Wireless Fronthaul Technology

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FrontLink™5 8 USER MANUAL

Description/Content

This document describes the FL58.

HISTORICAL OF MODIFICATIONS

VERSION	CHAPTER/PAGE	NATURE OF MODIFICATIONS	APPLICATION DATE
0.01	ALL	CREATION	2013-11-29
0.02	§4	Modification	2015-05-06

Table of Contents

Warning!
Read and follow all warnings notices and instructions marked on the product or included in the documentation.

Warning!
Only use attachments and accessories specified and/or sold by the manufacturer.

Warning!

Refer all servicing to qualified service personnel. Servicing is required when the device has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled, or objects have fallen into the device, the device has been exposed to rain or moisture, does not operate normally, or has been dropped.

Warning!

Do not open the chassis. There are no user-serviceable parts inside. Opening the chassis will void the warranty unless performed by an EBlink service center or licensed facility.

1. General Information

1.1. Purpose of Document

This manual is intended for all installation and service personnel involved in Operation and Maintenance of the FrontLink 58 (FL58) system. This information covered in this manual should be fully understood prior to installation.

The FrontLink 58 wireless fronthaul system has been designed for ease of installation and maximum performance. This manual describes the physical installation process recommended for achieving optimal performance.

1.2. Scope Of Document

This document is applicable to the FL58-45 and FL58-60 products.

The information contained in this document is subject to change without notice. EBlink shall not be liable for errors contained herein or for incidental or consequential damage in connection with the furnishing, performance, or use of this document or equipment supplied with it.

Any changes or modifications of equipment not expressly approved by the manufacturer could void the user's authority to operate the equipment and the warranty for such equipment.

1.1. Related documents

This paragraph lists the document related to this one, referenced or not.

Reference	Document
Ref [1]:	
Ref [2]:	

2. General Product description

EBlink's compact all-in-one outdoor Wireless Fronthaul unit provides a wireless connection between the base station processing element (BBU) and the remote radio heads (RRU). It offers a practical and economical alternative to the optical fiber generally used to connect the BBU and the RRU.

2.1. Compliance with the standard environmental conditions

The FL58 product is compliant with the European directive 2002/95/EC concerning the restriction of the use of certain hazardous substances in electrical and electronic equipment (**RoHS**). Additionally, EBlink approach to product design is to make our products more environmentally efficient and friendly. Like any product in the E-Blink portfolio, the FL58 is designed to be integrated in any environment without visual and health impacts. E-Blink takes environnemental issues into account.

2.2. CE marking and FCC

EBlink declares that FL58 products are in compliance with the essential requirements and other relevant provisions of Directive: 1999/5/EC[1] and FCC.

WARNING TO USERS IN THE UNITED STATES

Federal Communication Commission Interference Statement 47 CFR Section 15.105(b)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The device *FL58-45* complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

[1] E-Blink refers to Harmonized Standard, relying on the R&TTE Directive 1999/5/EC where according to its interpretation of Annex III, when a Harmonized Standard contains the essential radio test suites, a manufacturer, which chooses to use them does not need to affix a notified body number on the equipment CE mark.

