MARK-IVD 800MHz NARROWBAND SIGNAL BOOSTER
M4DBDA8

OPERATIONS & MAINTENANCE (O&M) MANUAL

REVISION 1
SUBMITTED BY:

CANAM TECHNOLOGY, INC.

May, 2015

Part 90 Signal Boosters THIS IS A 90.219 CLASS A DEVICE

WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class A signal boosters (as defined in 47 CFR 90.219) online at *www.fcc.gov/signal-boosters/registration*. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation."

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Section A. INTRODUCTION

The MARK-IVD 800MHz Narrowband Signal Booster (M4DBDA8) is a Class **"A"** Industrial Signal Booster for FCC Part90 PLMRS Public Safety Agencies used to operate within range 806-817 MHz (UL path), 851-862 MHz (DL path) for Land Mobile Radio.

This document is the M4DBDA8 Operations and Maintenance Manual, intended for the Radio Technical Personnel.

This manual is intended to be used with the M4DBDA8 Equipment only. It is not to be used with any other equipment unless it is authorized by Canam Technology, Inc.

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Signal boosters such as the M4DBDA8 generate radio signals and, therefore, electromagnetic fields. The technical personnel should have a complete understanding of FCC CFR Title 47 sections 1.1307 and 1.1310. Recommendations are included in this Manual, but they do not substitute the FCC guidelines.

M4DBDA8 Key Features:

- Narrowband Class A Signal Booster, per FCC Part 90.
- Maximum Output Power at the antenna port +37 dBm per carrier.
- AGC circuit provides a constant output power, regardless of the input power.

This device may require the use of antennas for proper functioning, depending on the application. The installation of the antennas should be performed by qualified technical personnel. All antennas should be fixed mounted and physically secured to one location **The people must be away from the antennas at least 1.0 meters to comply with the RF Human Maximum Permissible Exposure limits, as long as the antenna system gain is lower than 11.3 dBi.** If greater gain is used the separation should be increased, please refer to the FCC Rules.

If service should be performed on the antenna, please shut down the transmitter or lower its power in order to comply with the maximum permissible exposure.

Section B. GLOSSARY

- AC: Alternate Current.
- AGC: Automatic Gain Control, typically used on narrowband channel filters.
- DL: Downlink. Transmission link from the base station to the mobile station.
- DSP: Digital Signal Processing/Processor
- ECM: Embedded Control Module (also named as M4-ECM)
- GUI: Graphical User Interface
- iALC: Input Automatic Level Control (Input broadband limiter).
- MCPA: Multi-Carrier High-Power Amplifier
- PSU: Power Supply Unit
- Relay: Electromechanical switch. The system uses Form-C (SPDT) relays for external alarms
    - COM: Common contact or port
    - NC: Normally-Closed contact or port
    - NO: Normally-Open contact or port
- RF: Radio Frequency
- Rx: Receiver
- SNMP: Simple Network Management Protocol.
- Tx: Transmitter
- UL: Uplink. Transmission link from the mobile station to the base station.

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Section C. SAFETY PRECAUTIONS

Ensure that All Operating and Maintenance Personnel do follow INDUSTRY standard Safety Methods and Precautions. There are system-specific precautions that must be enforced, such as:

- Site Safety Policies
- Equipment Handling and Installation
- AC power feeds and Power Supply Converters
- Multi-Carrier (High) Power Amplifier (MCPA) modules hot surfaces
- RF Exposure

C.1 EQUIPMENT HANDLING AND INSTALLATION

1. The enclosure has a weight of 30 kg approximately.

C.2 POWER SUPPLIES

1. When servicing the internal Power Supply and wiring unit, be aware that power lines are in screw terminal blocks.

2. ***CAUTION:*** Removal and Installation requires that the main power switch be in the OFF position, and the power cord be disconnected from the enclosure.

C.3 MCPA MODULES

1. Internal MCPA modules are mounted to their corresponding heat sinks and are used to dissipate DC power. Both the Heat Sink and the MCPA module **MAY** be hot.

C.4 RF EXPOSURE

The RF Field Strengths that an individual will be exposed to while doing maintenance is well below the limits set forth by the FCC & State Laws.

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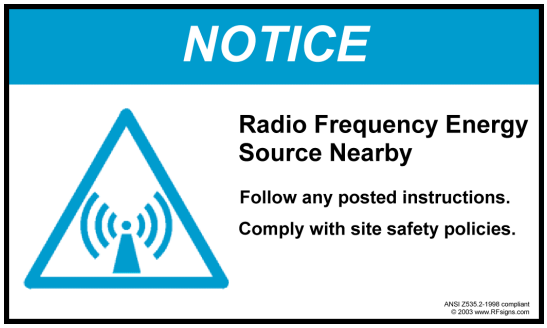
Nevertheless, there are Safety Precautions that should be adhered when performing any RF Tests:

1. Never Operate a Transmitter, or Booster Amplifier without adequate Load/Termination on the Output Port.

2. Ensure all Connections are tight and secured.

3. Ensure all Coaxial Cable Insulation covers the Outer Shield of the cable.

4. Do Not Touch Exposed System Ports or Coaxial Cable if system is Transmitting.



C.5 MOVING PARTS

1. The system has moving parts as fans.

2. Keep your hands and tools away from moving parts.

3. When servicing and wiring unit, be aware main power switch be in the OFF position and all moving parts are stopped.

Section D. THEORY OF OPERATION

D.1 DESCRIPTION

The M4DBDA8 is a stand-alone bi-directional & multi-channel Signal Conditioner that performs on-channel processing (narrowband filtering, automatic gain control and output level control) on the received signals and provides a composite equalized multi-channel signal suitable to drive its internal high-power amplifiers that feed the RF Tx Output signals.

The core Digital Signals Processor (DSP) board uses state-of-art reconfigurable logic to perform digital signal processing (channelization) thanks to its high-speed parallel hardware, high speed/performance Analog-to-Digital Converters (ADCs) and Digital-to-Analog Converters (DACs) to interface with the analog (Radio Frequency) world. Advanced digital filtering techniques deliver low group delay and excellent phase linearity to support current analog transmissions as well as new digital encoding systems.

High-linearity/low-noise analog interface hardware provides pass-band filtering and gain stages to perform proper signal conditioning to interface with the DSP digital core sub-system.

Discrete Digital I/O alarms are available for external monitoring.

A built-in Web Server provides a Graphical User Interface (GUI) to ease in remote monitoring & control. Access is obtained via a PC's Web Browser and a TCP/IP connection to the Unit.

