

# AARON 650

## Premium FM Rebroadcast Receiver

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### Installation & User Guide





**PRODUCT REGISTRATION RECORD**

AARON 650 – Serial No. \_\_\_\_\_

Purchase Date \_\_\_\_\_

Warranty Registered?  Web

Reg. Date \_\_\_\_\_ By: \_\_\_\_\_

# Installation & Operation User Guide

# AARON 650

## Premium FM Rebroadcast Receiver

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# Section I

## INTRODUCTION

### AARON 650 PRODUCT DESCRIPTION

Inovonics' AARON 650 is a professional-grade receiver for the commercial FM broadcast band, with features and performance that place it above even the most elite industrial or consumer receivers currently available.

Although the AARON's primary application is in re-broadcast (FM 'translator') service, this receiver finds use in any demanding reception situation.

#### **Features**

Leading features of the Inovonics AARON 650:

- All-digital "SDR" (Software-Defined Radio) design.
- Composite/MPX Pass-Through mode with negligible latency (delay), or Stereo-Regen mode with complete signal regeneration with original or modified RDS messaging. Composite signal processing available in either mode.
- Advanced and effective Reception Tools that mitigate poor reception situations and respond to changing RF signal conditions.
- Automatic failover program backup using a plug-in SD card or an IP network audio feed.
- Intuitive, menu-driven front-panel setup, plus a built-in Web server for full remote operation over any IP network.
- Supports SNMP remote monitoring.
- Built-in FM BandScanner™ gives a plot of the entire FM band or the spectrum around a specific frequency of interest.
- Local and remote graphic readout of the MPX spectrum, stereo image and program density (loudness) over time.
- Local, remote and self-logging alarms for audio loss, RF loss, and RDS loss (or 'hijacking'). Alarms include e-mail or text-message notification.
- Dual, selectable antenna inputs and dual, independent composite/MPX outputs. Balanced L/R analog and AES digital audio outputs; built-in test tone generator.
- The AARON 650 boots or resets *in less than one second* and draws only 5 watts from the AC mains.

# AARON 650 TECHNICAL SPECIFICATIONS

Certain technical specs of the AARON 650 (and receivers in general) are either difficult to quantify in tabular form, or they do not adequately reflect receiver operation in a real-world environment. Manual text further explains features and performance aspects in appropriate sections of the text.

## GENERAL PERFORMANCE

**Tuning Range:** 65.0MHz-108.0MHz

**Sensitivity/Noise Performance:**

**Unweighted monaural SNR for AES Digital and L/R Analog line outputs referenced to  $\pm 75$ kHz carrier deviation at specified RF input levels:**

$\geq 82$ dB Digital,  $\geq 80$ dB Analog at 60dB $\mu$ v  
 $\geq 78$ dB Digital,  $\geq 76$ dB Analog at 40dB $\mu$ v  
 $\geq 60$ dB Digital/Analog at 20dB $\mu$ v  
 $\geq 50$ dB Digital/Analog at 10dB $\mu$ v  
 $\geq 43$ dB Digital/Analog at 0dB $\mu$ v

**Selectivity:**

**Selectable IF bandwidths:**

311kHz, 287kHz, 254kHz, 236kHz,  
217kHz, 200kHz, 184kHz, 168kHz,  
151kHz, 133kHz, 114kHz, 97kHz,  
84kHz, 72kHz, 64kHz and 56kHz

**Frequency Response:**

**Composite/MPX Output (pass-through):**  
 $\pm 0.5$ dB, 20Hz-100kHz

**AES Digital & L/R Analog Line Outputs:**  
 $\pm 0.2$ dB, 20Hz-15kHz

**Stereo Separation (at 1kHz):**

**Composite/MPX Output:**  
>45dB in pass-through mode; >50dB in MPX-regeneration mode.

**AES Digital & L/R Analog Line Outputs:**  
>50dB

**Program Signal Latency (Delay):**

**Composite/MPX Output:**  
 $\leq 250$  $\mu$ s in pass-through mode;  $\leq 2.4$ ms in MPX-regeneration mode.

**AES Digital & L/R Analog Line Outputs:**  
 $\leq 2.4$ ms

**Regional Settings:**

**Tuning Steps:**  
200kHz, 100kHz or 10kHz

**De-Emphasis (Line Outputs):**  
75 $\mu$ s or 50 $\mu$ s

**Radio Data System:**  
RBDS or RDS

## REAR-PANEL APPOINTMENTS

**Antenna Inputs:**

Either of the two 50-ohm (N) inputs may be assigned to any station preset.

**Digital Line Output:**

The AES3 (XLR) 24-bit stereo output may be adjusted between -30dBFS and 0dBFS, corresponding to  $\pm 75$ kHz carrier deviation, with or without de-emphasis. The output sampling rate may be set to 32kHz, 44.1kHz or 48kHz.

**Analog Line Outputs:**

Active balanced (XLR) outputs are adjustable between -20dBu and +18dBu (+15.5dBm), corresponding to  $\pm 75$ kHz carrier deviation, with or without de-emphasis. Source impedance is 200 ohms.

**Composite/MPX Outputs:**

Two unbalanced (BNC) outputs are independently adjustable between 1V p-p and 6V p-p, corresponding to  $\pm 75$ kHz carrier deviation. Source impedance is 75 ohms.

**USB Port**

Delivers raw RDS data for analysis.

**Network Port:**

An RJ45 jack accepts TCP/IP network connections for remote setup and operation of the AARON 650.

**Headphone Jack (Front Panel):**

A quarter-inch (TRS) headphone jack monitors the off-air program signal. Headphone volume is a menu item.

## FAILOVER AUDIO PROTECTION

Upon loss of the incoming carrier, loss of program audio, or RDS 'hijacking,' the off-air program may be replaced with pre-recorded material on a plug-in SD card, a Web-streamed audio feed, or a secondary off-air frequency.

## AUDIO PROCESSING FEATURES

In either the pass-through or MPX regeneration modes, up to 3dB of composite clipping may be engaged to better define the FM deviation limit. The 19kHz stereo pilot and the 57kHz RDS subcarrier are stripped, filtered and reinserted after the clipper.

## THE USER INTERFACE

### **Front-Panel:**

A front-panel graphic display and jog wheel allow easy, menu-guided *in-situ* set-up and operation of the AARON 650. LED “VU” meters display L/R program audio levels.

### **Software Control:**

The IP network port enables complete remote setup and operation of the AARON 650 over a local network or the Internet using any Desktop, tablet or mobile browser.

### **SNMP:**

SNMP remote monitoring supported.

## MISCELLANEOUS

### **Test Tone Generator:**

20Hz - 20kHz; 60dB attenuator.

### **AC Mains Requirements:**

90-130VAC or 200-255VAC, 50/60Hz; 5W.

### **Size:**

H: 1¾in/44mm, W: 19in/483mm,  
D: 9½in/240mm (1U).

### **Weight:**

9lb/4kg (net), 12lbs/5.4kg (shipping).

### **Environmental:**

Continuous operation guaranteed at ambient temperatures between 32°F/0°C and 122°F/50°C; 0-95% relative humidity, non-condensing; altitudes to 10,000ft/ 3048m.

### **Conformances:**



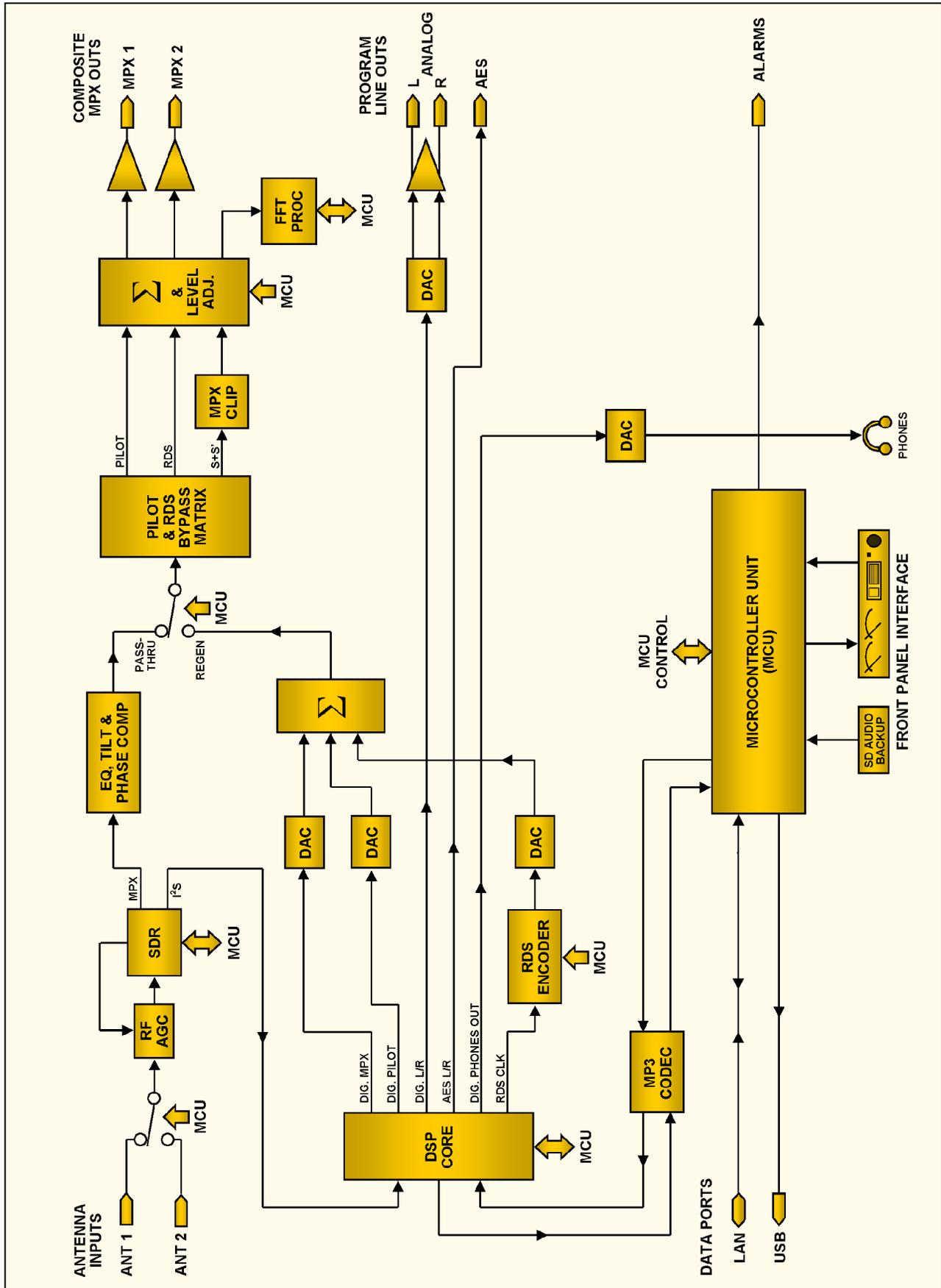
EN50081-1  
EN50082-1  
93/68/EEC



2002/95/EC

## BLOCK DIAGRAM

The AARON 650 is essentially a Software-Defined Radio (SDR) and is almost entirely DSP-based. Virtually all its functionality is provided through firmware coding. The Block Diagram presented on the following page illustrates receiver basics, but has been deliberately organized as if the AARON 650 were a more conventional *analog* design. This should give the reader a more familiar and understandable functional representation of the product, although the actual signal path may deviate appreciably from what's shown.



Block Diagram – AARON 650 Rebroadcast Receiver

## Section II

# INSTALLATION

### GENERAL

This section of the manual addresses the physical installation of the AARON 650 in its operating location, the ‘nuts and bolts’ of connecting the unit. This section also references pages where pertinent setup adjustments are discussed.

#### **Menu Navigation**

Throughout the manual initial references to AARON 650 setup and adjustment assume the use of the front-panel graphic display, jog wheel and Back button. A menu ‘tree’ is presented on Pages 18 and 19.

Basically, you *turn* the jog wheel to cycle among highlighted menu items, and then *push* the jog wheel to select the highlighted item for adjustment. The Back button returns you to the previous menu.

