

ATTACHMENT H.

- Hardware Manual -

Dualband Repeater User Manual

January, 2009

Version 0.6

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1. Summary

GRS-DU024-BC is a dualband repeater, which has been designed to improve signals in blanket/shadow areas inside of buildings to transmit Bell Mobility's signals at 1900MHz and 800MHz frequencies.

Characteristics (WCDMA 1900MHz)

WCDMA (PCS) Band: 80dB Gain with 24dBm maximum composite output power.

Bandwidth: Entire 1900MHz WCDMA (PCS) frequency B Block to F Block (45MHz). Bandwidth selection adjustable per user's situation.

- 5MHz, 10MHz, 15MHz, 20MHz, 25MHz Blocks
- Three non-contiguous 5MHz block combinations
- 10MHz, 15MHz, 20MHz Blocks can be divided by 5MHz Sub-block.
- See page 10 for more details.

Characteristics (Cellular 800MHz)

Cellular Band: 80dB Gain with 25dBm maximum composite output power.

Bandwidth:

- Downlink 880MHz~894MHz, Uplink 835MHz~849MHz (14MHz Band)
- See page 11 for more details.

Characteristics (Dualband)

GST's Dualband repeater is basically a combination of 800MHz 25dBm and 1900MHz 24dBm repeaters. Functional modules are classified as below:

- 4-Plex and Hybrid Multiplex Cavity Filters to combine the Full-Duplex input/output signals for: 1900MHz WCDMA (PCS), Cellular 800MHz.
- LNA (Low Noise Amplifier)
 - Gain Block to transmit output signal to PAM (Power Amplifier Module)
- Donor and Server LNA Modules, which include Divider / combiner for IF Module interface.
- IF Converter Modules (three for 1900MHz side)
- PAM Module to amplify output power linearly in accordance with optimal repeater output power.
- Power Supply Unit
- Controller to monitor each module in repeater.

All modules in the Dualband repeater are compatible with WCDMA (1900MHz) and Cellular (800MHz) standalone repeaters.

Abbreviation

PAM: POWER AMPLIFIER MODULE

LNA: LOW NOISE AMPLIFIER

AGC: AUTO GAIN CONTROL

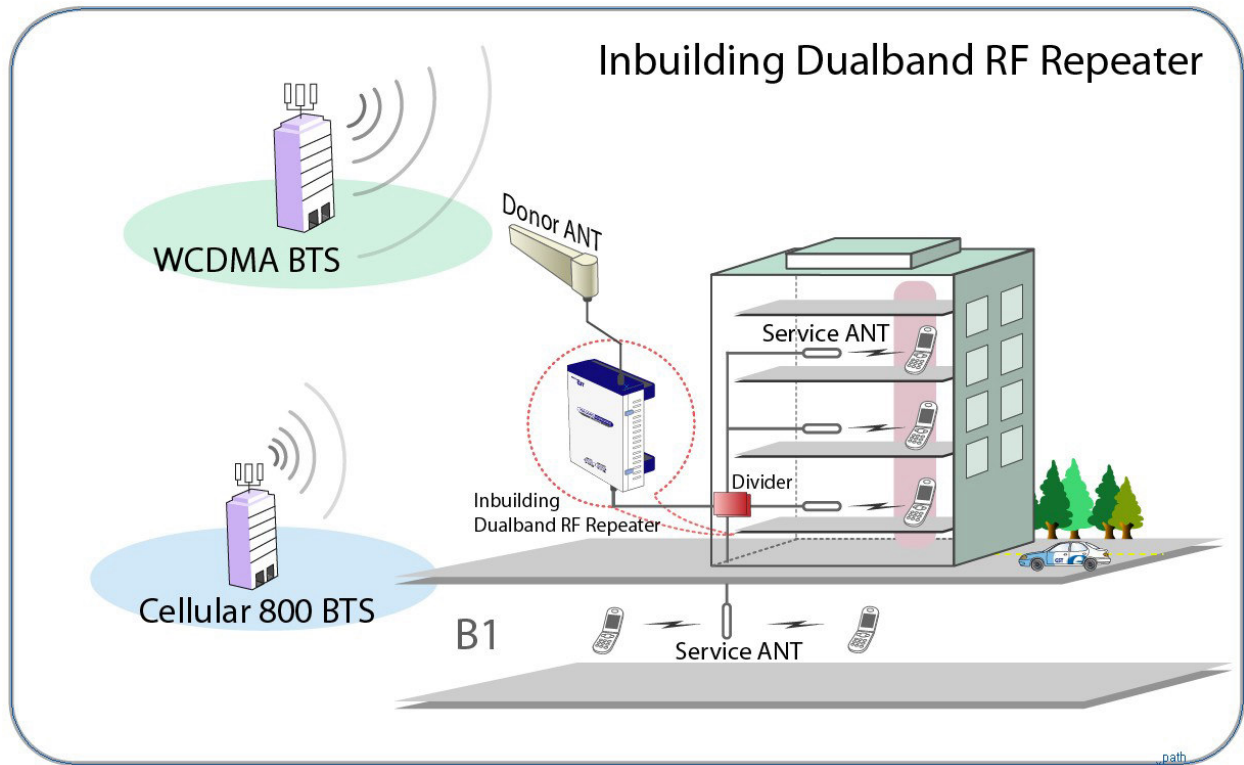
AFC: AUTO FREQ CONTROL



Caution: Risk of explosion if battery on the controller board is replaced by an incorrect type.

