CCI
EXTENDING WIRELESS PERFORMANCE

Cellular Band 5 MHz
(1 UMTS Channel) LLC
Operating Instructions

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Document Revision History

Document Number	Revision Number	Revision Date	Description of Change
Cellular Band 5 MHz (1 UMTS Channel) LLC Operating Instructions	1.1	06/20/07	Original Release
	1.2	10/28/08	Added UARFCN Channel Number Table at Appendix B; CCI Return Policy and RMA Form moved from Appendix B to Appendix C
	1.3	03/11/09	Added cover page & Tables of Contents, Tables and Figures; Updated the manual to show current screenshots; added "Unit Details" paragraph and screenshot; added Revision History Table Added "Preferred CDMA Channel Numbers" for Band Class 0, Band Subclass 0 and CDMA Frequency Assignment Correspondence for Band Class 0 to Appendix B.
	1.4	9/13/18	Redo the manual to show multiple combining schemes and show the spectrum with the "Notch" in the "Bandstop" filter; Update to match latest document formatting; update with latest RMA Form

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1   Introduction

1.1   Purpose

This manual contains information and procedures for the setup, tuning, testing / operation, maintenance, and troubleshooting of the Tunable Narrow Guard Band 850 MHz Low Loss Combiner (LLC) as well as the 850 MHz CDMA Low Loss Combiner, which can be used in conjunction with CCI's RX-AIT (Receive Antenna Interface Tray) solution. The 850 MHz LLC is utilized to share a feed-line for UMTS and GSM thus allowing addition of UMTS BTS equipment to existing GSM cell sites without the need to add coaxial cable or other equipment to the cell site. A CDMA version of the 850 MHz LLC is also available. The CDMA version of the LLC allows for up to three (3) 1.23 Hz CDMA carriers to be positioned anywhere in the band and added to existing CDMA2000 or cdmaOne (2G CDMA) or other technologies without the need to add coaxial cable or other equipment to the CDMA cell site. The models covered herein are designed for use in the 850 MHz band.

This manual will include sections on Introduction, Safety, Pre-Installation, Operating Instructions, Initial Startup and Operating Instructions, Maintenance, and Troubleshooting. It will also include appendices containing Component Specifications, Valid UARFCN Channel Numbers for 850 MHz, Preferred CDMA Channels (Frequency Assignments) for Band Class 0 (850 MHz) Band Subclass 0, CDMA Channel Number to CDMA Frequency Assignment Correspondence for Band Class 0, and CCI's Return Policy as well as an RMA (Return Material Authorization) form.

Please note that Installation and Integration of the LLC within an RX-AIT solution will be covered within CCI's RX-AIT System Integration Manual.

1.2   Abbreviations

Abbreviation	Definition
A.C.	Alternating Current
Bias-T	DC Injector used to power TMA's
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
cdmaOne	CDMA Systems based on "IS-95" (2G or 2nd Generation)
CDMA2000	CDMA Systems based on "IS-2000" (3G or 3rd Generation)
CDMA2000 1X	CDMA2000 System capable of doubling the Voice Capacity of cdmaOne Systems and with a peak data rate of 307 kbps for both downlink and uplink
CDMA2000 1x-EVDO	CDMA2000 Evolution Data Only (based on IS-856) peak data rate of 2.4 Mbps in the downlink (forward link) and 1X rate in the uplink (reverse link)
CDMA2000 1x-EVDV	CDMA2000 Evolution Data/Voice (based on IS-2000) peak data rate of 3.1 Mbps in the downlink (forward link) and 1.8 Mbps in the uplink (reverse link)
DAB	Dual Amplifier Booster
DAC	Dual Amplifier Combiner
D.C.	Direct Current
DDI	Dual Diplexer Unit (a.k.a. Cross-Band Combiner)
DDP	Dual Duplexer
DUP	Duplexer Unit
ESD	Electro-Static Discharge
EDGE	Enhanced Data Rates for GSM Evolution
GSM	Global System for Mobile Communications
IMD	Intermodulation Distortion
LLC	Low Loss Combiner
Rx	Receiver
RX-AIT	Receive Antenna Interface Tray
RMA	Return Material Authorization
RMC	Receive Multicoupler
TMA	Tower Mounted Amplifier
TTMA	Tower Top Masthead Amplifier
Tx	Transmitter
UMTS	Universal Mobile Telecommunications System

1.3 Product Overview

P/N – LLC-850-IN

CCI's Model Number LLC-850-IN Tunable Narrow Guard Band 850 MHz Low Loss Combiner combines a 5 MHz band pass port with a synchronously tuned band stop port (allows combining of multiple technologies) onto a single feeder without the insertion loss normally associated with passive combiners. Specifications for the 850 MHz LLC can be found in Appendix A of this manual. A precisely matched UMTS filter (Band Pass) allows the 5.0 MHz UMTS carrier to be positioned anywhere in the band and provides high rejection of unwanted spurious signals and noise. Transmit paths are fully isolated to prevent intermodulation distortion.

Multiple LLC's can be utilized for deployment of additional UMTS, LTE, CDMA or GSM channels for additional feeder reduction. When tuning is not being performed, no power is required, effectively becoming a pure passive low-loss filter combiner. The "**BANDPASS TX ONLY**" port allows only allows TX signals to pass, but the "**BANDSTOP TX/RX**" port is fully duplexed, and allows TX/RX signals to pass. Please note that tuning frequencies are available in 100 kHz increments. The unit is housed in a single 19" rack mounted assembly 2u (3.5") in height. See the Block Diagram in Figure 1.1 for signal path identification.

Tuning is performed via an Ethernet connection utilizing TCP/IP requiring only a computer with a web browser. All software is resident internally. If the 1900 850 LLC is tuned individually, no extra software or controller is required.

LLC-850C-IN (CDMA Version)

CCI's Model Number LLC-850C-IN "CDMA Narrow Guard Band 850 MHz Low Loss Combiner" combines Multiple CDMA signals (for example EV-DO and 3G-1X) (or even 3G CDMA and 2G CDMA signals) onto a single feeder without the insertion loss normally associated with passive combiners, nor the cost or DC power consumption of active combiner solutions. A precisely matched tunable filter (Band Pass) allows up to three 1.23 MHz CDMA Carriers to be positioned anywhere in the band. Each Tx port may be used for either CDMA 2G and/or CDMA 3G-1X, EV-DO technologies. The filter provides high rejection of unwanted spurious signals and noise. Transmit paths are fully isolated to prevent intermodulation distortion. Multiple units can be utilized for deployment of additional 3G channels. When tuning is not being performed, no power is required, effectively becoming a pure passive low-loss filter combiner. Tuning is performed via TCP/IP or Ethernet connection requiring only a computer with a web browser. All software is resident internally. No extra software or controller is required. Note that the "**BANDPASS TX ONLY**" port only allows TX signals to pass, but the "**BANDSTOP TX/RX**" port is fully duplexed (TX/RX). The unit is housed in a single 19" rack mounted assembly (2u in height), and can be used with CCI Cell Extender equipment for additional feeder reduction. See the Block Diagram in Figure 1.1 for signal path identification.
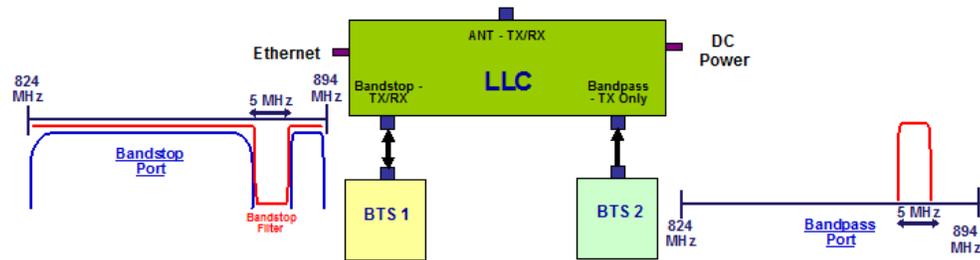
Figure 1.1 –Low Loss Combiner Block Diagram

1.3.1 Application

CCI's Model Number LLC-850-IN "PCS Band Tunable Narrow Guard Band Low Loss Combiner" can be utilized for combining of two technologies onto a single feeder line without the insertion loss normally associated with passive combiners. CCI's 850 MHz LLC can be used to combine multiple technologies as follows:

1) Combining of UMTS and GSM requires 500 kHz Guard Band on each side of the Bandpass spectrum.
2) Combining of UMTS with UMTS requires "0" Guard Band on each side of the Bandpass spectrum.
3) Combining of LTE with UMTS requires "0" Guard Band on each side of the Bandpass spectrum for 5 MHz or greater LTE carrier.
4) Combining of CDMA with LTE requires "0" Guard Band on each side of the Bandpass spectrum for 5 MHz or greater LTE carrier.

