated. This procedure however is likely to take up to 30 minutes longer than the procedure involving a PCMCIA card, resulting in a longer out of service time for the BTS.

Testing MCUF redundancy

The following procedure tests MCUF redundancy by forcing the master and redundant MCUFs to swap roles. The commands refer to the base transceiver processors (BTPs) within each MCUF.

1. Connect a PC to the TTY connection on the master MCUF.
2. At the CUST MMI prompt, type:

   `state <site #> btp * *`

   Where **<site #>** is the site number.

   The status of both BTPs will be displayed as follows:

   ```
   BTP 0 0 0      B–U   NO REASON
   BTP 1 0 0      E–U   NO REASON
   ```

   Where `B–U` is busy unlocked (master) and `E-U` is enabled unlocked (redundant).
3. At the CUST MMI prompt type:

   `swap_devices <site #> btp 0 0 0 btp 1 0 0`

   Where **<site #>** is the site number, **btp 0 0 0** is the master MCUF and **btp 1 0 0** is the redundant MCUF.

   This command will swap MCUF roles by forcing:

- the redundant MCUF into a busy state , and making it master.
- the master MCUF into an enabled state, and making it redundant.

4. At the CUST MMI prompt, confirm the swap by typing:

   `state <site #> btp * *`

   Where **<site #>** is the site number.

   The status of both BTPs will now show changed roles:

   ```
   BTP 0 0 0      E–U   NO REASON
   BTP 1 0 0      B–U   NO REASON
   ```
5. Make test calls on the site to verify the new master MCUF.
6. At the CUST MMI prompt type, swap the MCUFs back to their original states by typing:

   `swap_devices <site #> btp 1 0 0 btp 0 0 0`

   Where **<site #>** is the site number, **btp 1 0 0** is the master MCUF and **btp 0 0 0** is the redundant MCUF.
7. At the CUST MMI prompt, confirm the swap by typing:

   `state <site #> btp * *`

   Where **<site #>** is the site number.

   Both BTPs have now reverted to their original roles:

   ```
   BTP 0 0 0      B–U   NO REASON
   BTP 1 0 0      E–U   NO REASON
   ```
8. Make test calls on the site to verify the new master MCUF.

CHAPTER 1
INDOOR PARTS LIST

MOTOROLA

Category 623

Parts Information (Parts)

MOTOROLA

Chapter 1

Parts list

Chapter 1
Parts list

Horizon*macro* indoor parts list

Introduction to Horizon*macro* indoor parts list

In the parts lists contained in this chapter, each item consists of a location number (related to the associated diagram), description, and an order number. The order number uniquely identifies the required component. Some components are used in different equipment in addition to Horizon*macro* indoor. Many items are the same for Horizon*macro* outdoor. Several items are the same for M-Cell*6*.

FRU items

The majority of items on the parts list are field replaceable units (FRUs). It is not intended to supply sub-units of these spares.

Ordering method

Contact the local Motorola office for ordering information, including cost and delivery.

If an item in the parts list is marked **TBA**, this means that the part number for the item was not available at the time of publication of this manual.

NOTE	Motorola reserves the right to change the design of the product without notice. The information provided in this chapter is intended as a guide. If the customer requires the latest information, then consult the **Motorola local office** who will be able to check on the web and confirm the current situation. Some items, for example CCBs and PSMs, are produced by different manufacturers, and so a replacement may appear slightly different to the item it is replacing. All items bearing the same order number, regardless of manufacturer, are fully compatible.

Diagram of cabinet modules

Figure 1-1 to Figure 1-5 shows the cabinet modules, including major FRUs, without door or hood/stacking bracket for clarity.

