J4I-LTE Series
Industrial Signal Booster
User's Manual

Content

1. General

This user's manual provides information that includes installation, configuration, operation and maintenance of the booster. Specifications are also provided in details in order to help users better understand the booster. Please read this user's manual carefully and follow the instructions outlined to ensure long life span and trouble free operation of the unit.

1.1 Warranty

All outdoor antennas must be installed with lightning protection. Damage of power modules due to the lightning will not be covered by this 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 booster system. Manufacturer assumes no liability for customer's failure to comply with the precautions mentioned. This warranty will not cover such failures.

1.2 Safety Information

- ***Personnel Safety***

Before installing or replacing any of the boosters, the entire manual should be read and understood. Operators need to supply appropriate AC or DC power to the booster. Incorrect power settings can damage the booster and may cause electrical related injury to the user.

It is recommended that gloves are worn at ALL times when handling the product.

DO NOT operates equipment in an explosive environment.

DO NOT work on live circuits: Cell site technician and operating person are not authorized to remove equipment covers. Only personnel authorized by manufacturer may remove equipment covers to replace components or perform internal repairs.

- ***Equipment Safety***

The staff must follow all safety precautions during 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. The aluminum alloy enclosure is an excellent heat conductor, so during normal operation the unit may feel slightly warm. If it becomes too hot, please call maintenance immediately.

- ***Electrostatic Sensitivity***

ESD: Electrostatic Sensitive Devices

Semiconductor used in this product may be damaged by electrostatic discharge. When unpacking or handling the booster, follow precautionary procedures including use of grounded wrist straps, grounded workbench surfaces, and grounded floor mats.

- ***Grounding Electrical Instruments and Components***

To avoid power supply spark, please perform the grounding connection of the equipment racks, equipment chassis, and appropriate tools. And make sure insert the equipment's power cable into appropriate mains sockets (three pin or two pin).

In case of three-pin socket, the 3rd pin is used for grounding connection, directly connect the supplied power cable to the mains socket. In case of a two-pin socket, the green grounding wire provided with the package needs to be connected to the electrical grounding facility at the power outlet.

In order to avoid equipment damage or human injury by lightning, static electricity and other phenomenon of electricity leakage, Manufacturer suggest all products must do the electric-discharge of the electrical grounding in setup process. Power supply components must meet international electro-technical commissioning safety standards.

1.3 Other Precautions

- Only authorized personnel should be allowed to install and operate the booster.
- Make sure that the power is switched off when installing or disassembling the booster to avoid short circuit or electrical shock that may result in personal injury or damage to the equipment.
- The booster supports mains power for AC110/220V±20%, 50/60Hz. Please follow this power range to avoid any damage to the equipment.
- A 3-pin mains socket is recommended by Manufacturer to provide grounding connection for the booster.
- RF arrestor is recommended to connect to the booster's BTS port.
- Please make sure that the warning indicators on the enclosure are clearly visible for quick detection of alarm conditions.

2. Introduction to Boosters

2.1 System Introduction

A booster is a device that receives the RF signal, amplifies and then retransmits it to the weak or blind area. Boosters overcome the attenuation caused by propagation loss and obstacles.

Booster solutions are used in many different applications, such as basements, apartments, parking lots and highway, mountain areas etc, where mobile phone signals cannot penetrate.

Extending radio coverage into these dead zones, using the booster, allows mobile phones to establish a connection.

2.2 General Installation Layout

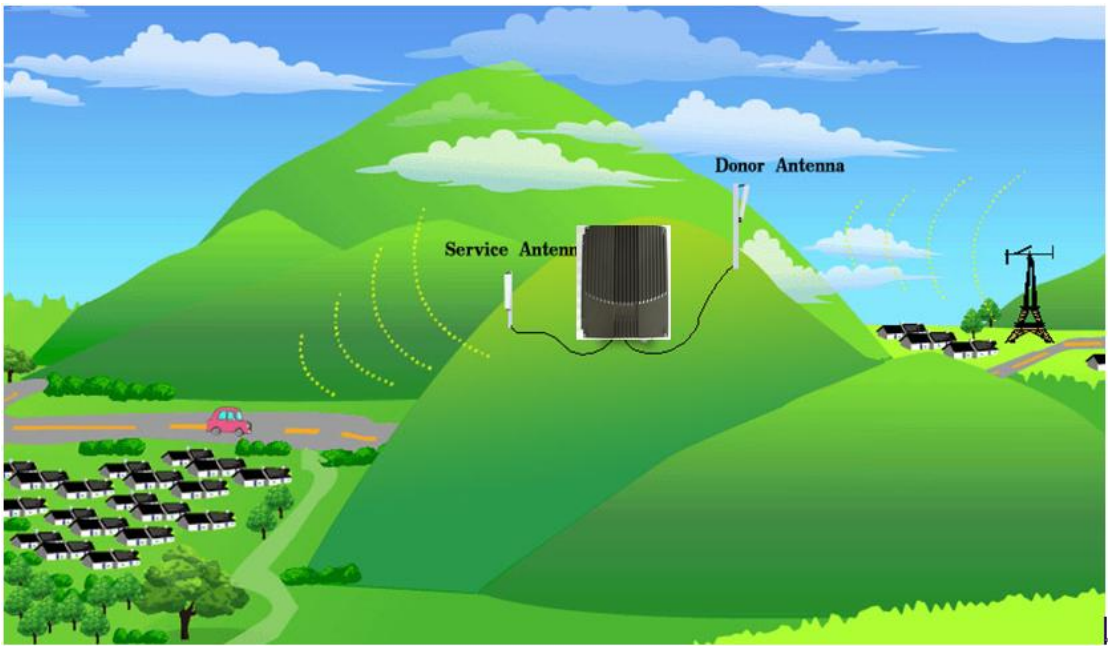

Figure 1 Outdoor Application

Above provides a typical installation layout of an outdoor project. The booster is connected via coaxial cables to donor and service antennas. The donor antenna is placed on one side of the mountain, pointing to the donor BTS to receive the signals. The service antenna is placed on the other side, pointing to the coverage area to make the coverage. By taking advantage of the mountain between them, the isolation requirement can be met. Mobile signals may then transmit via the service antenna, booster and donor antenna to the donor BTS