#### **Setup Over a Network**

Anything that can be done from the front panel may also be accomplished over a network from a remote location using the Web server built into the AARON 650. Refer to Section VI for details.

### UNPACKING AND INSPECTION

As soon as the equipment is received, inspect carefully for any shipping damage. If damage is found or suspected, notify the carrier at once, and then contact Inovonics.

We recommend retaining the original shipping carton and packing materials for return or transshipment. If returned for Warranty repair, shipping damage sustained as a result of improper packing for return may invalidate the Warranty!

**IT IS IMPORTANT** to register the Warranty of your AARON 650. This assures coverage of the equipment under terms of the Warranty, provides a means of tracing lost or stolen gear, and adds the user to a database to receive specific service instructions or software/firmware updates when issued. Register online at: [www.inovonicsbroadcast.com](http://www.inovonicsbroadcast.com).

***PLEASE NOTE:*** Many users choose first to familiarize themselves with equipment on the bench or at their desk, in which case they may immediately turn to Section III that describes AARON 650 setup and use. Do please refer back to this sec-

tion, however, to confirm proper physical installation and interconnection with other station equipment.

## MOUNTING

- Rack Requirement** The AARON 650 mounts in a standard 19-inch equipment rack and requires only 1¾ inches (1U) of vertical rack space. We recommend using plastic or fiber washers to protect the painted finish around the mounting holes.
- Heat Dissipation** Consuming roughly the same amount of energy as a cell phone charger, the AARON 650 itself generates negligible heat and thus has no noisy internal fan and associated filter to change. The unit is specified for operation within an ambient temperature range extending from freezing to 120°F/50°C. But because adjacent gear may radiate substantial heat, be sure that the equipment rack is adequately ventilated to keep internal temperature below the specified maximum ambient.

## AC (MAINS) POWER

- Mains Voltage Selector** Unless specifically ordered for export shipment, the AARON 650 is set at the factory for operation from 115V, 50/60Hz AC mains.
- To change the mains voltage, first *disconnect the mains cord* and then operate the slide switch adjacent to the AC mains connector on the rear panel. Use a small screwdriver to set the switch for 115V or 230V operation.
- Mains Fuse** It is important to install the appropriate fuse as noted on the rear panel next to the fuseholder: 1/4A for 115V mains, 1/8A for 230V operation. Fuses are the GMA/S500 type (5mm X 20mm size, 'fast blow').
- Power Cord** The detachable IEC-type power cord supplied with the AARON 650 is fitted with a North-American-standard male plug. If you need to replace the mains plug with another, you will find that the individual cord conductors are color-coded in one of two ways. US standards specify black for AC 'hot,' white for AC neutral and green for earth ground. European CEE standards specify brown for AC 'hot,' blue for AC neutral and green with a yellow stripe for earth ground. Please keep these straight.

## RADIO FREQUENCY INTERFERENCE (RFI)

- Location** Although it is expected that the AARON 650 will be co-located with FM transmission equipment, do practice care and common sense in locating the unit away from *abnormally* high RF fields.

**Ground Loops** Because the unbalanced composite/MPX outputs of the AARON 650 are referenced to chassis ground, a mains frequency or RF ground loop could be formed between cable shield grounds and the AC power cord ground. A 'ground-lifting' AC adapter may remedy such a situation, although the chassis must somehow be returned to earth ground for safety. Generally, being screwed-down in the equipment rack will satisfy the safety requirement.

## ANTENNA INPUTS

ANTENNA 1 and ANTENNA 2 are relay-selected 50-ohm 'N' connector inputs to the receiver. Either input may be selected and is automatically assigned to that station preset (Page 23). The antenna that is not selected is terminated in a 50-ohm resistor.

## PROGRAM LINE OUTPUTS

AARON 650 digital and analog line outputs are available simultaneously with independent settings.

### **AES Digital Line Output**

The male XLR connector labeled AES DIGITAL OUTPUT is a balanced, transformer-coupled digital stereo program output conforming to the AES3 (AES/EBU) specification. This is a 24-bit output at a sampling rate that may be set to 32kHz, 44.1kHz, or 48kHz under the Setup / Digital Audio Output menu.

This menu also sets the digital output level. The dB notation below the slider control corresponds to the level of program peaks at 100% modulation ( $\pm 75$ kHz carrier deviation). The output may be adjusted between 0dBFS (digital full-scale) and -30dBFS.

De-Emph (de-emphasis) may be set either On, which follows the regional standard (Page 23), or Off for an output that will retain the transmitted FM pre-emphasis curve. Your selection will depend on whether an exciter fed by the AARON 650 has an internal pre-emphasis network or depends on a pre-emphasized feed.

### **Analog Line Outputs**

Male XLR left- and right-channel ANALOG OUTPUTS on the rear panel are electronically-balanced. This means that they are ground-referenced and *not* transformer-isolated.

Under the Setup / Analog Audio Output menu, left and right line outputs may be adjusted to any level between -20dBu and +18dBu. The dB levels shown below the slider control represent the *unloaded* output level at  $\pm 75$ kHz carrier deviation. The outputs have a resistive source impedance of 200 ohms, with a 100-ohm 'buildout' resistor in each leg. When feeding a 600-ohm load the actual dBm level will be 2.5dB below the Analog Level shown under the slider.

Just as with the Digital Line Output discussed above, De-Emph (de-emphasis) may be turned On or Off here.

**Unbalanced  
Operation**

To connect the analog line outputs of the AARON 650 to the low-level, unbalanced inputs of consumer-grade equipment, connect the center conductor of the shielded output lead to Pin 2 of the XLR connector, and the shield to Pin 1. Leave Pin 3 floating (unconnected).

When driving unbalanced lines the actual output level will be *6dB lower* than the Analog Level shown in the Analog Audio Output menu, as only one side of the bridge-configuration output amplifier is driving the line.

## COMPOSITE/MPX OUTPUTS

There are two independent composite/MPX outputs on the rear panel of the AARON 650: MPX OUT 1 and MPX OUT 2. These are unbalanced BNC connectors with a resistive source impedance of 75 ohms.

The levels of the composite/MPX signals may be independently adjusted under the Setup / MPX Output menu. The level in open-circuit (unloaded) peak-to-peak volts is indicated in the menu, and can be adjusted between 1V p-p and 6V p-p, corresponding to  $\pm 75$ kHz deviation of the incoming carrier.

The composite/MPX signal may optionally be subjected to composite signal processing in both the Pass-Through and the Stereo-Regen modes. This optional processing of the composite/MPX is discussed on Page 32, and will be loosely referred-to as 'audio processing.' This will differentiate it from the several RF signal processing options available under Reception Tools that may be called into play to improve reception under adverse conditions.

## RDS DATA

This USB 'B' socket provides a 'raw' RDS data stream from the tuned station. A simple software routine that will allow further analysis and archiving of these data may be downloaded from the Inovonics Website.

## NETWORK PORT

A standard RJ-45 network jack is used to connect the AARON 650 to a Local Area Network (LAN) or to the Internet. Full remote control and off-air monitoring of the receiver is afforded via the internal Webpage interface. Networking setup and Web-based operation is explained in Sections IV and V.

## ALARM TALLIES

Four reception-error alarms are available on this terminal block, which may be unplugged from the chassis for ease in wiring and maintenance. These alarms are:

- Loss of program audio
- Interruption (loss or reduction) of the RF carrier
- Loss or 'hijacking' of the RDS/RBDS data subcarrier
- Loss of stereo pilot

Either an active-high or an active-low output may be programmed under the Setup / Alarms & Notifications / Alarm Tally Polarity menu. +5VDC and Ground are provided here also. The programming of these alarm functions is detailed on Page 36.

# Section III

## SETUP AND OPERATION

Instructions in this section cover AARON 650 setup using the front-panel graphic display screen and jog wheel. Anything that can be done from the front panel can also be accomplished using the Web interface, which closely follows the front-panel menus and readouts. Networking the AARON 650 is covered in Section IV, and remote operation in Section V. We recommend starting with front-panel setup, however, as this method not only gives the immediate gratification of a hands-on experience, but is necessary for initiating network connectivity in the first place.

### “QUICK START” TECHNOLOGY”

**‘Instant Boot’** ‘Boot’ (startup) time of AARON 650 is less than one second. When AC power is first applied, or after any momentary power interruption, the unit is back in full operation almost immediately. Setup and reception parameters in use previous to the power interruption are reloaded instantly from non-volatile memory to the receiver’s processing core.

**Brownout Detection** Although the AARON 650 power supply and digital logic circuits will operate at AC mains voltages down to about 50% of nominal, the graphic display and LED readouts would fail to give consistent indications at very low mains voltages. A ‘brownout’ detector reboots the unit at a mains voltage somewhat below the “low line” value given in the product specification.

### NAVIGATING THE MENUS

Setup and operating adjustments of the AARON 650 are under firmware control. There are no jumpers, switches or mechanical potentiometers, only the front-panel jog wheel A and Back button B identified in the illustration here.



**Graphic Display**

The graphic display screen C presents the intuitive setup menu tree in an easy-to-read format. The display uses a screen saver, so when the screen goes completely dark, simply *push* the jog wheel or Back button once to bring it back to life. No selection or change is made with this ‘wake-up call.’

**Jog Wheel and Back Button**

*Turn* the jog wheel knob to cycle among highlighted menu items, and then *push* the knob to select or adjust the highlighted item. The Back button returns you to the previous menu. Push the Back button repeatedly to return to the Main Menu screen.

In all setup instructions given in this manual, the menus will be shown as a string of commands. As an example, starting at the Main Screen: Setup / Analog Output would direct you to do the following:

- 1) *turn* the jog wheel knob so that Setup is highlighted;
- 2) *push* the knob to enter the Setup menu;
- 3) *turn* the knob to highlight Analog Output;
- 4) *push* the knob to enter the Analog Audio Output sub-menu;
- 5) *push* the knob again to enable the control ‘slider’;
- 6) *turn* the knob to set the output to the desired level;
- 7) *push* the knob (or Back button) to commit the adjustment to non-volatile memory.

If you make a mistake (for example, you might *push* the knob off-center, which could also rotate it and bring up the wrong menu), simply push the Back button to return to the previous menu and try again.

**Menu Timeout and Screensaver**

Once an adjustment is made, you may press the Back button to eventually return to the Main Menu screen, or simply leave any current screen showing. After 30 seconds, the current screen will ‘deselect,’ meaning that the jog wheel knob won’t accept an adjustment command without that command once again being selected.

After a programmed interval the screen will go dark. This screen-saving feature prolongs the life of the OLED graphic display. At any time, however you can press the jog wheel or Back button to bring the dark screen to life and display the last menu accessed

## THE AARON 650 MENU TREE

The several levels of setup and operating menus are laid out in an intuitive and easy-to-manage fashion. The complete Menu Tree is shown and explained on the following couple of pages.

Each menu level shown will indicate whether that level is simply a (display) or (listing) of some parameter, or whether it accepts some form of user entry. (set) generally signifies an on/off or enable/disable function, (select) denotes user control

over a much wider range of choices, perhaps selecting between a number of options or adjusting some value in very small increments. (data entry) calls for alphanumeric character entry into data fields.

Menu Titles are shown in a font that approximates that of the front-panel display. Main Menu items are against the left margin, submenu levels are indented appropriately. A contrasting font defines the descriptive callout in parentheses following menu items.