1.3.2   Cellular 5 MHz Low Loss Combiner (LLC) Combining Scenarios

1.3.2.1   GSM/UMTS Combining

CCI's 850 MHz LLC reduces the guard band requirement to only 500 kHz on either side of the UMTS Carrier, when performing GSM/UMTS combining. The GSM signals must be placed outside of the 5.0 MHz (2.5 MHz on each side of the center frequency (f_c) of the UMTS channel). See figure 1.2 below for an example of the Spectrum availability at the Bandstop and Bandpass ports.
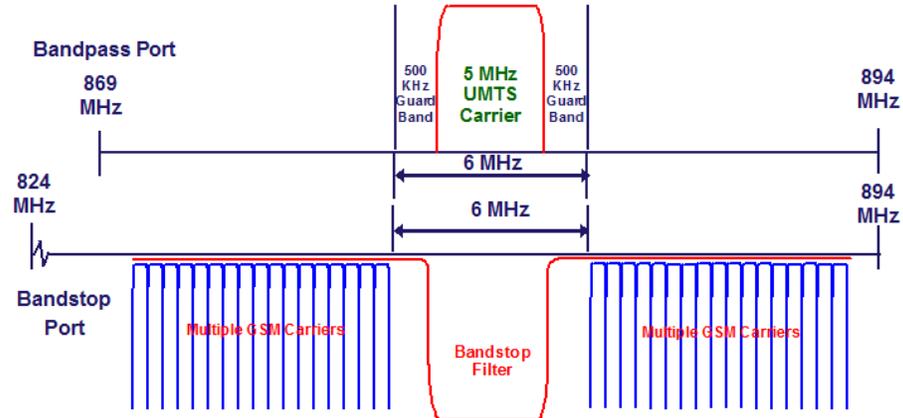
Figure 1.2 - GSM/UMTS Combining: 500 KHz Guard Band (each side) Required

1.3.2.2   UMTS/UMTS Combining

CCI's 850 MHz LLC does not require any guard band on either side of the UMTS Carrier, when performing UMTS/UMTS combining ("0" Guard Band required). See figure 1.3 below for an example of the Spectrum availability at the Bandstop and Bandpass ports.
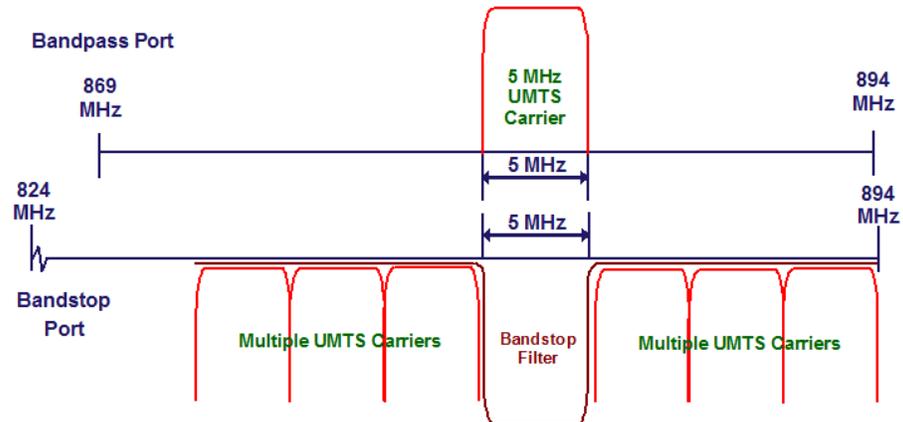
Figure 1.3 - UMTS/UMTS Combining: "0" Guard Band Required

1.3.2.3   LTE/UMTS Combining

CCI's 850 MHz LLC does not require any guard band on either side of the UMTS Carrier, when performing UMTS/LTE combining ("0" Guard Band required for LTE carriers of 5 MHz or greater). See figure 1.4 below for an example of the Spectrum availability at the Bandstop and Bandpass ports.
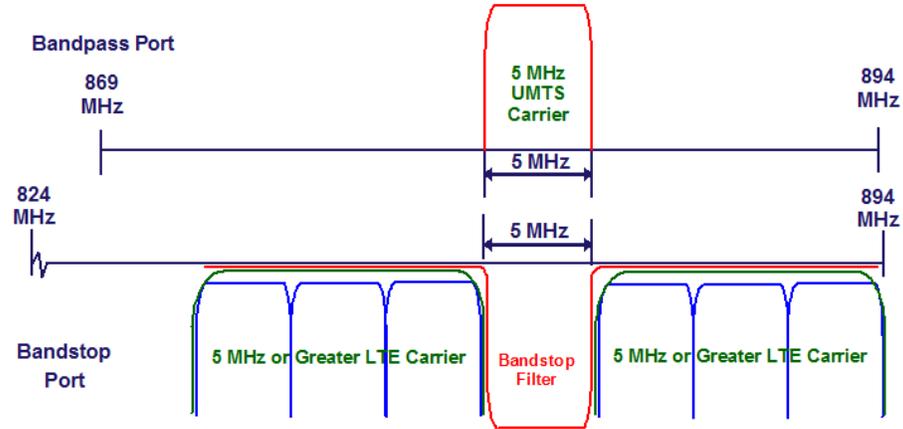
Figure 1.4 - UMTS/LTE Combining: "0" Guard Band Required

1.3.2.4   CDMA/LTE Combining

CCI's 850 MHz LLC does not require any guard band on either side of the 3 x CDMA 1.25 MHz Carriers, when performing CDMA/LTE combining ("0" Guard Band required for LTE carriers of 5 MHz or greater). See figure 1.5 below for an example of the Spectrum availability at the Bandstop and Bandpass ports.
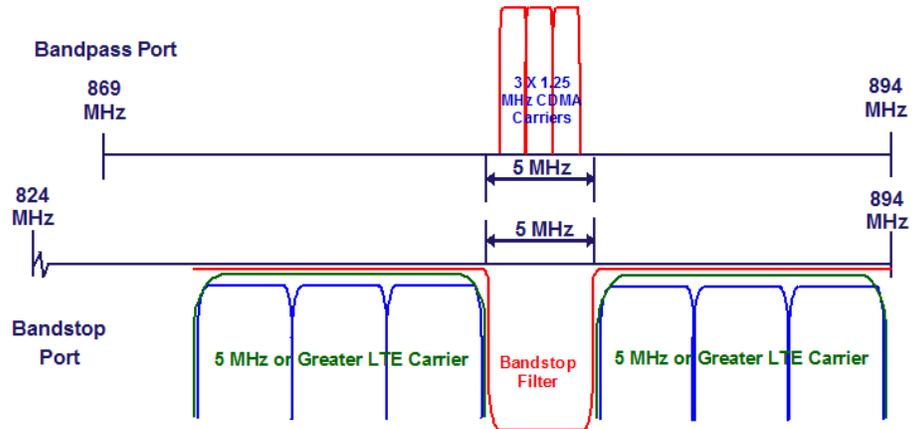
Figure 1.5 - CDMA/LTE Combining: "0" Guard Band Required

1.3.2.5 CDMA/CDMA Combining Utilizing CCI's CDMA LLC (LLC-850C-IN)

CCI's 850 MHz CDMA LLC (Model LLC-850C-IN) reduces the guard band requirement to only 1 MHz on either side of the CDMA Carrier, when performing CDMA/CDMA combining. The CDMA 3G-1X signals must be placed outside of the 6.0 MHz (3.0 MHz on each side of the center frequency (f_c) of the CDMA EV-DO channel). See figure 1.5 below for an example of the Spectrum availability at the Bandstop and Bandpass ports.
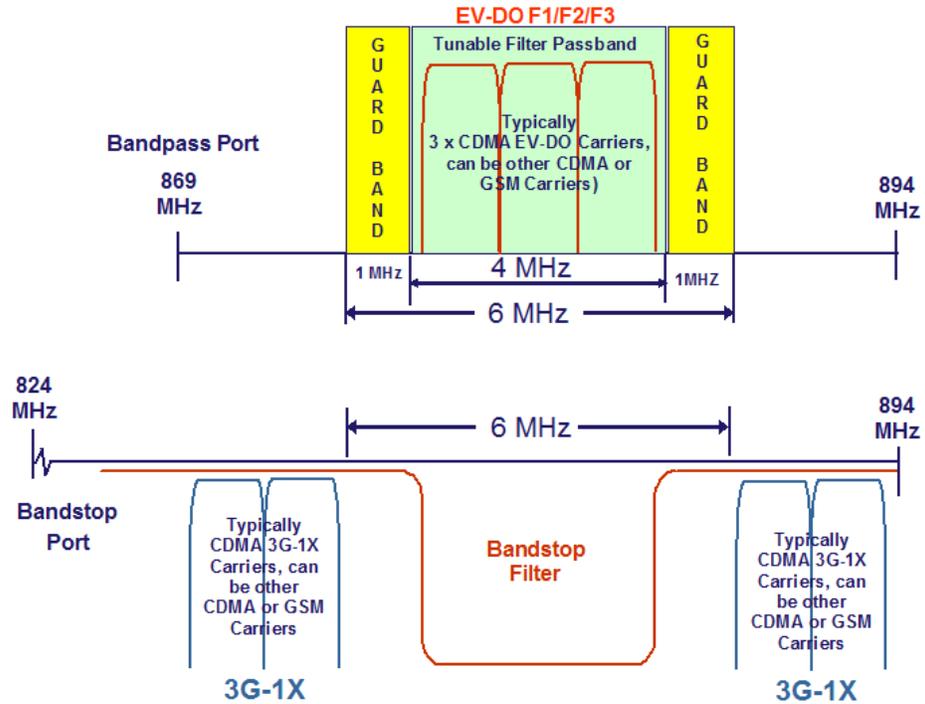
Figure 1.6 – CDMA/CDMA Combining: 1 MHz Guard Band (each side) Required

1.3.3 Functional and Physical Specification

Electrical and mechanical specifications for the CCI 850 MHz LLC product line components can be found in Appendix A.

1.3.4 Equipment Changes

CCI reserves the right to make changes to the equipment, including but not necessarily limited to component substitution and circuitry changes. Changes that impact this manual may subsequently be incorporated in a later revision of this manual.

2 Safety

2.1 Safety Instructions

This section illustrates the systems used for presenting safety information.

Note: Reduce the risk of accidents by studying all of the instructions carefully before starting work. If questions arise regarding the safety instructions, contact your supervisor or CCI Technical Support (information below).

Where local regulations exist, these are to be followed first. The safety information in this manual is a supplement to local regulations.

It is your responsibility to make certain that local regulations are known and followed.

This manual including safety information and specific instructions supplied by CCI personnel must be followed in any work performed on these products. A sufficient knowledge of English or any other languages in which the manuals or instructions are printed is required.

The safety information in this manual presupposes that any person performing work on CCI products or systems has the necessary education, training, and competence required to perform that work correctly. For certain work, additional training may be required.

2.2 Warnings

Warnings are used to indicate hazardous activities. The warnings are preceded by the common hazard symbol.

Hazard Symbol

P002644A

Radio frequency radiation

Danger means that an accident may   utions are neglected. This type of
ac

P002645A

Electrical hazard

Warning means that an accident ma   autions are neglected. This type
of accident may be fatal or   duct damage can occur.

P002646A

Electrostatic discharge

Caution

Caution means that an accident may occur if the safety precautions are neglected. This type of accident may cause serious injury. Product damage can occur.