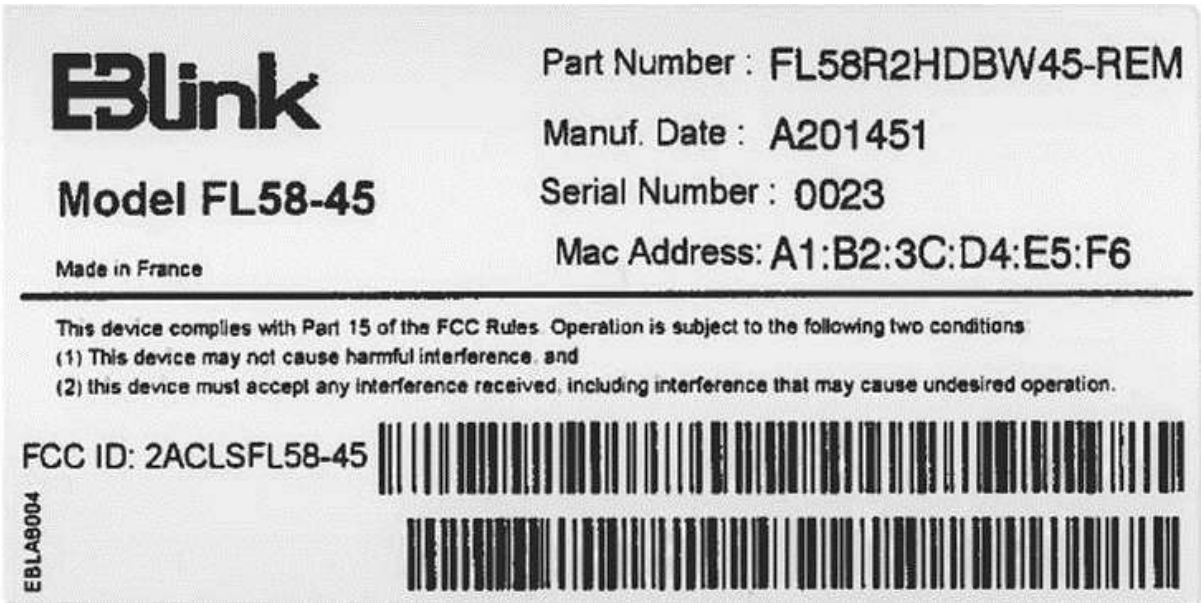
NO UNAUTHORIZED MODIFICATIONS

47 CFR Section 15.21

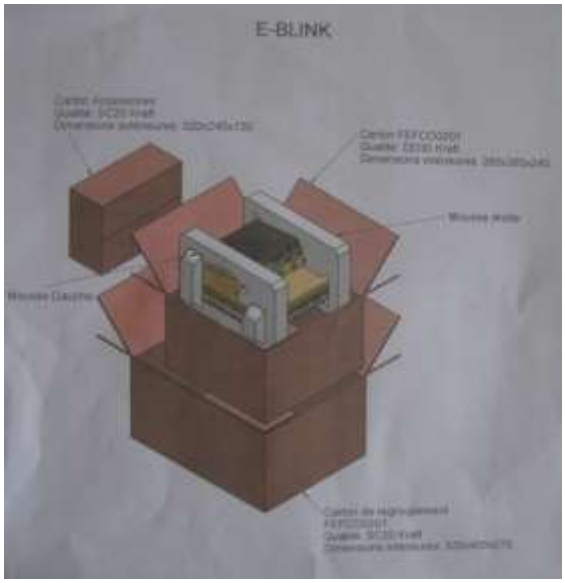
CAUTION: This equipment may not be modified, altered, or changed in any way without signed written permission from *EBlink*. Unauthorized modification may void the equipment authorization from the FCC and will void the *EBlink* warranty.

This device complies with FCC RF radiation exposure limits set forth for general population (uncontrolled exposure). This device must be installed to provide a separation **distance of at least 50cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.**

Example Labelling FCC :



