Product Manual

CS17-145-410
Single Band Repeater
LTE-700 Upper C

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Product Registration Information

The serial number may be found on the label on the bottom panel near the power connectors. Note this number below. Retain this manual, along with proof of purchase, to serve as a permanent record of your purchase.

MODEL NUMBER	SERIAL NUMBER	PURCHASE DATE

POINT OF SALE COMPANY

DISCLAIMER: All information and statements contained herein are accurate to the best of the knowledge of Cellular Specialties, Inc. (CSI), but Cellular Specialties makes no warranty with respect thereto, including without limitation any results that may be obtained from the products described herein or the infringement by such products of any proprietary rights of any persons. Use or application of such information or statements is at the users sole risk, without any liability on the part of Cellular Specialties, Inc. Nothing herein shall be construed as licence or recommendation for use, which infringes upon any proprietary rights of any person. Product material and specifications are subject to change without notice. Cellular Specialties' standard terms of sale and the specific terms of any particular sale apply.

Application

This guide should be applied whenever a need exists to add Repeater capability to an existing system or when this capability is being included with a new installation.

Radio and Television Interference

NOTE: This equipment has been tested and found to comply with the limits for a Class A 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 own expense. In order to maintain compliance with FCC regulations shielded cables must be used with this equipment. Operation with non-approved equipment or unshieled cabled is likely to result in interference to radio & television reception. Changes and Modifications not expressly approved by Cellular Specialties can void your authority to operate this equipment under Federal Communications Commissions rules.

The general safety information in this guideline applies to both operating and service personnel. Specific warnings and cautions will be found in other parts of this manual where they apply, but may not appear in this summary. Failure to comply with these precautions or specific warnings elsewhere in the manual violates safety standards of design, manufacture, and intended use of equipment. Cellular Specialties, Inc. assumes no liability for the customer's failure to comply with these requirements:

Grounding

This Repeater system is designed to operate from 100-240 VAC and should always be operated with the ground wire properly connected. Do not remove or otherwise alter the grounding lug on the power cord.

Explosive Atmospheres

To avoid explosion or fire, do not operate this product in the presence of flammable gases or fumes.

Lightning Danger

Do not install or make adjustments to this unit during an electrical storm. Use of a suitable lightning arrester, such as CSI's model number CSI-CAP, is very strongly recommended.

No User Serviceable Parts Inside

HAZARDOUS VOLTAGES ARE PRESENT WHEN THE COVER IS REMOVED. Opening the chassis will void your warranty. If you suspect a malfunction with this product, call your dealer or the Cellular Specialties Support Line at: **(603) 626-6677, Toll Free (USA) 1-877-844-4274**.

Important Safety Information

Antennas used for the purpose of radiating signals indoors are limited to a *maximum* gain of 3 dBi. The outdoor antenna used for the purpose of communicating to the wireless infrastructure is limited to 14dBi gain, or any combination of gain and loss that equates to 14dB at input. Each antenna must be positioned to observe minimum separation requirements from all users and bystanders. The following guidelines should be used when considering separation distances.

INDOOR antennas must be placed such that, under normal conditions, personnel cannot come within 20 cm (~0.65 ft.) from any inside antenna. Adhering to this minimum separation will ensure that the employee or bystander cannot exceed RF exposures beyond the maximum permissible limit as defined by section 1.1310 i.e. limits for General Population/Uncontrolled Exposure.

OUTDOOR antenna must be positioned such that, under normal conditions, personnel cannot approach closer than 122 cm. (~4 ft.). A directional antenna having a maximum gain of 14 dBi is used, precautions should be taken to prevent personnel from routinely passing through the main radiation beam at a distance closer than specified.

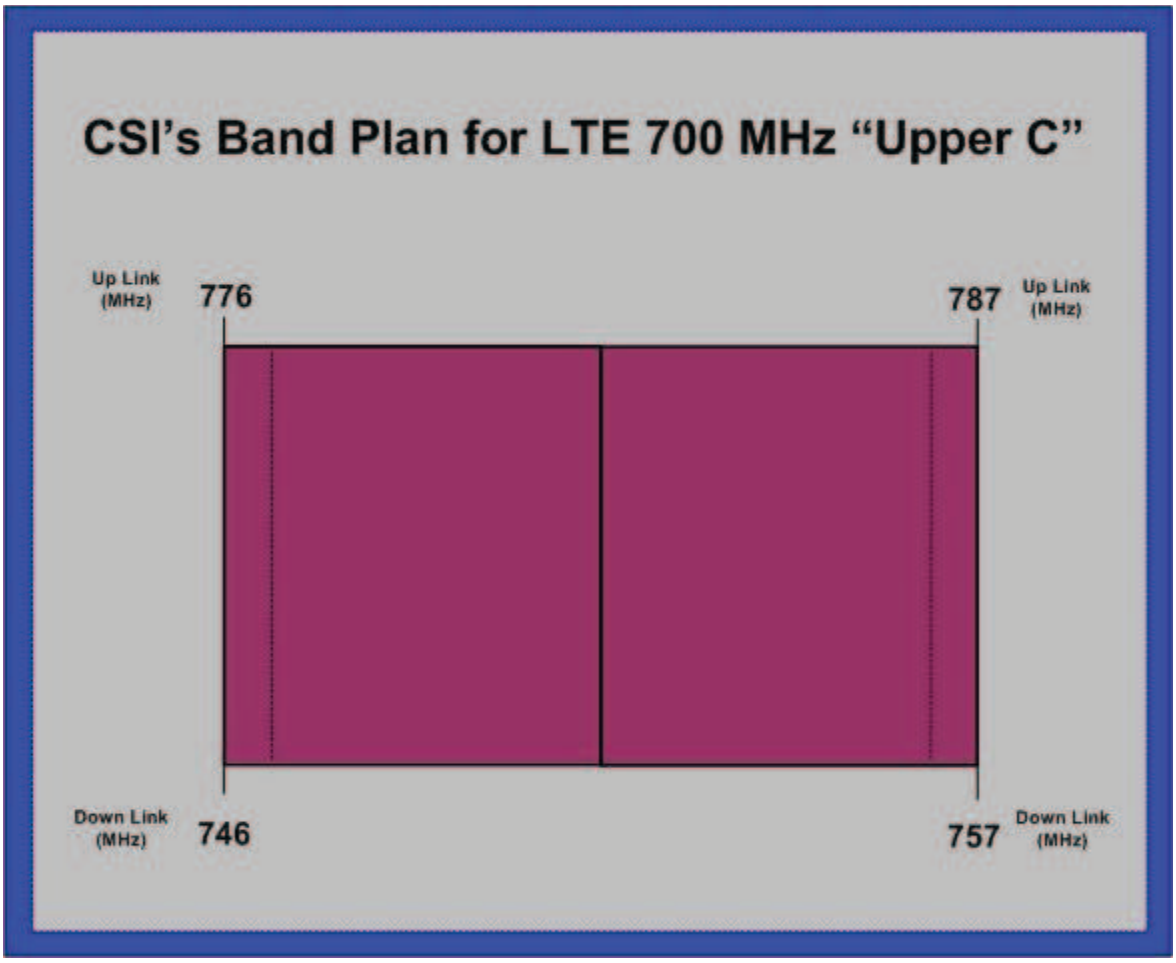
Product Introduction

Cellular Specialties, Inc. (CSI) developed the CS17-145-410 LTE - 700 U7C repeater for use within enclosed structures where signal strength from the local cell site is insufficient to operate mobile phones. Adequate signal must be available outside the structure as a prerequisite to achieving in-building coverage. The Repeater is connected via coax cable to an external antenna, usually on the roof, and to one or more internal antennas placed strategically throughout the area where wireless service is desired.