The following special symbols are used to indicate the risk of radio frequency radiation, electrical hazards, and ESD:

Warnings are used throughout this manual to alert the reader to special instructions concerning a particular task or operation that may be hazardous if performed incorrectly or carelessly. Therefore, read the instructions carefully.

Strict compliance with the special instructions while performing a task is the best way to prevent accidents.

2.3   Electrical Hazards

High Voltage

Danger
High Voltage is used in the operation of this equipment. Either direct contact with the mains power or indirect contact via dampness or collected moisture can be harmful and/or fatal

The A.C. Installation must be carried out according to local regulations. These regulations may require the work to be carried out by a qualified and authorized electrician.

Remove metal objects from your person that may come in contact with the equipment.
Switch off power if the equipment becomes wet or damp.
Prevent damp or water from entering the equipment in bad weather.

Electrical

Danger

Improper electrical installation may cause fire or electrical shock. Approved circuit breakers for the AC mains and the cable's cross sectional areas must always be selected in accordance with local laws and regulations. Only a qualified and authorized electrician is permitted to install or modify the electrical installation.

Cable marking – Verify cable markings correspond before connecting cables

2.4 ESD

Caution

Sensitive Components such as Integrated Circuits (ICs) can be damaged by discharges of static electricity

2.5 Working at Heights

Caution must be taken when working at heights installing racks. Please ensure that you are trained and have the appropriate equipment for this type of installation.

2.6 Radio Frequency Radiation

Danger

Radio Frequency Radiation (RF) from antenna systems can endanger your health

3   Pre-Installation

3.1   Introduction

Preparation of the site, unpacking, inspection and installation instructions for 850 MHz Low Loss Combiner (LLC) equipment will be detailed herein.

3.2   Unpacking and Inspection

Once the Low Loss Combiner (LLC) has arrived at the site for installation carefully unpack each container and remove the equipment. Be sure to retain all of the packing material, in the event that any piece of equipment must be returned to the factory.

Visually inspect each piece of equipment at the time it is unpacked. Be sure to check for any physical damage to the frames, faceplates, connectors, indicators, handles as well as all wiring and harnesses. Damage to any of these items could impede the installation or operation of the LLC. Additionally be sure to perform checks for water damage and loose hardware. Finally, all miscellaneous parts supplied should be inspected to insure that nothing is missing or damaged as well.

It is preferred that inspection be performed in the presence of the delivery person. If any damage to equipment is found the claim should be made with the carrier first. Note: When it is not possible, inspection should be performed as early as possible after delivery. When equipment is damaged and must be returned to the factory fill out the website form or if no internet access is available then call the factory to obtain a material return authorization. Please note that an RMA number must be assigned before RX-AIT equipment can be returned to CCI. An RMA form can be found in Appendix C.

4   Operating Instructions

4.1   Introduction

This section contains operating instructions for CCI's 850 MHz Low Loss Combiner (LLC). Front and Rear Panel controls, indicators, and connections will be described herein.

4.2   Low Loss Combiner (LLC) Controls, Indicators and Connections

The locations of the Controls, Indicators and connections on the 850 MHz Standard and CDMA Low Loss Combiner (LLC-850-IN and LLC-850C-IN respectively) are shown in Figure 4.1 for the front panel and figure 4.2 for the rear panel. The only difference between the two models is the addition of the letter "C" after "850" in the part number. The functions of the indicators are detailed in the following paragraphs. *Note that the figures are not necessarily to scale.*
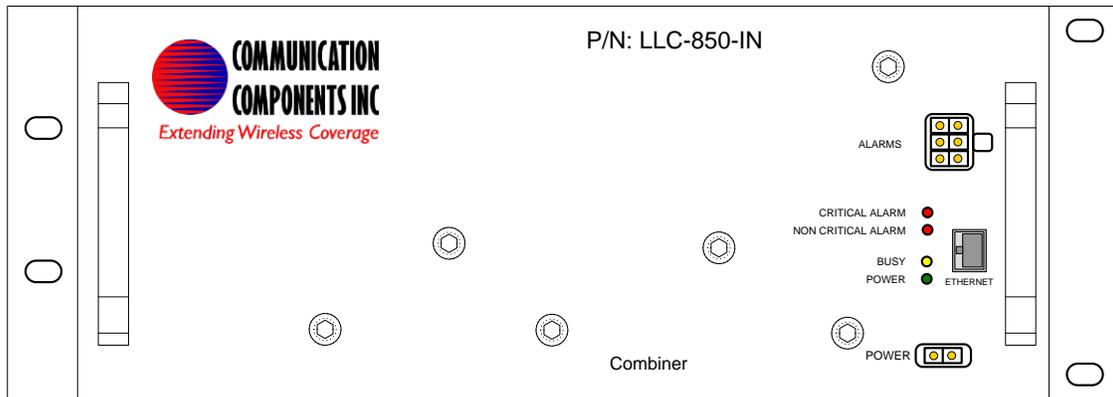
Figure 4.1 – LLC-850-IN (and LLC-850C-IN) Front Panel Controls, Indicators and Connectors
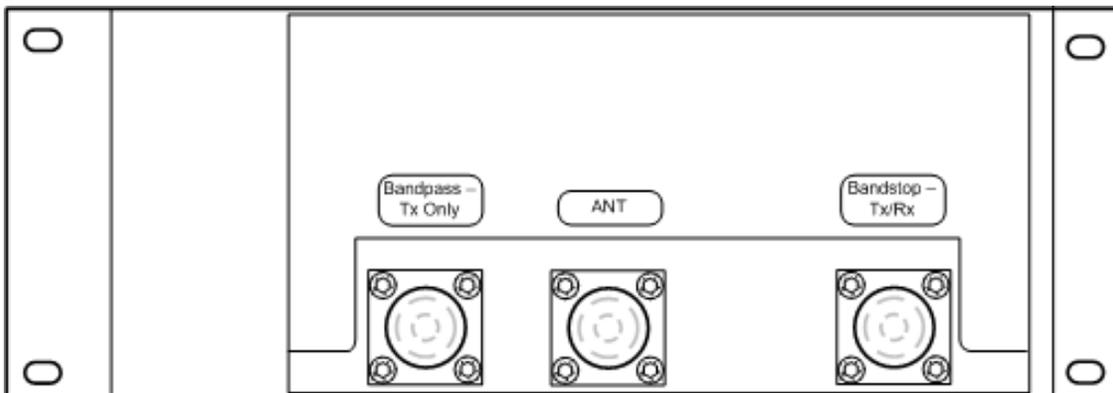
Figure 4.2 – LLC-850-IN (and LLC-850C-IN) Rear Panel Controls, Indicators and Connectors

4.2.1   Front Panel Status Indicators

4.2.1.1   "POWER" Indicator

When lit, the "POWER ON" indicator (Green LED) indicates that the supply voltage is present greater than or equal to ±18 VDC, and less than or equal to ±76 VDC (+24 VDC nominal or -48 VDC nominal).

4.2.1.2   "BUSY" Indicator

The "BUSY" Indicator (Yellow LED) illuminates only while the LLC is being tuned or during initial power up.

4.2.1.3 "NON CRITICAL ALARM" Indicator

The "NON CRITICAL ALARM" Indicator (Red LED) will illuminate if there is a failure of one power supply module. In this situation a second backup power supply module will automatically engage.

4.2.1.4 "CRITICAL ALARM" Indicator

The "CRITICAL ALARM" Indicator (Red LED) will illuminate if the unit fails to tune to a request frequency.

4.2.2 Controls

The 850 MHz LLC Tuning is controlled via an Ethernet connection to a PC.

4.2.3 RF Connections

The 850 MHz Low Loss Combiner provides Bandpass and Bandstop input ports (on the rear panel) via DIN connectors (labeled "**Bandpass – Tx Only**" and "**Bandstop – Tx/Rx**" respectively). The two signals are then combined and output to the Antenna via another DIN connector (on the rear panel) labeled "**ANT**."

4.2.4 DC Connections

A DC connector (on the front panel) provides power to the 850 MHz LLC. This connection is only required during tuning. The supply voltage should be greater than or equal to ±18 VDC, and less than or equal to ±76 VDC (+24 VDC nominal or -48 VDC nominal).

4.2.5 TCP/IP (Ethernet) Data Connection

An RJ45 (Ethernet) connector on the 850 MHz LLC front panel provides a TCP/IP data path to control and monitor the LLC. This connection is only required during tuning.

4.2.6 Alarm Out Connector

Two dry contact alarms are provided for non-critical and critical states.

5 Initial Startup and Operating Instructions

5.1 Initial Setup and Connection

The instructions for setup and connections are for the **Ethernet connection**.

5.1.1 Ethernet Connection

Connect a Standard CAT5 or better Ethernet cable from the PC being used to the PCS 10 MHz LLC. See figure 5.1 to view the Ethernet connector. *When connecting directly to a PC, an Ethernet "Crossover" cable is required for older PC's which do not have auto-detect Ethernet cards.* Newer PC's which incorporate auto-detect Ethernet cards generally have auto crossover functionality which allow for the use of a standard Ethernet cable.

5.1.2 Power Connection

Connect the factory supplied DC Power cable from the 850 MHz Low Loss Combiner (LLC) to a Power Supply capable of delivering 1 ADC at +24 VDC or 5 ADC at -48 VDC. See figure 5.1 to view the Power connection. A 5A breaker is recommended.

