

# **Smart-Cell Repeater User Manual**

**33dBm**

**April, 2016**

**Version 1.2**

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## 1. INTRODUCTION

Smart-Cell is a repeater, which has been designed to improve signals in blanket/shadow areas inside of buildings to transmit Verizon's signals at 700MHz, 850MHz, 1900MHz, and 2100MHz frequencies. User may choose filtering configuration according to the specific site circumstances.

### 1.1. Warning

#### 1.1.1 FCC Warning Statements

##### 1) FCC Part 15.19 :

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, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

##### 2) FCC Part 15.105 :

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his expense.

##### 3) FCC Part 15.21 :

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

#### **4) FCC Part 27.5, IC SRSP-518**

Antennas must be installed in accordance with FCC 27.50 and SRSP 518.

Please note that EIRP based on antenna gain after accounting for cable loss should be less than 50 Watt (47 dBm) for Donor side. For Service side, with 2dBi gain antennas the height of the antenna above average terrain (HAAT) must not exceed 14.496 m. For different gain antennas refer to the relevant rules.

#### **5) FCC Warning Label**

WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSE 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.

### 1.1.2. IC Warning state

#### 1) RSS-GEN, Sec. 7.1.2 – (transmitters)

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada.

Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs,

il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

#### 2) RSS-GEN, Sec. 7.1.2 – (detachable antennas)

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

#### 3) RSS-131 Section 5.3 User Manual

The following notice: "The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced

by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device."

#### **4) RF Radiation Exposure**

This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of at least 110 cm with 2dBi antenna gain or 500 cm with 15dBi antenna gain between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. RF exposure will be addressed at time of installation and the use of higher gain antennas require larger separation distances.

#### **5) RSS-102 RF Exposure**

L'antenne du donneur a une antenne 15dBi gain. Antenna doit être installé pour maintenir en tout temps un minimum de distance d'au moins 500 cm entre la source de rayonnement (antenne) et toute personne physique.

L'antenne de service comporte une antenne 2 dBi gain. Antenna doit être installé pour maintenir en permanence une distance minimale d'au moins 110 cm entre la source de rayonnement (antenne) et toute personne physique.

Cet appareil ne doit pas être installé ou utilisé en conjonction avec une autre antenne ou émetteur.

#### **1.1.3. etc.**

- 1) Use of unauthorized antennas, cables, and/or coupling devices not conforming with ERP/EIRP and/or indoor-only restrictions is prohibited.)
- 2) Home/ personal use are prohibited.

## 1.2. GST Smart-Cell Repeater Advantages

- It provides selectable RF power levels for any wireless technology / band.
- It has individual monitoring multiple technology.
- FPGA digital filtering provides optimized RF performance.
- It allows modification of technology via customer interface.
- It is easily installed.
- Frequency is easy to add / delete / change.
- It has scalable single and multi-service design.
- Customer data service is improved by adding 4G (LTE).
- It meets all Verizon's technology requirements.
- **It guarantees 5 year warranty for all individual components.**
- Its modular design is a customer friendly and efficient.

## 1.3. Repeater Operation

Simple replacing of the amplifier unit allows changing the service. Smart-Cell repeater provides service at 700MHz, 800MHz, 850MHz, 1900MHz, and 2100MHz. One PSU supplies electricity to maximum 4 amplifier units



#### 1.4. Abbreviation

DFM	Digital Filter Module
PSU	Power Supply Unit
ALC	Auto Level Control
SNMP	Simple Network Management Protocol
AOC	Auto Oscillation Check



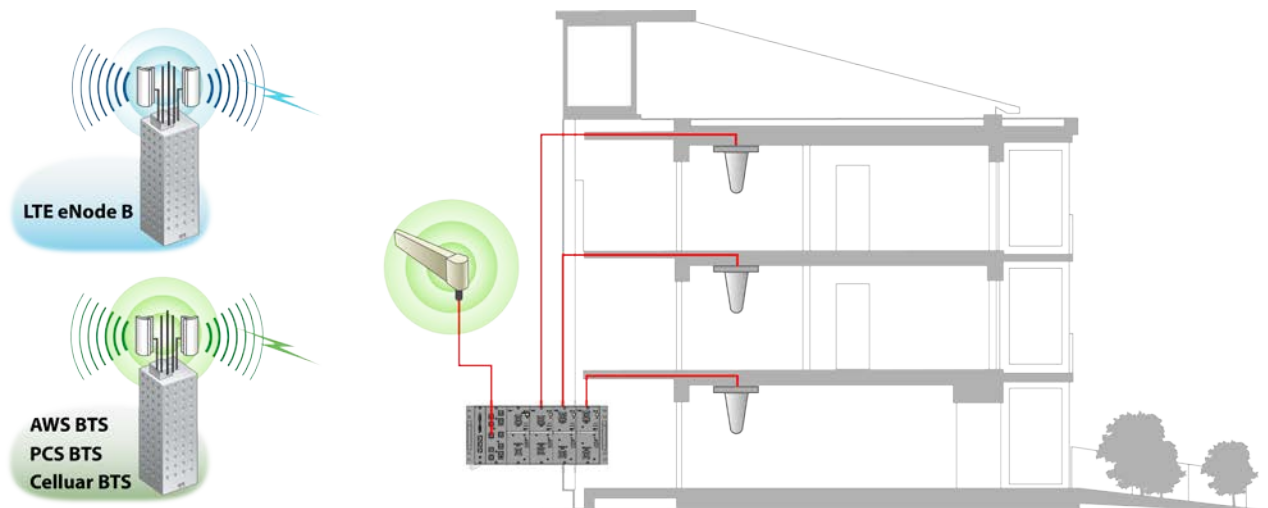
**Caution:** Risk of explosion if battery on the controller board is replaced by an incorrect type.