Now Playing (station information display)	RDS Info
Tuner	Decoded RDS (multi-parameter display)
Frequency Select (main tuning set)	Radio Text+ (display)
Antenna 1 / Antenna 2 (select)	Alternative Frequencies
Preset Stations	No. of AFs (display)
Save Preset	Frequencies List (listing)
Name Your Preset (data entry)	RDS Groups
Individual Presets / (Empty) (display)	Block Error Rate (display)
Delete Preset (select)	List of Active Groups (listing)
Reception Tools	Open Data Applications
IF Bandwidth	No. of ODAs (display)
Auto (set)	ODAs by RDS Group (listing)
Fixed (select 16 bandwidths)	Alarms & Notifications
Stereo Blend	Audio Loss
Auto (set)	Alarm (set)
RSSI (select)	Threshold On (select)
USN (select)	Time On (select)
Mpath (select)	Threshold Off (select)
High Blend	Time Off (select)
Auto (set)	Low Signal
RSSI (select)	Alarm (set)
USN (select)	Mute (set)
Mpath (select)	Threshold On (select)
High Cut	Time On (select)
Auto (set)	Threshold Off (select)
RSSI (select)	Time Off (select)
USN (select)	RDS Error
Mpath (select)	Alarm (set)
Stereo/Mono	PI Error (set)
Stereo (Auto) / Forced Mono (set)	Time On (select)
Enhancers	Time Off (select)
Multipath Suppression (set)	PI Code (data entry)
Channel Equalizer (set)	Pilot Loss
Graphs & Metering	Alarm (set)
MPX FFT (baseband spectrum display)	Time On (select)
BandScanner (FM spectrum display)	Time Off (select)
Center Freq. (select)	Stereo Regen
Step Size (select)	Regen On/Off
RSSI Range (select)	On/Off (set)
Scan (set)	Pilot
Processing (Reception Tools display)	Pilot On/Off (set)
XY Plot (stereo display)	Pilot Injection (select)
LR Plot (loudness display)	

Stereo Regen (continued)

- RDS Encoding
  - RDS On/Off & injection
    - RDS On/Off (set)
    - Injection (select)
  - RDS Regen Mode
    - (4 RDS encoding selections)
  - RDS Data (data entry)
  - PS Scroll Speed (select)
  - AF List
    - Frequencies (select)
    - Clear AFs (select)

Setup

- Analog Audio Output
  - Analog Level (select)
  - De-Emph (set)
- Digital Audio Output
  - Digital Level (select)
  - De-Emph (set)
  - Sample Rate (select)
- MPX Output
  - MPX1 Level (select)
  - MPX 2 Level (select)
  - Clipping (select)
- Network
  - IP Settings
    - Port: (data entry)
    - DHCP / Static IP (set)
    - Parameters (display)
  - Hostname
    - Hostname: (data entry)
  - Dynamic DNS
    - Mode: (select)
    - Host: (data entry)
    - User: (data entry)
    - Pass: (data entry)
  - Time
    - Time Zone & DST
      - DST / Auto / Off (set)
      - Time Zone (select)
    - Time Server (data entry)
  - SNMP
    - Mode & Communities
      - Mode (select)
      - Communities
        - Read (data entry)
        - Write (data entry)
    - SNMP Ports
      - General (data entry)
      - Trap (data entry)
    - Trap Destinations (data entry)
  - Status (network status display)

Setup (continued)

- Email Preferences
  - SMTP Server
    - Use SSL (set)
    - Port: (data entry)
    - SMTP Server (data entry)
  - Sender
    - Username: (data entry)
    - Password: (data entry)
  - Recipients
    - Select: (select from list)
    - Address: (data entry)
- Send Test Email (test utility)
- Alarm Log Settings
  - Status: (display)
  - Email When: (select)
  - Clear Log (set)
- Alarm Closure Polarity
  - Audio (set)
  - RSSI (set)
  - RDS (set)
  - Pilot (set)
- Region
  - Tuning Steps (select)
  - De-emph (select)
  - RDS/RBDS (select)
- Serial Port Baud Rate (select)
- Test Oscillator
  - Off / L only / R only / L+R (select)
  - Frequency (set)
  - Level (set)
- Admin
  - Security
    - Current Password: (data entry)
    - Enable (set)
  - Display
    - Brightness (select)
    - Timeout (select)
  - Firmware Update (utility)
  - About (display)
- Headphone Volume
  - Volume (select)

## AARON 650 READOUTS AND METERING

The AARON 650 offers an array of meters and data readouts that can be used to advantage in setting-up the unit and monitoring incoming and outgoing signal quality. The front-panel OLED display offers exceptional resolution for a 1U presentation, and the Web interface echoes the same information on any PC, tablet or mobile phone with network access.

The most useful ‘global’ displays will be described here at the outset, as they may have frequent reference. The more specific displays will be discussed along with their applications.

### The Now-Playing Screen

Now Playing is at the top of the Main Menu. Highlight this item and *push* the knob to bring up a readout of station information. This display always shows what is coming in off-air, even in the Stereo-Regen mode (Page 24) of operation.



**Top row:** 1) The frequency that the AARON 650 is tuned to; 2) The RDS PI code; 3) Station call letters (these are derived from the PI code in the US and Canada); 4) The antenna selected at the moment.

**Second row:** 1) The RDS PS field; 2) The RDS Radio Text field.

**Bottom row:** 1) Incoming carrier signal strength in dBuV; 2) The current IF bandwidth; 3) Multipath distortion relative to carrier modulation; 4) Ultrasonic noise relative to carrier modulation.

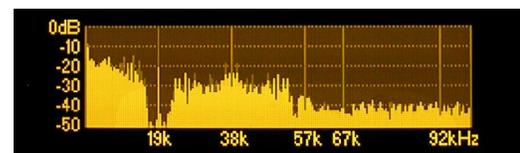
### Graphs and Metering

The Graphs & Metering sub-menu is a bit farther down the Main Menu. Navigate there and *push* the knob to bring up this screen.



### Baseband FFT

The first item, MPX FFT will give you a spectrum display of the composite/MPX baseband signal *leaving* the AARON 650. This means that, in the Pass-Through mode, you will see the off-air signal, and in the Stereo-Regen mode it will be the regenerated composite/MPX.

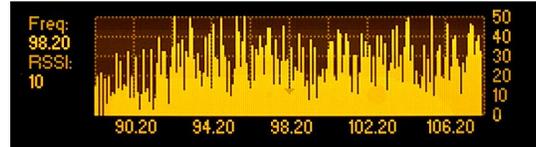


This is one of the more useful displays. Viewing this you can determine the injection levels of the stereo pilot and all subcarriers, view FM baseband noise and anomalies, and see the effect of different IF bandwidths in the Pass-Through mode. Refer to this spectrum plot as you switch between Pass-Through and Stereo-Regen to get an idea of how much ‘cleaner’ one mode is than the other.

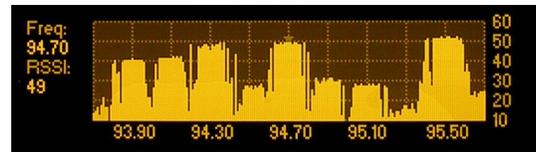
## FM BandScanner

The next Graphs & Metering item, the BandScanner, gives an RF spectrum display of the incoming signals at carrier frequencies. Here you can set the Center Freq of the display, the Step Size, or resolution bandwidth, and the RSSI Range where the vertical range of the 10dB/div display may be scaled to meet signal strength criteria. Bracket and select Scan to initiate the spectrum plot.

This shot is a wide-range analysis centered at 98.1 MHz with a step size of 100kHz. Here you see the entire FM band with the individual carriers of stations in the local market.



Zooming-in on the station at 94.7MHz, and narrowing to 10kHz steps, clearly shows the main carrier, the narrow HD Radio® digital carrier pair, and the significant adjacent channels.



The BandScanner is a handy utility for checking possible sources of adjacent-channel interference. It is normally used for aiming the receive antenna and other AARON 650 initial setup steps for the reason that follows.

*NOTE:* When the BandScanner is in use, the program signal going through the AARON 650 will be temporarily compromised. You will experience a ‘burbling’ in the MPX and program outputs during the scan.

## Reception Tools Processing

The next Graphs & Metering menu item, Processing, displays the real-time action of the three Reception Tools that can improve performance in the Stereo-Regen mode when the incoming signal is less than optimal.

The criteria for these Reception Tools are explained under Reception Tools beginning on Page 29. These readouts are actually redundant to similar displays associated with each of the Reception Tools, but on this menu screen they incorporate a peak-hold feature, have a higher readout resolution, and allow viewing all three readouts at once. Page numbers noted here refer to the corresponding Reception Tools setup notes.

Highcut shows the amount of high-end audio rolloff imposed on the demodulated and decoded L/R stereo program signal when poor reception conditions would otherwise contribute an annoying hiss to the program. The percentage figure at the end of the scale is somewhat arbitrary, but does depict the working range of this audio control. (Page 32)

The Stereo Blend display indicates the amount of broadband (full audio spectrum) blending put in effect to mitigate noise from a low level of incoming carrier or from multipath effects. (Page 31)

High Blend is similar to the broadband blending discussed above, except that the blending action is restricted to the upper audio frequencies only. (Page 31)

The actual result of both broadband and high-end blending action can be observed in graphical form on the XY Plot, discussed next.

**XY (Stereo Image) Plot**

On the XY Plot screen, the stereo sum and difference levels are separately shown on peak-reading bargraphs, and the left and right program audio channels are plotted against one another in an XY 'scope' box. The XY display gives a good measure of program audio stereophony, or how 'wide' the stereo image is, with a clear indication of monaural program signals and out-of-phase audio.

**Loudness Plot**

The LR Plot gives a history of the left and right channel peak values over a 10-second time period. This is a first-order measure of program loudness, as the amount of time that program peaks spend at or near the 0dB abscissa is a persuasive measure of program audio density. Remember: over-processed audio leads to early listener fatigue and lower TSL.

**RDS Information Display**

The AARON 650 provides a comprehensive display of RadioData (RDS/RBDS) parameters. From the Main Menu, navigate to RDS Info. The five submenu screens only display data; there are no adjustments or provision for data entry.



The RDS Info utility has marginal bearing on the use of the AARON 650 as a translator receiver even though it is still a powerful RDS diagnostics tool. It has been included for the interest and convenience of 'power users' of the Radio Data System and the many features that it offers in addition to scrolling song titles. Those users will already be familiar with what appears on these screens, so most details will be omitted in this manual.

The second of these screens, Radio Text +, will be of interest to those stations that practice RDS 'tagging.' RDS Groups will indicate the total data percentage used within each of the groups. RDS Groups also has a BLER (BBlock Error Rate) readout, which can indicate RDS data corruption due to poor reception conditions.

## QUICK RECEIVER SETUP

The AARON 650 may be placed in operation in very short order. In situations with a healthy incoming signal, you can probably accept factory-default setup options and values. Of course the receiver must be tuned to the incoming carrier, but for straight-forward pass-through-mode operation in a typical FM translator application, just set the MPX or line output level to match the input sensitivity of the FM exciter and assure proper carrier re-modulation.

## REGIONAL SETTINGS

From the Main Menu, navigate to: Setup / Region. This accesses three settings that, once set, can generally be forgotten. Here you can set the main Tuning Steps to 200kHz, 100kHz or 10kHz intervals; the program De-emph (de-emphasis) to either the 75 $\mu$ s or 50 $\mu$ s (microsecond) rolloff characteristic; and the proper RadioData registers for the European RDS or North American RBDS standards.

## TUNING AND PRESETS

### Tuning the AARON 650

From the Main Menu navigate to Tuner. (Menu navigation is explained on Page 11.) Turn the knob to bracket the receive frequency, push the knob to enter the edit mode, and then turn the knob to dial-in the desired frequency. Push the knob again to set this frequency in memory and return you to command of the Tuner screen. Check that the correct antenna input is selected, either  Antenna 1 or  Antenna 2.



### Station Presets

The AARON 650 has ten station presets. This memory function keeps track of frequency and antenna selection, Reception Tool settings and signal alarm setup options for each individual preset.

From the Main Menu jump down to Preset Stations and push the knob. Highlight Save Preset at the top of the list and push the knob again. This will open the data-entry field shown here, where you can name the preset with station call letters or other identifier of your choice. Just turn and push the knob to enter characters one at a time. Highlight and push Backspace to correct any errors, and when the field is complete, highlight and push Save.



This returns you to the Preset Stations menu where your entry will assume the top position in the station list. The arrow beside the entry shows that this is the station now being received. To tune between multiple presets, highlight the one you want to receive and *push* the knob to select the new frequency and its associated antenna, Reception Tool and alarm settings.



