EBlink®
Wireless Fronthaul Technology

FrontLink™58
INSTALLATION & COMMISSIONING GUIDE

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REVISION HISTORY			
VERSION	CHAPTER/PAGE	NATURE OF MODIFICATIONS	APPLICATION DATE
1.01	ALL	CREATION	2015-04-30
1.02	ALL	ALIGNMENT TO LRMT VERSION	2015-05-15
1.1	ALL	COMMISSIONING PROCEDURE IMPROVEMENTS	2015-07-29
1.2	ALL	MOUNTING KIT BJ removed and improvements	2015-09-14
2.0.0	ALL	EXT ANTENNA ADDED & ALIGNED WITH FW2.0.0	2016-05-27

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> **Warning!**
> Read and follow all warning 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, for example: power-supply cord or plug is damaged, liquid has been spilled, objects have fallen into the device, the device has been exposed to rain or moisture, does not operate normally, or has been dropped.

> **Warning!**
> It is the responsibility of the installer to ensure that when using the outdoor antenna kits in the United States (or where FCC rules apply) only those antennas certified with the product are used. The use of any antenna other than those certified with the product is expressly forbidden by FCC rules 47 CFP part 15.204.

> **Warning!**
> It is the responsibility of the installer to ensure that when configuring the radio in the United States (or where FCC rules apply) Tx power is set according to the values for which the product is certified. The use of Tx power values other than those certified with the product is expressly forbidden by FCC rules 47 CFP part 15.204.

> **Warning!**
> Where outdoor units are configurable by software to Tx power values other than those for which the product is certified, it is the responsibility of the installer to restrict the Tx power to the certified limits.

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

Table of Contents

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. The information covered in this manual should be fully understood prior to installation and commissioning.

The FrontLink 58 wireless fronthaul system has been designed for ease of installation and maximum performance. This manual describes the physical installation and commissioning 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 providing, performance, or use of this document or equipment supplied with it.

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

1.3. Related documents

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

Reference	Document
Ref [1]:EBPLM14-TR8	FL58 Product Description
Ref[2]:EBOP184-101	FL58 Troubleshooting Guide
Ref[3]:EBPLM15-TR12	FL58 LRMT User Guide

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 (RRH). It offers a practical and economical alternative to the optical fiber generally used to connect the BBU and the RRH.
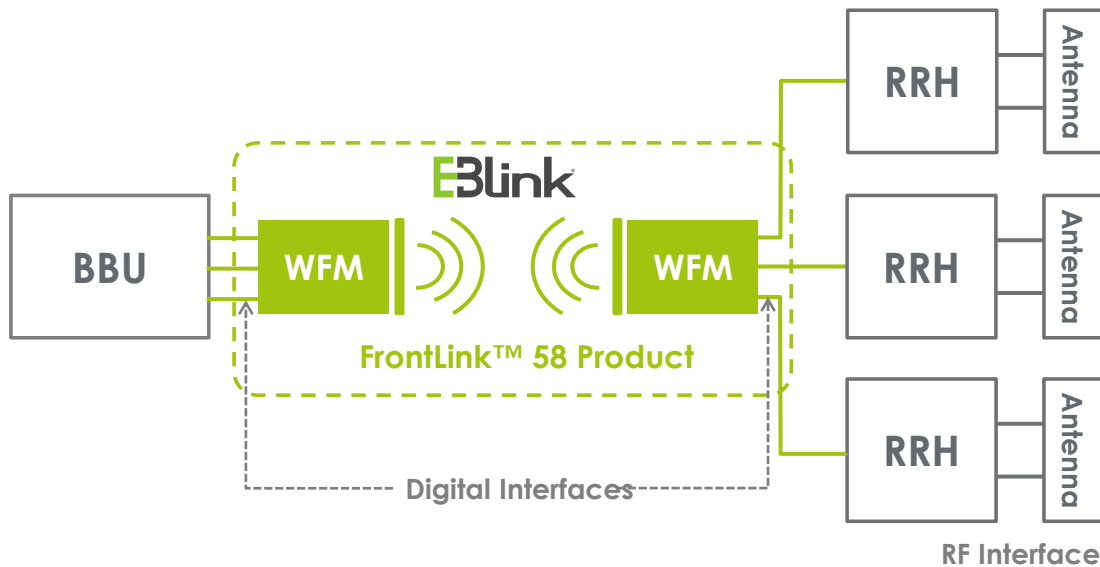
For more detailed information about FL58, refer to the product description manual.

2.1. Compliance with 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**). EBlink's 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 into any environment without negative visual and health impacts. E-Blink takes environmental issues into account **(ETSI300-019-1-4, class 4.1E).**

2.2. CE marking and FCC (In progress for External Antenna)

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

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[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 choosing to use them does not need to affix a notified body number on the equipment CE mark.

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 correcting the interference through one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance (separation) between the equipment and receiver.
- Connect the equipment to an outlet on a different circuit than the one where the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The *FL58-45* device 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.

<div align="center">

NO UNAUTHORIZED MODIFICATIONS
47 CFR Section 15.21

</div>

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 the general population (uncontrolled exposure). This device must be installed to provide a separation distance of at least 80cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

WEEE Directive

In accordance with the WEEE Directive (2002/96/EC), FL58 is marked with the following symbol:

This symbol indicates that the equipment should be collected separately for the purposes of recovery and/or recycling. For information about collection and recycling of EBlink equipment, please contact your local sales office. If you purchased your product via a distributor, please contact the distributor for information regarding collection and recovery/recycling.

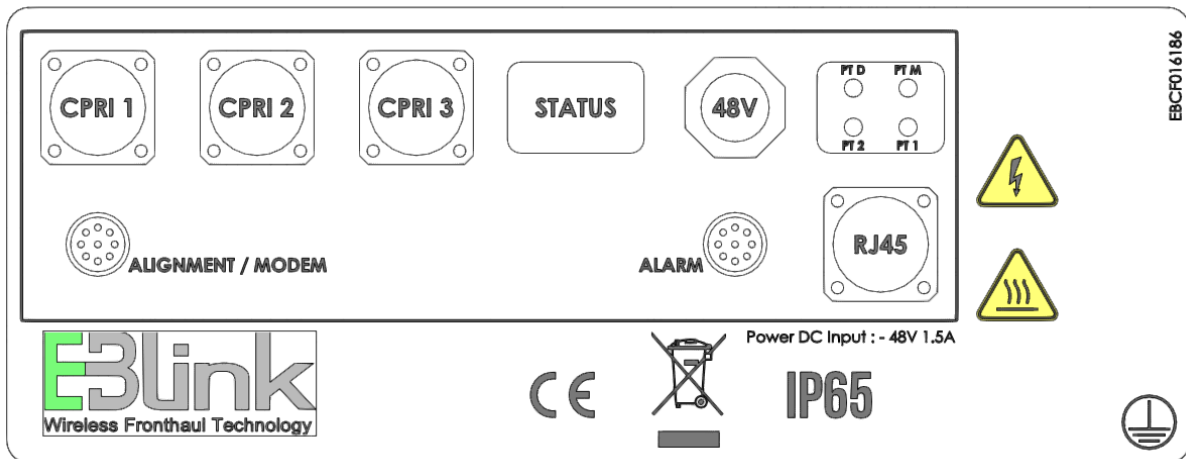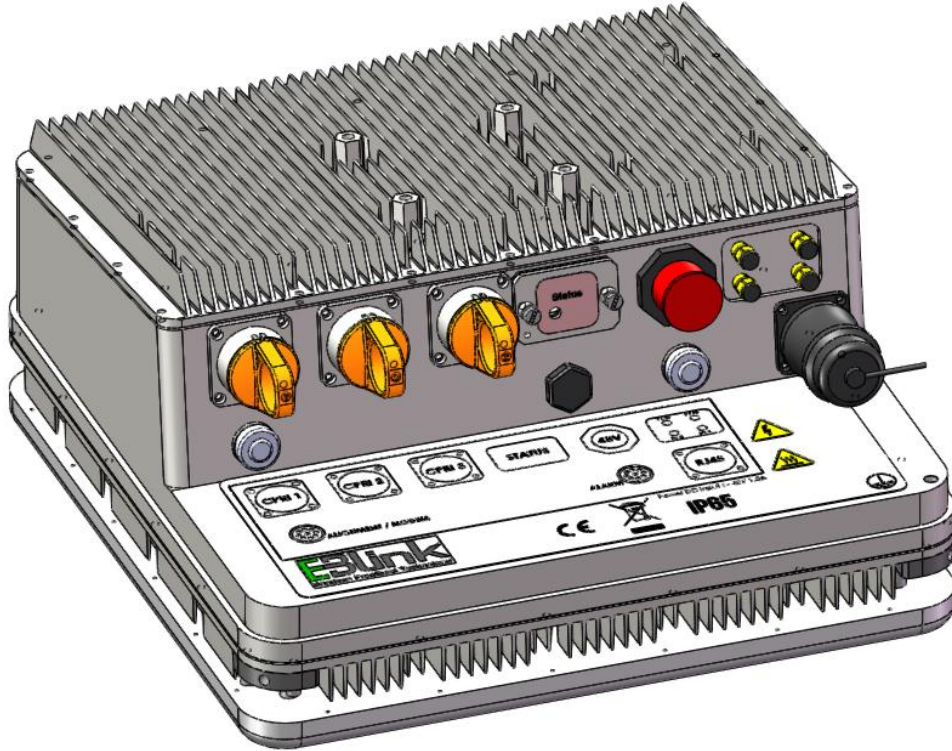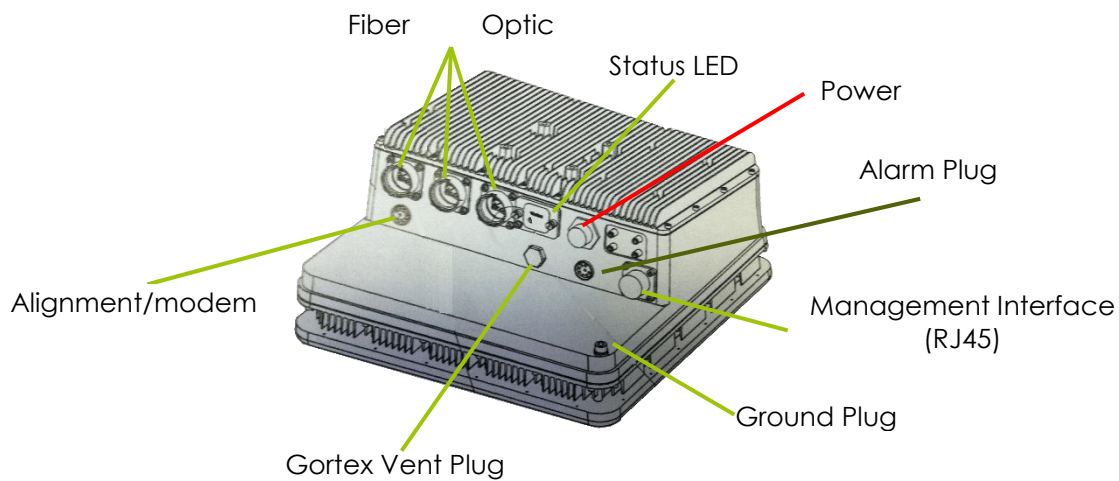(WEEE is the acronym is for Waste Electrical and Electronic Equipment)

3. Prerequisites

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

- Ensure that the contents of the FL58 packaging match 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 approximately but no more than 10kgs (22 lbs).

- Outdoor rated, UV protected Fiber Optic cables must be used between each of the FL58 units and the BBU or RRH.

- Power cables as well as a -48VDC power supply capable of at least 50W must be available for each FL58. The DC plug adaptor is provided by EBlink.

- The FL58 system has to be installed as part of a lightning protection system.

- The FL58 is designed to work 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 FL58 unit.

