



Samsung SOf50 Product Specification

Specifies hardware configuration, functions, specifications, components, ports and LED information for the SOf50, a small cell unit in the Samsung eNB.

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Radio Access Network

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Preface

This description describes the characteristics, features and structure of the Smallcell Outdoor FDD (SOF50), which is an LTE eNB.



Some hardware configuration are not supported by all software releases or approved for all markets.

New and Changed Information

This section describes information that has been added/changed since the previous publication of this manual.

- Minor edits.

Revision History







The following table lists all versions of this document.

Document Version	Publication Date	Remarks
1.0	15 May 2015	-
2.0	11 Jul 2015	-
3.0	22 Sep 2015	-

Conventions in this Document

Samsung Networks product documentation uses the following conventions:

Symbols

Name	Description
	Indicates a task.
	Indicates a shortcut or an alternative method.
	Provides additional information.
	Provides information or instructions that you should follow to avoid service failure or damage to equipment.
	Provides information or instructions that you should follow to avoid personal injury or fatality.
	Provides antistatic precautions that you should observe.

Menu Commands

menu | command

This indicates that you must select a command on a menu, where **menu** is the name of the menu, and **command** is the name of the command on that menu.

File Names and Paths

These are indicated by a bold typeface. For example:

Copy **filename.ext** into the **/home/folder1/folder2/bin/** folder.

User Input and Console Screen Output Text

Input and output text is presented in the Courier font. For example,

```
context< designated epc-context-name>
```

CLI commands are presented in bold small caps. For example,

Type the **RTRV-NE-STS** command in the input field.

Documentation

- *Samsung CDU10 Product Specification*
- *Samsung SDU10 Product Specification*
- *Samsung SDU11 Product Specification*
- *Samsung SOF50 Product Specification*
- *Samsung RF1 Series Product Specification*
- *Samsung SF1 Series Product Specification*
- *Samsung CDU10 Installation Manual for LTE Overlay*
- *Samsung SDU10 Installation Manual for LTE Overlay*
- *Samsung SDU11 Installation Manual for LTE Overlay*
- *Samsung SOF50 Installation Manual*
- *Samsung RF1 Series Installation Manual*
- *Samsung SF1 Series Installation Manual*
- *Samsung eNB Dimensioning and Configuration Manual*

Personal and Product Safety

This product safety information includes European directives, which you must follow. If these do not apply in your country, please follow similar directives that do apply in your country.

CE Marking

Samsung networks equipment supplied to certain European countries carries a CE marking. This is the manufacturer's declaration demonstrating that the product complies with the Radio and Telecommunications Terminal Equipment (R & TTE) Directive (1999/5/EC).

Electrical

The product is designed to operate from a -48 V DC supply and is therefore classified as Safe Extra Low Voltage (SELV) equipment.

All structural parts are grounded and all input and outputs have built-in isolation from the network. All input and output ports that connect to external power sources are designed to meet relevant national safety requirements.

The product contains hazardous energy levels as defined by EN 60950. Care must be taken when maintaining this equipment as injury to personnel or damage to the equipment could result from mistakes. Maintenance should only be carried out by trained and competent engineers who are familiar with the relevant procedures and instructions.

Lasers

The product is fitted with optic modules rated as Class 1 radiation-emitting devices under EN 60825-1. During installation, operation, and maintenance, never look into the end of an optical fiber directly or by reflection either with the naked eye or through an optical instrument. Do not operate equipment with exposed fiber connectors—cover these with fiber cables or blanking caps. Do not remove equipment covers during operation unless requested to do so in the documentation. Carry out normal safety precautions when trimming fibers during installation.

Manual Handling

Care should be taken when handling equipment. Give due consideration to the weight of the equipment, the physical capability of the individual(s) handling the equipment, and movements such as twisting, bending and stooping, which could lead to skeletal and muscular injuries.

Installation

Installation must be carried out by trained and competent engineers only. All relevant safety measures should be taken to ensure equipment is not connected to live power and transmission sources during installation. Equipment must be correctly installed in order to meet the relevant safety standards and approval conditions.

Each power feed to the unit requires a separate fused feed from the provided power supply. The cable between the power distribution point and the installed equipment must have a minimum cross-sectional area of 2.5 mm².