Figure 5.1 – Front Panel of the LLC showing Ethernet, Alarm and Power Connections

5.1.3 RF Connections

Connect RF cables (DIN Male to N-type Male) with the DIN Male connectors to the "**ANT**," "**2G**" (GSM or cdmaOne), and "**3G (5 MHz)**" (UMTS or cdma2000 technologies including 1X, 1xEV-DO and 1xEV-DV) ports of the 850 MHz Low Loss Combiner (LLC). Connect the N-Male connectors to the Anritsu or other Analyzer being used as appropriate to view the desired response. See Figure 5.2 to view the RF connectors on the 850 MHz LLC.
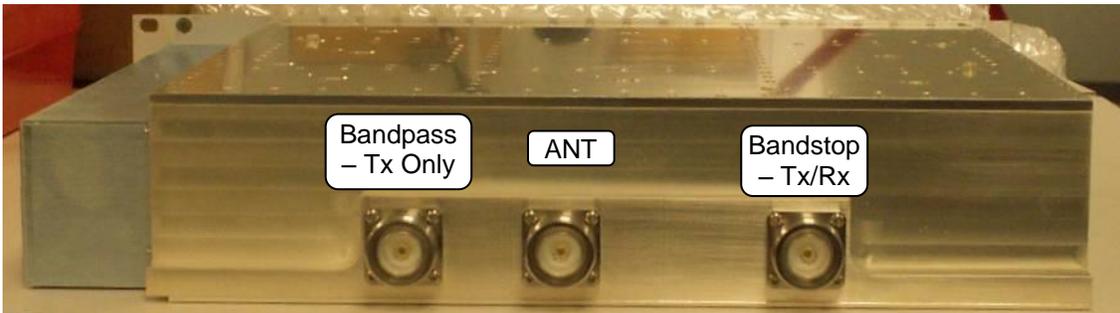
Figure 5.2 – Rear Panel RF showing RF Connections

5.2 Setup of Computer to Access LLC Software via HTML over TCP/IP

Instructions and figures that follow use Microsoft's Internet Explorer as the Web Browser used to control and monitor the 850 MHz Low Loss Combiner (LLC).

5.2.1 Turn on PC

Turn on the PC that will be used to access the Low Loss Combiner.

5.2.2 Go To Control Panel

Get to the "Control Panel" from the Main PC Screen, by clicking the selection for Control Panel from the Main Screen as seen in Figure 5.3 below.
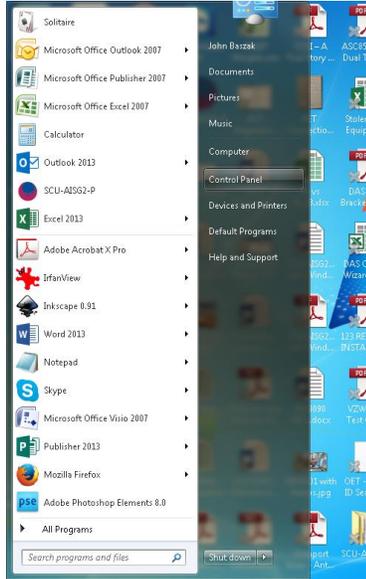
Figure 5.3 – Select "Control Panel"

5.2.3   Selection of Network and Sharing Center

Once in the Control Panel use the PC's mouse to select the "Network and Sharing Center" icon as seen in figure 5.4 below. Continue by clicking on the "Network and Sharing Center" icon.to open the Network and Sharing Center.
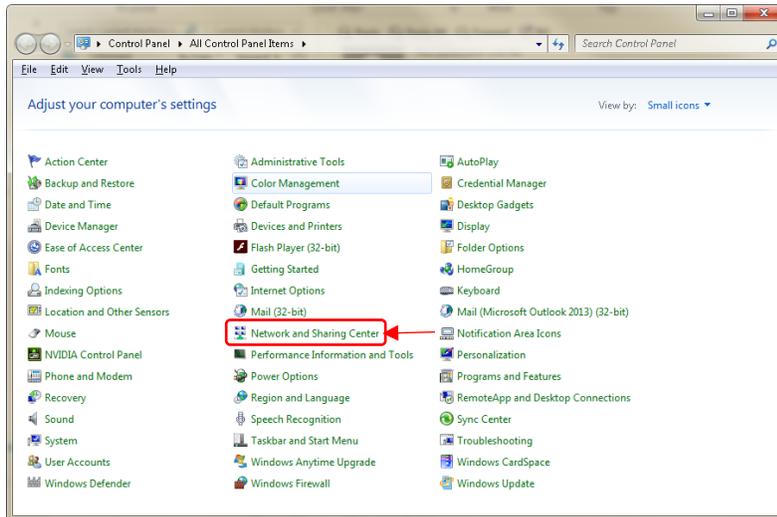
Figure 5.4 - Select "Network and Sharing Center"

5.2.4 Select "Local Area Connection" Icon

After the step taken in paragraph 5.2.3 the Network and Sharing Center window will appear. Using the PC's mouse, select the "Local Area Connection" icon and text (see figure 5.5) within the "Network and Sharing Center" window.
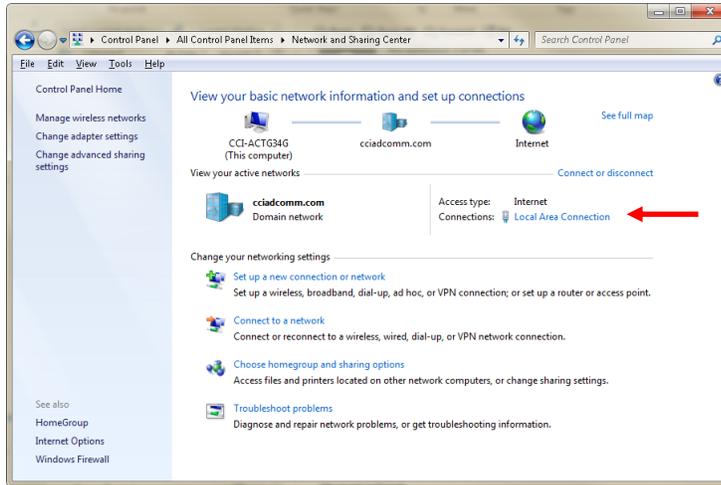
Figure 5.5 – Local Area Connection highlighted within the Network and Dial-up connections window

5.2.5 Select "Local Area Connections Properties"

Next, left-click the mouse on the "Local Area Connection" icon and text. This opens up the pop-up menu shown in figure 5.6 below. Move the PC's mouse over the pop-up menu to highlight the "Properties" label within the Local Area Connection Status pop-up window.
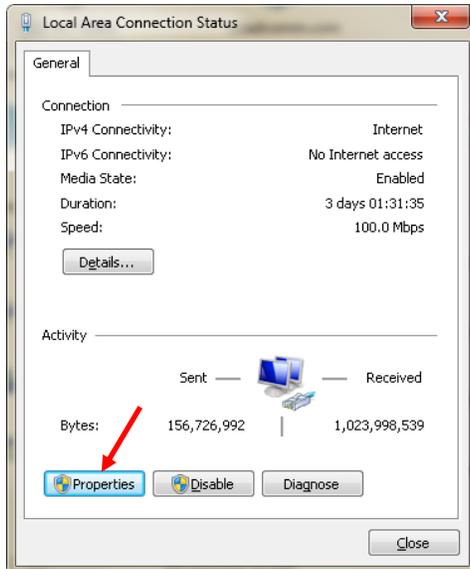
Figure 5.6 – "Local Area Connections Status" Window Display

5.2.6 Select "Internet Protocol Version 4 (TCP/IPv4) Connection Properties"

Use the PC's mouse (left click) on the "Properties" selection from the menu on the previous figure. This will open up the pop-up window shown in figure 5.7 below. Next, select (left click) the "Internet Protocol Version 4(TCP/IPv4)" label from the menu in the "Local Area Connection Properties" window.

Local Area Connection Properties

Networking | Sharing

Connect using:
Realtek PCIe GBE Family Controller

Configure...

This connection uses the following items:
- ☑ Client for Microsoft Networks
- ☑ QoS Packet Scheduler
- ☑ File and Printer Sharing for Microsoft Networks
- ☑ Internet Protocol Version 6 (TCP/IPv6)
- ☑ Internet Protocol Version 4 (TCP/IPv4)
- ☑ Link-Layer Topology Discovery Mapper I/O Driver
- ☑ Link-Layer Topology Discovery Responder

Install... | Uninstall | Properties

Description
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

OK | Cancel

Figure 5.7 – "Local Area Connections Properties" Window Display

5.2.7 Select "Use the following IP address:"

Use the PC's mouse (left click) on the "Properties" button on the previous figure. This will open up the window shown in figure 5.8. Next, select (left click) the "Use the following IP address:" radio button on the upper portion of the "Local Area Connection Properties" window.

Internet Protocol Version 4 (TCP/IPv4) Properties

General | Alternate Configuration

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

- ⦿ Obtain an IP address automatically
- ○ Use the following IP address:
  - IP address:
  - Subnet mask:
  - Default gateway:
- ⦿ Obtain DNS server address automatically
- ○ Use the following DNS server addresses:
  - Preferred DNS server:
  - Alternate DNS server:
- ☐ Validate settings upon exit

Advanced...

OK | Cancel

Figure 5.8 – "Use the following IP address:" Window Display

5.2.8 Setting the "TCP/IP Address"

Once you have selected the "Use the following IP address:" radio button in the previous step, this will now make the address entry fields within the window "available" for data entry. See figure 5.9.
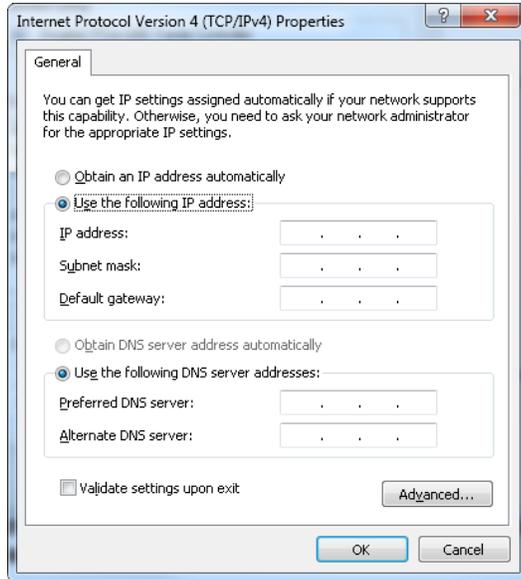
Figure 5.9 – "Use the following IP address:" portion of the Window Display with address fields "available" for data entry

