

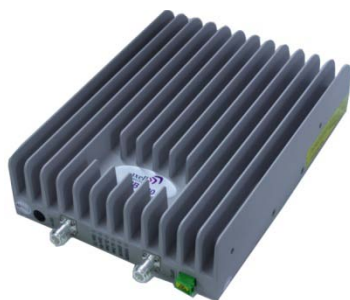
# MBF-20 Americas Multiband Fibre-Fed Remote

## Product Description and User's Manual

### Document P/N 00068UM Rev. 2.4

This document is valid for the following remote models

Product	Part Number	IC ID	FCC ID
MBF-2308-2319-M-1510 MBF-2308-2319-M-1530 MBF-2308-2319-M-1550 MBF-2308-2319-M-1570 MBF-2308-2319-M-1590	MBF2001 MBF2002 MBF2003 MBF2004 MBF2005	8749A-MBF23082319	NEOMBF23082319
MBF-2307-2317-M 1510 MBF-2307-2317-M-1530 MBF-2307-2317-M-1550 MBF-2307-2317-M-1570	MBF2006 MBF2007 MBF2008 MBF2009	8749A-MBF23072317	NEOMBF23072317



Dual band  
Remote Unit



Quad band  
Remote Unit

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## About This Manual

This Product Manual provides the following information:

- Description of the MBF-20 Remote
- Procedures for setup, configuration and checking the proper operation of the MBF-20
- Maintenance and troubleshooting procedures

## Intended Audience

This Product Manual is intended for experienced technicians and engineers. It is assumed that the customers installing, operating, and maintaining Axell Wireless Mini-Remotes are familiar with the basic functionality of Remotes.

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- **All antennas must be installed with lightning protection.** Damage to power modules, as a result of lightning are not covered by the warranty.
- **Antennas must be connected before switching on AC or DC power.** Switching power on prior to the connection of antenna cables is regarded as faulty installation procedure and therefore not covered by the Axell Wireless warranty.

## Exclusive Remedies

The remedies provided herein are the Buyer's sole and exclusive remedies. Axell Wireless shall not be viable for any direct, incidental, or consequential damages, whether based on contract, tort, or any legal theory.

## FCC Part 20 Warning Statement



WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC LICENCEES and QUALIFIED INSTALLERS. You must have an FCC LICENCE or express consent of an FCC Licensee to operate this device.

Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

## FCC Part 15

This 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.

If not installed and used in accordance with the instructions, this equipment generates, uses and can radiate radio frequency energy. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to RF reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- 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.

## Repeaters must be used ONLY for in-building applications

One must be aware that FCC regulation mandate that these repeaters are to be used *only* for in-building applications and thus feed passive or active DAS (Distributed Antenna Systems) accordingly.

## Unauthorized Changes to Equipment

Changes or Modifications not expressly approved by the manufacturer responsible for compliance could void the user's authority to operate the equipment

## FCC RF Exposure Limits

This unit complies with FCC RF exposure limits for an uncontrolled environment. This equipment must be installed and operated with a minimum distance of 32 cm between the radiator and any person's body.

## Antenna Installation

Installation of an antenna must comply with the FCC RF exposure requirements. The antenna used for this transmitter must be mounted on an indoor permanent structure.

The maximum antenna gain for indoor operation is 13 dBi. Antennas having a gain greater than these are strictly prohibited for use with this device. In indoor applications the antenna must be installed at a minimum separation distance of 32 cm from all nearby persons.

## Compliance with IC

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.





*Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.*





*La puissance de sortie nominale indiquée par le fabricant pour cet appareil concerne son fonctionnement avec porteuse unique. Pour des appareils avec porteuses multiples, on doit réduire la valeur nominale de 3.5 dB, surtout si le signal de sortie est retransmis et qu'il peut causer du brouillage aux utilisateurs de bandes adjacentes. Une telle réduction doit porter sur la puissance d'entrée ou sur le gain, et ne doit pas se faire au moyen d'un atténuateur raccordé à la sortie du dispositif.*

*Cet appareil est conforme aux limitations de la norme IC RSS-102 concernant l'exposition aux radiations dans un environnement non contrôlé. Cet appareil doit être installé et utilisé avec une distance minimale de 32 cm entre l'antenne et le corps de l'utilisateur.*

## General Safety Warnings Concerning Use of This System

Always observe standard safety precautions during installation, operation and maintenance of this product.

 <p>Caution labels!</p>	<p>Throughout this manual, there are "Caution" warnings. "Caution" calls attention to a procedure or practice, which, if ignored, may result in injury or damage to the system, system component or even the user. Do not perform any procedure preceded by a "Caution" until the described conditions are fully understood and met.</p>
 <p>Danger: Electrical Shock</p>	<p>To prevent electrical shock when installing or modifying the system power wiring, disconnect the wiring at the power source before working with un insulated wires or terminals.</p>
 <p>Caution: Safety to personnel</p>	<p>Before installing or replacing any of the equipment, the entire manual should be read and understood. The user needs to supply the appropriate AC or DC power to the repeater. Incorrect power settings can damage the repeater and may cause injury to the user. Please be aware that the equipment may, during certain conditions become very warm and can cause minor injuries if handled without any protection, such as gloves.</p>
 <p>Caution: RF Exposure</p>	<p>RF radiation, arising from transmitter outputs connected to AWL's equipment, must be considered a safety hazard. This condition might only occur in the event of cable disconnection, or because a 'spare' output has been left unterminated. Either of these conditions would impair the system's efficiency. No investigation should be carried out until all RF power sources have been removed. This would always be a wise precaution, despite the severe mismatch between the impedance of an N type connector at 50 Ohm, and that of free space at 377 Ohm, that would severely compromise the efficient radiation of RF power. Radio frequency burns could also be a hazard, if any RF power carrying components were to be carelessly touched! Antenna positions should be chosen to comply with requirements (both local &amp; statutory) regarding exposure of personnel to RF radiation. When connected to an antenna, the unit is capable of producing RF field strengths, which may exceed guideline safe values especially if used with antennas having appreciable gain. In this regard the use of directional antennas with backscreens and a strict site rule that personnel must remain behind the screen while the RF power is on, is strongly recommended. Where the equipment is used near power lines or in association with temporary masts not having lightning protection, the use of a safety earth connected to the case-earthing bolt is strongly advised.</p>

 <p>Caution: Safety to equipment</p>	<p>When installing, replacing or using this product, observe all safety precautions during handling and operation. Failure to comply with the following general safety precautions and with specific precautions described elsewhere in this manual violates the safety standards of the design, manufacture, and intended use of this product.</p> <p>Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.</p> <p>Axell Wireless assumes no liability for the customer's failure to comply with these precautions. This entire manual should be read and understood before operating or maintaining the repeater.</p>
 <p>Warning: Restricted Access Location</p>	<p>Access to the Axell unit installation location is restricted to SERVICE PERSONNEL and to USERS who have been instructed on the restrictions and the required precautions to be taken.</p>
 <p>Attention: Electrostatic Sensitivity</p>	<p>Observe electrostatic precautionary procedures. ESD = Electrostatic Discharge Sensitive Device.</p> <p>Static electricity can be conducted to the semiconductor chip from the centre pin of the RF input connector, and through the AC connector pins. When unpacking and otherwise handling the repeater, follow ESD precautionary procedures including use of grounded wrist straps, grounded workbench surfaces, and grounded floor mats.</p>
 <p>Caution: Class 1 Laser</p>	<p>The repeaters described in this manual are equipped with class 1 lasers, as per definition in EN 60825-1</p> <p>Caution - Un-terminated optical receptacles may emit laser radiation. Exercise caution as follows:</p> <ul style="list-style-type: none"> <li>• Do not stare into beam or view with optical instruments. Optical transmitters in the fibre optic converter can send out high energy invisible laser radiation. There is a risk for permanent damage to the eye.</li> <li>• Always use protective cover on all cables and connectors which are not connected.</li> <li>• Never look directly into a fibre cable or a connector.</li> <li>• Consider that a fibre can carry transmission in both directions.</li> <li>• During handling of laser cables or connections, ensure that the source is switched off.</li> </ul> <p>Regard all open connectors with respect and direct them in a safe direction and never towards a reflecting surface. Reflected laser radiation should be regarded as equally hazardous as direct radiation.</p>

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# 1 Introduction

Axell's MBF-20 Multi-Band Fiber Optic system provides a cost-effective, scalable indoor solution for single or multi operator use. Signals are coupled off from a nearby base station or off-air repeater to the OMU and then distributed via fiber to one or several MBF-20 remote units. These MBF-20 remote units can be installed up to 2 km from the base station site, offering great flexibility when providing RF coverage in areas where off air transmission is not a preferable solution.

A distributed antenna system can be used to distribute the signal throughout the area to be covered. A single F/O cable is used to connect the MBF-20 remote units to the OMU. Different colors (wavelengths) are used in order to combine the uplink of different MBF-20 remote units in a very cost effective way.

The MBF-20 is supplied in two physical configurations:

- Dual-band – consists of a single (Master) unit supporting two bands
- Quad-band – consists of two cascaded units: Master and Expansion (Slave) units, where the Expansion unit can be assembled by the user onto an existing Master MBF-20 unit (see section 3.2).