Rack-mountable equipment must be placed in a standard 19-inch rack and secured with the appropriate fixings as detailed in the installation manual.

Installation of the equipment must comply with national electrical codes or local electrical codes.

Maintenance

Maintenance must only be carried out by a suitably trained and competent technician. All safety instructions must be carefully observed at all times. Equipment covers should not be removed while live power and transmission is connected unless in a controlled environment by trained technicians.

Fire

The product is powered from a -48 V DC supply. To protect against fire, the equipment is fused.

Environment

The product must be operated in an environment with the specified relative humidity and ambient temperature ranges.

Keep all liquids away from the equipment as accidental spillage can cause severe damage.

Cooling

The product cools down by its own set of cooling fans housed in a fan module. Each fan module detects a fan that is not operating normally. LEDs on the front panel of the fan tray provide an alarm indication in the event of fan failure.

In the event of fan failure, take urgent remedial action to restore full cooling capacity.

Take appropriate measures to ensure that fan modules do not start spinning during repair and maintenance procedures.

Anti-Static Precautions

The circuit boards and other modules in the product are sensitive to and easily damaged by static electricity. If any card or sub-assembly is removed from the unit, the following anti-static precautions must be observed at all times:

- Service personnel must wear anti-static wrist straps.
- Circuit boards and sub-assemblies must be placed on ground conductive mats or in conductive bags.
- All tools must be discharged to ground before use.
- The anti-static wrist strap and cord must be checked at regular intervals for their suitability for use.

Grounding

To comply with IEC/EN 60950, the equipment must be connected to a safety grounding point via a permanent link. Grounding points are located on the product for this purpose. Always connect the ground cable before fitting other cables. The product must remain grounded continuously unless all connections to the power supply and data network are all removed.

If equipment is grounded through a cabinet or rack, make sure it is done so properly according to the installation instructions.

Power Supply Connection

The equipment is designed to be powered from a -48 V DC supply. Power connections and installation of associated wiring must be carried out by a suitably qualified technician.

Only devices that comply with all relevant national safety requirements should be connected to the unit's power supply inlets. Other usage will invalidate any approval given to this equipment.

Connection of this equipment to devices that are not marked with all relevant national safety requirements may produce hazardous conditions on the network.

When the power supply is obtained by a rectifier/safety isolation transformer, the supply must meet the requirements of EN 60950 providing double/reinforced insulation between hazardous voltages and SELV/TNV circuits. Any battery must be separated from hazardous voltages by reinforced insulation.

Indirect Connection

Before indirectly connecting any equipment to another device through a shared power supply, ALWAYS seek advice from a competent engineer.

Devices that are not marked according to the relevant national safety standards may produce hazardous conditions on the network.

Product Disposal

To reduce the environmental impact of products, Samsung has joined WEEE compliance activities.

The WEEE symbol on the product indicates that the product is covered by the European Directive 2002/96/CE for the disposal of Waste Electrical and Electronic Equipment (WEEE). This means that the product should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities. This will help prevent potential negative consequences for the environment and human health. Please check the terms and conditions of the purchase contract for information about correct disposal.

Battery Disposal

The product contains a battery on the processor card. The battery should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66. The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose it in a fire. Do not disassemble, crush, or puncture the battery.

End of life recycling materials information is available from Samsung.

Equipment Markings



Hereby, Samsung Electronics, declares that this product is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.'

The original Declaration of Conformity may be found at <http://www.samsungdocs.com>, go to eLibrary menu and enter the model or the product name.



This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g. charger, headset, USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.

For information on Samsung's environmental commitments and product specific regulatory obligations e.g. REACH visit:
samsung.com/uk/aboutsamsung/samsungelectronics/corporatecitizenship/ata_corner.html



Correct disposal of batteries in this product (Applicable in countries with separate collection systems.)

The marking on the battery, manual or packaging indicates that the battery in this product should not be disposed of with other household waste. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66.

The battery incorporated in this product is not user replaceable. For information on its replacement, please contact your service provider. Do not attempt to remove the battery or dispose it in a fire. Do not disassemble, crush, or puncture the battery. If you intend to discard the product, the waste collection site will take the appropriate measures for the recycling and treatment of the product, including the battery.

