MARK-IVD 700MHZ NARROWBAND SIGNAL BOOSTER M4DBDA7

OPERATIONS & MAINTENANCE (O&M) MANUAL

REVISION 0
SUBMITTED BY:

CANAM TECHNOLOGY, INC.

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Section A. INTRODUCTION

The MARK-IVD 700MHZ Narrowband Signal Booster (M4DBDA7) is a Class B Narrowband Signal Booster to operate within range 763-775 MHz (DL path), 793-805 MHz (UL path) for Land Mobile radio FCC Part 90.

This document is the M4DBDA7 Operations and Maintenance Manual, intended for the Radio Technical Personnel.

This manual is intended to be used with the M4DBDA7 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 M4DBDA7 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.

M4DBDA7 Key Features:

- Narrowband Class B 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.

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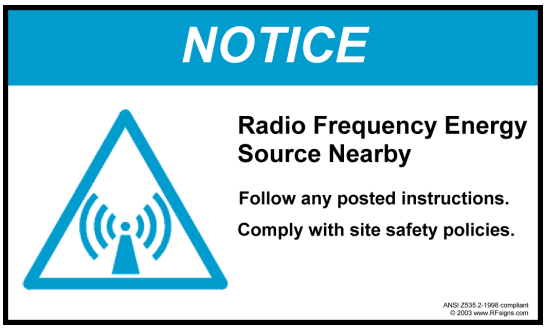
Nevertheless, there are Safety Precautions that should be adhered when performing any RF Tests:

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 M4DBDA7 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.

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D.2 FUNCTIONAL BLOCK DIAGRAM

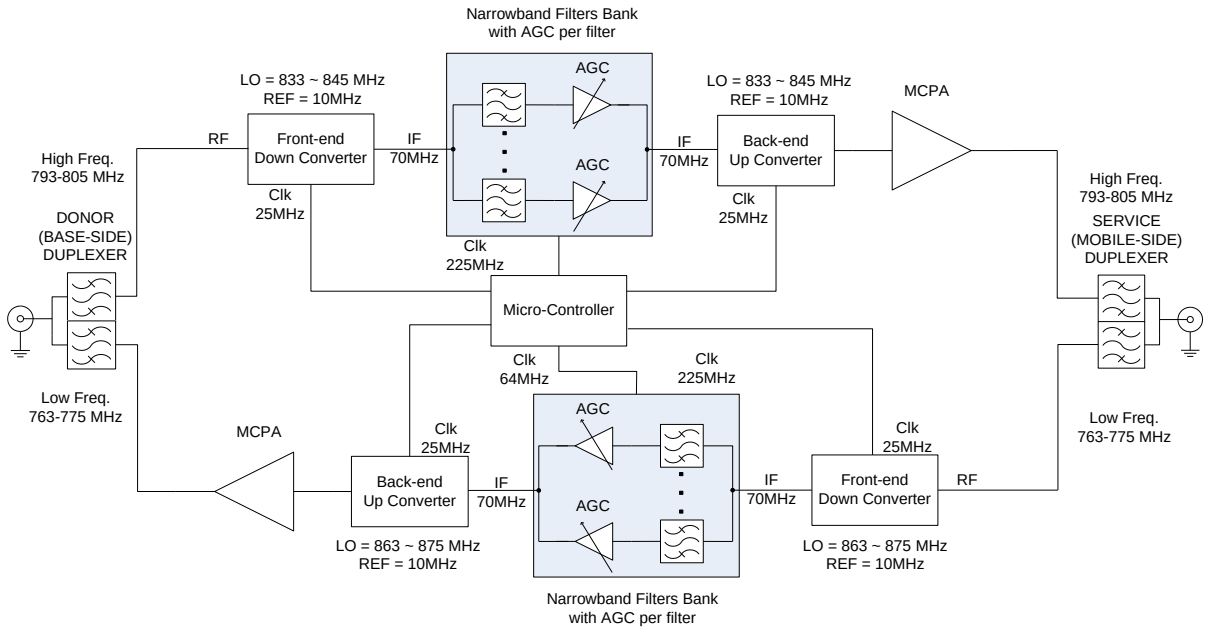

Figure 1 – M4DBDA7 General Block Diagram

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D.3 FEATURES

- 700MHZ 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 (<= -105 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

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D.4 SPECIFICATIONS

• Parameter	Spec
Frequency range:	763/769-775 MHz // 793/799-805 MHz range The overall system bandwidth per path (UL & DL) may be specified as 3, 6 or 12 MHz
Minimum Sensitivity for greater than 20 dB output SINAD (DAQ 3.4)	<-105 dBm
Narrowband filters Selectivity – Adjacent Channel Rejection (ACR)	20-70 dB. The Filters Response-Type, Group Delay, Bandwidth and Selectivity are software-defined.
Absolute Group Delay	10-120 uSec Programmable
NOTE: Absolute Group Delay, Selectivity and Response-type are software selectable off a standard library of filters or custom-filters upon order. Lower group delays are feasible at greater channel bandwidths. For example, one option can deliver ~30 usec with 70 dB rejection @ 90 kHz offset, and another option delivers <13 usec with 70 dB rejection at 200 kHz offset. **Please consult your specific requirements.**	
FIR-type filters Group Delay Variation (GDV) is very flat, the std. deviation within each filter pass bandwidth is <300 nsec. IIR-type filters GDV is low around the middle of each filter window passband (in 50% of the bandwidth), and their pass-bandwidth (PBW) is very wide but sharp enough to accommodate the stringent occupied bandwidth (OBW) requirements of all Digital Modulation protocol such as P25, iDEN, TETRA and others. Consult the specific digital filters performance.	
Analog FM Modulation Distortion & Digital Modulations B.E.R.	≤ 3%
Duty Cycle	Continuous
System small signal gain per filter window	120 dB max.
Narrowband (filter) Automatic Gain Control (AGC) range	40 dB
Constant Output level regardless of input level variations, per filter	+/- 2 dB
Broadband Input Automatic Level Control (iALC) range to prevent front-end undesired saturation, per path UL/DL	30 dB
Broadband input power attenuator adjustment range, per path UL/DL	25dB
Maximum input power (composite) for no-	-30 dBm