D.2 FUNCTIONAL BLOCK DIAGRAM

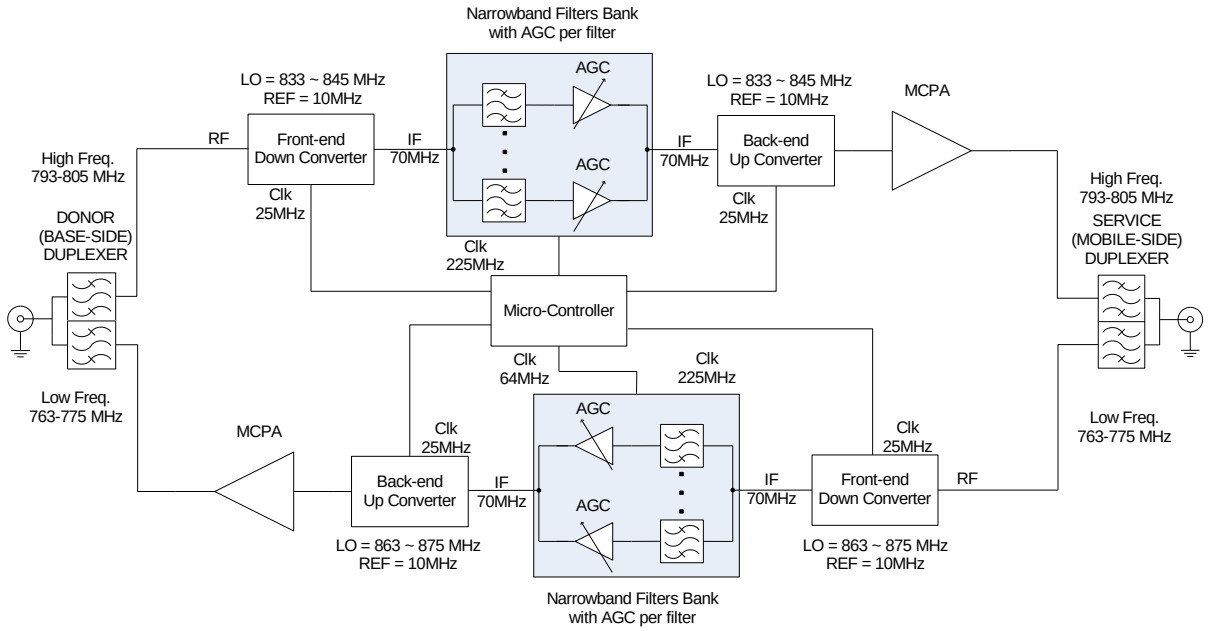


Figure 1 – M4DBDA8 General Block Diagram

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D.3 FEATURES

- 800MHz Digital Channelized Bidirectional Amplifier system.
- State-of-the-art Multi-channel digital processing system for on-frequency repeater applications (coverage extension, in-tunnel/in-building, etc).
- Preserves the frequency stability, audio fidelity and data content of the original over-the-air signal with minimum degradation
- 120 dB Gain per filter-window, maximum
- Individual Automatic Gain Control (AGC) per filter ensures effective recuperation of weak signals from far-end or worst case situations users, despite other strong simultaneous signals on-scene. AGC delivers constant output power level per channel regardless of their input level variations.
- High Input Sensitivity (<= -110 dBm) with programmable Individual Rx Threshold level (Squelch) per filter-window.
- Software-Defined Radio System architecture.
- Fully software programmable channel frequencies, monitoring and control settings & status indicators.
- High-linearity/ low-noise analog processing blocks.
- Embedded microcontroller for control and self-monitoring functions.
- Remote control via web-server.
- Discrete Digital I/O alarm signals available,
    - Opto-coupler inputs and relay contact outputs
- AC powered

D.4 SPECIFICATIONS

Parameter	Specification
Frequency range: Customs windows can be accommodated within the uplink/downlink sub-bands Contact Canam with your specific frequency plan	806-817 MHz / 851-862 MHz overall range The system bandwidth per path (UL & DL) may be specified as 3, 7, 10, 15 or 18 MHz USA post re-banding: 806-817/851-862 MHz
Minimum Sensitivity for greater than 20 dB output SINAD (DAQ 3.4) (excluding custom-built pre-selector cavity filters)	-110 dBm @ SINAD >= 20 -115 dBm @ SINAD >= 12 dB
Narrowband filters Selectivity – Adjacent Channel Rejection (ACR)	20-70 dB, per filter mask (programmable)
Absolute Group Delay	10-110 usec, per filter mask (programmable)
Example of model "30 Di" filter mask :	BW = 64 kHz @ -3dB passband typ. ACR ≥ 70dB @ +/- 75 kHz Group delay ≤ 30 usec (typ.)
Channel bandwidth	25kHz
Filter center frequency spacing	6.25kHz, 12.5kHz or 25kHz steps
Narrowband small-signal gain per filter window	120 dB max.
Narrowband Automatic Gain Control (AGC) range on a per-filter window basis	50 dB typ.
Maximum input power (composite) for no-damage	-20 dBm (typ.), or subject to custom factory build option
Input (Rx) IM Rejection, per TIA standard	>60 dB
Narrowband Constant Output level regardless of input level variations, per filter	+/- 1 dB typ
Broadband input Automatic Level Control (iALC) range to prevent Rx/front-end undesired saturation	0-30 dB, 1 dB digital step (automatic)
Analog FM Modulation Distortion & Digital Modulations B.E.R.	≤ 3%
Noise Figure (without custom front-end filtering or padding)	7 dB typical
Broadband output level adjustment range	1-30 dB typ. 1dB digital step
Output MCPA IMD at +25 dBm per channel, all channels transmitting	≥ 60 dBc typ.
Output Multi-Carrier Power Amplifier P1dB	≥ +47 dBm (50Watt)
Spurious & harmonics outputs	<-36 dBm (EU), <-13 dBm (US Narrow)
Input & Output RF ports (typ)	50 Ohm, Type-N (female), 1.5:1 VSWR

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Parameter	Specification
MAJOR SOFTWARE DEFINED FIELD-PROGRAMMABLE SETTINGS	
Narrowband Filters selectivity and bandwidth	(firmware system personality)
Filters central frequencies (Fo) in 3.125 KHz steps	
Input (Rx) Threshold level, per narrowband window/filter	
Output Power level, per channel or overall	
Receive Signal Strength Indicator level – RSSI, per window	
Number of filters per path (depending on selected firmware mask)	10 or 20
CTCSS PL Tone detection (programmable)	
OTHER	
4RU or 6RU Rackmount enclosures (total rack space depends on custom filtering requirements per actual user frequency plan)	NEMA-1
Wallmount enclosure (NEMA 12/4/4X)	Available upon request
Duty Cycle	100 %
Operating ambient temperature range	-30 to +60° Celsius standard
MBTF	> 50,000 hours (RF only) > 40,000 h (fiber-fed)
Power requirements @ full load (actual power draw depends on actual system configuration)	300 Watt max @ 100-240 Vac, 50/60 Hz 28 VDC input OPTIONAL
FIBER OPTICS (optional)	
Frequency Range	10 – 1000 MHz
Gain Flatness	±1 dB
Input Third Order Intercept	+13dBm
Noise Figure / Noise Floor	23dB / -110dBm @ 10kHz BW
Laser Type	DBF / 1310nm ± 20nm (CWDM available)

Parameter	Specification
INTERFACES, REMOTE CONTROL AND MONITORING	
Non-Intrusive (tap) coax RF ports	Type-N (female), 50 Ohm
Network remote control (Ethernet 10/100)	TCP/IP: web server, SNMP
PC Software	Any generic web-browser
Local Debug Port	Serial RS-232

Local Human-Machine-Interface	LCD display with 7-button keypad, plus LED Indicators
Factory-Programmable-function Discrete Digital I/O (Dry contact, voltage-free)	4 Relay output contacts 4 Opto-isolated inputs
Internal Sensors, overall system	Temperature, DC Voltage/Current, Locked-rotor cooling fan monitoring, Output RF Forward & Reverse, Input RF Composite Power (DL and UL) True-RMS RF Detectors/Limiters (In/Out)
CUSTOM BUILD OPTIONS	
Duplexer/Multiplexer filters for common Tx/Rx antenna, or separate DL and UL paths (custom build)	
Low noise RF-over-Fiber-Optic transceiver	
Multi Carrier Power Amplifiers (MCPA) are optional per system requirements	
CTCSS Analog PL Tone Detection	
NFPA72-2010 compliant or Custom Input/Output status/monitoring functionality, for example: Open door, Low-Battery, AC Power Failure, Smoke detector, Strobe light or Siren indicator, etc.	
Sensors DC Voltage Buffered Outputs 0-5V for external SCADA monitoring: MCPA DC Voltage/Current, Composite RF Output power, Temperature, RF output, ALC monitor, or others upon custom demand.	
Frequency (shift) in-band translator	

D.5 FRONT AND REAR PANEL PORTS AND INTERFACES

Figure 2 shows the system front panel. A brief explanation is given in Table 1.

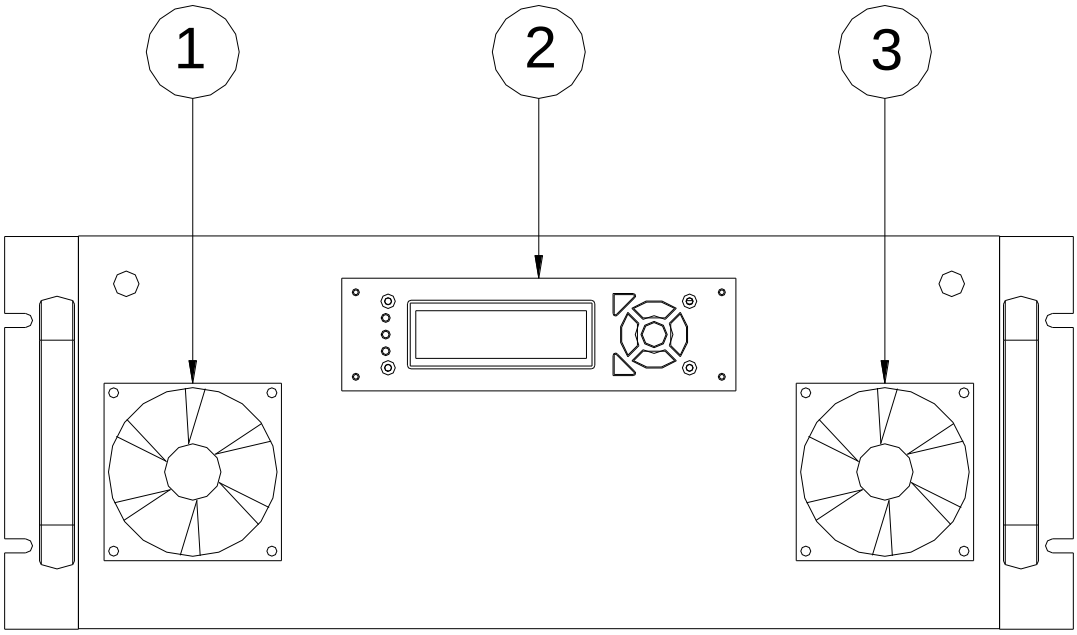

Figure 2 - Front Panel details

Table 1 – Front Panel details

Item	Description
1	Intake fan 1
2	LCD Display/Keypad
3	Intake fan 2

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Figure 3 shows the system rear panel. A brief explanation of each connector is given in Table 2.

