

Technical Service Bulletin 130812

AGC Installation Procedure for Paragon and DCX Series Transmitters

Service Bulletin 130812 details the installation and adjustment of the Total System AGC supplied with all ATSC8000, and ATSC5000 exciter installation kits. The AGC kit (part number **453523-01**) may also be purchased as an add-on feature to existing DCX Series Exciter cabinets that have the Total Power Control Unit (TPCU) installed. If installing this AGC kit into a Non-Millennium DCX exciter cabinet, the TPCU (part number **46745454.03**) must be installed per instructions in COMARK document number **46744200**.

Caution: The procedure contained below is for advanced users only and should not be attempted without a full understanding of the theory of operation of the transmitter gain control system. Incorrect set-up of the gain control system could result in damage to the transmitter amplifiers and IOT resulting from overdrive conditions.

Tools required for installation are, but not limited to;

- #2 Phillips head screwdriver
- Small flat blade adjustment tool (tweaker).
- Hand Drill
- 6-32 Thread Tap and drill bit
- Volt meter
- Wire cutters and crimper
- Spectrum Analyzer

1. AGC Simplified Theory of Operation

The transmitter gain control system uses the principal of negative feedback to maintain a steady operating power despite changes in amplifier gain due to temperature shifts or other component shifts.

Using active RMS power detectors, the Total Power Control Unit A2 (TPCU) provides precise DC voltages proportional to the levels of the system output power, and each HPA power output. These voltages are typically between zero and five volts.

The DCX AGC Interface PCB (AGC card) takes an amplified sample of each of these metering voltages and compares them according to a diode-OR selection rule. The diode-OR circuit allows only the highest metering value to pass on to the next stage: the exciter AGC input. All other diodes are reversed biased by the highest metering value passing through to the next stage.

The diode-OR selection is such that the transmitter gain control system will only track the highest metering voltage present on the AGC card. Under normal operation, the variable gain controls on the AGC card are adjusted such that system forward power metering voltage is slightly higher than the metering voltages from the individual HPA cabinets. This ensures that the AGC tracks the system forward power. Should the system forward power drop, the AGC will attempt to compensate by raising the output voltage therefore the exciter output power increases. When an individual HPA power level rises to 110% of nominal, it's metering voltage now becomes greater than that of the system forward, and takes control of the diode-OR preventing further increase in power. The level of the system reverse power metering voltage is adjusted such that a reflected power level of 2.5% allows it to seize control of the diode-or circuit and force the AGC to reduce the forward power while keeping the reflected power level constant (VSWR fold-back). VSWR fold-back is already implemented in the DCX series transmitter that has factory installed TPCU modules.

The diodes forming the diode-OR circuits are LED's, thereby allowing easy determination of which metering voltage is currently controlling the AGC system.

2. Installation Preparation

- a. Sort all RF cables, and hookup wire.
- b. Cut two sets of hook up wire approximately 18" long, and attach the supplies female pins to each set. See figure 1.

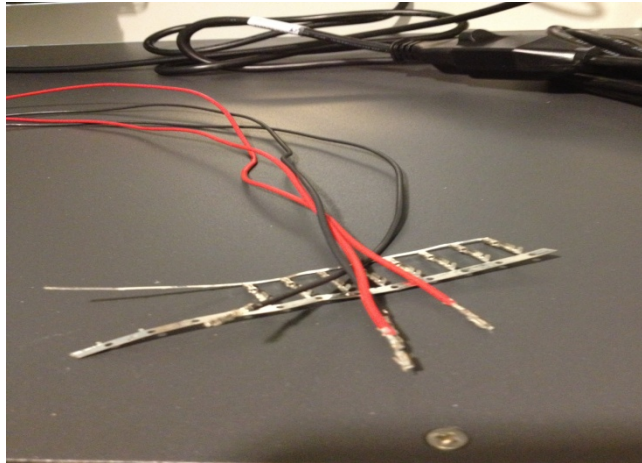


Figure 1

- c. Locate the AGC card, Figure 2, and remove all mounting hardware including the connector pin header. See Figure 3.