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• **Parameter**	**Spec**
damage, per path UL/DL at maximum sensitivity.	
Input (Rx) IM Rejection	>60 dB
System OIP3	>56 dBm
Output Multi-Carrier Power Amplifier (MCPA) capacity	>46 dBm (40 W)
FCC Certified maximum output power	37 dBm (5 W)
Output power level adjustment range per carrier (set-point)	20 dB
Output power level adjustment resolution	1 dB steps
Spurious & harmonics outputs	<-20 dBm (US), <-36 (EU)
RF Input & Output impedance (typ) MCPA with built-in output circulators for infinite mismatch or open load protection.	50 Ohm 1.5:1 VSWR
Time-out Timer	Coming Soon
Digital Modulations Support: Seamless performance with all signaling and Trunked Radio Systems, such as P25, iDEN, Motorola MCD-1200, among others.	Seamless. No headers are lost.
• **Software Defined Features (firmware build options)**	
Filters selectivity and bandwidth (factory personality, upon order)	
Filters central frequency (Fo) in 3.125 KHz steps	
Carrier detect threshold per filter window	
Output power AGC set-point level, per filter window	
Output ALC set-point per path (UL/DL)	
Adjustment of RF Power Output level per carrier, per path (UL/DL)	
Save & Load system settings, personality	
Several alarm thresholds and calibration settings	
Receive Signal Strength Indicator level – RSSI, per filter window	
User level categories and permissions	
• **Mechanical**	
Rackmount 19 in. shelf. Optional Nema 4X (IP65) wallmount enclosures upon request. Up to 10 channels per path: Up to 20 channels per path:	 4RU, 22 in. depth 6RU, 22 in. depth

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• **Parameter**	**Spec**
RF Connectors Input/Output	N-Female
Weight	4U enclosure: 44 lbs. (20 Kg), 6U enclosure: 55 lbs. (25 Kg)
Operating ambient temperature range	-30 to +50° Celsius
MTBF	> 90,000 hours
Power Requirements, 100-240 Vac 50/60Hz	450Watt
• **Interface and alarms**	
Non-intrusive RF coaxial sample test ports	50-Ohm Coaxial Type-N
Human-Machine-Interface	LCD display with 7-button keypad. LED Indicators
Computer Interface, Ethernet port	Embedded Web-server and SNMPv2 support over TCP/IP network.
Internal Sensors, overall system	Temperature, DC Current, Locked-rotor fan monitoring, Output RF Forward & Reverse, Input RF Composite Power, Input and Output RF Limiters
Summary Alarms Discrete I/O	4 Form-C Relays, 4 Opto-isolated inputs (dry-contacts)
• **OPTIONS (CUSTOM ORDERING)**	
1. 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.	
2. Duplexer for common Tx/Rx antennas, or completely separate DL and UL paths	
3. Fiber-fed, integrated very low noise RF/Optic transceivers with remote control data link	
4. Multi Carrier Power Amplifiers (MCPA) are optional, to configure the unit for RF-over-Fiber distribution	
5. Real-time clock, data-log (ALC operation and alarms) and events-log. COMING SOON.	
6. 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.	