The external antenna typically is directional, such as a “yagi”. Internal antennas are typically omnidirectional, although various other types may be used depending on the coverage application. The Repeater amplifies both the “uplink” (phone to tower) & “downlink” (tower to phone) signals thus facilitating communications to and from the intended wireless infrastructure.

With a maximum total of **+85**dB nominal gain on both the up and down links, gain can be adjusted over a range 30dB in 1.0dB steps. Control of the repeater is achieved utilizing a computer connected to the NMS 9 pin D-Sub RS323C port. This model is designed to cover the Upper C portion of the LTE 700 MHz band.

Band Plan



Feature Overview

The CSI-repeater incorporates the following features for convenient operation, access, protection, and control.

- Control using a Windows based Graphical User Interface and accessed by connecting a laptop or desktop computer the NMS 9 pin sub-D serial port.
- User Gain Control
- Automatic Level Control
- Automatic Shut Down Function
- Oscillation Protection
- Over Drive Protection
- Under/Over Voltage Protection
- Fault Protection
- Alarm Notification
- External Interfaces - Serial
- Persistent Status and Error information

Optional Accessories

A complete line of accessories is available from Cellular Specialties, Inc. Check with your CSI distributor for any additional items needed. Below are just a few examples suitable for most in-building needs.

•Outside Donor Antenna
Panel - model number: **CSI-AP/698/2.7K/7-10**

•Inside Omnidirectional Antenna
Quad-band - model number: **CSI-AO/700/2.7K/3**

•Directional Couplers
6dB - model number: **CSI-DC6/700-2.7K/N**
10dB - model number: **CSI-DC10/700-2.7K/N**
15dB - model number: **CSI-DC15/700-2.7K/N**
20dB - model number: **CSI-DC20/700-2.7K/N**
30dB - model number: **CSI-DC30/700-2.7K/N**

•Power Dividers
2:1 - model number: **CSI-SPD2/700-2.7K/N**
3:1 - model number: **CSI-SPD3/700-2.7K/N**
4:1 - model number: **CSI-SPD4/700-2.7K/N**

•Grounding Kit - model number: **CSI-GKIT**

•Lightning Arrestor - model number: **CSI-CAP**

•UPS
Battery backup, 2 hr Single band
1 hour dual band - model number: **CS48-985-600**

Battery backup, 4 hr Single band
2 hour dual band - model number: **CS48-985-601**

Important Installation Notes

- Inadequate isolation between the outside and inside antennas may cause regenerative feedback in the system. This feedback can cause the amplifier to emit a continuous signal at maximum amplitude and, in some cases, interfere with normal operation of the donor site. Careful consideration of the layout and placement of the system is imperative to minimize this possibility and to minimize the amount of signal leaking from the building. See installation tips for general guidelines.
- The installer should refer to the Safety Guidelines section and the Important Safety Information section for proper antenna selection and installation. To avoid serious injury or death and damage to the repeater, do not install donor or server antennas near overhead power lines or high power components. Allow enough distance so that if antennas should fall they will not come in contact with those components.
- Close proximity to the donor or server antennas with the repeater in operation may expose the user or installer to RF fields that exceed FCC limits for human exposure.

WARNING! AMPLIFIER OR HANDSET DAMAGE **MAY** OCCUR IF A HANDSET IS CONNECTED DIRECTLY TO THE REPEATER OR THE COAX THAT LEADS TO THE REPEATER.

Installation Tips

Donor Antenna

1. Accurately determine the azimuth to the donor site . **Obtain the donor site information and approval from the service provider/carrier.**
2. Ensure that the radiation path to the donor site is as unobstructed as possible.
3. Mount the donor antenna at or toward the edge of the roof, in the direction of the donor site. Try to avoid having the RF signal from the donor pass above the location(s) of the service antennas. Normally the service antennas will be behind and below the donor antenna if viewed from above. This approach will help avoid interference and feed back both, to and from the service antennas.
4. Normally mounting the donor antenna higher will allow a less obstructed path to the donor site. However, in high traffic metro areas avoid mounting the donor antenna any higher than necessary as the quality of the donor signal may start to become less stable and it is more likely to encounter adjacent channel interference.
5. When possible shield the donor antenna's back side by locating it so that any HVAC units and/or penthouse structures are behind the antenna relative to the donor cell site location.

Indoor Antennas

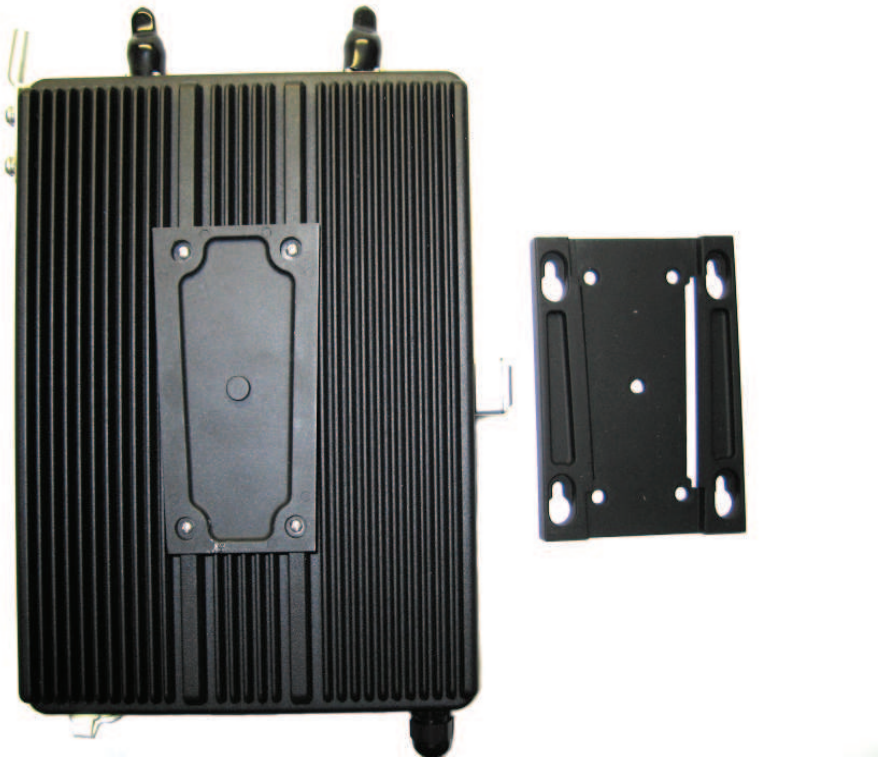
1. Use omnidirectional antennas (see optional accessories) indoors, and locate them centrally with respect to the intended coverage area to minimize signal leakage to the outside. Use directional antennas indoors only in special cases when higher gain and directionality would be helpful and RF exposure limits will not be exceeded.