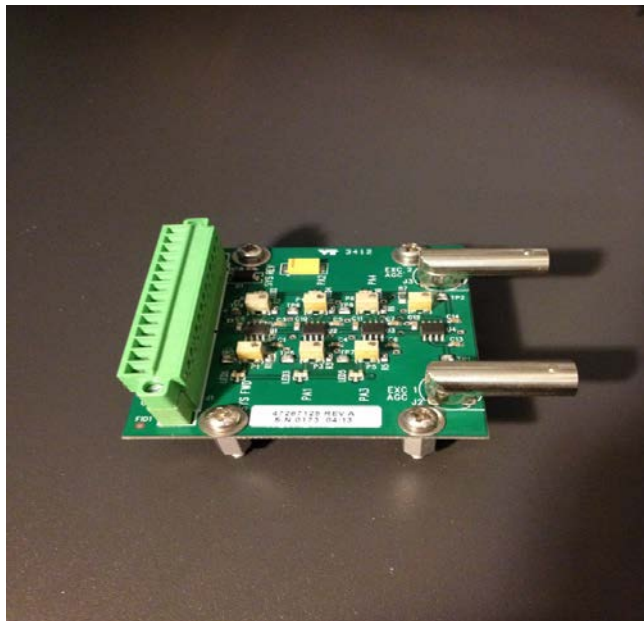


Figure 2



Figure 3

- d. Locate the mounting location, using the PC board as a template, mark all four mounting holes that will be drilled and taped. See figures 4 and 5.

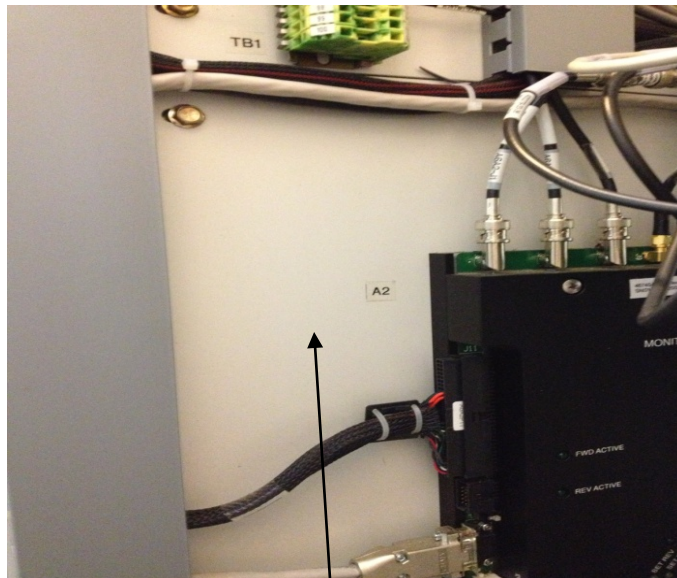


Figure 4 Mounting Location

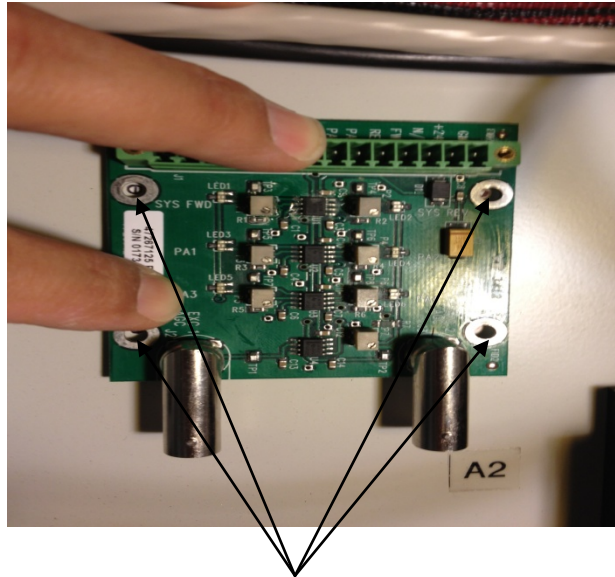


Figure 5 Marking mounting holes.