The MBF-20 is installed in conjunction with Axell Wireless Optical Management Unit (OMU II). The OMU II provides the head-end RF to optic conversion required to transport the services over fibre to the MBF-20 units. Up to 24 MBF-20 can be fed and managed from a single OMU II system.

MBF-20 commissioning is designed for plug-and-play simplicity: just mount, connect antennas, power and fibre. The unit is automatically discovered and commissioned on the OMU II side via a Web GUI connection to the OMU II.



*Figure 1-1. Axell MBF-20 Dual-band (left) and Quad-band (right) Remotes*

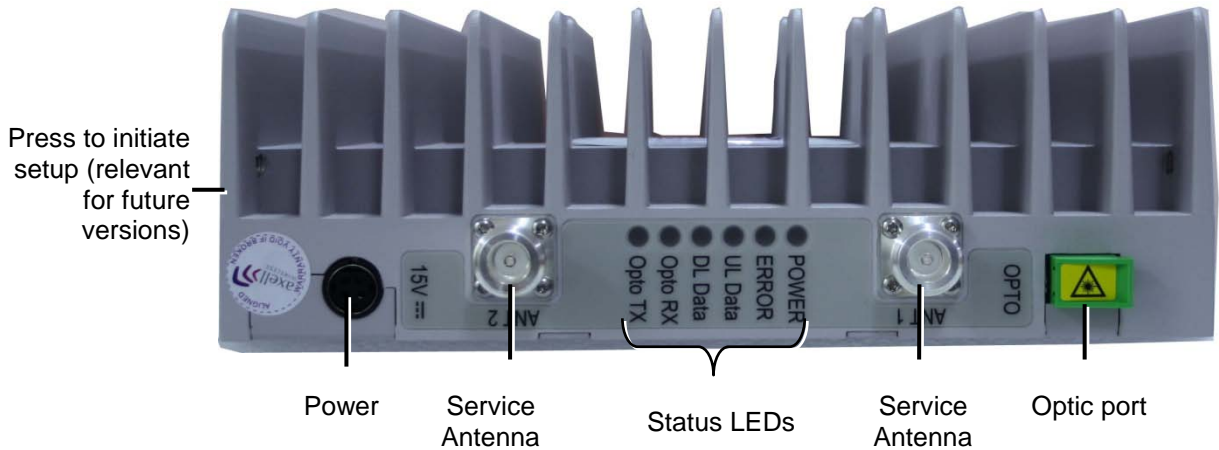
## 1.1 Features and Capabilities

- Comprehensive in-building coverage in a simple and cost effective manner
- Up to 4 frequency bands in two compact enclosures supported on one fiber strand, full multi-operator support
- Band support (model dependent):
- Band support (model dependent):
  - 850 MHz and 1900 MHz
  - 700 MHz and 1700MHz
- Two service antenna ports, 23dBm composite per antenna port per band (model dependent)
- Maximum uplink and downlink RF Gain: 18 dB
- Single fibre feed for a quad-band unit
- Flexible architecture allows MIMO support
- Plug-and-play:
  - More service support without adding F/O cables
  - Connected unit is automatically detected, commissioned and managed from the OMU II via a Web GUI sessions
- Very low noise factor (10 dB) minimizing interference to BTS and increasing high speed data throughput
- LEDs for local alarm indicators

## 1.2 Interfaces

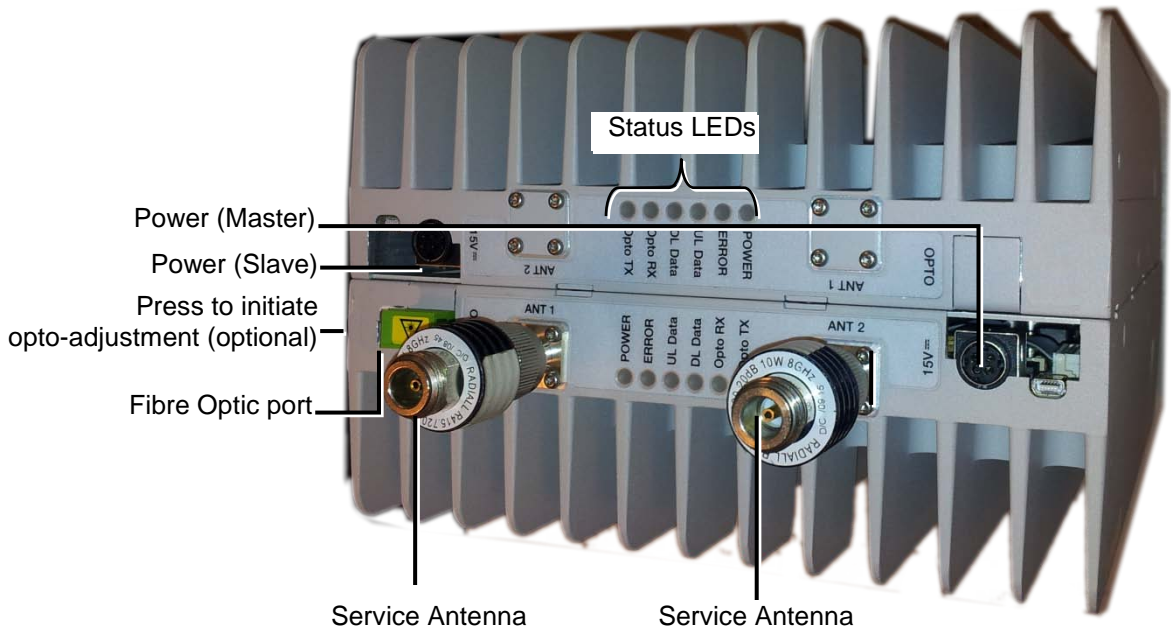
This section describes the interfaces for the MBF-20 Dual-band and MBF-20 Quad-band remotes.

The image below shows the dual-band unit without the wallmount bracket or power supply.



*Figure 1-2: MBF-20 Dual-Band Front Panel*

The image below shows the assembled quad-band unit without the wallmount bracket or power-supplies.



*Figure 1-3: MBF-20 Quad-Band Front Panel*

The following table provides a description of the front panel connectors.

Port	Description
Fibre I/O	Fibre-optic cable connection. Connected directly to an OMU optic module.
Service Antenna	Two Service antenna connections - DIN 7/16" connector, female
DC Power (15V)	Circular, 4-PIN power connection to provided power supply, assembled at the side of the MBF-20.
Status LEDs	Provide status on Power, Faults, Data and Opto Link. Described below.
Setup button	<i>(Relevant for future versions)</i> Located on the left panel. Press (using a sharp object such as a screw driver) to initiate opto-adjustment procedure. <i>Do NOT use a pencil.</i>

The following table provides a description of the front panel LED indicators. See Appendix D for more information.

LED	Description
Power	Power indicator (Green = ON)
Opto Tx/Rx	Green if DAS laser power is OK.
Opto Rx	Green if light is correctly received from OMU.
UL/DL Data	Flashes yellow periodically to indicate UL/DL traffic.
Error	Red Error LED flashes if DAS is not polled by OMU for over 30sec.

### 1.3 Power Supply

Each MBF-20 unit requires a power supply. MBF-20 Quad-band assembly requires two power supplies – one for the Master and one for the Expansion.



Figure 1-4: MBF-20 Power Supply

## 2 Installation Requirements

This chapter provides information on the Remote installation site requirements, on the installation requirements of the antennas, the specifications of the service antennas suitable for operation with this remote and RF and F/O cable requirements.

### 2.1 MBF-20 Installation Requirements

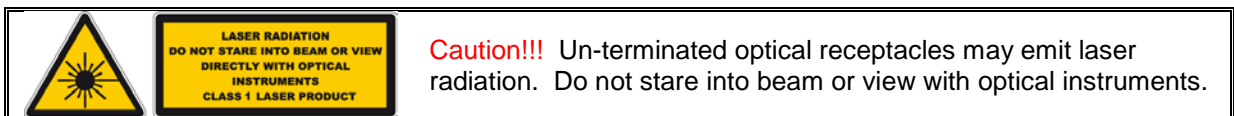
#### 2.1.1 Safety Guidelines

Before installing the Repeater, review the following safety information:

- Follow all local safety regulations when installing the Repeater.
- Only qualified personnel are authorized to install and maintain the Repeater.
- Ground the Repeater with the grounding bolt located on the external lower side of the Repeater).
- Do not use the grounding bolt to connect external devices.
- Follow Electro-Static Discharge (ESD) precautions.
- Use low loss cables to connect the antennas to the Repeater.

#### Class 1 Laser

This product is equipped with class 1 lasers, as per definition in EN 60825-1.



#### 2.1.2 Criteria for Remote Installation Location

The following criteria should be considered when selecting the Remote installation site location:

- Application type
- General surroundings
- Available installation
- Install the Remote in a shielded, ventilated, and easy-to-reach area.
- Verify that there is a minimum of a 50 cm (20") radius of space around the Remote, enabling easy access to the remote for maintenance and on-site inspection.
- Distance from antenna site - It is recommended that the installation location be as close as possible to the antenna site in order to maintain the cable loss to a minimum.
- The Remote is convection cooled so airflow and alternation should be possible.
- Install the Remote close to the service area to monitor the output power.
- Use low loss cables to connect the antennas to the Repeater.