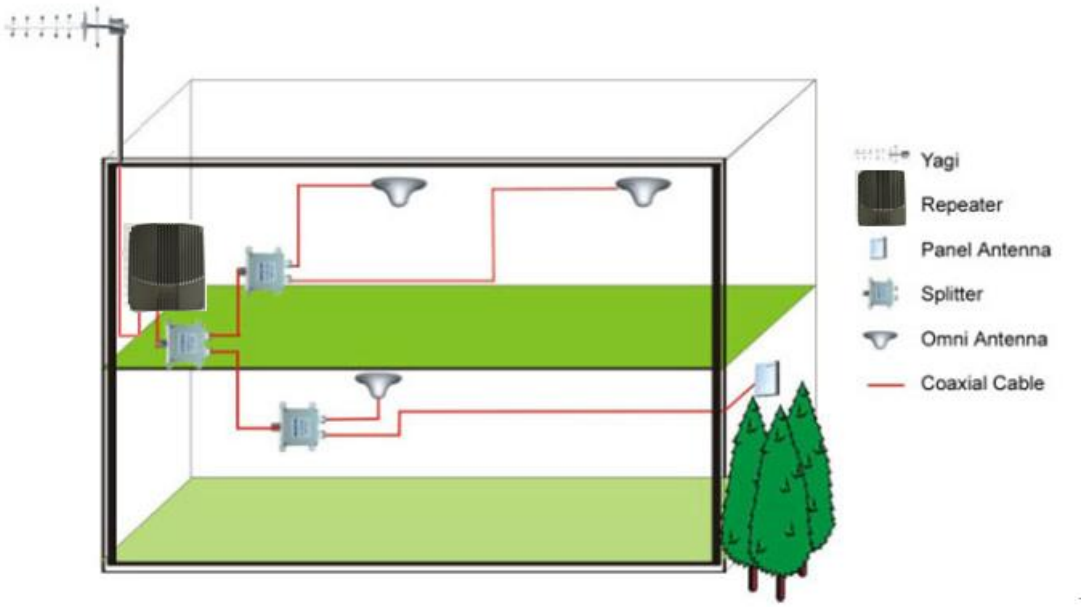

Figure 2: Indoor Application

Above is the example of booster's indoor application. The Yagi antenna is used as donor antenna, which is placed outside of the building where it has easy access to the donor BTS. Signals from the donor BTS are then introduced into the booster. After amplifying by the booster, signals are divided into several parts by splitters and sent to the service antennas. The service antennas are placed inside the building where it can extend radio coverage to the dead zones. By the same way, mobile signals are sent back to the BTS.

2.3 Basic Booster System Components

- ***Splitters***

Splitters are isolated dividers that split or combine RF power. According to the coverage requirement, splitter can distribute RF power into several paths to achieve coverage of each area. In the meantime, mobile signals from different coverage areas are combined together and transmitted into the booster. Here we recommend some famous brand that with good quality. ***Andrew*** brand from **Commscope**(www.commscope.com), model number: S-2-CPUSE-L-Ni or S-2-TCPUSE-H-D (2-way splitter), S-3-CPUSE-H-Di6 or S-3-CPUSE-L-Ni (3-way splitter); or the brand from **TATFOOK**(www.tatfook.com).

- ***Antennas***

Donor Antenna

Directional donor antenna, one for each booster, is recommended to improve signal strength. Here for the industrial outdoor booster, the directional big panel antenna is highly recommend.

Service Antenna

For outdoor coverage, the service antenna must be directional antenna whose half-power beam width is depending on coverage requirements. For indoor coverage, the omni-directional antenna can also be used in some condition.

- ***Coaxial Cables***

1/2” and 7/8” coaxial cables (50Ω impedance) are recommended to use with the booster. These coaxial cables have low attenuation properties and are ideal for longer cable run installations. There is a professional manufacturer in USA Commscope (www.commscope.com), ***Andrew*** brand: model number: FSJ4-50B, AVA5-50FX or AVA5RK-50FX are highly recommended. There is another manufacturer with similar product, ***Kingsignal*** (www.kingsignal.cn),

- ***Jumper Cables***

Jumper cables have the flexible characteristic and they provide an easy way to connect antennas, splitters and boosters to coaxial cables. Jump cables are just the same materials as coaxial cable with short length, which is used for adding the other passive components, such as splitters or couplers.

Warning: There are also many other brand or similar items, if clients need to change such items, please compare the specifications carefully and consult the professional manufacturer if it’s suitable to use the other brand. The usage of the unqualified antennas, cables or coupling device may result in the improper work of boosters and even damage the device. Please double check before changing these items.

2.4 Advantages of Booster

- ***Optimization***

During BTS coverage optimization, full coverage cannot always be achieved because of shadowing and blind spots. If optimization is carried out by simply adjusting antenna direction or height, the process can be tedious and a long process of trial and error until the required coverage is achieved. The process can be time consuming and most times indoor coverage are not achieved. With boosters, separate optimization is carried out while the whole interrelated parameters between systems remain unaffected.

- ***Same Service Quality with Low investment***

When coverage needs to be extended or optimized, installing a new BTS or micro cell may not be always the best solution and economical. In most cases a booster will be the best solution that will provide the same service quality at a relatively lower cost.

- ***Fast & easy Installation***

Compared to the Base Station, wireless boosters is space saving and does not need additional wiring. Its installation simplicity and operational user friendliness appeal greatly to many operators for the purpose of rural coverage or use of temporary coverage during network optimization.

2.5 Block Diagram

The booster has two similar circuits, which are designed for uplink and downlink respectively. Each circuit consists of three main modules, the Low Noise Amplifier (LNA), the Frequency Converter (FC), and the Power Amplifier (PA).

Let's just consider the downlink part first, which is from BTS to MS. Please note that uplink works in the same way except the signal direction is from MS to BTS. Figure 4 illustrates the self-explanatory signal path after entering into the booster.