(A small torpedo level or similar should be used to ensure the board is level.)

- e. After all the mounting holes are marked, drill the holes using a hand drill with a 1/8" steel drill bit. See figure 6.

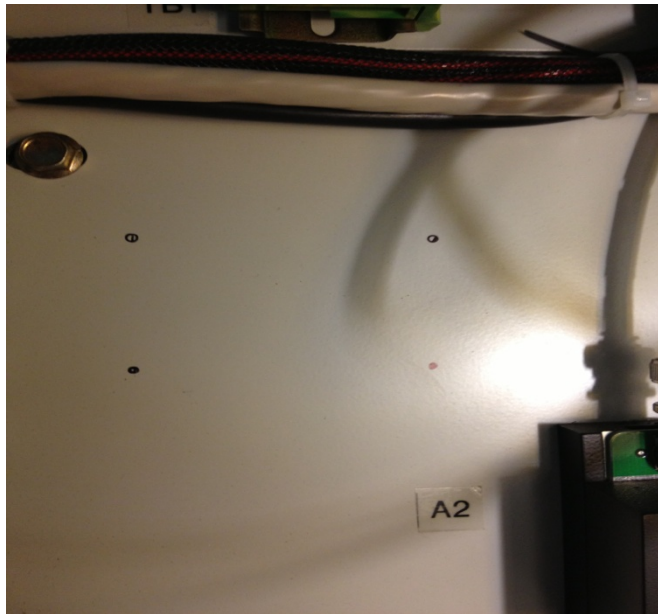


Figure 6

- f. After drilling the holes, cut the threads using the 6-23 thread tap. See figure 7.



Figure 7

3. Installation

- a. Using the supplied mounting hardware, secure the AGC board in place, with the connection pin header upright as shown in figure 8.



Figure 8

- b. Temporarily install the connection pin header in place. Cut and dress a pair of hook-up wire from pin 1 (Ground) and pin 2 (+24 volts). See figure 9.

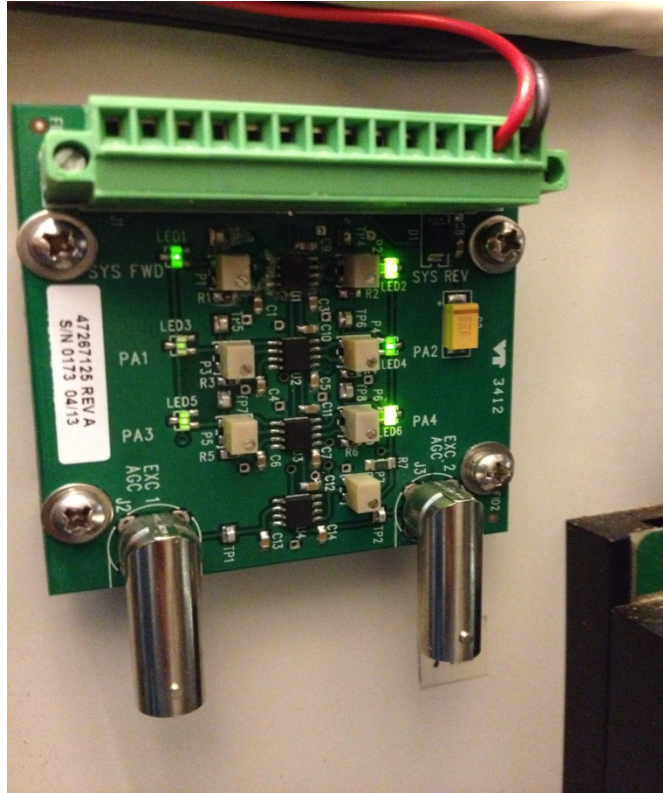


Figure 9

- c. Dress and cut to length the black hook-up wire from pin 1 on the AGC card, and connect it to TB1 – 93L (the exciter cabinet terminal block) for Ground. See Figure 10. The terminal block tool that was supplied with the transmitter should be used for all TB1 connections. See figure 10.

