



**MobilePartners  
MPW2100-23  
Remotely Managed  
3G repeater**

**User's Manual**

## **Preface**

This User Manual provides installation, configuration, operation and maintenance guidance of the repeater. Specifications are also provided at the end of this User Manual in order to help users better understand the repeater. Please read this user's manual thoroughly and follow the instructions outlined in this manual to ensure a long life span and a trouble-free repeater unit.

## **Warranty**

Lightning protection must be done for all outdoor antennas. Damage to power modules, as a result of lightning is not covered by the warranty.

Switching on the AC or DC power prior to connection of antenna cables is considered as an incorrect installation process and therefore faults arising thereafter are also not covered under the warranty.

This entire manual should be read and understood before operating or maintaining the repeater system.

We assume no liability for customer's failure to comply with the precautions mentioned. This warranty will not cover such failures to comply.

## **Safety Information**

Do not operate equipment in an explosive environment. Appropriate AC or DC power needs to be supplied to the repeater. To avoid power supply spark, please perform the grounding connection of the equipment.

In order to avoid equipment damage or human injury by lightning, static electricity and other phenomenon of leakage electricity, we suggest all products must do the electric-discharge of the electrical grounding in setup process. Incorrect power settings can damage the repeater and may cause electrical related injury to the user.

## **Acknowledgment**

Thank you for purchasing the MPW2100-23A repeater. Strict quality control system procedures are implemented to ensure you a high quality product; with numerous cellular operators acknowledging the product to be a high performance, low interference, transparent and simple to operate and maintain.

This document is written to the customer service personnel, who install, configure and commission the repeater system in a cellular network.

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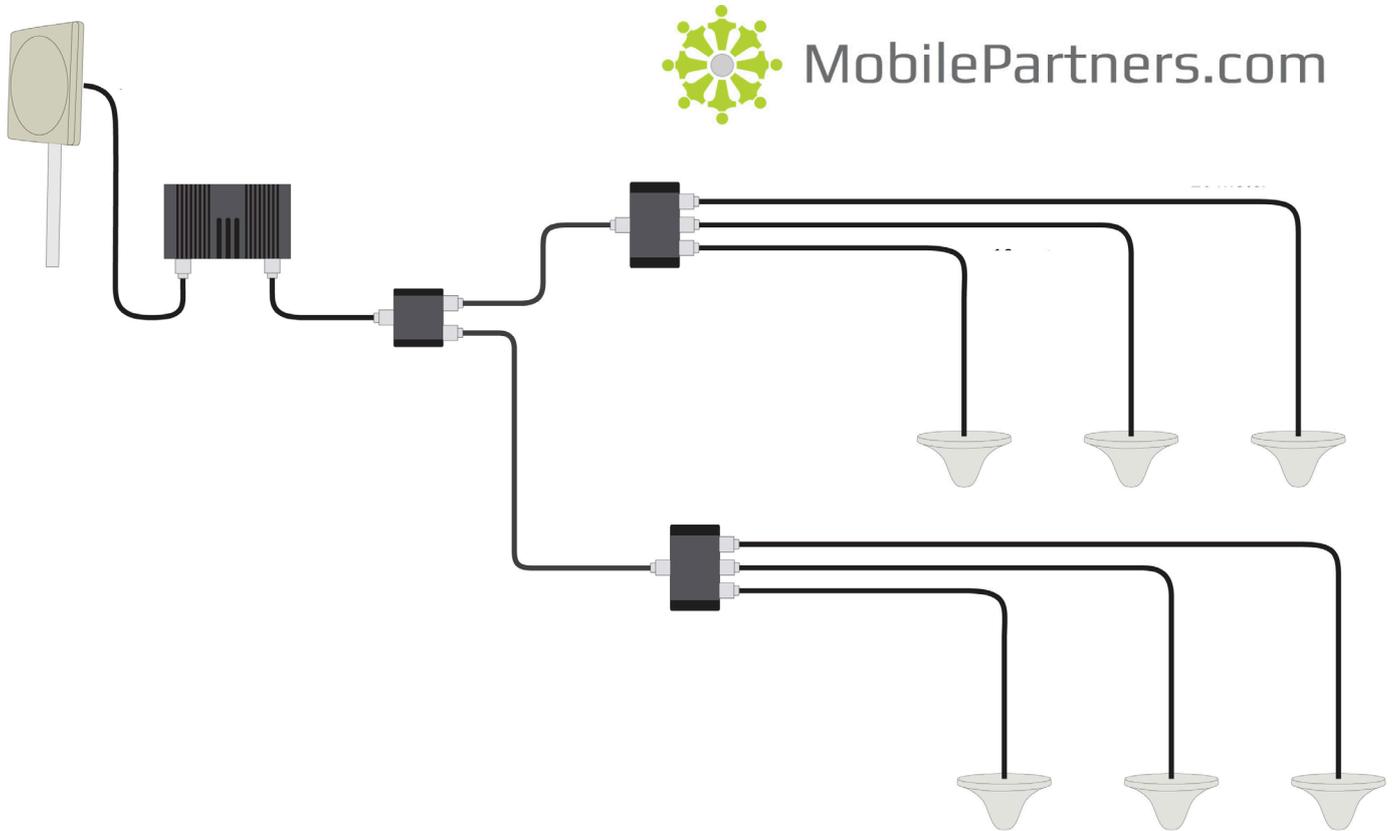
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# 1. Introduction