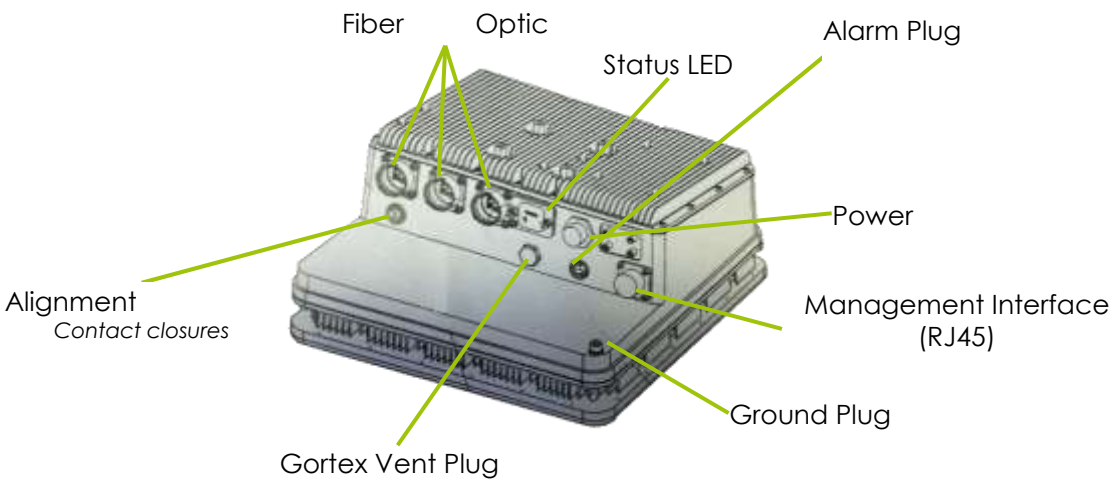
3. Prerequisites

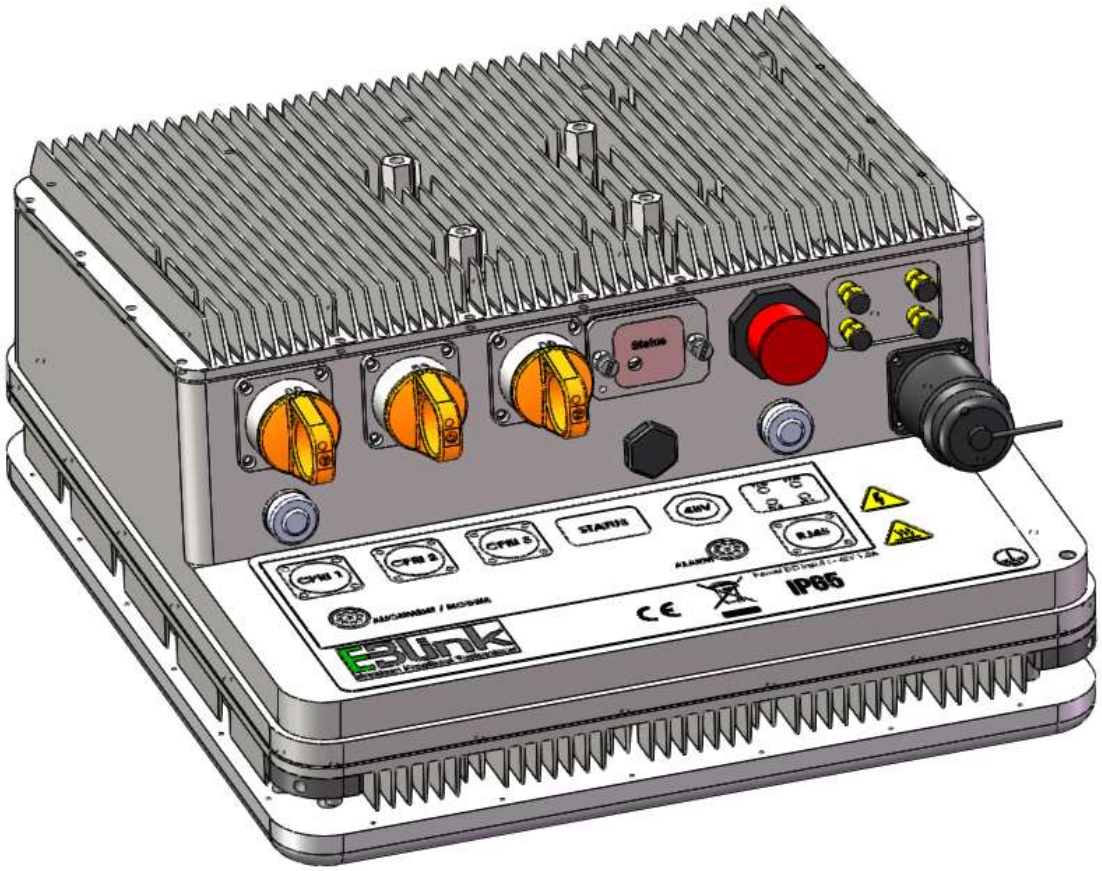


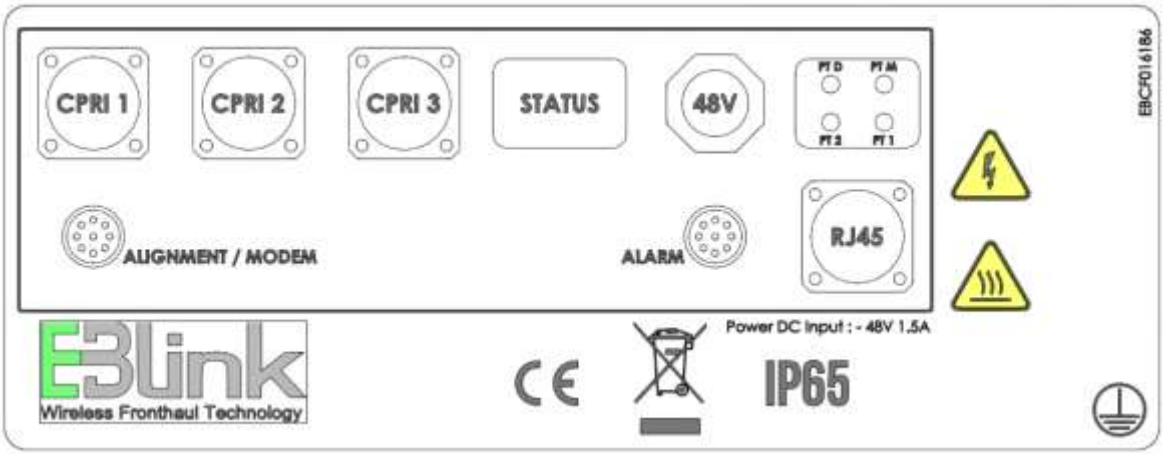
Before the actual installation and alignment, the following should be checked and supplied:

- Examine the shipping packaging and all products and components. Any damage should be reported to the shipper immediately.
- Check the items received in the FL58 packaging against the packing list to ensure all equipment and components are included. Report any exceptions to EBlink immediately.
- Mounting support (masts, etc.) for the FL58 must be engineered and built to support the weight and wind loading of the FL58 under the weather conditions expected for the area. A mounting bracket to attach the FL58 to the mounting equipment is provided by EBlink.
- The weight of each WFM module is around and less than 10kgs (22 lbs).
- Outdoor rated, UV protected Fiber Optic cables shall be used between each of the FrontLink™ 58 units and the BBU or RRH.
- Power cables as well as a -48VDC power supply capable of at least 60W must be available for each FL58. The DC plug adaptor is provided by EBlink.
- The FrontLink™ 58 is designed to interwork with most standard optical transceivers. The proper transceiver type must therefore be provided to match the ones used at the BBU and RRH.
- Proper grounding must be provided for each FrontLink™ 58 unit.
- The standard tools listed below must be available for installation.

4. WFM Component and Description







Interface type	Description
Gortex Vent Plug	Not user serviceable part allows for proper venting of the equipment while maintaining proper IP rating
Ground lug	Provides for connection to grounding
Management Interface	An RJ45 connection to management during Installation
Power Plug	Provides connection to -48VDC supply
Status LED	A single, multi-colored LED provides assurance the unit is powered as well as significant information about the system status.
Fiber Optic Input CPRI	Three fiber optic ports allow for access to SFP modules without requiring internal access.
Alarm plug	External access to contact closures. Dry-relay contact interface
Alignment	External access to contact Alignment system
Power Physical & Environmental	
Input Voltage	-48VDC +/- 10%
Power consumption	50W typical per module
Operating T°	-40°C to +55°C
Humidity	5 to 95% non-condensing
Altitude	Must be conformed to T° + Humidity

4.1. Labelling

The modules will have labels, containing the following information:

- Serial N°
- HW Reference :
  - Central/Remote (name ending by "REM" or "CEN")
  - 45MHz or 60MHz B/W
- MAC@
- FCC ID

4.2. External connectors

The following connectors are required for external usage, i.e. accessible by the customer:

- 1 Power connection
- 1 Ground point
- Up to 3 CPRI connections for BBU or RRH
- 1 Ethernet connection for Installation
- 1 External connector for Alignment during installation
- 1 Connector for external alarm Optionnal
- 1 LED for visual status monitoring

5. Installing the site

This chapter describes the physical installation and commissioning of the FL58 Fronthaul outdoor units, including environmental requirements, installation site, package contents or others requirements.

5.1. Preparing the site

Carefully select and prepare each FL58 site to make device installation and configuration as simple and trouble-free as possible. A proper site survey should be conducted prior to installation to verify that all aspects of installation and alignment are met.

During site selection and preparation, always consider the long term needs of both your network and your application.

This preparation must include:

- Evaluating the most appropriate location for the installation of the Module.
- Identifying an appropriate mounting structure (wall or mast) for each Module.
- Planning the cable routing from the network component to the Module.

5.2. Physical and environmental requirements

To insure a clear line of sight, there must be no obstruction between the two FL58 locations.

5.2.1. FL58 WFM Central & Remote location

When selecting the best location the following factors should be considered:

- Accessibility
- Type of mounting (e.g. wall or pole)
- Grounding connection point
- Power -48V DC
- Cable runs
- Line of sight

5.3. Unpacking the FL58

Please use proper care to avoid damages to the antenna radomes when unpacking the FL58 units:

- Do not touch the radome,
- Do not rest the radome facedown.
- It is important and crucial to prevent contact between the Radom and other objects.

5.3.1. Packaging list and contents

The FL58 shipping box must be left intact until the arrival at the installation site. Examine all FL58 package contents carefully upon arrival. Carefully unpack the Product, check for transportation damage or missing parts.

If a component is missing or damaged, contact your Distributor before attempting to install the equipment.

The FL58 system consists of 2 modules: each module contains the items, grouped in boxes as listed in the table below.

The boxes contain the following:

- WFM Central
- WFM Remote
- Pole Clamps, fixing and accessory kit (Option)
- Alignment tools (Option)
- Fiber connector (Option)
- Solar protection (Option)

Note: Fiber transceivers shall be provided separately to match the type used for both BBU and RRHs (Not provided by EBlink)

When the FL58 is shipped as link, it is composed of two boxes with one module each:

- The central FL58 wireless module that connects to the BBU
- The remote unitFL58 that connects to the RRH.

The type of each units is clearly marked for identification. Each module is shipped in its own package with different accessories.