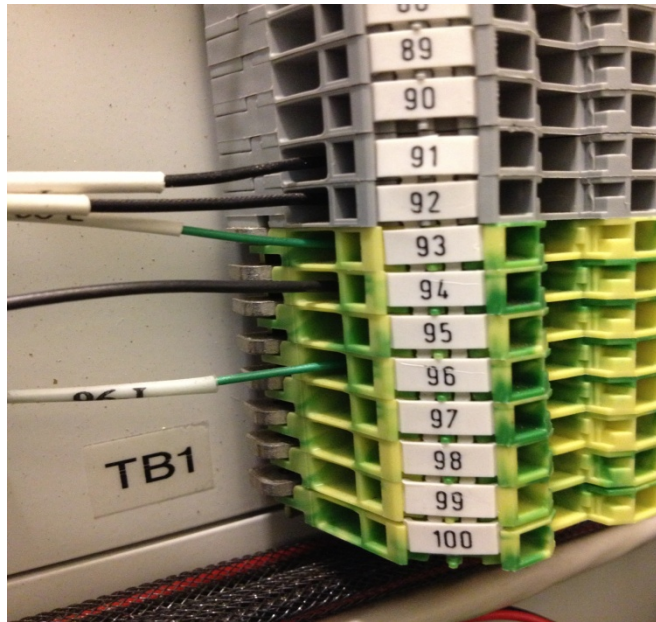


Figure 10

- d. Dress and cut to length the red hook-up wire from pin 2 on the AGC card, and connect it to TB1 – 48L (the exciter cabinet terminal block) for +24 volts. See Figure 11.

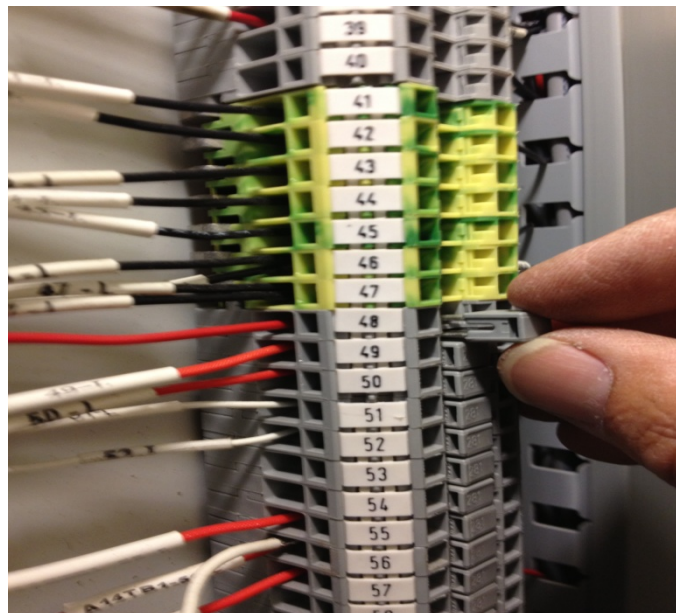


Figure 11

- e. Momentarily insert the WAGO jumper (supplied with the kit) between TB1-48L & TB1-49L and verify that the AGC card has power and the LED's are illuminated as seen in figure 9. Remove the plug after voltage verification; it will be reinstalled later in the procedure.

- f. Locate the TPCU (A2) Module and disconnect the A6A2P11 connector. See figure 12.

Caution: When the A6A2P11 connector is disconnected, the System Forward, System Reverse, and Reject Power meters will no longer indicate power. The remote monitoring of the System Metering will not be available until the connector is modified and re-inserted. The transmitter output power will not be affected during this time, only the metering indications.



