

**Flexstar to BE FMi Transmitter**  
**Quick Start**  
***TECHNICAL MANUAL***  
**888-2733-001**

# *Flexstar to BE FMi Transmitter*

## *Quick Start*



T.M. No. 888-2733-001

© Copyright Harris Broadcast 2012, 2013  
All rights reserved

Revision F  
June 12, 2013  
Revised to add FAX Boost Amp



# Section 1

# 1

## 1.1 Introduction

This guide provides an outline of the activities required to integrate a Harris Broadcast Flexstar Exciter into BE FMi Series FM Transmitters. This document is intended to be an initial setup guide to get the transmitter RF chain operational. For information on theory, operation and troubleshooting refer to the transmitter and exciter technical manuals.

It is important to read and follow this guide closely to ensure that the system functions as intended and no problems are encountered. This guide assumes that the transmitter is operating at the customer TPO and has no faults.



**Figure 1-1 Harris Broadcast Flexstar Exciter Front Panel**

## 1.2 RTAC Level Setup

The new Harris Broadcast Flexstar exciter has adaptive precorrection called RTAC and requires a RF sample from the output directional coupler to function correctly. This RF sample level needs to be set to ensure the exciter input is not overdriven and has an adequate sample that can be used for correction. The level range for proper operation is +5 dBm to -20 dBm and should be set as close to -5 dBm as possible.

Prior to performing these steps verify the transmitter is operating at full power so the maximum level that the exciter would see is at the -5 dBm level. A spectrum analyzer or power meter capable of measuring the range of power specified above is required to perform this procedure. Also at this time please take note of the power out of the BE exciter, when the Harris Broadcast exciter is installed and running it should be near the same power out.

If no test equipment is available, complete steps 1 through 6 then skip to the next section. The exciter has a bargraph that can be used for this purpose but is less accurate than the test equipment.

- STEP 1** Ensure BE FMI transmitter is operating at full TPO and has been running for at least 30 minutes. Note the BE FXi Exciter power out at this time.
- STEP 2:** Increase the transmitter power to maximum. Note the transmitter power as well as the exciter power out, these readings will be used to set the power limit in the Flexstar.
- STEP 3:** Set the transmitter back to the normal TPO before continuing.
- STEP 4:** If installing the Flexstar in a tube transmitter take note of all tube adjustment settings. This will allow them to be reset back to the starting point.
- STEP 5:** Take a screen shot of the RF spectrum. If the transmitter is severely out of tune for HD operation or a tube is weak, the Flexstar RTAC may not be able to correct for mask compliance.
- STEP 6:** If the exciter and accessories have not been unpacked please do so now. Locate the 2-way splitter, RF attenuator pads and RF Cables that were supplied with the Harris Broadcast exciter.
- STEP 7:** Refer to Drawing 839-8132-462 that is in the accompanying documentation. This drawing shows the connections to be made from the transmitter to the new Flexstar exciter.
- STEP 8:** If a modulation monitor cable is connected to the BE FMI transmitter sample port, locate the end that is connected to the sample port on the transmitter output directional coupler. Note this cable must be at the output of the transmitter not on the exciter sample port. Disconnect this cable and connect it to one of the OUT ports on the supplied 2-way splitter.
- STEP 9:** Connect the input (S Port) of the 2-way splitter to the location on the transmitter where the modulation monitor sample was located.
- STEP 10:** Connect a 10 dB BNC pad to the other OUT port of the 2-way splitter.

**STEP 11:** The other cable supplied is a BNC to SMA cable, if possible this cable should be used to obtain an accurate level at the input to the exciter. Connect it to the other OUT on the 2-way splitter. An adapter will be required to connect the SMA end to the test equipment. If no adapter is available use a BNC to BNC coax to connect the test equipment.

**⇒ NOTE:**

If no test equipment is available, connect the 20 dB SMA pad to the cable and connect it to the exciter. The level can be checked later with the exciter bargraph to ensure that the level is adequate for RTAC operation.

**STEP 12:** Connect the cable to the input of the test equipment. Check the level and add or remove either pad until it is as close to -5 dBm as possible.