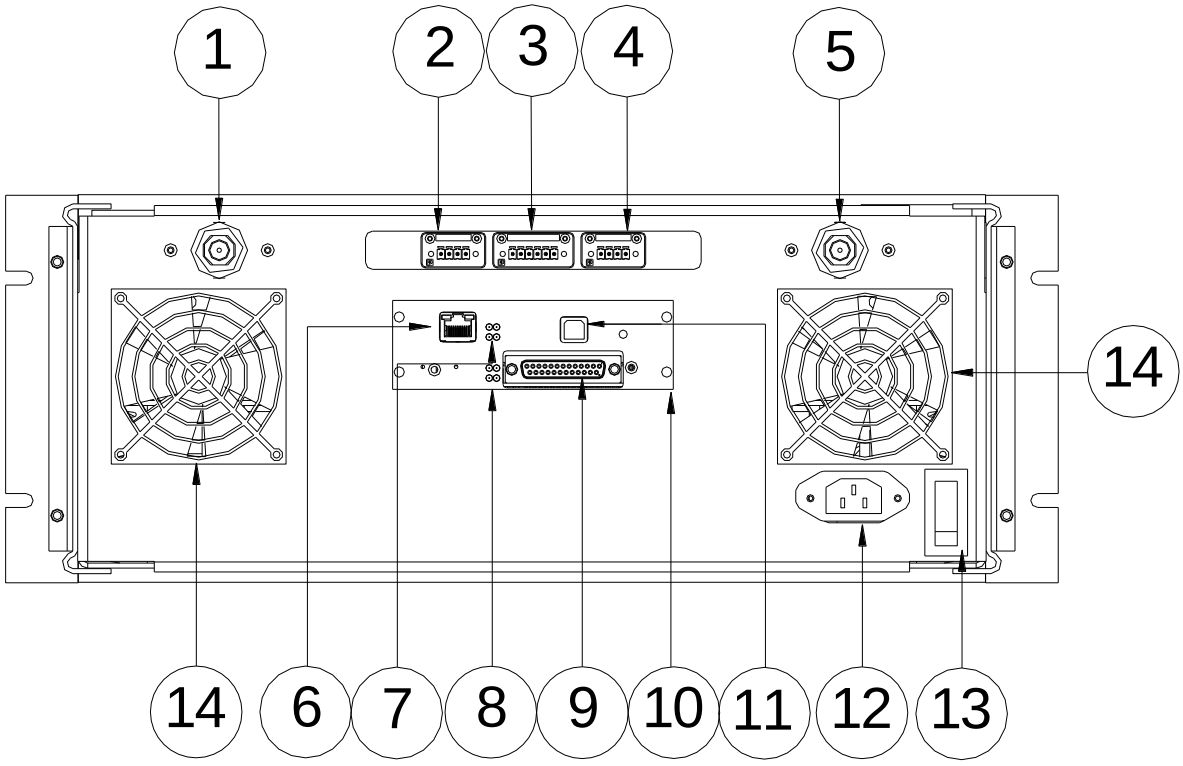

Figure 3 - Rear Panel details.

Table 2 – Rear Panel details.

Item	Description
1	DONOR/BASE T/R PORT
2	FAN 1 DE-01
3	AUX I/O DE-02
4	FAN 1 DE-03
5	SERVICE/SIDE T/R PORT
6	(ECM) ETHERNET 10/100 NETWORK PORT
7	(ECM) GREEN LEDS STATUS INDICATORS
8	(ECM) RED LEDS (RELAY CONTACTS)
9	(ECM) DB-25 I/O CONNECTOR
10	PLUGGABLE EMBEDDED CONTROL MODULE (ECM)
11	(ECM) FACTORY USB DEBUG PORT
12	AC POWER "IEC" INLET
13	AC MAINS ON/OFF POWER SWITCH
14	AIR EXHAUST REAR FANS

D.6 LCD-DISPLAY & KEYPAD ASSEMBLY

The LCD Display/keypad assembly allows the user/technician to read the system's meters, alarm status signals and system information.

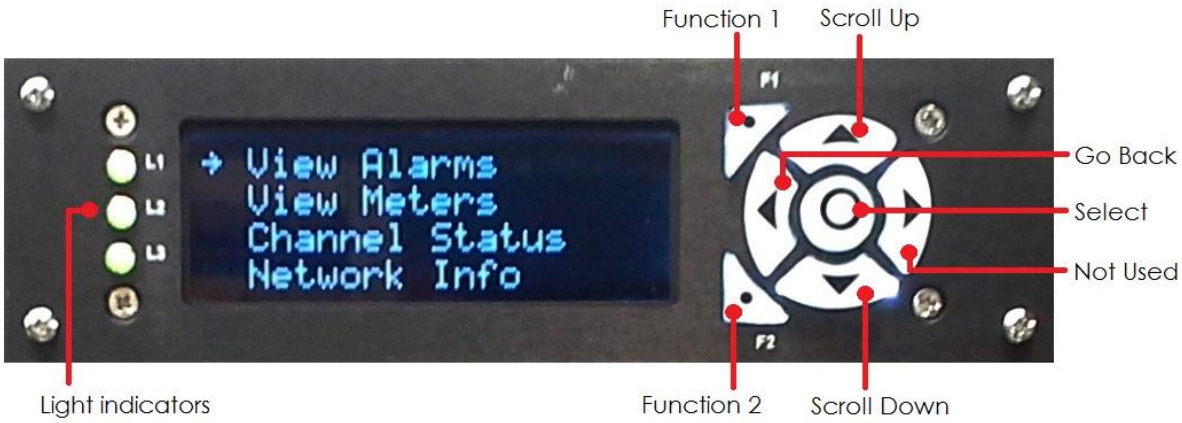

Figure 4 – LCD and Keypad Interface

Up and Down arrow are used to scroll up and down in the given menus, while the round button in the middle are used to select a desired option in the menus.

The information shown by the light indicators is factory configurable. The Function 1, Function 2 and the Right arrow buttons are not used in the model described in this document.

If the user wishes to go back to the main menu, use the Left arrow Key. It is possible to press the Left arrow or the *select* keys at any time, to jump directly to the desired menu.