2. System Configuration

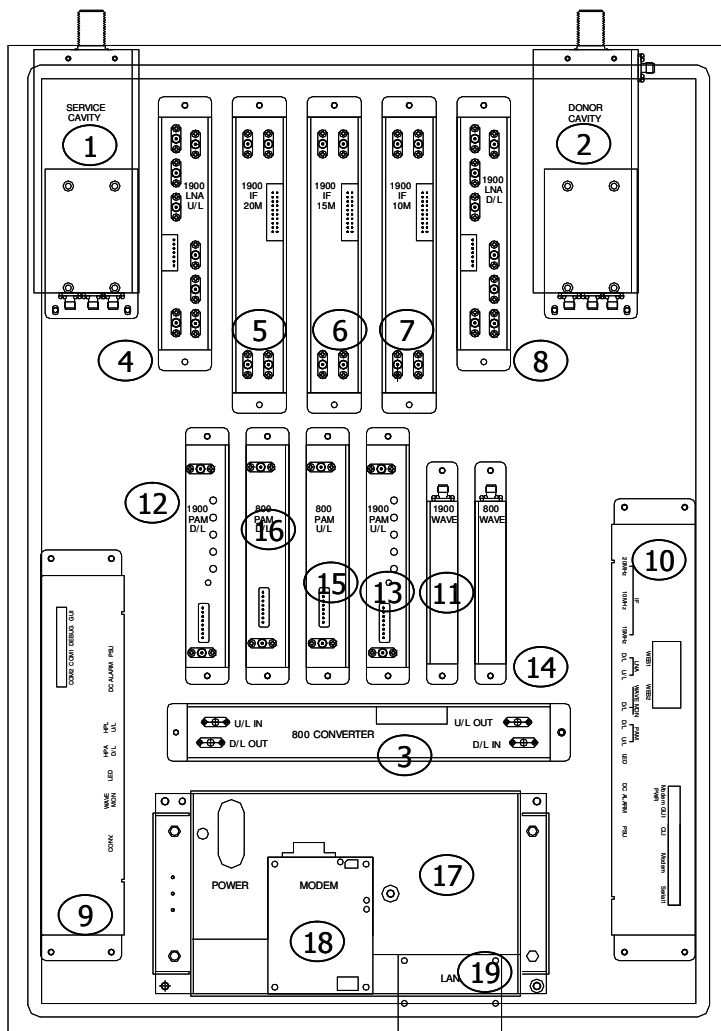
2.1 Dualband Repeater Service Network Configuration