### 2.1.3 RF Cable Installation Guidelines

**Required:**

- For all coaxial connections to/from the Repeater - high performance, flexible, low loss 50Ω coaxial communications cable.
- All cables shall be weather-resistant type.
- Cable length - determined by the Repeater installation plan. When calculating the cable length, take into account excess cable slack so as not to limit the insertion paths.

### 2.1.4 F/O Cable Installation Guidelines

**Use the following over the complete link between the Remote and OMU:**

- Use angled APC connectors at 8deg angle.
- APC type ODF connections.
- Cable length - determined by the Remote installation plan. When calculating the cable length, take into account excess cable slack so as not to limit the insertion paths.

**Recommended fibre-optic cable:**

- Single mode 9/125

## 2.2 Service Antenna Requirements (English)

This section provides information on the specifications of the service antennas suitable for operation with this repeater, on the installation requirements of the antennas and on the Repeater installation site and cable requirements.

**ATTENTION!!**

- The installer is held accountable for implementing the rules required for deployment.
- Good engineering practice must be used to avoid interference.
- Output power should be reduced to solve any IMD interference issues.

### 2.2.1 Required Antenna Information

The following antenna requirements, specifications and site considerations should be met.

- Service area type and size
- Antenna type and characteristics
- Height
- Length and type of coaxial cable required for connecting the Service antenna to the Remote and the attenuation.

### 2.2.2 Recommended Antennas

The Service antenna is installed indoors, where the type of antenna depends on the application.

### Specifications:

- One or a combination of the following antennas can be used: Ceiling Mount Patch antenna, Wall Mount Patch antenna, Corner Reflector.
- Choose an antenna with high side lobe attenuation which enables maximum isolation from other service/ mobile antennas.
- Net gain [Gain Antenna – Cable loss] must not exceed 13 dBi
- Antennas with gain < 13 dBi can be connected *directly* to the MBF-20 ports.
- Higher gain antennas may be connected to the MBF-20 ports along with adequate cable and splitting losses

### 2.2.3 Service Antenna Installation Criteria


Determine the antenna installation configuration, according to the transmission requirements and the installation site conditions.

#### Installation requirements:

- An indoor antenna should be installed at a convenient location. It should be free of metallic obstruction.
- Install the Service Antenna at the designated height and tune it roughly toward the Service coverage area.
- Installation of this antenna must provide a minimum separation distance of 35cm from any personnel within the area.

## 2.3 Service Antenna Requirements (French)

*Cette section fournit des informations sur les spécifications du donneur et des antennes de services adaptés pour fonctionner avec ce répéteur, sur les conditions d'installation des antennes et sur le site d'installation de répéteur et exigences de câblage.*

	<p><b>ATTENTION!!</b></p> <ul style="list-style-type: none"> <li>• <i>L'installateur est tenu pour responsable de la mise en œuvre des règles nécessaires au déploiement.</i></li> <li>• <i>Les bonnes pratiques d'ingénierie doit être utilisée pour éviter les interférences.</i></li> <li>• <i>Puissance de sortie doit être réduite pour résoudre tous les problèmes d'interférence de l'IMD.</i></li> </ul>
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### 2.3.1 Antenne Informations Requises

*Les exigences d'antenne suivants, les spécifications et considérations du site doivent être remplies:*

- *Type de zone de service et la taille*
- *Type et les caractéristiques de l'antenne*
- *Hauteur*
- *La longueur et le type de câble coaxial requis pour relier l'antenne au répéteur et l'atténuation.*

## 2.3.2 FCC et IC conformité de l'installation intérieure

*L'antenne de service est installé à l'intérieur, où le type d'antenne dépend de l'application.:*

- *Un ou une combinaison des antennes suivantes peuvent être utilisées: Antenne Patch pour montage au plafond, antenne Patch pour montage mural, Réflecteur en Coin.*
- *Choisissez une antenne à haute côté atténuation du lobe qui permet une isolation maximum des autres services / antennes mobiles.*
- *Gain net [Gain Antenna - la perte de câble] ne doit pas dépasser 13 dBi*
- *Les antennes à gain < 13 dBi peut être connectée directement aux ports MBF-20.*
- *Antennes à gain plus élevées peuvent être connectés aux ports MBF-20 avec des pertes de câble et de division adéquates.*

## 2.3.3 Critères d'installation de l'antenne d'installation d'intérieur

*Déterminer la configuration de l'installation de l'antenne, selon les exigences de transmission et les conditions du site d'installation.*

### **Exigences d'installation:**

- *Une antenne intérieure doit être installée à un endroit pratique. Il doit être libre de tout obstacle métallique.*
- *Installez l'antenne de service à la hauteur désignée et l'accorder à peu près vers la zone de couverture du service.*
- *L'installation de cette antenne doit fournir une distance minimale de séparation de 35 cm de tout le personnel dans la région*



## 3 MBF-20 Installation

A maximum of 24 MBF-20 dual/quad units can be connected to a single OMU II system. The number varies depending on the OMU II hardware configuration and any additional installed high-power fibre-fed remotes.

### Note the following:

- Up to four MBF-20 remotes can be installed per OMU II *node* (via an Optic Splitter).
- When multiple remotes are installed at a single node, each remote must support a unique UL colour wave (MBF-20 model specific).
- Each MBF-20 is connected towards an OMU II Optic Splitter module

### This section describes two types of installation procedures:

- Single MBF-20 unit – section 3.1.
- Quad-band assembly consisting of two MBF-20 units – section 3.2.

### 3.1 Dual-band Installation

The physical installation consists of mounting the unit, connecting antennas, power and the optic fibre. Once the physical installation is complete, the unit is automatically identified by the OMU II and can be setup from the OMU II side. *Not setup procedure is required from the remote site.*

#### 3.1.1 Overview

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**NOTE:** *The service antenna(s) can be positioned and installed (without being connected to the Remote) at any time either before or after remote installation*

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1. Unpack the Remote kit.
2. Connect the Power Supply to the bracket (**do not connect power**).
3. Mount the Bracket assembly on the wall.
4. Mount the Remote onto the bracket.
5. Clean and Connect the Fibre Optic cable.
6. Connect the antenna(s).
7. Power-on the Remote.

#### 3.1.2 Required Tools and Materials

The following is required in order to install the Remote:

- Standard professional tool box
- F/O cleaning kit

### 3.1.3 MBF-20 Dual-band Kit

Upon receiving the Remote, perform the following:

1. Examine the shipping container for damage before unpacking the unit.
2. Perform a visual inspection to reveal any physical damage to the equipment.
3. Verify that all of the equipment (listed below) is included. Otherwise contact Axell Wireless.

MBF-20 Dual band kit	
Description	Image
MBF-20 Remote	
Wallmount Bracket	
Remote Power Supply (15V)	
4 x N-6 x 10 panhead screws	

### 3.1.4 Mounting Remote

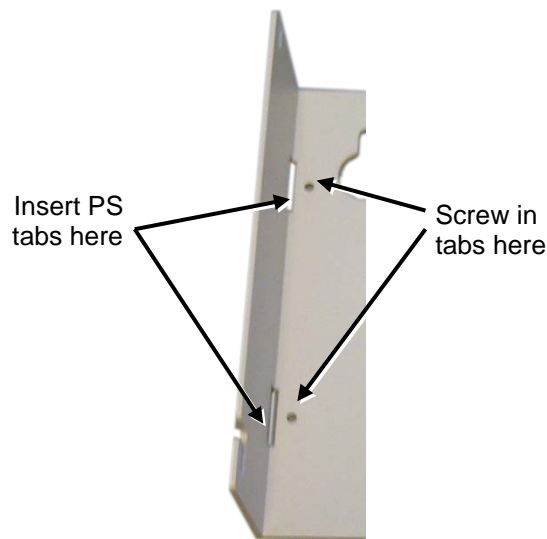
Choose the location of the Remote on the wall according to the following criteria:

- The location should be at normal eye level height, above ground.
- Be sure to allow easy access to the Remote for maintenance and on-site inspection.

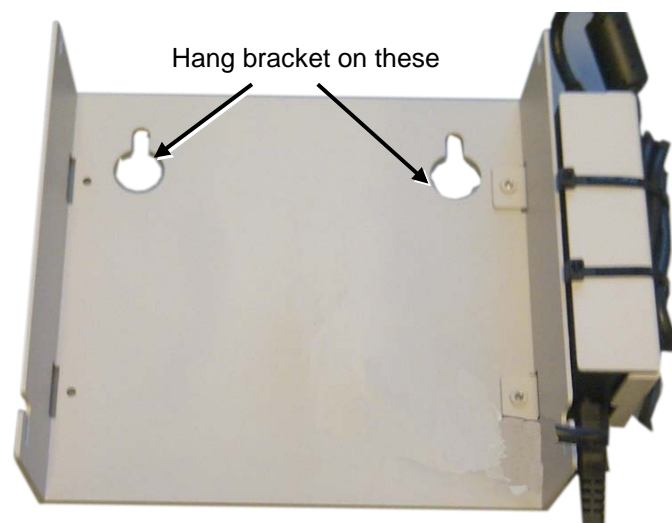
**WARNING!!!** The Remote must always be installed vertically and top-down, to allow free-flow of cooling air. Horizontal installation on a bench for prolonged period of time may cause damage to the Remote due to over-heating

#### To mount the Remote on the wall

1. Insert the supplied power supply tabs into the side of the bracket, each tab in its slot and tighten using the provided screws.