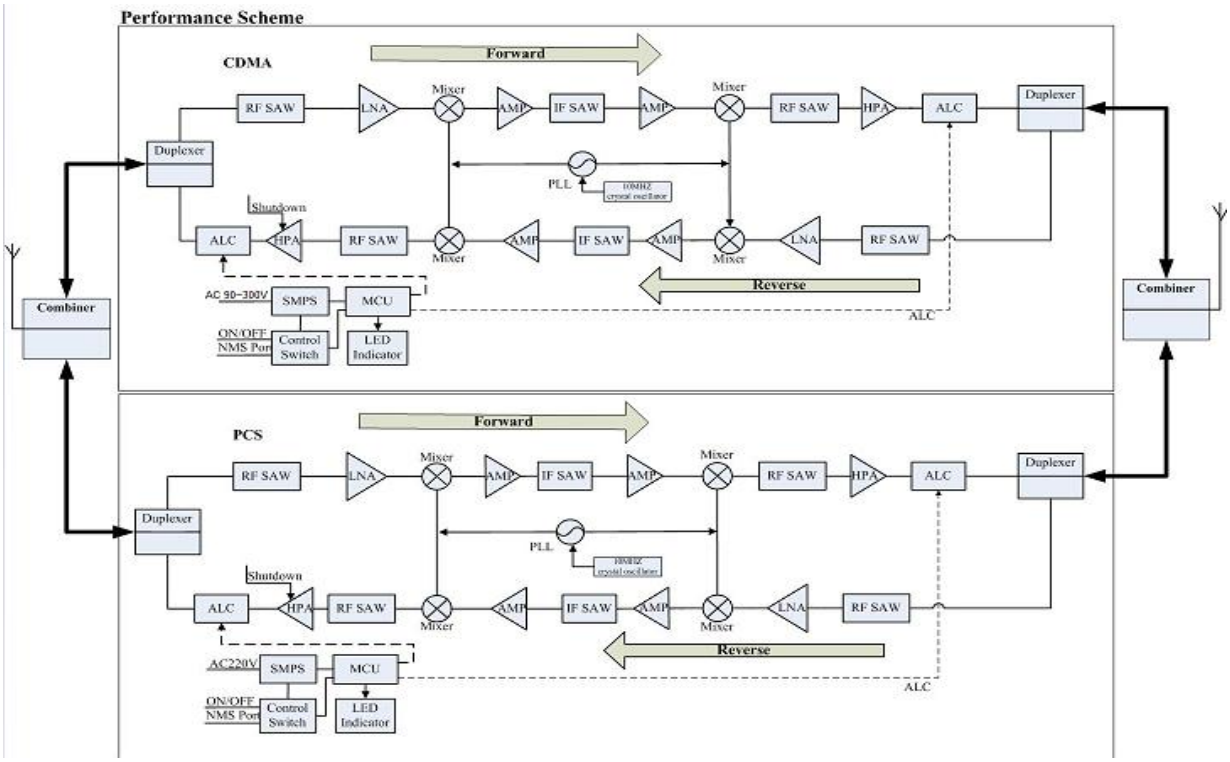

Figure 4 Dual Band Selective Booster

When uplink or downlink signal enters the booster, it is filtered by duplexer firstly. Then the filtered signal enters into LNA in which weak signals are amplified with low noise figure. Then the signal passes FC where signal frequency is made to IF to have a good filtration after passing through SAW filter in the FC. Through module FC, operator's signals are selected while the competitors' signals are strongly rejected. At last the signals are amplified in power amplifier (PA) and are sent to service antenna.

2.6 Outline of Available Functions

- ***Local Control***

This function is used when commissioning or checking booster status on site. Booster is connected to a Laptop using the RS-232 cable. Operators can configure, check parameters such as gain, alarm parameters etc. Refer to ***OMT User's Manual*** for more details about connection and OMT operation procedures.

- ***Remote Monitoring***

Through the wireless modem, all functions that are accessible on the local end can also be accessed from maintenance center remotely. Alarm signals are constantly reported to maintenance center for constant tracking of the overall system. Refer to ***OMT User's Manual*** for more details about connection and OMT operation procedure.

- ***MCB***

The booster is equipped with MCB (monitor and control board), which displays booster operating and various alarm status. At the mean time, the UL and DL attenuation can be adjusted to make booster to perform its best via the switch on this board

Detailed alarm of the booster can be viewed on the front panel, please refer to ***Section 5: Maintenance*** for in-depth details of each individual alarm condition and their solution.

- ***31dB Manual Gain Control***

During installation, please attenuate the booster's DL & UL gain (using the OMT software or via the switch on MCB), taking into account the path loss value and isolation issue to avoid interference towards the BTS and to optimize coverage region.

- ***31dB AGC***

The 31dB AGC is used to maintain steady output power even when the source signal fluctuates. It also can be used as an index to evaluate the amplifier. This function effectively prevents the equipment from entering into saturated state and thereby avoids signal distortion and call drops in the coverage area.

3. Installation

3.1 Preparation

a. Ensure the power to be accessed is within the booster's working range: AC 90V~300V. A separate circuit breaker is recommended.

b. Ensure there's sufficient isolation between the donor and service antennas.

c. Ensure there are adequate resources to handle the weight of the booster.

d. It's recommended to prepare some jumper cables.

e. Booster used for outdoor installation is water resistant, but it is possible that the booster's performance may be influenced by weather factors such as temperature and humidity. It is suggested to install the booster in an indoor location with good draught. If the booster needs to be installed outdoor, ensure that there is good draught and will not face direct sunlight and in a location that stays within - 25℃ to 55℃.

Recommended tools list

Table below lists the recommended tools that will be required for a successful installation:

Item	Quantity	Item	Quantity
Signal Generator	1	Spectrum Analyzer	1
Test Mobile	1	Laptop	1
50 Ω load (terminator)	2	Electrical Drill	1
Multimeter	1	Spanner	2
Hammer	1	Screwdriver	1
Waterproof glue	1	Safety belt	1
RF arrestor (optional)	1	Other accessories	

3.2 Antenna Installation

Selection of the correct antennas is one of the most important aspects for a successful installation of a booster system. Installation location and performance/characteristic of the antenna can strongly influence the Rxlev and RxQual of the intended coverage area.

Rxlev. and RxQual are two important parameters, which describe the power level and the quality of the GSM signal. Both parameters can be measured using a testing mobile such as TEMS®.

The antennas are usually selected and purchased by the customer. Manufacturer will provide recommendations for the most suitable types of antennas based on our experience for a successful and trouble free installation of the booster if required.