4. WFM Component and Description

Fiber Optic
Status LED
Power
Alarm Plug
Alignment/modem
Management Interface (RJ45)
Ground Plug
Gortex Vent Plug

Interface type	Description
Gortex Vent Plug	Not user serviceable part, allows for venting of the equipment while maintaining proper IP rating
Ground lug	Provides connection for grounding
Management Interface	An RJ45 connection to management (LRMT)
Power Plug	Provides connection to -48VDC supply
Status LED	A single, multi-colored LED indicates that the unit is powered, and provides 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/Modem	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

Example :
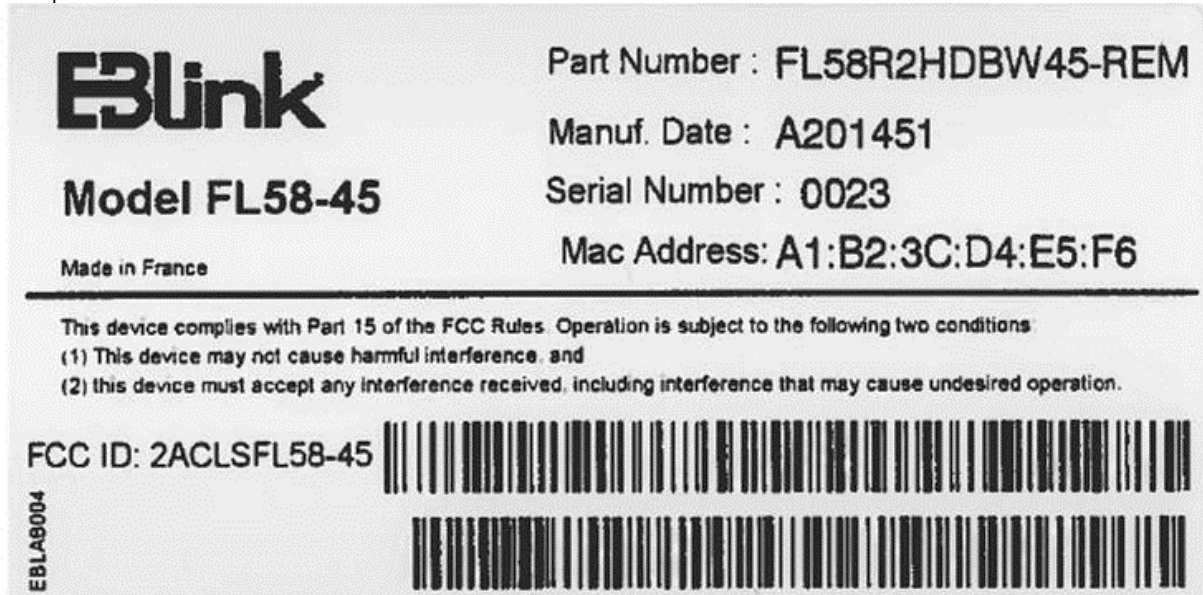
Modules have labels, containing the following information:

- Part Number (HW Reference):
  - Central/Remote (name ending by "CEN" or "REM")
  - HD for Heavy Duty or EA for External Antenna
  - 45MHz or 60MHz B/W
- Serial Number
- Mac Address
- FCC ID (FL58-45 only)

4.2. External connectors

The following connectors are accessible by the customer:
- 1 Power connection
- 1 Ground point
- Up to 3 CPRI connections for BBU or RRH (Optical transceivers)
- 1 Ethernet connection for OAM
- 1 Connector for Alignment/Modem
- 1 Connector for alarm – dry relay contacts
- 1 LED for visual status monitoring
- *(4 Test points for factory use only)*
- *For EA (External Antenna): 2 connectors (QN). V&H polarity.*

4.3. WFM with external antenna

WFM modules can be delivered with 2 external antenna options:
- 30x30 external antenna – the same than the integrated antenna – intended to ease integration in some specific cases
- 60x60 external antenna – with higher gain – intended to be used for longer FL58 radio link distances

The WFM module is slightly modified compared to the integrated antenna case to allow connection to external antennas – see below.
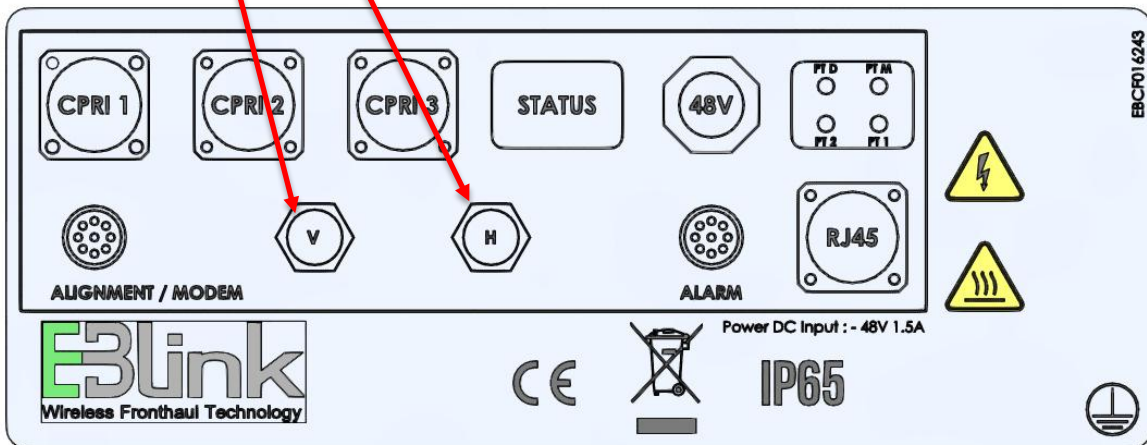
Integrated antenna is replaced by a sunshield – see below

Antenna types can be mixed for a link, i.e. it is possible to install a WFM with 60x60 cm external antenna close to the BBU and a WFM with 30x30 cm external antenna close to the RRH.

External antenna are ordered within kits. These kits composed of what is necessary to be ordered together with the FL58 – external antenna product.
Two antenna kits need to be ordered per product (1 per WFM module).

Ordering codes for FL58 with external antenna kits are:

Configuration	FL58EABW45	FL58EABW60	FL58EAK30	FL58EAK60
RF Antenna Gain EBANT23			24 dBi	
RF Antenna Gain EBANT25				29 dBi
FL58-45 with two 30x30 antennas	1 CEN 1 REM		2	
FL58-45 with one 30x30 antenna and one 60x60 antenna	1 CEN 1 REM		1	1
FL58-45 with two 60x60 antennas	1 CEN 1 REM			2
FL58-60 with two 30x30 antennas		1 CEN 1 REM	2	
FL58-60 with one 30x30 antenna and one 60x60 antenna		1 CEN 1 REM	1	1
FL58-60 with two 60x60 antennas		1 CEN 1 REM		2

5. Installation

This section describes the physical installation of the FL58 outdoor units, including environmental requirements, installation site, package contents and other requirements and the link configuration to perform alignment.

5.1. Preparing the site

Carefully prepare each FL58 site to ensure that device installation and configuration is as simple and trouble-free as possible. A proper site survey should have been 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 are considered:

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

Each FL58 WFM site should meet the following requirements:

- There must be a clear, unobstructed line-of-sight between FL58 units (first Fresnel zone clearance).
- 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 114.5mm.

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.

5.3. Installation Overview

This section provides a basic, step by step guide to the FL58 hardware installation process. Installation can be completed up to antenna alignment.

INSTALLATION STEP
Unpacking the equipment
Checking basic components
Checking accessories
Mounting the WFM module (and the external antenna if any)
Grounding the WFM
Connecting the power cable
Performing link alignment
Connecting Fiber Optic cable (CPRI Input)
Other connections (Management, Alarm)

5.4. Unpacking the FL58

Please use proper care to avoid damage to the antenna radomes when unpacking the FL58 units:
- Do not touch the radome.
- Do not set the radome facedown.
- It is crucial to prevent contact between the radome and other objects.

5.4.1. Packing list and contents

The FL58 shipping box must be left intact until 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 E-Blink, or your distributor before attempting to install the equipment.

The FL58 system consists of 2 modules. Each module contains the following items, grouped in boxes:
- WFM Central with accessories(1x power connector, 1x CPRI connector, 1x RJ45 connector, 2 meter of yellow/green ground cable 16mm^2 and lug M6/16mm^2)
- WFM Remote with accessories(1x power connector, 1x CPRI connector, 1x RJ45 connector, 2 meter of yellow/green ground cable 16mm^2 and lug M6/16mm^2)
- Pole Clamps, fixing and accessory kit (optional)
- Alignment tools (for DVM connection) (optional)
- Fiber connector (Option for additional CPRI connection)
- Alarm connection (optional)
- For EA Modules : Optional external antenna Kit (FL58EAK60 or FL58EAK30)

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

When the FL58 is shipped as a link, it is composed of two boxes with one module each:
- The central FL58 wireless module that connects to the BBU.
- The remote unit FL58 that connects to the RRH.

The type of each units is clearly marked on FL58 label for identification.

5.5. Accessories provided by Installer

Following site survey, the installer provides the following accessories and cables with appropriate length.

Accessories and cables provided by installer (Outdoor use)	
Grounding	Green & yellow cable (16 mm^2) for length exceeding 2 meters
Power cable	2-core cables with each conductor a minimum diameter of: 10 to 60meters – 2x1.5mm^2 (AWG 16) 60 to 100meters – 2x 2.5mm^2 (AWG 13)
Optical cable	Monomode or Multimode (site specific)
Optical transceiver	Compatible with BBU and RRH transceivers
Ethernet cable	Ethernet Outdoor CAT5 straight through cable
Alarm cable	2 pairs alarm cable
Installation tools	See detailed list below
Voltmeter	For link alignment

> **Warning!**
> **All installation tools need to be metric and not US sized.** Note that use of incorrect tools during FL58 installation may lead to damage not covered by E-Blink warranty.

Recommended Installer tool list	
General	▪ Standard open-end 13 millimeter (½-inch) wrench ▪ Cable ties ▪ Cutter ▪ Cable labelling ▪ 1 x 0.016 inch flat blade screwdriver (2mm) ▪ 2 x ½ inch socket or combination wrench (13mm) ▪ 2 x 10 mm socket or combination wrench ▪ Set of ALLEN key
For power connection	▪ Stripper (wire 1.5-2.5mm2) ▪ Cutter ▪ Electrician knife ▪ Flat screwdriver 2mm or 2.5mm
For grounding	▪ 1x 10mm wrench with one eye lug for 6mm cable 16mm²
For optical fiber	▪ 1 x 2.5mm ALLEN wrench
For pole mounting and alignment:	▪ 1x 10 mm wrench (bracket screws) ▪ 1x 13mm wrench (alignment) ▪ 1 socket wrench 13mm (alignment)

5.6. Mounting the WFM on the mast

The FL58 can be installed on poles or walls using the FL58 Mounting kit (reference FL58MOUNTKITJC) provided by EBlink. The connecting kit is attached, to a wall or pole on one side, and to the FL58 (or the external antenna) on the other side.

5.6.1. Mounting kit (FL58MOUNTKITJC)
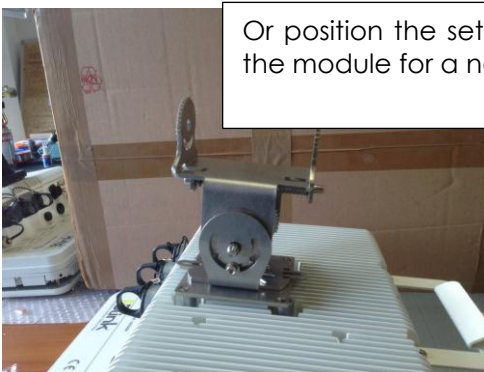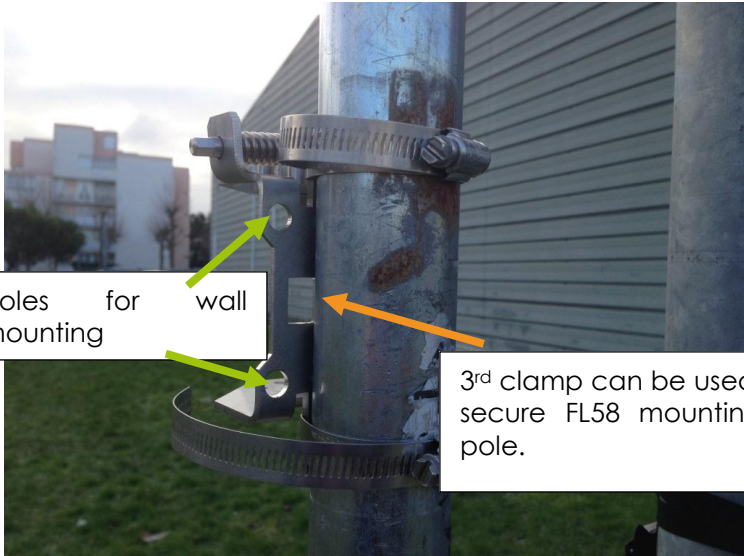
FrontLink™ 58 Mounting kit Option (FL58MOUNTKITJC)	
Mast Diameter	30 to 114.5 m mm (1 1/4 to 4.5 inch)
Mast Clamp	Metal
Articulation	Metal
Adjustment axis	Horizontal (Azimuth) Vertical (Tilt) Rotational (Polarity)
Weight	Net Weight approx =1250g, Gross Weight approx = 1450g

FL58MOUNTKITJC, Mounting kit Items:

1 x module side assembly	
1 x mast side assembly	
4 x screws CHC 4X16	
2 x metal clamps	
1 x Plate for attaching the mounting bracket to the FL58 module	

5.6.2. Attaching the Mounting Plate (FL58MOUNTKITJC) to the FL58

Step	Description
1	Choose the position of the mounting kit on the module according to the degree of elevation angle to be used. Position the set screw facing the bottom of the module for a positive site Or position the set screw facing the top of the module for a negative site