5.2.9   TCP/IP Address Entry

The "IP address:" field will show the blinking cursor after completion of the previous step. Enter "192" into the 1st position in the field. This will move the cursor into the 2nd position in the field. Enter "168" into this 2nd position in the field. This will move the cursor into the 3rd position in the field. Enter "0" into this 3rd position in the field. This will automatically populate the "Subnet mask:" field with "255.255.255.0," and the "Default gateway:" field with "0.0.0.0." Go back and enter "1" into the 4th position within the "IP address:" field. See figure 5.10.
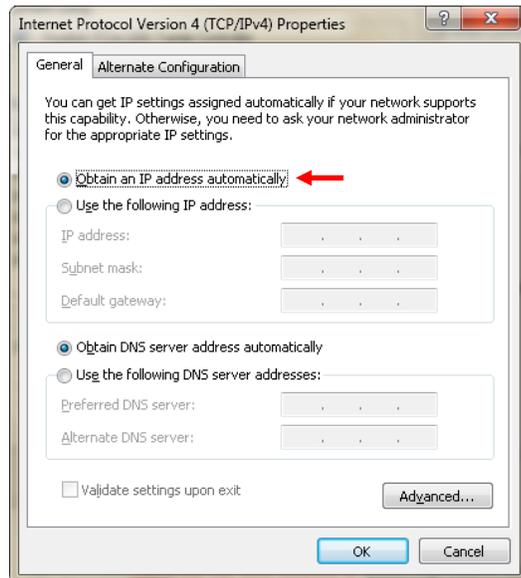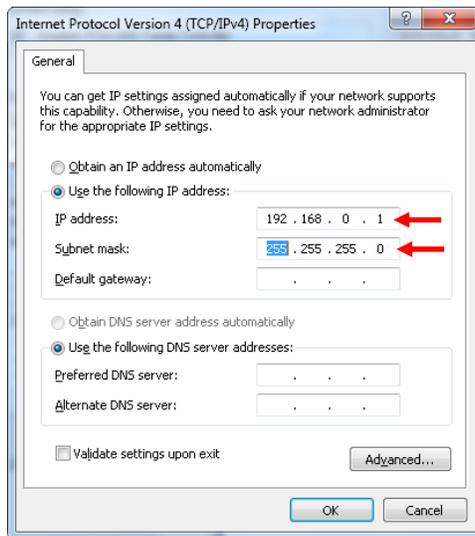

Figure 5.10 - "Use the following IP address:" portion of the Window Display with data entered into the "address" fields

5.2.10   Accept the modified "Local Are Connection Properties"

To accept the "Local Area Connection Properties changes on the PC select the "OK" button for each of the previously opened pop-up windows. Finally, close the "Network and Sharing Center" window.

5.2.11 Finalize PC Setup

To finalize the PC setup, open up the Internet Explorer Browser window and enter "http://192.168.0.3" in the address portion in the Internet Explorer window. See figure 5.11.
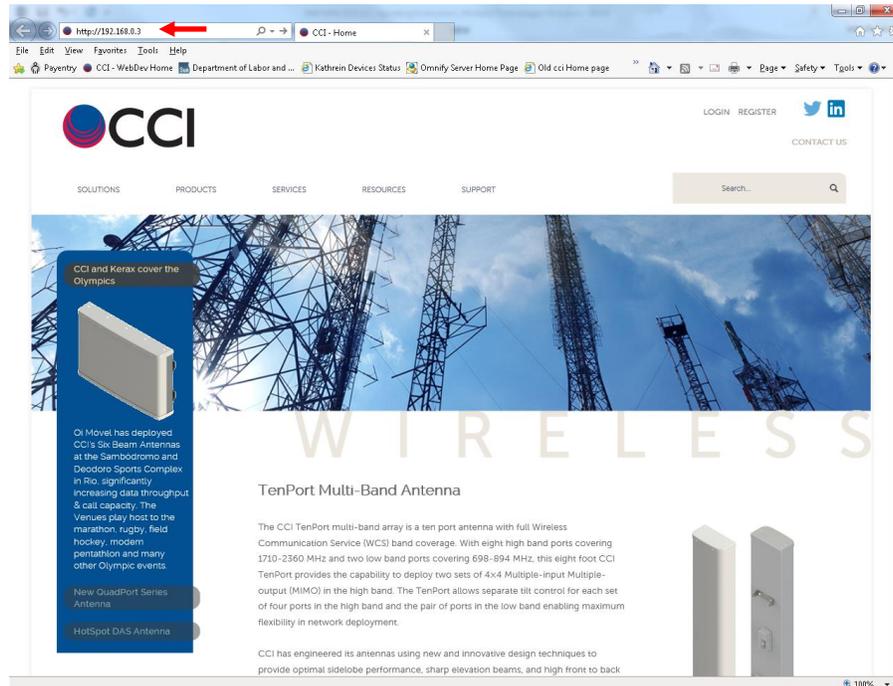
Figure 5.11 – Internet Explorer window with "Address:" field highlighted

5.3 Application of Power to the LLC and initial Screen

5.3.1 Apply Power to the LLC

Apply +24 VDC or -48 VDC to the LLC.

5.3.2 Initial Screen on Browser

Upon application of power to the 850 MHz LLC the Browser screen should appear per figure 5.11. The Browser screen should list the frequency (in MHz) that the 850 MHz LLC is presently tuned to.

Figure 5.12 – Initial browser screen upon application of power to LLC.

5.4   LLC Technical Specifications

5.4.1   Viewing LLC Technical Specifications

To view technical specifications for the 850 MHz LLC use the PC's mouse to highlight (left click on) the "Technical Specifications" link on the initial browser screen. The browser window will display basic technical specifications of the 850 MHz LLC. Please see figure 5.12 below for an example of how the technical specifications should appear.

Figure 5.13 – LLC Technical specifications window

5.5   LLC Unit Details

5.5.1   Viewing LLC Unit Details

To view unit details for the 850 MHz LLC use the PC's mouse to highlight (left click on) the "Unit Details" link on the initial browser screen. The browser window will display the Firmware and Software Details of the 850 MHz LLC. Please see figure 5.13 below for an example of how the technical specifications should appear.
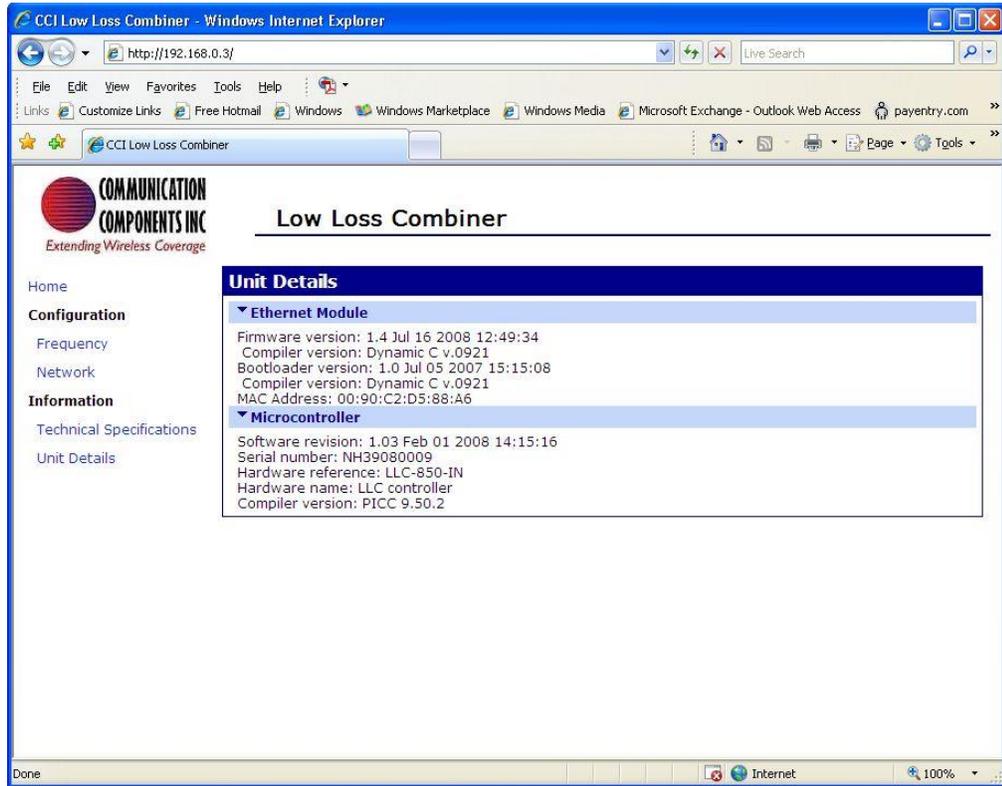
Figure 5.14 – LLC Unit Details window

5.6 Network Configuration Properties

Network configuration properties can be changed if so desired.
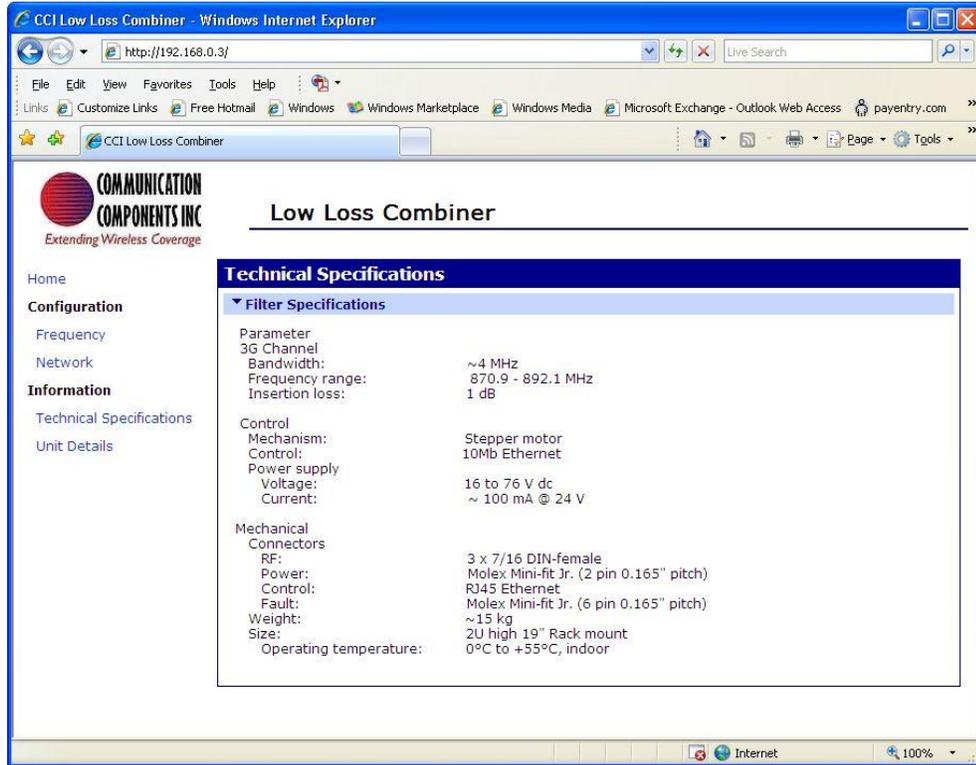
5.6.1 Changing Network Configuration Properties