2. To avoid repeater uplink overload and gain limiting mount the indoor antennas away from areas where mobile subscribers frequently use their phones such as desks or dispatch areas.

3. To determine the quantity and locations of indoor antennas, use an appropriate phone's signal meter to determine areas of weak signals. These are the approximate areas where indoor antennas may be needed. Also be aware the signal from an indoor antenna, in most cases, can be expected to penetrate about two standard office sheetrock type walls to reach users. After two walls or if the walls are made of other materials, it may be necessary to split the available signal and add more antennas.

Mounting the Repeater

The following photo illustrates the innovative mounting bracket design that makes wall mounting the repeater fast and easy.



1. Using the detachable bracket as a template, mark the locations for the wall anchoring system.

2. Drill holes, install wall anchors and lock the wall mount bracket in place.

3. Slid repeater into receiver rails of the wall mount bracket.

Note: The wall anchoring system selected will depend on the material used in the wall where the repeater is to be mounted. It will need to be capable of supporting the weight of the repeater (12.2 lbs / 5.5 kg) and all the cabling attached to it.

Physical System Set-Up Verification

All cables should be checked for shorts and opens. Also verify that there are no cables with loose or poor connections. RF leakage could cause oscillation to occur under some conditions.

The rooftop antenna (Donor Antenna), if directional, should be checked for proper alignment along the calculated compass heading. Typically, the directional antenna would be aimed at the same site that your handset uses, but it may not always be so. **It is critical the installer contact the service provider for information on, and approval of, the site he or she has selected before the system is turned on.**

If cables and alignment are acceptable and a problem persists, it may be necessary to use a spectrum analyzer to examine the signal environment in which the unit is operating. The existence of strong adjacent channel signals within the frequency band(s) can cause the AGC to reduce the amplifier's gain or cause alarms. In some cases additional filtering or attenuation might be required to reject these unwanted signals. In some instances, the donor antenna can be reoriented horizontally, to place the interference source in an antenna pattern "null". There also may be some cases where the interference from outside signals is so great that they cannot be filtered or otherwise reduced or eliminated without expensive and possibly prohibitive measures. In these cases it may not be practical to use the CSI repeater for providing coverage to these sites.

Controlling the Repeater

Control and monitoring of the repeater requires that a properly configured computer, with CSI's LTE700 control software installed, be connected via a serial cable (optional), as shown in figure 1, from the serial connector of the computer to the serial port labeled NMS on the bottom end panel of the repeater. If the gender of the connector is not the same as shown in figure 1, a null modem adapter (optional) as shown in figure 2 may also be required. If your computer does not have a serial connector, a USB to Serial Adapter may be a option for you.

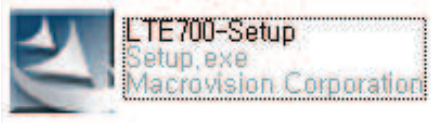
Figure 1

Figure 2

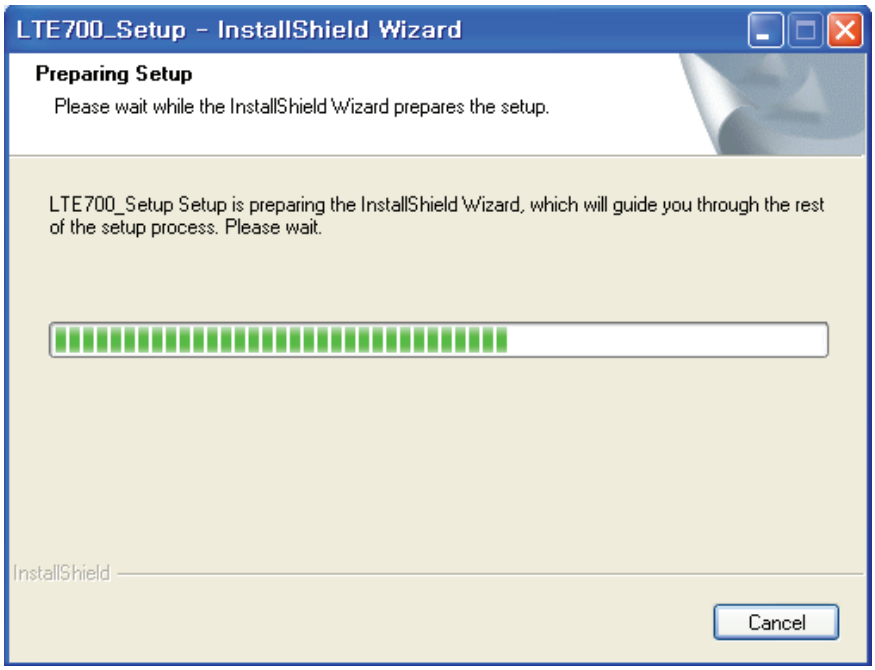
Note: It may be necessary, in the System Properties section of the control panel; using Device Manager to determine what COM port your computer uses for the communications port. In many cases it's COM 1.

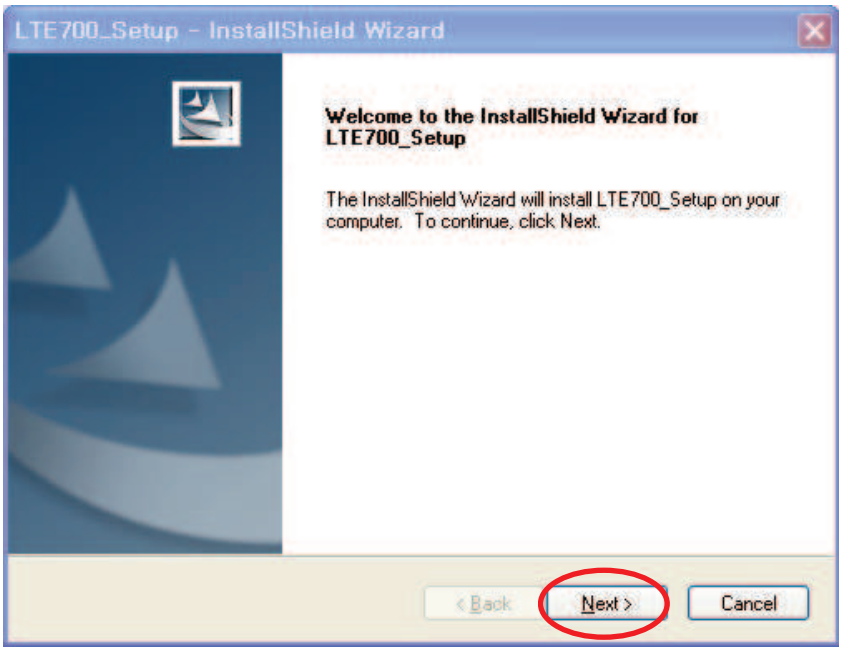
Software Installation

Locate the Software CD that came with the repeater and insert it into your CD drive. Browse the CD and find the LTE700-Setup file and double click on it.