**STEP 13:** This completes the setup for the RTAC level. Remove the cable from the test equipment but leave all other cables connected and continue to next section.

## 1.3 Removing BE Exciter and Installing Flexstar

---

Prior to performing these steps verify the transmitter is operating at full power with no faults. If any faults or warnings are identified, fix these issues before continuing with this procedure. Do not discard any cables or hardware as these will be required to install the Flexstar into the system.

Figure 1-2 shows the connections that will be made to the Flexstar Exciter..

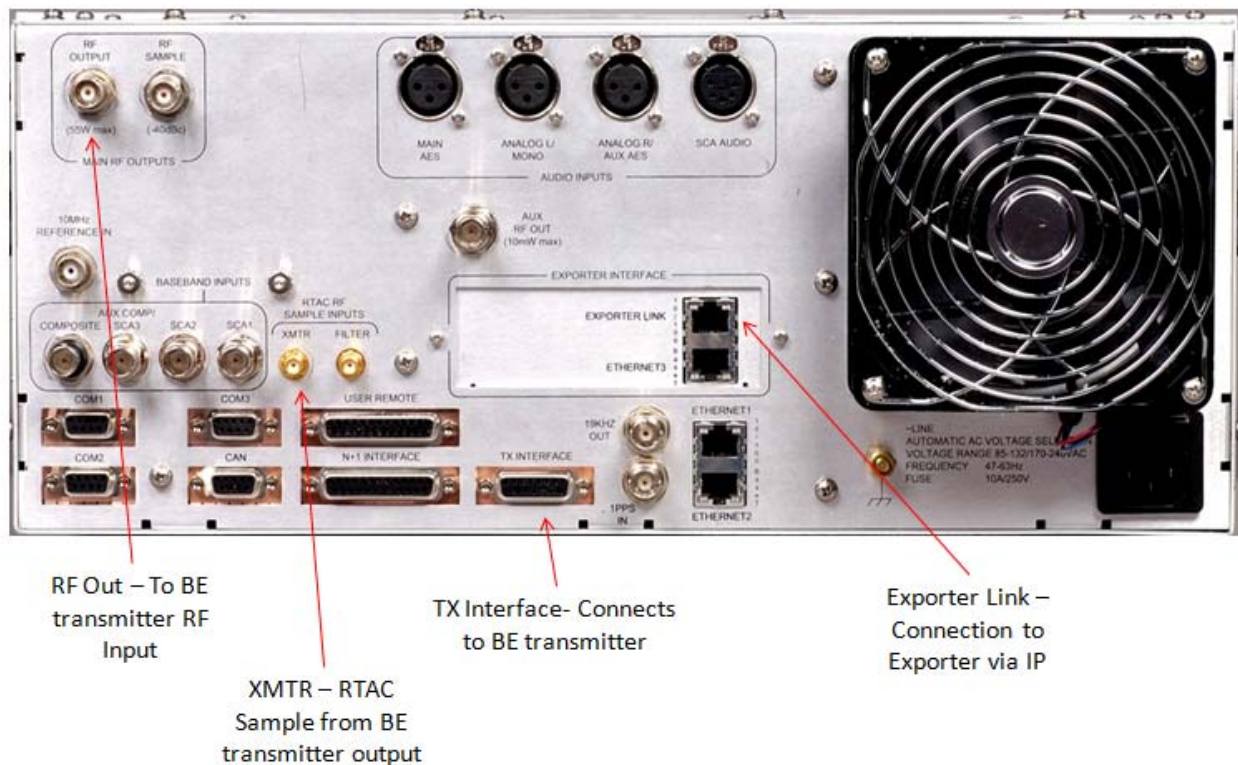


Figure 1-2 Flexstar Rear Panel Connections

- STEP 1** Before turning the transmitter OFF, press the lower power button on the transmitter to lower the transmitter TPO to approximately 50 %. This will keep the APC reference down to help keep the transmitter from overshooting power on initial turn on with the Flexstar.
- STEP 1** Turn the transmitter to the OFF state.
- STEP 2** Before disconnecting power to the BE exciter, it is necessary to make note of all network IP addresses and setup that will be required to enter into the new Flexstar.
- STEP 3** Disconnect AC power to all equipment in the rack.
- STEP 4** Disconnect all cables from the rear of the BE exciter. Do not remove any cables from the rack or discard any as these will be reused for installation of Flexstar.
- STEP 5** Remove BE exciter from the rack.
- STEP 6** Install the Flexstar in the same rack location the BE exciter was removed from.
- STEP 7:** If this system has the FAX Boost Amp, install the FAX in the rack. The only connections to the FAX are RF in and out, and AC. Also install the 30 dB pad in the rack. This will have to be set within the rack so the