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D.5 FRONT AND REAR PANEL PORTS AND INTERFACES

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

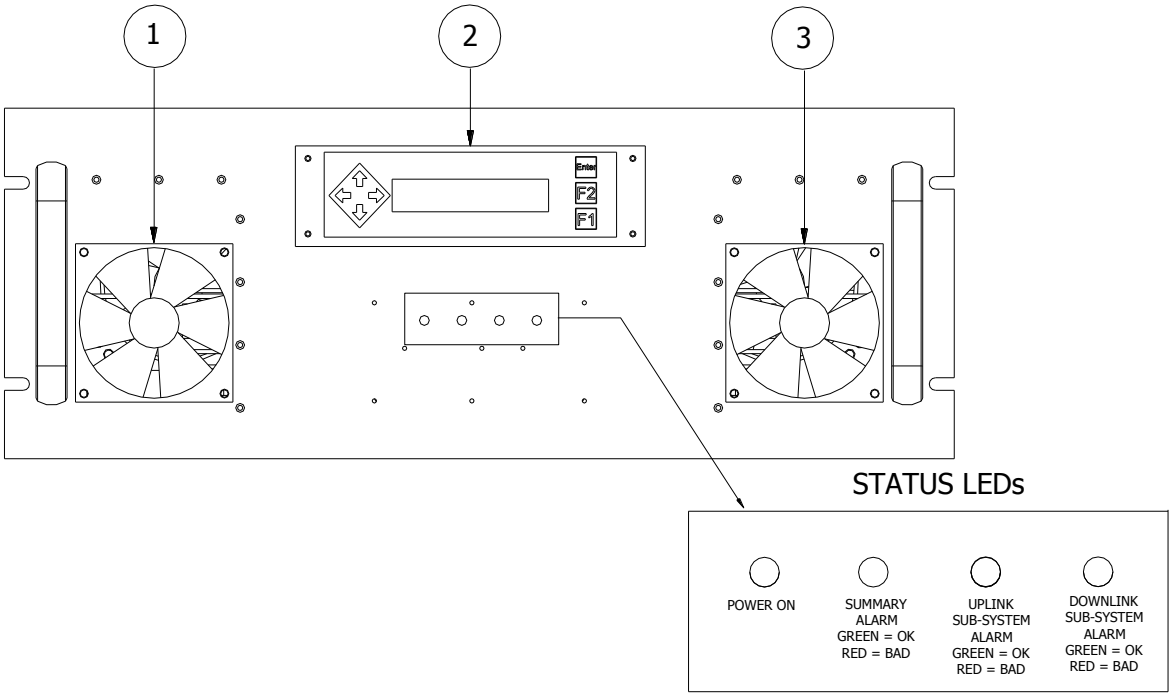

Figure 2 - Front Panel details

Table 1 – Front Panel details

Item	Description
1	Intake fan 1
2	LCD Display/Keypad
3	Intake fan 2
4	Power ON LED (Green = ok, Red = bad)
5	Summary Alarm LED (Green = ok, Red = bad)
6	Reflected Power Alarm LED (Green = ok, Red = bad)
7	Cooling Alarm LED (Green = ok, Red = bad)

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

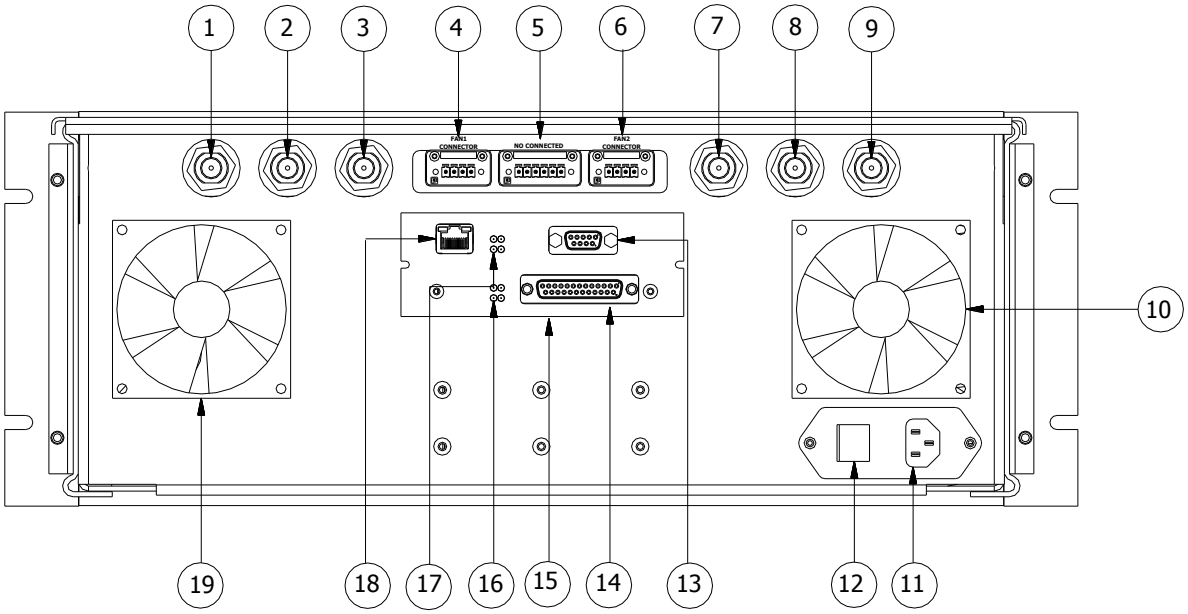

Figure 3 - Rear Panel details.

Table 2 – Rear Panel details.

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

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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

The "+" (plus) sign indicates when more screens or Menu are available. If a plus sign is located in the upper right corner, use the Up Key to show the previous screen. If a plus sign appears in the lower right corner (as in Figure 4), then press the Down key in order to see the next screen.

In order to access the System Meters, press "F1" key; for the System Alarms press the "F2" key. To view the System Network Information scroll down and press "F1"; for Channels Status scroll down and press "F2".

If the user wishes to go back to the main menu, use the Left arrow Key. It is possible to press the keys F1, F2 or Left arrow, 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
AC Power Alarm	N/A --- OK /BAD	AC Power Status [1]
Low UPS Level	N/A --- OK /BAD	Indicate if is Battery Level is out of range [1]
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
Door Open	N/A --- OK /BAD	Indicate if a Door is Open [1]
F.O RX Mon	N/A --- OK /BAD	RX Fiber Optic Status [1]
F.O TX Mon	N/A --- OK /BAD	TX Fiber Optic Status [1]

Notes:
[1] Optional (Configurable) alarm.

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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 [2]	---	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:
[2] 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

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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 RF Tx Output.
- 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:

F2: View alarms
F1: View meters +

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 Antenna Rx Input.
- ✓ Avoid excessive input power.
    - Do not drive the input signal above -30 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 Input and Output antennas 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.

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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.

http://support.mozilla.com/en-S/kb/Javascript#Enabling_and_disabling_JavaScript
http://support.microsoft.com/kb/154036
http://www.google.com/support/chrome/bin/answer.py?answer=114662

F.1.1 CONNECTING SYSTEM DIRECTLY TO PC COMPUTER

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

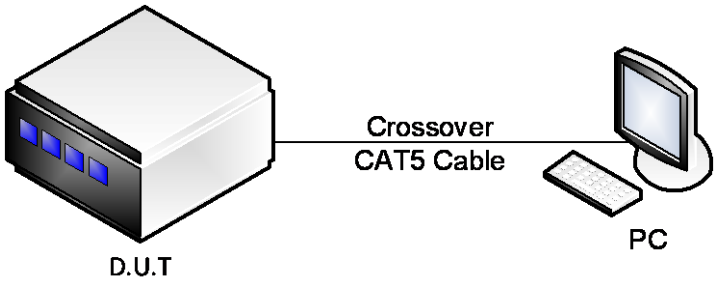

Figure 5 – System connected directly to PC computer.