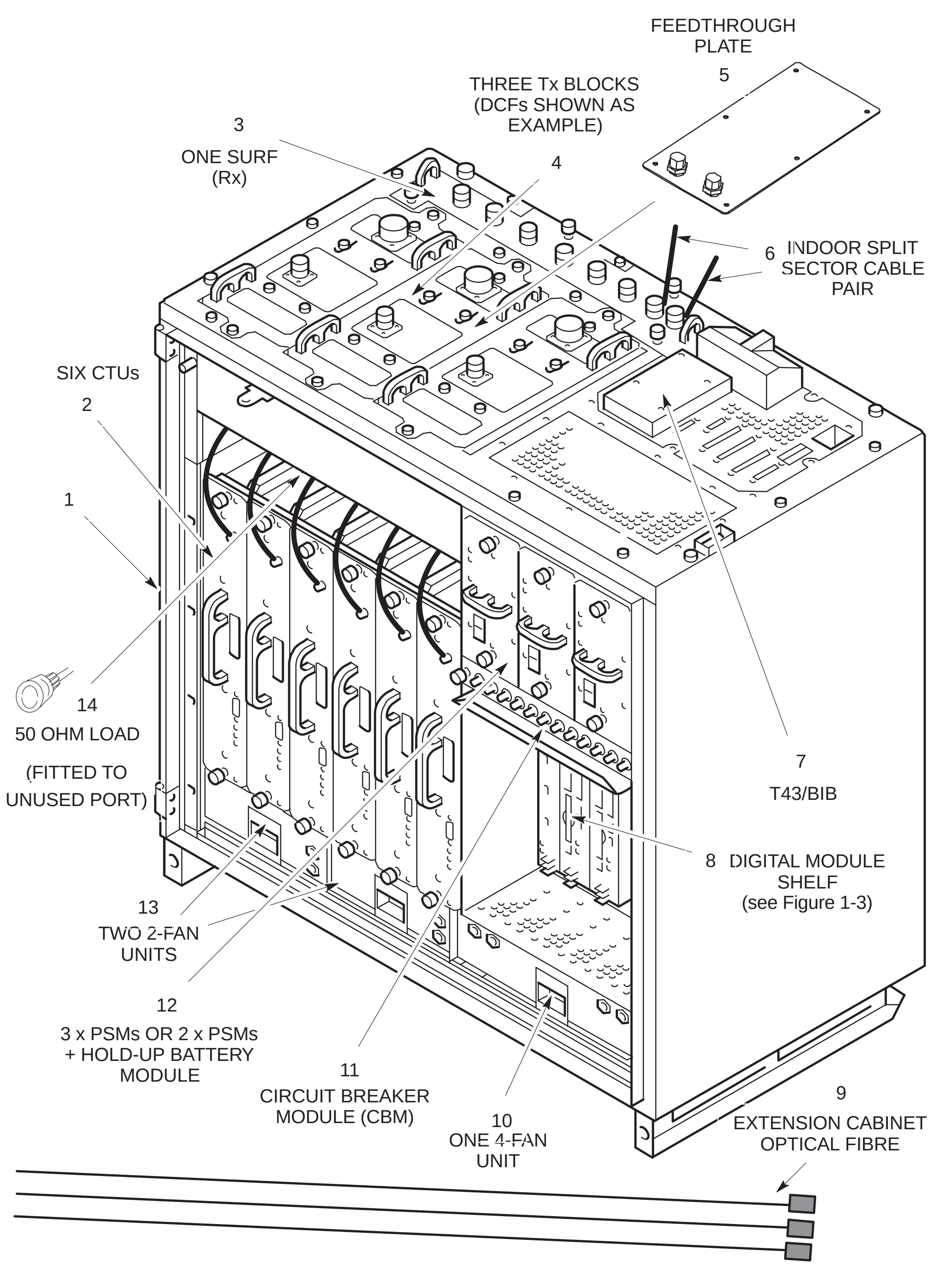


Figure 1-1 Diagram of indoor cabinet showing major FRUs

Spares tables

Table 1-1 to Table 1-5 list the Horizon*macro* indoor spares, available as at October 2001. Location numbers in each table refer to the associated preceding diagram. Contact the Motorola local office for an up to date list.

Table 1-1 List of Horizon*macro* indoor spares

Location	Description	Order No
1	Indoor cabinet	SW1053
2	1900 CTU	TBA
3	1900 SURF	TBA
4	1900 DCF	TBA
4	1900 DDF	TBA
4	1900 HCU	TBA
4	1900 TDF	TBA
2	1800 CTU	SWRG5197
3	1800 SURF (single band)	SWRG2880
3	1800 SURF (dual band)	TBA
4	1800 DCF	SVLG1224
4	1800 DDF	SVLG1225
4	1800 HCU	SVLG1227
4	1800 TDF	SVLG1226
2	900 CTU	SWRF5193
3	900 SURF (single band)	TBA
3	900 SURF (dual band)	SWRF2879
4	900 DCF	SVLF1224
4	900 DDF	SVLF1225
4	900 HCU	SVLF1227
4	900 TDF	SVLF1226
2	850 CTU	TBA
3	850 SURF	TBA
4	850 DCF	TBA
4	850 DDF	TBA
4	850 HCU	TBA
4	850 TDF	TBA
4	Dual band TDF	SVLX1198
5	Feedthrough plate assembly	SVLN1243
6	Indoor split sector cable pair	SVKN1233