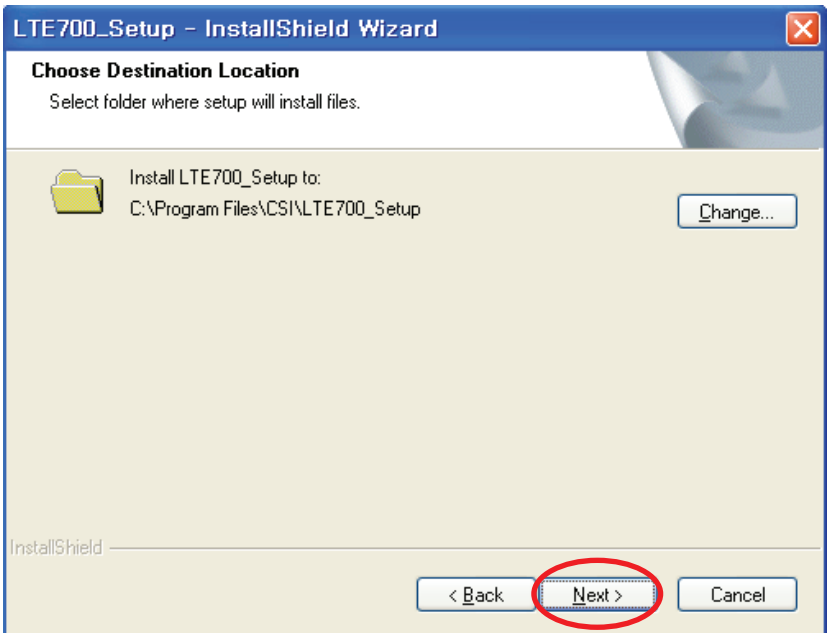
The following screen will be displayed showing the set up progress status.



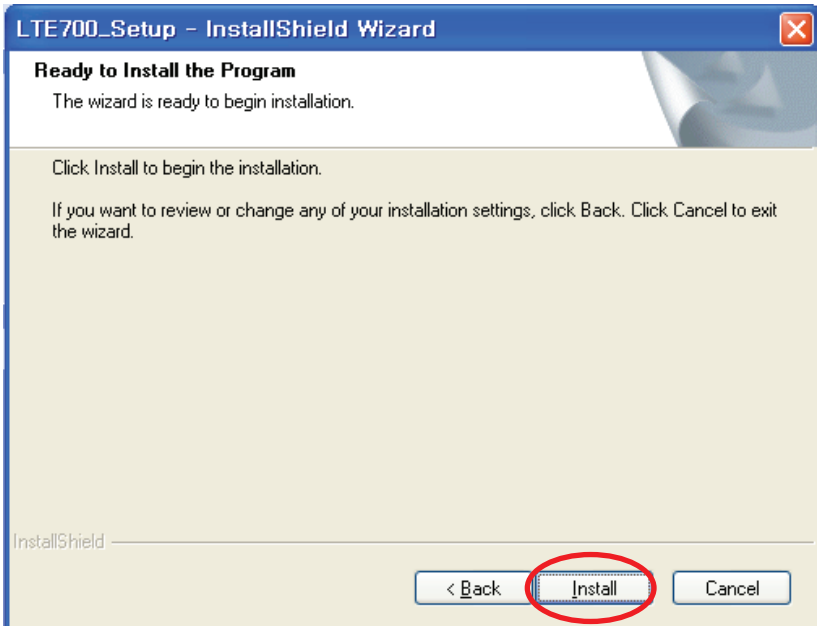


When the Install Shield Wizard has completed preparing setup, click next and you will be given the option to install to the default directory or choose another directory.

Directory Location

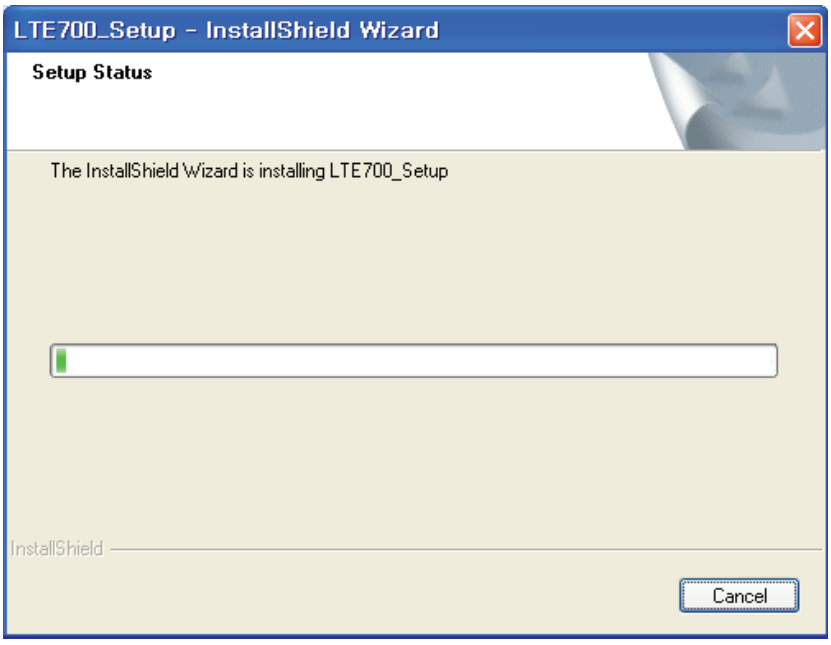


Once the directory where the program is to be installed has been selected, click next to continue the installation.

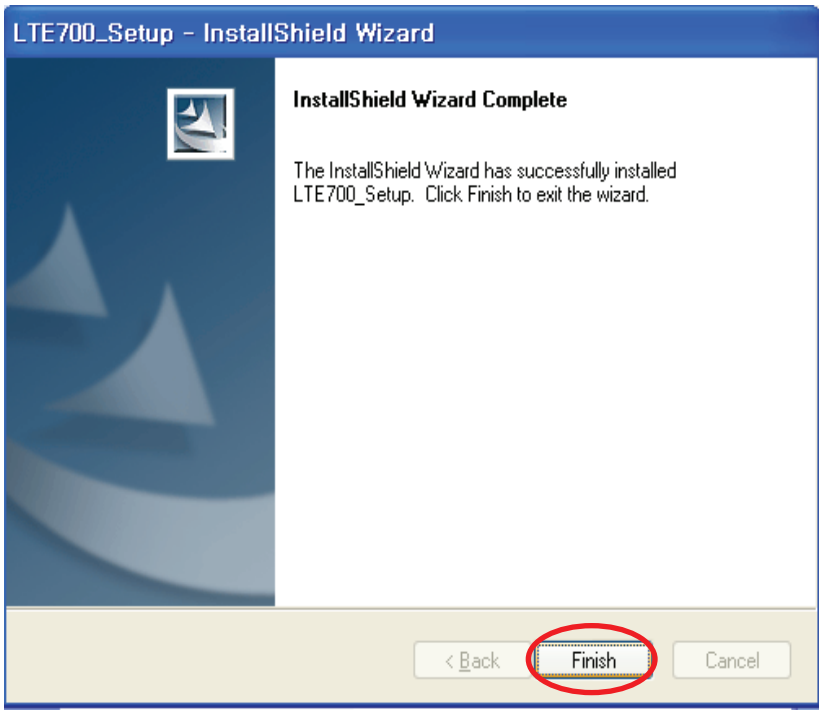


You will be given the option to review or change settings using the back button. If you're satisfied with the settings click Install.