## 1.1 MPW2100-23 Series Repeaters

The MPW2100-23 Series Repeater is compact in size and light in weight. Hence, the installation of the MPW2100-23 Series Repeater is easy, simply just plug and play. With the control panel in front of the repeater, the repeater status can be known during installation.

## 1.2 General Installation Layout



*Figure 1 Profile*

For indoor application, a typical installation layout of the Broad Band Repeater is shown in Figure 1. The MP17P 17dBi panel antenna is used as the donor antenna, and is connected to the repeater. Omni and panel antennas are being used as the server antennas.

The donor antenna is placed outside of the building, while the repeater is placed inside the building to extend radio coverage to the dead zones.

## 1.3 Advantages

### Fast & easy Installation

The installation of a repeater is easy and simple. With its plug and play design, installation simplicity, and operational user friendliness, these features appeal greatly to many operators for the purpose of indoor coverage or for temporary coverage during network optimization.

MPW2100-23A has a smart function which can be activated via the front panel. This smart function can prevent UL interference and self-oscillation caused by insufficient isolation between donor and server antennas, and also setup parameters and keep optimal condition automatically; the only thing for users is just activating this function by front panel.

Note. The users can't adjust by manual setting when smart function is active.

## **Auto Level Control**

The 25dB ALC is used to maintain steady output power even when the donor source signal fluctuates. Also when the ALC is activated, the ISOLATION LED indicator would be lighted in orange, which means the Isolation may not be enough. It also prevents UL interference and self-oscillation from insufficient isolation between donor and server antennas.

## **Antenna isolation testing**

MPW2100-23 series product also has an antenna isolation detection function. Equipment installation completed boot automatically after the onset detection transceiver antenna isolation, if transceiver antenna isolation can not meet the installation requirements, the device will automatically reduce the gain to guarantee the equipment in normal working, not self-excitation vibration, guarantee not to interference protection of base station, repeater itself. At the same time alarm exhibit of lanterns bright red light alarm.

Device LED gain display panel will display device is reduced after the equipment current gain state, which has the advantages of convenient construction, but also to protect the base station equipment, and does not generate interference.

## 2. Installation

### 2.1 Isolation

Isolation is an important concept for the repeater system, and it is one of the factors that affect the location of the donor antenna and the location of the server antenna. In the repeater system, the isolation must be enough, which means the donor antenna cannot be installed too close to the repeater. But what is isolation? The isolation is the propagation loss between the donor antenna and the server antenna which needs to be at least 15dB higher than the gain value of the repeater. Non-compliance to this criterion would result in poor signal quality or poor signal strength in the coverage area and the amplifier of the repeater may also be damaged.

Isolation => Repeater Gain + 15 dB

#### 2.1.1 Self-Oscillation Resistance

Self-oscillation is a phenomenon that would occur when the isolation for the repeater system is not enough. In other words, insufficient isolation between donor and server antennas would result in self-oscillation. Which means part of the signal that is being amplified by the repeater radiates back towards the donor antenna and got picked up by the donor antenna and went through the repeater amplification process again. Severe oscillation issue would result in poor signal quality and at times it can even damage the repeater amplifiers. Self-oscillation will deteriorate the signals inside the coverage area and interfere towards the BTS.