Location	Description	Order No
7	BIM/BIB	SWLN4024
7	CIM/T43	SWLN4025
8	Digital module shelf	(see Table 1-3)
9	2nd (Extension) cabinet fibre	SVKN1244
9	3rd (Extension) cabinet fibre	SVKN1245
9	4th (Extension) cabinet fibre	SVKN1246
10	4-fan unit	SWHN5790
11	CBM	SWHN5519
12	Hold-up battery module	SVPN1161
12	Indoor 27 V PSM	SVPN1220
12	Indoor –48 V PSM	SVPN1221
12	Indoor 240 V PSM	SVPN1222
13	2-fan unit	SWHN5289
14	SMA 50 ohm load	SVLN1230
	Indoor plinth	SVLN1247
	*Indoor blanks set	SVLN1219
	PCMCIA	SWLN5239
	Air filter kit (pack of 10)	SVFF1209
	CTU Tx cable	SVKN1304
	Duplexer cable	SVKN1305
	GPS cable	SWKN8115

NOTE *These are sets of blank plates which fit PSMs, Tx blocks and CTUs.

View of CCBs in stacking bracket

Figure 1-2 shows the CCBs located in the stacking bracket.

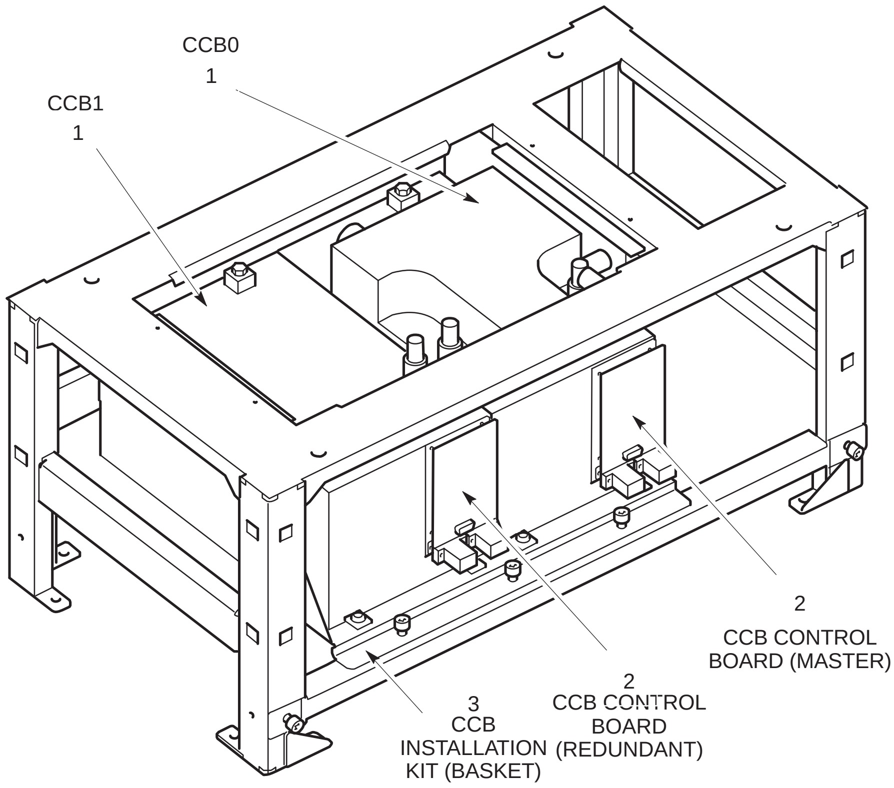


Figure 1-2 CCBs in installed position with CCB basket bar attached

CCB spares table

Table 1-2 outlines the spares for the CCBs and stacking bracket.

Table 1-2 CCB and stacking bracket spares

Location	Description	Order No
1	1800 CCB (Master)	SVLG1241
1	1800 CCB (Extender)	SVLG1242
1	900 CCB (Master)	SVLF1241
1	900 CCB (Extender)	SVLF1242
2	CCB control board	SWLN4507
3	CCB installation kit	SWHN5927

NOTE CCBs are not currently available for the GSM850 and PCS1900 BTS variants.

Digital module and BPSM locations

Figure 1-3 shows the individual digital module and microBCU power supply module (BPSM) locations.