<Pic.1> Dualband In-building Repeater Service Organization

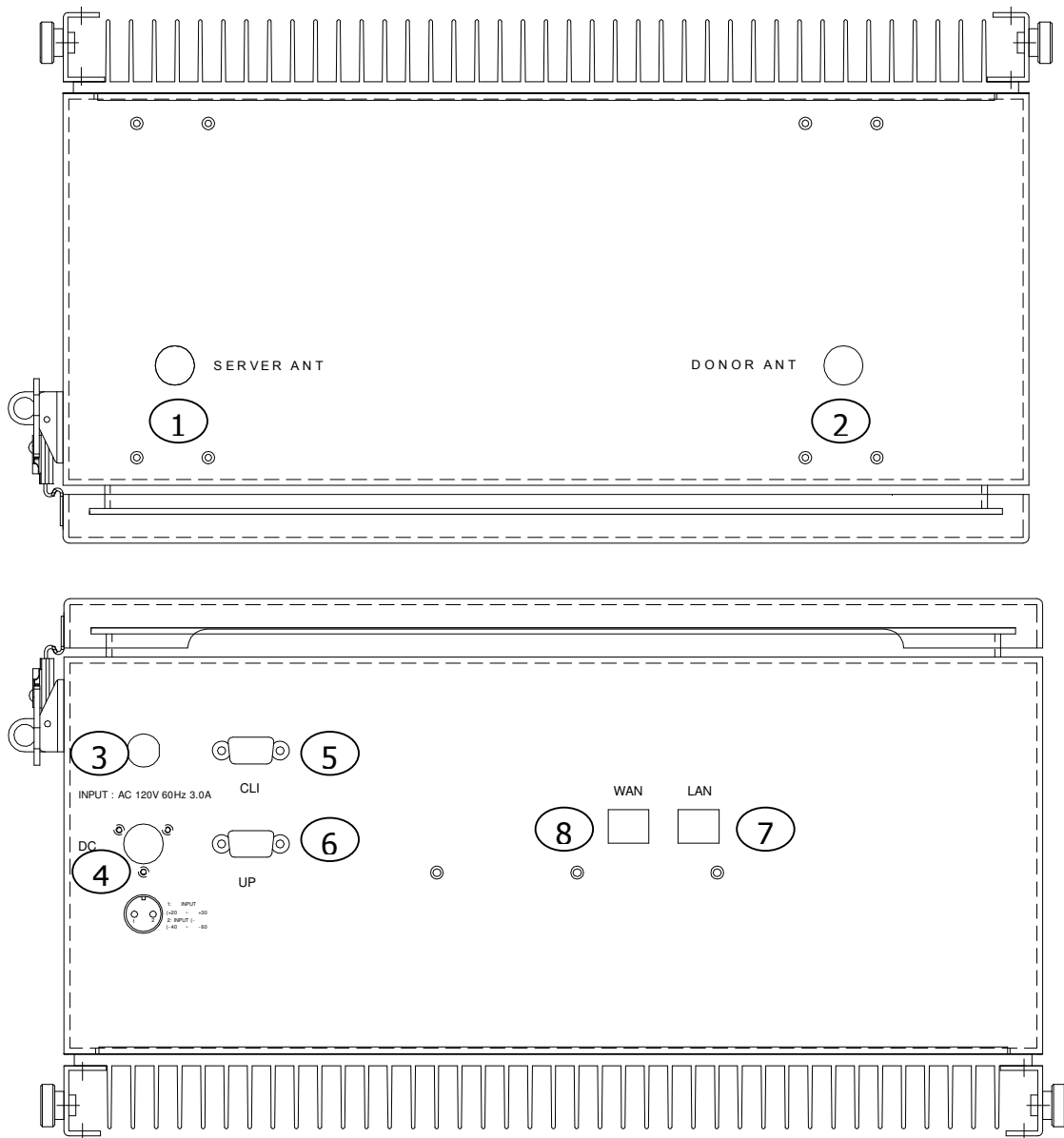
2.2 System Design and Operation

2.2.1 System Design



| NO. | PART | NO. | PART |
|-----|--------------------------------------|-----|---------------------------------------|
| 1 | SERVICE CAVITY MODULE | 11 | (1900) WCDMA WAVE MONITORING MODULE |
| 2 | DONOR CAVITY MODULE | 12 | (1900) WCDMA FWD PAM |
| 3 | (800) CELLULAR CONVERTER MODULE | 13 | (1900) WCDMA RVS PAM |
| 4 | (1900) WCDMA RVS LAN MODULE | 14 | (800) CELLULAR WAVE MONITORING MODULE |
| 5 | (1900) 20M IF CONVERTER MODULE | 15 | (800) CELLULAR RVS PAM |
| 6 | (1900) 15M IF CONVERTER MODULE | 16 | (800) CELLULAR FWD PAM |
| 7 | (1900) 10M IF CONVERTER MODULE | 17 | PSU |
| 8 | (1900) WCDMA FWD LAN MODULE | 18 | MODEM |
| 9 | (800) CELLULAR NMS& I'O BOARD MODULE | 19 | LAN, WLAN Ethernet Port |
| 10 | (1900) WCDMA NMS & I'O BOARD MODULE | | |

<Pic.2> Dualband In-building Repeater Internal Design

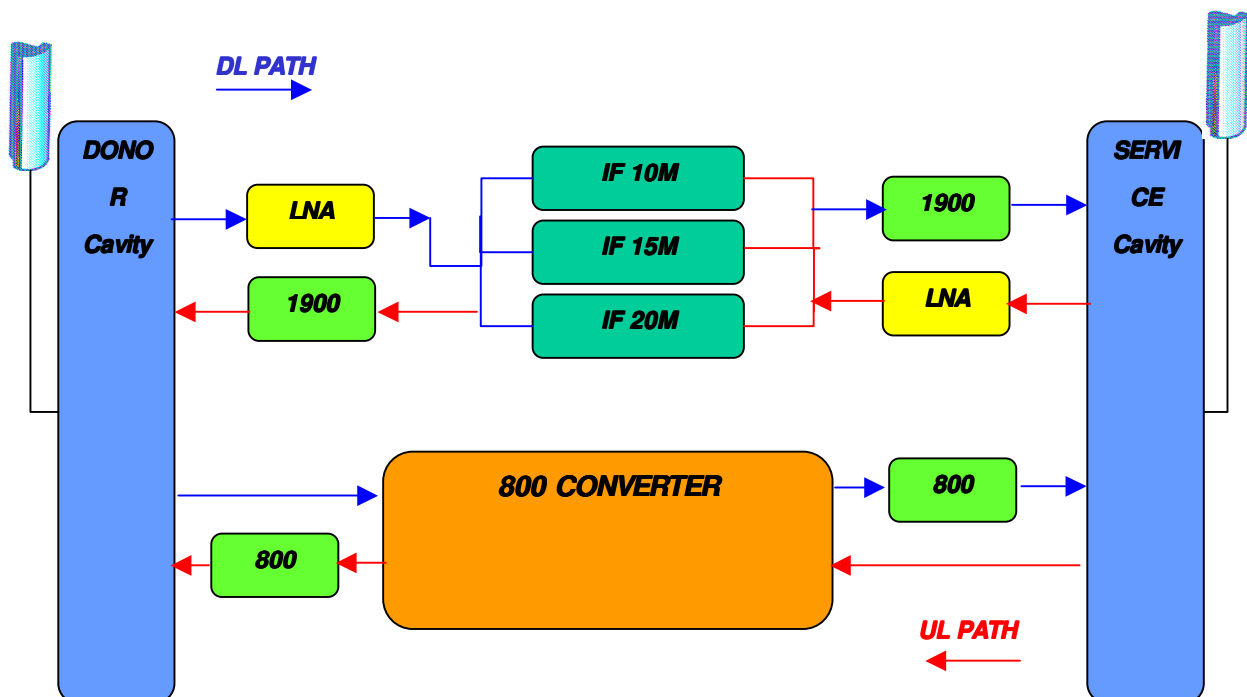


| NO. | PORT | NO. | PORT |
|-----|------------------|-----|------------------|
| 1 | SERVER ANT PORT | 6 | UPS MONITOR PORT |
| 2 | DONOR ANT PORT | 7 | LAN PORT |
| 3 | AC POWER PORT | 8 | WLAN PORT |
| 4 | DC POWER PORT | | |
| 5 | CLI MONITOR PORT | | |

<Pic.3> Dualband Port Design

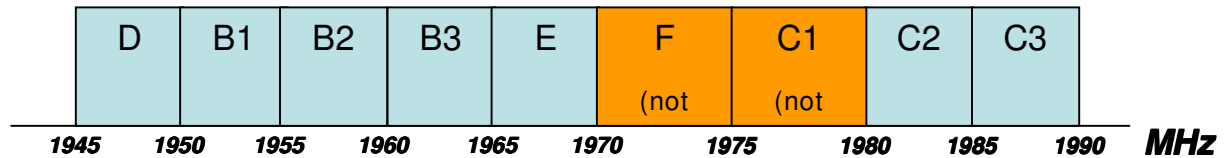
2.2.2 Downlink/ Uplink Path

Dualband In-building RF Repeater simultaneously operates: 1900 MHz WCDMA (PCS) and Cellular 800MHz and has one Donor ANT Port for aiming at each BTS, and one Server Port for the In-building coverage. Therefore the Cavity Filters applied to the Front End of Donor ANT Port and Server ANT Port consists of DPX for 1900MHz WCDMA (PCS) and 800MHz Cellular has 4-Plex which multiplexes all Tx/Rx into one path.