#### 2.1.2 The Isolation Value

The precise estimation of the isolation value can be obtained via a physical test measurement. This test measurement is done at the actual environment where the donor antenna and the server antenna are installed for a repeater system. The test measurement procedures are

- 1 Connect the signal generator to the donor antenna and transmit a signal with a frequency. Choose frequency 1995MHz to do the test. In simple words, choose the idle frequency of the system to do the test) of certain power level from the signal generator.
- 2 Connect the spectrum analyzer to the server antenna and scan for the known frequency (The frequency used by the signal generator). Mark the received power level on the spectrum analyzer.
- 3 Subtract the power level received at the spectrum analyzer from the output power (OP) level of the signal generator to obtain the isolation value.

Isolation (dB) = Output Power from the signal generator – Received Power on the spectrum analyzer

Transmit a strong Output Power from the Signal generator is recommended (excess of 20dBm) for easy recognition and detection by the spectrum analyzer.

### 2.2 Precautions and Preparation

- 1 Ensure the power applied to the repeater is within its working range. A separate circuit breaker is recommended.
- 2 Ensure the donor antenna is installed at the location where signal from the donor BTS (Node B) is good enough.
- 3 Ensure there's sufficient isolation between the donor and server antenna.
- 4 The repeater is designed for indoor application. Ensure the location of the repeater is dry and ventilated.
- 5 Ensure there are adequate resources to handle the weight of the repeater. 6. Some electronic parts contain carcinogenic constituents, please handle the repeater with care, and discard the in a safe place if necessary.

## 2.3 Donor Antenna Installation

The location of the donor antenna strongly influences the performance/characteristics of the RSCP and  $E_c/N_o$  of the intended coverage area.

The donor antenna is usually installed outside of the building, pointing towards the donor BTS (NodeB) for best reception of the receiving signal. When choosing the location for the donor antenna, there are 3 criteria need to be met:

- 1 The RSCP of the donor signal is suggested to be in the range of -60dBm to -70dBm.
- 2  $(E_c/N_o)_{AS\_CPICH} > -7\text{dB}$ ; AS\_CPICH is the Pilot Channel in Active Set (Serving Cell)
- 3  $(E_c/N_o)_{AS\_CPICH} - (E_c/N_o)_{MS\_CPICH} > 6\text{dB}$

The donor antenna should be installed at least 3 meters above the ground but not higher than 7th floor of any building. If the donor antenna is located at a high floor, it would be difficult to obtain a dominant BTS signal from nearby BTS.

A lightning rod is necessary when the donor antenna is located at a relative high position. A 50 ohm lightning arrestor could be connected between repeater and donor antenna for better protection.

Waterproofing of the antenna installation is also important, and it can be done with the following process:

- 1 Use the donor antenna cable to form a half loop at the point of entry into the house so that rain water would drop off instead of flowing inside along the cable, and also form a half loop before the antenna cable connects to the repeater as the waterproof measure.
- 2 Secure the cable entry point. Seal the donor antenna's connector and repeater's connector with a waterproof sealant.

## 2.4 Server antenna Installation

Find the right spot to install the server antenna so the required coverage can be fully covered by the repeater is one of the most important concepts that need to be considered.

However, the following three points should be considered while installing the server antenna.