## 2. SYSTEM CONFIGURATION

### 2.1. Smart-Cell Repeater Service Network Configuration

Smart-Cell RF Repeater is designed for improving coverage and capacity of Verizon's LTE & CDMA services nationwide. The repeater can provide coverage for all troubled areas such as suburban, shadow areas, backside of mountains, urban and metropolitan locations.

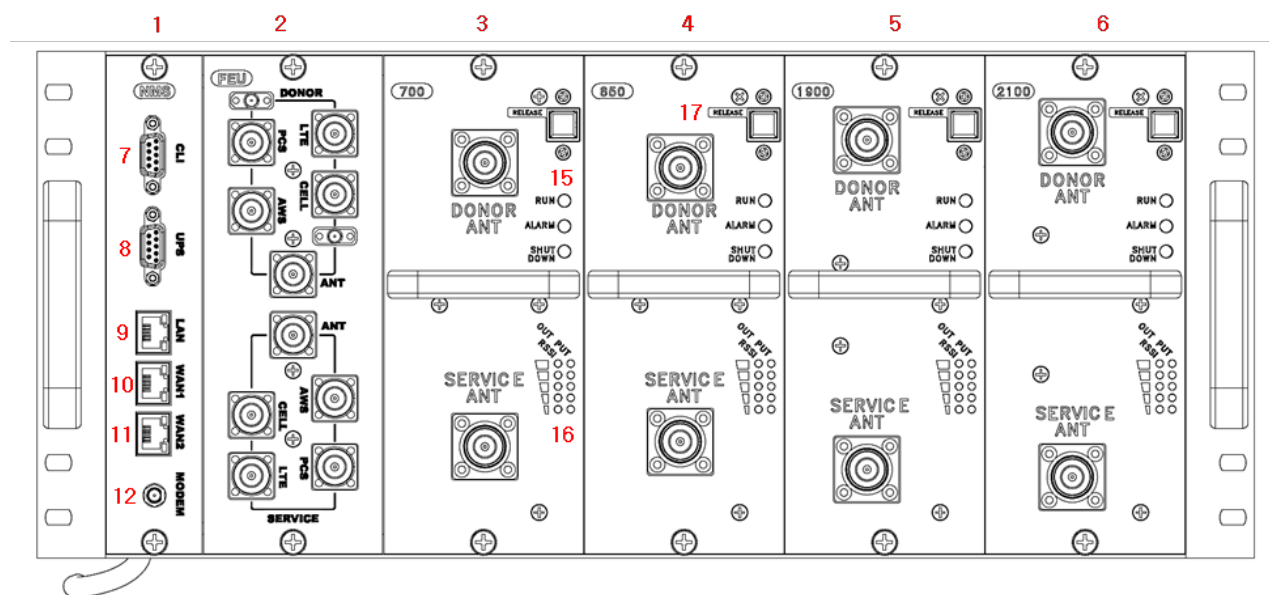
GST products are easy to install, have remote status monitoring and control functions (NMS System) via wired line and wireless modems.