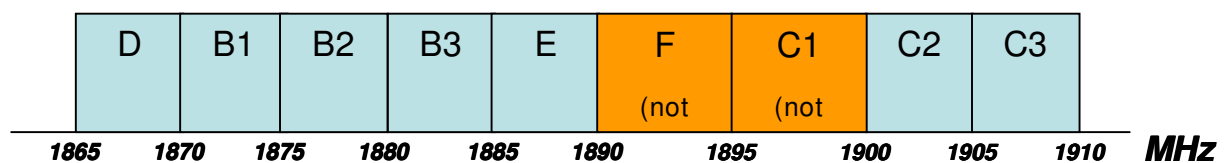


<Pic.4> Dualband In-building Repeater Block Diagram

2.2.3 1900MHz WCDMA Frequency Selection



1900 Downlink Frequency Table



1900 Uplink Frequency Table

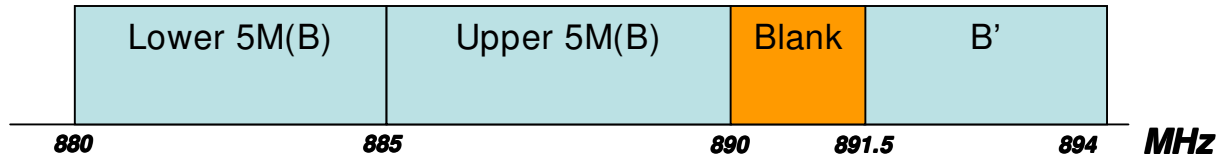
<Pic.5 > 1900MHz WCDMA Band Structure

1900MHz WCDMA repeater has 5MHz, 10MHz, 15MHz, 20MHz, 25MHz Paths in IF division, so any of these bandwidths can be selected for providing service.

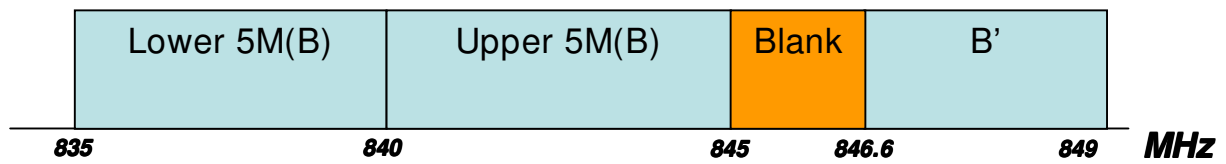
1900MHz WCDMA (PCS) Band Select Table

| Band | Configuration | D | B1 | B2 | B3 | E | F | C1 | C2 | C3 | Remarks |
|------|---------------|---|----|----|----|---|----------|----------|----|----|----------------|
| 5M | 1 | | | 0 | | | not used | not used | | | continuous |
| | 2 | | | | | 0 | | | | | continuous |
| 10M | 3 | 0 | 0 | | | | | | | | continuous |
| | 4 | | | | 0 | | | | 0 | | non-continuous |
| | 5 | | | | | 0 | | | | 0 | non-continuous |
| | 6 | | | | 0 | 0 | | | | | continuous |
| 15M | 7 | 0 | | | 0 | | | | 0 | | non-continuous |
| | 8 | 0 | | | | | | | 0 | 0 | non-continuous |
| | 9 | 0 | | | | 0 | | | | 0 | non-continuous |
| 20M | 10 | 0 | | | | 0 | | | 0 | 0 | non-continuous |
| 25M | 11 | 0 | | 0 | 0 | 0 | | | 0 | | Fixed band |

2.2.4 800MHz Cellular Frequency Selection



800 Downlink Frequency Table



800 Uplink Frequency Table

<Pic.6 > 800 MHz Cellular Band Structure

800 MHz Cellular Band Select Table

| Configuration | B (10MHz) | | B' (2.5MHz) |
|---------------|----------------|----------------|-------------|
| | Lower B (5MHz) | Upper B (5MHz) | |
| 1 | 0 | | 0 |
| 2 | | | 0 |
| 3 | 0 | | |
| 4 | 0 | | |
| 5 | | 0 | |
| 6 | 0 | | 0 |
| 7 | | 0 | 0 |

3. SPECIFICATIONS

3.1 System Capacity

| Item | | Specification | Remark |
|----------------------------|--------------|------------------------------------|---|
| Frequency | Cellular 800 | 880MHz ~ 894MHz | 14MHz |
| | WCDMA (PCS) | 1945MHz ~ 1990MHz | 45MHz |
| | Cellular 800 | 835MHz ~ 849MHz | 14MHz |
| | WCDMA (PCS) | 1865MHz ~ 1910MHz | 45MHz |
| Port | Donor | WCDMA / cellular Tx / Rx | 4-Plex |
| | Server | WCDMA / cellular Tx / Rx | 4-Plex |
| Capacity | | OMNI | |
| WCDMA Channel Capacity | | 5MHz, 10MHz 15MHz, 20MHz, 25MHz | Can select three separated blocks Simultaneously |
| Cellular 800 Bandwidth | | 14MHz | |
| Output Power (ANT Port) | Cellular 800 | +25dBm / 316mW Total | |
| | WCDMA (PCS) | +24dBm / 250mW Total | |

3.2 System Specifications

| Parameter | | | Specification | Remark |
|------------------------------------|--------------------------|----------|--|---|
| Cellular Band Select | B+B' | | DL: 880~894MHz UL: 835~849MHz | 1dB BW |
| | B | | DL: 880 ~ 890MHz UL: 835 ~ 845MHz | |
| | B' | | DL: 891.5 ~ 894MHz UL: 846.5 ~ 849MHz | |
| | Lower B or Upper B | | DL: 880 ~ 885MHz UL: 835 ~ 840MHz Or DL: 885 ~ 890MHz UL: 840 ~ 845MHz | |
| WCDMA Gain | Range | | 50dB ~ 80dB | |
| | Adjust Step | | ±1.0dB | |
| | Adjust Accuracy | | ±0.5dB | |
| Cellular Gain | Range | | 50dB ~ 80dB | |
| | Adjust Step | | ±1.0dB | |
| | Adjust Accuracy | | ±0.5dB | |
| Propagation Delay | WCDMA | | < 5.0us | |
| | Cellular | | < 6.0us | |
| Spurious Emission (Cellular) | F0±750kHz | | < -45dBc | Δmarker: 29dB |
| | F0±1.98MHz | | < -50dBc | Δmarker: 39dB |
| ACLR (WCDMA) | | | ±5MHz : ≤ 45dBc | |
| | | | ±10MHz : ≤ 50dBc | |
| Out Band Spurious Emission | | | < -13dBm | RBW: 30MHz (Cellular) |
| Flatness | | | < ±1.25dB | |
| Return Loss / VSWR | | | > 14dB / < 1.5 : 1 | |
| Uplink Noise Figure | | WCDMA | < 5dB @ Max gain < 12dB @ Min gain | |
| | | cellular | < 5dB @ Max gain < 8dB @ Min gain | |
| Roll off | WCDMA (PCS) | ±1.0MHz | > 40dBc | Test frequency measured from band edge |
| | | ±1.5MHz | > 50dBc | |
| | Cellular | ±1.5MHz | > 40dBc | |
| | | ±3MHz | > 50dBc | |
| Characteristic Impedance | | | 50Ω | |