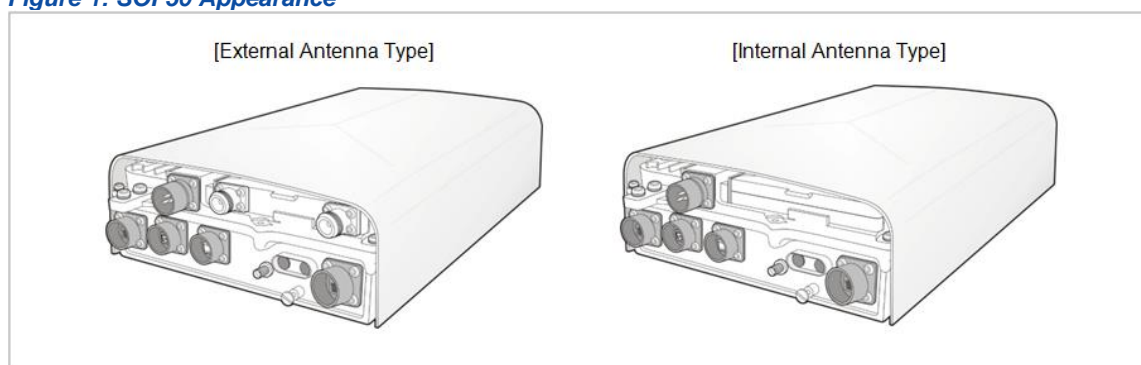
Overview

The SOF50 is located between UE and EPC. It interfaces wirelessly in accordance with LTE air standard and provides subscribers with wireless communications service. Also, it transmits and receives wireless signals to and from UE and processes the modulation and demodulation of traffic signals. In addition, it allocates packet scheduling and wireless bandwidth, and performs handover by interfacing with the EPC.

The SOF50 is an all-in-one unit. If a fault occurs, the unit must be replaced.

The following figure shows SOF50 appearance:

Figure 1: SOF50 Appearance

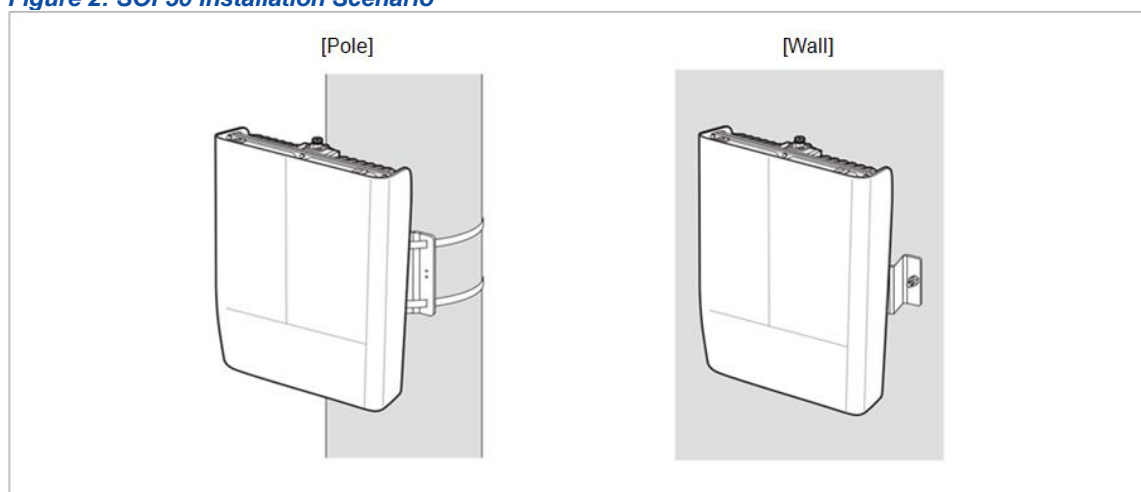


The SOF50 can be mounted in the following ways:

- Pole Installation
- Wall Installation

The following figure shows SOF50 installation scenario:

Figure 2: SOF50 Installation Scenario

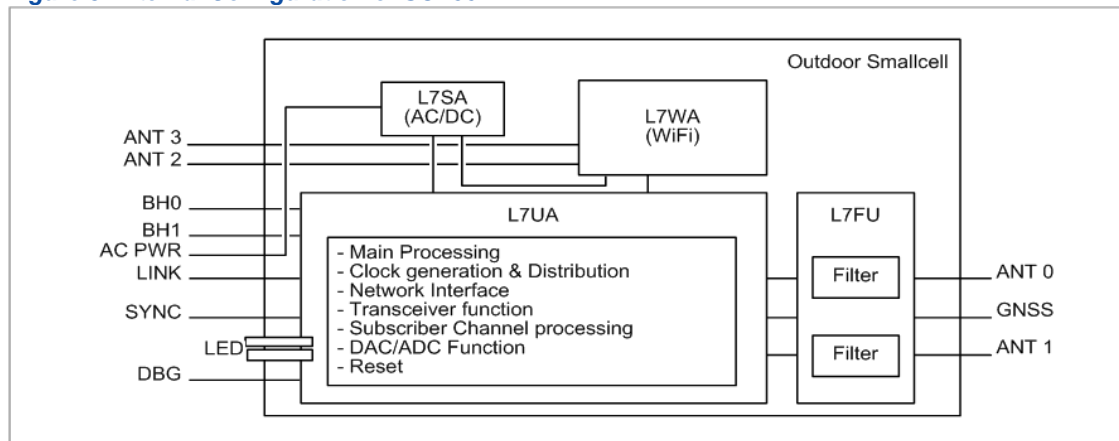


Functional Description

The SOF50 consists of main block (L7UA), which is a digital and RF processing board, AC/DC (L7SA), Wi-Fi block (L7WA), filter block (L7FU) and antennas.

The following figure shows internal configuration of SOF50:

Figure 3: Internal Configuration of SOF50



Main Block (L7UA)

The major functions of the L7UA are as follows:

- Main Control Functions
- Clock Generation and Distribution Function
- Network Interface Function
- Subscriber Channel Processing Function
- DAC/ADC Function
- 2Tx/2Rx MIMO Support
- Reset

Main Control Functions

The main processor of SOF50 takes the highest role of the system, and performs the communication path setup between UE and EPC, system operation and maintenance, and so on.

It also manages the statuses for all hardware and software in SOF50, allocates and manages resources, collects alarms, and reports all status information to the EMS.

Clock Generation and Distribution Function

The SOF50 selectively supports GPS/GLONASS, IEEE1588v2, SyncE Clock. Clock block allows each block of eNB to be operated with synchronized clock system.

GPS/GLONASS

The GPS/GLONASS block generates 1PPS and 10MHz signal through received synchronized signals from antenna and transmits the signals to clock distribution block.

The GPS/GLONASS block transmits the time and location information to CPU via TOD path. Also, it performs holdover function which provides normal clock for a specific time period if not receiving GPS/GLONASS signal.

IEEE1588v2

The IEEE1588v2 block generates 1PPS, 10 MHz by using the data, which is received from external IEEE1588v2 master and transmits the generated clock to Clock Distribution block. Also, it performs holdover function which provides normal clock for a specific time period if not receiving IEEE1588v2 packet.

SyncE Clock

The SyncE block receives 25 MHz Reference clock from Ethernet and distributes the clock to clock distribution block. The clock distribution block generates System Clock (30.72 MHz), PP2S (Even clock), and System Frame Number (SFN) based on the clock received from GPS/GLONASS, IEEE1588v2, and SyncE Block. In addition, it distributes the clocks to hardware block within system. The clock distribution block provides reference clock (1PPS), which is used in measuring devices and repeater.

Network Interface Function

The L7UA interfaces with EPC via Gigabit Ethernet/Fast Ethernet.

Subscriber Channel Processing Function

The L7UA has the modem that supports LTE standard physical layer. Also, it performs OFDMA/SC-FDMA channel processing and DSP processes RLC/MAC.

The modem modulates the packet data received from the upper processor layer and transmits it to the transceiver.

On the other hand, it demodulates the data received from the transceiver and, converts it into the type defined, for example, as indicated in the specification of physical layer in LTE standard, to transmit it to upper processor.

DAC/ADC Function

In downlink path, a baseband signal is converted into an analog signal through the Digital-to-Analog Converter (DAC). The frequency of those analog signals is up-converted through the modulator. Then, the signals are amplified into high-power RF signals through the power amplifier.