5.3.2. Modules

Each module is a compact all outdoor unit combining antenna, transceiver and interfaces. The FL58 central module may be connected to the network via a standard Cat 5e Ethernet cable with RJ-45 connectors. Connection to the BBU (central FL58) and RRU(s) (remote FL58) is done via fiber optic.

5.3.3. Mounting preparation

It is important to install the Module on the bracket with the same bracket with the same antenna polarization at both ends of the link. The modules must be mounted on the bracket in such a way that the polarization arrows point in the same direction.

5.4. Provided by Installer

- Green cable and screw:

Green & yellow cable (16 mm2) and screw (6M) are provided by installer.

- Power cable:

The following table provides recommendations on the cable diameter, depending on the distance between the bay and the energy EBlink module. It is mandatory to use a 2-core cable with a diameter of each conductor is 2.5mm² (or 4 x 2.5mm²).

Distance	Conductor diameter
10-60m	2x2,5mm²
60-100m	2x4mm²

- RJ45 Cable:
  - Length depend on site environment
  - Straight Through
- Cable and Connector for external alarm – dry relay contacts

- See chapter:
- Optic Fiber
  - See chapter:
  - Monomode, multimode,
- Optical Transceivers
  - Same as BBU and also used for RRU
- Installation tools
- Voltmeter

5.5. Required kits

In addition to the FL58 units, several kits are required to install the FL58 system:

- Power Connector Kit (Available)
- Optical Connector kit (Option for 2 and 3 CPRI)
- Mounting kit (Option)
- RJ45

5.5.1. Power Connector Kit

Contents of the power connector kit :

- 1 Power connector head (connects to the wires & power pins)
- 1 Body
- 1 Compression nut shell which compresses the glans and makes the plug water tight. **(the kit also contains a small rubber gasket intended for smaller wire cables – not recommended)**

5.5.2. Optical Connector Kit

Optic fiber cable and "Transceiver SFP" module will be provided by installer.

Warning!
Take care to connect correctly Rx and Tx from BBU/RRH to WFM
Rx from BBU or RRH will be connected to Rx WFM
Tx from BBU or RRH will be connected to Tx WFM

5.6. Mounting preparation

Both Wireless FrontLink™ 58 modules need to be installed such that the antennas polarization is the same at both ends of the link. The modules must be mounted on the bracket in such a way that the polarization arrows point in the same direction.

5.6.1. Preparing for installation

Each FL58 WFM site should adhere to the following requirements:

- There must be a clear, unobstructed line-of-sight between FL58 units (first Fresnel zone clearing).
- Each FL58 unit must be mounted on a fixed, stable, permanent structure. A reinforced steel mounting pole is required, with a diameter measuring from 30 to 60 mm.

Caution: Do not mount the WFM device on a structure that is temporary or easily moved. Doing so may result in poor service or equipment damage. The WFM should be mounted on a secure site with secure access.

5.7. Mounting the FrontLink™ 58 on the Mast

The mast bracket is used to mount the bracket onto a mast. The bracket is suitable for any pole diameter from 30 mm to 60 mm (1"1/4 to 2"). It is capable of coarse and fine alignment.

5.8. Connecting the cables

5.8.1. Cabling requirements

- Ensure that the power connection cable matches the FL58 power connector pin-outs.
- Install the FL58 where network connections (for the central unit) and optional power cabling are ready for operation and easily accessible.
- Use a 2-wire cable (14-18 AWG) to connect the power supply to the WFM.
- Outdoor-rated Cat5e cables terminated with RJ45 connectors should be used. Shielded cables and connectors should be used.
- Install the FL58 in a location where proper electrical outdoor grounding is readily available.

Note: Improper electrical grounding can result in excessive electromagnetic interference or electrical discharge. EBlink will not be held responsible for any malfunction or damage in the event that the WFM is not properly grounded.

5.8.2. General grounding information

Step	Description
1	Prepare a 10 AWG or thicker wire with an IEC Standard Cable Lug and insure you have all of the components shown below:  
2	Connect the lug to the FrontLink™ 58 system as shown below 
3	Properly attach the other end of the ground cable to the grounding system of the building or tower.

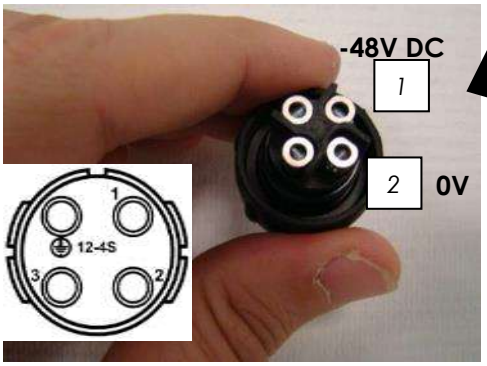
5.8.3. Steps to Connect the Weatherproof Power Cord Plug

The DC power input range of the WFM is 36 ÷ 75 VDC. The DC supply should be limited to 1.5 Ampere to avoid surges and possible damage to the WFM. For that, limited power supply or circuit breaker should be used.
When connecting the WFM to a MAINS DC distribution system, 1.5 Ampere circuit breaker should be used to enable the central DC system to isolate the WFM in an emergency case.