Step	Description
2	

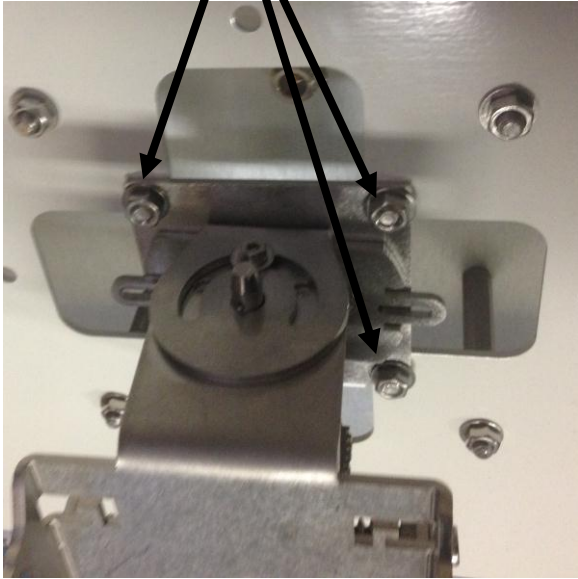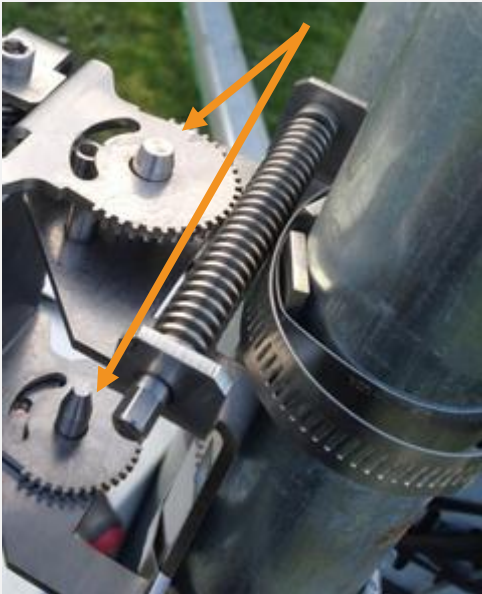|	
	  Fit the 4 screws CHC 4X16 (key 6 sides 3) or TH 4x16 (key flat / eye 10) and washers .
3	Attach the support plate on the mast (Ø60 to 115mm) using the supplied metal clamps or wall by the 4 holes of the plate (use screws and plugs for the wall type). Holes for wall mounting 3rd clamp can be used if required to secure FL58 mounting bracket to pole.
4	Insert the module with its supporting part in the pins
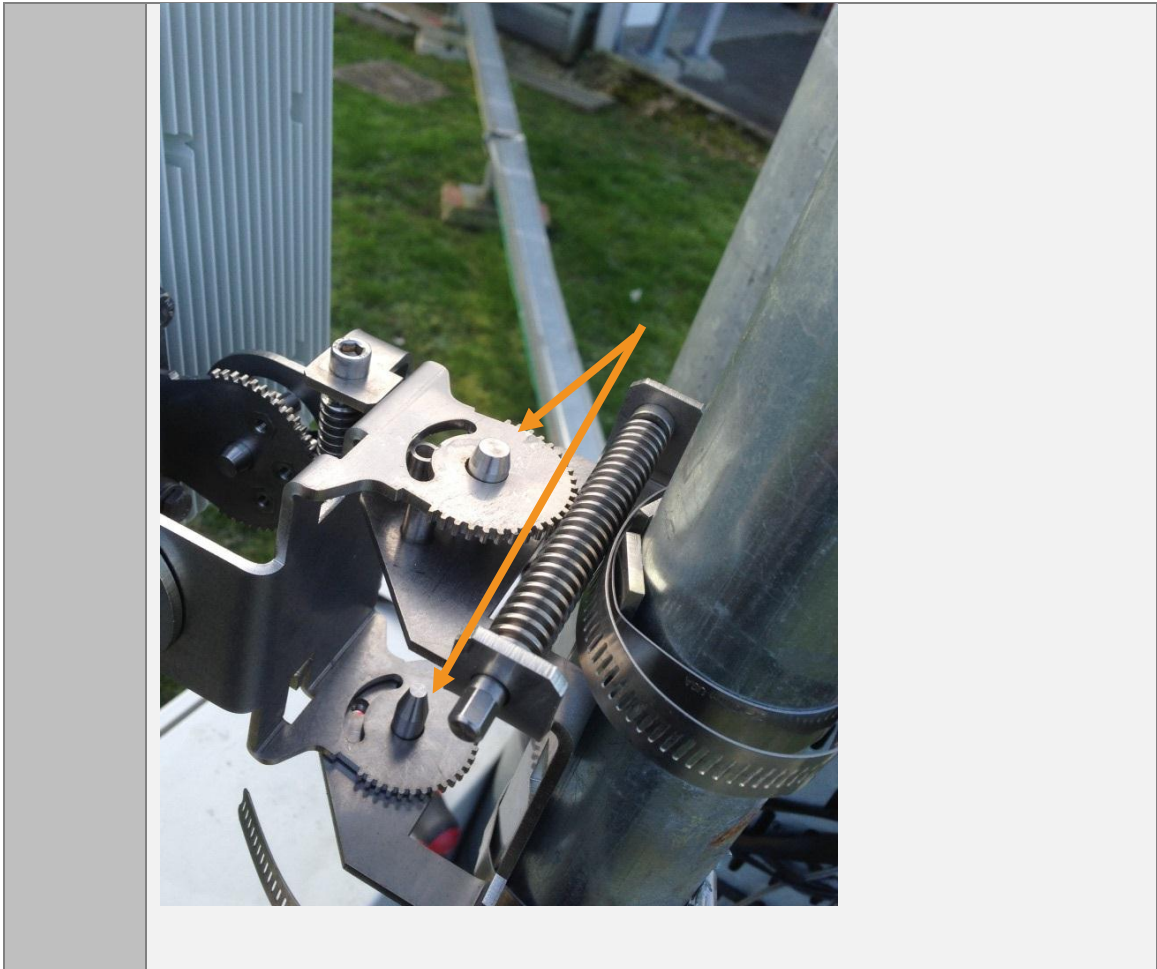
Step	Description
	Put the 2 clamping screws CHC with 4x10 6 Allen key
5	
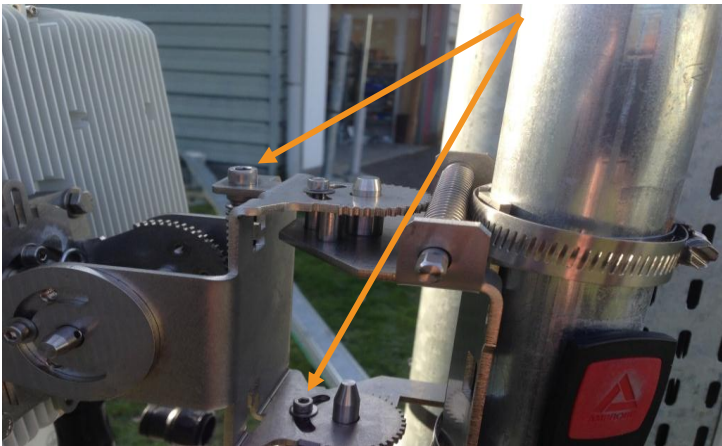
5.6.3. Attaching the Mounting Plate to the external antenna

Step	Description

1	Fit the 4 nuts and washers (using flat key /eye 10).
2	Insert the external antenna with its supporting part in the pins
3	Put the 2 clamping screws CHC 4x10 with 6 Allen key
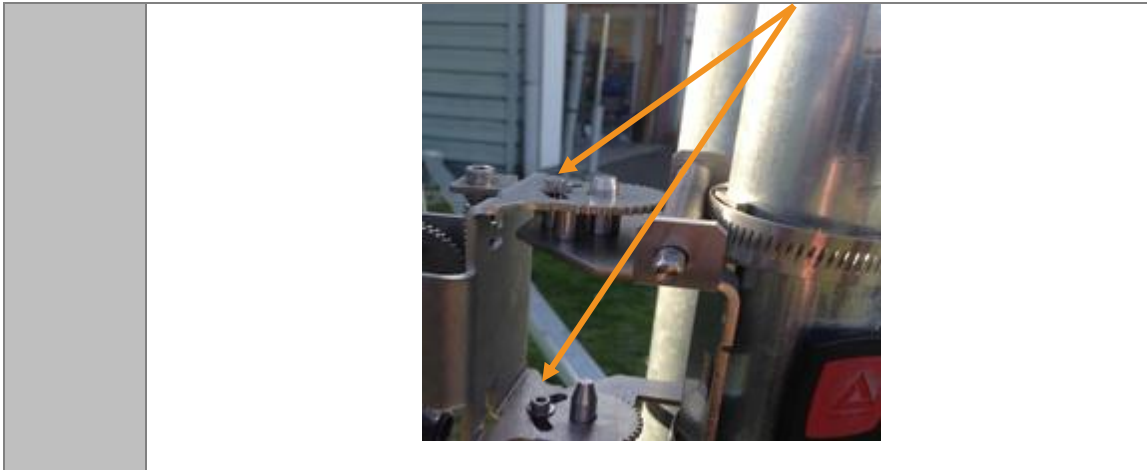
5.6.4. Connecting the external antenna to the FL58 module (FL58EAK60 or FL58EAK30)

The antenna kit is composed of:
- 1 flat panel antenna – size 60x60 cm² or size 30x30 cm²,
- 1 mounting kit. The mounting kit delivered within the antenna kit is identical to the mounting kit delivered with the WFM module.
- 2 feeders (radio connectorised cables) – 1m length - for antenna / WFM module connection.

Antenna side

WFM side

Feeder with one angle connector end (antenna side) and one QN connector (WFM side)

Connect the Vertical interface (Label V) of the external antenna to the Vertical interface (label V) of the FL58 module using one feeder.

Connect the Horizontal interface (Label H) of the external antenna to the Horizontal interface (label H) of the FL58 module using the second feeder.

60x60 cm² antenna connected to FL58 module with feeders

Antenna Gain	FL58EAK30	FL58EAK60
RF Antenna Gain EBANT23	24 dBi	
RF Antenna Gain EBANT25		29 dBi

5.7. Grounding the FL58

Step	Description
1	Prepare a 6AWG or thicker wire with an IEC Standard Cable Lug, and insure you have all of the components shown:
2	Connect the lug to the FL58 system as shown here
3	Properly attach the other end of the ground cable to the grounding system of

	the building or tower.

5.8. Connecting the power

Each WFM unit is provided with a power kit. 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 this, limited power supply or circuit breaker should be used.

When connecting the WFM to a MAINS DC distribution system, a 1.5 Ampere circuit breaker should be used to enable the central DC system to isolate the WFM in case of emergency.

5.8.1. Power Connector Kit

Power kit Items:
1 Power connector head (connects to the wires & power pins)
1 Body
1 Compression nut shell which compresses the cap and makes the plug water tight
the kit also contains a small rubber gasket intended for smaller wire cables – not to be used for the FL58

5.8.2. 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 this, 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 (13 or 16 AWG based on distance) 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.
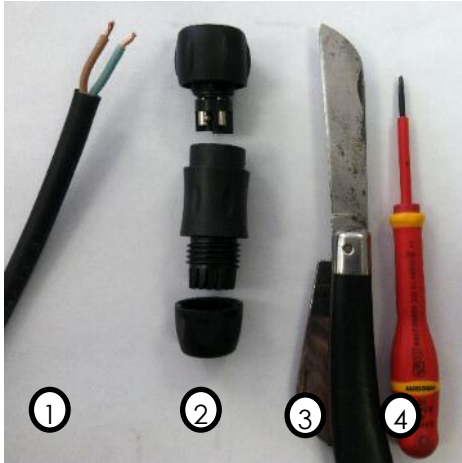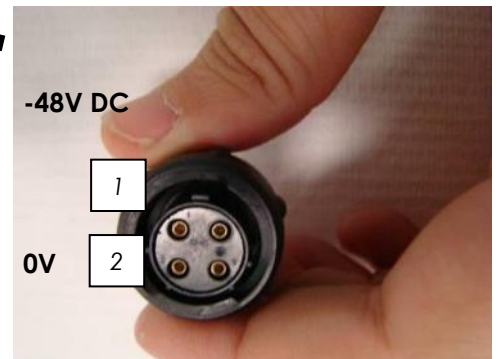

Item	Description
1	Appropriate length of two wire cable
2	Power Plug kit (provided by EBlink)
3	Electrician's knife appropriate for stripping cables
4	Flat blade screwdriver with 2mm blade
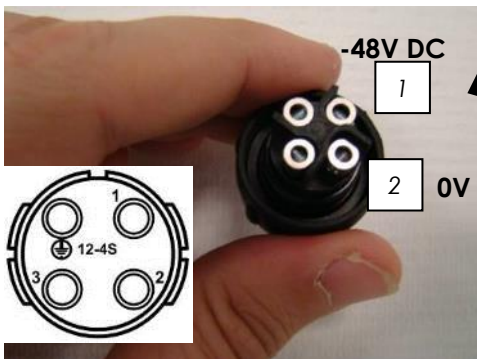
Pin out

Module BBU/RRU -48V

Module BBU/RRU -48V

AWG16 (1,5mm²) < 50m
AWG13 (2,5mm²) 50m to 100m

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 above
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. Performing link alignment

The FL58 features quick and easy antenna alignment for fast and cost effective installation. The WFM antenna must be aligned on both central and remote WFMs. A first, coarse alignment is performed visually, followed by fine tuning using the system's integrated tools.

Accurate alignment of the WFM is critical for achieving the strongest possible receive signal.

Two options are proposed to align FL58 links.

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

The other possibility is to use the LRMT in absence of multimeter.

5.9.1. Digital Voltmeter Cable for alignment (FL58VLTMCBL)

Alignment should be done using a voltmeter and cable with a circular 12 pin connector.

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

FrontLink™ 58 Voltmeter cable (FL58VLTMCBL)	
Connector	FL58 side : circular 12 pin Voltmeter : 2 banana plugs
Cable length	200 cm
Weight	Net Weight approx =100g, Gross Weight approx = 300g

5.9.2. Alignment optimization

5.9.2.1. Powering on equipment

The LED color changes according to the status of the link:

1- On power up the LED will stay off for several seconds and then turns red for 20 to 30 seconds.

2- The LED turns blue when the app is loaded and the link with the other module is not established.

3- The LED flashes green (slowly) when the link between the modules is established and no CPRI is connected. It turns on steady green (without flashing) if CPRI is connected and synchronized.

5.9.2.2. Setting the WFM to alignment mode at both ends

In order to align a FL58 link, the user needs to setup the FL58 modules in installation mode using the LRMT application (refer to LRMT User Manual for detailed explanation).