2. Using the bracket assembly for reference to the bolt locations, insert the appropriate bolts (not supplied) on the wall, according to the type of wall.
3. Hang the bracket assembly on the wall and tighten.



*Figure 3-1. Mounting the Bracket on the Wall*

4. Hang the Remote on the Bracket as illustrated below.  
To do so, refer to Figure 3-2:

- Loosely screw the 4 x N-6 x 10 panhead screws - two on each side of the MBF-20 (**red arrows**).
- Hang the MBF-20 on the bracket by sliding the four screws into the bracket inlets.
- Verify that the MBF-20 is firmly mounted and *tighten* the 4 x N-6 x 10 screws to secure the Repeater to bracket.



Figure 3-2. MBF-20 to Bracket Mounting

### 3.1.5 Antenna Connections

**CAUTION!!**

- Do not connect the antenna cables to the remote before verifying the installation parameters.
- Do not power-up the remote without either the antennas being connected or the antenna connections terminated with dummy loads..

**To connect the antennas to the MBF-20 Master**

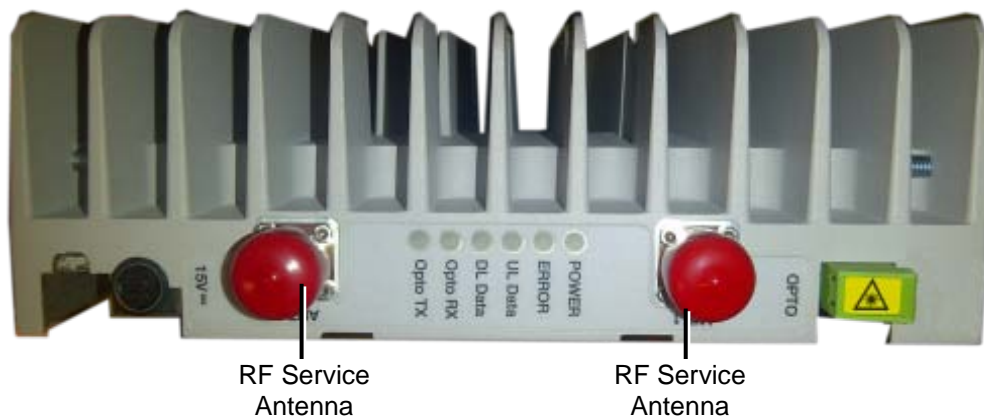
1. Install the antenna cables along their path to the Remote, and connect them to the Antennas.

---

*NOTE: Be sure to use low loss cables.*

---

2. Connect the Service antenna(s) to any of the MBF-20 Master MOBILE ports. (Mobile antenna specifications and installation criteria are described in section 2.2).
3. Terminate any unused service antenna port.
4. Verify all RF connectors are tightened and the cables and antennas are secured.



*Figure 3-3: MBF-20 Single/Dual-Band Antenna Connections*

### 3.1.6 Power Up

#### To power up

Connect the Remote P.S. to the AC power outlet and to the Remote DC connector.

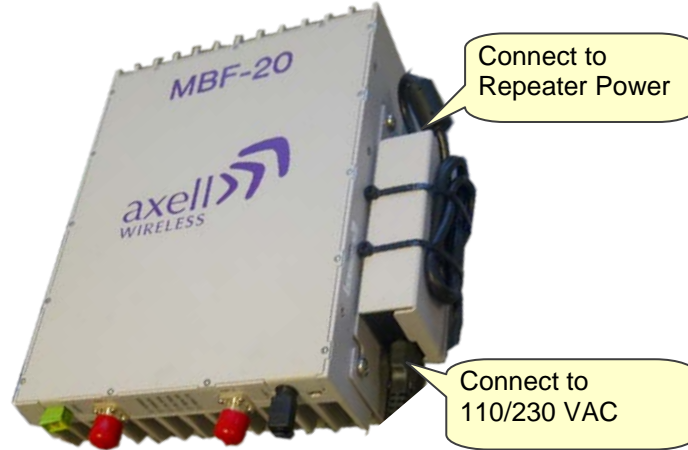


Figure 3-4. Powering Up

### 3.1.7 Fibre Optic Connections

Note the following:

- Be sure to use low loss optic fibre cables
- Install according to F/O specifications and installation criteria are described in Appendix B.

#### To connect the F/O cable from the OMU II side to the Remote

*NOTE: Be sure to use low loss cables.*

- 1.. Connect the F/O cable from the OMU II side to the Remote's F/O port.
2. Verify F/O is securely connected.
3. Verify LEDs (see Appendix D).



Figure 3-5: MBF-20 Dual-Band Fibre Optic Connection

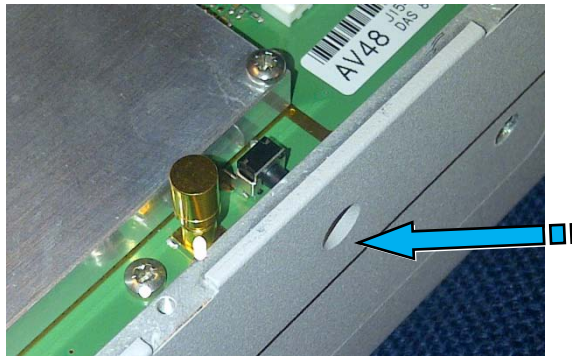
### 3.1.8 MBF-20 Local Optical Link Adjustment (N/A)

*NOTE: This option will be available in future versions.*

To verify the link is operational, you can initiate Optical Link Adjustment (OLA) by pressing a button at the side of the MBF-20.

#### To initiate OLA from the MBF-20 side

1. Locate the auto-config button at the side of the remote (see below).



2. Use a pin (or similar thin object) to press the sunken button.
3. Wait two minutes and verify LED Opto Tx and Opto Rx status.

### 3.1.9 What Next

After completing the physical installation, the MBF-20 is automatically detected by the OMU II. The adjustment and setup procedure is then performed from the OMU II side (Chapter 4).

### 3.2 Quad-Band Installation

The MBF-20 Quad-band consists of two assembled MBF-20 remotes: an MBF-20 Master and an MBF-20 Expansion. The MBF-20 Quad-band unit is fed by a single F/O cable and shares two service antennas, where the F/O and service antenna interfaces are located on the MBF-20 Master unit. A dedicated power supply is installed for each unit.

If a Master MBF-20 is pre-installed, it is required to dismount the unit before assembling it to the MBF-20 Expansion unit.

*NOTE 1: The MBF-20 Quad-band Installation Sheet provides Instructions for assembling the Master and Expansion unit and installing the assembly.*

*NOTE 2: For optimal VSWR performance on QUAD-band units, you can use an external two way splitter (acquired free of charge) from you local Axell wireless sales representative.*



Figure 3-6: Cascaded MBF-20 Quad-band



## 4 MBF-20 Setup and Commissioning

The MBF-20 Remote is a Plug-and-Play solution that requires no configuration at the remote installation site. *The setup procedure described in this section is performed by opening a management session to the host OMU II unit.*

### The MBF-20 Setup and Commissioning consists of:

1. Accessing the MBF-20 via OMU session.
2. Verifying and (if necessary) performing Optical Loss Adjustment.
3. Setting the required RF attenuation and gain levels.
4. Assigning the unit a recognizable name according to its location.

### 4.1 Open a Session to the MBF-20 via the OMU II

1. Open a local or remote session to the host OMU II:
  - Remote session – open a Browser session in the same subnet as the host OMU II and enter the IP of the host OMU II. Enter the OMU II User Name (**axell**) and Password (provided by your system administrator).
  - Local session– connect to the OMU II Control Module USB port or Ethernet port. Enter the OMU II User Name (**axell**) and Password (provided by your system administrator).



Figure 4-1: Connection to OMU II

The OMU II main screen appears (see example below).