In uplink path, a RF signal is amplified in LNA with low noise and it is down-converted in frequency through the demodulator. These down-converted frequency signals are converted into baseband signals through the Analog-to-Digital Converter (ADC). Then, the converted baseband signal is transmitted to the modem.

2Tx/2Rx MIMO Support

The RF part of L7UA consists of a transceiver and an amplifier. It supports the 2Tx/2Rx RF path for each band.

The maximum output is 5 W/path for the antenna port at outside of the enclosure.

Reset

The operator can perform the remote reset of SOF50 via LSM. The L7UA receives reset order from LSM and then the power is initialized.

Filter (L7FU)

The filter block is band-pass filter unit and supports 2Tx/2Rx RF path for two ports. It suppresses the radiation of unnecessary frequencies outside the bandwidth.

Wi-Fi Block (L7WA)

The major functions of the L7WA are as follows:

- Digital Unit (DU) Interface
- Wi-Fi Channel Supporting
- 2Tx/2Rx MIMO

Digital Unit (DU) Interface

The Wi-Fi board integrates with L7UA within the unit for communication and connects to L7UA through Ethernet transceiver (RGMII to SGMII).

Wi-Fi Channel Supporting

The Wi-Fi-standard physical level is supported. The wireless network environment is created by providing WLAN 802.11 a/b/g/n/ac feature. Also, 2.4 GHz and 5 GHz dual bands can be serviced simultaneously via a wireless interface.

2Tx/2Rx MIMO

The RF part is composed of baseband chipset, AMP, and a filter and supports RF path of 2Tx/2Rx. The maximum output is 200 mW/path based on the antenna port standard of the enclosure exterior.

ANT

LTE Antenna

The integrated antenna that adheres to the front surface of SOF50 is provided as the basics. External antenna connection is also possible. Two paths are supported for transmitting and receiving RF signals.

Wi-Fi Antenna

The integrated antenna that adheres to the front surface of SOF50 is provided as the basics. External antenna connection is also possible. Wi-Fi antenna is a dual band antenna that operates at 2.4 GHz and 5 GHz. Two paths are supported for transmitting and receiving RF signals.

AC/DC (L7SA)

The L7SA is a customized AC/DC converter.

Specifications

Table 1. General Specifications

Item	Specification	
Air Specification	LTE FDD	802.11 a/b/g/n/ac
Operating Frequency (MHz)	1.8 GHz (Band 3) • DL: 1,805~1,880 • UL: 1,710~1,785	2.4 GHz, 5 GHz (Dual)
RF Chain	2Tx/2Rx	2Tx/2Rx per band
Output Power	5 W/path	200 mW/path
Capacity	1 Carrier Omni	-
Backhaul	Copper GE 1 port & Optic GE 1 port	
Clock solution	GPS/GLONASS, IEEE1588v2, SyncE	-
Holdover	8 h for GPS/GLONASS	-
Input Power (VAC)	220/230	
Size (W x D x H, mm)	<ul style="list-style-type: none"> Without cosmetic cover: 230 x 74 x 410 With cosmetic cover: 245.5 x 105.5 x 413 	
Volume /Weight	<ul style="list-style-type: none"> Volume <ul style="list-style-type: none"> Without cosmetic cover: Max 6.98 Liter With cosmetic cover: Max 10.66 Liter Weight <ul style="list-style-type: none"> Without cosmetic cover: Under 8 kg With cosmetic cover: Under 9 kg 	
Cooling	Convection cooling	
Operating Temperature (°C)	<ul style="list-style-type: none"> Without solar radiation: -40~50 With solar radiation <ul style="list-style-type: none"> Gray cosmetic cover: -40~45 Black cosmetic cover: -40~40 Cold start: -30 	
Operating Humidity	5~100 Condensing, not to exceed 30 g/m ³ absolute humidity	
Earthquake	Telcordia GR-63-CORE, Section 4.4, Earthquake Zone4	
Vibration	Telcordia GR-63-CORE <ul style="list-style-type: none"> Office Vibration Transportation Vibration 	
Noise (sound pressure level)	Max. 60 dBA at distance of 1.0 m and height of 1.0 m	
EMC	EN 301 489-1, EN 301 489-17, EN 301 489-23	
Safety	EN 60950-1, EN 60950-22	