To change the Default IP Address of the LLC, use the PC mouse to highlight (left click on) the "Network" link on the browser screen. There are two ways of assigning an IP address to the LLC. One method involves using a "Dynamic Host Control Protocol" (DHCP) server to assign an IP Address to the unit. The other method allows the assignment of a "Static IP Address" to the LLC. To assign an alternate Static IP Address to the LLC, use the PC mouse to select the "Use the following IP address:" radio button. At this time you must enter the appropriate: 1) IP Address:, 2) Subnet Mask:, and Default Gateway: addresses. Once you have determined that your new address information is correct, select the "Apply" button. See figure 5.14 for details. **Note: It is extremely important to record these changes to ensure future access.**
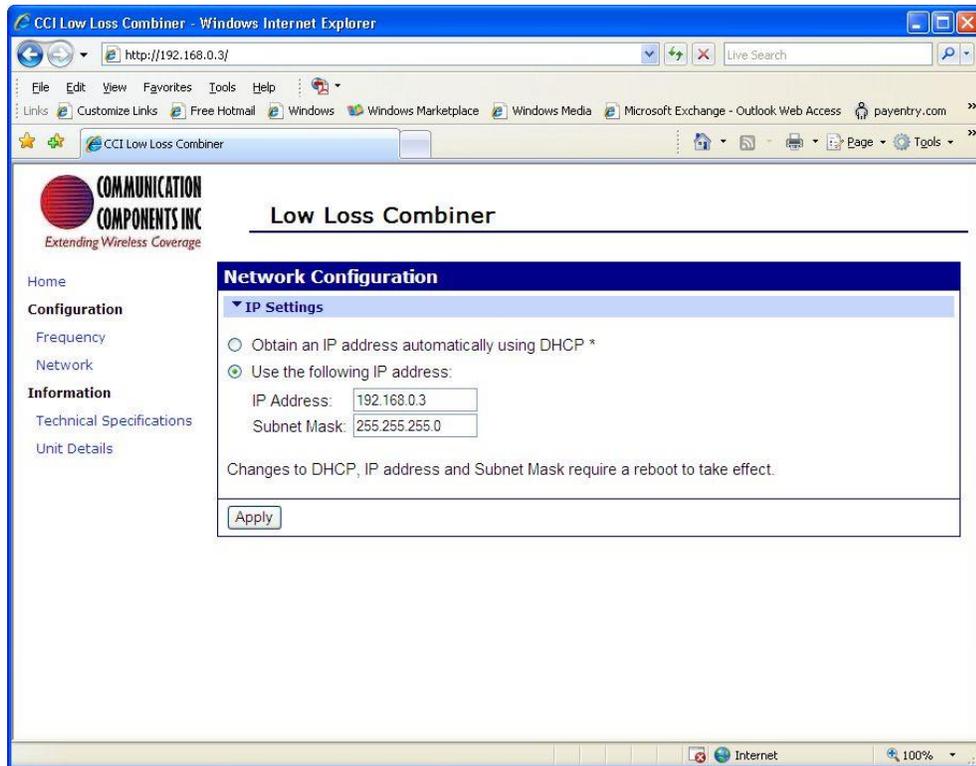
Figure 5.15 – Network Configuration Browser Screen (old address information shown)

5.7 Tuning procedure

The LLC can be tuned to any frequency within the operating band and will remain at the set frequency after the power has been removed.

5.7.1 Tuning with "Enter Frequency"

Tuning with "Enter Frequency" (a user chosen frequency) allows the user to tune the LLC to center frequencies between 870.9 MHZ and 892.1 MHz in 50 kHz increments (Notch filter will cover the full 3.84MHz ie 1.920MHz either side of the chosen frequency). In order to perform "Enter Frequency" tuning you must first select (left click) the PC mouse on the Frequency Configuration link at the left of the browser display. Then you must select (left click) the "Tune" button. Figure 5.15 highlights the "Frequency Configuration" and "Enter Frequency" selections.
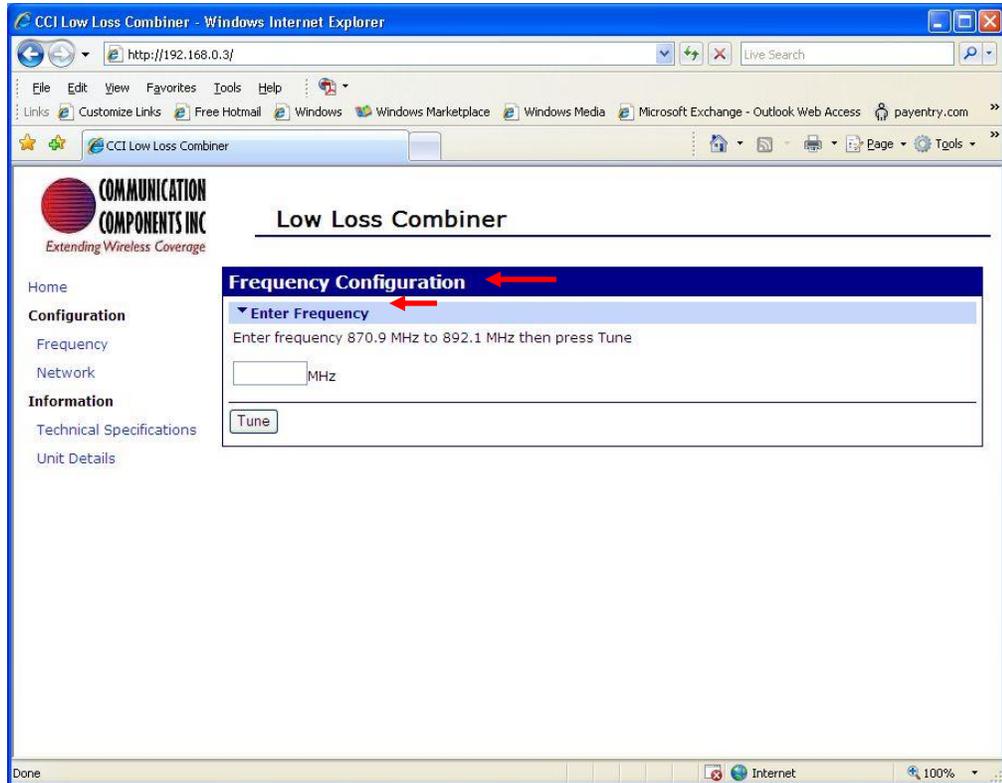
Figure 5.16 - Browser Screen showing "Frequency Configuration" & "Enter Frequency" selection

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5.7.1.1 "Enter Frequency" Tuning Process

Use the PC mouse to select the "frequency entry field" and enter the desired UMTS frequency (any frequency between 870.9 MHZ and 892.1 MHz in 50 kHz increments). Figure 5.16 highlights the "frequency entry field" and which has 891.1 MHz entered (frequency that will actually be tuned to in the example shown).
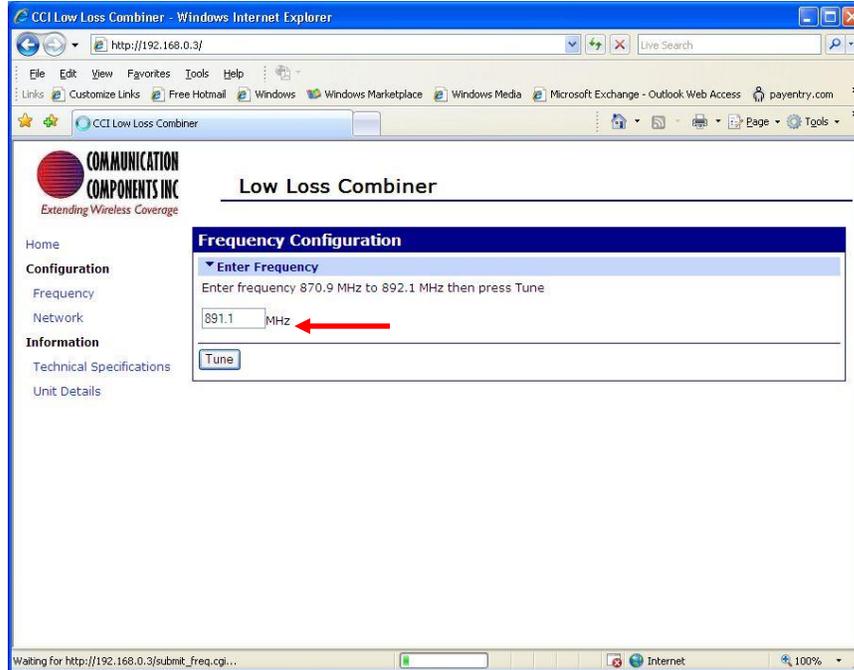
Figure 5.17 – Browser Screen indicating the field used to enter the desired Frequency

5.7.1.1.1 Activities during "Enter Frequency" Tuning

After selecting the "Tune" button during "Enter Frequency Tuning," the following actions will occur. The display on the analyzer will begin to show a "detuning" action. At the same time the "Activity" LED on the LLC will flash. Similarly, the Ethernet port LED's will also be active at this time. The LED's noted can be found (for reference) on Figures 4.1 and 5.1

5.7.1.1.2 Continuing Activities during "Enter Frequency" Tuning

As the tuning process continues the display on the analyzer will begin to show tuning of each stage to the "Chosen" frequency. The "Activity" LED and Ethernet port LED will continue to flash.