- Connect the system to PC computer directly into the ECM LAN port.

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- The equipment IP address (192.168.100.87) and Network Mask (255.255.255.0) are shown in the LCD display.
  - 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 XP

1. Go to **"Start >> Control Panel >>Network Settings"**.
2. Right-Click on the **"Local Area Connection"** and choose **"Properties".**

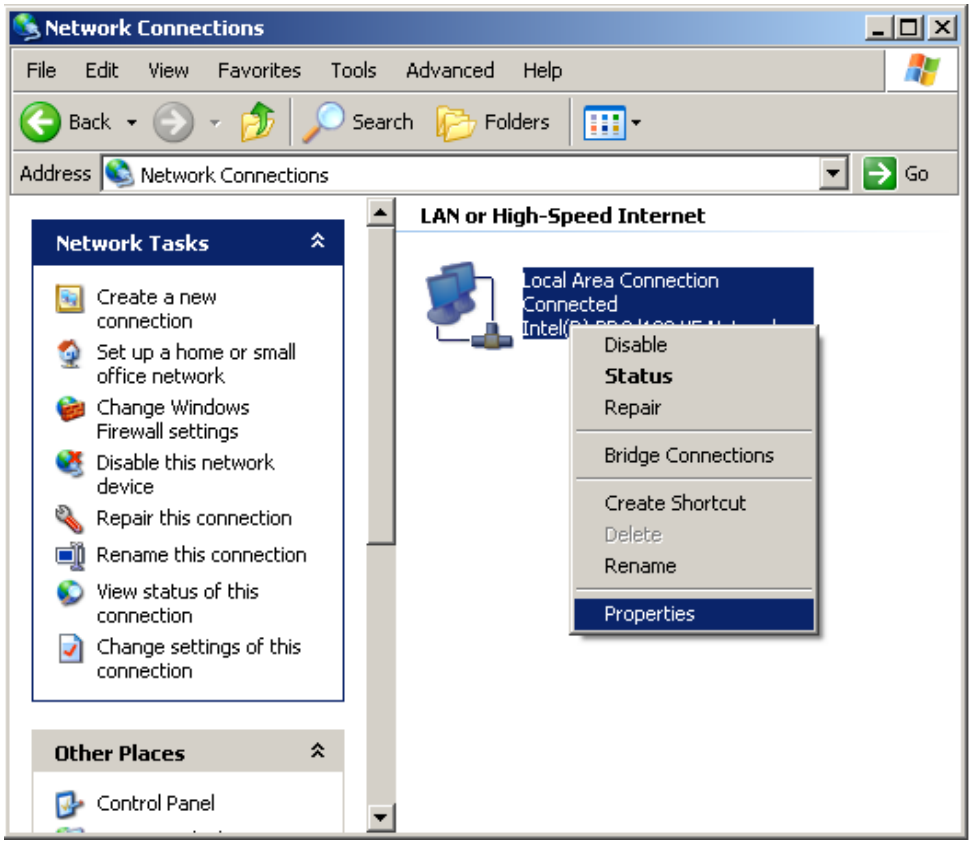

Figure 6 – Menu options for Local Area Connection.

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3. Look for **"Internet Protocol"** and click **"Properties".**

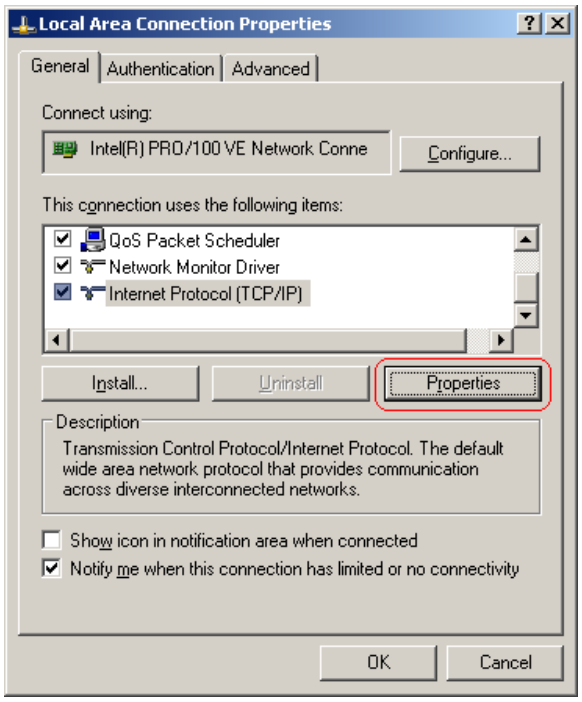

Figure 7 – Local Area Connection Properties.

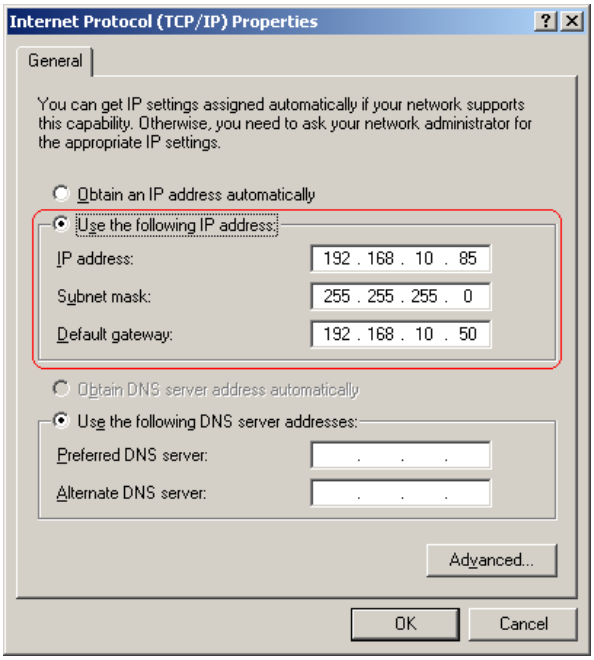

Figure 8 – Internet Protocol (TCP/IP) Properties.