## PASS-THROUGH vs. STEREO-REGEN

Most basic rebroadcast receivers will have a composite/MPX ‘baseband’ output, plus the obligatory left/right program line outputs. These receivers are commonly connected to the baseband input of the FM exciter to rebroadcast the entire demodulated FM baseband spectrum. This includes the FM-multiplex program signal along with any and all subcarriers that the station might carry. With a clean, noise-free incoming carrier, this Pass-Through method is generally preferred.

### Regeneration Advantages

However, there are advantages to ‘regenerating’ the composite baseband signal. Regeneration refers to demodulating the incoming carrier down to left and right program audio and then re-encoding the FM baseband, either with a standalone stereo-gen or one built into the exciter.

Leading the regeneration advantages is a ‘clean-up’ of the incoming signal. ‘Ultrasonic’ noise (USN) above the program subcarrier compromises modulation efficiency, and regeneration removes this source of noise. The AARON 650 has a variety of Reception Tools that are active only in the Stereo-Regen mode, which are very effective in reducing audible noise and preserving the quality of the program as it is rebroadcast. RDS data can be regenerated as well, or replaced with alternative house-keeping and messaging that may be more pertinent in the rebroadcast signal coverage area.

The AARON 650 has the stereo regeneration capability built in, one that can regenerate or completely replace the RDS data subcarrier at the same time. The only disadvantage of stereo regeneration is the slight time delay (latency) that is introduced, but this is a very low figure in the AARON 650 specifications.

### Switching Modes

Even using the factory-default settings, one can easily switch between the Pass-Through and the Stereo-Regen modes. From the Main Menu, navigate to Stereo Regen and *push* the knob.

Highlight the first menu item, Regen On/Off and *push* the knob. A pair of ‘radio buttons’ will then allow you to select either ☉ On (Compo-



site Regen) or  Off (Composite Pass-Through). You must base your decision as which mode to use on the overall quality of the *re-transmitted* program signal. This means that you must monitor the translator frequency off-air, as the front-panel headphone jack will not reflect the difference between modes. Alternatively, if you have a means of decoding and monitoring the composite/MPX feed at the exciter input, this allows an equivalent A/B comparison.

The full advantage of regeneration will not be realized, however, until Reception Tools setting have been optimized (Page 29).

## STEREO-REGEN MODE OPTIONS

### Stereo-Regen Mode Defaults

The stereo regeneration mode offers operating options that need to be considered when this mode is selected. Not only do the built-in Reception Tools need to be optimized for best performance, but additional options deal with stereo vs. monaural transmission and RDS encoding. Factory defaults are stereo transmission with a typical 9% pilot injection, and the RDS subcarrier turned off. These options, discussed next, may be changed under the Stereo Regen menu.

### Monaural Operation

Under the Stereo Regen menu, select Pilot On/Off & Injection. The screen that pops up will allow you to control the 19kHz stereo pilot in the stereo regen mode. The factory default values of On and 9% are typical for normal everyday operation. Turning the pilot Off for mono automatically takes the injection to zero (despite the number showing under the adjustment slider), and turns off the 38kHz suppressed-carrier DSB stereo difference subcarrier as well.



## STEREO-REGEN MODE RDS OPTIONS

From the Main Menu, navigate to Stereo Regen / RDS Encoding. Here you will see five submenus, each offering various programming options for the RDS data stream.



### RDS On/Off and Subcarrier Injection

**NOTE:** Do not turn RDS  On until all pertinent option fields have been programmed as described in this subsection!

Highlight the first submenu, RDS On/Off & Injection and *push* the knob. The factory default for RDS transmission in the stereo regen mode is  Off. This menu allows you to turn the 57kHz subcarrier  On and set Injection at any value between 3% and

8%. The factory-default value of 5% is typical for reliable RDS reception by most consumer receivers. Again, do *not* turn RDS  On yet.

### RDS Regen Mode

This submenu presents four choices for encoding the RDS data subcarrier. These choices are explained in the paragraphs that follow.



Re-encode RDS simply regenerates and re-transmits the incoming RDS data in its original form. The 57kHz subcarrier is regenerated and remodulated, but this is a true RDS *data* pass-through. What comes in goes right back out again (except for noise and jitter!).

Re-encode RDS with new PI Code re-transmits all the original RDS data, just like the first option, but with the sole exception of the PI code: the station's 'digital address.'

Every FM broadcast signal source (transmitter site) is supposed to have a separate and unique PI code. Adhering to the letter of this operating practice requires even rebroadcast translators to have their own digital identity, despite the fact that they are simply relaying a broadcast in real time on another frequency. When the Re-encode RDS with new PI Code option is selected, the AARON 650 strips the PI code from the incoming RDS data and substitutes the one entered by the user in the RDS Data menu (see next margin heading).

Song title and artist information is an example of 'dynamic' RDS messaging, and must be tied-in to station automation or even a third-party data consolidator. Choosing the Built-in RDS option removes the entire incoming data stream and replaces it with 'static' RDS data that is entered manually in the RDS Data menu.

In the RDS PS field, this static (fixed) messaging can contain up to 128 characters. Any entry in excess of 8 characters is automatically parsed and scrolled across the faceplate of listeners' radios. Radio Text is a separate message field of up to 64 characters.

Static messaging can be updated remotely through the AARON 650 Web interface, but still requires manual data entry. It cannot be programmed by station automation, thus relegating static messages to station and program promos.

Built-in RDS with Internet Time is identical to the mode just discussed, except that the AARON 650 inserts current clock-time derived from the Internet. For this service to function, however, the timekeeping function must first be set up separately under: Main Menu / Setup / Network / Time.

## Entering the RDS Data

From the Stereo Regen submenu, navigate to RDS Encoding / RDS Data. This brings up the data-entry screen shown at the right.



Turn the knob to see how each of the data-entry fields may be 'bracketed' for further action. Beginning with the PI field, *push* the knob to enter this information.

- PI** A station's PI (Program Identification) code consists of four 'hexadecimal' alphanumeric characters. PI codes are derived from the station's call letters In the US and Canada, although translators of the station's main signal may require a separate assignment. The PI code of the incoming, off-air signal appears on the Now Playing, Tuner and RDS Info / Decoded RDS menu screens. PI calculators for the US and Canada may be found with an Internet search.

Turn the knob to select among the 16 hexadecimal characters, *push* the knob to enter each character sequentially. Use Backspace to correct any errors, and Save to commit the entry to memory.

- PTY** The PTY (Program TYPe) field identifies the station's format, or primary program content. Bracket PTY and *push* the knob. Turn the knob to scroll through the various choices, there are 23 genres, plus None. The PTY code of the incoming signal may be found on the RDS Info / Decoded RDS menu screen. Select an appropriate format and *push* the knob to commit it to memory.

- PS** PS (Program Service Name) is the display that appears on the faceplate of every RDS-equipped consumer radio. The radio display is limited



to 8 characters, however, so any message longer than call letters (KDEF) or the station's 'street name' (HOT 105) will automatically be 'parsed' and scrolled. (Parsing refers to organizing small words or breaking apart long words so that they fit in an easy-to-read 8-character display.) You may enter a PS message of up to 128 characters here using the knob in the manner already described. Once you complete the entry and issue a Save command, you still need to set the scrolling speed (Page 28).

- RT** RT, or Radio Text, is another messaging field. Not all RDS radios display Radio Text, and in many cases the listener must press a TEXT or INFO button to see this information. Automobile radios may even inhibit the Radio Text display when the vehicle is moving.

Radio Text messages are restricted to 64 characters. The data is transmitted in blocks, which are reassembled by the receiver for display in a variety of styles, depending on the radio. Historically, the Radio Text field was relegated to static infor-

mation such as the station's Web address, phone number, etc. Now many stations provide playout (artist and title) information in the Radio Text field, even though not all radios are capable of displaying it.

The AARON 650 allows only static messaging in the Stereo-Regen mode, so the Radio Text field should probably be used for its original purpose: station or program contact or promotional information. Enter data in the manner previously described, ending with a Save command.

**RDS Flags** RDS offers a number of 'housekeeping' features. Some tell the radio how to decode certain programming; others help a receiver keep track of a primary station and its translators.

The AARON 650 supports four housekeeping 'flags.' Three of these may be found at the bottom of the RDS Data data-entry menu.

The utility of the M/S (Music/Speech switch) and the DI (Decoder Information) functions seem to be lost in RDS history. Both tell the receiver what it might expect in the way of programming; that is, either Music or Speech (speech-only), or a Stereo or Mono broadcast. As best we Inovonicians know, no radios being manufactured today utilize these flags. But in the interest of consistency you might as well maintain the factory-default Music and Stereo selections, unless you are fulltime monaural or an all-news station.

The TP (Traffic Program) flag is associated with an RDS feature that seems useful in concept, but has proven insidious in application. The TP flag tells the RDS radio that the station is one that broadcasts traffic alerts on a regular basis. TP is used in conjunction with an accompanying TA (Traffic Announcement) flag to re-tune a listener's radio to a different station when that station is broadcasting an important traffic-related message. When the AARON 650 is programmed to Re-encode RDS, both flags will come through and the feature will function. But the AARON 650 cannot generate a TA flag on its own, so in the Stereo-Regen mode all the TP flag can do is let the radio know that, once it's back in the range of the station's main signal, it will be primed for a traffic alert. So if your station performs a legitimate news function and reports major traffic snarls and accidents, set the TP flag On. Otherwise leave it Off.

**PS Scroll Speed** As mentioned earlier, the PS field can display only 8 characters at a time. Messages that exceed 8 characters must be 'parsed' and scrolled in the PS field. This means that the entire eight-character block must be reparsed and retransmitted (refreshed) at a rate of once per second or so.

Actually, the PS field was never meant for scrolling messages, and some consumer radios cannot cope with a PS field that is refreshed at a fast clip. Highlight the PS Scroll Speed menu and *push* the knob to show the Speed slider, *push* the knob again to

activate it. *Turn* the knob to set Speed between 1 (slow scrolling) and 9 (fast scrolling). Somewhere in the middle of this range is a good compromise. There will be some radios that will not be able to keep up with a setting of 6 or higher, and anything less than a 3 will take a long time to complete a wordy message.

**AF List** The other RDS housekeeping function alluded to involves the AF (Alternative Frequency) list. An RDS station with rebroadcast translators sends a list of all the frequencies it is using. The radio then searches for a better signal on one of the given frequencies and switches to it with almost no audible interruption. The main transmitter and all associated translators must retain and transmit this same list for the feature to work properly.

Highlight the AF List menu item and *push* the knob. Bracket the list of frequencies on the left and *push* the knob again. Now *turn* the knob to scroll up and down through all the FM broadcast allocations.



When you get to the frequency of your main signal, or any translator for that signal, *push* the knob again to enter that frequency into memory. A checkmark will appear beside the frequencies chosen, and the total number selected for your list will appear in the AFs window.

To delete any single AF, simply select it and *push* the knob. You may bracket the Clear AFs button and *push* the knob to delete *all* AFs to start over. Don't fail to enter the frequency of the main transmitter in addition to all translator frequencies.

**Finally!** When all RDS parameters have been set, *then* navigate to RDS On/Off & Injection and turn RDS  $\odot$  On.

## RECEPTION TOOLS

The SDR (Software-Defined Radio) front-end of the AARON 650 incorporates various means of improving reception under adverse conditions. A complete technical explanation of these utilities is not within the scope of this manual, but each will be addressed as to its basic function and how it may be adjusted to help cope with reception problems.

We refer to these built-in utilities as Reception Tools and offer a range of adjustments over parameters that affect their operation.

**NOTE:** Most of these tools are available only when the AARON 650 is operated in the Stereo-Regen mode; exceptions will be noted.

From the Main Menu, highlight Reception Tools and *push* the knob. This presents the menu shown here, listing the various utilities.



**IF Bandwidth** The first of the Reception Tools to be discussed may be used in both the Pass-Through and the Stereo-Regen modes.