3.2.1 Donor Antenna

3.2.1.1 Donor Antenna Selection

There are many types of antennas on the market, but the following general characteristics should be met during selecting the donor antenna, we will also list some of the popular brand for your option in below:

1. *Working frequency*: The donor antenna needs to be compatible with the booster's operating frequency range.
2. *Directivity characteristic:* An antenna with good directivity is recommended, it is essential for the booster to introduce a clean donor signal to amplify.
3. *Waterproof*: The donor antenna needs to be waterproof to prevent rainwater from affecting the antenna's characteristics, ultimately affecting the performance of the booster.
4. For outdoor booster, antenna's front to back ratio must be higher than 20dB to assure excellent isolation on the site.
5. **Recommended donor antennas: *Argus*** brand from **Commscope** (www.commscope.com): CNNPX306R-6P (16dBi gain) or CNNPX308M-4P (17dBi gain). While for a safe working conditions of the booster, please don't choose any antennas that over 19dBi gain. There are also other related items from **Kenbotong** (www.kenbotong.com) or T**ongyu Communication Inc.** (www.tycc.cn).

3.2.1.1 Donor Antenna Installation

Donor antenna is to be installed at the location where excellent signals from donor BTS can be received. When installing the donor antenna, the following conditions need to be considered:

1. The antenna is recommended to be installed where donor BTS is in line of sight. The signal level at the BTS port of the booster is recommended to be in the range from -60dBm to -40dBm with an RxQual index ranging from 0 to 2. The Rxlev of the primary BCCH is at least 6dB higher than

the BCCH of neighboring BTS sites.

2. When installing the donor antenna in a relatively high location, lightning arrestor is necessary. Grounding of the arrestor and the antenna are essential.
3. Waterproof of donor antenna's connector with sealant is highly recommended.
4. For outdoor project, the antenna needs to be positioned in an area between the donor BTS and the coverage area, pointing to the donor BTS to get an excellent donor signal.
5. For indoor project, usually the donor antenna is installed against the wall of the building pointing towards the donor BTS. It should be installed at least 3 meters above the ground to avoid shadowing when objects pass in the front of the donor antenna. Also install the donor antenna higher than the 7^{th} floor is not recommended. When the antenna is located in a high floor, it will be difficult to obtain a signal with good RxQ due to the interference of signals from various nearby BTSs.

3.2.2 Service Antenna

3.2.2.1 Service Antenna Selection

The service antenna is usually selected and purchased by the customer, we will also list some of the popular brand for your option in below. It needs to meet the requirements below:

1. *Working frequency*: The service antenna needs to be compatible with the booster's operating frequency range.
2. *Half-power Beam width:* Select the antenna with suitable half-power beam width according to the coverage area.
3. For outdoor coverage, the service antenna needs to meet two conditions below: Waterproof and excellent Front-to-back Ratio. The antenna needs to be waterproof to prevent rainwater from affecting the antenna's characteristics, ultimately affecting the performance of the booster. At the meantime, the front to back ratio needs to be bigger than 20dB to assure enough isolation of the site.
4. For indoor coverage, a broadband antenna, which can support the frequency range of 824~2200MHz, are selected to be compatible to all systems.

5. **Recommended service antennas:**

The maximum gain of the service antenna should no more than **7dBi**. Here are some of the brand that used for indoor coverage antenna: ***Andrew*** brand from **Commscope** (www.commscope.com): **CJLPA401U-W1** (7dBi gain) or **CLNA001U-CN2** (3 dBi gain); ***Kenbotong*** band (www.kenbotong.com): TDJ-0825BKM-L (7dBi) or TQJ-0825XTS1 (3dBi).

3.2.2.2 Service Antenna Installation

It is necessary to find a good location for the service antenna in order to achieve best coverage.

For indoor coverage, the following conditions need to be considered:

1. Avoid installing near metal or obstacles that may influence its coverage performance.
2. Install the antenna at least 2m above the floor for the best coverage and for the convenience of passers-by.
3. The service antenna should not be installed close to the donor antenna to avoid isolation issues.

For outdoor coverage, the following conditions need to be considered:

1. Avoid installing near trees or other obstacles that may influence its coverage performance.
2. The service antenna should not be installed too close to the donor antenna to avoid issues with isolation. The angle between donor antenna direction and service direction needs to be larger than 90 degrees. The best condition is when the donor and the service antennas are installed in opposite directions.

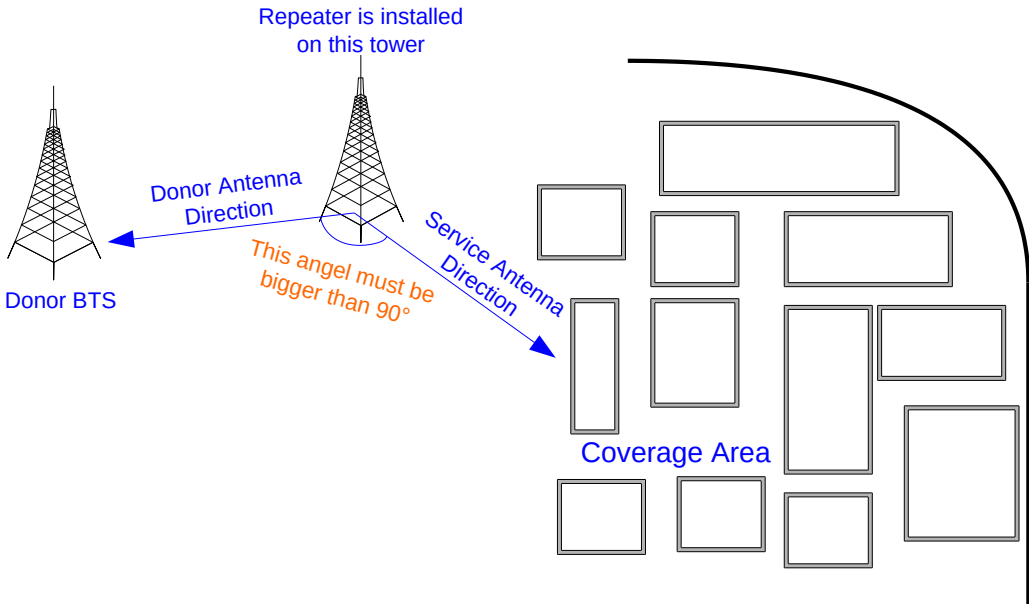

Figure 5

3. When installing the service antenna in a relatively high location, lightning arrestors are necessary. Grounding of arrestor and antenna is essential.
4. Waterproofing of service antenna's connector with sealant is highly recommended.