External Interface

The following figure shows an external interface of SOF50:

Figure 4: External Interface of SOF50 (External Antenna Type)

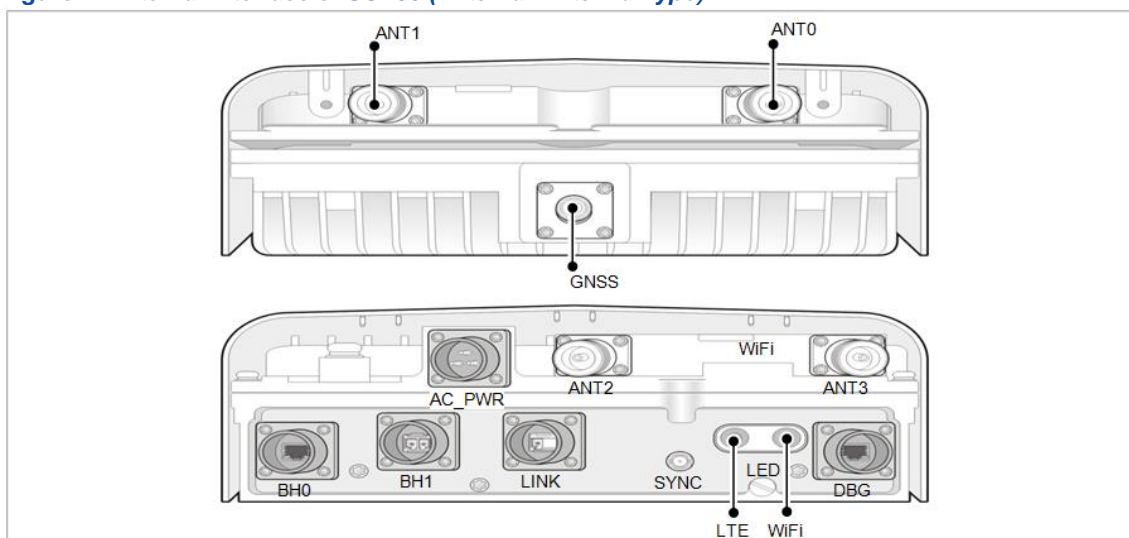
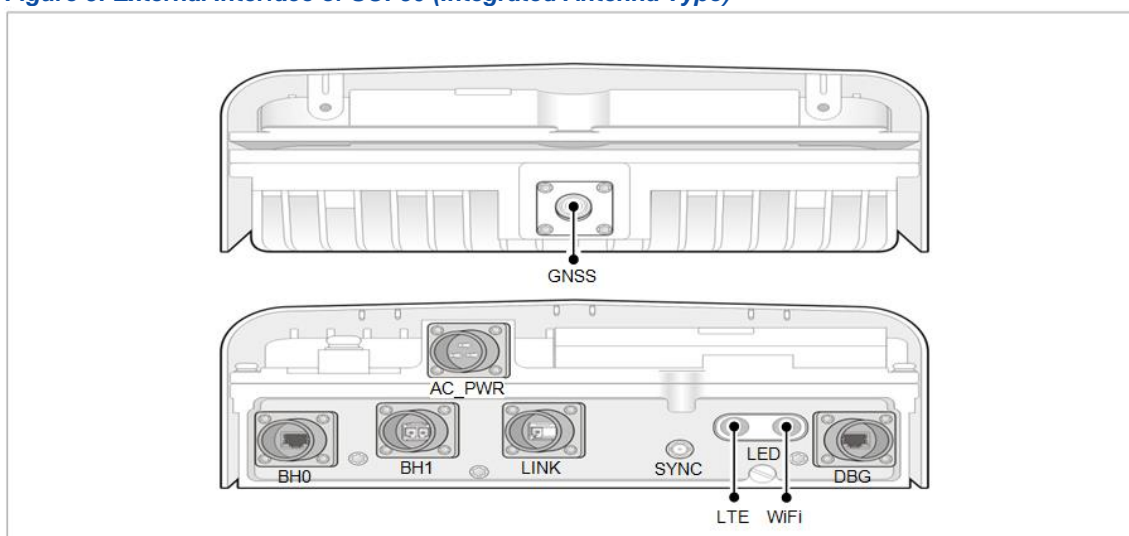