Highlight IF Bandwidth and push the knob. You will be presented with a pair of ‘radio buttons’ and a slider adjustment. In the factory-default  Auto mode, the Fixed Bandwidth slider is grayed-out and inoperable. Receiver bandwidth is controlled in this case by a composite of signal parameters, which will always strive to maintain maximum bandwidth consistent with signal quality. The actual bandwidth selected may be confirmed on the Now Playing menu screen at the top of the Main Menu.

To set the IF bandwidth manually, bracket  Fixed and push the knob. Then bracket and select the Fixed Bandwidth slider to set IF bandwidth incrementally between 56kHz and 311kHz. For an incoming carrier with RDS, you would want to use a minimum setting of 151kHz to assure good stereo and solid data recovery. Any additional subcarriers above the 57kHz RDS subcarrier may require an even wider setting.

This rule of thumb holds true for the Stereo-Regen mode as well, if the RDS data is being regenerated from the incoming signal.

In the Pass-Through mode, use the AARON 650’s built-in metering to gauge the effects of bandwidth settings. Under Graphs and Metering, the MPX FFT will display reductions in ultrasonic noise, and the effects of bandwidth on subcarrier levels. The XY Plot will indicate to what extent the stereo image collapses when bandwidth is reduced.

**FM Advantage vs. Stereo Disadvantage** In terms of immunity from sources of noise and interference, frequency modulation (FM) enjoys a certain advantage over amplitude modulation (AM). This is known as “The FM Advantage.” But with the advent of stereophonic FM transmission in 1961, a significant amount of inherent noise immunity was lost forever.

It is a matter of the physics of the Zenith/GE FM multiplex system that monaural FM “goes farther” than stereo. Actually, the signal-to-noise ratio (SNR) of a stereo broadcast is always about 20dB worse than mono, but in the fringe reception areas the effect is pronounced.

Most high-quality FM receivers have a “blend” function that incrementally changes the reception mode from stereo to mono as the incoming signal deteriorates. This helps the perceived noise performance of these radios, but at the expense of stereo separation as the sound field ‘collapses’ under poor signal con-

ditions. Another option is to roll-off the higher audio frequencies as the incoming signal deteriorates.

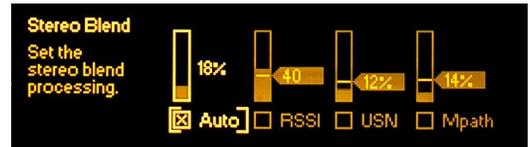
The AARON 650 analyzes three independent properties of the incoming carrier to control the amount of L/R broadband blending, high frequency blending, and top-end program audio rolloff.

The effect these properties have on stereo blending or HF rolloff can either be ‘automatic,’ or placed entirely under user control.

### Stereo Blend

From the Reception Tools menu, enter the setup menu for the Stereo Blend function, active in the Stereo-Regen mode only.

The factory-default setting is Auto. The bargraph and numerical readout above this selection shows the amount of stereo blending in effect, whether the function is automatic or under user control. Note that the three other setup options are grayed-out. Push the knob again to uncheck the Auto box and to gain user control over these adjustments.



Blending (ultimate to mono) may be based on RSSI (incoming signal strength), on USN (ultrasonic noise) or Mpath (multipath effects). Bargraphs and numerical readouts give a realtime measurement of these criteria.

Turn the knob to scroll through the setup options. You can bracket signal property callouts and *push* the knob to activate any or all. You may also bracket the bargraph above each property to set the threshold where that property will begin to effect noise and stereo separation.

RSSI is a ‘good’ quality, so blending begins as the indicated signal strength dips *below* the threshold value. USN and Mpath are ‘bad’ qualities, and blending will begin as these parameters climb *above* their thresholds. Blending will be proportional to the property’s value relative to the threshold you dial-in.

You will need to experiment with these settings as there are no hard-and-fast rules for their adjustment. Every signal reception scenario is a bit different, so *listen* for the effects of these Reception Tools. You may use the headphone jack in this case, but remember: these tools only work in the Stereo-Regen mode of operation.

### High Blend

The High Blend setup menu is identical to the Stereo Blend menu just discussed, and the very same setup criteria and notes apply. The difference here is that only the higher audio frequencies are progressively blended toward mono, the idea being, “why blend everything to mono when most of the noise is high-end hiss?” Whether you use Stereo Blend, High Blend or a combi-

nation of the two will, again, depend entirely on reception conditions, the character of the noise you are trying to get rid of, and other factors best decided after critical listening in each situation.

**Highcut** The Highcut setup menu looks identical to the two blending menus, the difference being that instead of sacrificing stereo separation for a lower noise floor, the high audio frequencies are progressively rolled-off as the RF signal deteriorates. Highcut may prove of some use in translator applications, but the downside is that the program will lose its ‘sparkle,’ and even sound ‘dead’ when enough top-end rolloff is dialed-in to make an audible improvement in noise.

Again, use your ears to evaluate the value of Highcut, and remember: it works only in the Stereo-Regen mode. Setup guidelines are the same for this function as outlined for blending, above.

**Stereo/Mono** The Stereo/Mono setup menu simply allows the AARON 650 to be placed in  Forced Mono in the Stereo-Regen mode. Normal operation is  Stereo (Auto).

**Enhancers** The SDR front end offers two Reception Tools of an advanced nature. These operate in the RF/IF signal path and thus are active in both the Pass-Through and the Stereo-Regen modes.

There are no adjustments for these two tools, and use of them is dictated solely on their sonic merits when receiving a signal of marginal quality. The factory default for both of these is ‘on’ (both boxes checked):  Multipath Suppression and  Channel Equalizer.

## SETTING OUTPUT LEVELS

From the Main Menu, navigate to any output level adjustment utility of interest: Setup / Analog Audio Output, Setup / Digital Audio Output or MPX Output. The characteristics of each of these outputs, their options and adjust ranges explained on Pages 13 and 14. Just bracket, *push* and *turn* to set levels.

## COMPOSITE/MPX SIGNAL PROCESSING

The AARON 650 includes a ‘composite clipper’ in the composite/MPX output path to better define and control the peak-to-peak amplitude of the output signal. This processing block is available in both the Pass-Through and the Stereo-Regen modes of operation.

The composite waveform is first stripped of the 19kHz stereo pilot and 57kHz RDS subcarrier, which are re-introduced after the clipper. (See Block Diagram, Pages 9 and 10.) This exercise

prevents pilot modulation and RDS perturbations at any clipping depth.

From the Main Menu, navigate to: Setup / MPX output. This data-entry screen is where you set the final peak-to-peak amplitude of the MPX 1 and MPX 2 outputs. The Clipping slider adjustment allows anywhere from -2dB to +3dB of composite clipping, which requires a bit of further explanation.



The composite/MPX signal level at this point in the circuit is at a specific peak-to-peak level that assumes  $\pm 75\text{kHz}$  of stereo-encoded carrier deviation. The audio program components (without pilot and RDS in this case) will be right at the clipper threshold when Clipping is set to 0dB. If peak deviations of the incoming carrier are strictly held to “100% modulation,” the clipper will never touch the program waveform.

The *program* peak level of a monaural broadcast will be about 1dB higher than a stereo transmission, simply from the lack of 19kHz stereo pilot modulation. The Clipping control in this case would thus be set to -1dB, assuming  $\pm 75\text{kHz}$  deviation of the (mono) carrier.

In the real world, however, this assumption may be naïve. For example, FCC regulations in the US permit a bit of over-deviation when data and audio subcarriers are present. Moreover, enthusiastic broadcasters in competitive markets occasionally ‘speed’ a bit, subcarriers or not. This is why the Clipping adjustment has a plus-and-minus range (plus for more clipping, minus for less), and why we suggest judicious use of this control.

The obvious downside to composite clipping is the introduction of ‘harmonics’ (harmonic and IM distortion products, actually) within the audible spectrum and beyond. Use the MPX FFT display (Page 20) to help analyze possible problems associated with use of this feature.

## ALARMS

The AARON 650 includes alarms to apprise the user of these signal reception problems: 1) Loss of audio, 2) Loss of Carrier (or a drop in level) 3) RDS Error (subcarrier loss or ‘hijacking’), and 4) Loss of Pilot (stereo loss). These alarms are indicated on the front panel of the AARON 650 and are available as alarm ‘tallies’ (contact closures) on the rear panel. In addition, alarms may be set up independently to send e-mail or text messages to selected station personnel.

Carrier, audio and RES alarms may also be programmed to replace the off-air program with an alternative audio feed, either

from an SD memory card inserted into the front-panel slot, or from a LAN/Internet source of the main program or backup programming. This ‘failover’ feature is detailed on Page 36.

From the Main Menu, navigate to Alarms & Notifications. This menu screen gives access to individual alarm setups, and to the Audio Failover, Email Notifications and Alarm Log settings. These will be described in menu order, but as there are setup redundancies among the alarms, do please read them all.



### Audio Loss

*Push* the knob to enter the Audio Loss setup menu and *turn* it to bracket the five setup options. Individual options are accessed by *pushing* the knob, then *turning* it to change parameters.



When Alarm shows a checkmark in the box, the alarm is activated. An empty Alarm box means that the alarm is turned off.

The Threshold On slider sets the threshold that will trigger an alarm when program audio falls *below* the user-programmed point. The slider actually gives a display of program audio in real time, and also has a flag that shows the set point in dB with reference to full modulation.

When the program level falls below the Threshold On value, the alarm does not pop on immediately. Instead, the program must *remain* below the threshold for the time period programmed into the Time On box. Bracket this box and push the knob, then turn the knob to adjust the time. The figure you select will be dictated to some degree on the station’s format, and on your intended use for this particular alarm.

Once the program returns, the alarm does not immediately reset either. First of all, the program must reach the Threshold Off level. This may be set to the same level as Threshold On, or to a higher level to afford some hysteresis for this alarm function. Moreover, the program must remain above the Threshold Off figure for the time period programmed into the Time Off box. Only then will the alarm be reset.

You will find that the Threshold On and Threshold Off sliders are interactive; you cannot set the ‘off’ level lower than the ‘on’ level.

### Low Signal

The Low Signal alarm is so very similar to the Audio Loss alarm discussed above that its explanation will be abbreviated here. Refer back up for clarification.

On the Low Signal setup menu, Threshold On, Time On, Threshold Off and Time Off are adjusted to give an alarm when the incom-

ing carrier falls and stays below a programmed threshold value. Units of measure in this case are dBuV, rather than the dB associated with the audio program level threshold.

**Audio Muting**

The Low Signal alarm has one additional feature. When the Mute box is checked, program audio will be interrupted (turned off!) during the alarm condition. The Alarm box must of course be checked as well. This is true in both the Pass-Through and the Stereo-Regen modes.

**RDS Error**

Enter the RDS Error setup menu to access these options.

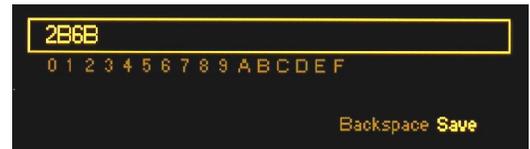


When the Alarm is set (box checked), loss of the 57kHz RDS subcarrier will initiate an alarm following the interval entered in the Time On box. Once the RDS subcarrier returns, and remains for the period entered in the Time Off box, the alarm will reset.

The RDS Error alarm may also be used to guard against ‘hijacking,’ which refers to receiving a distant station when the main signal is lost, or some nefarious pirate taking over the legitimate broadcaster’s translator. The RDS Error utility may be programmed to give an alarm when the incoming PI code does not match the code programmed into the AARON 650.

The PI code of the incoming carrier shows up in the PI box at the lower-right of the menu screen. Make note of this code and then highlight the PI Code box and push the knob.

Using Backspace, remove the four factory-default zeros and enter the PI code of the incoming carrier. Execute a Save to return to the RDS Error menu screen. Now check the PI Error box to engage the anti-hijacking feature. The Alarm box must also be checked for the feature to function.



**Pilot Loss**

An incoming signal that contains the 19kHz stereo pilot tone in the FM baseband will light the front-panel STEREO PILOT indicator whether the Pilot Loss alarm is armed or not. This LED is an instantaneous indicator of stereo pilot presence and is independent of the Pilot Loss alarm.