Figure 12

- g. Cut the two zip ties from the connector body and push the wire mesh covering away from the connector. Install the two sets of hookup wire as follows:

A6A2P11	AGC Card	Wire Color
Pin 46	J1-6 (HPA 1)	Red
Pin 47	J1-7 (HPA 2)	Red
<i>Pin 48*</i>	<i>J1-8 (HPA 3)</i>	<i>Red</i>
Pin 16	J1-12 (GND)	Black
Pin 17	J1-13 (GND)	Black
<i>Pin 18*</i>	<i>J1-14 (GND)</i>	<i>Black</i>

**Valid only when a third HPA is present, otherwise J1-8 is grounded.*

See Figure 13



Figure 13

- h. Dress the wire through the TB1 Panduit to the AGC card. Pull the wire mesh back up to the connector body and replace the wire ties. The A6A2P11 connector can now be reconnected to the TPCU module, and System Power monitoring will be restored. See Figure 14.

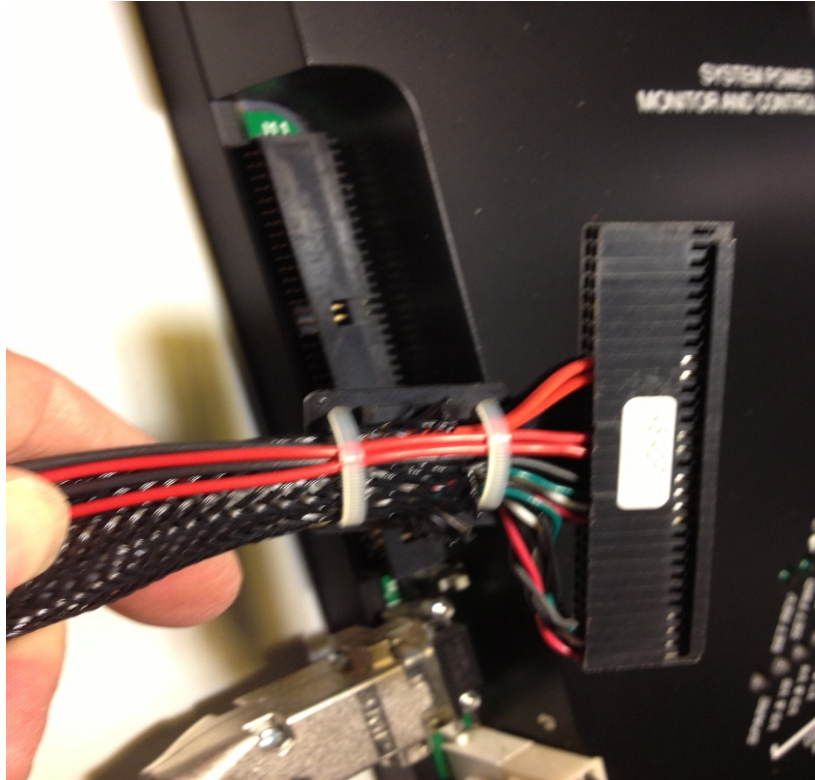


Figure 14

- i. Cut a length of the supplied audio cable long enough to be dressed from the AGC card J1 connector, to the TB1-1L and TB1-2L connections. Leave the drain wire intact on the TB1 end. Connect the Red wire to the AGC Card J1 pin 4 (System Forward) and TB1-1L. Connect the black wire to the AGC J1 pin 10 (Ground) and TB1-2L (Include the drain with this connection). See figure 15.



Figure 15

- j. Inspect the bulkhead of the Exciter cabinet for N-type connectors labeled APC Input. Some earlier DCX transmitters do not have these connectors on the bulkhead. If that is the case, select two unused N-type connectors and re-label them APC Input. See figure 16. Paragon transmitters will have these connectors.



Figure 16

- k. Find and install the two N-type to BNC-type cables. Connect one from J8 APC Input, to A2 (TPCU) J5. Connect the second from J9 APC Input to A2 (TPCU) J6. If a third HPA is in use, it will connect to TPCU J7.

Note: Paragon transmitters have a customer RF sample available on the connector block in the rear of the rear of the cabinet. This sample is fed from a forward sample of the calibrated coupler located on the output stack of the CEA IOT. This connector is J6.