<Figure 1> In-building Repeater Service Organization

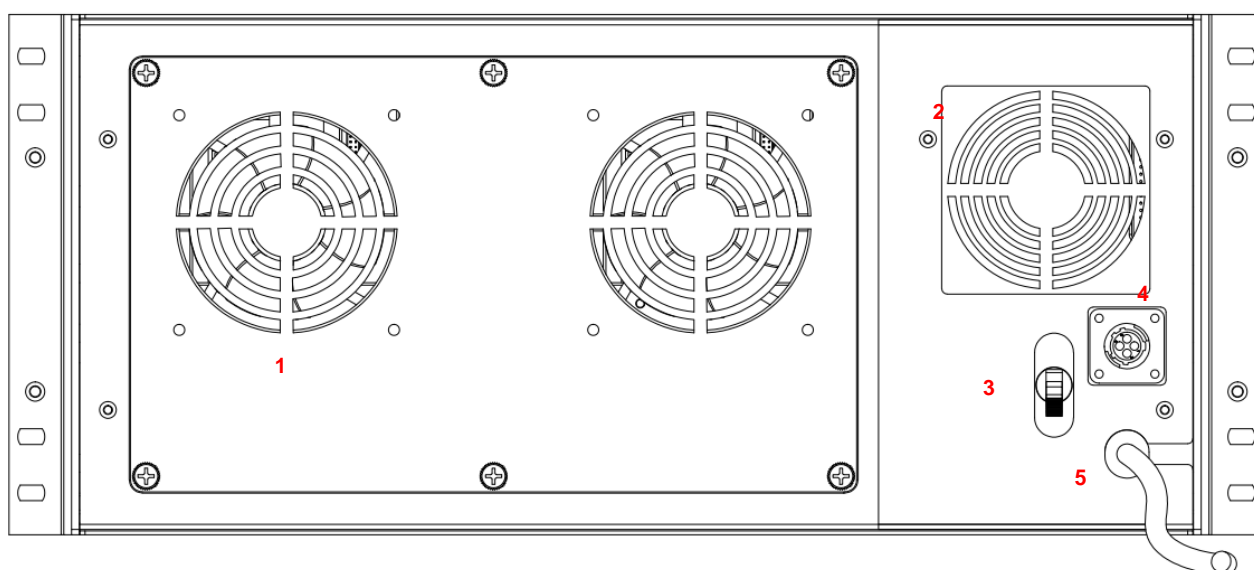
## 2.2. System Design and Operation

### 2.2.1. System Design



<Figure 2> Smart-Cell Repeater Front Design

NO.	PART	NO.	PART
1	SNMP	10	WAN 1
2	FEU (Cavity Filter) , optional	11	WAN 2
3	Service Unit #1	12	Modem Connector
4	Service Unit #2	13	Donor Port
5	Service Unit #3	14	Coverage Port
6	Service Unit #4	15	Status LED (RUN/Alarm/Shutdown)
7	CLI	16	Input / Output LED
8	UPS	17	Release Button
9	LAN		



<Figure 3> Repeater Port Design (Rear View)

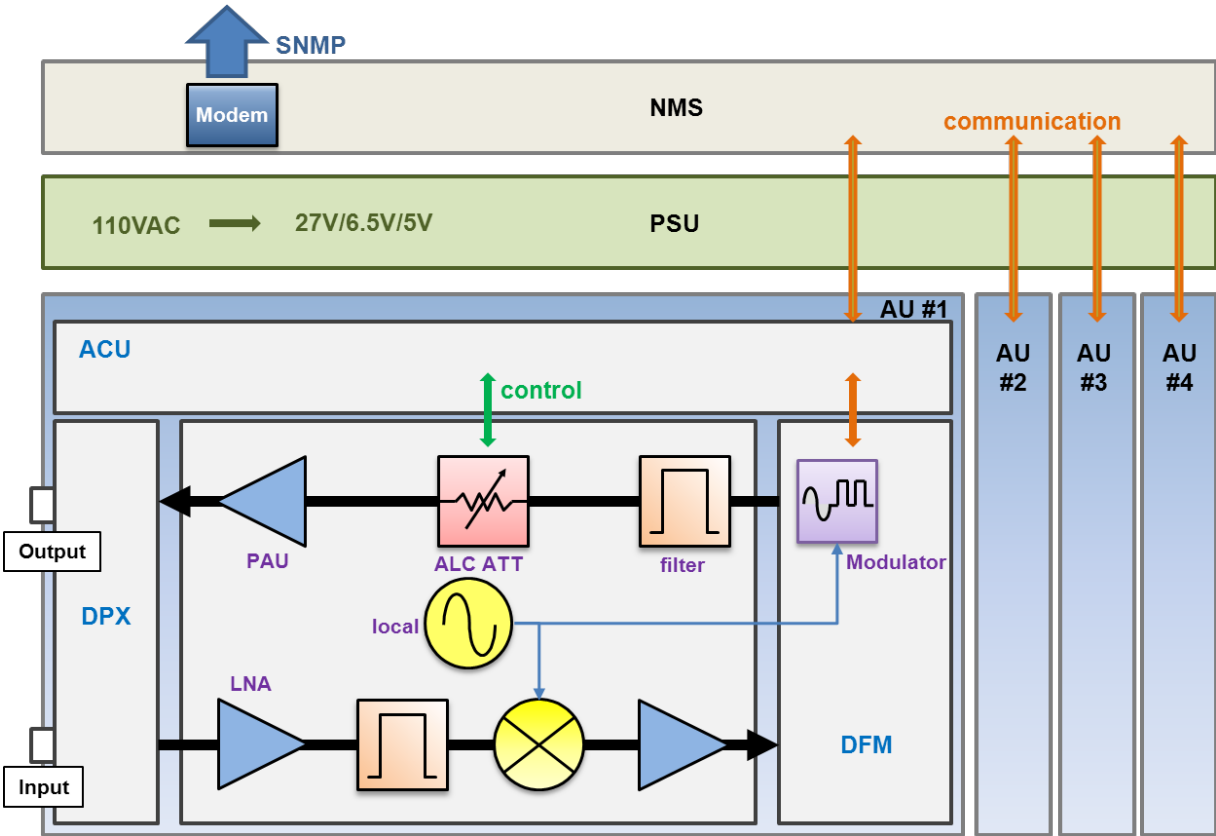
NO.	PORT	NO.	PORT
1	Main FAN	4	DC 12V output (for EMB)
2	PSU FAN	5	Power Cable
3	Main Switch		

### 2.2.2. Downlink/ Uplink Path

The Smart-Cell repeater improves service in the 700MHz, 800MHz, 850MHz, 1900MHz and 2100MHz frequency bands. User may select frequency band according to the site peculiarities. After receiving a weak signal from donor antenna, the repeater improves and sends securely isolated signal out to service antenna.