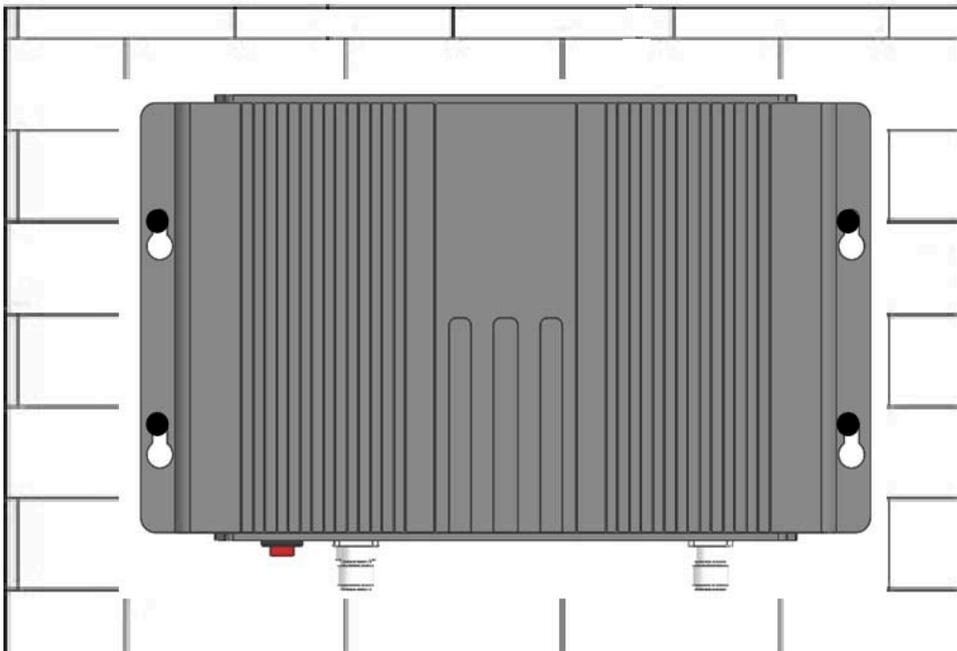
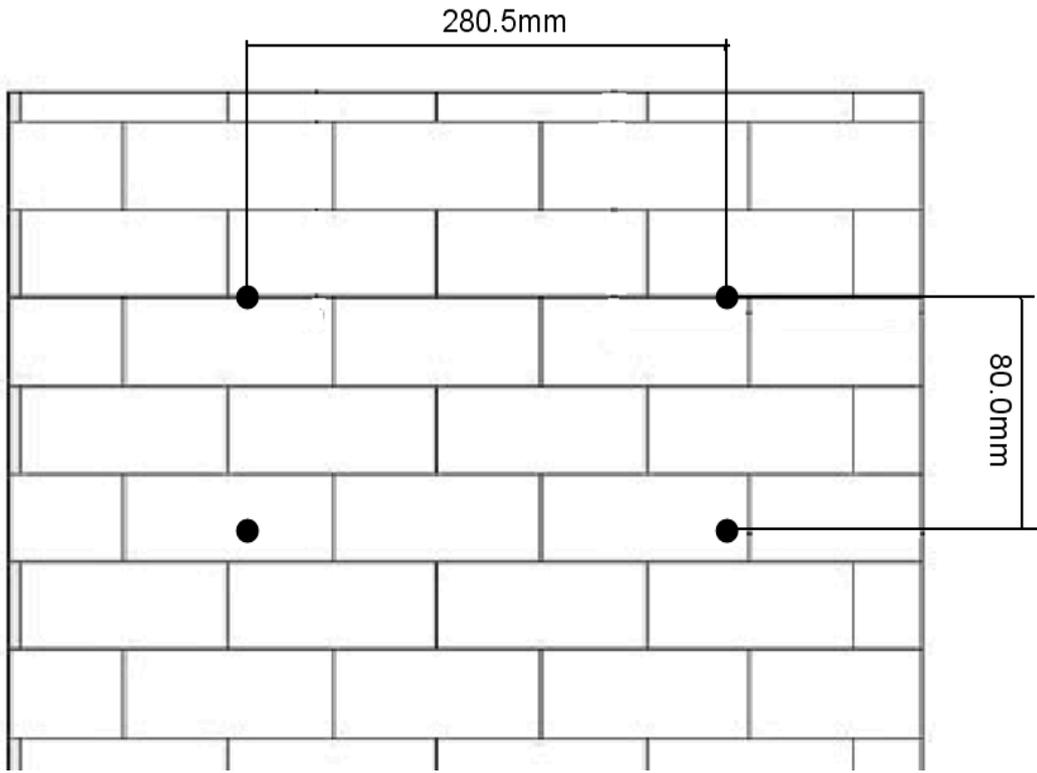
- 1 Do not install the server antennas near metal or obstacles that may influence its coverage performance.
- 2 Do not install server antennas near other electronic equipment (minimum 1 meter) and not near fluorescent lamps or tubes (minimum 2 meters).
- 2 It is suggested to install the antennas at least 2m above the floor for the best coverage.
- 3 The server antenna should not be installed too close to the donor antenna to avoid issues with isolation.