3.2.3 Isolation

Isolation is an important concept when it comes to the implementation of a booster system, especially for the outdoor project. There must be sufficient isolation within the booster system, which means there must be enough distance and obstacles between the donor and the service antennas, and their directions are recommended to be in opposite directions. The propagation loss between the antennas needs to be at least 15dB above the gain value used by the booster. Non-compliance to this criterion can result in poor signal to the coverage area and may damage the PA of the booster.

3.2.3.1 Self-oscillation Concept

Isolation is the propagation loss value from the booster's output port to its input port. For a wireless booster, insufficient isolation between donor and service antennas will result in self-oscillation.

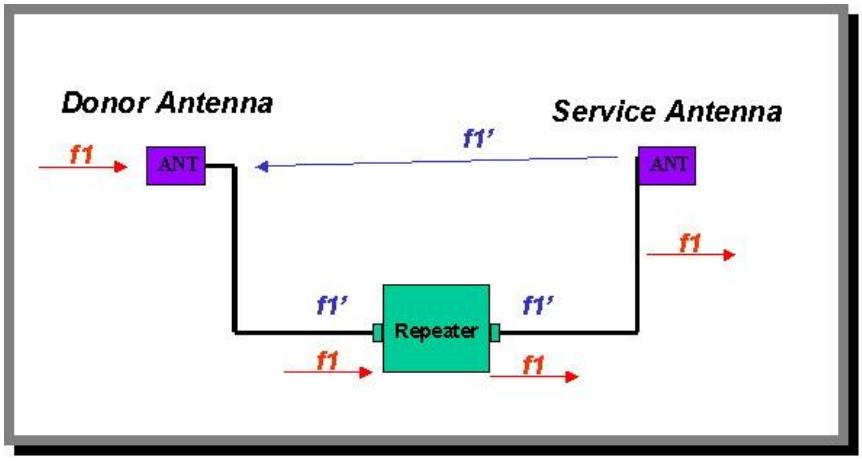

Figure 6

As shown in the above diagram, the donor antenna receives a RF signal ***f1*** from the Donor BTS, after amplification by the booster with a gain G, the signal radiates out via the service antenna. Part of ***f1 (f1')*** radiates back towards the donor antenna (due to side lobe characteristics of antennas) and is picked up by the donor antenna again and goes through the amplification process again. Severe self-oscillation

issue result in poor signal quality and at times it can damage the boosters' amplifiers. To prevent self-oscillation from occurring, the isolation value must be at least 15dB above the booster gain.

Isolation ≥ Gain of Booster + 15dB

When self-oscillation occurs, the alarm LED, "AGC Alarm" will be flashing. Booster may be damaged if it operates under self-oscillation condition.

3.2.3.2 Obtaining the Isolation Value

- ***Theoretical calculation (for reference only)***

The physical isolation between the donor and the service antennas can be theoretically estimated using the following formulas.

Vertical Isolation: I (dB) = 28 + 40 log (D/λ)
Horizontal Isolation: I (dB) = 22 + 20 log (D/λ) – (G_d + G_s)

I = Isolation
D = Distance between donor and service antennas (m)
λ = Wavelength (m)
G_d = Gain of donor antenna facing service antenna
G_s = Gain of service antenna facing donor antenna

If there is an obstacle (wall etc.) between donor and service antenna, the attenuation value of the obstacle need be added into the equation.

- ***Physical Test***

To obtain an accurate and more precise estimation of the isolation value, a physical measurement may be carried out to obtain the isolation value for the actually environment where the booster is installed. The measurement procedures are:

- Connect a signal generator to the donor antenna cable as illustrated below and transmit a known frequency and power level from the signal generator. Frequency needs to be within the idle frequency between the uplink and the downlink frequencies.

  For example, in GSM 900 system, uplink is 890~915MHz and downlink is 935~960MHz. We can use the frequency 920MHz, which is within 915MHz and 935MHz, to do the measurement. In DCS 1800 system, the uplink is from 1710~1785MHz and the downlink is from 1805~1880MHz. The idle frequency 1795MHz can be used to do the measurement.

- Connect the service antenna to a spectrum analyzer and scan for the

known frequency.

- Make a record of the power level from the spectrum analyzer.
- Subtract the power level received at the spectrum analyzer from the power level of the signal generator to obtain the isolation value..

Isolation (dB) = Output Power from Signal Generator – Received Power at the Spectrum Analyzer

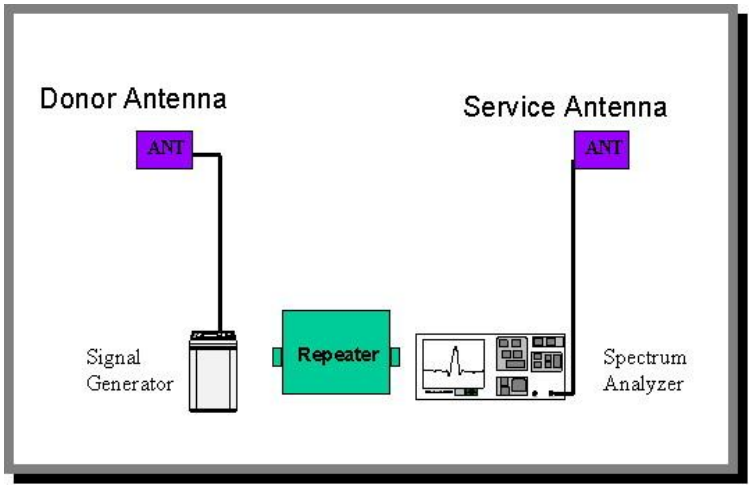

Figure 7

A relatively strong transmitting power from the signal generator is recommended (excess of 25dBm) for easy recognition and detection by the spectrum analyzer.

For example, signal generator sends out a signal 1795MHz with 25dBm power level.

The signal scanned by the spectrum analyzer = –70dBm.

So, Isolation = 25dBm - (-70dBm) = 95dB

In this condition, to avoid self-oscillation, the gain of booster must be set to be no more than 80dB, which is 15dB lower than the isolation value.