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Table 3 – Alarm available at the Front Panel LCD

Parameter	***Possible values***	***Remarks***
Summary Alarm	OK /BAD	Master Summary Alarm
DSP Conf Stat	OK /BAD	Status DSP Configuration
UL FWD Alarm	"N/A"/OK/BAD	UL MCPA Forward Power Alarm
DL FWD Alarm	"N/A"/OK/BAD	DL MCPA Forward Power Alarm
UL REF Alarm	LAT/"N/A"/OK/BAD	UL MCPA Reflected Power Alarm
DL REF Alarm	LAT/"N/A"/OK/BAD	DL MCPA Reflected Power Alarm
I PA UL	OK /BAD	UL MCPA DC current within expected range
I PA DL	OK /BAD	DL MCPA DC current within expected range
I PSU 5V	OK /BAD	PSU 5V DC current within expected range
I PSU 12V	OK /BAD	PSU 12V DC current within expected range
UL TEMPERATURE	OK /BAD	UL MCPA temperature within expected range
DL TEMPERATURE	OK /BAD	DL MCPA temperature within expected range
AIC UL IDC	OK /BAD	UL AIC current is lower than expected threshold.
AIC DL IDC	OK /BAD	DL IAC current is lower than expected threshold.
AIC UL Status	OK /BAD	UL Analog Interface Module Status
AIC DL Status	OK /BAD	DL Analog Interface Module Status
AIC UL Comm	OK /BAD	UL Analog Interface Module Communication
AIC DL Comm	OK /BAD	DL Analog Interface Module Communication
Local Osc UL	OK /BAD	UL Local Oscillator Status
Local Osc DL	OK /BAD	DL Local Oscillator Status
SubSystem UL	OK /BAD	UL SubSystem Status
SubSystem DL	OK /BAD	DL SubSystem Status
IALC ATT UL	OK /BAD	UL Analog Interface Module Attenuation Status
IALC ATT DL	OK /BAD	DL Analog Interface Module Attenuation Status
AIC Temp UL	N/A	UL Analog Interface Module Temperature
AIC Temp DL	N/A	DL Analog Interface Module Temperature
Intake Fan 1	OK / BAD	Front Panel Fan summary alarm
Exhaust Fan 1	OK / BAD	Rear Panel Fan summary alarm
Intake Fan 2	OK / BAD	Front Panel Fan summary alarm
Exhaust Fan 2	OK / BAD	Rear Panel Fan summary alarm
DSP FAN	OK / BAD	DSP Module Fan alarm

Possible values for Alarms

OK There is not alarm condition.

BAD There is an alarm condition.

LAT Applies only for High Reflected Power Alarm when a previous alarm has not been cleared.

N/A Applies only for High Reflected Power Alarm and Forward Power Alarm. It will be displayed when is not possible determinate the alarm status due the read power is lower than minimum readable.

Table 4 – Meters available at the Front Panel LCD

Parameters	*Possible values*	*Remarks*	*Units*
UL FWD [1]	---	UL Output Forward RF power (Composite)	dBm
UL REF[2]	---	UL Output Reflected RF power (Composite)	dBm
DL FWD[2]	---	DL Output Forward RF power (Composite)	dBm
DL REF[2]	---	DL Output Reflected RF power (Composite)	dBm
I PA UL	---	UL MCPA current drain	A
I PA DL	---	DL MCPA current drain	A
I PSU 5V	---	5V DC current drain	A
I PSU 12V	---	12V DC current drain	A
IAC UL	---	UL Analog Interface current drain	A
IAC DL	---	DL Analog Interface current drain	A
Temp UL	---	UL MCPA Temperature	°C
Temp DL	---	DL MCPA Temperature	°C
iATT UL	---	UL Fixed Input Attenuation	dB
iATT DL	---	DL Fixed Input Attenuation	dB

Table 5 – Filters windows (Channels) RSSI available at the Front Panel LCD

Parameters	*Possible values*	*Remarks*	*Units*
UL n: ____ dBm	>-105dBm	UL Filter n received power	dBm
DL n: ____ dBm	>-105dBm	DL Filter n received power	dBm

Notes:
[1] These values can appear as "< ##.#", when the read power is lower than minimum readable.

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Table 6 – Network Settings available at the Front Panel LCD

Parameters	***Possible values***	***Remarks***
Model Name	---	System Model Name
Serial Number	---	System Serial Number
Filter Model	---	Depends on firmware
IP Address	---	System IP ADDRESS
Subnet Mask	---	System Subnet Mask
Default Gateway	---	System Default Gateway

Section E. INITIAL CONFIGURATION

Canam Technology's Equipment is factory configured. All setup and wiring is performed by Canam's Personnel. There is no need to disconnect the equipment unless the units should be serviced.

If any module should be disconnected, it should only be done by qualified technical personnel.

The unit operates stand-alone and only requires initial configuration, by means of the Web Server Interface (over its LAN Ethernet interface).

The following guidelines provide information on how to get started with the unit.

- Make sure the power switch is **OFF**, and plug the AC power cord into the IEC inlet receptacle.
- Provide a connection from the off-air antenna interface to Antenna Rx Input.
- Provide a connection from the in-tunnel (in-building) antenna point-of-interface to the DONOR/BASE T/R PORT and SERVICE/SIDE T/R PORT.
- The dry-contact alarms are available on a pluggable mini-terminal block on the shelf's rear panel DB-25 connector.
- Additional I/O signals are available on a 6-contacts pluggable terminal block.
- The technician's computer shall be networked with the device, by means of an Ethernet switch/hub or a direct PC-to-device connection using a crossover cable. The computer shall have a Mozilla's Firefox web-browser software installed, or similar.

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- Provide a network connection to the system, directly into the ECM LAN port.
    - Use an Ethernet crossover cable for direct connection to a PC computer LAN port.
    - Use a standard straight-thru cord when using a network switch/hub connection

Once the physical connection has been established, power-on the device. Wait a 2 minutes period for the embedded management software to load-up.

After the load up is completed, the device's LCD display will look like this once:

→ View alarms
View meters
Channel Status
Network Info

Now the device is ready for management functions using the web-browser on the PC computer.

E.1 GENERAL GUIDELINES REGARDING RF CONNECTIONS & OPERATIONS WITH TEST INSTRUMENTS

- ✓ Mute the MCPA prior to connect a signal source to the DONOR/BASE T/R PORT or SERVICE/SIDE T/R PORT.
- ✓ Avoid excessive input power.
    - Do not drive the input signal above -20 dBm, which is the recommended maximum input level (composite).
- ✓ Make sure your RF Test Instrument (Communications Monitor, Spectrum Analyzer, etc) has an input port rated for high RF power.
    - Do not exceed the test-instrument's input rating.
- ✓ The system has been limited to a maximum gain of 120 dB. A -100 dBm sensitivity will limit to +20dBm maximum output, and so on. For example, to set one channel to +27 dBm desired output, the user may choose to set the RX Threshold to -90 dBm (or -93 dBm minimum).

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E.2 ANTENNA INSTALLATION

The DONOR/BASE T/R and SERVICE/SIDE T/R antennasT are not included with this equipment. Nevertheless, if this device is used in an application that requires direct connection to an antenna, Canam Technology recommends following the FCC guidelines for its installation:

- Antenna Installation should be performed by qualified technical personnel.
- The installations instructions are for the purpose of complying with FCC RF Exposure and are not optional.
- All antennas should be fixed mounted and physically secured to one location.
- Non-building mounted antennas must be greater than 10 meters above ground.
- Minimum Separation to any body part of any person is 25cm.

Section F. WEB-SERVER GRAPHICAL USER INTERFACE

F.1 FIRST-TIME START CONFIGURATION

The system can be connected directly to PC computer using an Ethernet crossover cable or to LAN using a standard straight-thru cord when using a network switch/hub connection.

Section F.1.1 shows how to interface a computer directly to the system using a cross-over cable in case there is no network switch available.

Section F.1.2 shows how to interface the computer to the RF device by means of a network Ethernet switch.

Before to access system built-in Web Server verify your web browser is working with java script enabled.

These are some web links showing HOW-TO enable java script.

https://support.microsoft.com/en-us/gp/howtoscript

F.1.1 CONNECTING SYSTEM DIRECTLY TO PC COMPUTER

Use an Ethernet crossover CAT5 cable for direct connection to a PC computer LAN port.

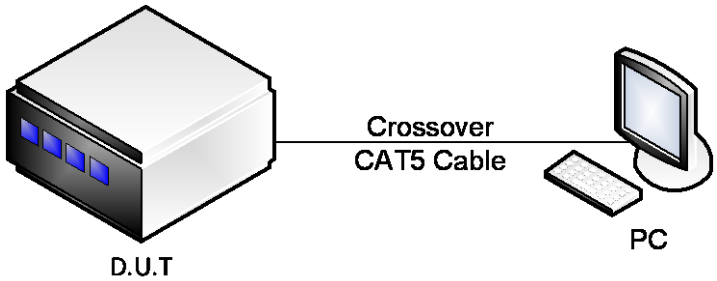

Figure 5 – System connected directly to PC computer.

- Connect the system to PC computer directly into the ECM LAN port.
- The equipment IP address (192.168.100.75) and Network Mask (255.255.255.0) are shown in the LCD display.

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- To verify IP address press the Down key in LCD Display and Keypad assembly until get IP ADDRESS and SUBNET MASK values.

- Configure the local computer IP address and Network Mask to allow access to the controller, within the same sub-net.