3.3 Electrical and Environmental Specifications

| Item | | Specification | Remark |
|------------------------------|---------|---------------------------------|-------------------------|
| RF Connector | | N-Type Female | Donor & Server ANT Port |
| Power Connector | AC | MS3102A-10SL (3Pin) | MIL-C-5015 Type |
| | DC | SCK-16-2P (2Pin) | Circular Type |
| AC Supply | | AC 120V 60Hz 3.0A | |
| Out Dimension | | 580(L)*418(W)*204(H) | cm |
| Net Weight | | 26.5 | kgs |
| Material | Module | AL6063S-T5 | |
| | Cabinet | AL5052P | |
| Operation Temperature | | 5℃ ~ +45℃ | Convection cooling |
| Humidity | | 5% ~ 95% | Non-condensing |
| Dust Resistance | | TELCORDIA GR63-CORE | |
| Vibration Resistance | | 1G, 10~150Hz 0.1 Octaves/min | |
| Environmental specifications | | NEMA1 | |
| MTBF | | 100,000 hours | |

3.4 Functions

| Parameter | Specification |
|------------------------------|---|
| Gain Control | <ul style="list-style-type: none"> Adjustable DL and UL Gain range 50~80dB (800MHz Cellular) and 50~80dB (1900MHz WCDMA) Display default Gain and current Gain function |
| AGS Auto Gain Setting | <ul style="list-style-type: none"> AGS (Auto Gain Setting) Use for convenient Set-up <pre> graph TD Start([AGS start]) --> Init[D/L,U/L ATT: 0dB HPA: ON, ALC: ON, Isolation Check: ON] Init --> Isolation[Isolation generation: Wave detection using noise floor level detect Isolation analysis: isolation fault -> System Gain 3dB reduce] Isolation --> Dec1{System Gain + 7dB < isolation detection value} Dec1 -- No --> Reinstall[Sever ANT Tuning Re-installation: AGS] Dec1 -- Yes --> Dec2{Max. Gain & isolation O.K.} Dec2 -- No --> Warning[Gain reduce & isolation O.K Display Notice (AGS Warning) HPA: Off] Dec2 -- Yes --> Settings[HPA: ON, Gain balance: ON, AGC: ON, Shutdown: ON] Settings --> End([AGS done]) Warning --> Dec3{Current setting maintenance} Dec3 -- Yes --> HPA_ON[HPA: ON] HPA_ON --> End Dec3 -- No --> Reinstall </pre> <p>AGS (Auto Gain Setting) → Installation algorithm for AGS .</p> |
| AGC Auto Gain Control | <ul style="list-style-type: none"> It always operates in Downlink AGC ON status To maintain same Downlink output power despite flexible input signal strength. To add or subtract Attenuation level referring to AGC Power Limit level. Used with the Automatic Setup (Auto Gain Setting) |
| ALC Auto Limit Control | <ul style="list-style-type: none"> To limit output power as far as default range Used for DAS configuration and when oscillation/isolation is a concern Automatic Gain decrement when output power of repeater is higher than default level Automatic Gain recovery when output power of repeater is reduced. Shutdown when output power is higher than default level in Minimum Gain Automatic Recovery Algorithm conversion after Shutdown status |
| Band Select | <ul style="list-style-type: none"> To select either 5MHz/10MHz/15MHz/20MHz/25MHz (1900MHz WCDMA) B+B' Band (14MHz) |

| | |
|------------------------------|---|
| Power Monitoring Function | <ul style="list-style-type: none"> Monitoring repeater's output level |
| Oscillation Check | <ul style="list-style-type: none"> Isolation Check in initial set up or Reset Monitoring Oscillation comparing to minimum/maximum Noise Floor level When Oscillation occurred, repeater attempts to stabilize Isolation through Gain control function. Shutdown repeater when Oscillation still occurs in Minimum Gain Automatic Recovery Algorithm conversion after Shutdown status |
| Spurious Emission Alarm | <ul style="list-style-type: none"> Noise Floor Observation in case of $\pm 2.25\text{MHz}$ down at the center In case of Noise level $> -13\text{dBm}$, Spurious Emission is stabilized automatically In case of Oscillation Spurious Emission Alarming in Minimum Gain, repeater will be shutdown Automatically Switch to Recovery Algorithm at Shutdown |
| DL Input control | <ul style="list-style-type: none"> Monitoring Donor ANT input power of DL |
| Automatic Recovery | <ul style="list-style-type: none"> When repeater is shutdown, it periodically recovers output power of repeater then monitors alarming |
| Security | <ul style="list-style-type: none"> Support HTTPS for Web Browser security User authentication through User ID and Password |
| Temperature Control | <ul style="list-style-type: none"> Monitoring temperature of repeater Maximum and minimum set up is possible. Shutdown in over temperature Automatic recovery after temperature becomes normal. (Hysteresis 10degree) |
| VSWR Monitoring | <ul style="list-style-type: none"> Monitoring VSWR of Donor ANT Port (Every 90 seconds) Reporting VSWR Alarm and Shutdown when the rate is 3:1 Automatic Recovery Algorithm conversion after Shutdown status |
| IP address report via E-mail | <ul style="list-style-type: none"> When in PPP reconnection, E-mail which includes HTML to connect to newly assigned IP Address, reports to operator. |
| DHCP Client | <ul style="list-style-type: none"> Automatic IP assignment |
| DHCP Server | <ul style="list-style-type: none"> Server function for automatic IP assignment |
| Web GUI | <ul style="list-style-type: none"> Remote and local user browser support through Web Browser |
| SNMP Agent | <ul style="list-style-type: none"> NMS report via SNMPv2 Trap |
| LED Display | <ul style="list-style-type: none"> LED displays power and operation status on front side of repeater system. Input and Output signal levels are verified by LED bars. |