3.3 Booster

3.3.1 Installing the Booster

3.3.1.1 Wall Mount Installation

There are 2 steps of installing the booster. Mounting the bracket on the booster with screws: See the below in figure 8.

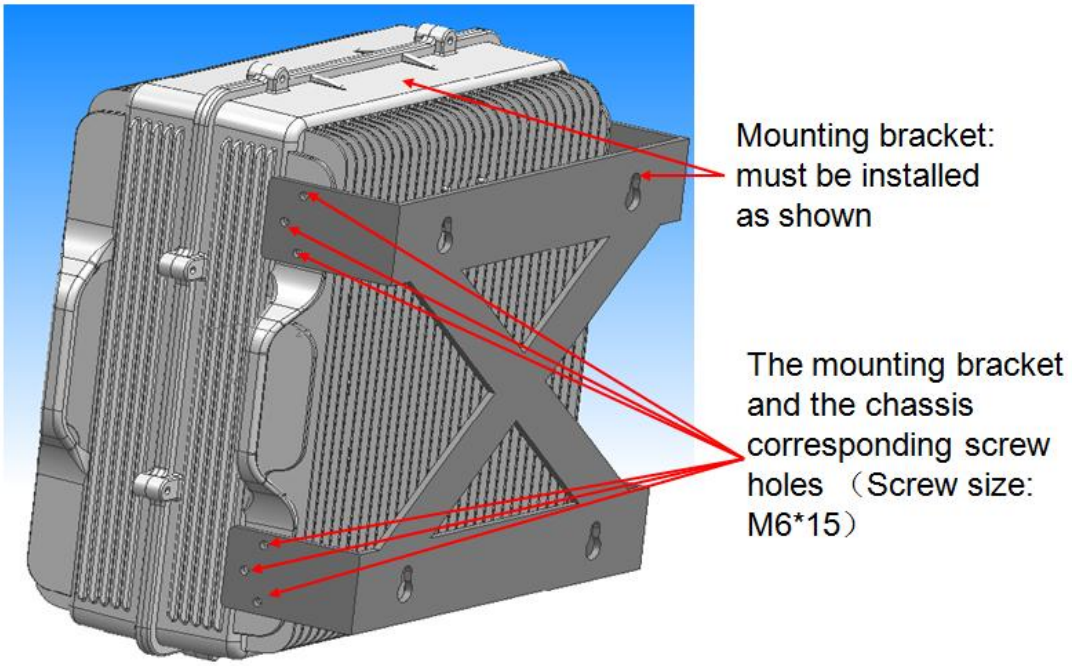

Figure 8

Drill 4 holes in the wall for hanging the bracket that hold the booster:

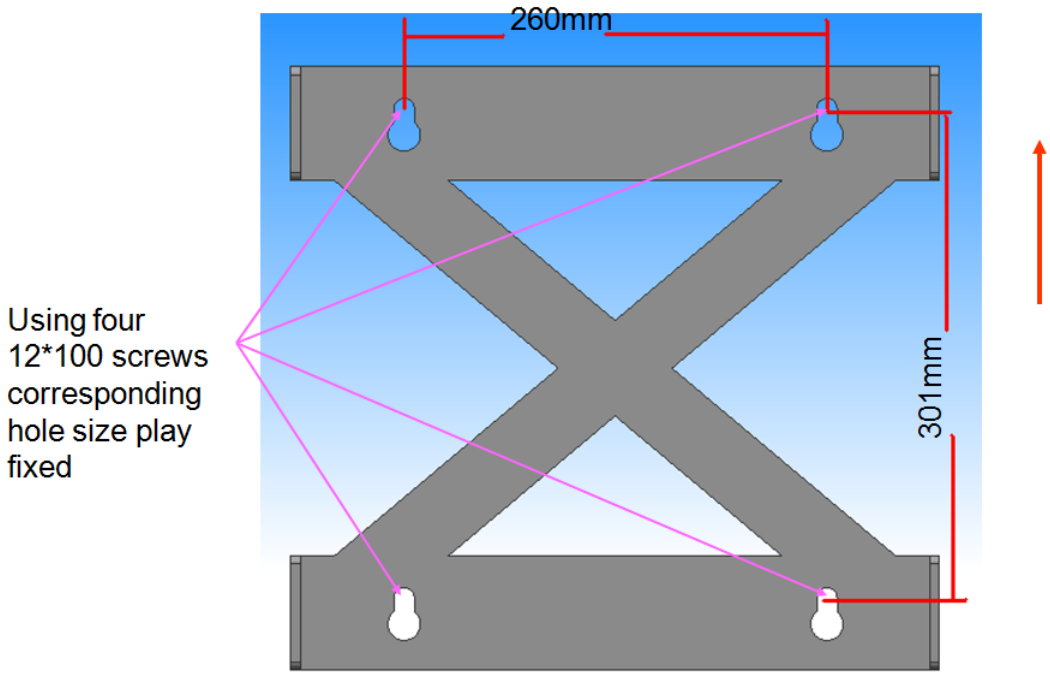

Figure 9

After that you will see the final pictures after installation.

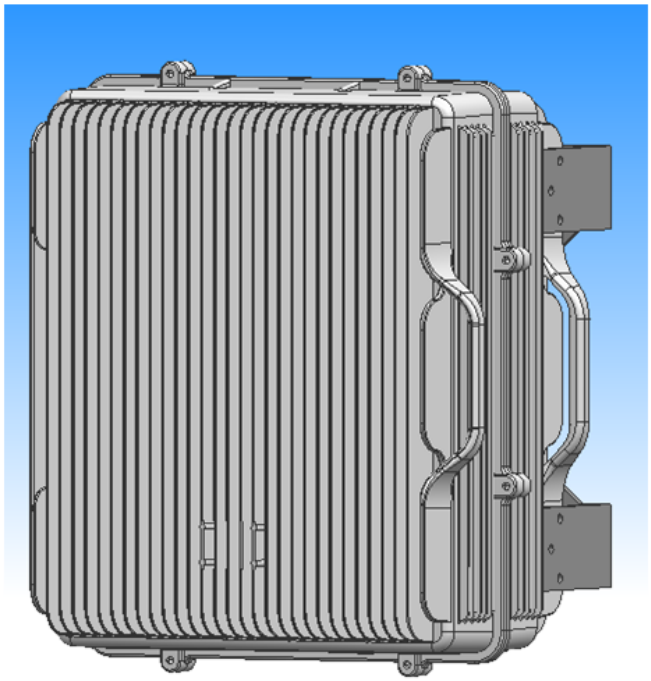

Figure 10

4. Commissioning

The following chapter outlines the process to optimize the performance of the booster. The gain setting, isolation, downlink output power, and booster uplink noise contribution will be considered

4.1 Commissioning Principle

4.1.1 Downlink Output Power

The total downlink output power of the booster is depending on the input power and the booster gain. To ensure the maximum power of the booster is achieved at the MS port of the booster, the following condition should be met.