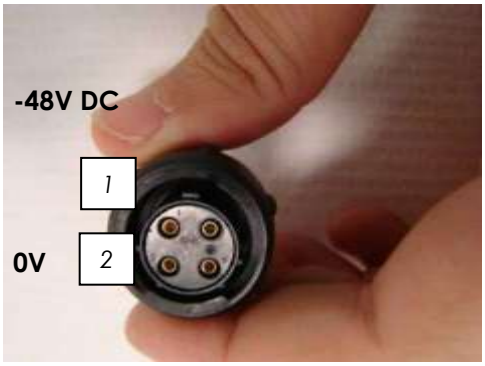
The DC input is floating, so either (+) or (-) can be connected to the GND on the power supply side. For the sake of consistency with other systems, EBlink recommends that you connect the (+) to the GND.
Use a 2-wire cable (14-18 AWG) to connect the power supply to the WFM. On the WFM DC Module, connect only the (+) and (-) wires. Do not connect to the WFM's GND input.

Item	Description
1	Appropriate length of two wire cable
2	Power Plug kit (provided by EBlink)
3	Electrician's knife appropriate for stripping cables
4	Flat blade screwdriver with 2mm blade

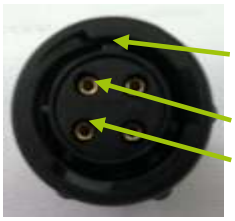
Pin out



Module BBU/RRU -48V



Module BBU/RRU -48V

Step	Description
1	**Prepare the power cable** ▪ Prepare the cable by stripping 1 cm of the outer protective coat, exposing the two internal wires. ▪ Strip the ends of the two internal wires exposing 4mm of bare wire.  Inner cable with protected outer covering stripped 4mm to expose bare Two-stranded cable with uV protected outer covering
2	**Thread the wire through the components**  Insert the components of the kit over the wire as shown in the picture
3	**Connect the wires to the plug**  Connect the wires to the plug as shown above
4	**Temporarily attach to WFM**  Temporarily attach the plug head to the wireless fronthaul module
5	**Hand tighten the components**  ▪ Hand tighten the main body ▪ Hand tighten the end connector to the main body
6	**Remove from Wireless Fronthaul Module** The process is now complete

5.9. CPRI connection

The WFM could use up to 3 CPRI connections. Each connection is similar to one another. Details in CPRI connectors and associated weatherproofing solution can be found below.

5.9.1. Required Items

No additional tools are required, only the kit supplied by EBlink.

REP	COMPONENT
1	Nut Spiral
2	Thigtening cone
3	Elastic Shell
4	Split gasket
5	Coupling nut & spring
6	LC support
7	Plug body
8	Protection cap
Do not use -6-	

5.9.2. Assembly Steps

See appendix below

5.10. Aligning the antenna

The FrontLink 58 features quick and easy antenna alignment for fast and cost effective installation. Antenna alignment does not require any external alignment tools: a first, coarse alignment is performed visually, followed by fine tuning using the system's integrated tools.

The WFM antenna must be aligned on both central and remote WFMs. Visual alignment is first performed for each WFM, followed by fine alignment.

5.10.1. Alignment/Modem connector

Connection of an external system will be possible for Product alignment, typically a voltmeter. This connector is also used to connect the buzzer.

In order to ease monitoring, a modem option will be provided. An Outdoor housing will integrate a modem function. The modem function will allow to interact with the FL58 via SMS. It will send/receive commands to/from the FL58 using a serial line accessible on the modem connector. It will be powered by the modem connector as well.

5.10.2. Output alarms

Output alarms will be accessible via a dry relay mechanism, and a special electrical connector. The connector should allow up to 12 points for an output alarms.