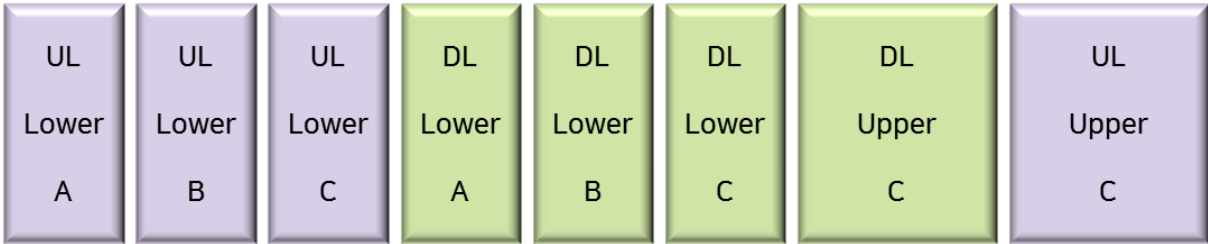
Amplifier unit is designed for correspondent operation with digital filter module (DFM). The AMP unit consists of a down and up converters, cavity filter and power amplifier (PAU).

In Downlink Path, a weak RF signal is received from Donor Antenna. Being converted from RF to IF signal, it is transferred to the DFM, where after digitalizing by DA converter, signal is filtered by FPGA. **After filtering digital, signal is converted into analog RF signal with modulator. Transmit to amplifier.** Desirable signal is amplified and outputted through Service Antenna. Uplink path works vice versa.



<Figure 4> Smart-Cell Repeater Block Diagram

2.2.3. 700MHz Frequency Selection (LTE)

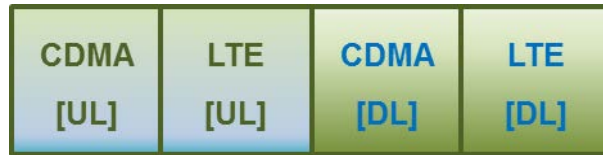


<Figure 5> Smart-Cell Repeater 700 Block Diagram

700MHz Amp Unit provides a service that meets the 3GPP2 LTE standard. Support up to two non-contiguous blocks. And each block has the minimum 5MHz bandwidth.

BAND	DL	UL	Remarks
Lower A	731	701	LTE 5MHz
Lower B	737	707	LTE 5MHz
Lower C	743	713	LTE 5MHz
Upper C	751	782	LTE 10MHz

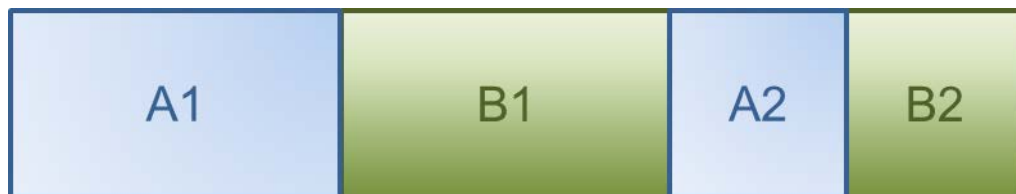
#### 2.2.4. 800MHz Frequency Selection (iDEN)



<Figure 6> Smart-Cell Repeater 800 Block Diagram

800MHz Amp Unit has service Cellular 1FA and provides LTE 5MHz (25RB) by default. On / Off control of the service Block is possible. Each block's bandwidth are as follows. (CDMA[UL] – 1.25MHz, LTE[UL] – 4.505MHz, CDMA[DL] – 1.25MHz, LTE[DL] – 4.505MHz)

#### 2.2.5. 850MHz Frequency Selection (Cellular)



<Figure 7> Smart-Cell Repeater 850 Block Diagram

850MHz Cellular service provides by default, and supports up to two non-contiguous blocks. Each block's bandwidth are as follows, and it is possible to choose any combination of any band. (A1 - 11MHz, B1 - 10MHz, A2 - 1.5MHz, B2 - 2.5MHz.)

#### 2.2.6. 1900MHz Frequency Selection (PCS)



<Figure 8> 1900MHz Band Frequency

1900MHz AMP Unit is basically complied with PCS Band block, where maximum three non-contiguous filtering configurations are available. Each sub block is adjustable per 1.25MHz bandwidth step up to 20MHz. Following table shows user selectable channel numbers.

BAND		DL CENTER [MHz]	CHANNEL	BAND	DL CENTER [MHz]	CHANNEL	
A	A1	1931.25	25	guard	1965	700	
		1932.5	50	E	1966.25	725	
		1933.75	75		1967.5	750	
	guard	1935	100		1968.75	775	
	A2	1936.25	125	guard	1970	800	
		1937.5	150	F	1971.25	825	
		1938.75	175		1972.5	850	
	guard	1940	200		1973.75	875	
	A3	1941.25	225	guard	1975	900	
		1942.5	250	C	C1	1976.25	925
		1943.75	275			1977.5	950
	guard	1945	300			1978.75	975
	D	1946.25	325	guard	1980	1000	
		1947.5	350	C2	1981.25	1025	
1948.75		375	1982.5		1050		
B	guard	1950	400		1983.75	1075	
	B1	1951.25	425	C3	guard	1985	1100
		1952.5	450		1986.25	1125	
		1953.75	475		1987.5	1150	
	guard	1955	500		1988.75	1175	
	B2	1956.25	525				
		1957.5	550				
		1958.75	575				
	guard	1960	600				
	B3	1961.25	625				
		1962.5	650				
		1963.75	675				

### 2.2.7. 2100MHz Frequency Selection (AWS)



<Figure 7> 2100MHz Band Frequency

2100 Amp Unit has basically satisfies the CDMA standard, and supports non-contiguous 2 block. If you select "contiguous button", Web UI has select the contiguous F band. And you don't select "Contiguous button", Web UI has select the each band of F1 and F2. Frequency range of each band as follows.