Step	Description
1	Connect laptop running LRMT to the WFM management port.
2	Set up laptop IP address to be in the same subnet as WFM management IP address (default IP WFM CEN = 192.168.1.78, default IP address WFM REM = 192.168.1.79)
3	Launch LRMT application Select Installer/Commissioning user and fill the password (default password is commissioning)
4	From main screen, select Installation menu.
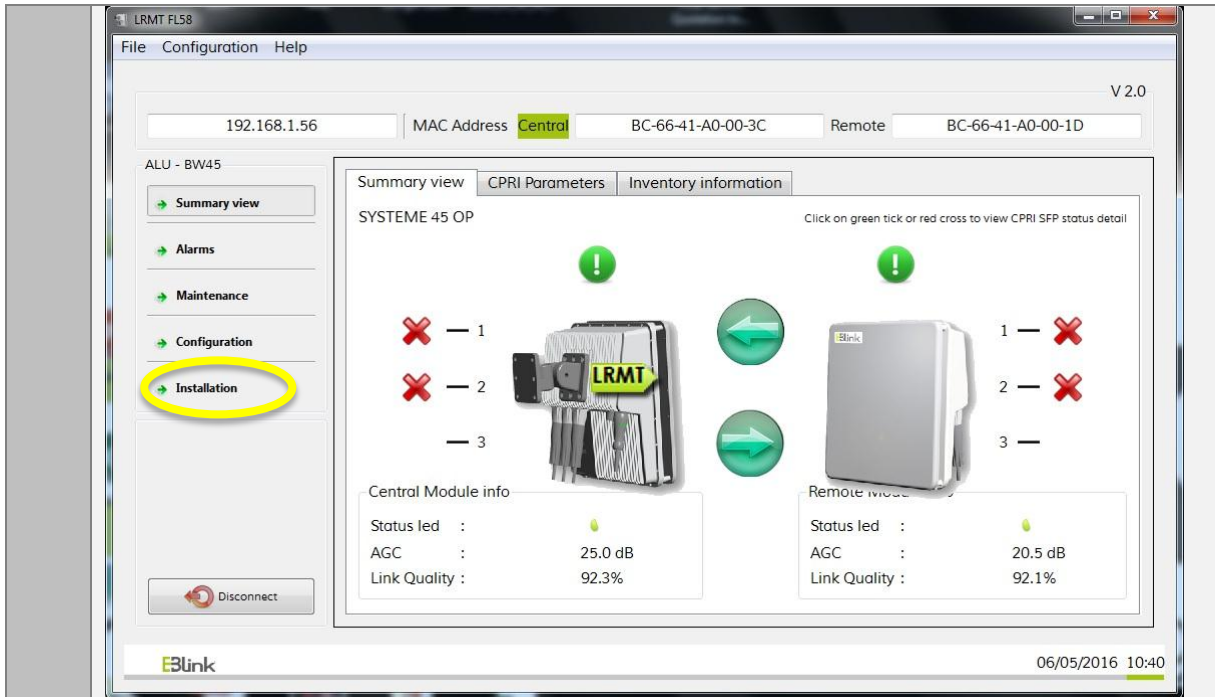
5	Link settings window is the first step of the configuration wizard.
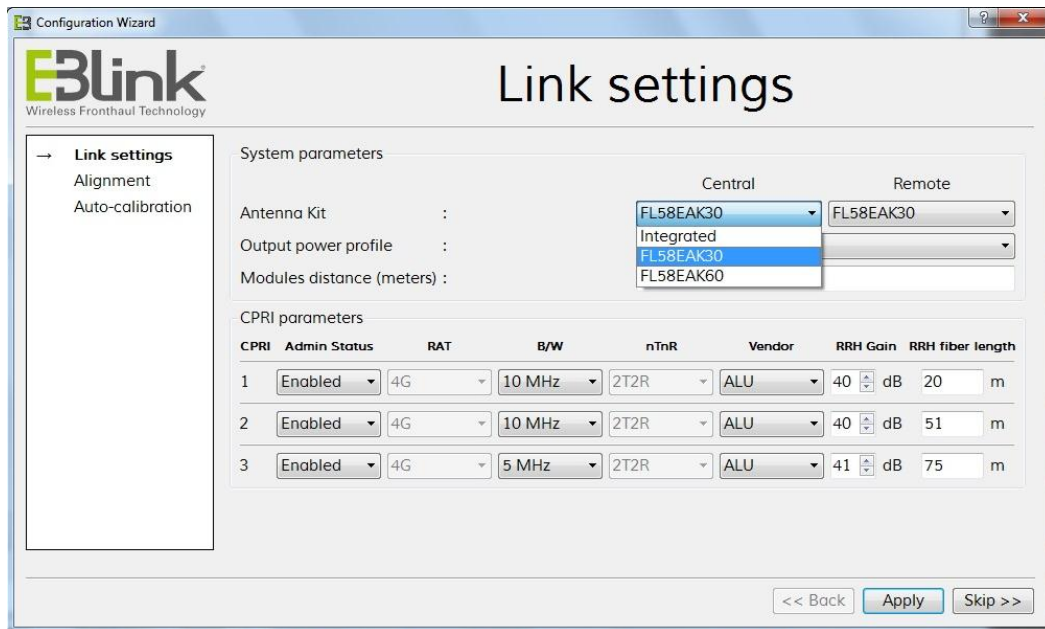	
	System parameters:
	Select the type of antenna for central module and remote module:
	    - Integrated (for FL58HD model),
	    - FL58EAK30 (for external antenna 30x30 cm²),

- FL58EAK60 (for external antenna 60x60 cm²).

Select the output power profile:
- For FL58-60, only ETSI - 14 dBm is available,
- For FL58-45, select between FCC – 53 dBm, MII/ETSI – 33 dBm or ETSI – 30 dBm.

Enter the distance in meter between the two modules.

CPRI parameters:

For each physical CPRI port (1 to 3), configure the following parameters:

Set the administrative status of the port: Enabled or Disabled,

Set the RAT type: 4G by default,

Set the bandwidth: 5 MHz, 10 MHz, 15 MHz or 20 MHz,

Set the MIMO type: 2T2R by default,

Set the Vendor type: ALU (eNodeB Nokia, former Alcatel-Lucent) or ERI1 (eNodeB Ericsson RRUS11/mRRU2203) or ERI2 (eNodeB Ericsson RRUS12/mRRU12),

Set the RRH gain according to the type of RRH connected to.

When using FL58 with Ericsson RAN, an additional field needs to be set by entering the fiber length (in meter) between the FL58 Remote module and the RRU.

Note: Frequencies are preset and doesn't need to be changed unless presence of an interferer in the 5.8 GHz RF band.

When all parameters are set, click on the Next button. All parameters will be saved into the system and then, Alignment window will appear.
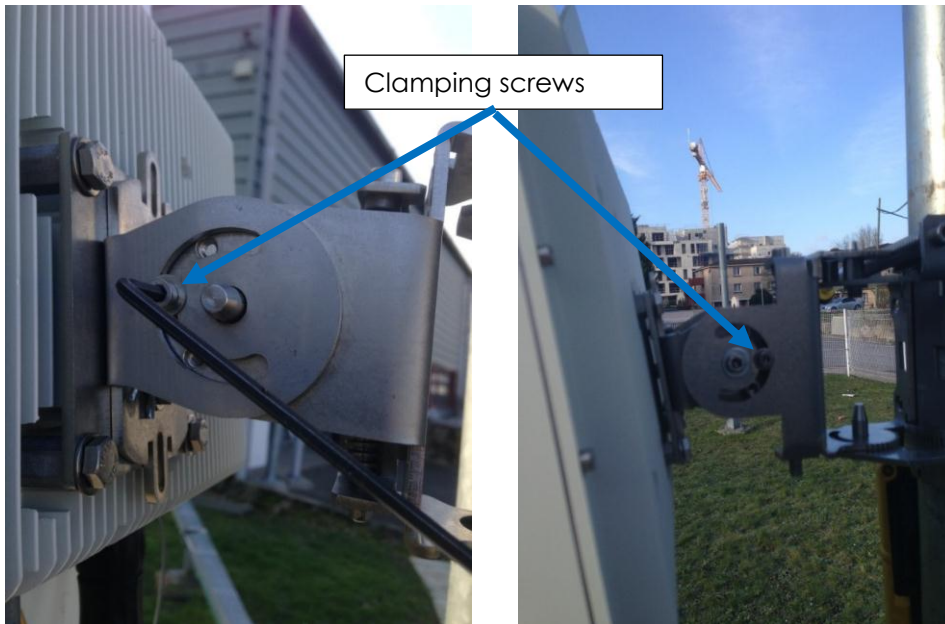
Alignment screen windows is the second step of the configuration wizard.

Press the Start button and perform fine alignment of the link to obtain maximum voltage at multimeter.
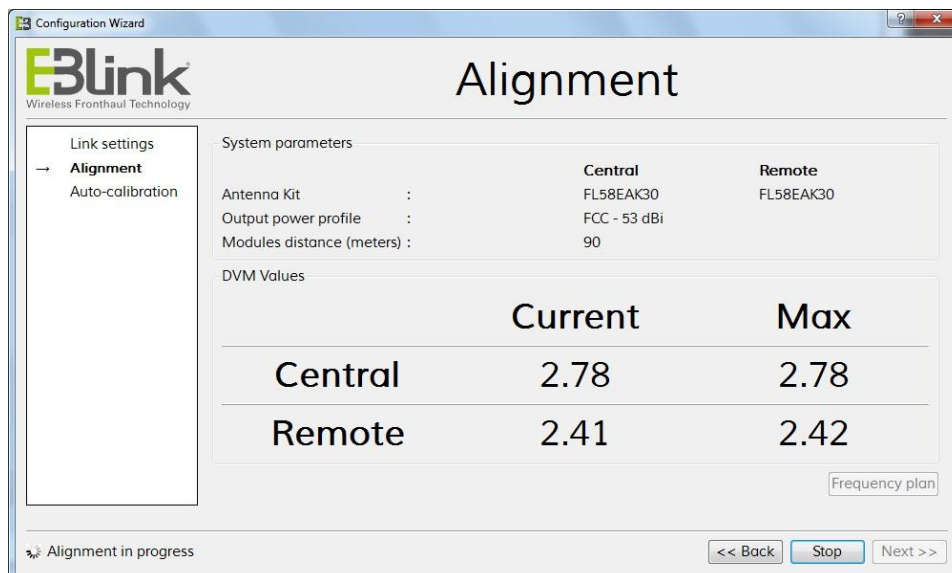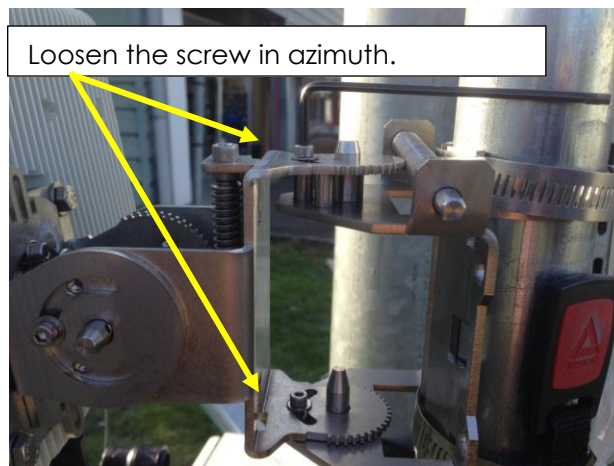

Site alignment (vertical alignment):

Carefully loosen the screw site adjustment

Clamping screws

Adjust in elevation module to obtain a maximum voltage on the voltmeter.
Tighten the screw, checking during clamping that the voltage does not move.

## Azimuth Alignment (horizontal)

Loosen the screw in azimuth.

Adjust the azimuth module to obtain a maximum voltage on the voltmeter.

Tighten the screw, checking during clamping that the voltage does not move.

Polarization Alignment (rotational)

Loosen the screw for polarization alignment(see details below).
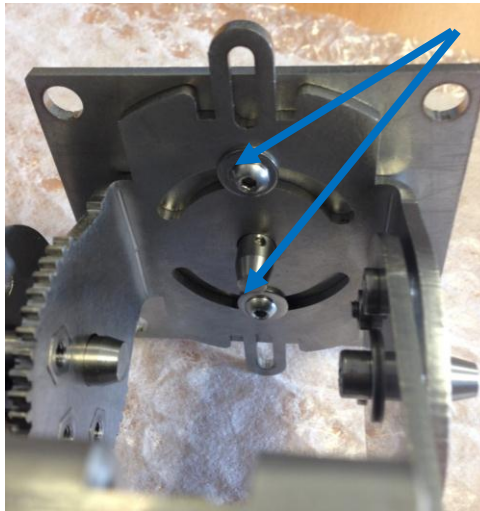
Antennas are polarized, so **their axes must be vertically aligned**. The angle between the two axes must not exceed 5°.
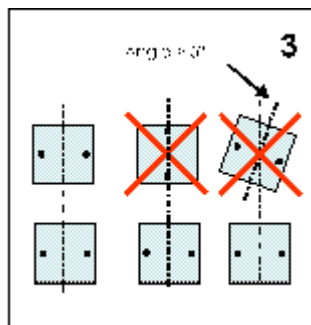
After aligning WFM Central, repeat the steps for aligning WFM Remote.

Perform the azimuth and tilt alignment to find the maximum voltage (0 to 3V) on the DVM or displayed in the LRMT alignment screen.
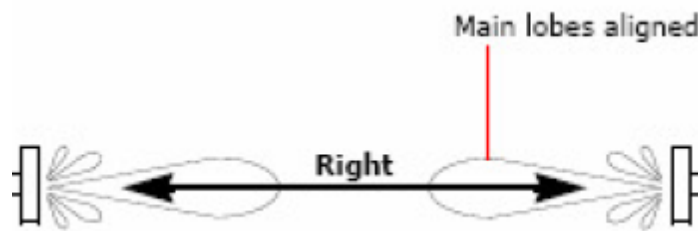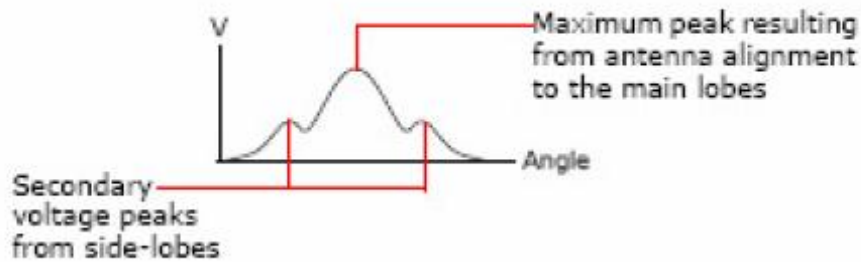
When alignment is completed, click on Stop button and wait until Next button becomes accessible. click on Next button to perform Auto-calibration.

