CELLULAR COVERAGE SOLUTIONS
Through its extensive and unique repeater product portfolio for cellular operators, Axell Wireless provides solutions for an effective rollout of GSM or WCDMA networks for all types of environments. Three of these solutions are described in this brochure: Multi-band solution for indoor coverage, frequency shifting repeaters for rural coverage and channel selective repeaters for gap-filling of in-building coverage.

1. For in-building coverage Axell Wireless offers a multi-band fibre fed (MBF) repeater solution that is especially suitable in multi operator scenarios. The MBF Repeater is available in single, dual or tri band versions and operates on all cellular frequency bands (850, 900, 1800, 1900 and 2200 MHz).

2. In rural areas where the capacity requirements are limited, repeaters can often be a cost effective complement to the backbone of macro base stations. Rural coverage deployment is made simple and inexpensive by using our repeater equipment that offers high output power and high gain and that are easy to install and maintain.

3. For an indoor environment where there is a need to increase the coverage with a limited capacity (2 to 4 carriers), the channel selective repeaters are ideally used. These repeaters offer optimum levels in terms of output power and gain. In a WCDMA network it’s important to balance downlink, power per channel to the uplink gain to maintain the Node B’s original coverage.

**EFFECTIVE SUPERVISION TOOLS**

By using advanced yet user-friendly supervision tools, downtime costs as well as costs for training remain low. The Axell Wireless Element Manager (AEM) keeps you in complete control of your network elements 24 hours a day, 7 days a week. The repeater’s architecture leads to easy maintenance and spare parts handling, which is a cost-saving factor. The AEM software tool also acts as a quality assurance, reducing the Total Cost of Ownership.

**GUI - Graphical User Interface**

*The main status screen in the RMC, OMU connected to the MBF.*
1. MBF - THE MULTI-BAND AND MULTI-OPERATOR IN-BUILDING SOLUTION

The MBF repeater offers seamless multi-band coverage in any environment including tunnels, metros, stadiums, airports and large buildings and it is available in single, dual or tri-band versions which support an increasing number of wireless technologies including GSM900, GSM1800 and WCDMA.

The MBF repeater is suitable for single operator coverage demands as well as in cases where mobile operators collaborate and share the investment of deploying an active infrastructure solution in an indoor environment.

MEETS THE INDUSTRY’S HIGHEST STANDARDS

It is specifically designed to meet the industry’s highest standards as it offers exceptionally high output powers, yet uses convection cooling instead of fans, thereby lowering power consumption and significantly extending the equipment’s total lifetime. Hence, the MTBF figures are increased compared to if active fans were to be used. The high output power results in a need to deploy a fewer number of sites, which in turn lowers the capital expenditures for the roll-out as a whole.

Signals are coupled off from a nearby base station and then distributed via fibre to one or several MBF repeaters. These remote units can be installed up to 20 km from the base station site, offering a great flexibility when providing RF coverage in areas where off air transmission is not a practical solution. A distributed antenna system can be used to distribute the signal throughout the area to be covered.
AUTOMATIC OPTICAL GAIN SETTING

The MBF repeater is part of a fibre optic system that puts a clear focus on user friendliness and ease of installation. Commissioning is easily performed through an automatic optical gain setting, thus reducing the time it takes to put the equipment in service; this also means that the training is significantly simplified and the need for installation effort is decreased.

A COMPLETE SOLUTION

Axell Wireless can provide a complete solution including design, site surveys and equipment related to the POI (Point of Interface) such as combiners, filters, cross band couplers, etc. The MBF repeater family includes version for single band, dual band as well as tri band coverage.

SINGLE BAND

The Single band version is available for the E-GSM band, the DCS (1800) band or WCDMA (3G) band.

DUAL BAND

The Dual band version is available in the following combinations:

- E-GSM band & DCS band
- E-GSM band & WCDMA
- DCS band & WCDMA
- E-GSM & PCS or WCDMA band
TRI BAND
The Tri band version is available in the following combinations:

- E-GSM & DCS & WCDMA
  The technical performances for each band are found inside this brochure. Regardless of the MBF repeater version (single, dual or tri band) these high performances remain constant.

MAIN BENEFITS OF THE MBF

- High output power
- Low noise figure leading to higher system sensitivity
- Advanced and user-friendly remote control and supervision
- Three Bands in one enclosure
- Convection cooling
2. FREQUENCY SHIFTING REPEATERS

Rolling out and expanding GSM networks quickly at a minimised cost is no longer a challenge. Axell Wireless Frequency Translating Repeaters have the power to provide as much coverage as macro base stations do but at a fraction of the cost. Planning and deploying the network with Frequency Translating Repeaters substantially reduces the total lifetime cost.

Frequency translation technology allows the use of an omni directional antenna at the repeater site. By shifting the frequency, the isolation requirements are reduced and lower masts can therefore be used. This also enables high output powers, in other words, large areas can be covered at a minimised cost.

- The donor unit is installed next to the base station where the signal is coupled off via a directional coupler.
- Following frequency translation, the signals are transmitted on a link antenna and received at the remote site where signals are converted back to the original frequencies.
- Finally, the signals are amplified in the remote unit and then transmitted on a server antenna.

Operators with licenses within both GSM 900 and 1800 bands have through the Axell Wireless Band Shifting Repeaters the possibility to use link frequencies on the GSM1800 band, while providing coverage on the GSM900 band. Such a solutions eliminates the isolation requirement altogether, resulting in shorter masts. Installation as well as site acquisition is simplified. In other words, Capital Expenditures are significantly reduced.

There is no need for line of sight between the repeater site and the base station site because of the high gain in the repeater. The site cost is kept low since there is no need for transmission links or shelters. In addition, site costs are reduced due to the possibility to use low masts. This in turn leads to easy site acquisition, reducing the rollout time and cost.
3. CHANNEL SELECTIVE REPEATERS

For an indoor environment where there is a need to increase the coverage with a limited capacity (2 to 4 carriers), the channel selective repeaters are ideally used. These repeaters offer optimum levels in terms of output power and gain. In a WCDMA network it’s important to balance downlink power per channel to the uplink gain to maintain the Node B’s original coverage.

Studies and calculations show that a gain capability of up to 90 dB and an output power in the downlink direction of around 33 dBm per channel is optimal. Higher downlink power can be used, but will particularly in multi-repeater systems result in an unbalanced link budget if not severe degradation of the NodeB’s sensitivity. The noise figures in these repeaters are impressively low, which contributes to increasing the footprint of the repeater coverage.

In the world of UMTS, the channel selection filter characteristics are important to signal quality as well as maintaining seamless network operation in overlapping coverage areas. Axell Wireless has for this reason designed a filter that meets the high demands of selectivity as well as delay.

The medium power repeater can be set to amplify any channel within the UMTS band, which means that it can be used as for multi-operator purposes.

The CSR2222 Repeater can be used to provide coverage in a five-story building of 1000 m².

With an integrated optical module, these channel selective repeaters become fibre fed. A distributed antenna system can then be created using such a fiber fed repeater (CSF2222 or CSF2224) as the remote RF-head feeding a multitude of antennas and/or radiating cable networks.

Through this unique design of Axell Wireless medium power repeater, there are substantial cost-savings to be made. Both the capital and the operational expenditures are reduced as an effect of deploying a repeater that “takes you even further”.

An office building of 10 floors and 3000 m² where several CSF2224 are needed and used in a combination with a distributed antenna system.