DL Gain = Min {(DL Required Output Power - Input Power), Maximum DL Gain}

4.1.1.1 Gain and Output Power

The gain is the amplifying ability of the booster. The booster has a constant gain for both uplink and downlink. Both uplink and downlink gain can be adjusted by setting attenuation values.

The maximum output power of the booster is determined by the linearity of the amplifier block of the booster. For any given input signal power, its corresponding output is increased by the gain of the booster, the output power will increase along a linear curve based on the fixed gain value.

If the input signal amplified by the gain set exceeds the rated maximum output, the AGC (automatic gain control) function will be triggered. The AGC ensures that the maximum output power of booster is maintained and does not overdrive the booster's amplification circuit. Figure 15 demonstrates the relation between the output power and the gain.

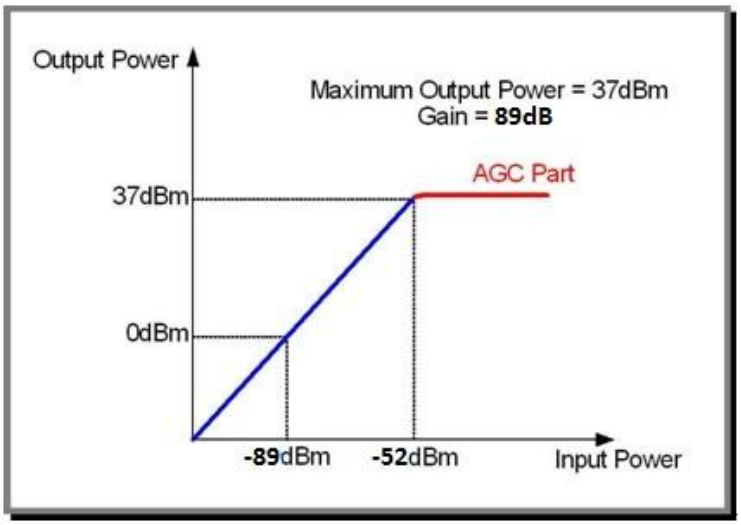

Figure 11

Suppose maximum output power of booster is 37dBm and its gain is 89dB:
So, when input power is weaker than –52dBm, output power = Input Power + 89dB
When input power is stronger than -52dBm, output power = 37dBm

4.1.1.2 Link Budget

Below provides a typical process for calculating the link budget of the booster system. Note that gain is 89dB in the picture below.

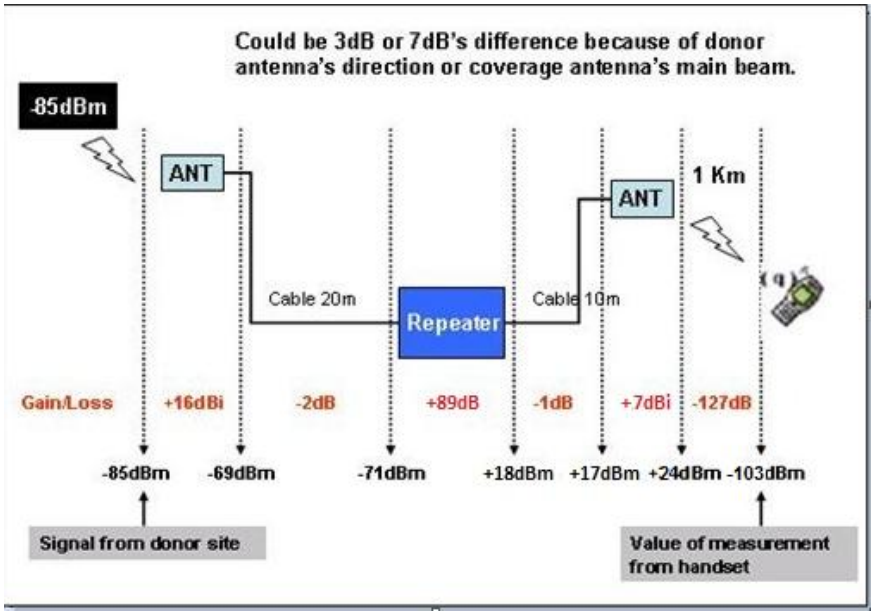

Figure 12

4.1.2 Isolation

Isolation is an important condition that MUST be met for trouble free operation of the booster. To ensure the booster's working properly, the following equation MUST be met.

Refer to ***Section 3.2.3 Isolation*** for further details about isolation and how to measure the value.

Booster Gain ≤ Isolation – 15dB

5. Maintenance

The proceeding section outlines the definition of the alarm conditions on the front panel and OMT, and the steps that can be used to rectify or clear the alarms.

5.1 Alarms and Solutions

When an alarm is triggered, its corresponding LED will change to be red and displayed on the front panel.

The following table lists the different alarms and possible solutions to correct the fault.

Alarm	Cause	Solution
DL AGC Alarm AGC Alarm	1. High input level at the BTS port of the booster, AGC is active and more than 20dB attenuation has been applied. 2. An isolation condition may also have occurred.	1. Add the RF attenuator in BTS port to decrease the input power. And decrease the downlink gain by adjusting the downlink attenuation. 2. Increase the separation distance of the donor and service antenna. And then adjust the gain to meet the isolation issue.