- l. Connect an N-type cable from V1 J6 to the Exciter cabinet J8 APC Input.
- m. Connect an N-type cable from V2 J6 to the Exciter cabinet J9 APC Input. See figure 17 & 18.



Figure 17



Figure 18

Note: When fitting a DCX transmitter with AGC, the RF samples to the APC Input must be connected directly to the customer sample coupler located on the front of the IOT output stack.

When using ATSC8000, or Adapt IV excitors, the outputs of the AGC card connect directly to the AGC Input connectors on the rear of the excitors. J2 Exc 1 AGC on the AGC card will connect to Exciter 1 AGC Input. J3 Exc 2 on the AGC card will connect directly to the AGC Input of Exciter 2.

When Using Adapt III (MODAP) excitors, the AGC Input (J17) is located on the rear backplane. A factory installed jumper cable connected between J21 and J17 must be removed to allow connection of the external AGC circuit to be connected. See figure 19 for the location of J17.



Figure 19

4. Adjustment

Before the set up of the AGC circuit, the transmitter power output (TPO) should be verified by using the calorimetric method, or a thermal power meter connected to a calibrated system output port. If necessary, the output power should be adjusted and the Forward Power Meter calibration should be adjusted to indicate 100%. This procedure is outlined in the DCX Exciter manual.

In addition, the forward power calibration of all HPA's should be verified and calibrated if needed. It is important that Non-Linear corrections be active with overall good shoulder performance. The HPA Forward, Reverse, and Drive metering all see a wide band RF signal. If the out of band power is higher than normal due to poor Non-linear correction, the power indications will also be higher. After good performance is verified, the HPA meters should then be precisely adjusted.

DCX HPA Power Metering calibration is outlined in **Service Bulletin 030616**.

Paragon HPA Power **Meter** calibration is outlined in **Service Bulletin 031209**.

Paragon HPA Power **Sensor** calibration is outlined in **Service Bulletin 031210** (for Bipolar HPA Drivers) and **Service Bulletin 031210** (for LDMOS HPA drivers).

The sensor calibrations should only be performed **AFTER** the meter calibration.

- a. After confirming all wiring is connected, reconnect the J1 connector on the AGC card, and re-insert the WAGO jumper between TB1-48L and TB1-49L. Several of the LED's should now be illuminated. See figure 9 in section 3.
- b. From the supplied hook-up wire, cut short jumpers and connect all un-used inputs to ground.

Caution: If any unused input is left un-grounded, the AGC system will not operate properly and damage to the transmitter may occur by overdriving the amplifiers.

- c. With the transmitter operating at 100%, performance verified, and the HPA forward power metering at 100% the AGC card can now be adjusted.
- d. Measure the System Forward power metering voltage present on the AGC card J1 pin 4 referenced to ground. The nominal voltage is 2.5 volts, the operating range is 1 to 5 volts. The measured voltage is the target voltage for the HPA power metering voltages feeding the AGC board.
- e. Measure the HPA1 Forward power voltage on J1 pin 6 referenced to ground. The voltage should be close to the target voltage measured in the previous step. If the voltage is not between 1 and 5 volts, the voltage should be adjusted using the TPCU mode select buttons. See figure 20.