Auto-calibration window is the last step of the configuration wizard.
Click on Start button to launch the auto-calibration process.
The three screens below illustrate all the auto-calibration process up to his completion.

Auto-calibration

Link settings
Alignment
→ Auto-calibration
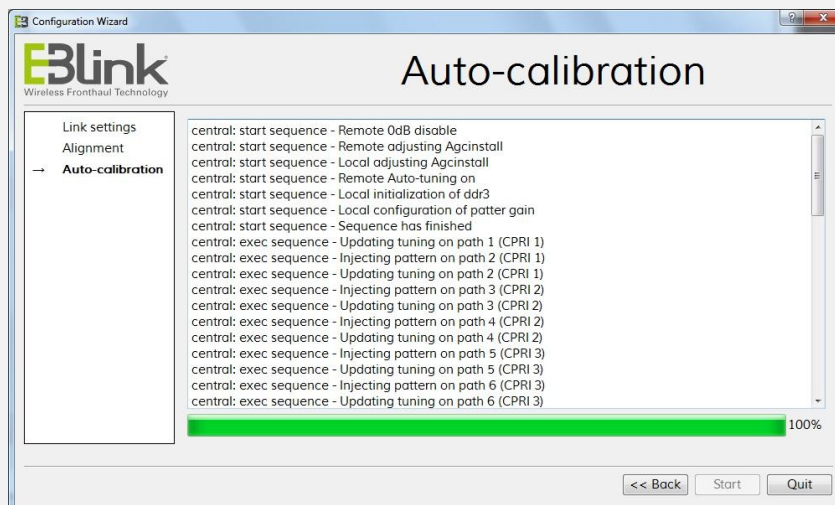
central: exec sequence - Updating tuning on path 6 (CPRI 3)
central: exec sequence - Sequence has finished
central: stop sequence - Remote FFT enable
central: stop sequence - Remote Auto-tuning off
central: stop sequence - Remote save DDC gain
central: stop sequence - Remote setting CPRI mode
central: stop sequence - Local setting CPRI mode
central: stop sequence - Local reseting the ddr3
central: stop sequence - Local 0dB enable
central: stop sequence - Sequence has finished
remote: start sequence - Remote FFT disable
remote: start sequence - Remote 0dB disable
remote: start sequence - Remote adjusting Agcinstall
remote: start sequence - Local adjusting Agcinstall
remote: start sequence - Remote Auto-tuning on
remote: start sequence - Local initialization of ddr3
remote: start sequence - Local configuration of patter gain
remote: start sequence - Sequence has finished

100%

<< Back   Start   Quit

Auto-calibration

Link settings
Alignment
→ Auto-calibration

remote: exec sequence - Injecting pattern on path 1 (CPRI 1)
remote: exec sequence - Updating tuning on path 1 (CPRI 1)
remote: exec sequence - Injecting pattern on path 2 (CPRI 1)
remote: exec sequence - Updating tuning on path 2 (CPRI 1)
remote: exec sequence - Injecting pattern on path 3 (CPRI 2)
remote: exec sequence - Updating tuning on path 3 (CPRI 2)
remote: exec sequence - Injecting pattern on path 4 (CPRI 2)
remote: exec sequence - Updating tuning on path 4 (CPRI 2)
remote: exec sequence - Injecting pattern on path 5 (CPRI 3)
remote: exec sequence - Updating tuning on path 5 (CPRI 3)
remote: exec sequence - Injecting pattern on path 6 (CPRI 3)
remote: exec sequence - Updating tuning on path 6 (CPRI 3)
remote: exec sequence - Sequence has finished
remote: stop sequence - Local stop injection of ddr3
remote: stop sequence -
remote: stop sequence - Local 0dB enable

Auto-calibration success.

100%

<< Back   Start   Quit

The installation process is now completed, click on Quit and then close LRMT session.

5.10. Connecting Fiber optic cable (CPRI input)

As a baseline, the FL58 is provided with three CPRI port activated and with three connecting kit, enabling to wirelessly connect up to 3 RRH to the BBU. Each connection is similar to the others.

Details on CPRI Radiall OSIS connectors and the associated weatherproofing solution can be found below.

5.10.1. Prerequisites

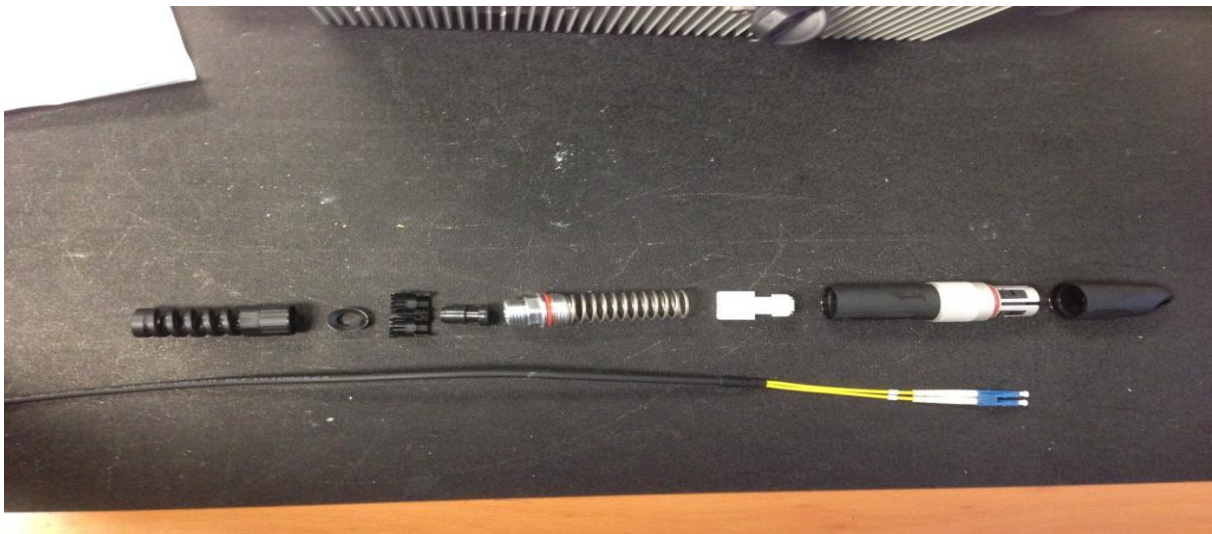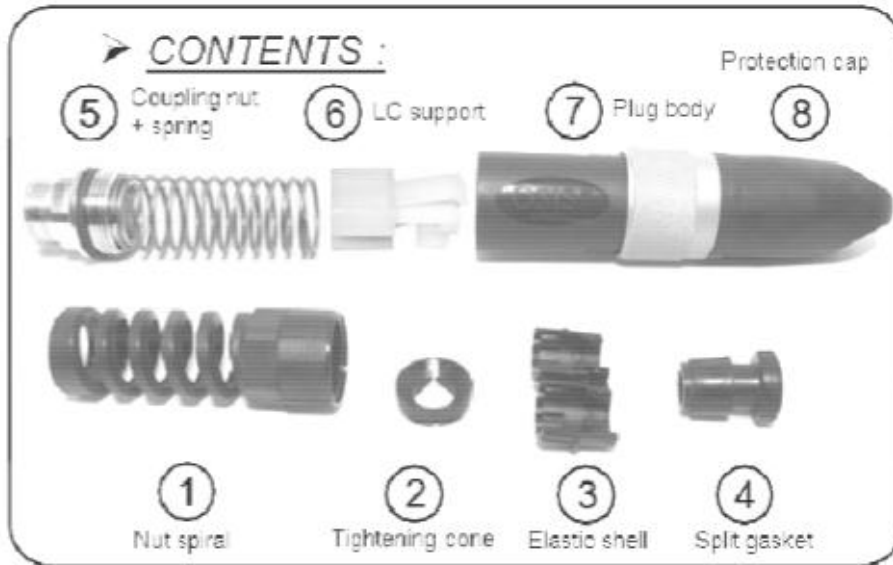Optic fiber cable and "Transceiver SFP" module are provided by the installer.

> ⚠️ **Warning!**
> Rx from BBU or RRH will be connected to Tx WFM
> Tx from BBU or RRH will be connected to Rx WFM
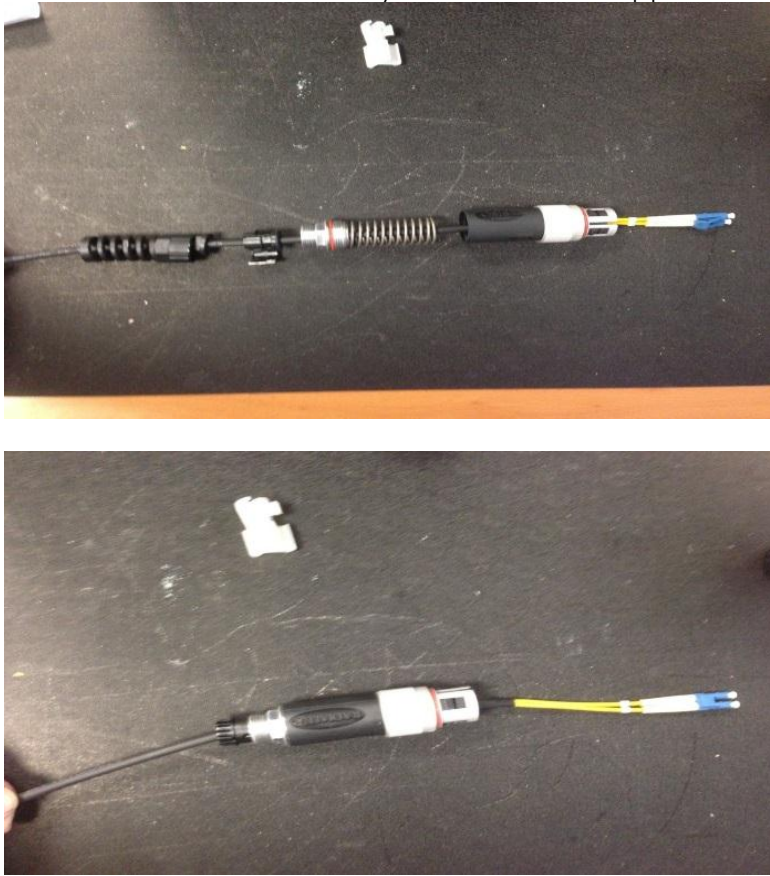
Three CPRI connector kits are provided per WFM.

Fiber Optic connector parts list:
1: Spiral nut
2: Tightening cone
3: Elastic shell
4: Split gasket
5: Coupling nut & spring
6: LC support (do not used)
7: Plug body
8: Protection cap

FL58 CPRI connector kit	
Connectors	CPRI Optic Fiber
Breakout Length	90 mm
Fiber Type	Single Mode or Multi-mode
Tranceivers	Not provided by EBlink
Weight	Net Weight approx =110g, Gross Weight approx = 300g

5.10.2. Steps to connect the Optic fiber cable

Step	Description
1	Follow the instructions provided with the connector kit closely, to assemble the connector correctly. Discard the LC support.
2	Plug Fiber Optic cable into the SFP on the FL58 system as shown below

|	
3	Secure the connector to the FL58 system
4	Tighten the gland using appropriate wrench

CPRI Fiber Optic connection is now completed.

