

## **MBF2006 to MBF2009 MBF-2307-2317-XXXX Multi Band Fibre Repeater Operational Description**

The Axell Wireless MBF2006 to 2009 repeaters are dual band mini fibre fed repeaters intended for use with the Axell Wireless OMU2 Optical Master Unit. The purpose of the system is to provide distributed in building radio coverage for popular cellular system frequencies.

The MBF2006 to 2009 repeaters are bidirectional amplifiers for three different frequency bands. There are two Low bands (LTE band 12, 698-716MHz UL, 728-746MHz DL and LTE Band 13, 777-787MHz UL, 746-756MHz DL) and One High Band (1710-1755 MHz UL, 2110-2155MHz DL) integrated with all necessary duplex filters and a Fibre Optic transceiver.

The Fibre Optic Transceiver section of the unit is a modulator demodulator between RF signals and Infra Red Light which is carried over single mode fibre. It operates at wavelengths between 1300-1600nm with bidirectional transmission using Wavelength Division Multiplex. Light around 1310 nm is used for Downlink between OMU2 and MBF2006-9 while a wavelength around 1550nm is used to return Uplink signals to OMU2. (NB. The last digit of the part number MBF200x denote the Uplink Laser wavelength in nm 6=1510nm 7=1530nm 8=1550nm 9=1570nm). Since low back reflection is a prerequisite for good performance of Single Mode Fibre Links the connectors employed are type SC/APC – APC denoting Angle Polished Connector and always having a body coloured Green.

Modulated Light arriving in the Downlink from OMU2 and the Cellular Base Station equipment is demodulated in a PIN Diode Optical Detector (with optical power monitoring and a low frequency supervisory modem circuit using FSK transmission) The DL RF signals are amplified in a 3 stage amplifier having adjustable gain controlled by software programmable attenuators. A pilot tone receiver can detect a carrier sent at 1050 MHz from the OMU, at a known injection level, the detector allows receiver gain to be preset in compensation for different optical link losses / distances.

The DL RF signal is divided in a wideband hybrid coupler, one port of which is terminated by a 50 Ohm load in a dual band unit, but which may be used for adding extra frequency bands using an MBF2000 Expansion Unit. The RF path is divided into the high and low bands above & below 1GHz where it passes to Downlink amplifiers that are preset for the frequency ranges of interest by multi pole ceramic filters. The gains of the Downlink amplifier chains (approximately 55dB) are adjusted by software programmable attenuators. In each band the final output stages are pairs of 2W devices operated in parallel for increased power output. A detector is implemented at the output of the power amplifier for measurement and for automatic level control.

The UL path is a chain of amplifiers and attenuators having similar overall gain but in this case a 0.5W device is sufficient at the output to drive the Uplink Optical Transceiver. Operating frequency pass bands are also preset by ceramic filters. Software gain control, power output measurement and ALC are implemented in a similar way to Downlink direction. The first stage LNA is chosen for Low Noise Figure and the gain distribution is carefully controlled to preserve that at all gain settings. The outputs of the two Uplink paths, high band & low band, are combined by a ceramic diplexer and routed to a wideband hybrid coupler. In dual band units the spare hybrid port is terminated by a 50 Ohm load. The function of the coupler is to combine additional UL frequency inputs from the MBF2000 Expansion Unit.

The Uplink Inputs and the Downlink Outputs of each frequency band (Low and High) are combined together by multi-pole Ceramic duplexers to provide isolation and protect against desensitisation.

The duplexer antenna (common) ports of the High and Low Bands are combined/split depending on direction, in a third ceramic diplexer. The common port of the diplexer (carrying all frequencies in both directions) feeds a wideband hybrid coupler that allows the connection of two antennas at the N type connectors Ant1 and Ant2. The fourth port of the hybrid coupler is provided with a 50 Ohm termination in dual band units but it allows bidirectional access to the Antenna ports for the MBF2000 Expansion Unit.

A PIC microcontroller supervises the operation of all circuitry and collects the levels measured by temperature sensors, RF detectors, optical TX and RX power monitors etc. The PIC controller has a data communication circuit using a pair of 26/29MHz FSK modems which allows it to communicate with the Optical Master Unit (OMU) over the fibre. The 29MHz FSK circuit passes data from OMU to MBF (downlink) while the 26MHz circuit acts in the reverse direction. The data rate is 57600 Baud.

Each MBF repeater has a unique serial number for communication so that commands can be issued and data polled by the Master controller in the OMU. The GUI provided at the OMU controller enables users to view settings and levels and enable or disable freq bands/paths. Settings for calibration variables (Laser power, detectors, Preset RF gain, ALC levels) are held in the PIC EEPROM and are retained at power off. They cannot be changed other than by the Automatic Test Station which calibrates them during production or with the Engineering level software tool which is not available to any but Axell Wireless service personnel.

The MBF2000 Series Repeaters are powered by 15V DC Negative Ground. Power Consumption is 45Watts when all Amplifiers and Optical Section are on. The units are supplied with a matching 115V/230V AC PSU and power cable to suit the Market Area. (UK/EU/USA). The unit is supplied with a wall mounting cradle fixed by M6x10 Bolts. The cradle includes a side pocket to hold the AC PSU.