Windows 7

1. Go to **"Start >> Control Panel >>Network and Internet"**.
2. Left-click on **"View network status and tasks".**
3. In **"Network and Sharing Center"**, right click on **"Local Area Connection"** and go to **"Properties**".

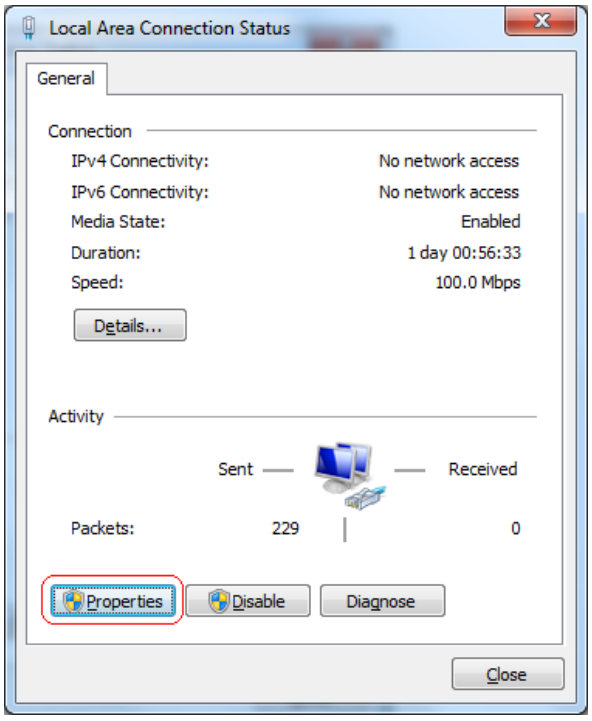

Figure 6 – Local Area Connection Status.

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4. Look for **"Internet Protocol Version 4 (TCP/IPv4)"** and click **"Properties".**

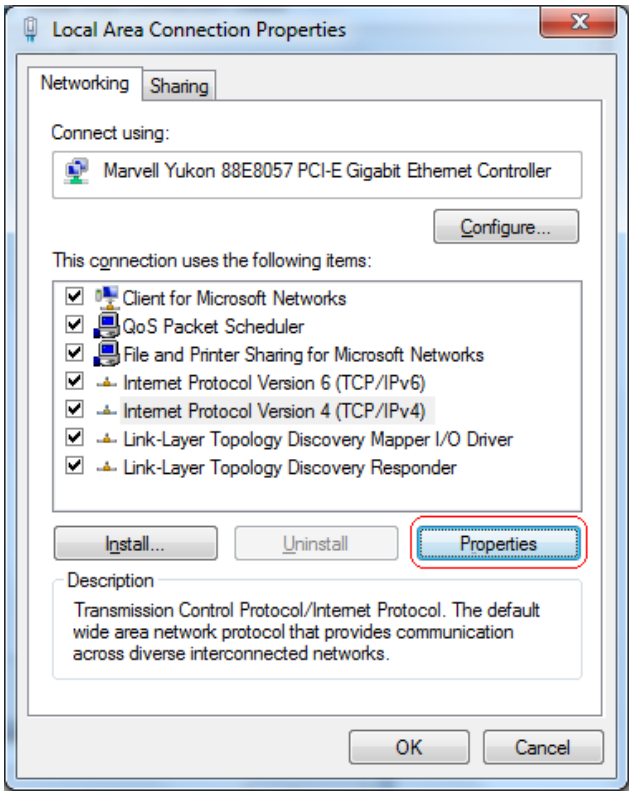

Figure 7 – Local Area Connection Properties.

5. Follows steps 4 and 5 as for Windows XP.

- Open a web browser and access the equipment by typing, in the address bar, the IP address of the equipment (ex.: http://192.168.100.75).
  - Login with username = operator, password = operator.

F.1.2 CONNECTING SYSTEM TO LOCAL AREA NETWORK

Use standard straight-thru cable for network switch/hub connection.

To connect system to LAN, it is necessary to know the subnet the PC computer is currently plugged into.

If no network is available the user shall remain using the crossover interconnection

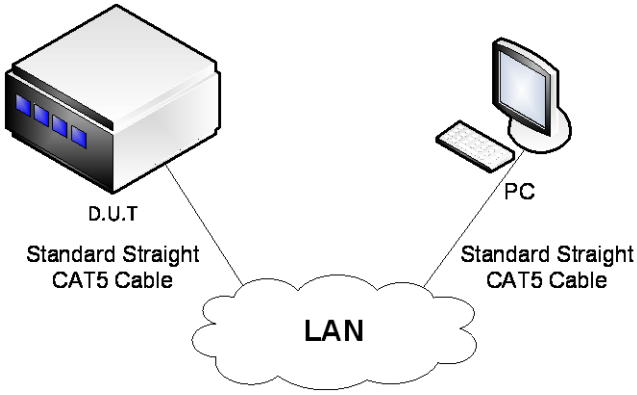

Figure 8 – System connected into local area network.

The following steps are necessary to connect system to LAN:

1. Connect the radio system and the computer together by means of ethernet switch.
2. The radio system has a default IP address similar to 192.168.100.75 (S.M. 255.255.255.0)
3. Configure the computer's IP address within the same subnet as the radio system, 192.168.100.X (for example 192.168.100.75, S.M = 255.255.255.0) as shown in previous section.
4. Open a web browser and access the equipment by typing, in the address bar, the IP address of the radio equipment (http://192.168.100.75).
5. Login with username = operator, password = operator

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User may change the radio system's IP Address to a different subnet setting if desired.

1. First, it is necessary to connect system directly to PC Computer using the crossover cable.
2. Open a web browser and access the equipment by typing, in the address bar, the IP address of the equipment.
   - Login with username = technician, password = technician.
3. Go to the "Network Settings" page (see left-side menu) to change the current settings to be assigned by the network administrator.
   - IP Address, Network Mask, Gateway Address.
   - The controller requires a fix address; it does not allow DHCP settings.
   - Enter or press "Apply" button to apply the new parameters, and then restart the system.
   - Now the system controller can be plugged into the local area network served by your LAN Switch or Router.

F.2 WEB SERVER OPERATIONS

The built-in Web Server provides a Graphical User Interface (GUI) to ease in remote monitoring & control. Some pages shown by the Web Server are the following:

- "Main Status": depicts status alarm indicators and meters.
- "Filter Status": depicts filter windows status and indicators.
- "Main Settings": is used to configure system-level macro settings.
- "Filter Settings" contains the settings that can be configured for each filter window.