5.11. Other connections

The FrontLink 58 is also equipped with an RJ45 port for management purposes (LRMT and SNMP), an Alarm port for connection to third party environmental input alarm and a MODEM port for remote connection.
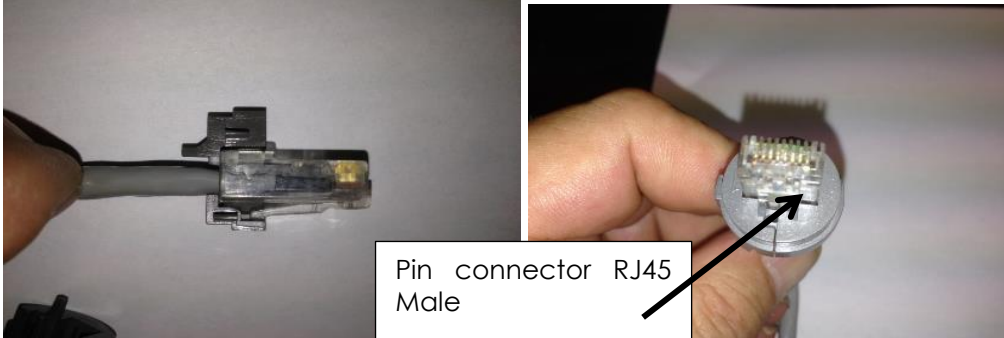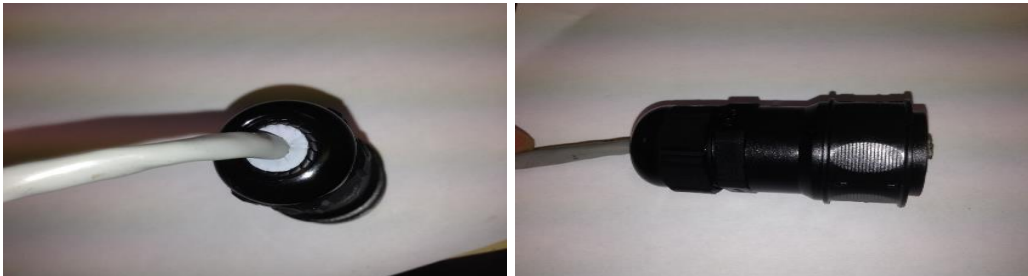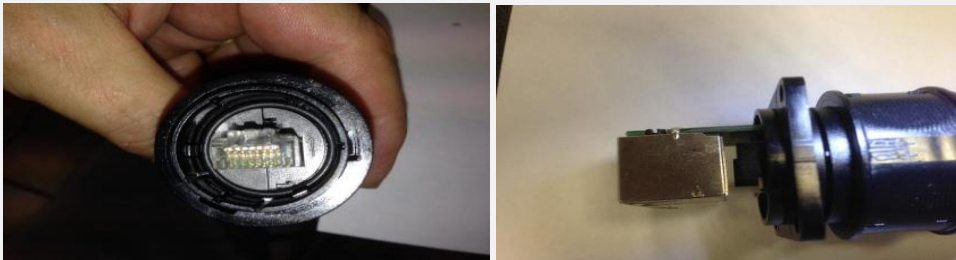
5.11.1. Ethernet OAM connector RJ-45

The OAM port provides a 10/100/1000 Mbps Ethernet interface via a RJ45 port. The following illustrates the RJ45 connector for the FL58, and its recommended installation.
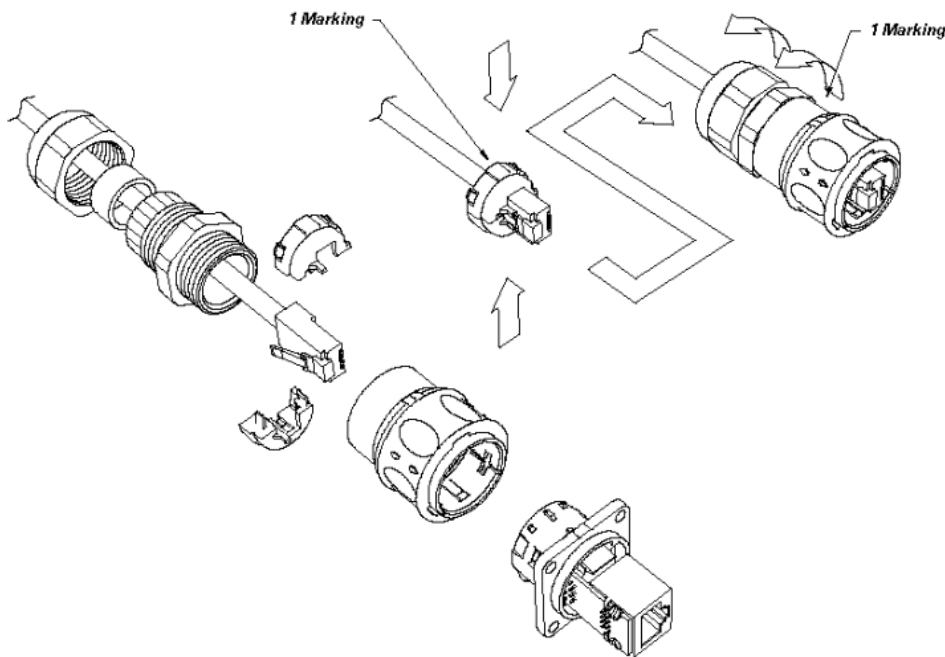
5.11.1.1. Ethernet RJ-45 connection preparation

Step	Description
1	Prepare the RJ45 male connector with the CAT5 cable.

Pin connector RJ45 Male

2	Position the cover and tighten it
3	Screw and lock the back part of the connector
4	Connector is ready to be plugged into the FL58 RJ45 OAM Port

Distance	Type
TBD according to the site requirement	Straight Trough 5E - FTP

www.e-blink.com

5.11.2. Alarm connector

Output alarms are accessible via a dry relay mechanism, and a special electrical connector (option FL58ALCAB217). The connector allows up to 12 pins for an output alarms.
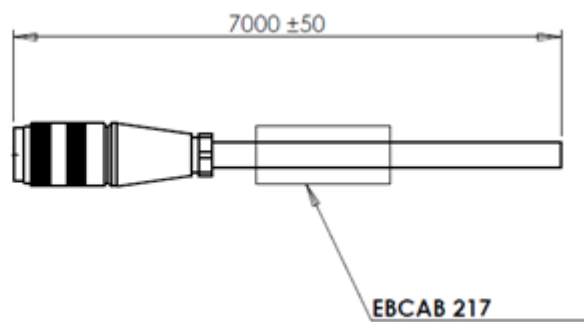
This cable is not supplied by EBlink. The cable length is dependent on the environment of the site. It will be developed and built by the installer.

The connector is linked to the alarm output of the FL58.

2 alarms are available:
- Alarm output 1, general alarm WFM Central,
- Alarm output 2, general alarm WFM Remote

EBCAB 217

Alarm cable pinouts (NC = No alarm, NO = Alarm)		
Pin A	AWG22 white wire (pair 1)	General alarm WFM Central or UL path
Pin M	AWG22 black wire (pair 1)	
Pin B	AWG22 white wire (pair 2)	General alarm WFM Remote or DL path
Pin L	AWG22 brown wire (pair 2)	

FL58 Alarm cable (FL58ALCAB217)	
Connectors	FL58 side : circular 12pins
Alarms	Output signals 2 pairs
Cable length	TBD according to the site requirement; standard 7m
Weight with plastic bag	400g
Weight without plastic bag	350g

6. Commissioning

This section provides a basic, step by step guide to the FL58 commissioning process using LRMT.

COMMISSIONING STEPS
Setting site code and site contact
Checking link configuration
Setting management parameters

6.1. Setting site code and contact

Connect LRMT to WFM central management port.

Launch LRMT application. Following connection screen appears:

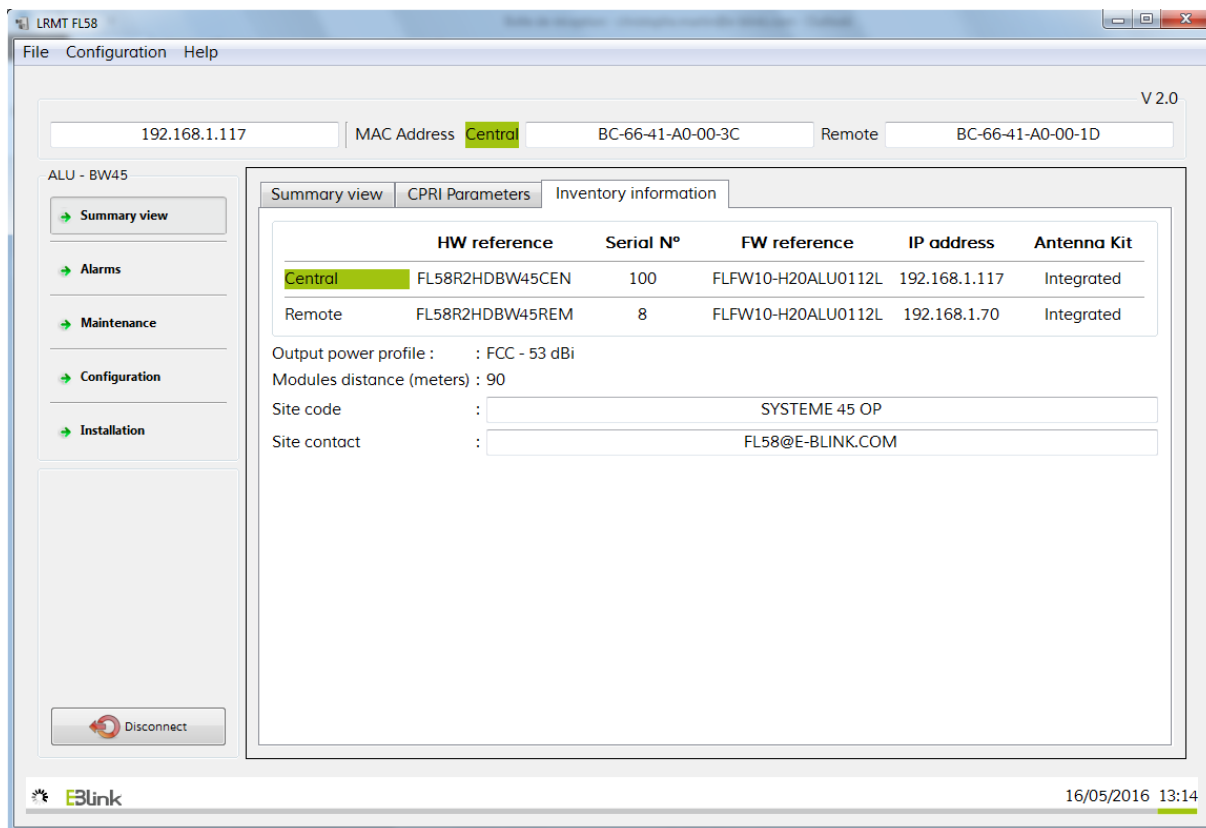Fill in the default WFM CEN IP address as target equipment (192.168.1.78).

Select Installer/Commissioning user level.

Fill in the default password (commissioning) and click on Connect button.
LRMT Summary view is now displayed.

Click on the Inventory information tab.

- Fill in the site code (user definable link label), typically identifying the site,
- Fill in the site contact (user definable label), typically giving a contact email or phone number.
- Check also that both WFMs have the same FW release. If not, refer to the appendix A1 for Firmware upgrade procedure.
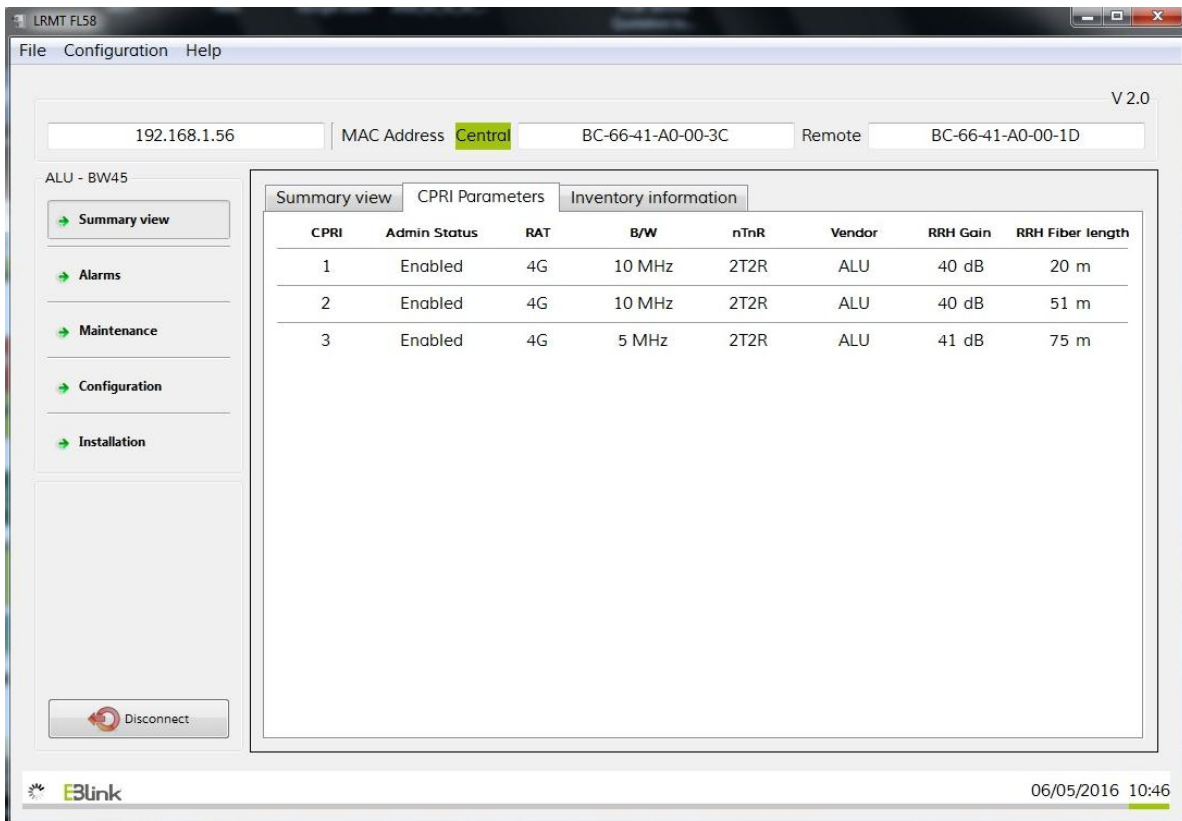
6.2. Checking link configuration

6.2.1. Checking Carrier number

The total number of carrier (number of CPRI interface used in FL58), is currently used for increasing power of emission (Pout= f(carrier total number)).
From the summary view, click on the CPRI parameters tab.
The CPRI 'Admin status' column indicates if the related CPRI link is whether activated or not.

CPRI parameters are read only. If one parameter has been set improperly, to change it:

1) Select Installation menu,
2) Modify the parameters and click on Next,
3) In Alignment wizard, click on skip to access the Auto-calibration window.
4) Perform an Auto-calibration to ensure UL unitary gain is maintained after the changes.

6.2.2. Checking RAT configuration

The FL58 is able to support a mix of LTE bandwidth, 1 carrier per port, in MIMO2x2 mode. The following table shows the RAN configuration currently supported. More configurations will be supported in the future. Please contact EBlink for the latest status.