BAND		Downlink		Uplink	
		Start	Stop	Start	Stop
F	F1	2145.15	2149.85	1745.15	1749.85
	guard	-	-	-	-
	F2	2150.15	2154.85	1750.15	1754.85



## 3. SYSTEM SPECIFICATIONS

### 3.1. RF Performance

Item		Specification	Remark
Frequency	700MHz	DL : 728.5MHz ~ 739.5MHz 746MHz ~ 756MHz UL : 698.5MHz ~ 709.5MHz 777MHz ~ 787MHz	5MHz / 10MHz
	800MHz	DL : 862MHz ~ 863.8MHz 864MHz ~ 868.6MHz UL : 817MHz ~ 818.8MHz 819MHz ~ 823.6MHz	1.8MHz + 4.8MHz
	850MHz	DL : 869MHz ~ 894MHz UL : 824MHz ~ 849MHz	25MHz
	1900MHz	DL : 1930MHz ~ 1990MHz UL : 1850MHz ~ 1910MHz	60MHz
	2100MHz	DL : 2145MHz ~ 2155MHz UL : 1745MHz ~ 1755MHz	10MHz
Maximum Input Power		-27dBm	
Output Power (ANT Port)		+33dBm / 2W Total	

### 3.2. System Specifications

Parameter		Specification	Remark
Gain	Range	60dB ~ 90dB	
	Adjust Step	±0.5dB	
	Adjust Accuracy	±1dB	
Flatness	700MHz	< 3.0dBp-p	
	800MHz		
	850MHz	< 5.0dBp-p	
	1900MHz		
	2100MHz		
Propagation Delay		≤ 6us	
VSWR		1.7 : 1	
Noise Figure	Max Gain	< 7dB	
ACP	750MHz	45dBc @±5MHz/10MHz	
	800MHz	> 45 dBc ±750KHz	CDMA
		>50dBc@±1.98KHz	LTE
	850MHz	> 45 dBc ±885KHz	
		>52dBc@±1.98KHz	
	1900MHz	<-13dBm@Fc±2.25MHz (RBW: 1MHz)	
> 45 dBc ±750KHz			
2100MHz	>52dBc@±1.98KHz		
	2100MHz	45dBc @±5MHz/10MHz	
Roll off	700MHz	±1MHz	> 45dBc
	800MHz	±1MHz	> 45dBc
	850MHz	±1MHz	> 45dBc
		±250kHz	> 30dBc
	1900MHz	±1MHz	> 50dBc
	2100MHz	±1MHz	> 40dBc
Characteristic Impedance		50Ω	

### 3.3. Electrical and Environmental Specifications

Item	Specification	Remark
RF Connector	N-Type Female	Donor & Server ANT Port
AC Supply	AC 110V 60Hz 3.0A	
Out Dimension	3.1" x 15.5" x 7.7"	AMP unit
	19" x 19" x 7.9"	System (Rack mount)
Weight	13lbs	700 unit
	11.5lbs	850 unit
	11.5lbs	1900 unit
	10lbs	2100 unit
	23	19" rack + NMS + PSU (except AMP units and FEU)
Operation Temperature	-10°C ~ +50°C	Convection cooling
Humidity	5% ~ 95%	Non-condensing
Vibration Resistance	1G, 10~150Hz 0.1 Octaves/min	
MTBF	50,000 hours	

### 3.4. Functions

Parameter	Specification
Gain Control	<ul style="list-style-type: none"> <li>Adjustable DL and UL Gain range 60dB ~ 90dB.</li> <li>Display default Gain and current Gain function</li> </ul>
<b>ALC</b> Auto Limit Control	<ul style="list-style-type: none"> <li>To limit output powers as far as default range.</li> <li>Used for DAS configuration and when oscillation/isolation is a concern.</li> <li>Automatic Gain decrement when output power of repeater is higher than default level.</li> <li>Automatic Gain recovery when output power of repeater is reduced.</li> <li>Shutdown when output power is higher than default level in the minimum gain.</li> <li>Automatic Recovery Algorithm conversion after shutdown status.</li> </ul>
Band Select	<ul style="list-style-type: none"> <li>700MHz : Lower A(5MHz)/Lower B(5MHz)/Upper C(10MHz)</li> <li>850MHz : A1(11MHz)/B1(10MHz)/A2(1.5MHz)/B2(2.5MHz)</li> <li>1900MHz : 1.25MHz ~ 20MHz/1.25MHz step</li> </ul>