4. SETUP

4.1. Equipment Needed for Dualband Repeater Setup

| Parameter | Item | Quantity | Remark |
|---------------------------------|--|----------|-----------------|
| Major Component | Repeater GSR-DUO24-BC | 1 EA | Provided by GST |
| Additional Components | Mounting Bracket | 1 EA | Provided by GST |
| | CD which contains User Manual V0.1 and Installation Guide V0.1 | 1 EA | |
| | Ethernet Cable 6.6ft (2m) | 1 EA | |
| | Ground Cable 6.6ft (2m) | 1 EA | |
| | Ground Sems Screw M4 x 8mm | 4 EA | |
| | Bracket Sems Screw M6 x 16mm | 4 EA | |
| | Lag Screw 12.7mm x 50.8mm | 4 EA | |
| | Anchor Bolt Set 12.7mm x 50.8mm | 4 EA | |
| Antenna | Donor ANT | 1 EA | Not Included |
| | Server ANT | 1 EA | |
| RF Cable | Antenna connection Cable | TBD | Not Included |
| Testing and Measuring Equipment | Spectrum Analyzer | 1 EA | Not Included |

4.1.1 Checkpoints before turning on the Repeater

- 1) **System Power Check:** AC electrical power to the repeater should be 110V, input electricity only after power verification.
- 2) **Input RF Signal Range:** Optimal input RSSI into the repeater is -55dBm ~ -25dBm for 800MHz Cellular, and -56dBm ~ -26dBm for 1900MHz WCDMA. User should verify input condition of Donor ANT. If the input RSSI exceeds -20dBm, then external attenuators should be used.
- 3) **Isolation check between DONOR/SERVER ANT:** Isolation condition of this equipment is 87dBc (Gain+7dB) for Cellular, and 87dBc (Gain+7dB) for WCDMA. User should check its condition before installation.

4.1.3 System Setup

- 1) This equipment is basically wall mountable.
- 2) Installer will have to connect the power supply (after verifying the input power) and RF cable to the Repeater and then it will be ready to use.
- 3) For grounding, there is a grounding terminal in main power supply which will be plugged into power outlet. There is also a separate grounding terminal on the repeater which should be connected to the on-site grounding terminal to ensure proper grounding.
- 4) Mounting of repeater should be done by at least two technicians to ensure a safe and proper installation.

4.1.4 Open for Service

1) Check points before open:

a. Verification of system installation status:

- Electricity, In/Out antennas, cable connection, and equipment mount status.

b. Verification of system accessories:

- User should check all necessary accessories.

c. Check receipt signal level

- Installer should check whether environmental conditions are in accordance with system specification to ensure that system operation will be optimized.

2) Check points after open:

a. Check external LED

1) RUN: Green light ON (Off: all lights off)

2) ALARM: Green light in normal status, Red light in alarming

3) SHUT DOWN: Green light in normal status, Red light in Shutdown status

800MHz Cellular 25dBm:

Number of LED bars on front side of repeater will show input signal level.

Less than ~ -85dBm: LED 1bar

-84dBm~-67dBm: LED 2 bars

-66dBm~-49dBm: LED 3 bars

-48dBm~-31dBm: LED 4 bars

More than -30dBm: LED 5 bars

Number of LED bar on front side of repeater will show output power signal level.

Less than ~ -10dBm: LED 1bar

-9dBm~+1dBm: LED 2bars

+2dBm~+12dBm: LED 3bars

+13dBm~+24dBm: LED 4bars

More than +25dBm: LED 5bars

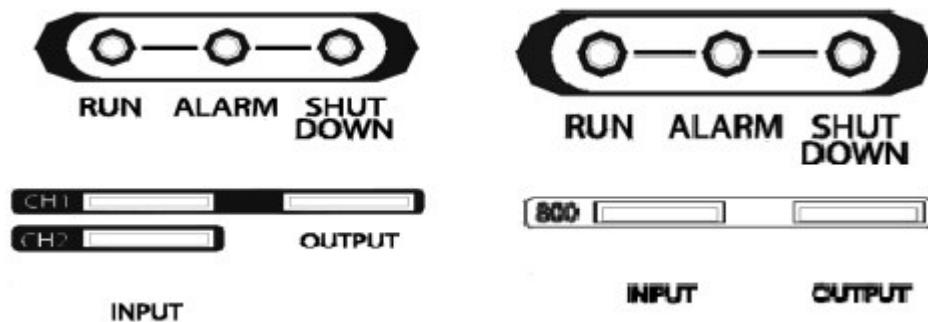
1900MHz WCDMA 24dBm:

Number of LED bar on front side of repeater will show input signal level:

- Less than -76dBm: LED 1bar
- 75dBm~-61dBm: LED 2bars
- 60dBm~-46dBm: LED 3 bars
- 45dBm~-31dBm: LED 4 bars
- More than -30dBm: LED 5 bars

Number of LED bar on on front side of repeater will show output power signal level:

- Less than +15dBm: LED 1bar
- +16dBm~+17dBm: LED 2 bars
- +18dBm~+19dBm: LED 3 bars
- +20dBm~+22dBm: LED 4 bars
- More than +23dBm: LED 5 bars



<Pic.9> Dualband In-Building Repeater Front LED

b. Verification of operation status

User should verify following status with Output monitoring terminal, which is provided by Spectrum Analyzer:

- Output power generation status, system spurious emission characteristics.

c. Verification of signal quality and strength in service area

User should verify signal strength and quality of in-service coverage area by using cell phone or other measuring device.

d. Verification of upper-level NMS operation status

4.2 Troubleshooting

In case of abnormal operation, technician should diagnose abnormality via remote access or directly connecting to repeater using Ethernet cable. If technician is required to conduct repairs due to major alarm, repeater should first be powered off, and then technician should prepare the proper measurement equipment before trying to fix the problem. In most cases of major repairs, GST will simply replace the unit and conduct repairs at the appropriate facility.