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4. Select "Use the following IP Address".
   - Configure PC computer IP address as 192.168.X.X (X is a value between 0-255) with Network Mask = 255.255.255.0.
   - Default gateway can be same value as IP address.

5. For the option "Use the following DNS server addresses" leave blank.

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**".

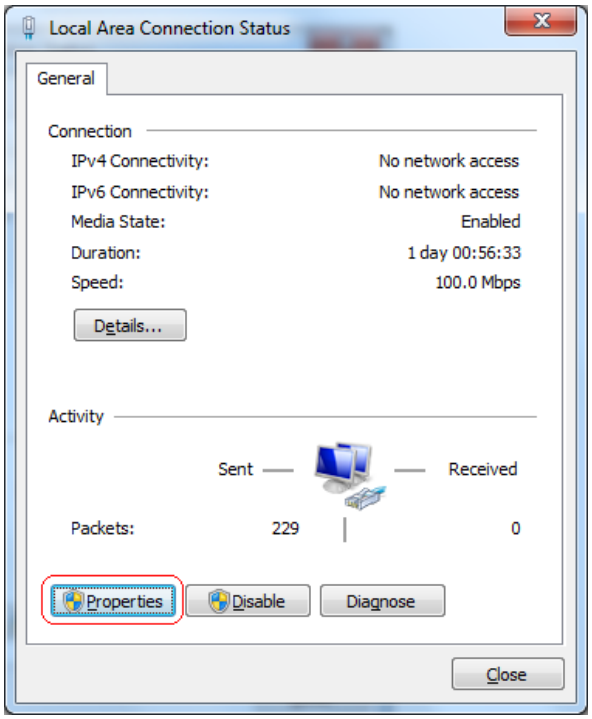

Figure 9 – Local Area Connection Status.

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

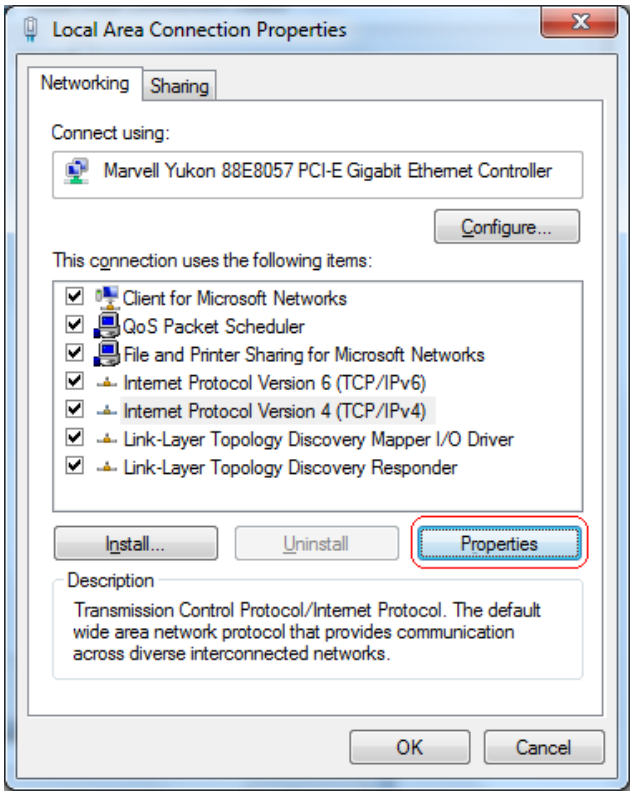

Figure 10 – Local Area Connection Properties.

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://192.168.100.87).
    - Login with username = operator, password = operator.

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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

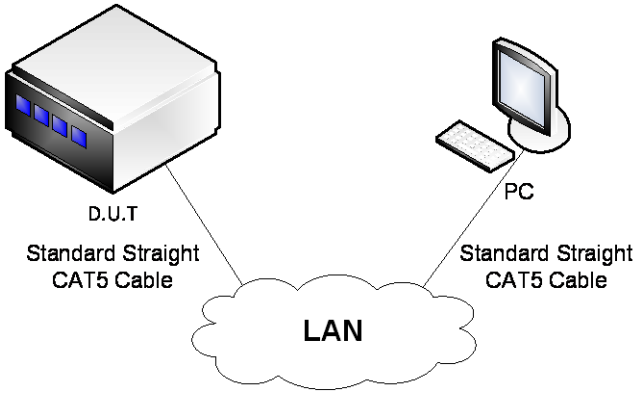

Figure 11 – System connected into local area network.

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 192.168.100.87 (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 192.168.100.87, 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://192.168.100.87).
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.

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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