## 2.5 Repeater Installation

### 2.5.1 Installing the Repeater

A lightning arrestor needs to be connected to the repeater's BTS port when the donor antenna is installed in a high position. Grounding is essential for the arrestor to work.

Plug the power cable to the repeater first before plugging in the power cable to the mains socket. Use the power cable that comes with the package.



## 3. Commissioning

This chapter outlines the process to optimize the performance of the repeater. The gain setting, isolation concept, and downlink output power.

### 3.1 Downlink Output Power

The downlink output power of the repeater mainly depends on the input signal power and the repeater gain. The gain is the amplifying indicator for both uplink and downlink in the repeater, and it can be adjusted. Hence, the output power of the repeater can be estimated.

Signal Input Power + DL Gain = DL Output Power

For any given input signal power, its corresponding output is increased by the gain of the repeater. To ensure the maximum output power, the following condition should be met.

DL Gain = Min [(DL Output Power – Input Power), Max. DL Gain]

If the input signal amplified by the gain set exceeds the rated set output limit, the ALC (Automatic Level Control) will be triggered. The ALC ensures that the maximum output power of repeater is maintained at a certain point and does not overdrive the repeaters amplification circuit.

### 3.2 Repeater Configuration

The MPW2100-23A series repeaters are designed with plug and play ability. The configuration for these repeaters is not necessary, simply just switch the Smart function on, and the repeater would auto adjust its gains according to the environment condition.

Use the OMT software to set operator prior to installation.

#### 3.2.1 Start-up the Repeater

Note: It is suggested that only when isolation is 15dB higher than repeater's gain then the repeater can be switched on.

Make sure power supply cable is connected to the repeater properly, and the voltage is within repeater's voltage working range: 110/220V ± 20%

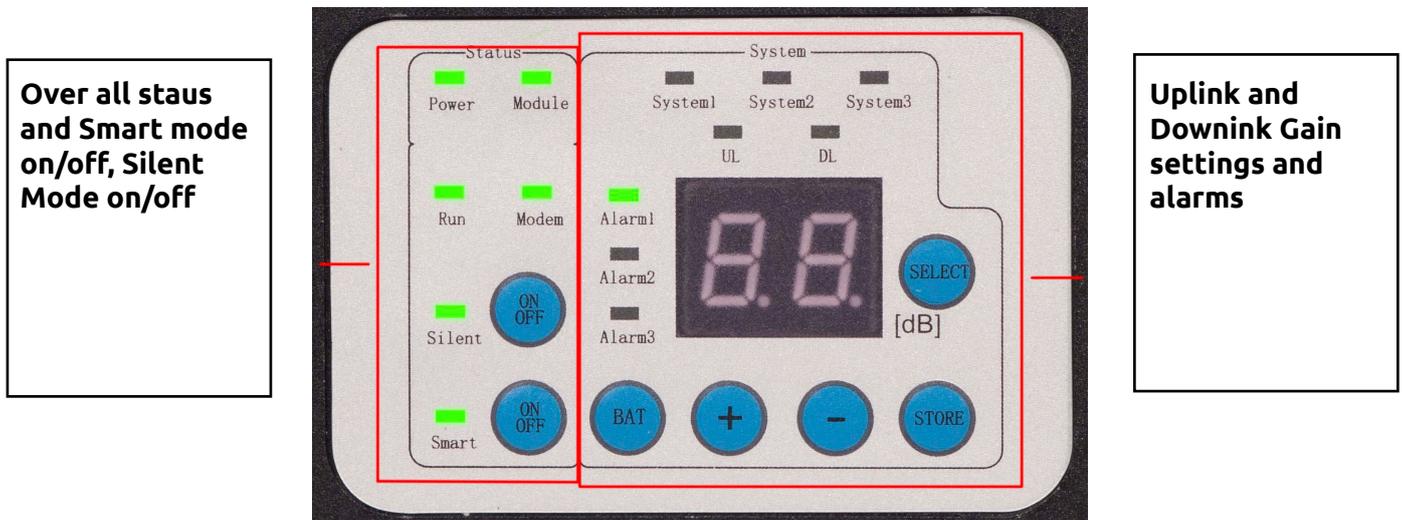
Plug the power cord into the proper socket. Once the repeater is on, it requires several seconds for initialization.