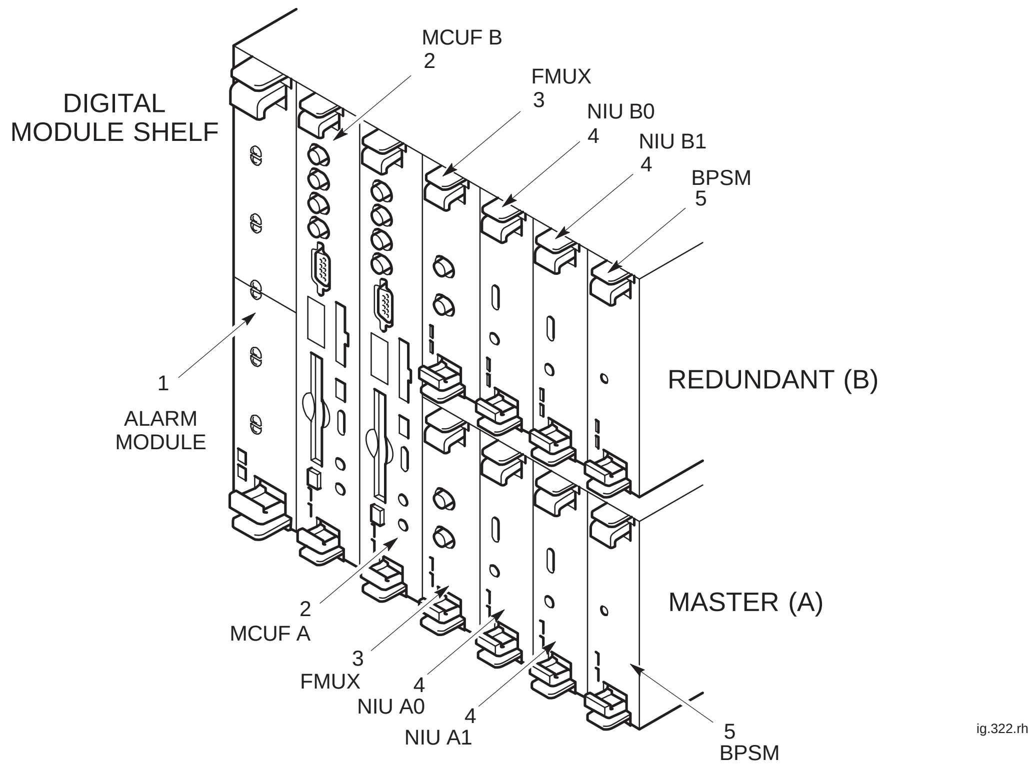


Figure 1-3 Digital module and BPSM locations

Digital module and BPSM table

Table 1-3 outlines the spares for the digital modules and BPSM.

Table 1-3 Digital module and BPSM spares

Location	Description	Order No
1	Alarm module	SWLN5228
1	Alarm module with GPS functionality	SWLN8510
2	MCUF	SWLN5227
3	FMUX	SWLN4406
4	NIU-E1	SWLN4403
4	NIU-T1	SWLN4404
5	BPSM	SWPN2567

Diagram of the door

Figure 1-4 shows the internal and external view of the door.