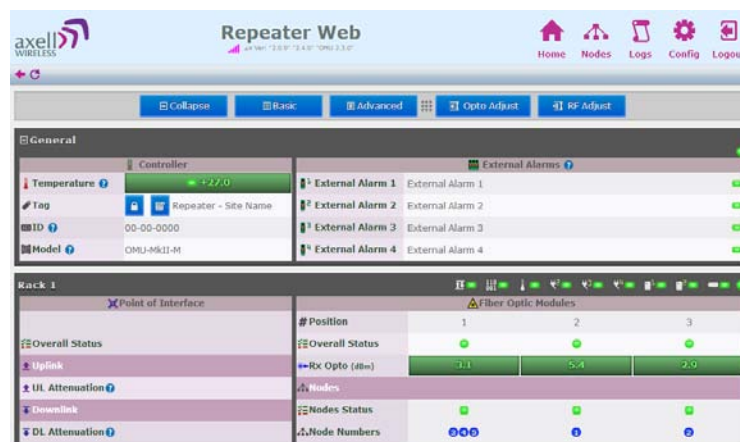


Figure 4-2: OMU II Main window

## 4.2 Optical Loss Adjustment (OLA)

*NOTE: (In future versions), the optical loss adjustment (OLA) for the unit may have already been performed from the installation site by pressing the button on the unit left pane (section 3.1.8).*

Perform OLA from the OMU II. This section describes how to verify the OLA status for a specific MBF-20 unit and how to perform the OLA if necessary.

### To view OLA status and perform OLA

- From the OMU II main window, click the **Opto Adjust** button.

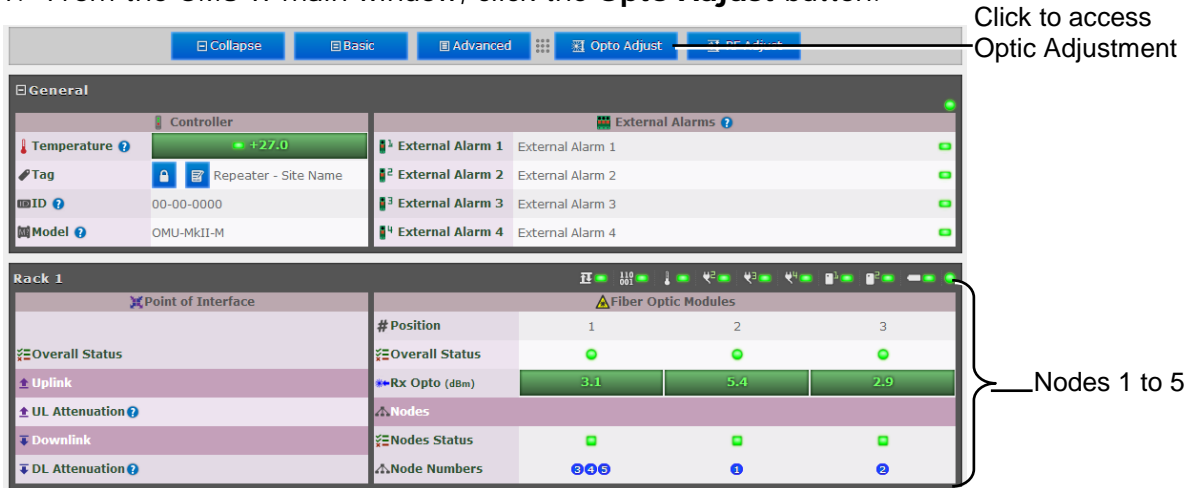


Figure 4-3: OMU II Main window

- The following window appears. The window provides optical adjust options and shows the optical adjust status for each fibre-fed remote link. The links are listed according to the OMU II unit and nodes represented by Optic Conversion Units, along with optical adjustment status information.

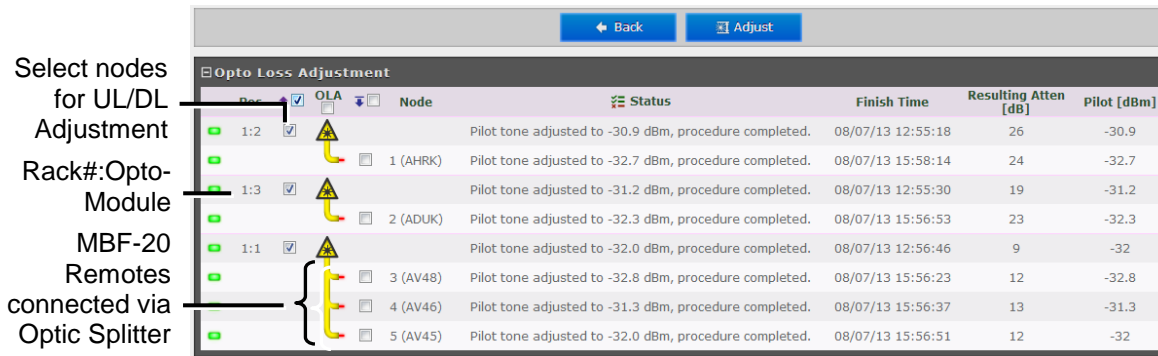


Figure 4-4: OMU II Opto Adjust Pane

- Verify that adjustment has been performed successfully on the relevant node (s):
  - The adjacent LED is GREEN.
  - The Progress column provides detailed information on when the adjustment was performed.
  - The Compensation column shows the required compensation.

4. If necessary, perform adjustment on the link(s) by doing the following:
  - Checkmark the node(s) – or click on one of the buttons for other selection options.
  - Click Adjust.

The status of the adjust procedure for each selected node, and the amount of compensation (for completed adjustment procedures) is displayed in the corresponding row(s).

5. Perform the RF balancing according to the following section.

## 4.3 MBF-20 RF Balancing

The MBF-20 RF Balancing procedure can be performed manually (the automatic option specified in section 4.3.2 will be available in the future) via the OMU II web interface.

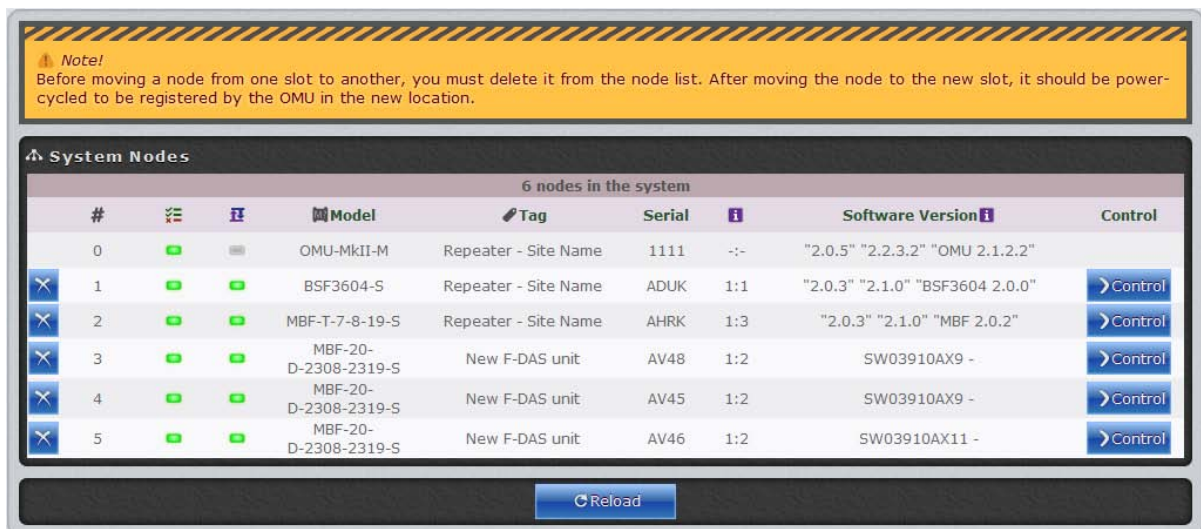
### 4.3.1 Manual MBF-20 RF Balancing

The manual balancing procedure consists of the following steps:

- Verifying a DL RF output level of 18/23dBm by setting the required DL attenuation of the signal.
- Setting the UL attenuation according to the DL.
- In case of noise, adjusting the UL attenuation to reduce noise

#### To balance the MBF-20 UL and DL outputs

1. Access the MBF-20 Configuration window:
  - Click on the **Nodes** button. The below pane appears
  - Click **Control** next to the node to be balanced.




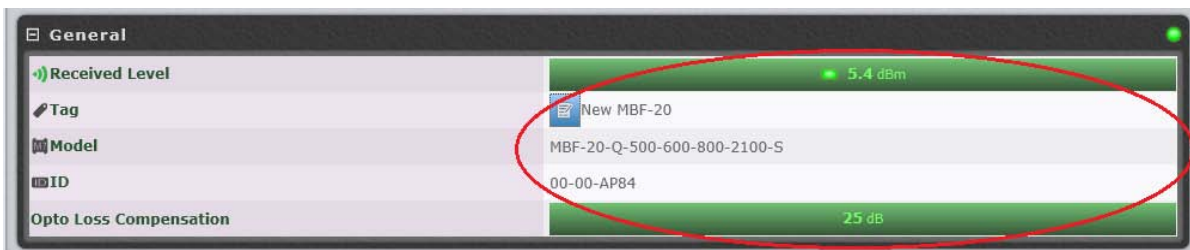
2. The resulting pane can be displayed in two views:
  - Basic – default view (**Basic** button)
  - Advanced – provides more information (**Advanced** button)

The dialog below shows an example of the Basic (default) view.