	<ul style="list-style-type: none"> <li>• 2100MHz: 5MHz/10MHz</li> </ul>
Power Monitoring	<ul style="list-style-type: none"> <li>• Monitoring repeater's output level.</li> </ul>
Oscillation Check	<ul style="list-style-type: none"> <li>• Isolation Check in initial set up or Reset.</li> <li>• When Oscillation occurred, repeater attempts to stabilize Isolation through Gain control function.</li> <li>• Shutdown repeater when oscillation still occurs in the minimum Gain.</li> <li>• Automatic Recovery Algorithm conversion after shutdown status.</li> </ul>
Automatic Recovery	<ul style="list-style-type: none"> <li>• When repeater is shutdown, it periodically recovers output power of repeater then monitors alarming.</li> </ul>
Security	<ul style="list-style-type: none"> <li>• Support HTTPS for Web Browser security.</li> <li>• User authentication through User ID and Password.</li> </ul>
AOC Auto Oscillation Check Function	<ul style="list-style-type: none"> <li>• AOC Use for prevented oscillation</li> </ul> <pre> graph TD     Start[AOC on] --&gt; D1{Isolation Detect &lt; Isolation Limit}     D1 -- Yes --&gt; D2{ALC Attenuation &gt;= 30dB}     D1 -- No --&gt; D3{Isolation Detect &lt; Isolation Limit -4}     D2 -- Yes --&gt; Shutdown[Shutdown]     D2 -- No --&gt; D3     D3 -- Yes --&gt; A5[ALC Attenuation +5dB]     A5 --&gt; A1[ALC Attenuation +1dB]     D3 -- No --&gt; D4{Isolation Detect &gt; Isolation Limit -3}     D4 -- Yes --&gt; A1     D4 -- No --&gt; Start     A1 --&gt; Start     </pre>
VSWR Monitoring	<ul style="list-style-type: none"> <li>• Monitoring VSWR of Service ANT Port.</li> <li>• Reporting VSWR Alarm and Shutdown when the rate is 3:1.</li> </ul>
DHCP Client	<ul style="list-style-type: none"> <li>• Automatic IP assignment.</li> </ul>
DHCP Server	<ul style="list-style-type: none"> <li>• Server function for automatic IP assignment.</li> </ul>
Web GUI	<ul style="list-style-type: none"> <li>• Remote and local user browser support through Web Browser.</li> </ul>
SNMP Agent	<ul style="list-style-type: none"> <li>• NMS report via SNMPv2 Trap.</li> </ul>
LED Display	<ul style="list-style-type: none"> <li>• LED displays power and operation status on front side of repeater system.</li> <li>• Input and Output signal levels are verified by LED bars.</li> </ul>

## 4. SETUP

### 4.1. Equipment Needed for Repeater Setup

Parameter	Item	Quantity	Remark
Major Component	Smart-Cell Repeater	1 EA	Provided by GST
Additional Components	WALL Mounting Bracket	1 EA	Provided by GST
	CD which contains User Manual V.1.0 and Installation Guide V.1.0	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 10mm	4 EA	
	Lag Screw 12.7mm x 50.8mm	4 EA	
	FEU-AMP unit cable	8 EA	
	FEU-Wall Bracket cable	2 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. Check points before turning on the Repeater

##### 1) System Power Check

- ① AC electrical power to the repeater should be 110V, input electricity only after power verification.

##### 2) Input RF Signal Range

- ① Optimal input RSSI into the repeater is -57dBm ~ -27dBm for 700MHz/850MHz/1900MHz/2100MHz. User should verify input condition of Donor ANT. If the input RSSI exceeds -27dBm, then external attenuators should be used.

### 3) Isolation check between DONOR/SERVEICE ANT

- ① Isolation condition of this equipment is 105dBc (Gain+15dB). User should check its condition before installation.

#### 4.1.2. Open for Service

##### 1) Check points before open:

- ① Verification of system installation status :
  - Electricity, In/Out antennas, cable connection, and equipment mount status.
- ② Verification of system accessories :
  - User should check all necessary accessories.
- ③ 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:

- ① Check external LED
  - RUN: Green light ON (Off: all lights off)
  - ALARM: Green light in normal status, Red light in alarming
  - SHUT DOWN: Green light in normal status, Red light in Shutdown status

### 4.1.3. Signal Strength LED Check

Number of LED bars	Input Signal Level	Output Power Signal Level
LED 1 bar	Less than -86dBm	Less than +5dBm
LED 2 bars	-85dBm ~ -79dBm	+6dBm ~ +10dBm
LED 3 bars	-78dBm ~ -72dBm	+11dBm ~ +15dBm
LED 4 bars	-71dBm ~ -65dBm	+16dBm ~ +20dBm
LED 5 bars	More than -64dBm	More than +21dBm



<Figure 9> Modular Repeater Front LED

## 4.2. Setting up the Repeater

### 4.2.1. Quick GUI/Configuration

Use the following steps to commission the Repeater after all the cabling and antennas are fixed in place and the Repeater is supplied with proper electrical power. The repeater will need a good quality stable Downlink RSSI input level in the range of -85dBm to -60dBm.