When Repeater is close to the BTS, hence there is a high input power at the donor antenna. Even with the smart ability of the auto gain adjustment, it is still recommended to add an RF attenuator at repeater's BTS port to avoid interference to the BTS.

### 3.2.2 Repeater Settings

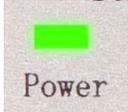
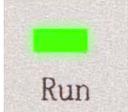
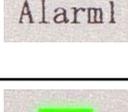
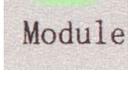
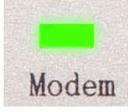
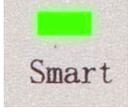
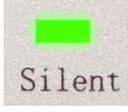
After switching on the repeater, the repeater would automatically adjust both uplink and downlink gain value based on the repeater installation environment if the smart function is turned on. The repeater can also be adjusted manually via the front control panel.

Figure 5 Front panel of the repeater



#### Buttons Function Explanations

Buttons	Function	Explanations
	Smart mode key	Press this key, the repeater can convert between Smart mode and normal mode. Press up to two times to switch. Make sure that the Smart LED changes.
	Silent Mode key	Press this key to activate or deactivate Silent mode. Silent mode on will activate the uplink sleep mode that will save energy and most of all save the load on the operators BTS
	Gain attenuation key	Intelligent mode off, Press this key, the uplink and downlink gain will reduce. The greatest reduction is 31dB. Each press of the key is 1 dB.  When Intelligent mode turned on this key is invalid.
	Gain increase key	Intelligent mode off, Press this key, uplink and downlink gain will increase. Each press of the key is 1 dB.  When Intelligent mode turned on this key is invalid.
	Store key	Press Store to store all changes in settings
	Select Uplink/Downlink key	Press Select to change from Uplink to Downlink Settings. The UL and DL LEDs will indicate selected Uplink/Downlink
	Battery key	Enable/Disable backup battery power.  Used to shut down OMT module and internal 3G modem while repetaer is running on battry backup power.

LED	Function	Explanations
 Power	Power LED	DC-ON, Power LED is Green, Indicates that the power supply is normal.
 Run	Run LED	Green: Monitoring module is on and working Off: Monitoring module is off
 Alarm1	Alarm1 LED	Green: No problems Red: Automated Gain Control is out of range Alarm2 an Alarm3 LEDs are not used on MPW2100-23
 Module	Module LED	Green: OMT module has a working connection to the repeater. Red: OMT module has problem communicating with repeater
 Modem	Modem LED	Green: Modem is working ok.
 Smart	Smart LED	Green: Smart Mode is on. Off: Smart Mode is odd
 Silent	Silent LED	Green: Silent Mode on Off: Silent Mode off
 System1	System LED	Green: Indicates the active band. System1 is 3G on 2100 MHz. MPW2100-23 does not support other bands so System2 and System3 is not use

### Manual gain mode



When not using Smart Mode, you can manually lower your repeaters gain by adding attenuation. Every press on the - or + button will manually decrease (or increase) the total gain by 1 dB. You can manually decrease gain from 70/75 down to 36/41dB.

While pressing + or - the LED display will be blinking to show you your settings. Use Store key to store settings.

This can be very useful if you have very strong input signal or if you need to keep internal repeater signals from leaking out from your house/apartment/office or if your operator is experiencing interfer

An Example of Setting (To set attenuation for the uplink)

Step 1: Press SELECT till the indicator stops at uplink.

Step 2: Press STORE and LED monitor starts blinking.

Step 3: Press "+", "-" to an intended gain value.

Step 4: Press STORE to set the value and the LED stop blinking and showing the gain value at the moment, the process is done.