Techno	Configuration	FL58-45	FL58-60
4G	1xL20-2T2R + 1xL20-2T2R + 1xL20-2T2R	✘	✔
4G	1xL20-2T2R + 1xL20-2T2R + 1xL15-2T2R	✘	✔
4G	1xL20-2T2R + 1xL20-2T2R + 1xL10-2T2R	✘	✔
4G	1xL20-2T2R + 1xL20-2T2R + 1xL5-2T2R	✔ (*)	✔
4G	1xL20-2T2R + 1xL20-2T2R	✔	✔
4G	1xL20-2T2R + 1xL15-2T2R + 1xL15-2T2R	✘	✔
4G	1xL20-2T2R + 1xL15-2T2R + 1xL10-2T2R	✔ (*)	✔
4G	1xL20-2T2R + 1xL15-2T2R + 1xL5-2T2R	✔	✔
4G	1xL20-2T2R + 1xL10-2T2R + 1xL10-2T2R	✔	✔
4G	1xL20-2T2R + 1xL10-2T2R + 1xL5-2T2R	✔	✔
4G	1xL15-2T2R + 1xL15-2T2R + 1xL15-2T2R	✔ (*)	✔
4G	1xL15-2T2R + 1xL15-2T2R + 1xL10-2T2R	✔	✔
4G	1xL15-2T2R + 1xL15-2T2R + 1xL5-2T2R	✔	✔
4G	1xL15-2T2R + 1xL10-2T2R + 1xL10-2T2R	✔	✔
4G	1xL15-2T2R + 1xL10-2T2R + 1xL5-2T2R	✔	✔
4G	1xL10-2T2R + 1xL10-2T2R + 1xL10-2T2R	✔	✔
4G	1xL10-2T2R + 1xL10-2T2R + 1xL5-2T2R	✔	✔
4G	1xL10-2T2R + 1xL5-2T2R + 1xL5-2T2R	✔	✔
4G	1xL5-2T2R + 1xL5-2T2R + 1xL5-2T2R	✔	✔

(*): some restriction can occur with these configuration – please contact your EBlink representative).

The first column indicates on which technology the RAN configuration is supported.
The 2nd column describes the RAN configuration.

nxCC-xTyR + mxDD-zTwR means that:
- CPRI port 1 carries n carriers of type CC in xTyR mode
- CPRI port 1 carries m carriers of type DD in zTwR mode

With

- CC & DD being either:
- L5 for a 5MHz LTE carrier
- L10 for a 10MHz LTE carrier
- L15 for a 15 MHz carrier
- L20 for a 20MHz LTE carrier

- xTyR & zTwR being either:
- 2T2R for 2 Tx path and 2 Rx path (typically MIMO2x2 DL and 2Rx Diversity UL)
- 2T4R for 2 Tx path and 4 Rx path (typically MIMO2x2 DL and 4Rx Diversity UL)
- 4T4R for 2 Tx path and 2 Rx path (typically MIMO4x4 DL and 4Rx Diversity UL)

Column 3 indicates if the configuration is supported on the FL58-45 product, while column 4 indicates if the configuration is supported on the FL58-60 product.

6.2.3. Checking RRH gain

The FL58 supports a variety of RRHs. The RRH gain can vary depending on the type of RRH used (Macro cell RRH, Small cell type MRO, RRUS 11, RRUS 12, others…).

Table below gives a non-exhaustive list of typical RRH UL gains for Alcatel-Lucent RAT:

MRO refer either to 9768 MRO V2 B13 (700 MHz) or 9768 MRO V2 B4 (AWS).
RRH refer to: B4 RRH2x60-4R (AWS) operating in 2T2R mode, B25 RRH4x30 (PCS 1900) operating in 2T2R mode, B13 RRH4x30 (700 MHz) operating in 2T2R mode, RRH2x40-07U (700 MHz), RRH2x60-1900A (PCS), RRH2x40-700U, MCRRH2x40-18.

This list is not exhaustive. Contact your E-Blink representative for RRH not in the list.

RRH Type – LTE BW	Typical gain setting
MRO - LTE BW 5 MHz	22 dB
MRO - LTE BW 10/15 MHz	19 dB
MRO - LTE BW 20 MHz	17 dB
RRH - LTE BW 5 MHz	41 dB
RRH - LTE BW 10/15 MHz	38 dB
RRH - LTE BW 20 MHz	35 dB
RRUS 11 - LTE BW 5/10/15/20 MHz	38 dB
RRUS 12 - LTE BW 5/10/15/20 MHz	38 dB

Up to 3 different RRHs can be connected to the FL58. Each RRH gain value* must be set according to the type of RRH (Macro versus Micro) to optimize dynamic UL range of FL58 according to type of RRH. This value is adjustable by step of 1 dB.

*In any case, whatever the setting of this parameter is, the actual output power will always be lower than the maximum declared output power (within the authorized FCC limit of 53 dBm).
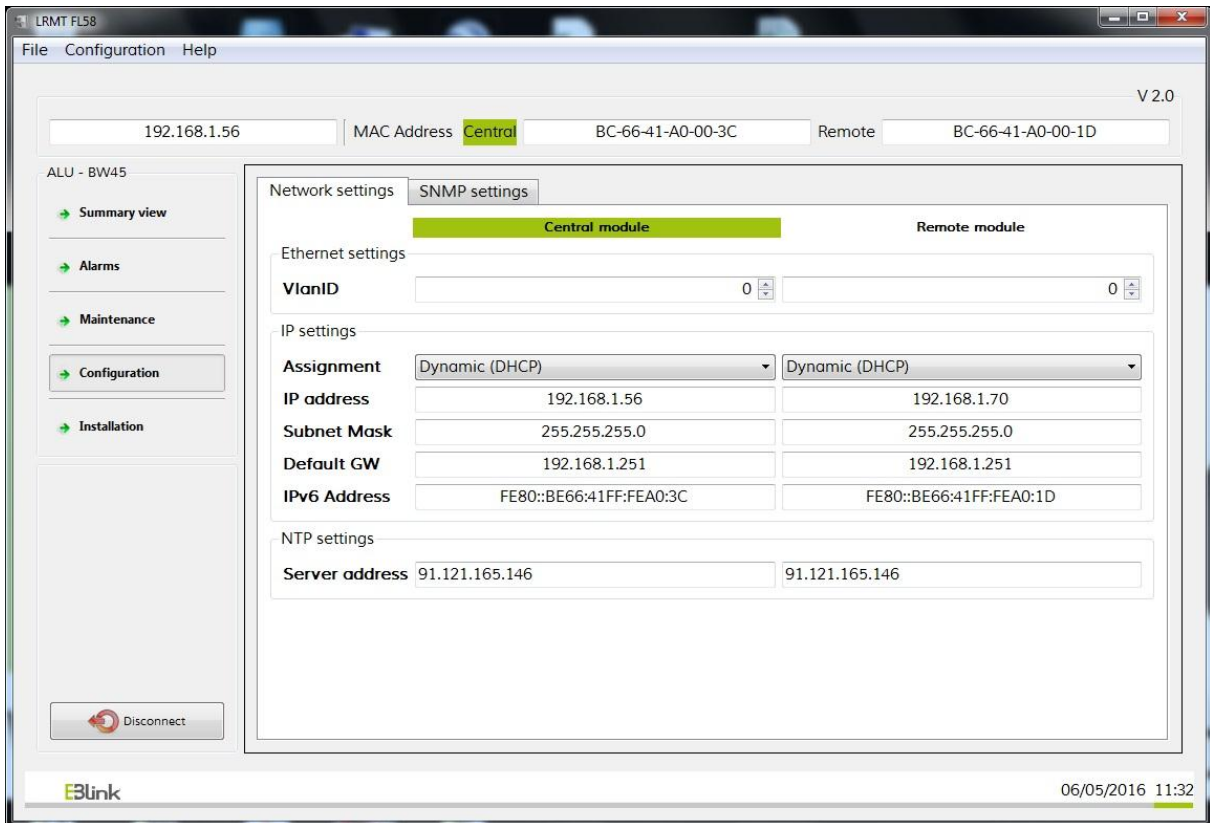
6.3. Setting management parameters

6.3.1. Network settings

From Configuration menu, select the tab Network settings.

The following Configuration screen appears:

6.3.1.1. Ethernet settings

To ease management of FL58 within a DCN, a VLAN ID can be assigned for management traffic. As soon as the VLAN has been assigned, LRMT connection will be lost up to the computer hosting LRMT is reconfigured to support this VLAN ID (During FL58 start-up, a grace period allows LRMT to connect without VLAN tagged traffic during 3 minutes).

VLAN ID value can be set to any value within the range 1 to 4090 (setting VLAN ID value to 0 is equivalent to no VLAN ID set).

6.3.1.2. IP settings

Management mode is Out of band only.

IP address assignment can be set to dynamic (DHCP) or static.

When Dynamic is selected, IP address assigned by the DHCP server is displayed.

In the case of a static IP address, following parameters has to be set:
- IP address (support IPV4 or IPV6 addressing)
- Subnet mask
- Default gateway

After changing any value, click on Apply Setting to send modifications to the equipment.

6.3.1.3. NTP settings

This field allows you to view and set IP-10 Network Timing Protocol information.

For Server address, enter the IP address of the NTP server. This timing reference will be used by the system to time stamp the records into the FL58 log file.

After changing any value, click on Apply Setting to send modifications to the equipment.

6.3.2. SNMP settings

From Configuration menu, select the tab Network settings.

The following Configuration screen appears:
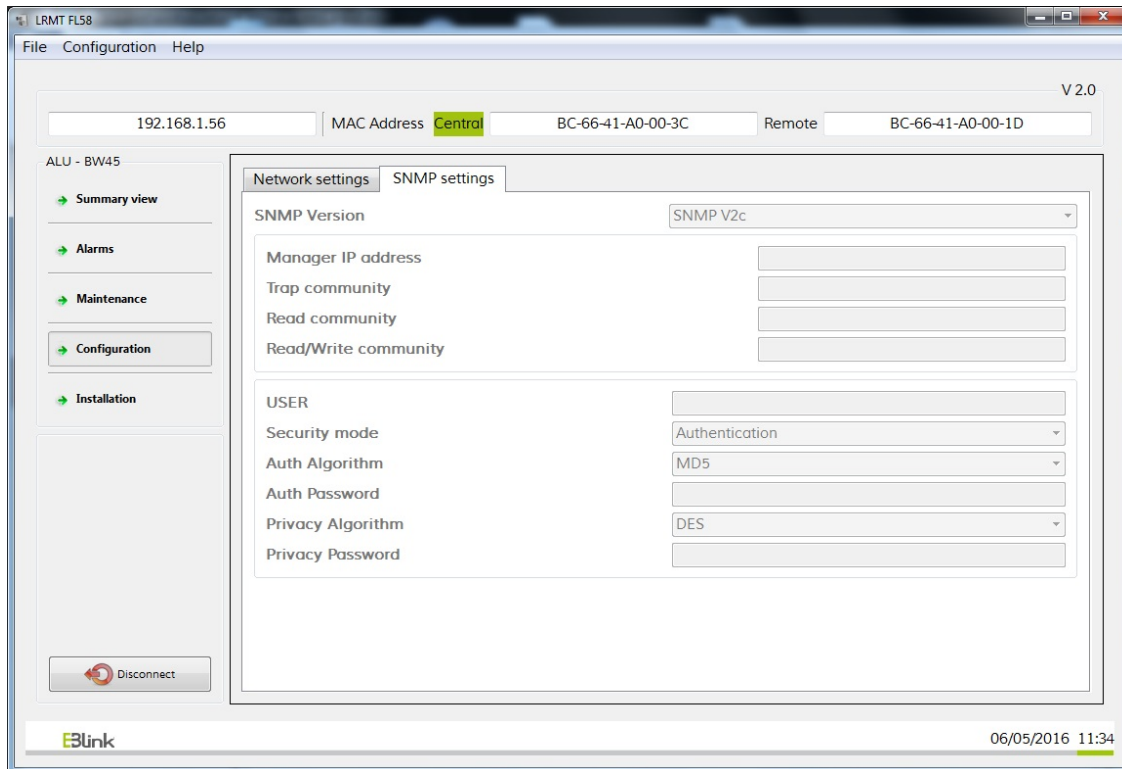
First parameter to be configured is the SNMP manager IP address for the FL58 system to be able to send traps. Number of manager is limited to 1, either SNMPv2 or SNMPv3. IP address can be IPV4 or IPV6 type according to the type set for the module.

A selection box allows the choice between SNMPv2c and SNMP3 protocols.
SNMPv2 fields are only editable when SNMPv2c protocol is chosen.
SNMPv3 fields are only editable when SNMPv3 protocol is chosen.

- For SNMPV2c protocol (community fields):
    - Trap community (public by default),
    - Read community (public by default),
    - Read/Write community (private by default).
- For SNMPV3 protocol (User Security Model fields):
    - Security mode (Authentication or Authentication & Privacy),
    - Auth Algorithm (**SHA-1** or MD5),
    - Auth password (to be set to match with SNMPV3 manager USM settings),
    - Privacy algorithm (**DES** or AES),
    - Privacy password (to be set to match with SNMPV3 manager USM settings).

After changing any value, click on Apply Setting to send modifications to the equipment.

6.4. Setting frequencies

From the configuration screen, click on advanced menu to open Frequency range window.

Note: Frequencies are preset and doesn't need to be changed unless presence of an interferer in the 5.8 GHz RF band.

If you change any frequency (Carrier n or the Control channel), don't forget to click on Apply settings.