- 1) Connect your laptop to the repeater with a Crossover Ethernet cable.
- 2) Verify that your laptop has all wireless connections off and is Obtaining an IP address automatically, or is using a proper fixed IP address such as: Use the following IP address: 172.16.6.81 with a Subnet Mask of 255.255.255.252.
- 3) Open Internet Explorer and go to: 172.16.6.81
- 4) User name: admin
- 5) Password: admin

### 4.2.2. Quick Setup

- 1) Go to the RF Configuration page.
- 2) Before the Amplifier (HPA) can be turned on, set the Uplink and Downlink attenuation (ATT) to the maximum value and click Apply.
- 3) Select the correct Band Block and set the ALC Downlink and Uplink Limits to the desired level and click Apply. (To adjust the Output Power, change the ALC Downlink and Uplink Limits to the desired levels).
- 4) To check the Repeater's status, click on the Status page.
- 5) To change the Repeater's gain/attenuation, adjust the Uplink and Downlink attenuation in equal amounts not more than 5dB at a time and click Apply.



### 4.3. Web UI Ranges Table

GUI Feature	Range	Description
Downlink and Uplink Output Power Display	Below 0dBm to 35dBm	The output Power of the Repeater
Downlink Low RF Power	2dB to 10dB	Threshold for Low RF Power
Downlink and Uplink Attenuation Control	0dB to 30dB	Reduces Gain Internally
Downlink and Uplink ALC Limit	0dBm to 33dBm	Limits Output Power
Downlink RSSI Display	-100dBm to -27dBm	Downlink Receive Level at Donor Antenna Port
Downlink Low RSSI	-93dBm to -57dBm	Threshold for Low RSSI
Downlink and Uplink AMP Control	On/Off	High Powered Amplifier
Gain Balance Control	On/Off	Equalizes Uplink and Downlink Gain
Gain Balance Value	0dB to 15dB	Subtract Uplink Gain by G/B Value
Shutdown Control	On/Off	Shutdown if Major Alarm is Reported
Auto Gain Setting	On/Off	Automatic Gain Setting for the Repeater
Auto Oscillation Check	On/Off	Preventing Oscillation
Temperature Display	32 to 260.6 Degrees	Internal Repeater Temperature
AMP Temperature Upper Limit	0 to 299 Degrees	Threshold for Temperature Alarm
Band Blocks Used/Bandwidth	Each AMP	The Channel the Repeater will be using
Delay Alarm Report	0 or 5 Minutes	Time Delay of Reporting after Alarm is Detected

#### 4.4. 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.

##### 4.4.1. Simple Troubleshooting Method

- 1) Verify LED Status, both on external LED's as well as internal module LED's
  - Normal operation: Green light on. Alarming: Red LED on.
- 2) Technician should check external and internal connectors to ensure that all connections are tightly secure. These connectors should be cleaned regularly.
- 3) 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)

##### 4.4.2. Alarm Information

Alarm Name	What causes this alarm	Troubleshooting Methods
Downlink Spurious emissions out of spec	Downlink Output Power exceeds Downlink Upper Limit	* The Downlink Output Power should not exceed the maximum composite power spec for this unit. * If the Downlink Output Power is not exceeding the composite power spec for this unit, try to increase the Downlink Upper Limit on the RF Configuration Page. * Add equal amounts of Uplink and Downlink attenuation until the Downlink Output Power is less than the Downlink Upper Limit. * Set the ALC Downlink Limit on the RF Configuration Page to a value lower than the Downlink Upper Limit

Downlink Hardware failure	Downlink path gain is 6dB less than RSSI plus Output Power	<ul style="list-style-type: none"> <li>* By default, if the Downlink Low Output Variance is set to 10dB, the Repeater will not report this alarm.</li> <li>* Increase the Downlink Low Output Variance on the RF Configuration Page.</li> </ul>
Downlink Donor power too low	Input RSSI from Donor site is 8dB less than Downlink Low Input Limit	<ul style="list-style-type: none"> <li>* By default, if the RSSI Lower Limit is set to -93dBm, the Repeater will not report this alarm.</li> <li>* Decrease the Downlink Low RSSI Limit level on the RF Configuration Page.</li> <li>* Increase the RSSI level into the Repeater.</li> </ul>
Downlink VSWR	When the VSWR Ratio on the Server Port is greater than 3 : 1	<ul style="list-style-type: none"> <li>* "Sweep the line" to check for loose or damaged connectors and/or cabling.</li> <li>* If after checking the entire Server side, the VSWR alarm still exists and the system is working fine, Disable the alarm on the Alarm Configuration page.</li> </ul>
Downlink Donor power too high	Downlink Input Power exceeds - 25dBm	<ul style="list-style-type: none"> <li>* Check the direction of donor antenna</li> <li>* Even if higher input power after the modifying direction of donor antenna, Be adding an attenuator at the Donor port.</li> </ul>
Downlink Synthesizer failure	Synthesizer (in Downlink path) has occur Failure	<ul style="list-style-type: none"> <li>* By using a switch on the back of the repeater, resets the power</li> <li>* Call to GST's Tech Support Team and exchange the AMP unit.</li> </ul>
Downlink Interfere power exceeded	If an external signal is higher than the in band signal, more than 15dB signal	<ul style="list-style-type: none"> <li>* Call the GST's Tech Team, resolved in accordance with the procedure.</li> </ul>
Uplink Out of band emissions out of spec	Uplink Output Power exceeds Uplink Upper Limit	<ul style="list-style-type: none"> <li>* The Uplink Output Power should not exceed the maximum composite power spec for this unit.</li> <li>* If the Uplink Output Power is not exceeding the composite power spec for this unit, try to increase</li> </ul>