5.10.3. Status LED

The following information can be deduced by looking to the RGB LED status on a working FL58 Module/system. The LED status is written here starting by the highest priority and ending by the lowest priority:

WFM Status	LED status					
	Red Stable	Blue Blinking Slowly	Blue Blinking Rapidly	Blue Stable	Green Blinking Slowly	Green stable
WFM not powered	Off					
WFM up & running SW download in progess		X				
WFM up & running Loopback mode activated			X			
Critical HW failure Send to repair center	X					
WFM fully operationnal Not paired with remote / central WFM				X		
WFM fully operationnal Paired with central / remote WFM No CPRI signal synchronisation					X	
WFM fully operationnal Paired with central / remote WFM CPRI signal synchronised						X

5.10.4. Performing the alignment

5.10.4.1. Setting the WFM to alignment mode at both end

Setting the WFM to Alignment Mode is performed automatically using the Data Volt Meter (DVM).
To verify that the WFM is in Alignment Mode:

- Switch the FL58s to Alignment Mode by inserting the DVM probes into the DVM Probes at Alignment / Modem Interface.
- The WFM will remain in Alignment Mode even if the DVM probes are ejected, until the WFM is locked.
- **Course alignment (Azimuth, Tilt)**
- Loosen the Unit Mounting Bolts slightly in order to allow the WFM some freedom of movement.
- Perform a course WFM alignment using a line-of-sight visual check with the remote FL58. Ideally, this WFM alignment should be accurate within of the final alignment position.

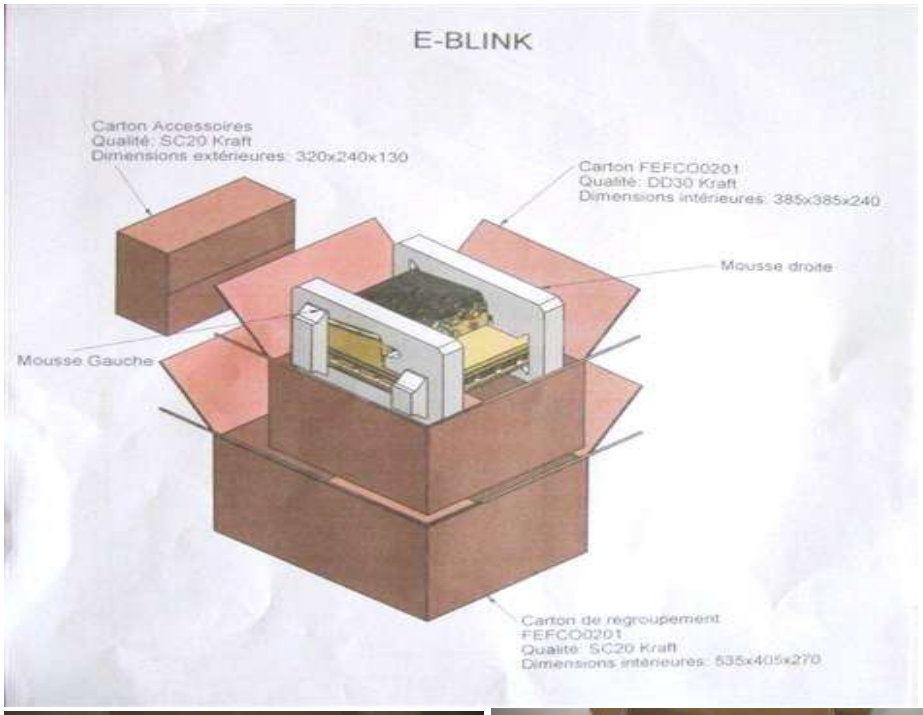
- Lock the Unit Mounting Bolts.

  5.10.4.1.1. Repeat Steps above on the remote WFM.

- Repeat steps x through y for the remote WFM.
- Use the DVM to verify that the received signal strength has not changed on either the local or the remote WFM after final tightening of the brackets.
- Antenna alignment is now complete.