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F.2.1 MAIN STATUS PAGE

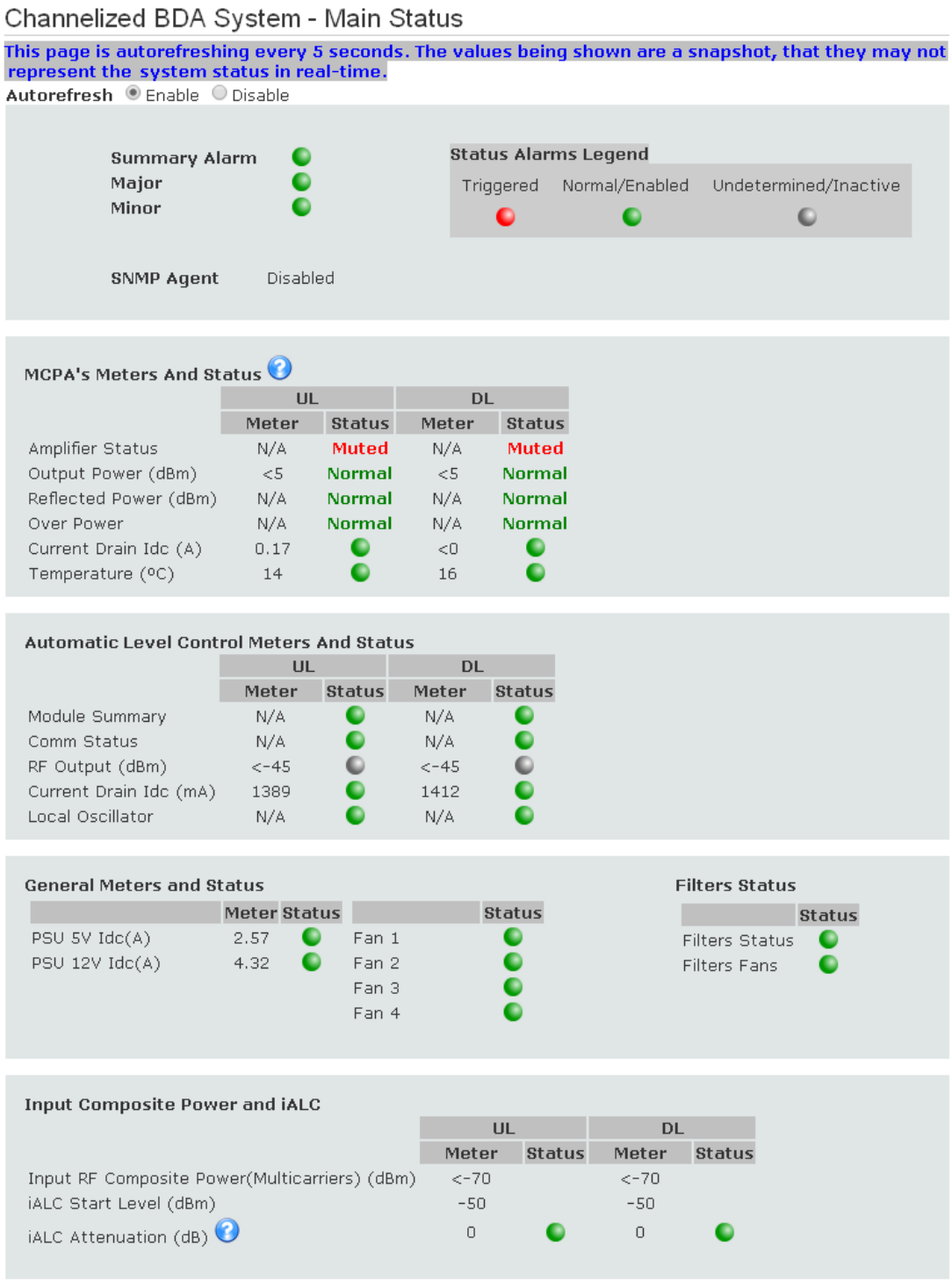

Figure 9 – Main Status page

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This page shows meters and the different alarms and meters. The auto-refresh radio-button allows periodic page updates every 5 seconds approximately.

Summary Alarm	Master Summary alarm Indicator. Green if no single alarm is present in the system, red otherwise.
Major Alarm	Major Alarm indicator. It summarizes the DSP Modules Status alarms, the RF Output Status alarm and the off-air Receive Warning alarm. The indicator is Green if all this alarms are ok, red otherwise.
Minor Alarm	Minor Alarm indicator. It summarizes the alarms that concern to the Fan status, current consumption and temperature status. The indicator is Green if all this alarms are ok, red otherwise.
SNMP Agent	Shows the SNMP Agent current status.

MCPA's Meters and Status

Amplifier Status	Indicates if the MCPA Output is "Unmuted", "Muted" or "Muted by Alarm"(in case the MCPA Reflected Power Alarm is "Triggered" or "Latched" and the option "Enable Automatic Mute upon Reflected Power Alarm" has been selected in Main Settings page).
Output Power (dBm)	Composite Output Power. The Status will be "Undetermined" when the power is not readable; "Normal" when it is above the threshold and "Triggered" if it is below the threshold.

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Reflected Power (dBm)	Composite Reflected Power. The Status will be "Undetermined" when the power is not readable; "Normal" when it is below the threshold; "Triggered" if it is above the threshold and "Latched" when a previous Reflected Power Alarm has not been cleared.
Current Drain Idc (A)	MCPA DC current drain. The Status indicator will be green when the current is within the operating levels, red otherwise.
Temperature (°C)	MCPA heat-sink temperature. The Status indicator will be green when the temperature is within the operating levels, red otherwise.

Analog Interface Meters and Status

Modules Summary	Indicator is Green if module is active with no alarms, red otherwise.
Comm Status	Indicator is Green if Analog Interface Card communication is working, red otherwise.
RF Output (dBm)	Composite Output Power. This is the multi-carriers signal coming out of the DSP filtering process, used to drive the broadband output MCPA. The Status indicator will be green if the power is above the threshold, gray otherwise (no traffic).
Current Drain Idc (mA)	Analog-Module DC Current Drain (mA). The Status indicator will be green when the current is above the threshold, red otherwise.
Local Oscillator	Indicator is Green if Local Oscillator is locked, red otherwise.

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General Meters and Status

PSU 5V Idc (A)/ PSU 12V Idc (A)	5Vdc/12Vdc current meter. Indicator is green if current is within the operating levels, red otherwise.
Fan 1/ Fan 2	Indicator. Green if front fans are fully operational as detected by the air flow sensors; red otherwise.
Fan 3/ Fan 4	Indicator. Green if rear fans are fully operational as detected by the air flow sensors; red otherwise.
Filter Status	Indicator. It will be green if DSP Module firmware or communication are working as expected; red otherwise. In case the alarm is triggered (indicator red), the icon ⚠ DSP Not Responding is displayed in Main Status, Filter Status UL, Filter Status DL, Filter Settings UL, Filter Settings DL and Filters Configuration Pages. Any action related to DSP Filters configuration is blocked. In addition, the MCPAs are automatically muted. The message "Both MCPA have been automatically muted due to a DSP Module Alarm" is displayed in Main Settings page.
Filter Fans	Indicator. DSP module fan is fully operational; red otherwise.

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Input Composite Power and iALC

Input RF Composite Power (Multicarriers) (dBm)	Received level (composite) near or within the limiter range. For RSSI per filter window above -105dBm please go to Filters Status page.
iALC Start Level (dBm)	Input Automatic Level Control limiter threshold.
iALC Attenuation (dB)	Input Automatic Level Control attenuator dynamic value. Valid for CW signals, intended for maintenance purposes. The Status indicator will be green when the value is less than 1; yellow is the value is greater than 1 but less than 15; red otherwise. The iALC input Attenuation is automatically set by the system in order to limit the Input RF Composite Power at the value indicated as iALC Set Point. If the Input RF Composite Power is greater than iALC Start Level it is attenuated to avoid system saturation.

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F.2.2 FILTER STATUS PAGE

It shows the incoming Receive Signal Strength ("RSSI") within each filter passband window.

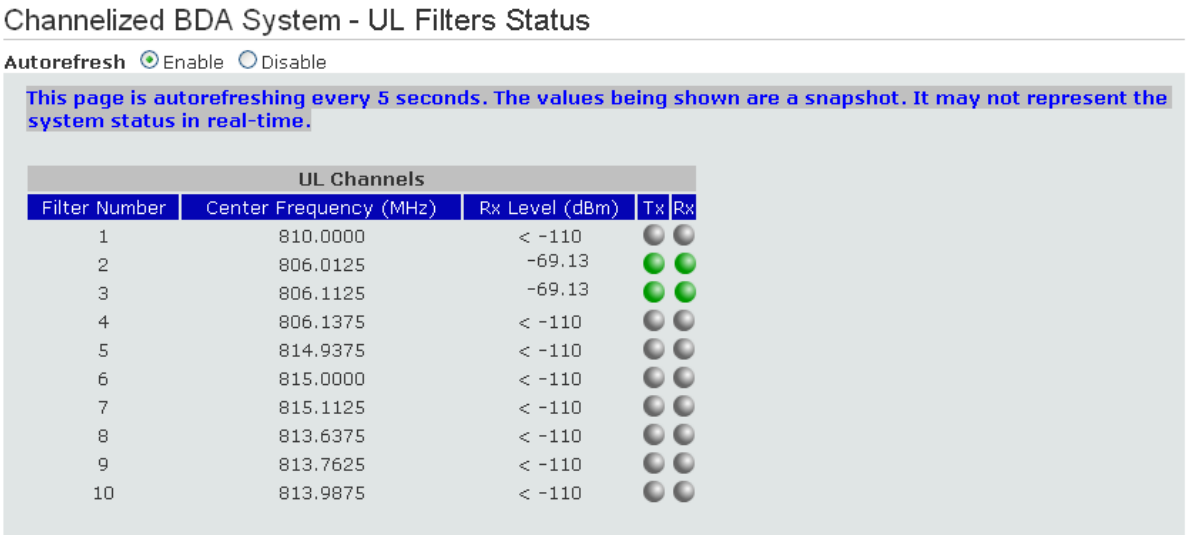

Figure 10 – Filter Status page

Filter Number	Processing slot number.
Center Frequency (MHz)	Filter Center Frequency.
Rx level (dBm)	RSSI meter reading.
Rx Status	Filter Rx Status. Indicator is green is filter Rx Level is above filter Rx Threshold; grey otherwise.
Tx Status	Filter Tx Status. Indicator is green is filter is transmitting; grey otherwise.