coax can reach from the RF out of the Flexstar to the input of the pad and coax from the output of the pad to the FAX EXT RF Input.

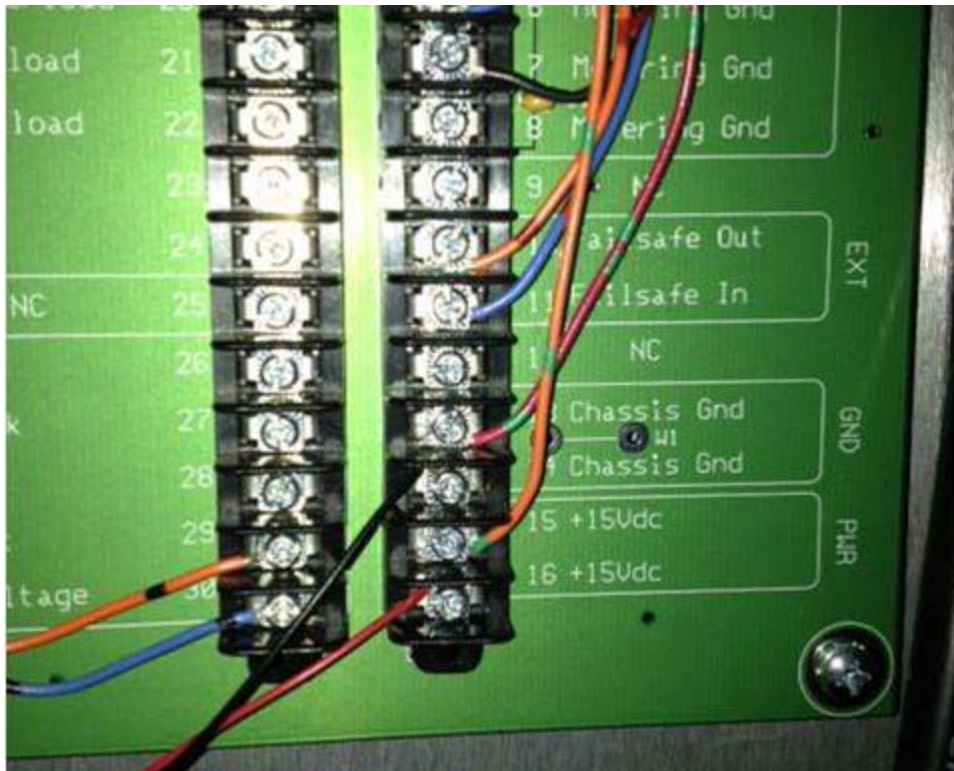
**STEP 8:** Locate the BNC to N adapter and screw it on to the RF drive cable and connect it to the RF OUT of the Flexstar.

**STEP 9:** Refer to Drawing 839-8132-462 that is in the accompanying documentation. This drawing shows the connections to be made from the transmitter to the new Flexstar exciter as well as the part number for the correct cable to be used.

**STEP 10:** Locate the correct control cable for your transmitter type, for tube type transmitters there will be 2 wires on 25 pin end of the cable. Connect the Dsub-25 female end to the existing control cable at the end that was connected to the FXi exciter Remote J3 connector. For tube type transmitters this will be the end with the extra wires. Make sure the cable is secure with the screws.

**STEP 11:** Connect the other end of the control cable to TX INTERFACE on the rear of the Flexstar and secure with screws.

**STEP 12:** For the tube transmitters only, the 2 wires must be connected to the customer I/O board in the BE transmitter. This board is located in the control cabinet upper left corner. Connect the red wire (+15 VDC) to TB2-16. Connect the Black wire (Chassis Gnd) to TB2-14.