A. Appendix

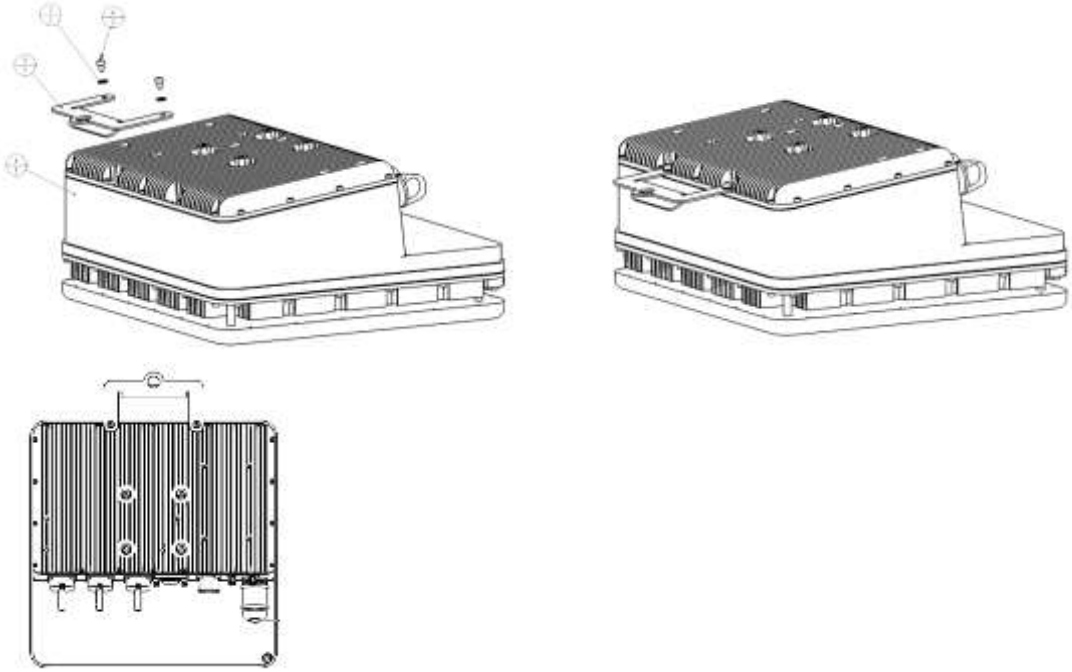
A.1. Packaging



A.2. Handle with hole device

A handle composed of a hole allows the installer to perform the movement of the module from one point to another.

In difficult cases, the installer can use the hole in the handle to lift the FL58 module from a high point or to provide a temporary placement.



FrontLink™ 58 Handle device	
Handle	Qty = 1
Screw	Qty = 2, CHC M4x6
washer	Qty = 2, M4

A.3. Alignment Option

FL58 advantages is the fast, quick, easy alignment procedure. The modules can be coarse aligned optically. Electrical alignment is then used to optimize performance.

The WFM antenna must be aligned on both central and remote WFMs. Visual alignment is first performed for each WFM, followed by fine alignment. Accurate alignment of the WFM is critical for achieving the strongest possible receive signal.

Beyond the usage of the LRMT, two options are proposed to align FL58 links. These options can be useful typically when the link distance becomes significant.

The first possibility is to use a Multimeter. In this case, EBlink proposes a cable allowing to connect a **Multimeter to the FL58** : FrontLink™ 58 Voltmeter cable (reference FL58VLTMCBL).

The other possibility is to use the **Buzzer solution**. The buzzer solution, FrontLink™ 58 Buzzer (reference FL58BZZ), is composed of an external box and its connecting kit to the FL58.

A.3.1. Data Volt Meter Cable for alignment (FL58VLTMCBL)

An aliment could be based on received powered level of each module should be done. Use voltmeter and cable with a female SMA connector.

The special cable is connected to the Voltmeter (DVM) on one side and to the FL58 on the other site (Connection Alignment/Modem Labelling).

A.3.2. Alignment Buzzer Tools (FL58BZZ)

The other possibility is to use the buzzer solution. The buzzer solution, FrontLink™ 58 Buzzer (reference FL58BZZ), is composed of an external box and its own cable to connect with the FL58 (Alignment/Modem Labelling).

A.4. Capacity Option (FL58ACTIVEPORTBR)

As a baseline, the FL58 is provided with one CPRI port activated and with one connecting kit, enabling to connect wirelessly one RRH to the BBU. The optional extension feature (reference FL58ACTIVEPORTBR) enables the activation of one additional CPRI port on the FL58 product and includes one additional connecting kit. Up to 2 additional ports can be activated on the FL58 product (i.e., max number of port equal to three).

A.4.1. CPRI connection

The WFM needs 3 CPRI connections. Each connection is similar to one another.
CPRI signal is carried over fiber, will use optical connector solution.
Details in CPRI connectors and associated weatherproofing solution can be found below.

A.4.2. Prerequisite

Optic fiber cable and "Transceiver SFP" module will be provided by installer.

Warning!
Rx from BBU or RRH will be connected to Rx WFM
Tx from BBU or RRH will be connected to Tx WFM

A.4.3. Required Items

No additional special tools are required, only the kit supplied by EBlink.

REP	COMPONENT
1	Nut Spiral
2	Thigtening cone
3	Elastic Shell
4	Split gasket
5	Coupling nut & spring
6	LC support
7	Plug body
8	Protection cap

Do not use -6-

FrontLink™ 58 capacity Option (FL58ACTIVEPORTBR)	
Connectors	CPRI Optic Fiber
Breakout Length	90 mm
Fiber Type	Single Mode or Multi-mode
Tranceivers	Not provided by EBlink
Weight	Net Weight around =110g, Gross Weight around = 300g

A.5. Alarm Cable Option (FL58ALCAB217)

This cable is not supplied by EBlink. The cable length is dependent on the environment of the site. It will be developed and built by the installer.

A.6. Technical Assistance

Please visit the web site

A.7. Glossary