Open the Pilot Loss alarm setup menu. You may turn the Alarm on here by checking the box. The figure you enter in the Time On box will fix the interval between loss of pilot and the alarm; the Time Off setting determines how fast the alarm resets after the pilot returns.

## ALARM TALLIES

The four alarms discussed above are available as rear-panel ‘tallies’ as well. Normally these would just be closures-to-ground, but we have made these tallies more versatile by enabling the logic states.

From the Main Menu, navigate to: Setup / Alarm Closure Polarity. This matrix allows the user to decide whether he gets a ground or an open for each of the four alarms. Simply use the knob to bracket and select a  Ground or an  Open condition when each of the alarms activates.



## AUDIO FAILOVER

The AARON 650 has an audio ‘failover’ (program audio substitution) feature that can replace the off-air program feed if the carrier is lost or the audio becomes unusable.

From the Main Menu, navigate to Alarms & Notifications and then highlight Audio Failover. Push the knob to enter the setup menu.



Note the three checkboxes at the left. These correspond to the three associated alarms (Audio Loss, Low Signal, RDS Error), which themselves, must be activated (the  Alarm box checked as described on Pages 34 and 35) for the failover function to operate.

When one or more of these boxes is checked, the corresponding alarm will switch the AARON 650 to the failover Source that has been preselected following the alarm’s programmed Time On. Highlight Source, turn the knob and note the options offered.

### Streaming Sources

With a working Internet connection, the AARON 650 is able to decode streaming audio and substitute that for a missing or corrupt off-air feed.

Highlight the Stream box and *push* the knob. This brings up a screen where you can enter the URL of a streaming audio source. *Turn* and *push* the knob to enter the URL, and when the address is complete, initiate a Save command to return to the Audio Failover menu.

Test the streaming audio source by highlighting Test Backup in the lower-right corner of the menu screen. *Push* the knob to play the stream. Remember, *this will actually put the streaming audio on the air*. *Push* Stop Test to restore the normal program source.

- SD Card Audio** An SD (Secure Data) card must be pre-programmed with replacement audio in .wav or MP3 formats, and at a ‘normalized’ level that brings the highest music peaks within 10dB or less of digital clipping.
- Plug a programmed SD card into the front-panel SD slot, notch-up. To test SD playback, first set the Source box to SD Card. Next highlight Test Backup in the lower-right corner of the menu screen. *Push* the knob to begin playback of the SD card audio. *This will actually put the SD card audio on the air*, so you may want to make this test offline or sometime in the dead of night. *Push* Stop Test to restore the normal program source.
- The .wav and MP3 decoders in the AARON 650 can cope with any of the usual and customary sampling and encoding rates. Files will play in the order they were recorded onto the SD card. After the last file is played, the files will repeat-play, in order, indefinitely.
- Stream → SD** This audio failover option defaults to the programmed Internet stream when a reception alarm is registered, but then advances to SD card audio if the stream is absent, or if the stream is lost once it begins playing. Once the SD card begins playing in this mode it continues to play, even if the Internet stream returns. This option may also be tested with the Test Backup button.
- Next Preset** The third audio failover option is for the AARON 650 to retune to the next frequency programmed into the Preset Stations list (see Page 23). If an alarm occurs for the primary frequency, the receiver will switch to the next preset, and will continue down the Preset Stations list until a good signal (with no alarm conditions) is received. If this audio failover mode is selected, be sure to keep only those presets in memory that will replace the main channel programming!
- Audio Failover Reset** In the case of the first two audio failover options (Stream, SD Card or Stream -> SD), return of the main channel will restore normal operation. But once the receiver tunes to an alternative frequency, it must be manually reset by selecting the main channel station preset, either from the front panel or through the Web interface.
- Audio Failover Processing** The AARON 650 incorporates internal AGC, plus both wide-band and high-frequency peak limiting. You can expect the program density (loudness) of replacement audio to match that of typically-processed off-air broadcasts.

## E-MAIL NOTIFICATIONS

*NOTE:* The time-stamp feature for e-mail notifications and the Alarm Log depends on Internet time, and with the proper time offset entered. This is done under: Setup / Network / Time as detailed on Page 48.

Any or all alarms can send e-mail or text notifications to one or more recipients, and which alarms go to whom may be programmed as well. This feature naturally requires an Internet connection (Page 42).

E-mail recipients must first be entered in another area, however. From the Main Menu, navigate to: Setup / Email Preferences / Recipients.



Highlight the Address box and *push* the knob. This brings up an entry screen for an e-mail address. *Turn* and *push* the knob to enter each character sequentially. Once the address is entered, as in the example, execute a Save.



Back on the Recipients screen, the address you just entered will show up in the Select box headed by a number. Up to ten e-mail addresses may be entered in this same fashion; just bring up a 'blank' number and enter the address the same way. Addresses are edited or deleted by bringing up the particular Address and using Backspace to erase it.

Now **BACK** out to the Main Menu and navigate to: Alarms & Notifications / Email Notifications. Highlight the upper box and turn the knob to bring up any of the e-mail addresses you have entered under Recipients.

With a recipient showing, check boxes to select the alarm(s) for that person's notification. In addition to the four signal property alarms, you may also send that person a complete log of all alarms on a D (daily), W (weekly), or M (monthly) schedule, or any combination of these intervals.

## THE ALARM LOG

NOTE: The time-stamp feature for e-mail notifications and the Alarm Log depends on Internet time, and with the proper time offset entered. This is done under: Setup / Network / Time as detailed on Page 48.

From the Main Menu, navigate to: Alarms & Notifications / Alarm Log. This shows a listing of all alarms received since the last reset of the log. Alarm (type of alarm), Station (frequency) and Time & Date of the alarm are maintained. The Time & Date function requires an Internet connection (Page 42).

### Alarm Log Settings

From the Main Menu, navigate to: Setup / Alarm Log Settings. At the top of the screen is a notation of how full the log is at the moment. Although the log is capable of containing a couple of thousand events, it might be important to know when you have

accumulated a certain number of entries, as this could be an indication of some recurring reception problem. Highlight the Email When: box, *push* the knob, and *turn* it to set a desired figure. A setting of 10% equates to about 200 log entries.

Clear Log is at the bottom of the screen. Highlight the box, *push* the knob and, when prompted, *push* it again to delete all alarm history. The AARON 650 Web interface provides means of downloading the alarm log if desired.

## SNMP OPERATION

- SNMP Overview** SNMP, or Simple Network Management Protocol, allows other TCP/UDP/IP equipment on the same Local Area Network (LAN) to communicate directly with the AARON 650, and for the receiver, itself, to initiate an alarm on the network.
- The AARON 650 will interface directly with a network controller, which technically is known as the SNMP 'Manager.' The AARON 650 incorporates an embedded ASCII text file called a Management Information Base, or MIB. In setting up for SNMP operation, the MIB file will have to be downloaded from the AARON 650 and uploaded to the SNMP Manager. Downloading the MIB file employs the AARON 650 Web interface and is detailed on Page 47.
- SNMP Mode** From the front panel, navigate to Setup / Network / SNMP, and then select Mode & Communities. The default setting for Mode: is Disabled, which inhibits communication between the AARON 650 and the SNMP Manager.
- Changing Mode: to Read Only allows the AARON 650 to be interrogated by the SNMP Manager so that stream metadata, alarms, etc. can be integrated with other equipment on the network.
- Setting the Mode: to Read & Write allows the SNMP Manager to send commands to the AARON 650. At present the only command that the receiver can execute are to tune the current frequency, change the antenna selection, or select a Preset Station.
- SNMP Security** SNMP 'Communities' serve as passwords for this function. Go into the Read: and Write: boxes to enter text that is specified for the read/write strings on the SNMP Manager monitoring device. As with similar text-entry screens, execute a Save after entering.
- SNMP Traps** When the AARON 650 *initiates* an alarm, rather than being *queried* or *polled* for one, the alarm is known as a 'trap.' Navigate to Setup / Network / SNMP / Trap Destinations. Here three local network IP addresses may be entered, each corresponding to other devices on the LAN that want to be apprised of alarms.
- SNMP Ports** The default SNMP Ports, General Port 161 and Trap Port 162, are customary for a majority of SNMP operations. These may be changed as required in the usual way.

**NOTE:** The foregoing discussion of SNMP operation is purposefully abbreviated. SNMP is a complex utility, managed exclusively by whatever SNMP Manager (the monitoring equipment) is employed. Refer to all instructions for the SNMP Manager in setting-up the AARON 650. From the active AARON 650 browser screen, you can download the MIB file to help unravel mysteries in this regard as well (see Page 47).

## MISCELLANEOUS SETTINGS

From the Main Menu, navigate to: Admin. These Administrative Settings enable the setup of the functions listed, which are explained below.



**Security** AARON 650 settings may be protected by a password, which must then be entered before any subsequent changes can be made. The password will lock both front-panel (jog wheel) and software control of the AARON 650.

Highlight **Security** on the Administrative Settings menu and push the knob. With the Current Password field highlighted, *push* the knob.

*Push* and *turn* the knob to enter an initial password, using the uppercase and lowercase alphabet, numbers and any punctuation marks shown, up to 31 characters.

Once the password is entered, highlight **Save** and *push* the knob. This will return you to the Security menu. Next highlight  **Enable** and *push* the knob to set the password.

The AARON 650 will lock any time the screen times-out (goes dark) after the unit is untouched for the programmed timeout period. It may also be locked immediately by holding down the **Back** button for a few seconds.

Once the AARON 650 is password-protected you will be prompted to enter the password before any menu can be accessed and any adjustments made. After entering the password, highlight: **Done** and *push* the knob. This will be necessary each time the unit is awakened from a dark screen. Similarly, the password must be entered on the controlling computer whenever connection is made via the Web.

When working on a password-protected unit, uncheck  **Enable** to keep from having to enter the password each time the screen times-out. Remember to  **Enable** the password when finished.

**Lost Password (Hard Reset)** To recover control of the AARON 650 if the password is lost, you must do a “hard reset” of the unit. This is accomplished by holding down the **Back** button as you power-cycle the unit (disconnect and then reconnect AC-mains power).

***WARNING:*** A hard reset deletes not only the password, but will also return the AARON 650 to all-factory-default values. *User settings will all be lost!*

**Display  
Settings**

The Display menu offers an OLED display Brightness choice. You may change the brightness of the graphic display from 60% default value to a higher or lower setting. We don't recommend a much higher setting because this may shorten the life of the OLED graphic display. A lower setting may actually appear a bit sharper and kinder on the eyes in subdued lighting.

Timeout programs the interval between last using the jog-wheel knob and the screen going into its 'screen-saver' (dark) mode. This may be set in 5-minute increments between 5 min and 60 min. You may put the unit into the screen-saver mode manually by holding-down the Back button.

**Firmware  
Update**

Updates to AARON 650 firmware are covered separately in Section VI.

**About**

The About screen shows the current Firmware Rev., the appropriate Webpage Rev. for that unit, Ethernet: and USB: port status, the Serial # of the particular unit, and Uptime:, or how long the AARON 650 has been running since power was last applied.

**Headphone  
Volume**

Although this is a separate submenu under the Main Menu, Headphone Volume rarely needs to be brought up manually. Whenever a pair of headphones is plugged into the front panel jack, this menu automatically pops up. *Push* and *turn* the knob to adjust headphone level to a comfortable listening point.

## Section IV

# CONNECTING TO THE INTERNET

**NOTE:** The AARON 650 should always have a wired connection to the Internet router or server. Never attempt a Wi-Fi connection using a Wi-Fi ‘bridge.’

### FRONT PANEL VS. WEB INTERFACE

The ‘responsive’ design of the AARON 650 Web interface provides an optimal viewing experience across a wide range of devices. From desktop computer monitors to tablets to mobile phones, a minimum of resizing, panning or scrolling is required. Data entry using a real keyboard will almost always prove easier than knob-and-button menu navigation, and use of the Web interface is thoroughly covered in Section V.