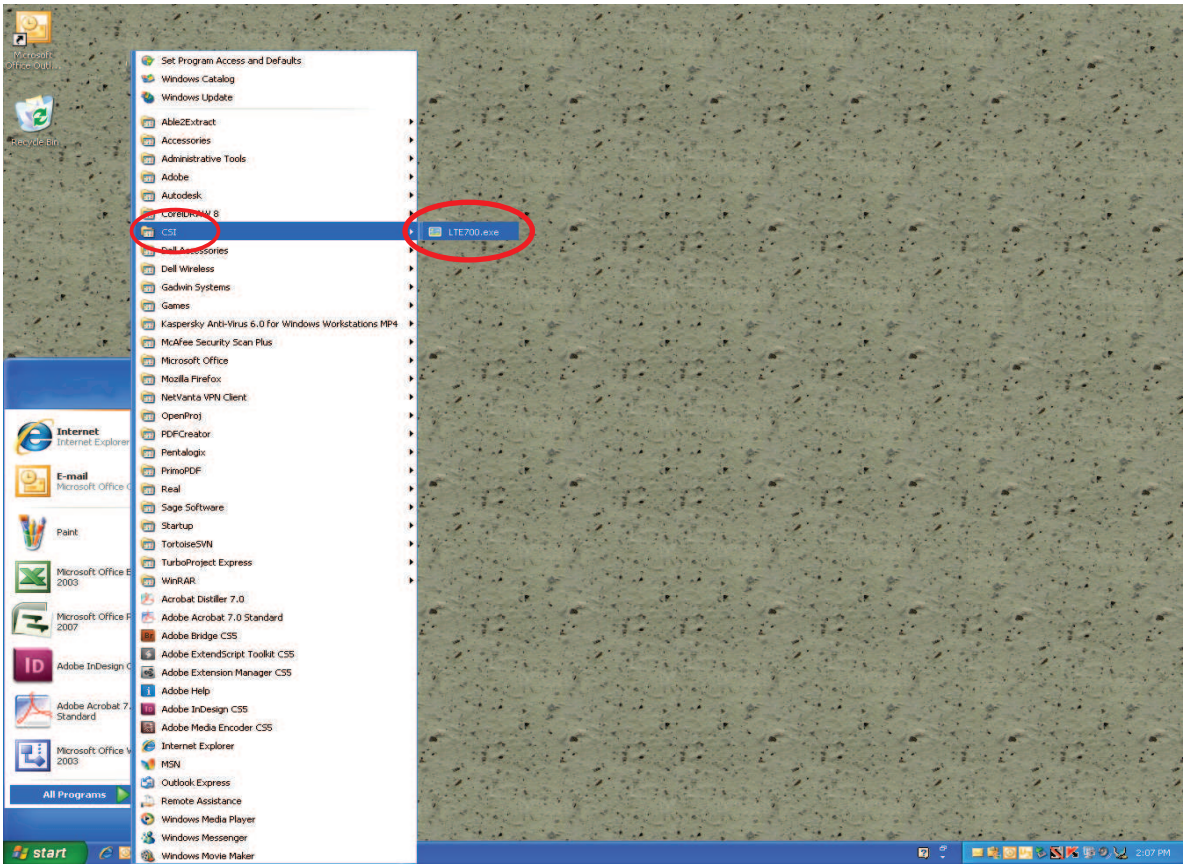
Installation Status



During the install process the Setup Status screen is displayed, showing the progress of the software installation. When complete click finish to close the install wizard and begin using the software.