Figure 4-5: Example of MBF 20 Quad Band Configuration window

- The **General** area provides basic identification and status information and enables assigning an identifiable name:
  - Received level – opto signal level at the MBF-20 (from the optic fibre)
  - Tag – identifiable name currently assigned to the unit. Click the  icon to change the name.
  - Model – unit type, frequencies and Master (M) or Slave (S)
  - ID – unique serial number associated with this unit (automatically assigned by AEM)
  - Opto Loss Compensation – compensation allocated on the UL during the Optical Adjustment procedure

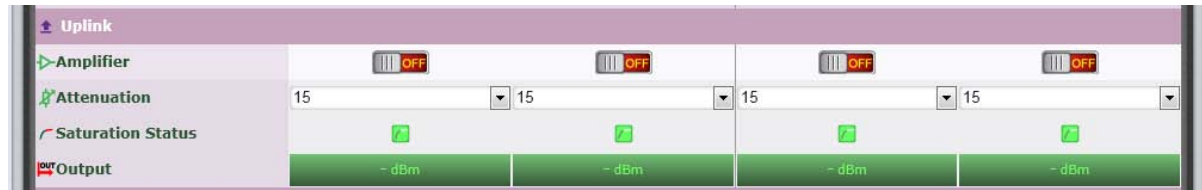


- In the Downlink:
  - Verify the **Amplifier** for each band is ON.
  - Set **Attenuation** to maximum value (15dB).
  - Lower the **Attenuation** level step by step until the desired Output power level is reached. (Zero attenuation = maximum gain).
  - Verify the Amplifier Saturation is GREEN.



5. In the Uplink:

- Verify the **Amplifier** for each band is ON.
- Set **Attenuation** equal to the value set in the DL (above).
- Verify the Amplifier Saturation is GREEN.



*NOTE: If noise is detected on the link, reduce only the Uplink for optimal signal.*

### 4.3.2 Automatic MBF-20 RF Balancing

*NOTE: This feature will be available in future release.*

#### To access the Automatic RF Adjustment pane

1. Access the OMU II **Home** window and click on **RF Adjustment**.

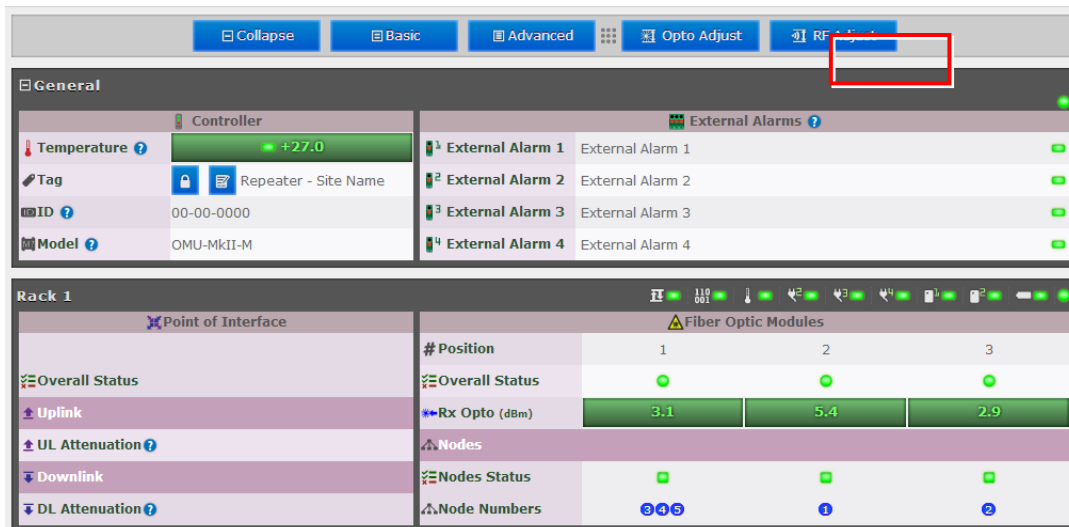


Figure 4-6: OMU II Main window

The following pane appears.

**Note:**  
 The automatic RF Adjustment procedure will adjust the output in the downlink path for each chain to the nominal level and then set uplink gain according to the Delta configuration. For this to work, there must be a downlink signal enabled in the downlink from the base station allowing to reach the desired output power level. Before performing RF Adjustments it is strongly recommended to adjust corresponding opto links in the opto adjustment page.

MBF-20 remote  
with selected  
bands to adjust

Node #3, AV48, MBF-20-D-2308-2319-S, New F-DAS unit, 1:1							
?	Freq [MHz]	Nominal Level [dBm]	Uplink Delta [dB]	Status	Finish Time	Resulting Atten [dB]	Output Level [dBm]
<input type="checkbox"/>	850	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:40	3	-
<input checked="" type="checkbox"/>	1900	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:29	3	-

Node #4, AV46, MBF-20-D-2308-2319-S, New F-DAS unit, 1:1							
?	Freq [MHz]	Nominal Level [dBm]	Uplink Delta [dB]	Status	Finish Time	Resulting Atten [dB]	Output Level [dBm]
<input checked="" type="checkbox"/>	850	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:23	3	-
<input type="checkbox"/>	1900	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:17	3	-

Node #5, AV45, MBF-20-D-2308-2319-S, New F-DAS unit, 1:1							
?	Freq [MHz]	Nominal Level [dBm]	Uplink Delta [dB]	Status	Finish Time	Resulting Atten [dB]	Output Level [dBm]
<input checked="" type="checkbox"/>	850	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:11	3	-
<input checked="" type="checkbox"/>	1900	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:05	3	-

2. Select the bands of each remote to be adjusted (e.g. 1900MHz band on Node #3)
3. Adjust the following for each band:
  - Nominal Level (dBm)
  - Uplink Delta (dB)
4. Click **Adjust**. The procedure may take several minutes depending on the number of units selected.

## 4.4 What Next?

The MBF-20 unit is now ready for operation. You may monitor the unit general status via the OMU II Main window and if the node is faulty (red LED), access the dedicated configuration pane in Basic and Advanced view for more information.

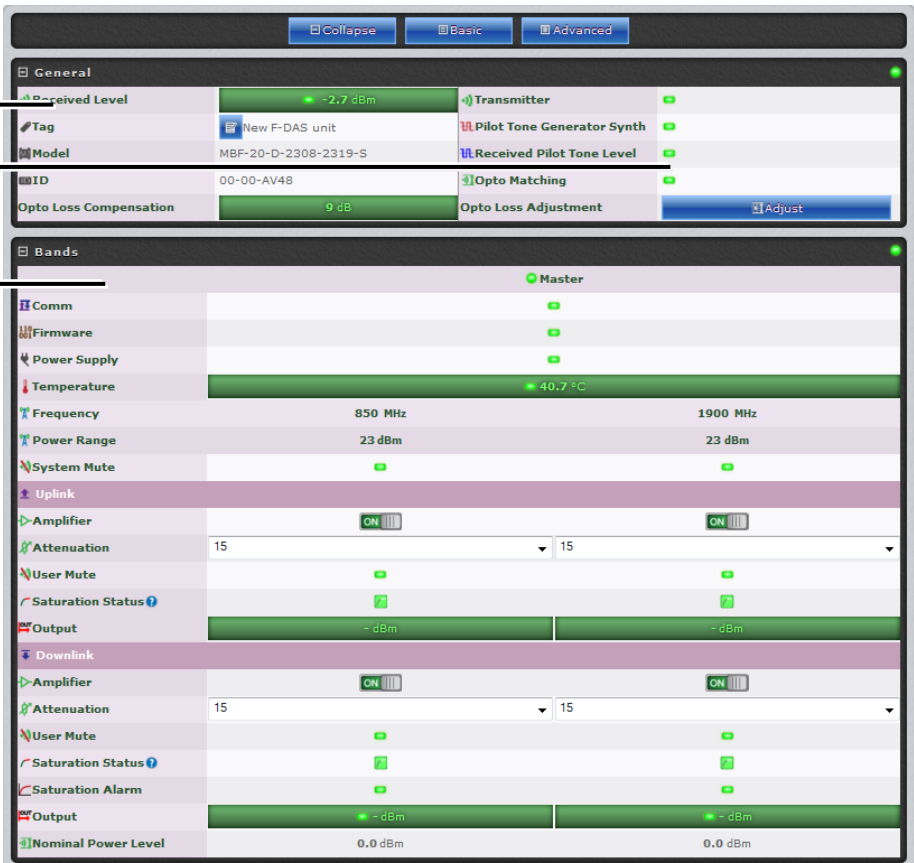


## Monitoring Via the MBF-20 Home Screen

In addition to RF settings and readings, the MBF-20 Home screen provides detailed information on the operation status of internal modules. This information can be used to aid in remotely troubleshooting the unit.

### To access the MBF-20 Main Monitoring and Configuration window

1. Access the OMU II main windows, click the **Nodes** button, choose the remote related node and click the adjacent **Control** button. The MBF-20 Home window appears in Basic View. To view more details, click **Advanced**.