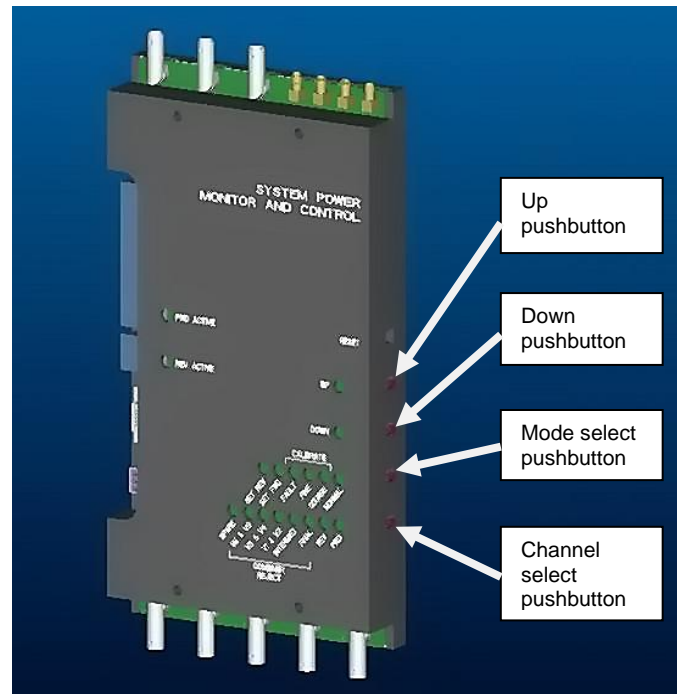


Figure 20

- f. To adjust the HPA metering voltage, press the Mode Select pushbutton on the TPCU to select Coarse. The LED will move one step to the left with each push of the button.
- g. Select V1 + V2 (HPA1) using the channel select button. Again, each press of the pushbutton will move the LED one channel to the left.
- h. With V1 + V2 selected for coarse calibration, use the Up and Down buttons to adjust the metering voltage to the target value.
- i. Measure the voltage on the AGC card J1 pin 7. If adjustment is necessary advance the channel to the V3 + V4 (HPA 2) channel, and adjust the target voltage using the Up and Down pushbuttons.
- j. Once the voltages have been set, push the Mode Select pushbutton until "Normal" mode is active.
- k. Adjust all potentiometers on the AGC card fully counterclockwise.
- l. Measure the voltage at TP3. Adjust P1 to obtain a voltage of +15.75 volts.
- m. Measure the voltage at TP5. Adjust P3 to obtain a voltage of +15.60 volts.
- n. Measure the voltage at TP6. Adjust P4 to obtain a voltage of +15.60 volts.
- o. Measure the voltage at TP1. Adjust P7 to obtain a voltage of +3.2 volts.

The AGC reference voltage is now present at the exciters.

ATSC8000: Navigate to the System>RF menu. Advance the cursor to the LVL indication, press the Up arrow to select, then press the OK button. The AGC LVL and REF value should now be the same. Move the cursor to the AGC on/off setting, press the up arrow (AGC ON) and press OK. System AGC is now active. See figure 21.



Figure 21

Adapt IV: Press the F3 button twice to arrive at the AGC setting window. The AGC LVL should indicate a value. Using the arrows, navigate to the "Set REF" selection and press OK. The AGC LVL and REF LVL should now be the same. Navigate to the Manual/Auto gain selection and select Auto gain, then press OK. See figure 22.

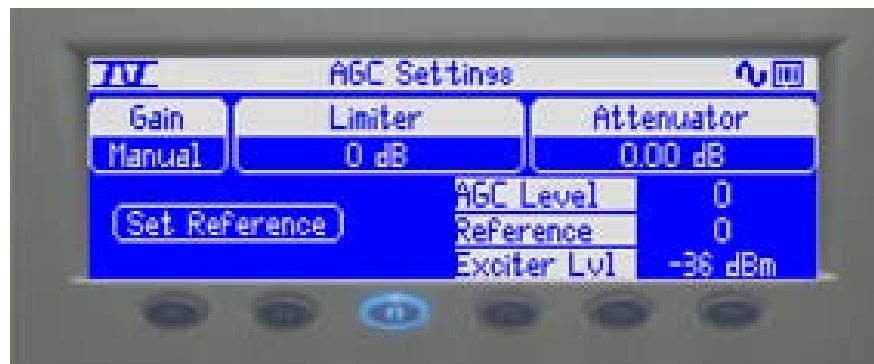


Figure 22



Here at COMARK, we are constantly striving to improve the satisfaction of both our new and existing customers. Continually working to improve the reliability of the installed fleet of COMARK transmitters in the field is another way in which we demonstrate our commitment to you, our valued customer.

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