**Figure 1-3 Customer I/O Connections**

**STEP 13:** Connect the SMA cable that was connected to the test equipment in Section 1.2 above to the RTAC XTMR on the rear of the Flexstar.

**STEP 14:** Reconnect the audio cable to the correct audio input of the Flexstar.

**STEP 15:** Reconnect AC to all equipment.

**STEP 16:** This completes the Installation portion of the procedure. Continue to the next section.

## 1.4 Initial Setup of Flexstar

---

This Section details the steps for turn of the transmitter now that the Flexstar is installed.



**STEP 1** Turn the AC mains back on to the entire transmitter. The Screen on the Flexstar should come on and be sitting at the home screen. There should be no faults and the exciter should be muted.

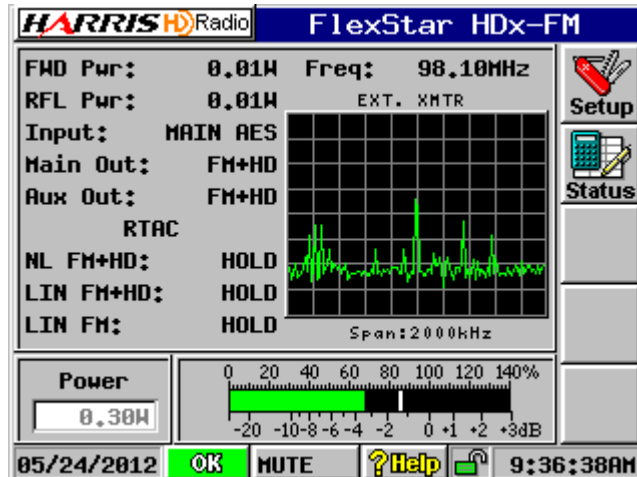


Figure 1-4 Flexstar Home Screen

**STEP 2:** Verify the frequency in the upper right corner of the home screen is correct for the transmitter the exciter is being installed in.

**STEP 3:** On the Flexstar goto SETUP>OUTPUT SETUP 1/5. Set the Engine Buffer (sec) to 1.486 per Figure 1-5 .

**STEP 4:** Steps 4 and 5 are for tube type transmitters only, for solid state skip to Step 6. The mute logic for the BE FMi-17-25T series transmitters is active LO (LO out of the transmitter mutes the exciter). This must be setup manually as a custom transmitter. Select the Transmitter Type to be "CUSTOM" per Table 1-1

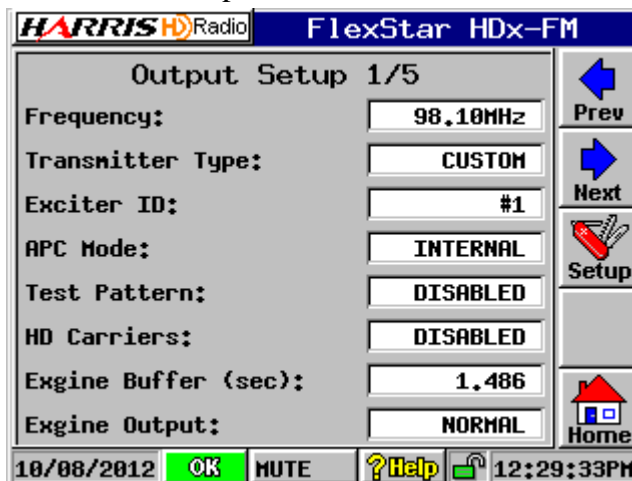


Figure 1-5 Output Setup Screen

**STEP 5** To set the mute logic, goto Setup> More Setup> NEXT> NEXT> ADVANCED SETUP 3/4. Change the "Mute Input" to ACTIVE LOW and the "Mute Pull Up/Down" to PULL DOWN. See Figure 1-6