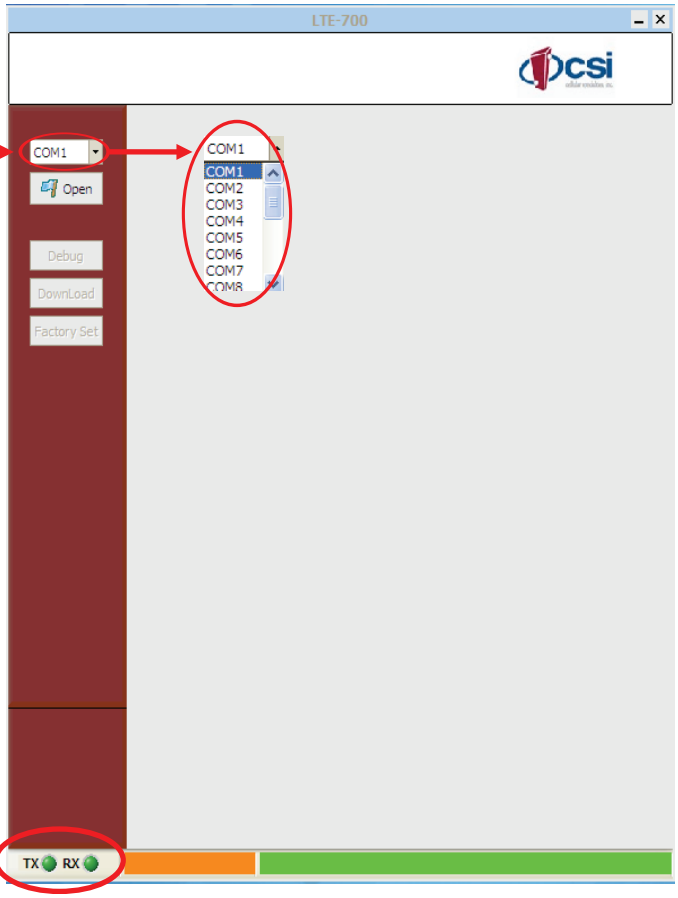


Starting the Program



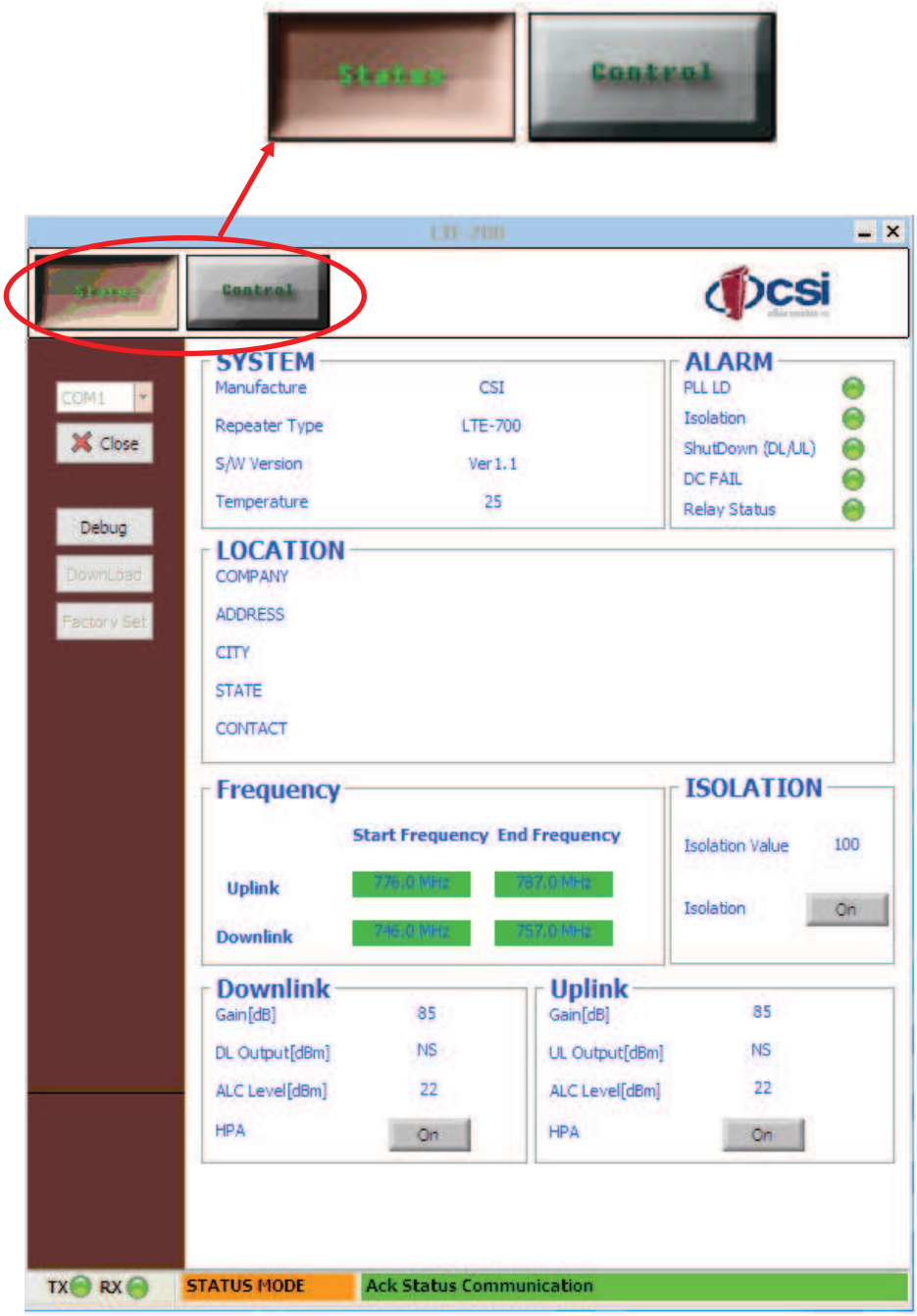
When the LTE700 software installation is complete the program may be launched by clicking ***start >CSI>LTE700.exe***

To configure the LTE700 software to communicate with the repeater, click the down arrow to the right of "COM port" selection box. A fly out menu will be displayed and allow the user to select the COM port configured for use on the controlling computer.



When the "COM port" has been selected the program will interface with the repeater and the TX and RX indicators will illuminate green. If red, check the COM port settings on the computer and that the correct COM port has been selected in the fly out above.

Status Mode



The LTE700 repeater control software features three modes of operation, Status Mode, Control Mode and Management mode. Selecting the Status Mode by clicking the Status button allows the user to review the system settings for seven main categories.

The SYSTEM box displays Manufacturer, Repeater Type, S/W Version and current Temperature.

The ALARM section notifies the user if alarm conditions exist for PLL LD, Isolation, Shut Down (DL/UL), DC Fail and Relay Status. Green indicates a normal condition is present, if illuminated Red an alarm condition exists.

The LOCATION box will show the address information set by the user, if a new installation, it will be blank but can be populated by entering the Control Mode which will be covered later in this manual.

The box for Frequency shows the user start and stop frequencies for uplink and downlink.

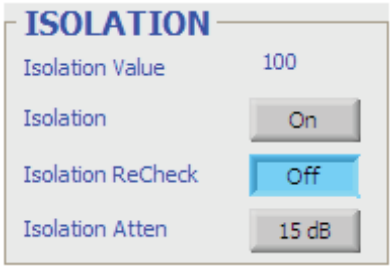
Isolation value and enable status can be viewed in the box labeled ISOLATION.

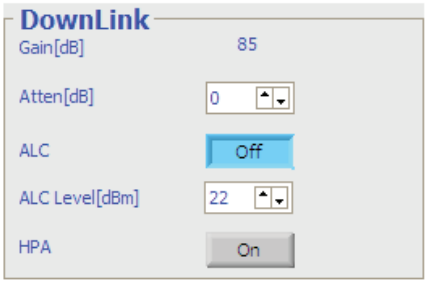
Finally the Downlink and Uplink sections show Gain, Output(dBm), ALC Level(dBm) and HPA enable status for there respective links.

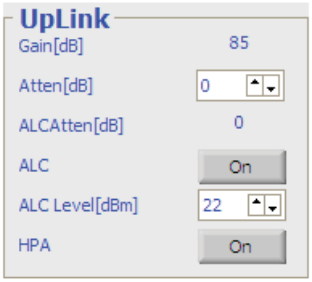
Control Mode

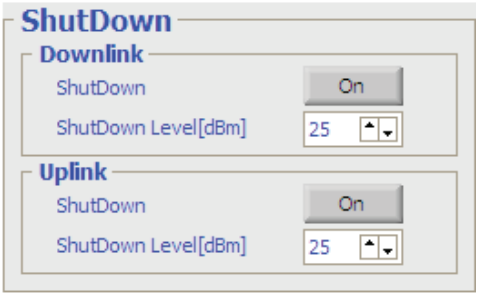
Selecting the Control Mode by clicking the Control button will display a similar user interface to the one used in the Status mode but allows the user to change the system settings described in the previous section.

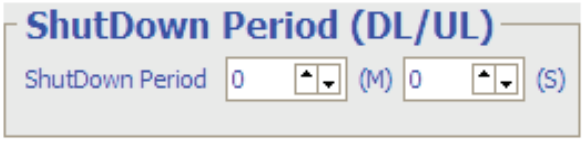
In this mode the user may make changes in the sections shown below.