**General**

**Detailed fibre optic status**

**Detailed Repeater Status view**

*Figure 4-7: MBF-20 Main Screen Advanced*

### 4.4.1 General Area

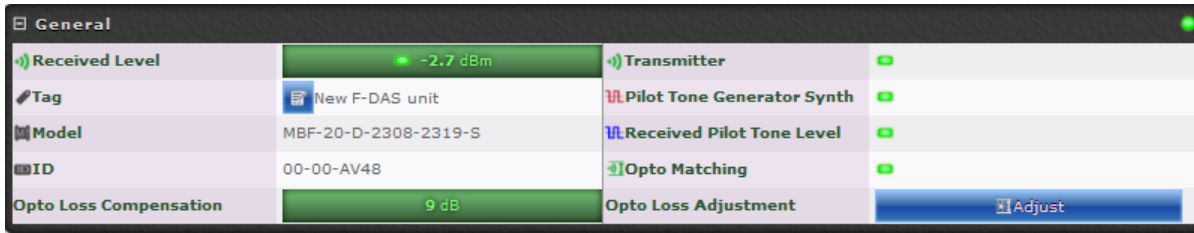



Figure 4-8: MBF-20 General Advanced View

Indicator	Description
Received level	Opto signal level at the MBF-20 (from the optic fibre)
Tag	Identifiable name currently assigned to the unit. Click the  icon to change the name.
Model	Unit type, frequencies and Master (M) or Slave (S)
ID	Unique serial number associated with this unit
Opto Loss Compensation	Power dedicated by OMU to compensate for the signal.
Transmitter	RF transmitter status
Pilot Tone Generator Synth	Pilot tone synthesizer module status
Received Pilot Tone Signal	Received pilot tone status
Opto Matching	Indicates OMU and MBF-20 are connected (if green)
Opto Loss Adjustment	Perform OLA via MBF-20



### 4.4.2 Detailed view of the MBF-20

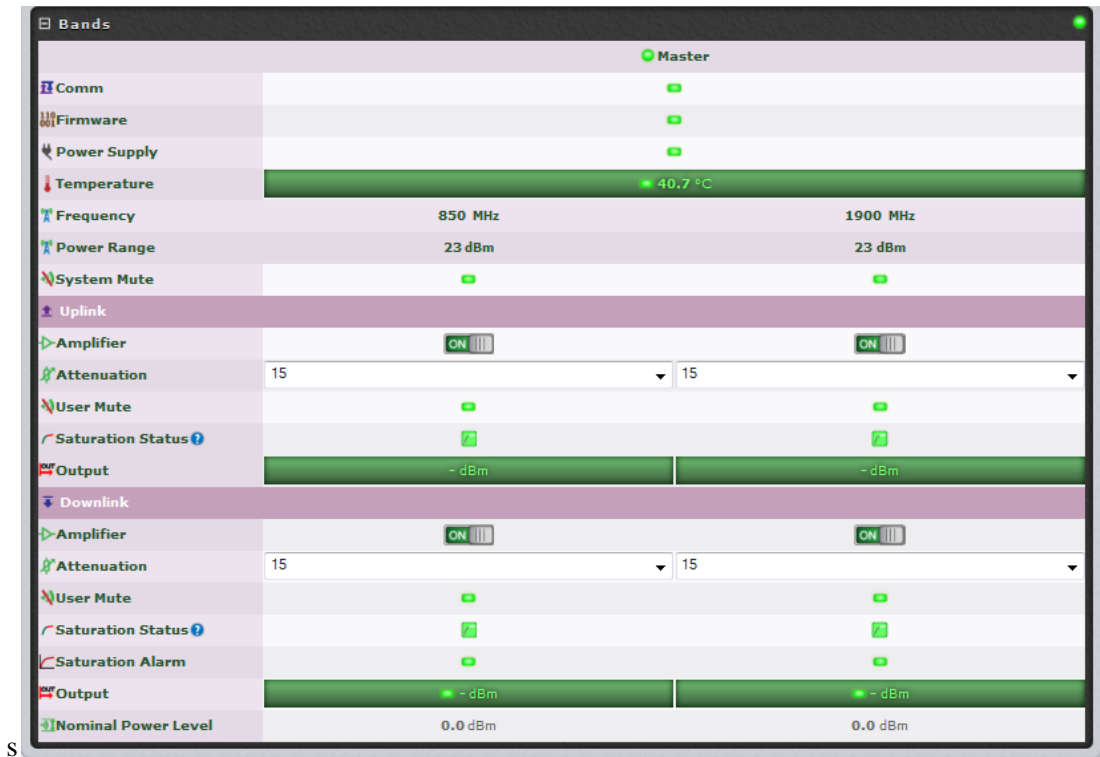


Figure 4-9: MBF-20 Band Status


Indicator	Description
Comm	Communication status
Firmware	Firmware related error
Power Supply	Power supply related error
Temperature	Temperature level and status indicator
Frequency	Band frequency used
Power Range	Output power
System Mute	Indicates system has muted a specific amplifier (will turn red)
Amplifier	Turn amplifier on/off
Attenuation	Set attenuation of RF signal (UL/DL)
User Mute	If Red - system has been muted by user
Saturation Status	Saturation level status
Output	Output power level used
Saturation Alarm	See above
Nominal Power Level	Displays the current nominal power level of the system

## Appendix A: US/Canada Specifications

Frequency Range	Uplink		Downlink
700MHz	Lower band 698-716MHz or Upper band 776-787MHz		Lower band 728-746MHz or Upper band 746-757MHz
850MHz	817-849MHz		862-894MHz
1900MHz	1850-1915MHz		1930-1995MHz
1700MHz	1710-1755MHz		2110-2155MHz
Versions	700MHz	1900MHz	1700MHz
Operational Bandwidth	29MHz	60MHz	45MHz
Composite Power	+23dBm	+23dBm	+23dBm
Ripple in Passband	±2dB	±3dB	±2dB
Service Antenna ports	2		
Noise Figure	10dB Typical (maximum gain)		
Propagation Delay	< 2µs		
Modulation Accuracy at Nominal Output Power			
GSM/GMSK	< 2.5° RMS and <10° peak		
EDGE/8-PSK	< 3% EVM RMS		
WCDMA/EVM	< 12.5% RMS (composite according to ETSI TS 25.106 with TM1/64 DPCH)		
PKCDE	< -33dB (according to ETSI TS 25.106 with TM 1/64 DPCH and spreading factor 256)		
General Parameters			
Gain UL/DL	18/18dB Adjustable, in 1dB steps		
System Impedance	50 Ohm		
Antenna Connectors	N-Type		
Electrical ratings	110/230VAC		
Power Consumption	Single/Dual Band		Tri/Quad Band
	30W/50W		75W/100W
Optical Parameters			
DL Wavelength	1310nm		
UL Wavelengths	1510, 1530, 1550, 1570, 1590nm		
F/O Connector	SC/APC		
Max Optical Loss	3dB		
Mechanical	Dual Band		Tri/Quad Band
Dimensions	11.8" x 8.66" x 2.91" (300 x 220 x 74mm)		11.8" x 8.66" x 5.8" (300 x 220 x 148mm)
Weight	8.9lbs (4kg)		17.8lbs (8kg)
Enclosure	IP 30		
Environmental			
Operating Temperature	32 to + 113°F (0 to + 45°C)		
Storage	-40 to 185 °F (-40 to +85°C)		
Humidity	ETSI EN 300 019-2-4		
Complies with	FCC/IC		

## Appendix B: Optic Fibre Cables Connections

This product is equipped with Class 1 lasers, as per definition in EN 60825-1.

	<p>LASER RADIATION DO NOT STARE INTO BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS CLASS 1 LASER PRODUCT</p>	<p><b>Caution!!!</b> Un-terminated optical receptacles may emit laser radiation. Do not stare into beam or view with optical instruments.</p>
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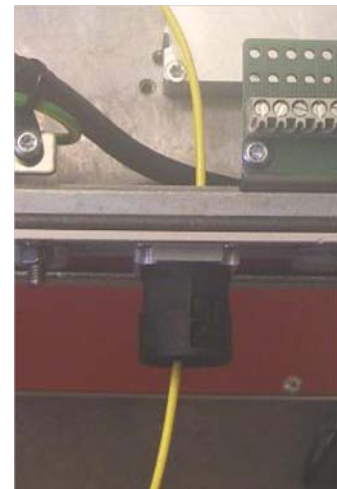
*Note: Angled connectors, APC, need to be used throughout the whole link between the unit and the remote. The angle needs to be 8 degrees. Also the ODF connections need to be APC type. The fibre must be monomode type.*

### Connecting the Fibre Optic Cable

1. Select type of optic fibre (Recommended fibre cable is single mode 9/125).
2. Run the fibre through a corrugated sleeve.