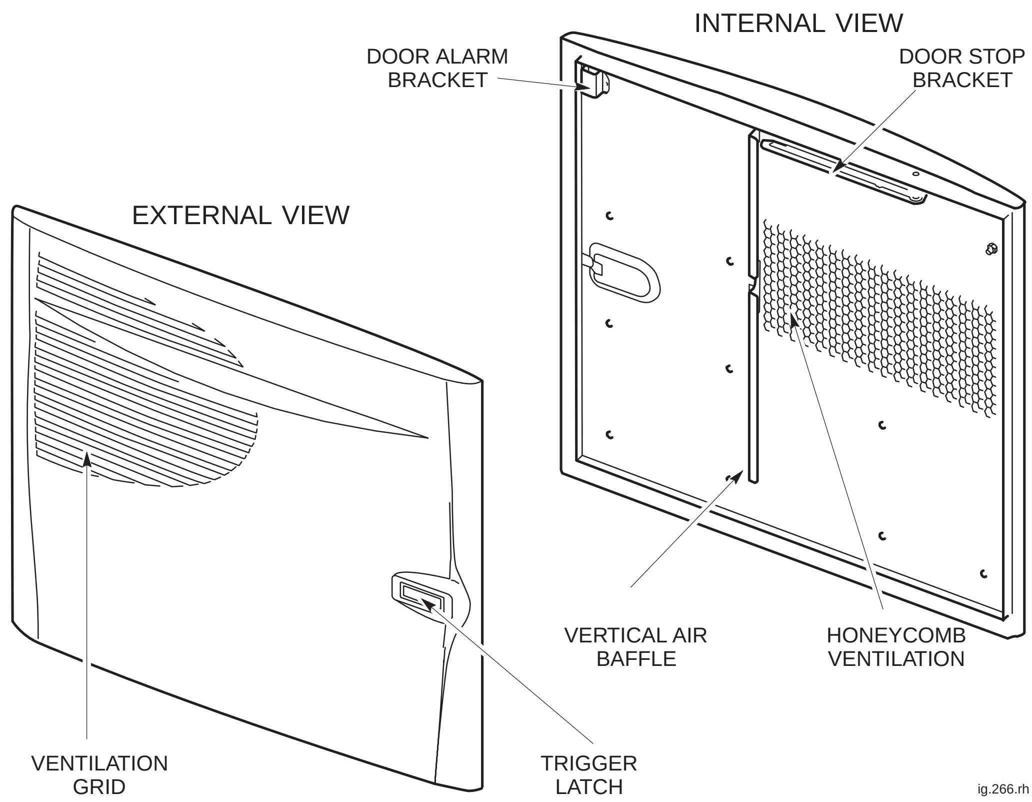


Figure 1-4 Internal and external view of the door

Door table

Table 1-4 outlines the door spare.

Table 1-4 Door spare

Location	Description	Order No
1	Indoor door	SWHN5556

Diagram of hood

Figure 1-5 shows a top view of the optional hood.

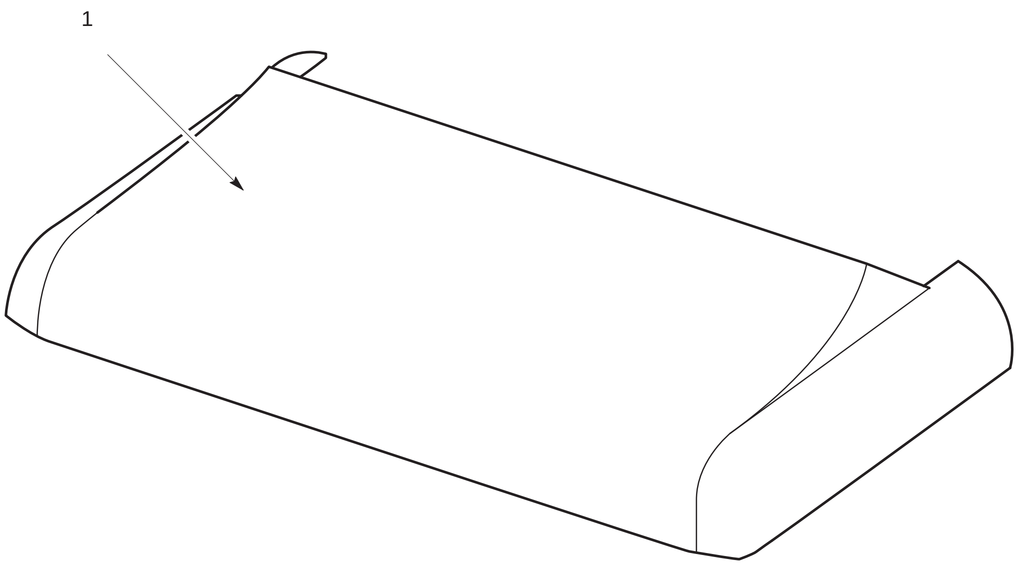


Figure 1-5 View of the hood as seen from the front of the cabinet

Indoor hood table

Table 1-5 outlines the indoor hood spare.

Table 1-5 Indoor hood spare

Location	Description	Order No
1	Indoor hood	SVLN1231

Glossary of unique terms for this equipment

Overview

These glossary items have been selected as unique to this Horizon*macro* product, or common only to M-Cell*6*. These and other GSM terms can be found in *System Information: General: (GSM-100-101)*.

Glossary terms

BPSM

Micro BCU Power Supply Module

CBM

Circuit Breaker Module

CCB

Cavity Combining Block

CTU

Compact Transceiver Unit

DCF

Duplexed Combining bandpass Filter

DDF

Dual-stage Duplexed combining Filter

FMUX

Fibre optic Multiplexer

HCU

Hybrid Combining Unit

HPD

High Powered Duplexer

MCUF

Main Control Unit with dual FMUX

NIU

Network Interface Unit

SURF

Sectorized Universal Receiver Front-end

TDF

Twin Duplexed Filter

MOTOROLA

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