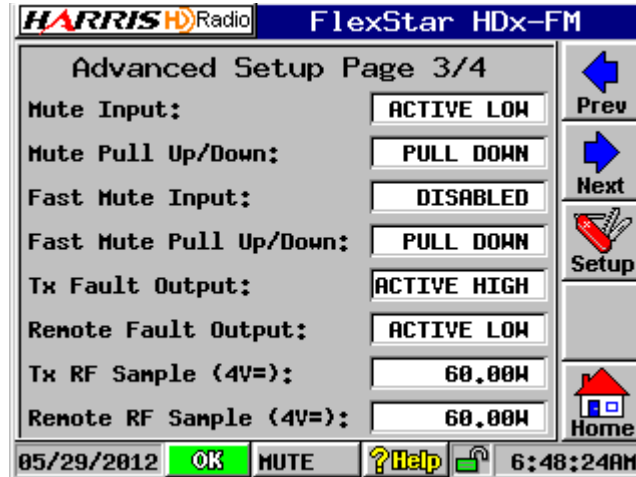


Figure 1-6 .Mute Setup Screen

TX Model	TX Type
FMi17-25T	CUSTOM
FMi31-402	BE TX Type 1
FMi703-1405	BE TX Type 2

Table 1-1 BE FMI Transmitter Type Selection

**STEP 6:** The mute logic for the FMI-31-402 series transmitters is active LO (LO out of the transmitter mutes the exciter). For the FMI-703-1405 the mute is active HI (HI out of the transmitter mutes the exciter). The selection of transmitter type in the Flexstar will automatically set the mute logic correctly for these type transmitters. On the Flexstar goto SETUP>OUTPUT and select the Transmitter Type to be either BE TX Type 1 or BE TX Type 2 per Table 1-1

**STEP 7:** For tube type transmitters the RTAC Coefficients and Interpolation Rate must be set so the correction will operate properly for this type of transmitter. For solid state transmitters the factory defaults may be used. To set the Coeffs, on the Flexstar home screen goto SETUP> More Setup> Advanced Setup 1/4. The top box is Interpolation Rate and the default setting is Auto. For tube transmitters change this setting to 600 by tapping the box and using the down arrow.

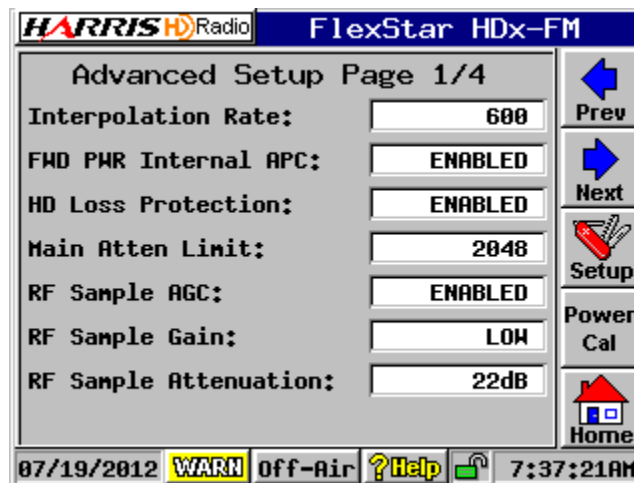


Figure 1-7 Interpolation Rate Setting Tube Transmitters

**STEP 8:** To set the Coefficients goto Setup> RTAC and set the NonLin FM+HD Coeffs box to 13.

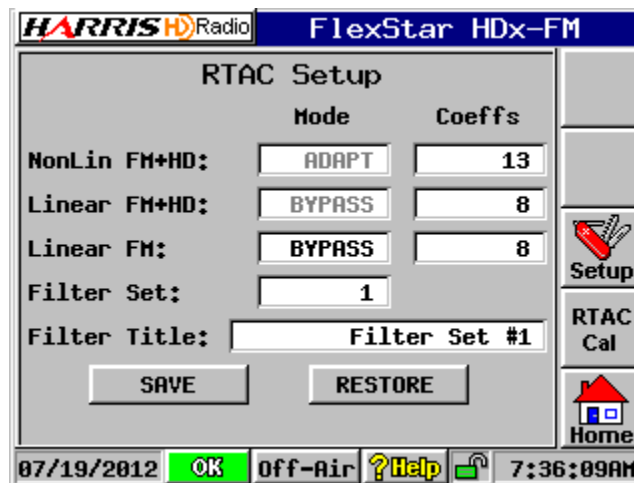


Figure 1-8 Coeffs Setting Tube Transmitters

**STEP 9** Next the Network properties will have to be entered so the Exporter can be linked to the exciter. Press Setup>Serial>Prev to get to the Serial Setup 4/4. In the screen below, each box can be edited by taping on the box. This should match what was in the BE exciter written down in Section 1.3 Step 2. After the correct network information is entered press ACCEPT.