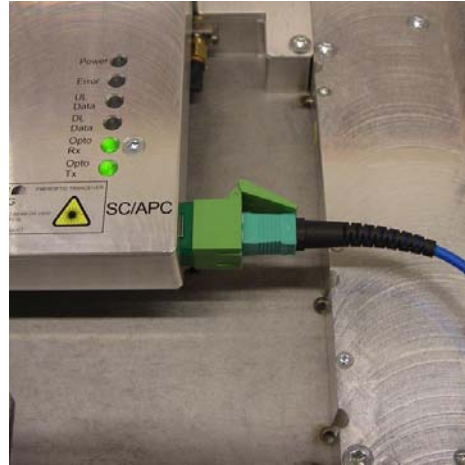


3. Insert the cable via the Fibre input.



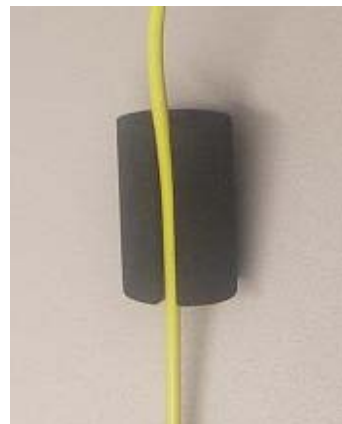
4. Connect the fibre to the Fibre Optic Converter inside the repeater.

*NOTE: Make sure the fibre is not bent too sharply inside the repeater as to avoid communication disruptions.*



5. Place the fibre in the rubber seal.

*Note: The sleeve, together with the rubber seal, meets the protection standard IP65.*



6. Adjust the fibre length inside the repeater and insert the seal into the fibre input interface.



7. Attach the sleeve to the fibre optic inlet.

---

*Note: Clean the fibre connector before connecting it to the system.*

---

Optical reflections from a discontinuity such as a poor connector interface appear on an RF spectrum analyzer trace as stable variations in the noise floor amplitude that are periodic with RF frequency. If the reflection is bad enough, it could impact the system performance. The most common cause for a large discrete reflection is a dirty optical connector. A bit of dust or oil from a finger can easily interfere with, or block this light.



---

*Note: Perform the cleaning procedure as described in Appendix C: F/O Cleaning Procedure.*

---



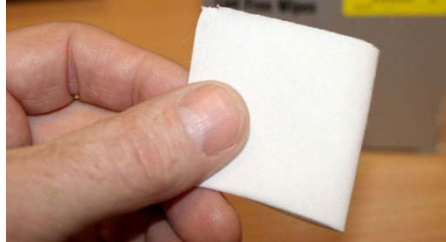



Be sure to use the correct procedure for the given connector.

When disconnected, cap the SC/APC connector to keep it clean and prevent scratching the tip of the ferrule.

## Appendix C: F/O Cleaning Procedure

*NOTE: The process is demonstrated on an OMU F/O module and is similar to all F/O equipment supplied by Axell.*

**Tools:**

Tool Description	Illustration
<p>Fibrescope connected to a PC running the appropriate viewing software.</p> <p>It is highly recommended that some form of fibre viewing equipment such as a Fibrescope is used to ensure that all fibre connections are clean before termination; failure to do so could result in poor system performance</p>	
<p>Lint-free swabs (box), Axell P/N 99-000127</p>	
<p>Lint-free wipes (pack) Axell P/N 99-000125</p>	
<p>Fujikura "One Click" cleaner, Axell P/N 98-900004.</p>	
<p>99% isopropyl alcohol (can), Axell P/N 99-000126</p>	
<p>Cletopt type S Cassette Cleaner, Axell P/N 98-900068</p>	

## The Cleaning Procedure:

### Dry Cleaning



**ATTENTION!** Invisible laser radiation might be emitted from disconnected fibres or connectors. Do not stare into beams or view directly with optical instruments.

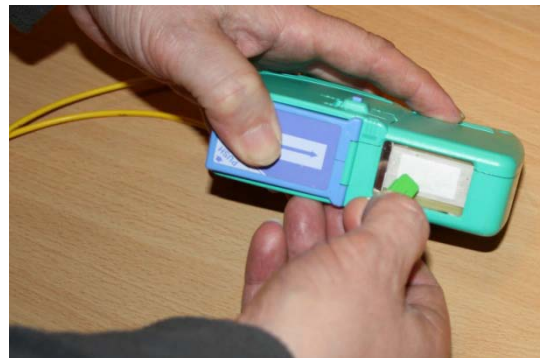
#### Note the following:

- Before cleaning the optical connectors on the OMU it is advisable to clean the connector of the mating cable being attached to the optical port.
- An unclean optical connector is often the cause for reduced system performance. A bit of dust or oil from a finger can easily interfere with, or block light. Fortunately, it is very easy to clean the connector. Be sure to use the correct procedure for the given connector. When disconnected, cap the SC/APC connector to keep it clean and prevent scratching the tip of the ferrule.
- Use a product specially designed for the purpose, such as the Cletop type S Cassette Cleaner.



**IMPORTANT:** Always make sure there is a way of inspecting the connector after cleaning. Cleaning can actually leave the end-face in a worse condition, since alcohol residue is one of the most difficult contaminants to remove.

1. Begin by dry cleaning the F/O bulkhead connector (shown below is the Fujikura One-Click in use).



2. Remove the protective cap from the cleaning-head end of the "One Click" cleaner, lift the protective end-cap on the fibre connector and offer-up the end to the fibre connector



3. With the cleaning-head end fully engaged in the connector, push until an audible "click" is heard
4. Without fully withdrawing the cleaning head end push it in again twice more, each time until an audible "click" is heard.



5. Withdraw the "One Click" cleaner and replace the protective end cap.
6. Inspect the fibre connector using a Fibrescope. On the PC monitor, verify that there is no contamination present on the connector end-face.
7. If the connector is dirty, clean it with a wet cleaning technique followed immediately by dry cleaning. This is to remove any remaining residue from the wet clean (the following steps demonstrate a wet cleaning technique).



## Wet Cleaning



Invisible laser radiation might be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.

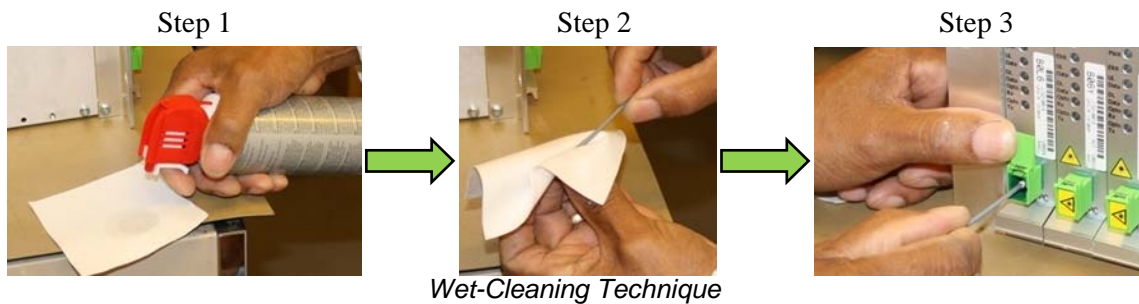
1. Lightly moisten a new lint-free wipe with 99% isopropyl alcohol. (Step 1 below).

---

*Tip: Have a dry lint-free swab available for immediately drying after performing the wet-cleaning.*

---

2. Lightly press and turn a clean lint-free swab in the moistened area of the wipe to moisten the swab. It is important that the swab is not too wet. (Step 2 below).
3. Insert the moistened lint-free swab into the bulkhead adapter. Lightly press and rotate several times in the same direction. (Step 3 below).



4. Immediately use a dry lint-free swab to clear any remaining alcohol residue.

---

**NOTE:** Do **not** re-use any of the wipes and/or swabs. Dispose of them properly.

---

5. Follow steps 3 to 6 of Dry Cleaning above
6. Re-inspect the fibre using the Fibrescope. On the PC monitor, verify that there is no contamination present on the connector end-face.
7. If the fibre is still dirty, go back to step 1 (Wet Cleaning) and repeat the entire process.

---

**NOTE:** The entire wet/dry cleaning cycle should only be used twice, if the fibre is still dirty after two cycles of wet/dry cleaning seek advice from the Axell Wireless Support Desk.

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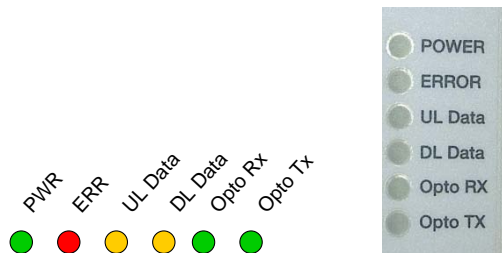
## Appendix D: LED Troubleshooting

MBF-20 provides two types of indications of Remote failure:

- Alarms screen in Web access application
- Status LEDs on Dual-Band Remote front panel

The following section provides a description of the troubleshooting procedures according to the Repeater LED indicators. For Web-access alarm specifications, refer to the OMU II User Manual.

The MBF-20 remote includes six LEDs on its front panel (see section 1.2). The following table provides a description of the LED troubleshooting procedures.



LED 1, Power, Green	
On	Unit is powered on
Off	Unit has no power
LED 2, Error, Red	
On	Error detected
Off	No error
LED 3, UL Data, Yellow	
On	Communication is ongoing in the uplink direction
Off	No communication
LED 4, DL Data, Yellow	
On	Communication is ongoing in the downlink direction
Off	No communication
LED 5, Opto Rx, Green	
On	Received RF signal on fibre channel is above threshold
Off	Input level below threshold
LED 6, Opto Tx, Green	
On	Transmitted RF signal on fibre channel is above threshold
Off	Output level below threshold