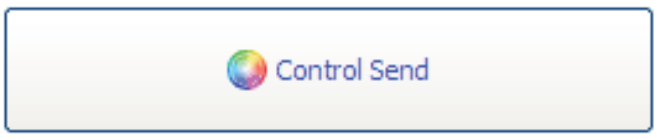








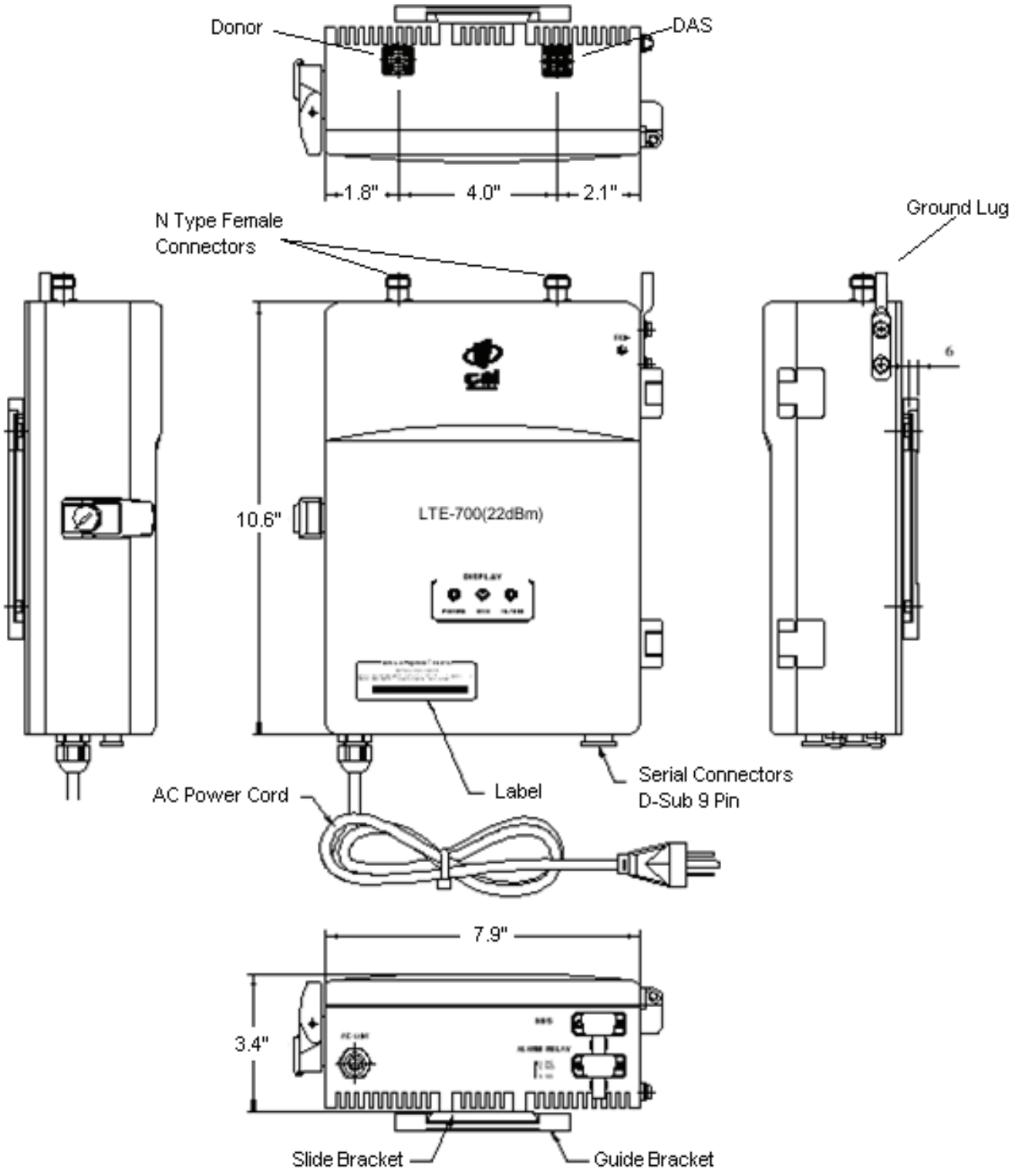
When the user has completed modifying all the fields he or she would like to change it is necessary to click the Control Send button to incorporate them into the repeater. Note: The changes will not take affect until they are sent to the repeater.