4.2.1 Necessary Testing and Measuring Equipment

- a. RF Power Meter: 10Watt Max, 50ohm
- b. Signal Generator: 3GHz
- c. Spectrum Analyzer: 3GHz
- d. Multi-Meter

4.2.2 Notice

- a. Troubleshooting should be performed by a trained technician.
- b. Parts that seem to be not used should not be disassembled.
- c. While troubleshooting, technician should use attenuator to check RF Signal output.

4.2.3 Simple Troubleshooting Method

- a. Verify LED Status, both on external LED's as well as internal module LED's
 - Normal operation: Green light On. Alarming: Red LED on
- b. Technician should check external and internal connectors to ensure that all connections are tightly secure. These connectors should be cleaned regularly.
- c. If technician thinks there is a serious problem, call after sales team for over-the-phone technical support. 1-866-9-GST-USA (1-866-947-8872)

4.2.4 Troubleshooting Guide

| Item | Check Point | Trouble shooting | | | | | | | | | | |
|------------------------------|--|--|--------------|--|------------------------|-----------------------------|----------------------|-----------------------------|--------------------------|-----------------------------|------------------------|-----------------------------|
| Note before system operation | * System Input power range | <table><tr><th colspan="2">Input Level</th></tr><tr><td>Downlink (WCDMA 1900M)</td><td>-56dBm/Total ~ -26dBm/Total</td></tr><tr><td>Uplink (WCDMA 1900M)</td><td>-56dBm/Total ~ -26dBm/Total</td></tr><tr><td>Downlink (Cellular 800M)</td><td>-55dBm/Total ~ -25dBm/Total</td></tr><tr><td>Uplink (Cellular 800M)</td><td>-55dBm/Total ~ -25dBm/Total</td></tr></table> | Input Level | | Downlink (WCDMA 1900M) | -56dBm/Total ~ -26dBm/Total | Uplink (WCDMA 1900M) | -56dBm/Total ~ -26dBm/Total | Downlink (Cellular 800M) | -55dBm/Total ~ -25dBm/Total | Uplink (Cellular 800M) | -55dBm/Total ~ -25dBm/Total |
| Input Level | | | | | | | | | | | | |
| Downlink (WCDMA 1900M) | -56dBm/Total ~ -26dBm/Total | | | | | | | | | | | |
| Uplink (WCDMA 1900M) | -56dBm/Total ~ -26dBm/Total | | | | | | | | | | | |
| Downlink (Cellular 800M) | -55dBm/Total ~ -25dBm/Total | | | | | | | | | | | |
| Uplink (Cellular 800M) | -55dBm/Total ~ -25dBm/Total | | | | | | | | | | | |
| Note before system operation | * System Gain | <table><tr><th colspan="2">Gain</th></tr><tr><td>Downlink (WCDMA 1900M)</td><td>50 ~ 80dB</td></tr><tr><td>Uplink (WCDMA 1900M)</td><td>50 ~ 80dB</td></tr><tr><td>Downlink (Cellular 800M)</td><td>50 ~ 80dB</td></tr><tr><td>Uplink (Cellular 800M)</td><td>50 ~ 80dB</td></tr></table> | Gain | | Downlink (WCDMA 1900M) | 50 ~ 80dB | Uplink (WCDMA 1900M) | 50 ~ 80dB | Downlink (Cellular 800M) | 50 ~ 80dB | Uplink (Cellular 800M) | 50 ~ 80dB |
| Gain | | | | | | | | | | | | |
| Downlink (WCDMA 1900M) | 50 ~ 80dB | | | | | | | | | | | |
| Uplink (WCDMA 1900M) | 50 ~ 80dB | | | | | | | | | | | |
| Downlink (Cellular 800M) | 50 ~ 80dB | | | | | | | | | | | |
| Uplink (Cellular 800M) | 50 ~ 80dB | | | | | | | | | | | |
| Note before system operation | * Output power at Server port | <table><tr><th colspan="2">Output power</th></tr><tr><td>Downlink (WCDMA 1900M)</td><td>24dBm/Total</td></tr><tr><td>Uplink (WCDMA 1900M)</td><td>24dBm/Total</td></tr><tr><td>Downlink (Cellular 800M)</td><td>25dBm/Total</td></tr><tr><td>Uplink (Cellular 800M)</td><td>25dBm/Total</td></tr></table> | Output power | | Downlink (WCDMA 1900M) | 24dBm/Total | Uplink (WCDMA 1900M) | 24dBm/Total | Downlink (Cellular 800M) | 25dBm/Total | Uplink (Cellular 800M) | 25dBm/Total |
| Output power | | | | | | | | | | | | |
| Downlink (WCDMA 1900M) | 24dBm/Total | | | | | | | | | | | |
| Uplink (WCDMA 1900M) | 24dBm/Total | | | | | | | | | | | |
| Downlink (Cellular 800M) | 25dBm/Total | | | | | | | | | | | |
| Uplink (Cellular 800M) | 25dBm/Total | | | | | | | | | | | |
| Check in Advance | * Check points before open for service | <div>* Please check quantity of all accessories with specification before you set up.</div> <div>* Fit cable length in accordance with field condition.</div> <div>* Set up 1900MHz WCDMA Donor antenna to secure Isolation (More than 87dBc)</div> <div>* Set up 800MHz Cellular Donor antenna to secure Isolation (More than 87dBc)</div> | | | | | | | | | | |