A pop-up menu will appear to confirm that frequency plan has been applied:
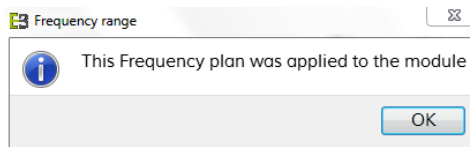
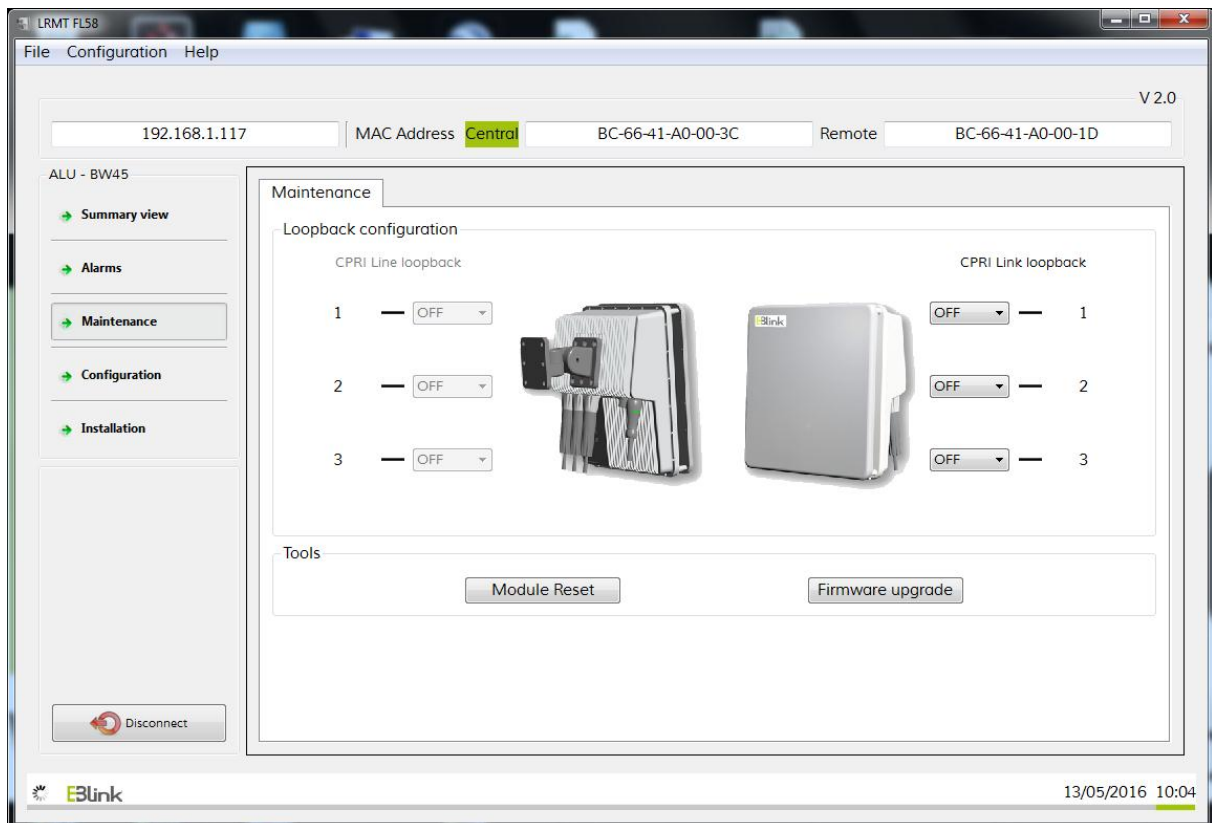Click on OK to have frequency changes stored in memory.
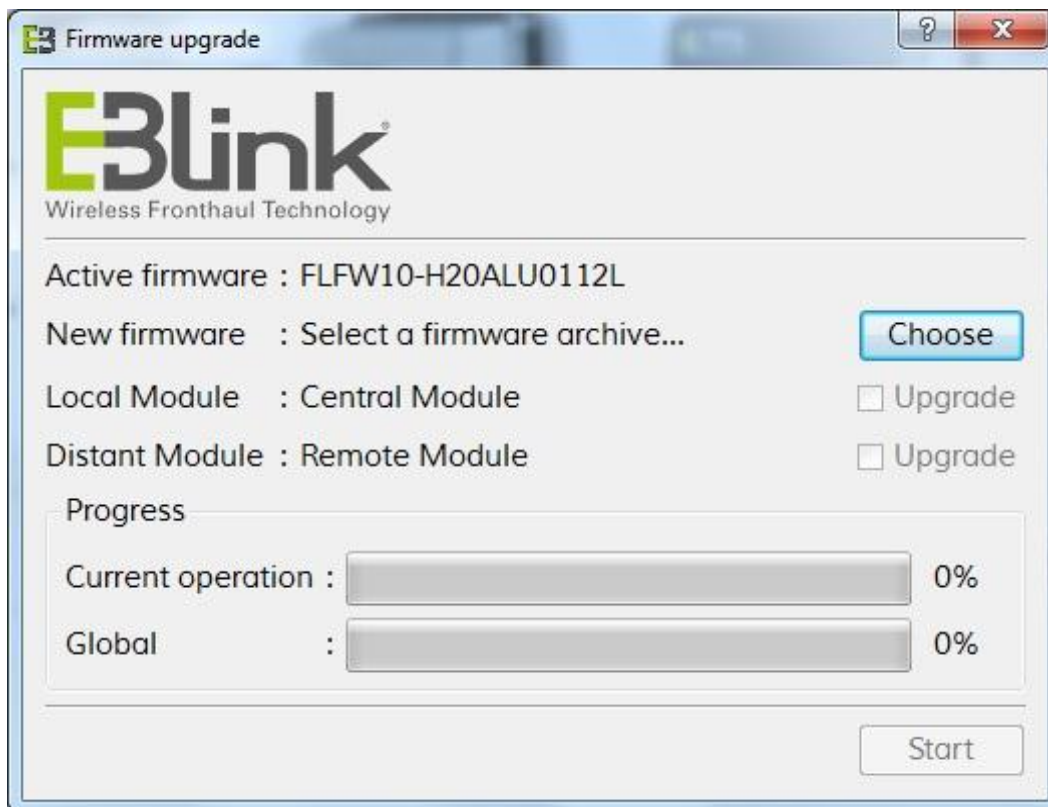
A. Appendix

A.1. Firmware upgrade procedure

FL58 firmware release is a zip file containing a set of files. Firmware upgrade is activated from the LRMT.

Select Maintenance menu from the main screen. Following Maintenance screen is displayed.

Click on Firmware upgrade button

Select the firmware zip file you want to use by clicking on Choose button.

You can either select to upgrade the local module you are connected to or select to upgrade the distant module or the full system (WFM central and remote).

Click on Start button to initiate the module(s) upgrade.

Progress of the upgrade is displayed (current file advancement percentage and overall upgrade percentage).

At the end of the upgrade process, a pop up window allows to initiate a reboot of the system.
Following the reboot, FW reference information in LRMT inventory zone will be refreshed, displaying the running FW version just loaded and activated.

A.2. Capacity upgrade

Cell capacity upgrade may require modification of the existing BW from 10 MHz to 15 or 20 MHz for example and therefore, modification of the LTE BW setting at FL58 level is also mandatory.

After changing LTE BW using LRMT (refer to section checking RAT parameters), follow the main steps below to finalize LTE BW changes:

1) Connect LRMT to WFM CEN. Select installation menu.

2) Change LTE BW parameters from the link settings screen and click on Apply button.

3) On alignment window, click on skip to display the Auto-calibration window.

4) Run Auto-calibration process by clicking on start button. After Auto-calibration is done, new Wireless Fronthaul link is ready to carry traffic.

A.3. Coverage optimization

Cell coverage optimization audit may require modification of the existing RRH location and therefore, redeployment of the WFM REM nearby new RRH location

Follow the main steps below to perform REM relocation:

1) Power on WFM REM and wait for 2 minutes before connecting LRMT.

2) Select installation menu to perform alignment following REM relocation.
From Link settings window, enter the new distance between modules and click on apply.

3) From alignment window click on start to start aligning Antenna REM module.

4) When Alignment is completed and antenna is locked, click on Stop button and then click on Next button to access Auto-calibration window.

5) Run Auto-calibration process by clicking on start button. After Auto-calibration is done, new Wireless Fronthaul link is ready to carry traffic.

Glossary

About This Glossary
This Glossary defines terms and acronyms used in E-Blink manuals and in fronthaul technology.

A
AGC,
Automatic Gain Control. A process that automatically adjusts gain as a function of a specified parameter, such as received signal level. AGC is used to help maintain a constant output level when the input signal level is changing.

AWG,
American Wire Gauge. A wire diameter specification. The smaller the AWG number, the larger the wire diameter.

Azimuth
The angle in the horizontal ground plane with respect to true North (such as, horizontal direction); used in reference to antenna alignment.

B
BBU
BaseBand Unit. Unit that contains the digital functions of a LTE eNodeB.

C
CAT5
Category 5 cable. Cat5 is a twisted pair cable for carrying signals. This type of cable is used in structured cabling for network such as Ethernet. The cable standard provides performance of up to 100 MHz and is suitable for 10BASE-T, 100BASE-TX (Fast Ethernet), and 1000BASE-T (Gigabit Ethernet).

CE
Conformité Européenne. The CE marking indicates that the product has been designed and manufactured in conformity with the essential requirements of all relevant EU (European Union) directives, and submitted to the relevant conformity assessment procedure.

CLI
Command Line Interface

Commissioning
An FL58 link is commissioned when customer traffic circuits have been connected and the link is completely ready to provide a data service.

CPRI
Common Public Radio Interface. CPRI standard defines the interface of base stations between the Radio Equipment Controllers (REC) in the standard, to local or remote radio units, known as Radio Equipment (RE).

D

DB

DeciBel. The abbreviation for decibel; the standard unit of measure for relative signal power..

DC

Direct Current. DC is the unidirectional flow of electric charge.

Default Gateway

In computer networking, a gateway is a node (a router) on a TCP/IP network that serves as an access point to another network. A default gateway is the node on the computer network that the network software uses when an IP address does not match any other routes in the routing table.

E

EMC

ElectroMagnetic Compatibility. EMC is the branch of electrical sciences which studies the unintentional generation, propagation and reception of electromagnetic energy with reference to the unwanted effects (electromagnetic interference, or EMI) that such energy may induce.

Ethernet

The term Ethernet refers to the family of local-area network (LAN) products covered by the IEEE 802.3 standard that defines what is commonly known as the CSMA/CD protocol. Data rates are defined for:
10 Mbit/s - 10Base-T Ethernet
100 Mbit/s - Fast Ethernet
1000 Mbit/s - Gigabit Ethernet
10000 Mbit/s - 10-Gigabit Ethernet

F

FCC

Federal Communications Commission. The FCC is an independent United States government agency, directly responsible to Congress. The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. The FCC's jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions.

Fronthaul

In LTE network, an eNodeB is split into two units: a baseband unit or BBU, and the remote radio unit (RRU) or sometimes the remote radio head, mounted at the top of the tower, next to the antennas. The link between the two units is defined as Fronthaul.

FW

In electronic systems and computing, firmware is "the combination of a hardware device, e.g. an integrated circuit, and computer instructions and data that reside as read only software on that device".

G

GB

The GigaByte is a multiple of the unit byte for digital information.

GHz

The GigaHetz is a multiple of the unit Hertz, unit of frequency in the international system of units.

I

IEC

International Electrotechnical Commission

IP

Internet Protocol. A method or protocol by which data is sent from one device to another on the Internet.

L

LED

Light Emitting Diode.

Loopback

A diagnostic function designed to assist testing of system components by routing traffic back to the direction it came from.

LRMT

The LRMT is a software application which runs on a PC connected to the FL58 through its IP port.

LTE

LTE, an abbreviation for Long-Term Evolution, commonly marketed as 4G LTE, is a standard for wireless communication of high-speed data for mobile phones and data terminals.

M

MAC address

Media Access Control address. A unique number assigned to every layer 2 Ethernet device in the world.

MRO

Metro Radio Outdoor. A model of eNodeB manufactured by Alcatel-Lucent.

O

OAM

Operations, Administration and Management or Operations, Administration and Maintenance (OA&M or OAM) is the processes, activities, tools, standards etc. involved with operating, administering, managing and maintaining any system.

P

Path

A radio path refers to the path traversed by the signal between two wireless system.

PLL
Phase-locked Loop. A circuit that controls an oscillator so that it maintains a constant phase angle relative to a reference signal.

R

RAT

A Radio Access Technology or (RAT) is the underlying physical connection method for a radio based communication network. Mobile phones support several RATs in one device such as Bluetooth, Wi-Fi, and 3G, 4G or LTE.

RRH

In wireless system technologies such as GSM, CDMA, UMTS, LTE, the Radio Equipment is remote to the BTS/NodeB/eNodeB, and is also called Remote Radio Head. The equipment will be used to extend the coverage of a BTS/NodeB/eNodeB like rural areas or tunnels. They are generally connected to the BTS/NodeB/eNodeB via a fiber optic cable using Common Public Radio Interface protocols.

S

SFP

The small form-factor pluggable (SFP) is a compact, hot-pluggable transceiver used for both telecommunication and data communications applications.

STPC

Static Transmit Power Control. STPC is a mechanism used during link installation. STPC optimizes the transmit power based on the distance between equipment to minimize interference between different wireless networks.

Subnet mask

A 32-bit combination used to describe which portion of an address refers to the subnet and which part refers to the host in IPV4.

W

WEEE

Waste Electrical and Electronical Equipment.

WFM

Wireless Fronthaul Module. FL58 is a wireless system composed of two WFM.

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