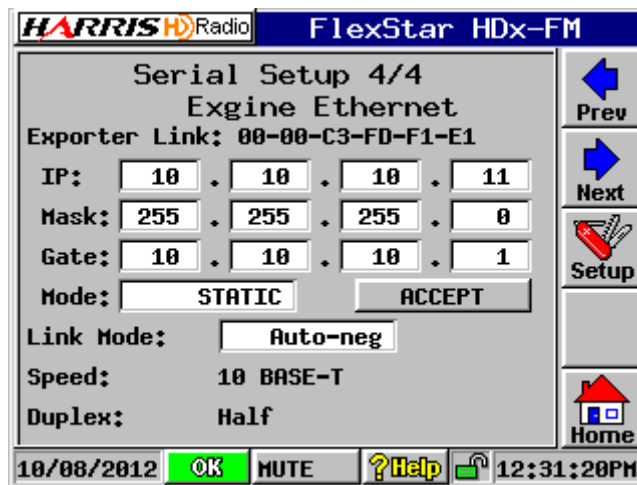


Figure 1-9 Flexstar Ethernet IP Setup Screen

- STEP 10** It may be necessary to enter the MAC address in your exporter. This can be found as shown in Figure 1-9. Enter the MAC address shown on your Flexstar screen into the Exporter.
- STEP 11** Go to the Exporter and enter the MAC address that was obtained from the Flexstar Exgine screen.
- STEP 12:** After Exporter is rebooted, on the Flexstar press the SIGNAL PROCESSING button on front panel> Next>Next and verify that the HD RUN, HD BUF, DSP RUN and EL RUN are all ok.

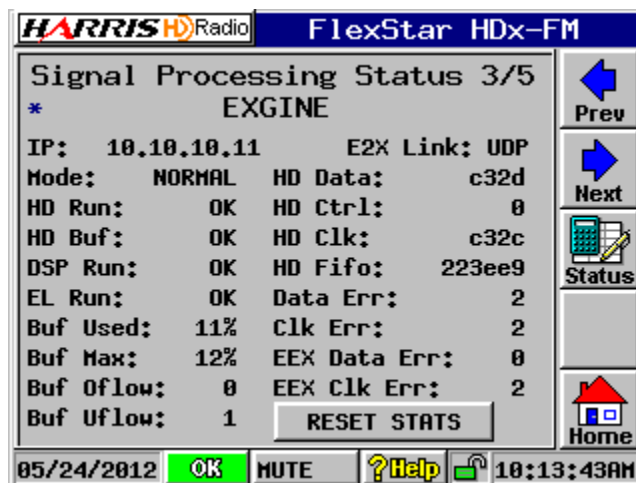
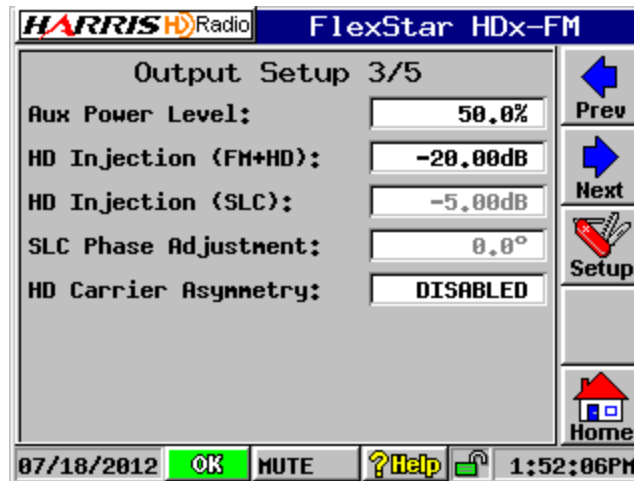


Figure 1-10 Flexstar Signal Processing Screen

**STEP 13** Next the transmitter type and HD setup must be verified. Press HOME>SETUP>OUTPUT and verify Transmitter Type is correct, see Section 1.4 Step of this guide for correct setting.