Figure 5: External Interface of SOF50 (Integrated Antenna Type)



LED Information

LED (LTE)

		Description
	Red ON	• Board initialization

		Description
		<ul style="list-style-type: none"> Critical alarm or backhaul link down detected
	Amber Blinking (Fast)	Software download state (blinking period: 200 ms)
	Amber Blinking (Slow)	System registration state (blinking period: 1000 ms)
	Amber ON	Booting completion
	Green ON	Software activation state
	Green Blinking	Normal operation
	Red Blinking (Fast)	Firmware fusing state (blinking period: 200 ms)
	Red Blinking (Slow)	Major/minor alarm is detected.
	LED OFF	No power supply

LED (WIFI)

Status		Description
	Red ON	<ul style="list-style-type: none"> Board initialization Booting fail
	Amber ON	Booting is in progress
	Amber Blinking (Slow)	Connecting to APC (blinking period: 1000 ms)
	Amber Blinking (Fast)	Provisioning state (blinking period: 200 ms)
	Green Blinking (Fast)	Normal operation
	Red Blinking (Fast)	Firmware fusing state (blinking period: 200 ms)
	Red Blinking (Slow)	Network alarm is detected (blinking period: 1000 ms)
	Red and Amber Blinking	Fail to connect to APC
	LED OFF	No power supply

Port Information

ANT0, ANT1

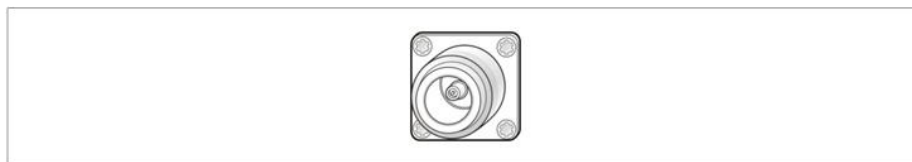
- N-type Connector
- Main RF input/output port for Path #0 and Path #1



ANT2, ANT3

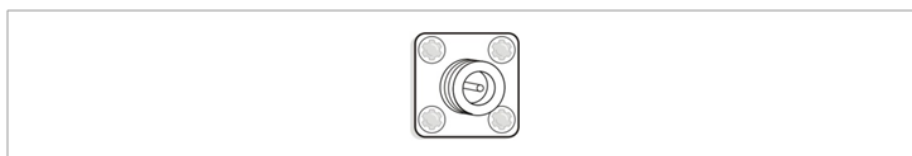
- N-type Connector

- Wi-Fi RF input/output port for Path #2 and Path #3



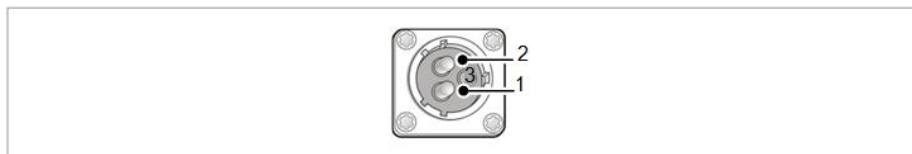
GNSS

- TNC Connector
- GPS/GLONASS antenna interface



AC_PWR

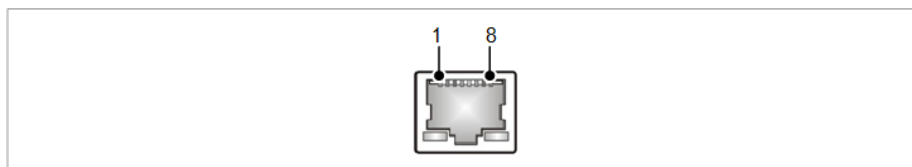
- Bayonet type connector
- AC Power input (220/230 V AC)



Pin No.	Description
1	AC-L
2	AC-N
3	AC-PE (FGND)

BHO

- RJ-45, 8 Pin
- Gigabit Ethernet port supporting 10/100/1000 Base-T
- Ethernet port for backhauling