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F.2.3 MAIN SETTINGS PAGE

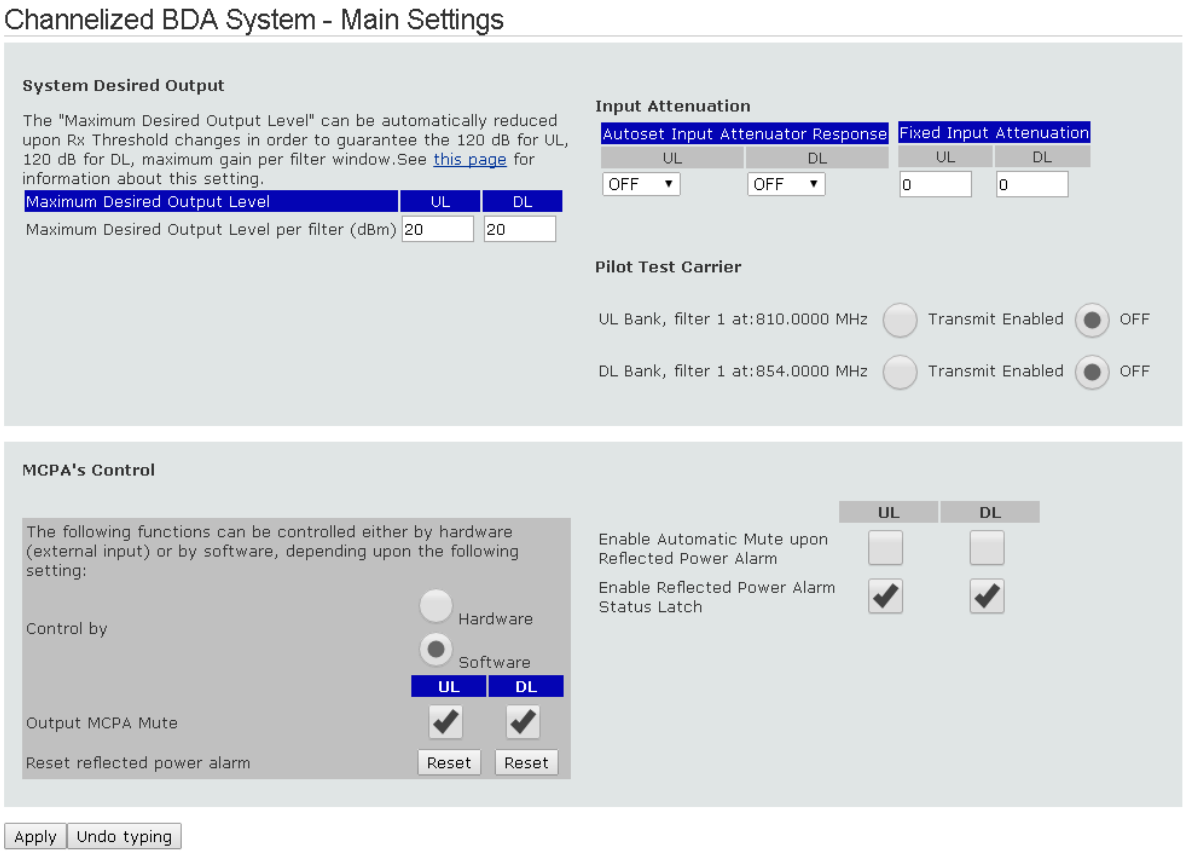

Figure 11 – Main Settings page

The Main Settings page is for configuring general system-level macro settings.

F.2.3.1 Maximum Desired Output Level per filter(dBm):

- ✓ Allows the configuration of the output level such as the maximum gain per sub-band will be less than or equal to 120dB.
- ✓ The specified value cannot be modified in case the maximum gain would be greater or equal than 120dB.

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- ✓ The Maximum Desired Output Level is the user setting or goal set point for the RF Output power level per filter window, subject to the following:

  Due to the Automatic Gain Control (AGC) function, the system calculates the Gain starting at the minimum signal level able to be received, which is defined by the Rx Threshold (Squelch) setting. Signals coming in at that threshold level will be amplified a maximum of 120 dB. Therefore:

  - Actual Maximum Desired Output(Set-point) <= Min Rx Threshold + 120dB.

    THUS: The User entered Set-point may be automatically reduced to meet the maximum 120dB Gain. For example, this will happen if the User reduces an Rx Threshold setting.

  - The Desired Output (Set-point) values are limited by this constraint.

  - This equation is driven by the lowest Rx Threshold value in the filters bank, i.e. if at least one filter is set lower than the rest, that value drives the output Set-Point for the entire bank.

F.2.3.2 Input Attenuation Control

AutoSet Input Attenuator Response	Select the response speed for the Fixed Input Attenuator shown in Main Status page.
Fixed Input Attenuation	The fixed input attenuation can be modified if the "AutoSet Input Attenuator Response" is OFF. In other modes (FAST, MED and SLOW) this text field will be disabled and the fixed input attenuation can change automatically.

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F.2.3.3 Pilot test carrier

The pilot test carrier is related to each bank first channel at current first channel frequency.

The test carrier may be ON (transmitting) when the pilot test carrier setting is enabled and the first filter in each bank has checked Tx Enable.

F.2.3.4 MCPA Control:

For the "Output MCPA Mute" and "Reset Reflected Power Alarm Reset" commands, the user can set the preferred control method by choosing Software or Hardware in the "Control by" field.

Output MCPA Mute	Mute/un-mute MCPA
Reset Reflected Power Alarm	Clear the Reflected Power Alarm Latch.

a. If the user chooses hardware control, the controller will respond to the opto-isolated inputs located in the ECM I/O DB25 Connector and the software commands for these two parameters will have no effect.

   The Reset Reflected Power Alarm command mapped to ECM I/O DB25 Connector can be controlled through pins 3 and 4 for both Service Side (DL Tx) and Donor Base (UL Tx) outputs.

   The Power Amplifier Mute command mapped to ECM I/O DB25 Connector can be controlled through pins 1 and 2 for both Service Side (DL Tx) and Donor Base (UL Tx) outputs.

   When "Control by Hardware" is selected the UL and DL MCPAs are automatically un-muted unless the corresponding opto-isolated input is energized.

b. On the other hand, if the user chooses software control, the controller will respond to these software commands instead of to the opto-isolated inputs.

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Also, there two settings that can be controlled using software commands:

Enable Automatic Mute upon Reflected Power Alarm	Check-box to enable/disable automatic MCPA mute upon excessive reflected power.
Enable Reflected Power Alarm Status Latch	Check-box to enable/disable the alarm status latch.

F.2.3.5 Updating operational settings

- Write down the desired value in corresponding field.
- Using the checkboxes click to check/un-check.
- Press enter or "Apply" button for the system to validate the data and apply changes.
    - If the value is not valid, an error message will be displayed (see Figure 12) and the new value will be not accepted keeping the previous value.
- The current state applied to system is saved to the controller's internal nonvolatile memory for effective recovery after a power loss or system reset.

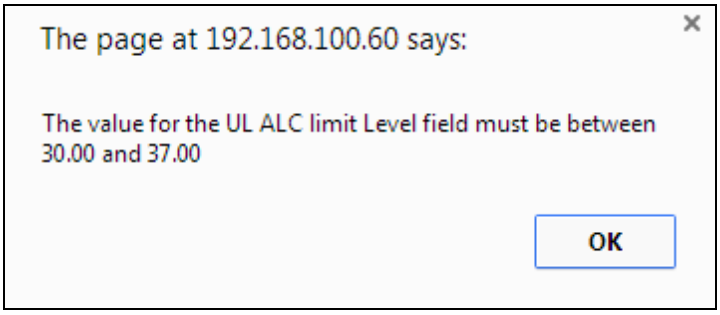

Figure 12 – Value is not into valid range error message

F.2.4 FILTER SETTINGS PAGE

In this page the user can configure the filters as follow:

- The "Apply to all filters" section (Figure 13) allows configuring all filters per bank using the same Rx Threshold, Hysteresis, Fine-Tune Output Level, CTCSS Tone Enable and Tx/AGC enable status.