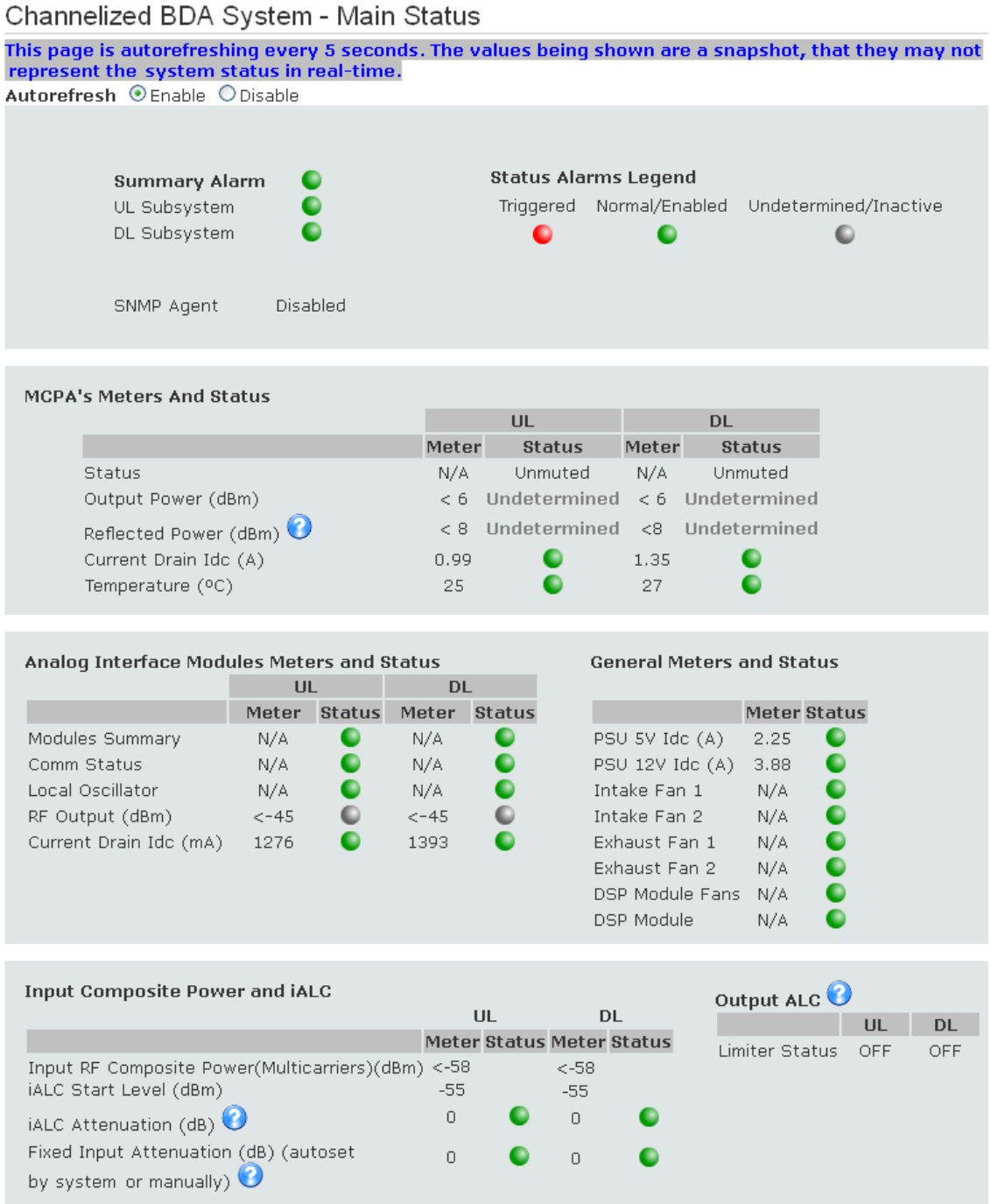

Figure 12 – Main Status page

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This page shows meters and the different alarms as well as the iALC (input ALC) and the Output ALC Status. 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.
UL Subsystem	Shows the UL subsystem current status. Indicator is Green if UL MCPA Current drain Alarm is cleared and AIC module and DSP are active without alarms; red otherwise.
DL Subsystem	Shows the DL subsystem current status. Indicator is Green if DL MCPA Current drain Alarm is cleared and AIC module and DSP are active without alarms; red otherwise.
SNMP Agent	Shows the SNMP Agent current status.

MCPA's Meters and Status

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.
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.
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).
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.
Intake Fan 1/ Intake Fan 2	Indicator. Green if front fans are fully operational as detected by the air flow sensors; red otherwise.
Exhaust Fan 1/ Exhaust Fan 2	Indicator. Green if rear fans are fully operational as detected by the air flow sensors; red otherwise.
DSP Module Fans	Indicator. DSP module fan is fully operational; red otherwise.
DSP Module	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, Filter Settings UL 465-468/486 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.

Input 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.

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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.
Fixed Input Attenuation (dB)	Automatic Level Control for input attenuator. 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 Fixed Input Attenuator can be automatically set by the system if the AutoSet Input Attenuator function is enabled (set to SLOW, MED or FAST modes) in the Main Settings page. Or manually when AutoSet Input Attenuator function is disabled (OFF). Applies only for UL Analog Interface Modules.

Output ALC

Limiter Status	The Output Automatic Level Control (MCPA ALC) limits the composite multi-carriers output power from exceeding the preset level. The indicator is ON when the MCPA is limiting; OFF otherwise. If the option is disabled in Main Settings, the Limiter Status will show DISABLED.