**STEP 14** Press Next and verify Primary Mode is set to the same as the FXi exciter.

**STEP 15:** If running FM+HD, press Next and Verify the Injection Level is correct. This should be -20 dB from factory.



**STEP 16:** For audio setup refer to Flexstar Technical Manual Section 2.6.4 for connections and correct levels and Section 3.3.1 for setup.

## 1.5 Transmitter Setup without Boost Amp

This section details the steps necessary to get the transmitter running at full power out, correct power limits set and to ensure the transmitter is meeting the spectral mask.

### ⇒ NOTE:

If the exciter shipped with a FAX150 as a Boost Amp for certain model BE transmitters, skip to Section 1.6 for setup in the transmitter.

### ▲ WARNING:

*At no time should the Flexstar exciter be switched into the FM only mode without consulting the BE transmitter technical manual. The PA modules in the BE transmitter require the operator to manually set the jumpers for correct bias on the PA FET's. Failure to adhere to this warning may result in damage to you PA Modules.*

### ▲ WARNING:

*At the end of this procedure the exciter power out of the Flexstar should match closely to the BE exciter prior to removal. The power should have been noted in*

Section 1.2 Step 1.1 above. If the power exceeds this level by a large margin, damage may occur to the PA modules. Make sure the power limit setup procedure is performed per this guide to ensure safe operation of the transmitter.

Mode	Max Pout	Power Limit	Power Set Point
FM	57 W	5 W	1 W
FM+HD	22 W	5 W	1 W
HD	12 W	5 W	1 W

Table 1-1 Exciter Power Limits and Factory Default Setting

Table 1-1 shows the maximum power obtainable from the exciter as well as the factory power limit set prior to shipping and power set points for each mode of operation. The power limits will be changed based on the model of transmitter in operation. The power limit is set so the transmitter will deliver the same maximum power obtained with the BE FXi exciter.

**STEP 1** The first step is to setup the power limit for the particular transmitter in operation. This screen is located by pressing SETUP> OUTPUT> NEXT.

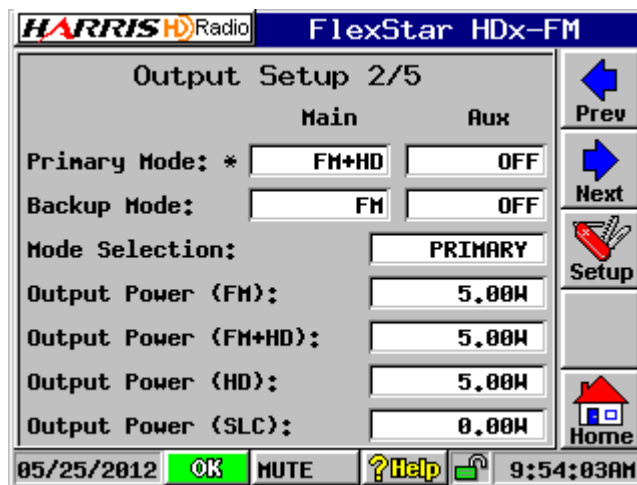
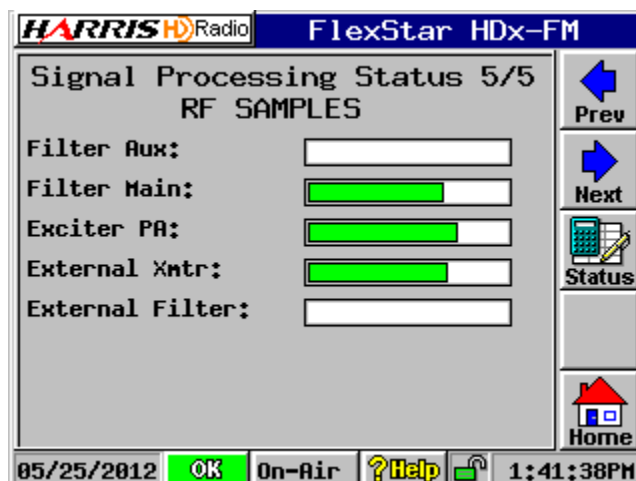