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| Check after open | * Check points after open for service | <ul style="list-style-type: none"> * Check following status <ul style="list-style-type: none"> - Verify that the antennas are securely mounted and pointed in the correct directions - Connection status between antennas and RF cable - Verify that the Repeater is securely mounted - Proper AC power status - Grounding status of electrical circuit - Coaxial cable (RF) construction status - Connectors and combiners connection status - Cable connection status against leakage of water |
|------------------|---------------------------------------|--|

4.2.5 Troubleshooting Guide Related to RF

| Symptom | Check Point | Troubleshooting |
|--------------------------------------|--|--|
| When repeater does not work properly | * Check Electricity Cord connection status | * Re-plug in AC power cord |
| When repeater does not work properly | * Checking electricity input to AC power outlet. | * Please verify AC power input by using DVM (Digital Voltage Meter) |
| When in alarming | * DL over-input alarm | <ul style="list-style-type: none"> * Please Check following status <ul style="list-style-type: none"> - Proper maximum output power limit level - BTS input level (Spectrum Level) - Input RSSI value on Status Page - Downlink Attenuation level * Please reset AC power upon completing Alarm troubleshooting |
| When in alarming | * DL over-output alarm | <ul style="list-style-type: none"> * Make sure output power is operating normally. * Reset AC power upon completing Alarm troubleshooting. |
| When in alarming | * UL over-output alarm | <ul style="list-style-type: none"> * Please make sure output level is operating normally * Please reset AC power upon completing Alarm troubleshooting |

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|------------------|---------------------------|---|
| When in alarming | * VSWR alarm | <ul style="list-style-type: none"> * Check following status <ul style="list-style-type: none"> - Antenna port connection - Verify that cable from I/O filter is secure. * Disconnect all antenna cables from the repeater and then reboot the repeater. If the VSWR alarm still occurs then equipment should be replaced. If the alarm goes away, then the VSWR issue is somewhere in the cabling or connectors. * Reset AC power upon completing Alarm troubleshooting |
| When in alarming | * IF Module alarm | <ul style="list-style-type: none"> * Verify IF Module LED is On. * When LED is Off, module should be defective. |
| When in alarming | * DL, UL PAM alarm | <ul style="list-style-type: none"> * Reset AC power upon completing Alarm troubleshooting |
| When in alarming | * DC matter/Current alarm | <ul style="list-style-type: none"> * Verify DC power by using DVM (Digital Voltage Meter) * Reset AC power upon completing Alarm troubleshooting. |
| When in alarming | * UL Oscillation | <ul style="list-style-type: none"> * Check Isolation between Donor and Server. * Reset AC power upon completing Alarm troubleshooting |
| When in alarming | * DL / UL LNA alarm | <ul style="list-style-type: none"> * Check connection status of LNA. * Reset AC power upon completing Alarm troubleshooting |
| When in alarming | * Temperature alarm | <ul style="list-style-type: none"> * Check following status: <ul style="list-style-type: none"> - Setting level of maximum temperature limit - Temperature offset is normal or not. - Circumstances of temperature. * Reset AC power upon completing Alarm troubleshooting |
| When in alarming | * DL low-input alarm | <ul style="list-style-type: none"> * Reset AC power upon completing Alarm troubleshooting |

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| When in alarming | * DL low-output alarm | <ul style="list-style-type: none"> * Check following status <ul style="list-style-type: none"> - Output power level is normal or not. - Whether minimum output limit level is normal. - Compare RSSI to maximum gain. * Reset AC power upon completing Alarm troubleshooting |
| When in alarming | * RF OFF | <ul style="list-style-type: none"> * Verify that the HPA's are On. * Reset AC power upon completing Alarm troubleshooting |
| When output power is no longer problem | * Technician should verify category of alarm at the front side of repeater. | * When Red light on the Shutdown LED, technician should troubleshoot the alarm via Notebook computer. |
| When output power is no longer problem | <ul style="list-style-type: none"> * Technician should connect antenna with output port of repeater. * Please make sure all connectors are fastened | <ul style="list-style-type: none"> * Reconnect the connector. * Change it if the connector is defective. |
| When output power is no longer problem | * Check the input level | * Increase output power or check input change of BTS side. |
| When output power is no longer problem | * Check Gain of the unit | * If the Gain is different from normal level, please contact A/S team. |
| When output power is no longer problem | * Cable connector loose. | <ul style="list-style-type: none"> * It is possible for connectors to get too tight and damage the equipment or throughput. * Please contact installer or service provider upon verification. |
| In case of dropped call or bad signal after set up | * Check input signal strength in the service area | * Increase output power level of repeater by adjusting attenuation level. |

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|--|---|---|
| In case of drop call or bad signal after set up | * If input signal strength is not a problem, please check delay of calling time. | * Increase output level of Uplink signal, then set to optimal level. |
| In case of dropped call or bad signal after setup | * Check RSSI signal strength | * Contact network management team or service provider |
| In case Output Signal wavelength is not shown flat or looks like oscillation | * Check connection fastened between antenna and cable (Signal wavelength should be flat and stable if technicians shake CABLE. If not, it is connection problem.) | * If connection is not proper, reconnect cable and connector and then check the output power again. |
| Same as above | * Input level change or module overheating. | * Check input level from BTS side. * Check performance of each module. (Diagnosed by A/S team.) |
| Same as above | * Please check VSWR of the Cable is normal. | * Change to normal Cable. |

4.2.6 Troubleshooting Guide Related to NMS

| Symptom | Check Points | Troubleshooting |
|-----------|---|--|
| Link Fail | * Communication problem | * In case of Ethernet, verify IP addressing, DHCP function, and that Cookies are deleted. * Verify that a crossover Ethernet cable is being used. |
| Link Fail | * CLI Connection, Cable status check | * Make sure 1:1 connection. * Follow instructions in the installation guide for this connection procedure. |
| Link Fail | * CLI connection Check by USB to Serial Cable | * Please verify Port number of PC communication. * Please check Cable connection status. |