		<p>the Uplink Upper Limit on the RF Configuration Page.</p> <ul style="list-style-type: none"> <li>* Add equal amounts of Uplink and Downlink attenuation until the Uplink Output Power is less than the Uplink Upper Limit.</li> <li>* Set the ALC Uplink Limit on the RF Configuration Page to a value lower than the Uplink Upper Limit</li> </ul>
Uplink Power at coverage port too high	Uplink Input Power is higher than -25dBm	<ul style="list-style-type: none"> <li>* Check the direction of Coverage antenna</li> <li>* When another device is connected to the Coverage port as DAS System</li> </ul> <ol style="list-style-type: none"> <li>1) Add an attenuator on Coverage port, or</li> <li>2) Uplink to adjust the output of the additional equipment.</li> </ol>
Uplink Synthesizer failure (Uplink Hardware failure)	Synthesizer (in uplink path) has occur Failure	<ul style="list-style-type: none"> <li>* By using a switch on the back of the repeater, resets the power</li> <li>* Call to GST's Tech Support Team and exchange the AMP unit.</li> </ul>
Uplink (Downlink) Software failure	When an alarm occurs in DFM's at the AMP unit.	<ul style="list-style-type: none"> <li>* By using a switch on the back of the repeater, resets the power</li> <li>* Call to GST's Tech Support Team and exchange the AMP unit.</li> </ul>
Oscillation detected/Low isolation	Insufficient isolation is detected when the Repeater is at minimum gain	<ul style="list-style-type: none"> <li>* Verify that the Donor antenna is on the same side of the building as the Donor site, and if needed, raise the Donor antenna up on a pole.</li> <li>* Change the types of antennas used, such as Yagi to Corner-Reflector for outdoors, and Omni to a Panel for indoor use.</li> <li>* Move the closest indoor service antenna farther away from the outside Donor antenna.</li> </ul>

		* Close the repeater door if opened and verify that the closest indoor coverage antenna is not in the same room as the repeater.
Field Replaceable module failure	Filter service has not matches between Amp Unit and DFM	* Call to GST's Tech Support Team to verify that all the settings are correct.
Tamper Detected	When mount information (in the system ) is changed	* After 5 minutes clear automatically. * If you want to disable, you can on the Alarm Configuration page.
Communication Failure	If the communication between the NMS Board and Amp Unit would not operating normally	* SNMP board or AMP unit need to reset. * Open the rear cover and check the each cable.
Power Supply out of range	The internal Power Supply detects improper Voltage	* If the system is working fine, disable the alarm on the Alarm Configuration page. * Call to GST's Tech Support Team to verify that all the settings are correct.
Over Temperature	Internal AMP temperature exceeds the Temperature Limit	* Verify that the Temperature Limit is set between 176 °F ~ 201 °F on the RF Configuration page. (Default Value is 163°F)
Reset alarm	When the unit has reset	* After 30 seconds clear automatically.
Manual Shutdown	When the operates shutdown algorithm, after re-check	* By using a switch on the back of the repeater, resets the power * Reset the AMP unit, By Web UI.
FAN	in the event of a fan failure	* Replace the fan

#### 4.4.3. Troubleshooting Guide Related to RF

Item	Check Point	Troubleshooting
Check before system operation	System input power range	-Downlink: -100dBm ~ -27dBm -Uplink: -100dBm ~ -27dBm
	System gain (DL/UL)	- 60dB ~ 90dB
	Output power at server port	- Downlink: 33dBm ± 2dB - Uplink: 33dBm ± 2dB
	Check points before open for service	-Please check quantity of all accessories with specification before you set up -Fit cable length in accordance with field condition
Check after system operation	Check points after open for service	Check following status; -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
When repeater does not work properly	Check electricity cord connection status	-Re-plug in Adapter cord

When in alarming	DL VSWR alarm	Please Check following status; -Make sure Server Antenna Port is disconnected. -Please reset Adapter upon completing Alarm troubleshooting
	DL over-output alarm	-Make sure output power is operating normally -Please Reset Adapter upon completing Alarm troubleshooting
	UL over-output alarm	-Please make sure output level is operating normally -Please reset Adapter upon completing Alarm troubleshooting
	Temperature alarm	Check following status; -Setting level of maximum temperature limit -Temperature offset is normal or not -Circumstances of temperature -Please Reset Adapter upon completing Alarm troubleshooting
	RF off	-Verify that the HPA's are On -Please Reset Adapter 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
	-Technician should connect antenna with output port of repeater -Please make sure all connectors are fastened	-Reconnect the connector -Change it if the connector is defective
	Check the input level	-Increase output power or check input change of BTS side

	Check gain of the unit	-If the Gain is different from normal level, please contact A/S team
	Cable connector loose	-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
	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.
	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
	Input level change or module overheating	-Check input level from BTS side. -Check performance of each module (Diagnosed by A/S team)
	Please check VSWR of the cable is normal	-Change to normal Cable



#### 4.4.4. 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
	CLI connection, cable status check	-Make sure 1:1 connection -Follow instructions in the installation guide for this connection procedure
	CLI connection Check by USB to serial cable	-Please verify port number of PC communication -Please check cable connection status

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).**