5.7.1.1.3   Tuning Completion

Once the tuning process has completed the "Activity" and Ethernet port LED's will extinguish. The Analyzer will now show the response for the newly tuned frequency selection. The browser screen (see figure 5.17) on the PC will indicate that the filter is now tuned to 885.1 MHz.
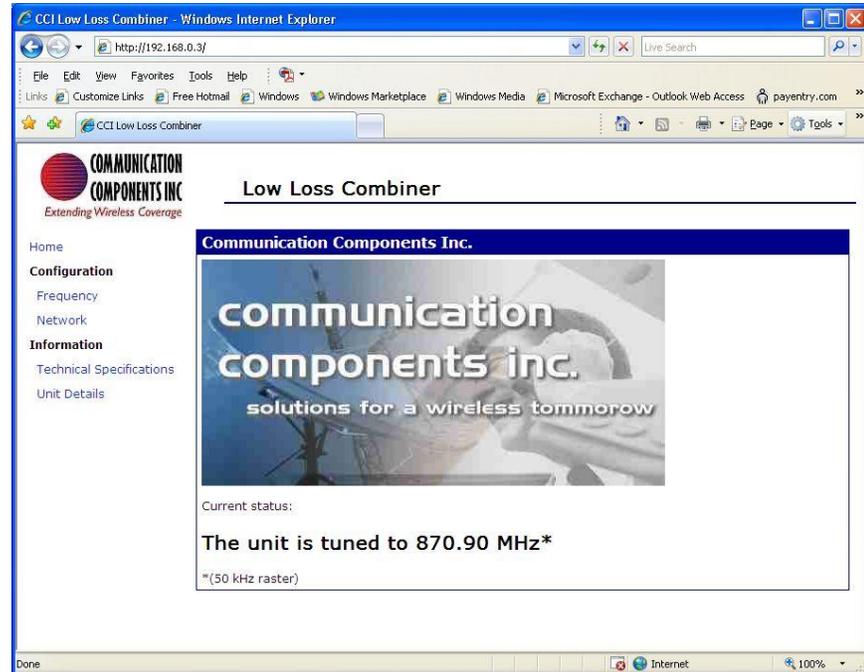
Figure 5.18 – Browser screen indicating completion of "Enter Frequency" tuning process

5.7.1.1.4   Analyzer response at Tuning Completion

The analyzer response for S21 (Transmitted Power) and S11 (Reflected Power) is shown as tuned to the UMTS frequency of 885.1 MHz, in figure 5.18 for connection to the UMTS port, and figure 5.19 for connection to the GSM port.
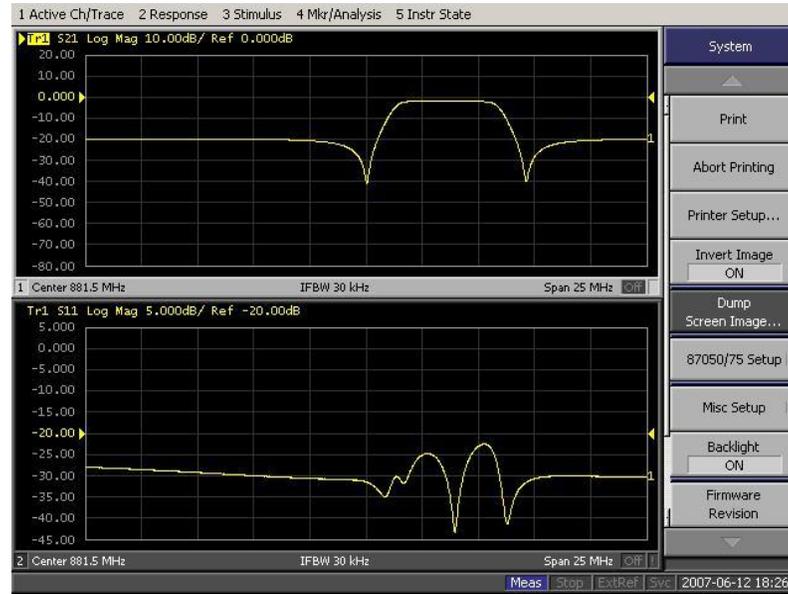
Figure 5.19 – Analyzer response when viewing the UMTS port (UMTS frequency tuned to 885.1 MHz)

Figure 5.20 – Analyzer response when viewing the GSM port (UMTS frequency tuned to 885.1 MHz)

6   Maintenance

6.1   Introduction

There is no requirement for periodic maintenance on an LLC.

6.2   Periodic Maintenance

Not applicable.

6.3   Test Equipment Required for Test

Spectrum analyzer and any additional equipment such as cabling, attenuators, couplers, etc.

6.4   Performance Test

A performance test should be performed to insure that the LLC meets the specifications listed in Appendix A.

6.5   Field Replaceable Parts and Modules

Parts and modules within an RX-AIT solution that can be replaced by a qualified technician in the field include the Low Loss Combiner (LLC).

6.5.1   Low Loss Combiner (LLC) Replacement

To replace an LLC within an RX-AIT solution, perform the following steps:

1) Ensure that all RF sources are "Off."

2) Set the appropriate circuit breaker (associated with the RX-AIT in the affected sector) on the BTS to "Off."

3) Remove the Input and Output RF Cables from the LLC. Also remove the DC and Ethernet (RJ45) cables from the LLC. Ensure that the cables are properly labeled for later reconnection.

4) Remove the hardware holding the LLC on the 19" rack.

5) Remove the LLC from the 19" rack.

6) Reverse the order of the procedure to install a new LLC.

7   Troubleshooting (Component Level)

7.1   Introduction

This section will cover the troubleshooting of CCI LLC's which have LED Indicators, as well as RF measurements that can be performed.

7.2   Troubleshooting

The troubleshooting covered herein contains details of the LED Status Indicators and/or the alarm contact pin combinations. In the event of a suspected failure please see section 7.3 "Return for Service Procedures."

7.2.1   Low Loss Combiner (LLC) Troubleshooting

The following paragraphs describe the LED state, trigger conditions and corrective actions for failures of the LLC. The LLC Tuning Manual can also be found on CCI's website at **www.cciproducts.com**.

7.2.1.1   "POWER ON" Not Illuminated

If the "POWER ON" (green) LED is illuminated, this indicates that the unit is powered (only required when "tuning" is being performed) and is operational. If the green LED is off, check the condition of DC input cable, the associated circuit breaker, and that the DC input cable is properly connected to the DC Input connector on the LLC.

7.2.1.2   "Busy" Not Illuminated

The "Busy" LED (yellow) will only be illuminated during "tuning" of the LLC. If the LED is not illuminated, but the "POWER ON" LED is illuminated during tuning, check to insure the condition of the Ethernet Crossover cable and that it is indeed connected to the RJ45 (Control – Ethernet) port on the LLC.

7.2.1.3   "ETHERNET ENABLED" Not Illuminated

The "ETHRNET ENABLED" Indicator (Green LED) will only be illuminated while the Ethernet cable is connected to the LLC and the LLC is powered. If the green LED is off but the Ethernet cable is connected while the LLC is powered, then check the other end of the Ethernet cable for a proper connection to an Ethernet adapter.

7.2.1.4   "Critical Error" Illuminated

If the "Critical Error" (Red) LED is illuminated, this indicates that the LLC has failed to tune to a given frequency due to an internal problem. Attempt to retune the LLC. If multiple attempts fail, return the unit to CCI using the RMA process described in section 7.3 and Appendix C.

7.2.1.5   Test

Troubleshooting of the Low Loss Combiner is performed by testing the LLC with a Network Analyzer. This testing validates the UMTS "Pass" frequencies, the GSM "Reject" frequencies, the Return Loss of the UMTS "Pass Band," and the Return Loss of the GSM "Pass Band." The values for these tests can be found in Table A-1 herein for the Low Loss Combiner.

7.3 Return for Service Procedures

7.3.1 Obtaining an RMA

When equipment is damaged and must be returned to the factory be sure to fill out the website form or if no internet access is available then call the factory to obtain a material return authorization. Please note that an RMA # must be assigned before RX-AIT equipment can be returned to CCI. Please note that CCI's return policy and an RMA form can be found in Appendix C.

The following information is required to obtain an RMA:

1) Serial number of the unit in question. Serial number is found on the silver label next to the bar code.

2) Model number of the unit in question. Model number is also found on the silver label.

3) Name and phone number of a contact at your company.

4) Detailed description of the reason for return.

5) Date Code. Date Code is found either on the silver label as D/C, or on a separate label. Date code is required to determine warranty status. The standard warranty period extends to 1 year after the date shown on the date code label.

7.3.2 Repacking for Shipment

Be sure to retain all of the packing material, in the event that any piece of equipment must be returned to the factory.