Initial configuration (setup) of the AARON 650 has been presented using front-panel ‘knob and button’ data entry, as this is necessary to get the unit online in the first place. However, other setup programming of the unit is easier and faster with a conventional keyboard, once the unit’s Webpages can be brought up in a computer browser (see Section V).

#### **DHCP IP Assignment**

With the LAN jack on the back of the AARON 650 connected to your network, navigate from the Main Menu to Setup / Network / IP Settings. Here you may select:  DHCP to have your router automatically assign an IP address to the receiver. Once DHCP connection is established, the fields on the right-hand side of the screen will populate automatically.



#### **Manual IP Setup**

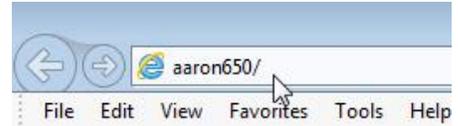
For any of several reasons you may need to set the IP address of the AARON 650 manually. Select the  Static IP radio button and use the knob to bracket the various network parameter options. *Push* the knob to bring up each data-entry field, and then *turn* and *push* to enter the proper decimal-delineated numbers. Use Backspace to erase an entry or to make corrections, and when you’re finished be sure to Save the new entry.

It is not within the scope of this discussion to detail the complete static-IP setup procedure, but a competent IT professional should be familiar with the intricacies of this operation.

## Assigning a Host Name

Hostname is the second item on the Network menu. It allows the user to assign a unique name to a particular Internet Radio Monitor, and will identify the AARON 650 when accessing it via the network. The factory-default name is AARON650. You may change this to personalize the equipment name, or to differentiate one receiver from another on a common network.

*Push* and *turn* the knob to assign a new name and Save the name when finished. Host Names are entered in all-capital letters and the Hostname assignment cannot include spaces. It is not necessary to use all-caps when addressing the monitor, however. Under Windows operating systems you may access the AARON 650 through a Web browser on the same network simply by typing its name and a forward-slash into the browser address bar as shown here.



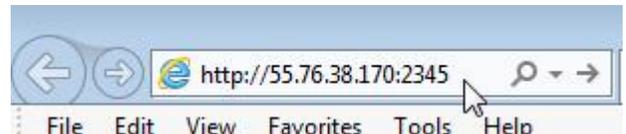
Non-Windows browsers may require you to enter the complete IP address of the unit, which you may find by front-panel navigating to: Setup / Network / IP Settings.

## ACCESSING THE AARON 650 REMOTELY

On a common local network (LAN), access the receiver's Web interface by entering its IP address or, under Windows, its Host Name into your browser's address bar as shown above.

To address the AARON 650 from outside your LAN (from the Internet), the unit must have a static IP address. If your router makes DHCP assignments for other equipment on the network, simply assign the receiver a static IP that is outside the router's DHCP range. This is an easy matter with the aid of the router's Help utility.

It is also necessary to open a specific port for the AARON 650 on the network router. Within the router's Port Forwarding utility you will be able to enter your static IP address for the unit (Internal IP), followed by a colon and a port number. The port number may be any number in the router's range. If your Internet Service Provider (ISP) assigns you a static IP address, then it is a simple matter to address the receiver from anywhere. Just type the IP address and port number into your browser as shown in this example.



But if your ISP issues you a *dynamic* IP, which is most often the case, this mandates 'Dynamic DNS' operation, using the services of an IP-forwarding provider.

**Dynamic DNS**

It would not be possible to address equipment behind a dynamic IP address if it were not for IP-forwarding providers available on the Internet. Their services, which are either free or at a very modest charge, will allow the AARON 650 to keep the provider apprised of its reassigned IP address each time that address is updated by the ISP. The IP-forwarding provider intercepts data attempting to connect with the receiver and converts the IP address to the updated one.

There are three popular forwarding service providers available on the Internet. Their basic service (all you really need) may be free of charge, but advanced features may command a nominal annual fee. All services require registration on the appropriate Website.

From the Main Menu, navigate to Setup / Network / Dynamic DNS. Disabled is the default selection in the Mode: field, but here you may choose among the three popular providers. Write down these provider names and enter each in your Web browser to learn more about their services and to register with whichever provider seems best to meet your needs.



When you register, the provider will issue you a Hostname, Username and Password. Use the front-panel knob to enter these into each of the three fields. When finished, the screen should look something like the example above.

**Network Status**

Highlight Status at the bottom of the Network menu and push the knob. This brings up a screen that gives full particulars of the network connection. This screen is useful for troubleshooting and for verifying connection parameters.

## Section V

### THE AARON 650 WEB PAGE

Up to this point we've used the front-panel display and 'jog wheel' knob to get the AARON 650 receiver up and running. Nearly any function may be accessed in this manner, but entering and editing text is much easier using the Web interface screen and a real-live keyboard.

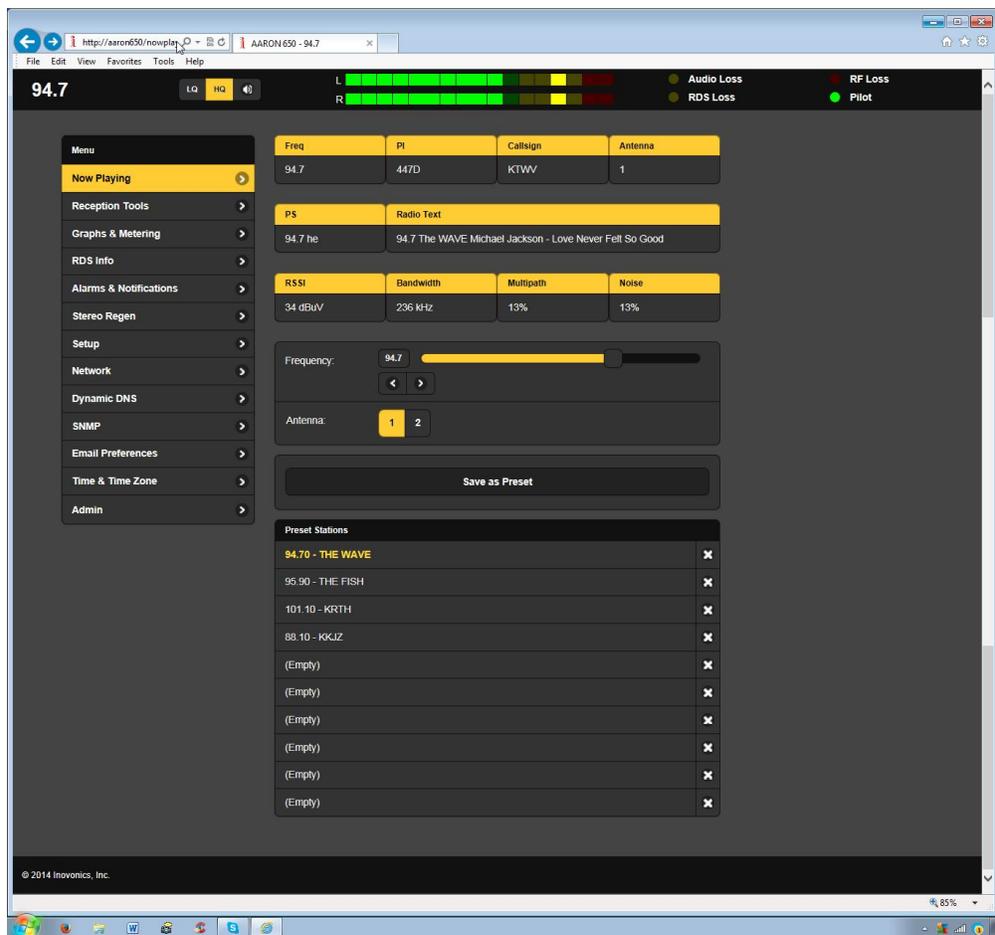
Because the functionality of the Web interface is identical to what can be accomplished from the front panel, this discussion will not detail each Web screen. Each function has already been covered where operation is presented from a front-panel perspective. The front-panel and Web interface menus are arranged in much the same order, but you will find some functions organized a bit differently between various presentations: front-panel display, desktop PC, tablet and mobile device. All menus may be accessed remotely, however, so if one seems to be missing, just look around... it's there.

#### CONNECTING WITH THE AARON 650

Once you are connected to the same network as the AARON 650, from a Windows-environment browser type in the Host Name followed by a / (forward slash). Otherwise enter the full IP address of the receiver (shown under Setup / Network / IP Settings). This will take you to the receiver's main Now Playing Webpage, as illustrated using Microsoft's Internet Explorer browser at the top of the next page.

#### THE WEB INTERFACE PAGES

Each of the individual AARON 650 Webpages will display a Menu list that follows the form of the front-panel Main Menu. For higher-resolution computer or tablet browser screens we are able to consolidate menu functions, so Web interface Menu choices may be greater (or fewer!) for different Web-enabled devices. Everything will be there somewhere, however, so scan the various screens to learn the correlation between front-panel menu choices and what is displayed on your device.



The main Now Playing screen pictured above enables remote listening via the Internet and displays alarms, RDS data, and reception parameters concerning the station currently playing. The Left/Right ‘VU’ Meters may be found here, as well as the tuning and antenna selectors and the station presets utility. Metering, listening options and alarm information will “tag along” and appear at the top of all AARON 650 Web pages.

### Tuning the AARON 650

The receiver may be tuned by any of several means. You can: 1) grab the tuning bar and slide it back and forth; 2) click the ◀ and ▶ (down/up) buttons to step the frequency; 3) overwrite the numbers in the digital Frequency: display box; or 4) click any of the Preset Stations underneath.

### Station Presets

When you have tuned a station that you wish to keep as a preset, click on one of the (Empty) slots down below. This will bring up a Save Station data-entry box where you may type in call letters or other identifier and Save the selection. Your preset will be added at the top of the list.

To reorganize the list, you must re-enter presets, as required, in reverse order that you want them to appear (enter the top preset last). Duplicates may be deleted afterward by clicking the ✕ to the right of the name.

**Remote Listening** A loudspeaker icon appears at the top of the Now Playing screen. Click this to listen to the station from a remote location.

There are two audio quality options available. LQ has an MP3 data rate of 64kbps, and HQ is 128kbps. With marginal connections, LQ may prove the better choice.

The encodings/decoding and buffering time (latency) of the audio will depend to some degree on the connection path and network quality, but is a minimum of 8 to 10 seconds, even on a Local Area Network. This listening utility has been included to confirm the presence of audio, not for performing a critical assessment of off-air audio quality. Keep in mind that the audio will lag the metering by several seconds.

## THE MENU LIST

The other remote, on-screen menus are arranged as much as possible in the same order as the front-panel menus. Differences will be discussed in the remainder of this section.

**Graphs and Metering** Remote screen representations of FFT and XY readouts will necessarily have lower resolution and slower refresh than the front-panel OLED display. The Peak History (LR Plot) is not available for remote viewing.

**Alarms and Notifications** The Alarms and Notifications screen contains all relevant sub-menus on the one Webpage. After first entering e-mail recipients on the Email Preferences menu, set the 'who gets what' notification preferences for each recipient under Alarms and Notifications by selecting the name from the pull-down menu and then checking appropriate boxes.

The Web interface further enables the Alarm Log download to your computer as a 650alarmlog.csv (comma-separated values) file in typical Windows fashion. The log file may be read using a text editor like Windows Notepad, or may be brought into a spreadsheet program such as Microsoft Excel for further use in analyzing failure modes.

**Networking Issues** Between the Network and the Dynamic DNS screens, connection parameters may be set up and confirmed just as they are from the front panel of the unit.

**Downloading the MIB File** The SNMP screen similarly allows setup of this function, and also enables downloading the MIB file. An outline of SNMP operation begins on Page 38 of this manual. The MIB file is a small text (.txt) file that is required by the SNMP Manager. Click: Download MIB to initiate the process; the file is saved in the usual Windows manner. The MIB file is in plain text and may be read with Windows Notepad.

**E-Mail or  
Text Message  
Notifications**

The e-mail or text-message addresses for recipients of alarm notifications are entered on the Email Preferences menu page. Notification preferences (who gets which alarm messages) are set on the Alarms and Notifications menu page described earlier.