  Pressing the "Apply" button (it is enabled upon a setting change) the values in the fields will be applied to all filters.

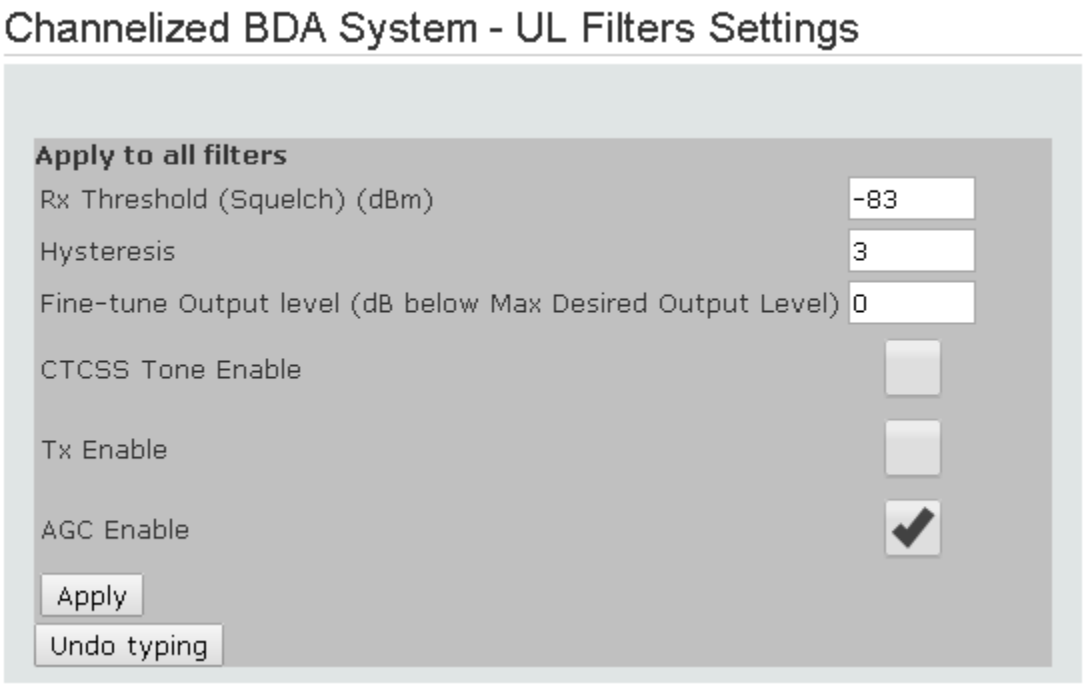

Figure 13 – Filter Settings page (1/2)

- The user may define the settings for each filter window as is shown in Figure 14.

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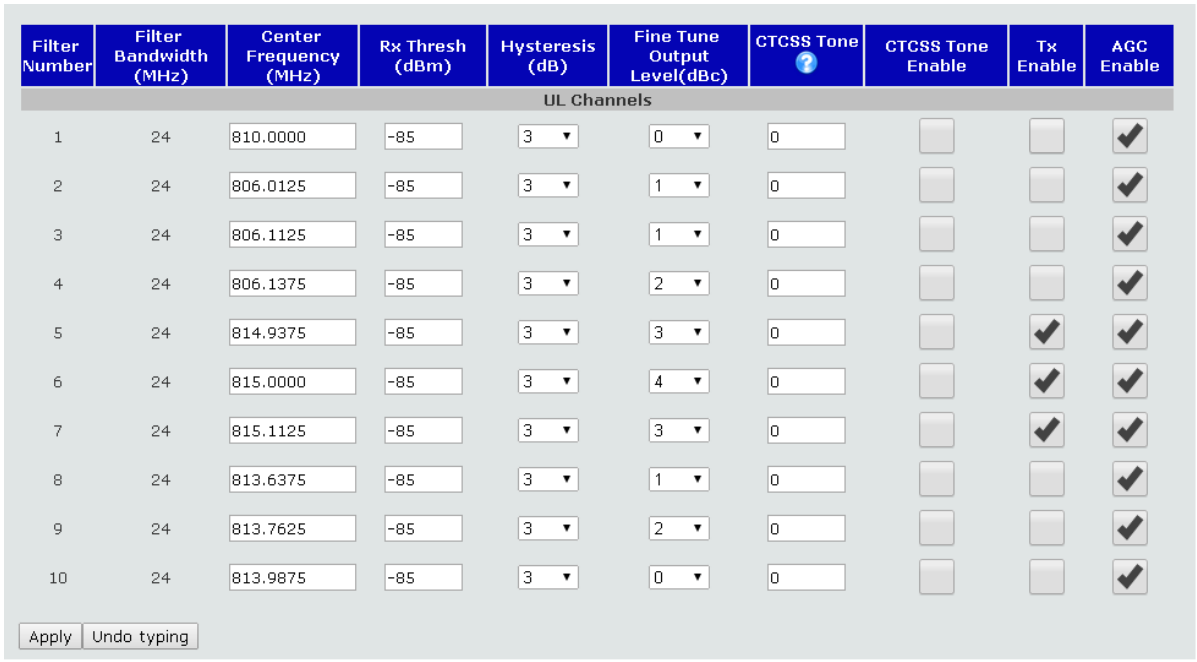

Filter Number	Filter Bandwidth (MHz)	Center Frequency (MHz)	Rx Thresh (dBm)	Hysteresis (dB)	Fine Tune Output Level(dBc)	CTCSS Tone	CTCSS Tone Enable	Tx Enable	AGC Enable
UL Channels									
1	24	810.0000	-85	3	0	0	☐	☐	☑
2	24	806.0125	-85	3	1	0	☐	☐	☑
3	24	806.1125	-85	3	1	0	☐	☐	☑
4	24	806.1375	-85	3	2	0	☐	☐	☑
5	24	814.9375	-85	3	3	0	☐	☑	☑
6	24	815.0000	-85	3	4	0	☐	☑	☑
7	24	815.1125	-85	3	3	0	☐	☑	☑
8	24	813.6375	-85	3	1	0	☐	☐	☑
9	24	813.7625	-85	3	2	0	☐	☐	☑
10	24	813.9875	-85	3	0	0	☐	☐	☑

Apply Undo typing

Figure 14 – Filter Settings page (2/2)

Filter Number Read-only attribute. Processing slot number.

Filter Bandwidth (kHz) Read-only attribute. The filter Bandwidth is defined by the Filter Configuration currently loaded.

Center Frequency (MHz) Filter Center Frequency (MHz).

Rx Threshold (dBm) Rx Squelch Level.

Hysteresis (dB) Rx Squelch hysteresis.

Fine-Tune Output Level (dBc) It is a fine-tuning control that provides 5 dB range. It is use to define how many dB below of Maximum Desired Output Level will the particular signal be.

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CTCSS Tone CTCSS Tone Frequency. In order to choose the tone frequency, write one of the codes shown in Table 7. Also, this table will be shown in a pop up window when you pass the mouse pointer over symbol.

CTCSS Tone Enable CTCSS enable/disable.

Tx Enable Transmitter ON/OFF.

AGC Enable Automatic Gain Control ON/OFF.

Table 7 – CTCSS Tone frequency codes.

Code	CTCSS Frequency (Hz)
0	67.0
1	69.3
2	71.9
3	74.4
4	77.0
5	79.7
6	82.5
7	85.4
8	88.5
9	91.5
10	94.8
11	97.4
12	100.0
13	103.5
14	107.2
15	110.9
16	114.8
17	118.8
18	123.0
19	127.3
20	131.8

Code	CTCSS Frequency (Hz)
21	136.5
22	141.3
23	146.2
24	151.4
25	156.7
26	162.2
27	167.9
28	173.8
29	179.9
30	186.2
31	192.8
32	203.5
33	206.5
34	210.7
35	218.1
36	225.7
37	229.1
38	233.6
39	241.83
40	250.33
41	254.13

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Useful Tips for configuring Filters

- Center frequency corresponds to the filter-window center. For narrowband windows, please make sure the programmed frequency corresponds to the actual radio signal frequency to avoid interference.
- The Fine Tune Output Level setting is used for adjusting down the carrier power level on an individual "per-window" basis, and provides around 5 dB fine-tuning range.

How to update operational settings?

- Write down the desired value in corresponding field.
- Press enter or "Apply" button for the system to validate the data and apply changes.
- Using the checkboxes click once and then press "Apply" button.

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