A   Appendix A Specifications

A.1   850 MHz Low Loss Combiner

Table A-1 850 MHz Low Loss Combiner Specifications

Description	Typical Specifications
Electrical Specifications	
BANDPASS TX ONLY Port	
Bandwidth	Any 5 MHz centered between 869 - 894 MHz (LLC-850-IN); Any 4 MHz centered between 870.9 - 892.1 MHz (LLC-850C-IN)
Channel Positioning	50 kHz steps
Insertion Loss	0.7 dB typ. / 1 dB max.
Insertion Loss Variation	0.3 dB max.
EVM	2.5% (across 4 MHz)
Attenuation in the Bandstop band	15 dB min
Return Loss all port	18 dB min.
BANDSTOP TX/RX Port	
Bandwidth	824-894 MHz except 6 MHz for Bandpass Channel + Guardband
Insertion Loss	0.15 dB typ. / 0.7 dB max.
Insertion Loss Variation	0.3 dB max.
Attenuation in the Bandpass band	15 dB min
Return Loss all port	18 dB min.
Isolation	
Bandstop port to Bandpass port (Bandpass Frequencies)	27 dB min. / 32 dB typ.
Bandpass port to Bandstop port in (Bandstop Frequencies)	33 dB min. / 40 dB typ.
General Characteristics	
Guard Band	
GSM/UMTS Combining	500 kHz each side of Bandpass required
UMTS/UMTS Combining	"0" Guard Band Required
UMTS/LTE Combining	"0" Guard Band Required for 5 MHz or greater LTE
CDMA/LTE Combining	"0" Guard Band Required for 5 MHz or greater LTE
CDMA/CDMA Combining (LLC-850C-ON Only)	1 MHz each side of Bandpass required
Power Handling	500 W / 2000 W PEP
IMD	<-110 dBm (-153 dBc) typical (2 x +43 dBm tones)
Reconfiguring the combiner	
Mechanism	Stepper Motor
Control	Any web enabled computing device with a 10/100 or greater RJ-45 Ethernet Port
DC Supply	
Current	1 A at +24 V
Voltage	± 18 to ± 76 V
Mechanical	
RF Ports	3 x 7-16 DIN-female
Control Port	1 x RJ45 Ethernet
DC Input	1 x Molex "Mini-Fit Jr." (2 Pin – male, .165" Pitch)
Alarm Output	1 x Molex "Mini-Fit Jr." (6 Pin – male, .165" Pitch)
Weight	28.5 Lbs. (12.9 kg)
Size (Includes Connectors and Handles)	3.5 x 19 x 18.175 in. (88.9 x 482.6 x 461.65 mm)
Indicators	
Power	Green LED (±18 VDC to ±76 VDC present)
Busy	Yellow LED (illuminates during tuning or initial power up)
Non Critical Alarm	Red LED (illuminates if a power supply module fails)
Critical Alarm	Red LED (illuminate if LLC fails to tune)
Environmental	
Operating Temperature:	0°C to +55°C, Indoor
MTBF	>5000Khrs

B   Appendix B Valid Channel Numbers for 850 MHz

B.1   Valid UARFCN (UMTS) Channel Numbers for 850 MHz

Table B-1 Valid UARFCN (UMTS) Channel Numbers for 850 MHz

DL MHz	DL UARFCN	UL MHz	UL UARFCN	UARFCN Fdl offset	UARFCN Ful offset
871.50	1007	826.50	782	670.1	670.1
872.50	1012	827.50	787	670.1	670.1
876.50	1032	831.50	807	670.1	670.1
877.50	1037	832.50	812	670.1	670.1
882.50	1062	837.50	837	670.1	670.1
887.50	1087	842.50	862	670.1	670.1
871.40	4357	826.40	4132	0	0
871.60	4358	826.60	4133	0	0
871.80	4359	826.80	4134	0	0
872.00	4360	827.00	4135	0	0
872.20	4361	827.20	4136	0	0
872.40	4362	827.40	4137	0	0
872.60	4363	827.60	4138	0	0
872.80	4364	827.80	4139	0	0
873.00	4365	828.00	4140	0	0
873.20	4366	828.20	4141	0	0
873.40	4367	828.40	4142	0	0
873.60	4368	828.60	4143	0	0
873.80	4369	828.80	4144	0	0
874.00	4370	829.00	4145	0	0
874.20	4371	829.20	4146	0	0
874.40	4372	829.40	4147	0	0
874.60	4373	829.60	4148	0	0
874.80	4374	829.80	4149	0	0
875.00	4375	830.00	4150	0	0
875.20	4376	830.20	4151	0	0
875.40	4377	830.40	4152	0	0
875.60	4378	830.60	4153	0	0
875.80	4379	830.80	4154	0	0
876.00	4380	831.00	4155	0	0
876.20	4381	831.20	4156	0	0
876.40	4382	831.40	4157	0	0
876.60	4383	831.60	4158	0	0
876.80	4384	831.80	4159	0	0
877.00	4385	832.00	4160	0	0
877.20	4386	832.20	4161	0	0
877.40	4387	832.40	4162	0	0
DL MHz	DL UARFCN	UL MHz	UL UARFCN	UARFCN Fdl offset	UARFCN Ful offset
877.60	4388	832.60	4163	0	0

DL MHz	DL UARFCN	UL MHz	UL UARFCN	UARFCN Fdl offset	UARFCN Ful offset
877.80	4389	832.80	4164	0	0
878.00	4390	833.00	4165	0	0
878.20	4391	833.20	4166	0	0
878.40	4392	833.40	4167	0	0
878.60	4393	833.60	4168	0	0
878.80	4394	833.80	4169	0	0
879.00	4395	834.00	4170	0	0
879.20	4396	834.20	4171	0	0
879.40	4397	834.40	4172	0	0
879.60	4398	834.60	4173	0	0
879.80	4399	834.80	4174	0	0
880.00	4400	835.00	4175	0	0
880.20	4401	835.20	4176	0	0
880.40	4402	835.40	4177	0	0
880.60	4403	835.60	4178	0	0
880.80	4404	835.80	4179	0	0
881.00	4405	836.00	4180	0	0
881.20	4406	836.20	4181	0	0
881.40	4407	836.40	4182	0	0
881.60	4408	836.60	4183	0	0
881.80	4409	836.80	4184	0	0
882.00	4410	837.00	4185	0	0
882.20	4411	837.20	4186	0	0
882.40	4412	837.40	4187	0	0
882.60	4413	837.60	4188	0	0
882.80	4414	837.80	4189	0	0
883.00	4415	838.00	4190	0	0
883.20	4416	838.20	4191	0	0
883.40	4417	838.40	4192	0	0
883.60	4418	838.60	4193	0	0
883.80	4419	838.80	4194	0	0
884.00	4420	839.00	4195	0	0
884.20	4421	839.20	4196	0	0
884.40	4422	839.40	4197	0	0
884.60	4423	839.60	4198	0	0
884.80	4424	839.80	4199	0	0
885.00	4425	840.00	4200	0	0
885.20	4426	840.20	4201	0	0
885.40	4427	840.40	4202	0	0
885.60	4428	840.60	4203	0	0
885.80	4429	840.80	4204	0	0
886.00	4430	841.00	4205	0	0
886.20	4431	841.20	4206	0	0
DL MHz	DL UARFCN	UL MHz	UL UARFCN	UARFCN Fdl offset	UARFCN Ful offset
886.40	4432	841.40	4207	0	0
886.60	4433	841.60	4208	0	0
886.80	4434	841.80	4209	0	0
887.00	4435	842.00	4210	0	0

887.20	4436	842.20	4211	0	0
887.40	4437	842.40	4212	0	0
887.60	4438	842.60	4213	0	0
887.80	4439	842.80	4214	0	0
888.00	4440	843.00	4215	0	0
888.20	4441	843.20	4216	0	0
888.40	4442	843.40	4217	0	0
888.60	4443	843.60	4218	0	0
888.80	4444	843.80	4219	0	0
889.00	4445	844.00	4220	0	0
889.20	4446	844.20	4221	0	0
889.40	4447	844.40	4222	0	0
889.60	4448	844.60	4223	0	0
889.80	4449	844.80	4224	0	0
890.00	4450	845.00	4225	0	0
890.20	4451	845.20	4226	0	0
890.40	4452	845.40	4227	0	0
890.60	4453	845.60	4228	0	0
890.80	4454	845.80	4229	0	0
891.00	4455	846.00	4230	0	0
891.20	4456	846.20	4231	0	0
891.40	4457	846.40	4232	0	0
891.60	4458	846.60	4233	0	0

B.2 Preferred CDMA Channels (Frequency Assignments) for Band Class 0 (850 MHz), Band Subclass 0

Table B-2 Preferred CDMA Channels (Frequency Assignments) for Band Class 0 (850 MHz), Band Subclass 0

Band Name	DL MHz	DL CDMA	Delta from Previous Channel (MHz)	UL MHz	UL CDMA
A"	869.88	1019	-	824.88	1019
A	871.11	37	1.23	826.11	37
A	872.34	78	1.23	827.34	78
A	873.57	119	1.23	828.57	119
A	874.8	160	1.23	829.8	160
A	876.03	201	1.23	831.03	201
A	877.26	242	1.23	832.26	242
A	878.49	283	1.23	833.49	283
B	881.52	384	-	836.52	384
B	882.75	425	1.23	837.75	425
B	883.98	466	1.23	838.98	466
B	885.21	507	1.23	840.21	507
B	886.44	548	1.23	841.44	548
B	887.67	589	1.23	842.67	589
B	888.9	630	1.23	843.9	630
A'	890.73	691	-	845.73	691
B'	892.74 (Qualcomm)	758	-	847.74	758
B'	893.31 (3GPP)	777	-	848.31	779

[1] All Numbers in Table are from Band Class 0 Band Subclass 0 of the 3GPP Band Class Specification for cdma2000 Spread Spectrum Systems, except for the last pair of channels. Channel 758 is from a Qualcomm document & Channel 777 is from the 3GPP document for the B' Band. Channel 1019 is from a Qualcomm document (does not exist in the 3GPP document) for the A" Band.

B.3   CDMA Channel Number to CDMA Frequency Assignment Correspondence for Band Class 0

Table B-3 CDMA Channel Number to CDMA Frequency Assignment Correspondence for Band Class 0

Transmitter	CDMA Channel Number	Center Frequency for CDMA Channel (MHz)
Mobile Station	$1 \leq N \leq 799$	$0.030 * N + 825.000$
	$991 \leq N \leq 1023$	$0.030 * (N-1023) + 825.000$
	$1024 \leq N \leq 1323$	$0.030 * (N- 1024) + 815.040$
Base Station	$1 \leq N \leq 799$	$0.030 * N + 870.000$
	$991 \leq N \leq 1023$	$0.030 * (N-1023) + 870.000$
	$1024 \leq N \leq 1323$	$0.030 * (N- 1024) + 860.040$

C   Appendix C Return Policy & Return Material Authorization (RMA) Form

C.1   CCI's Return Policy

See CCI's separate "Return Material Authorization Policy & Process Guide"

C.2   Return Material Authorization (RMA) Form

Figure C.1 Return Material Authorization (RMA) Form