**Timekeeping**

The Time & Time Zone menu screen sets the internal timekeeping function of the AARON 650 to Internet time, including allowance for Daylight Saving Time as appropriate. Timekeeping is vital in tagging tag alarm notifications and for the Alarm Log.

The Admin menu screen is any easy means of setting up a password for the AARON 650, but also has another bonus feature, the Hardware Profile.

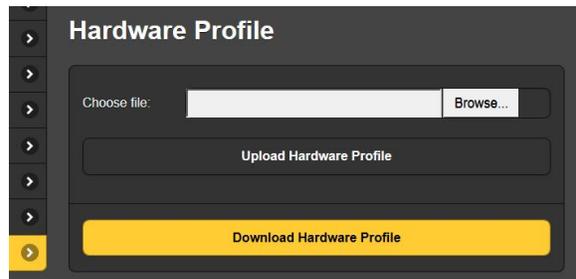
## SAVING THE HARDWARE PROFILE

The entire AARON 650 setup, which includes the Preset Stations list, receiver setup choices, hardware options, alarm notification preferences and SNMP options, may be saved to your computer as a small text file. The Hardware Profile is useful for restoring a previous receiver setup or for ‘cloning’ a second unit for backup service.

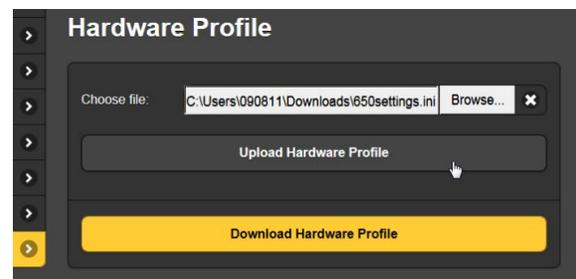
The Hardware Profile utility is found under the Web interface Admin screen.

Click: Download Hardware Profile to save the profile to your system.

With the version of Windows Internet Explorer used in this example, the file is saved to a Downloads folder. Other browsers may ask you to specify a ‘save to’ location. The file has a default name of 650settings.ini.



To upload a saved setting to your AARON 650, first click: Browse... to locate the saved profile, and then click: Upload Hardware Profile. This will replace all setup parameters that are currently loaded and running in your receiver.



## Section VI

# UPDATING AARON 650 FIRMWARE

## THE FIRMWARE UPDATER

The AARON 650 is a firmware-based product. The term ‘firmware’ refers to the code loaded into the microcontroller and DSP chips, the ‘smarts’ that make the product work.

The AARON 650 includes a ‘bootloader’ utility that allows firmware to be updated whenever Inovonics issues changes to add features to improve performance or otherwise expand the usefulness of the product. Inovonics supplies firmware updates free of any additional charge.

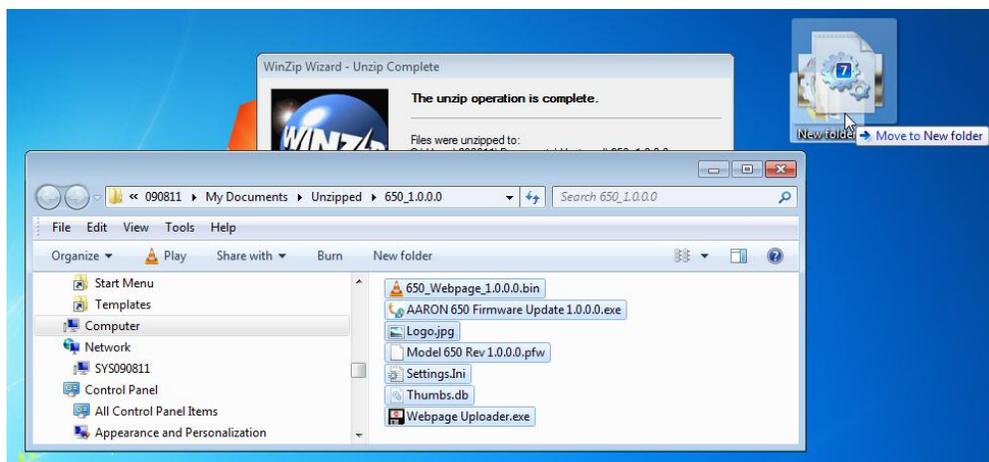
A bootloader is a simple software routine that runs on any PC that is on the same network as the AARON 650. Refer to Section IV for specifics on assuring a connection between the AARON 650 and your computer. This *must* be a wired, LAN connection for both the PC and for the AARON 650. Attempting to use a Wi-Fi link will almost guarantee failure.

### Warning

A firmware update will restore the AARON 650 to factory defaults. *All settings and presets will be overwritten!* Always perform a Hardware Profile Save (Page 48) before proceeding with an update. This will save all user setup parameters.

### Firmware Update Files

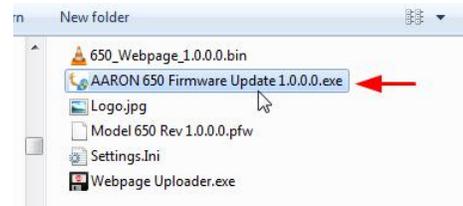
A firmware update will be supplied as a ‘zipped’ folder containing a number of files. This may be distributed as a download from the Inovonics Website or supplied on a CD-ROM or USB flash drive. Regardless of how the update is received, make a temporary New Folder on your PC Desktop and unzip these files to it as shown below.



One of the supplied files is the third-party bootloader utility, an 'executable' (.exe) file. Because executables are notorious for propagating viruses, many antivirus programs will not allow .exe files to be downloaded and will urge you not to install them. But you must trust us and throw caution to the wind.

### Running the Firmware Updater

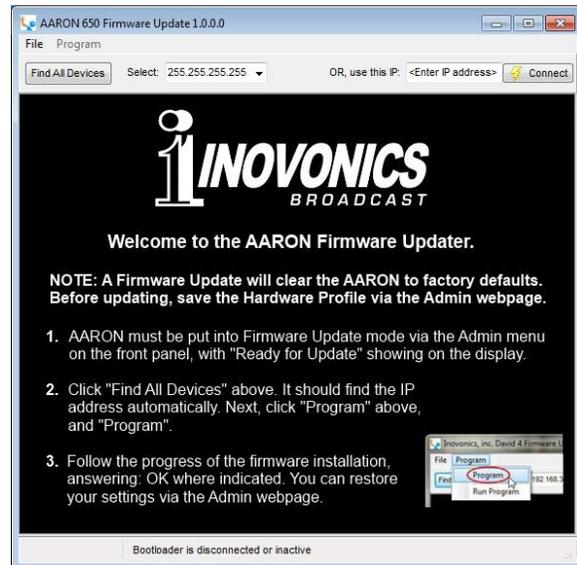
Navigate to your temporary Desktop folder (New folder) and double-click the bootloader .exe file. This is the file marked with the arrow in the snapshot on the right.



That will bring up this Information message, advising that the Firmware Updater does not yet find the AARON 650. Click: OK. This will start the firmware updating utility and display its main screen.



The bootloader window outlines the firmware update process in three easy steps.



The first step advises that the AARON 650 must, itself, be in the Firmware Update mode.

Using the front-panel jog wheel, navigate to: Admin / Firmware Update. This will bring up the first of two front-panel screens, each with a stern warning about proceeding. If you have backed up your

Hardware Profile and are reasonably certain that the AARON 650 and your computer are ready to connect properly, select:  Yes in both cases, paying close heed to the warnings in each.

When the AARON 650 is ready to accept the firmware update it will display this message.

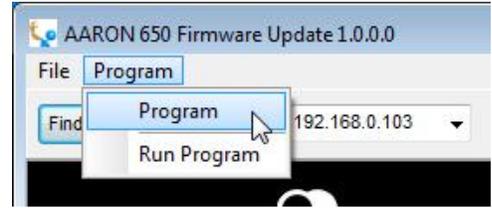


Next, click: Find All Devices at the top of the bootloader window.

The IP address of your AARON 650 should appear in the Select: field, confirming that you are properly connected. If you do *not* see the IP address of your AARON 650, abort the update (described below) and troubleshoot connection issues. You may always bring up the AARON 650 Webpage to test the interconnection. If you can bring up the main Webpage, the Firmware

Updater should connect.

In step 2 first click: Program at the top of the bootloader screen to display the drop-down menu shown here. Then click: Program (*not* Run Program!) to start the firmware update process.



The PC screen will display various progress bars as firmware is uploaded to the AARON 650.

In Step 3 click: OK as directed at the end of the upload. The AARON 650 will revert to the main menu where you can confirm the version number of the uploaded firmware.

### Aborting a Firmware Update

Before you have committed to a firmware update, pushing the Back button will return you to previous screens, effectively aborting the update process.

But once you see this message on your AARON 650 it is *almost* too late to turn back. If for some reason the Firmware Updater cannot connect to the AARON



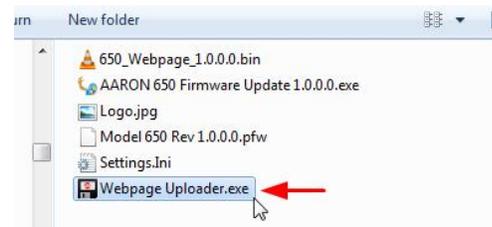
650, and you have not yet initiated Step 2 to begin the update routine, even at this point, and with this message showing, you may power-cycle the AARON 650 as a last-ditch means of aborting the process and returning to the existing version of the firmware. *Do not* hold down the Back button while doing this abort; that is, *do not* perform a hard reset!

If for some reason the firmware update does not 'take,' do not power-cycle the AARON 650. Continue to re-run the bootloader until all hope is gone, then call us.

### Updating the AARON 650 Webpages

The various Webpages (menu pages) for IP remote communication of the AARON 650 are updated separately from the general firmware files.

If a new version of firmware calls for a Webpage update, there will be one extra file in the bootloader folder. This image shows such a file with an arrow to mark the Webpage Uploader.exe file.



Immediately after the firmware update is bootloaded, and while the AARON 650 is still in communication with your computer, return to the unzipped bootloader folder and double-click the Webpage Uploader.exe entry. You also will need to enter the IP address of your AARON 650. The existing Webpages will be summarily replaced with the new ones.





# INOVONICS WARRANTY

- I **TERMS OF SALE:** Inovonics products are sold with an understanding of “full satisfaction”; that is, full credit or refund will be issued for products sold as new if returned to the point of purchase within 30 days following their receipt, provided that they are returned complete and in an “as received” condition.
- II **CONDITIONS OF WARRANTY:** The following terms apply unless amended *in writing* by Inovonics, Inc.
- A. The Warranty Registration Card supplied with this product *must* be registered online at [www.inovonicsbroadcast.com](http://www.inovonicsbroadcast.com), within 10 days of delivery.
  - B. This Warranty applies only to products sold “as new.” It is extended only to the original end-user and may not be transferred or assigned without prior written approval by Inovonics.
  - C. This Warranty does not apply to damage caused by misuse, abuse, accident or neglect. This Warranty is voided by unauthorized attempts at repair or modification, or if the serial identification label has been removed or altered.
- III **TERMS OF WARRANTY:** Inovonics, Inc. products are warranted to be free from defects in materials and workmanship.
- A. Any discrepancies noted within THREE YEARS of the date of delivery will be repaired free of charge, or will be replaced with a new or remanufactured product at Inovonics’ option.
  - B. Parts and labor for factory repair required after the three-year Warranty period will be billed at prevailing prices and rates.
- IV **RETURNING GOODS FOR FACTORY REPAIR:**
- A. Equipment will not be accepted for Warranty or other repair without a Return Authorization (RA) number issued by Inovonics prior to its return. An RA number may be obtained by calling the factory. The number should be prominently marked on the outside of the shipping carton.
  - B. Equipment must be shipped prepaid to Inovonics. Shipping charges will be reimbursed for valid Warranty claims. Damage sustained as a result of improper packing for return to the factory is not covered under terms of the Warranty and may occasion additional charges.