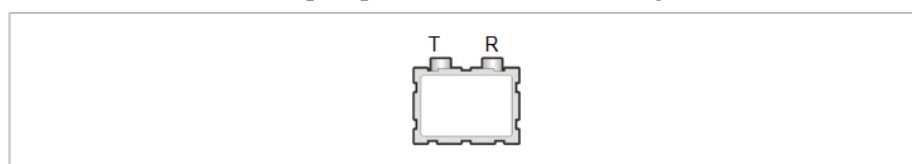


Pin No.	Description
1	Gigabit Ethernet Tx/Rx0+

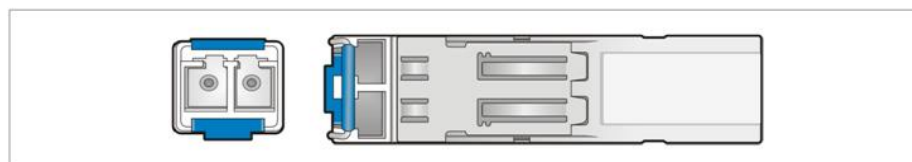
Pin No.	Description
2	Gigabit Ethernet Tx/Rx0-
3	Gigabit Ethernet Tx/Rx1+
4	Gigabit Ethernet Tx/Rx2+
5	Gigabit Ethernet Tx/Rx2-
6	Gigabit Ethernet Tx/Rx1-
7	Gigabit Ethernet Tx/Rx3+
8	Gigabit Ethernet Tx/Rx3-

BH1

- Small Form factor Pluggable (SFP)
- A connector for 1 Gbps Optical Ethernet interfacing



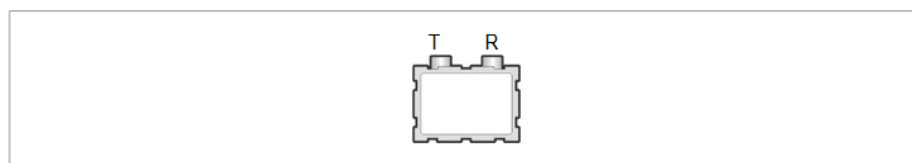
The following optical module can be inserted to this connector for use.



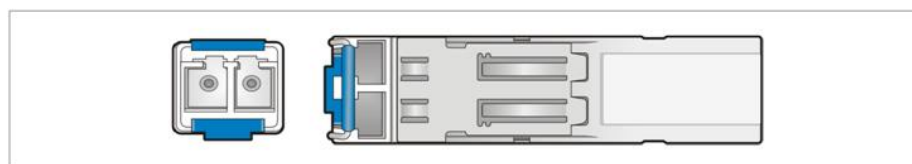
If BH 1 is optical module, operator should not directly look into the optical module from card's front side as a caution for eye protection.

LINK

- Small Form factor Pluggable (SFP)
- A connector for 5 Gbps Optical CPRI or SRIO interfacing



The following optic module can be inserted to this connector for use.



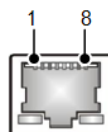
SYNC

- 1PPS, 10 MHz, and TDD Clock
- Used as a measuring device for test.



DBG

- RJ-45, 8 Pin
- As UART signals, used for debugging
- Debug (RS-232) port support



Pin No.	Description
1	NC
2	NC
3	NC
4	Ground
5	ETH MODEL SEL
6	NC
7	RS-232 Tx
8	RS-232 Rx

Acronyms

CPRI	Common Public Radio Interface
EMI	Electromagnetic Interference
EPC	Evolved Packet Core
GNSS	Global Navigation Satellite System
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System
L7FA	LTE 7 Frontend board Assembly
L7SA	LTE 7 power Supply Assembly
L7UA	LTE 7 baseband and transceiver Unified board Assembly
L7WA	LTE 7 Wi-Fi AP module Assembly
LSM	LTE System Manager
LTE	Long Term Evolution
OFDMA	Orthogonal Frequency Division Multiple Access
SFN	System Frame Number
SFP	Small Form factor Pluggable
SOF	Smallcell Outdoor FDD
SYNC	Synchronization
UART	Universal Asynchronous Receiver/Transmitter
UDE	User Defined Ethernet



Samsung SOF50
Product Specification

Document Version 3.0

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