## 4.Maintenance

### 4.1 Status, Alarms possible Solutions

#### Local alarms

Alarm LED	Cause	Solutions
Alarm1 Green	Automatic Gain Control working normal	Normal
Alarm1 Red	Automatic Gain Control out of limit	<ol style="list-style-type: none"> <li>1. Increase the distance between donor and server antenna</li> <li>2. Decrease gain</li> <li>3. Check antenna directions</li> </ol>

#### Remote alarms using OMT software

Alarm	Cause	Solutions
DL AGC alarm	<ol style="list-style-type: none"> <li>1. High input level at the BTS port of the repeater, AGC is active and more than 30dB attenuation has been applied.</li> <li>2. An isolation condition may also have occurred.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase the separation distance of the donor and service antenna.</li> <li>2. Decrease the gain by adjusting the manual attenuation accordingly to clear the alarm.</li> </ol>
PA Failure	The power of PA is not stable	<ol style="list-style-type: none"> <li>1. Check whether the input DC power is stable. If the DC is not stable, an UPS with square wave is recommended.</li> <li>2. Restart this repeater. If input DC power is correct and alarm still exists, return the unit to place of purchase for repair.</li> </ol>
Power Module Alarm	<ol style="list-style-type: none"> <li>1. Input AC power is not stable.</li> <li>2. Repeater's power supply module has been damaged</li> </ol>	<ol style="list-style-type: none"> <li>1. Check whether the input AC power is stable, it should be within <math>110/220V \pm 20\%</math>. If the AC is not stable, an UPS with square wave is recommended.</li> <li>2. In the condition input AC power is correct and alarm still exists, return the unit to place of purchase for repair.</li> </ol>
PLL Unlock	The PLL circuit cannot lock onto the programmed frequencies. The operating frequencies of repeater may have been accidentally shifted from the OMT software.	<ol style="list-style-type: none"> <li>1. Execute the Default Setting through OMS. Refer to OMT User's Manual for more detail.</li> <li>2. If the alarm cannot be solved, it means repeater has been damaged. Please return the unit to place of purchase for repair.</li> </ol>

## 4.2 Troubleshooting

This table offers the fundamental guidelines for troubleshooting advice for the MPW2100-23A. Before sending the repeater back to the factory for service, please check the troubleshooting measures listed below first.

Status	Possible reason	Solution
No LED is lit	No AC power.	Check if the power cord is plugged into the repeater and the socket properly.
No amplification after repeater installed.	<ol style="list-style-type: none"> <li>1. Your phones is showing LTE or GSM signals.</li> <li>2. Donor Signal is poor</li> <li>3. Bad service antenna/cables</li> <li>4. Wrong operator band?</li> </ol>	<ol style="list-style-type: none"> <li>1. If you have a LTE/4G phone it would probably lock to LTE/4G signal (even if that signal is very low) when you are not making phonecalls. This is normal.  Test by locking your phone in 3G only mode or test by making a phone call and see if it switches to 3G.</li> <li>2. Ensure signal strength and signal quality at the donor antenna is good enough. Check signal meter on the repeatre for input signal</li> <li>3. Check cables and connector to the internal service antenna.</li> <li>4. Check the selected operator band by the software.</li> </ol>
Coverage decreased after certain period.	<ol style="list-style-type: none"> <li>1. Donor signal strength decreased.</li> <li>2. The quality of feeder cable system decreased due to oxidization especially in harsh conditions, or cable damage by mice or insects.</li> <li>3. Change of indoor structure or furniture.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the signal strength at donor antenna. Re-locate the Donor Antenna to solve problem.</li> <li>2. Check the VSWR of the feeder cable system to find out the faulty point and then replace it</li> <li>3. Reconsider the position of antennas and the layout of cables if such change occurs.</li> </ol>
Bad Ec/No Quality inside the coverage area	<ol style="list-style-type: none"> <li>1. Self-oscillation occurred severely. ISOLATION LED may be lighted in red.</li> <li>2. Poor Ec/No Quality from donor source</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the isolation between donor and server antenna.</li> <li>2. Adjust the donor antenna direction or relocate the donor antenna.</li> </ol>
Call drop frequently	<ol style="list-style-type: none"> <li>1. Self-oscillation occurred.</li> <li>2. Signal handover frequently.</li> <li>3. Donor BTS problem</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the isolation between donor and server antenna. Turn on the Intelligent Mode</li> <li>2. Make sure the RSCP for primary BCCH &gt; than 1st neighbor BCCH by a minimum of 6dB</li> <li>3. Consult the operator's RF engineer.</li> </ol>