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F.2.2 FILTER STATUS PAGE

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

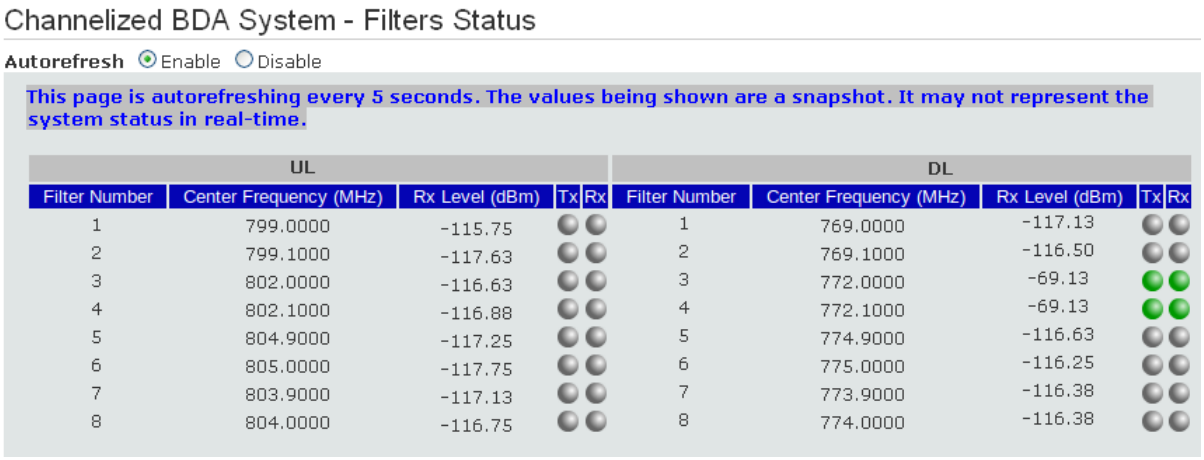

Figure 13 – Filter Status page

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

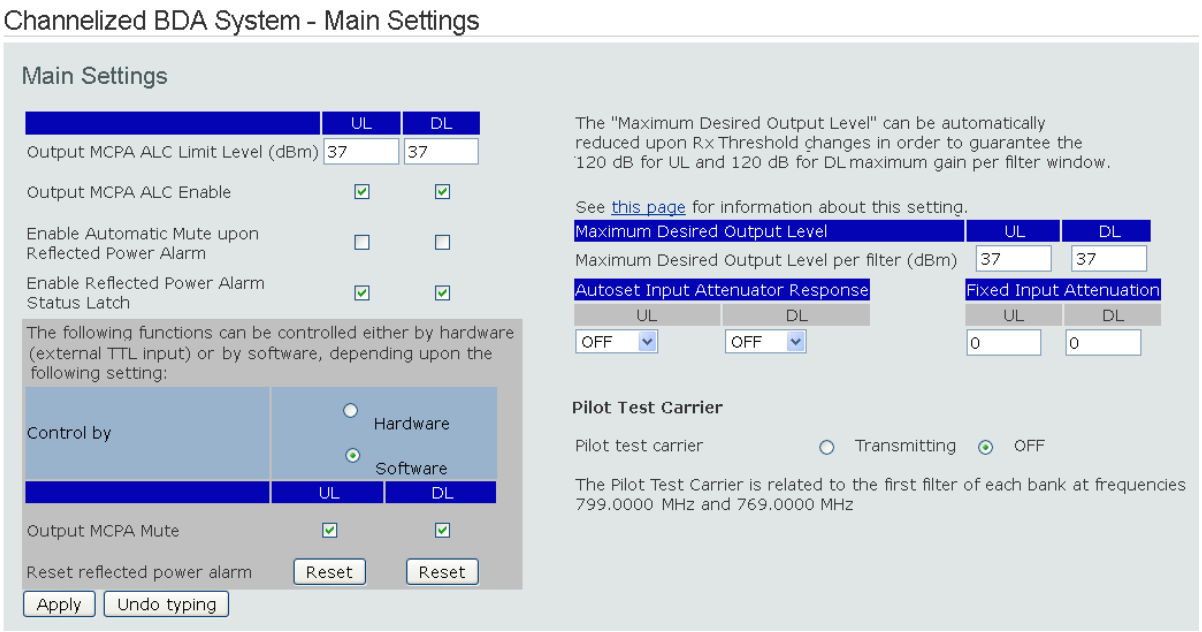

Figure 14 – Main Settings page

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

MCPA Control:

There are four RFA-2-ECM-6URM settings that can be controlled using software commands:

Output MCPA ALC Limit Level	Output limiter set point 30 to 37 dBm.
Output MCPA ALC Enable	Check-box to enable/disable the output ALC.
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.

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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 commands mapped to ECM I/O DB25 Connector can be controlled through pins 7 and 8 for both Service Side (DL Tx) and Donor Base (UL Tx) outputs.

   The Power Amplifier Mute commands mapped to ECM I/O DB25 Connector can be controlled through pins 5 and 6 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.

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 105dB.
- ✓ The specified value cannot be modified in case the maximum gain would be greater or equal than 105dB.

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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 105 dB. Therefore:

  - Actual Maximum Desired Output (Set-point) <= Rx Threshold + 105dB.

    THUS: The User entered Set-point may be automatically reduced to meet the maximum 105dB 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.

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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How to update 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 15) 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.

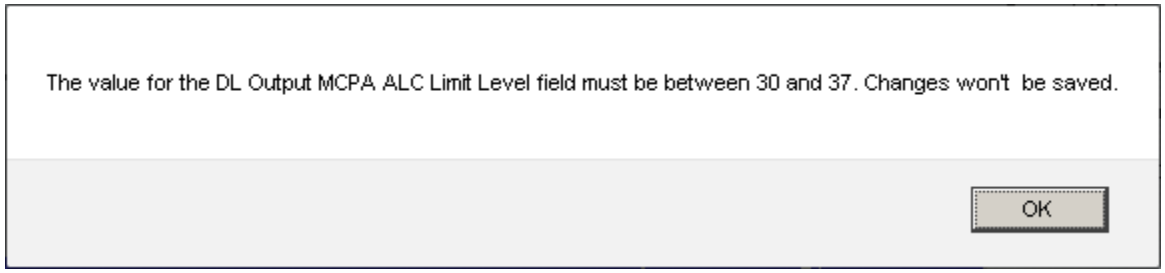

Figure 15 – Value is not into valid range error message

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F.2.4 FILTER SETTINGS PAGE

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

- The "Apply to all filters" section (Figure 16) allows configuring all filters per bank using the same Rx Threshold, Hysteresis, Fine-Tune Output Level 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.