Specifications Section

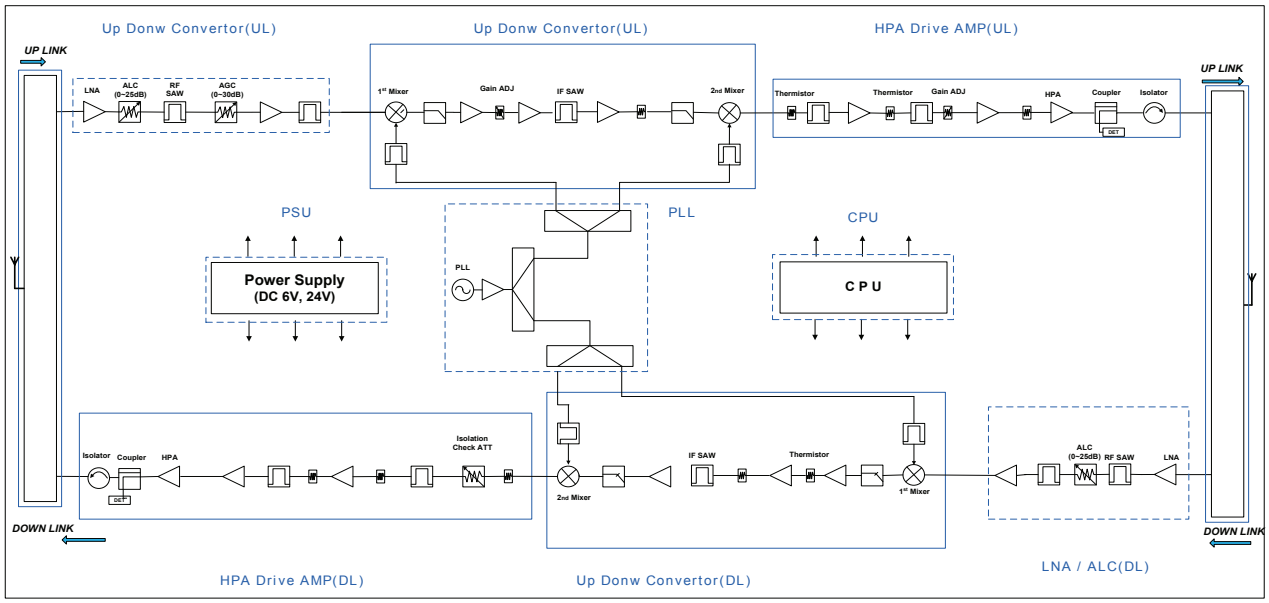
Repeater Photographs

Outline Drawing



System Block Diagram

LTE - 700 Block Diagram



RF Specifications

ITEM			Specification
FREQ. RANGE	UL DL		776~787MHz 746~757MHz
Frequency Selectivity	UL / DL		@-40dBc ±2MHz
Gain	UL / DL		85dB(±1.0dB)
Gain Adjustment Range	UL / DL		30dB/30dB(±1dB, 1dB step)
ALC Range	UL / DL		25dB / 25dB(±1dB)
Pass Band Ripple	UL / DL		±1dB(Peak-To-Peak 2dB)
Linear Output Power	UL / DL		+22dBm
1dB Gain Compression	UL / DL		26dBm
Input VSWR	UL / DL		< 2:1
Propagation Delay	UL / DL		3us
Frequency Error	UL / DL		< ±0.01ppm (± 7.5Hz)
EVM	UL / DL		DL : 8% , UL : 12%
Out of Band Gain	1.0≤f_offset_CW<5.0MHz 5.0≤f_offset_CW<10.0MHz 10.0MHz≤f_offset_CW	UL/DL	45 dB 45 dB 35 dB
Operating Band Unwanted Emission	5.05MHz≤f_offset<10.05MHz 10.05MHz≤f_offset<f_offsetmax	UL/DL	-14dBm -13dBm
ACRR	± 5MHz ± 10MHz	UL/DL	20dB
Spurious Emission	DL: 9 ~150kHz 150 ~ 30MHz 30 ~ 740MHz 760 ~ 1GHz 1GHz ~ 12.75GHz	UL: 9 ~150kHz 150 ~ 30MHz 30 ~ 770MHz 790 ~ 1GHz 1GHz ~ 12.75GHz	-13dBm
Noise Figure	UL		< 6.5dB @Max. Gain

Power Specifications

Parameter	Specification	Remark
Main Power Input Voltage	AC110V @0.7A	Internal AC DC Power Supply

Mechanical Specifications

Parameter	Specification	Remark
Size (Inch)	7.9” x 10.6” x 3.4”	(L x H x D)
Size (mm)	200 x 270 x 86.5 mm	(L x H x D)
Connectors	Link/Service Antenna Ports	N – female
	AC Power In	AC cord 4.9 ft (1.5M)
	Frame Ground	External grounding point to be provided
	RS232C (External)	9 Pin D-SUB, female
	Alarm (External)	9 Pin D-SUB, female
Mounting Type	2 part Wall Mounting Bracket	Repeater plate section slides into wall bracket.
Enclosure Lock	Key Lock	
Heat Dissipation	Natural Convection	

Environmental Specifications

Parameter	Specification	Remark
Operating Temperature (F)	14°F ~ +122°F (ambient)	Indoor
Operating Temperature (C)	-10°C ~ +50°C (ambient)	Indoor
Storage Temperature (F)	-22°F ~ +131°F (ambient)	
Storage Temperature (C)	-30°C ~ +55°C (ambient)	
Humidity	95%	

Alarm Configuration

Alarm Relay

Shutdown Signal	Relay Status	Remark
High	NO + CC	1 NC, 2 NO, 3 CC
Low	NC + CC	

Alarm Interface

Repeater LED			Condition/Troubleshooting
POWER	**ISO**	**ALARM**	
GREEN Off	RED Off	RED Off	Power Supply has failed or unit is unplugged.
GREEN Blinking	RED Blinking	RED Blinking	Checking status.
GREEN Solid	RED Off	RED Off	Normal condition at Power Up
GREEN Solid	RED Solid	RED Off	Insufficient isolation exists between the donor and DAS antennas. Turn off power. See Installation Tips section. The Donor and DAS antennas may need to be adjusted or relocated to obtain sufficient isolation.
GREEN Solid	RED Off	RED Solid	Shut-Down Alarm. Received signal from donor source is too strong (Exceeding AGC range). Relocate or attenuate donor antenna to reduce received signal.
GREEN Solid	RED Off	RED Blinking	PLL Lock Detect Fail Alarm.
GREEN Blinking	RED Off	RED Off	Repeater is off line. Contact Customer Service.

Suggested spectrum analyzer setting

When troubleshooting RF issues, and when surveying challenging RF environments, it's important to have a spectrum analyzer capable of measuring the frequency that you are working with. An attenuator should be used to protect the input, when connected to a source of RF power such as the repeater or a powered DAS.

Both Uplink and Downlink should be measured. Downlink should be measured on the donor cable and at the output (server) port of the powered up repeater, and Uplink at the lead from the DAS (on fiber/powered DAS's, where the lead would connect to the server port on the repeater) and at the donor port with the repeater powered up. Measurements may also be necessary at server antenna locations. Your spectrum analyzer will need to be equipped with a whip antenna for this.

Resolution Bandwidth (RBW) should be set at 200 kHz for GSM and 1 MHz for CDMA. If you cannot select these values, the closest available values should be used. Video filter should be about one tenth of RBW. Other settings like span are whatever is appropriate. One should also make sure that there are no signals above the top of the screen.

If you cannot see an adjacent out of band signal when using the 1 MHz RBW filter, you can decrease the RBW, to see the close-in-frequency signals. Be sure to set the RBW back when you want to measure the power level.

One Year Limited Warranty

Seller warrants that its products are transferred rightfully and with good title; that its products are free from any lawful security interest or other lien or encumbrance unknown to Buyer; and that for a period of one year from the date of installation or fifteen months from the date of original shipment, whichever period expires first, such products will be free from defects in material and workmanship which arise under proper and normal use and service. Buyer's exclusive remedy hereunder is limited to Seller's correction (either at its plant or at such other place as may be agreed upon between Seller and Buyer) of such defects by repair or replacement at no cost to Buyer. Transportation costs in connection with the return of products to Seller's plant or designated facility shall be paid by Buyer. The provisions of this warranty shall be applicable with respect to any product which Seller replaces pursuant to it. SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, OTHER THAN AS SPECIFICALLY STATED ABOVE. EXPRESSLY EXCLUDED ARE THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE. THE FOREGOING SHALL CONSTITUTE ALL OF SELLER'S LIABILITY (EXCEPT AS TO PATENT INFRINGEMENT) WITH RESPECT TO THE PRODUCTS. IN NO EVENT SHALL SELLER BE LIABLE FOR SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES, INSTALLATION COSTS, LOST REVENUE OR PROFITS, OR ANY OTHER COSTS OF ANY NATURE AS A RESULT OF THE USE OF PRODUCTS MANUFACTURED BY THE SELLER, WHETHER USED IN ACCORDANCE WITH INSTRUCTIONS OR NOT. UNDER NO CIRCUMSTANCES SHALL SELLER'S LIABILITY TO BUYER EXCEED THE ACTUAL SALES PRICE OF THE PRODUCTS PROVIDED HEREUNDER. No representative is authorized to assume for Seller any other liability in connection with the products.

Registration Numbers:

FCC: NVRCSI-LTEU7C

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960-1050-019 rev 004

cellular specialties, inc.

670 North Commercial Street
Manchester, NH 03101

Toll Free: 1.877.844.4274
Phone: 603.626.6677
Fax: 603.626.6042

www.cellularspecialties.com