DL Low O/P Alarm	1. DL input power of booster is low. 2. Too much attenuation value has been set according to insufficient isolation. 3. Unsuitable setting in OMT. 4. Amplifier inside the booster has been damaged.	1. Adjust the donor antenna to receive a stronger signal. Input signal of booster within -40dBm ~ -60dBm is recommended. 2. Increase the distance between donor and service antenna to increase the isolation between them, so that more gain can be used. 3. Check the OMT, and make sure the DL PA switch is ON and limit value has been set to be 20dB lower than booster's total output power. Refer to ***OMT User's Manual*** for more detail. 4. If all the problems above don't exist, please check the output power with the spectrum analyzer. If the output power is low, which cannot meet the formula: Output = Input + Gain, booster is damaged. Return the unit to place of purchase for repair.
DL Over O/P Alarm	1. Extremely high input level at the BTS port of the booster. The output power has exceeded the AGC's control. 2. Insufficient isolation will also cause this alarm.	1. Decrease the gain by adjusting the relevant manual attenuation or add an RF attenuator at the BTS port of booster to decrease the input signal power. 2. Move the location of antennas to increase the distance between them.
Over Temp Alarm	The temperature of the booster is above the set threshold, which is caused by the installation environment.	Booster has to be installed vertically. Relocate the booster to a more ventilated position.
Power Module Alarm	1. Input AC power is not stable. 2. Booster's power supply module has been damaged	1. Check whether the input AC power is stable, it should within 110/ 220V ± 20%. If the AC is not stable, an UPS with square wave is recommended. 2. In the condition input AC power is correct and alarm still exists, return the power supply module to place of purchase for repair.
UL PA Failure UL LNA Failure DL PA Failure	The UL or DL PA/ LNA module has been damaged. Most times this is	Return the damaged module back to the place of purchase for repair.

DL LNA Failure	caused by self-osciallation.	
Band1/ CH1 PLL Unlock Band2/ CH2 PLL Unlock	The PLL circuit cannot lock onto the programmed frequencies. The operating frequencies of booster may have been accidentally shifted from the OMT software.	1.1 Execute the **Default Setting** through OMT. Refer to **OMT User's Manual** for more detail. 1.2 If the alarm cannot be solved, it means booster has been damaged. Please return the damaged FC module to place of purchase for repair.
Master Power Failure	If the booster's AC input is shut down, the back-up battery inside the booster will work, and this alarm will be sent out.	1.1 Check whether the power cable has been connected properly and the power outlet are switched on. 1.2 Check the power switch of booster.
Battery Power Low Alarm	When the battery voltage is below 7.7V.	Recharge or change the battery immediately
M/S Module Comm. Failure	1. Internal cable connection loose 2. Cable booster's modules have been damaged	1. Check whether the internal communication cable has been connected properly 2. If the communication cable connected properly and this alarm still exist, return the unit to place of purchase for repair.

5.2 Troubleshooting

Below is a table that lists some of the conditions, possible reasons and solutions for situations in which the booster is not faulty but fault are due to some other conditions. Before sending the booster for factory service, please check the trouble shooting parts listed below.

Status	Possible Reason	Solution
Power LED doesn't glow after power is switched on.	1. Power cable doesn't connect properly. 2. Input AC is out of the rated voltage range.	1.Check the power cable and outlet to make sure there are no discontinuities. 2. The AC voltage range must be between AC100/220±20%V.

Signals have not been amplified after booster installed.	1. No AC input. 2. Antennas are wrongly connected with booster's ports.	1. Check power cable and the power outlet are switched on. 2. Ensure BTS port is connected to donor antenna and MS port is connected to service antenna.
Coverage decreases after a period operation.	1. Donor signal strength decreased. (P.S. The signal strength can fluctuate because of environmental changes. E.g. Construction of new buildings.) 2. The quality of feeder cable system decreases because of oxidization of the cable connector after certain period of usage especially in harsh conditions (e.g. Seaside, areas with chemicals) or cable damage by mice or insects. 3. Change of indoor structure or upholstery. The change of indoor structure or upholstery will influence directly the predicted propagation loss in the previous design.	1. Check the signal strength at donor antenna. Re-position Donor Antenna to solve problem. 2. Check the VSWR of the feeder cable system to find out the faulty point and then replace the damaged cable or connector. 3. Reconsider the position of antennas and the layout of cables if such change occurs.
AGC alarm displays in LCD panel, and successful call can be achieved inside the coverage	Donor antenna is near the donor BTS, and the input donor signal of booster is extremely strong.	Add an RF attenuator in the BTS of the booster to decrease its downlink input power. So that the alarm will disappear.
AGC alarm displays in LCD panel. Inside the coverage, received signal power is fluctuating, and Ec/No is deteriorated. In this condition, successful call cannot be achieved.	This condition occurred when self-oscillation occurs on the site. When isolation of the site cannot meet the formula: Isolation > booster gain +15dB, self-osciallation will occur.	Increase the separate distance between donor and service antenna to increase the isolation. And then adjust the booster's gain to the safe value. Please refer to ***Booster Configuration*** part to see how to set booster's gain properly.

5.3 Booster Replacement

If the booster needs to be replaced, the following procedure is recommended:

- Switch off the power supply
- Disconnect the power cable
- Disconnect the RF feeder cables
- Disconnect the grounding cable of booster
- Loosen the screws at the bracket of booster
- Lift the booster off from the bracket

If the booster is not replaced immediately with another unit, make sure to weather protect the open-ended cables

6. FCC Statement and Warning

1. 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.
(2) This device must accept any interference received, including interference that may cause undesired operation.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
NOTE:
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
Reorient or relocate the receiving antenna.
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.
Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with Minimum distances 80cm between the radiators include antenna & your body.

Warning:

This is **NOT** a **CONSUMER** device. It is designed for installation by FCC **LICENSEES** and **QUALIFIED INSTALLERS**. You **MUST** have an **FCC LICENSE** 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.

7. Appendix

7.1 Abbreviations

AGC	Automatic Gain Control
BTS	Base Transceiver Station
RXLEV	Signal Strength
DEC	Decrease
DL	Downlink
Ec/No	Signal energy per chip to noise ratio
FC	Frequency Converter
IF	Intermediate Frequency
INC	Increase
LED	Light Emitting Diode
LNA	Low noise Amplifier
MS	Mobile Station
Min	Minimum
OMT	Operation & Maintenance Terminal
PA	Power Amplifier
PLL	Phase Locked Loop
RF	Radio Frequency
RSSI	Receive Signal Strength Indication
SIM	Subscriber Identity Module
TEMP	Temperature
UL	Uplink
VSWR	Voltage Standard Wave Ratio
WCDMA	Wide Code Division Multiple Access