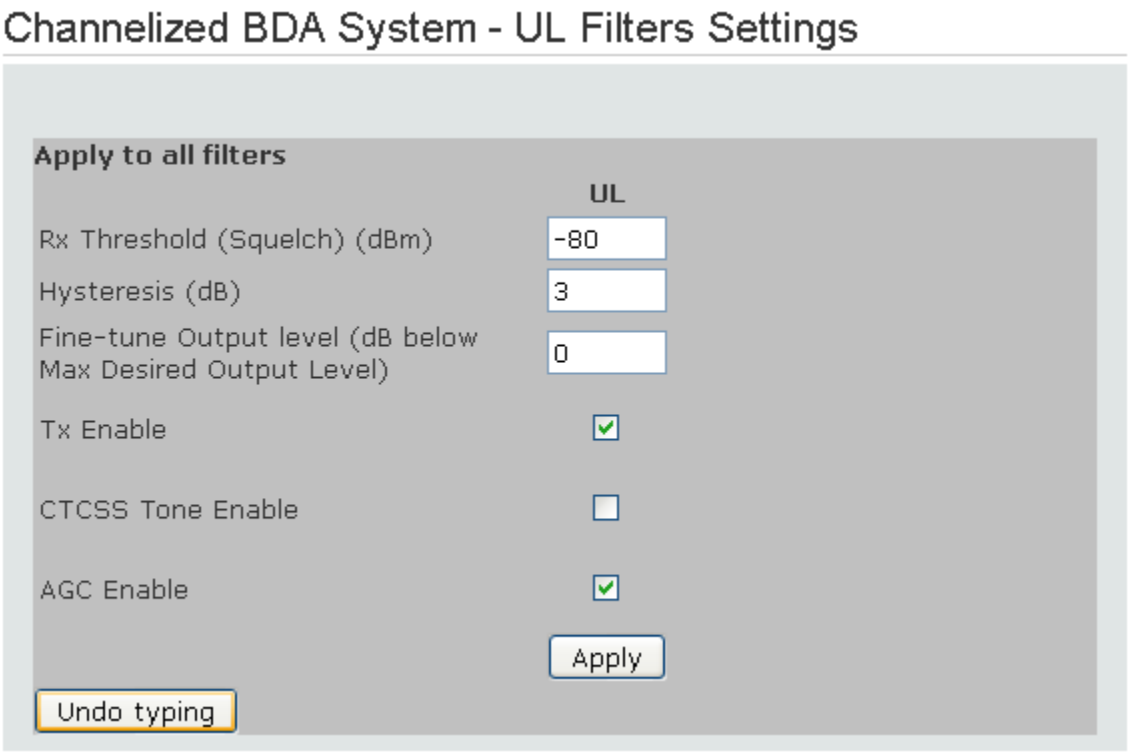

Figure 16 – Filter Settings page (1/2)

- The user may define the settings for each filter window as is shown in Figure 17.

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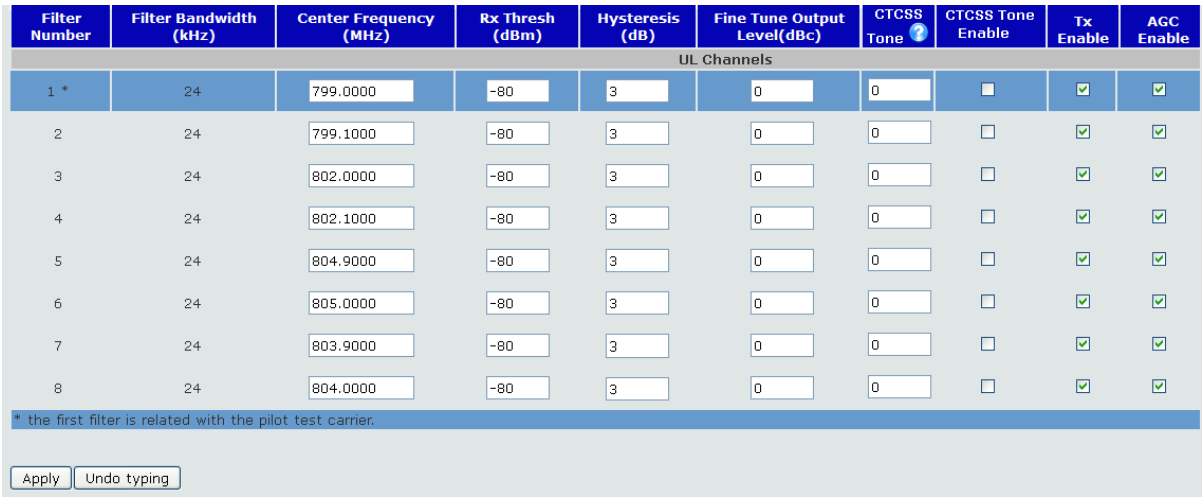

Filter Number	Filter Bandwidth (kHz)	Center Frequency (MHz)	Rx Thresh (dBm)	Hysteresis (dB)	Fine Tune Output Level(dBc)	CTCSS Tone	CTCSS Tone Enable	Tx Enable	AGC Enable
UL Channels									
1 *	24	799.0000	-80	3	0	0	☐	☑	☑
2	24	799.1000	-80	3	0	0	☐	☑	☑
3	24	802.0000	-80	3	0	0	☐	☑	☑
4	24	802.1000	-80	3	0	0	☐	☑	☑
5	24	804.9000	-80	3	0	0	☐	☑	☑
6	24	805.0000	-80	3	0	0	☐	☑	☑
7	24	803.9000	-80	3	0	0	☐	☑	☑
8	24	804.0000	-80	3	0	0	☐	☑	☑

* the first filter is related with the pilot test carrier.

Apply Undo typing

Figure 17 – 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.

Tx Enable Transmitter ON/OFF.

AGC Enable Automatic Gain Control ON/OFF.

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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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