Figure 1-11 Flexstar Power Limit Setup Screen

**STEP 2** The factory default power limit for each mode is 5 Watts. The power limit should be set to the exciter power level obtained in Section 1.2 Step 2. If the power was not increased to maximum power, set the limit to 3

watts above the FXi exciter power recorded in Section 1 Step 1. Set the new limit by taping the box and entering the new power limit for the mode of operation in use. The power limits for the other modes of operation should NOT exceed this limit.

- STEP 3:** The power out of the exciter was set to 1 Watt at the factory. When the transmitter is turned on it should come up and begin to raise until the transmitter is at the TPO that it was when last turned off, for example if the power out in Section 1.2 Step 3 was 5 kW the transmitter should come back to this power.
- STEP 4:** Turn the transmitter on, transmitter power should increase to TPO and once at TPO exciter should be near the power obtained in Section 1.2 Step 1.
- STEP 5:** Verify APC on Exciter by pressing the RF SYSTEM button on the front panel then PREV. The External APC should be approximately 2.5 V. Press the Lower Power button on the BE FMi transmitter this voltage should drop to 0.8 to 2 V and the power should drop smoothly. Press the Raise Power button on the BE FMI transmitter and the voltage should increase to above 3 V and the power should raise smoothly. Set the power back to the TPO.
- STEP 6:** Verify the RTAC level by pressing SIGNAL PROCESSING button on front panel then press PREV. The Filter Main, Exciter PA and External Xmtr bars should be at approximately 2/3 full scale. If the setup in Section 1.2 could not be completed, and the bargraph is too low it may be necessary to remove the 10 dB pad. If the bargraph is still too high more pad will be required to obtain the 2/3 full scale.



- STEP 7:** On the Home screen of the exciter the NL FM+HD should say ADAPT. Verify that the transmitter output spectrum is meeting the mask.

**STEP 8:** Let transmitter run for at least 30 minutes, reverify that the transmitter still meets the spectral mask and TPO is stable.

**STEP 9:** Press the transmitter Raise Power button on the BE FMi transmitter and verify that the power out is still capable of the level obtained in Section 1. Step 2. If not see that the exciter is hitting the power limit. If the exciter has hit its maximum level go back and set the limit slightly higher and recheck.

**STEP 10:** Set the transmitter back to the correct TPO.

## 1.6 Transmitter Setup with Boost Amp

---

### ⇒ NOTE:

This section is for exciters that include a FAX150 Boost Amp ONLY!

This section details the steps necessary to get the transmitter running at full power out, correct power limits set and to ensure the transmitter is meeting the spectral mask.



### WARNING:

*At no time should the Flexstar exciter be switched into the FM only mode without consulting the BE transmitter technical manual. The PA modules in the BE transmitter require the operator to manually set the jumpers for correct bias on the PA FET's. Failure to adhere to this warning may result in damage to you PA Modules.*



### WARNING:

*At the end of this procedure the exciter power out of the FAX Boost Amp should match closely to the BE exciter prior to removal. The power should have been noted in Section 1.2 Step 1.1 above. If the power exceeds this level by a large margin, damage may occur to the PA modules. Make sure the power limit setup procedure is performed per this guide to ensure safe operation of the transmitter.*

**STEP 1** Setup in the FAX Boost Amp so the settings match the FXi exciter mode and frequency. In the FAX LCD verify/Set the following:

SETUP>TX CONFIGURE

- FREQ - Set to operating frequency (used for accurate power readings only)
- APC MODE - Set to BOOST AMP
- EXT RF SOURCE - Set to YES
- RF SW MODE - Set to MANUAL
- PRIMARY RF SOURCE - EXT
- EXT RF MODE - Set to match FXi (FM+HD or HD)



## SETUP&gt;TX CONTROL

- EXT APC GAIN - Set to 0 (this sets the RF output to 0 Watts for setup)
- RF GAIN - Set to 2 (will need to be adjusted depending on Power output requirements)

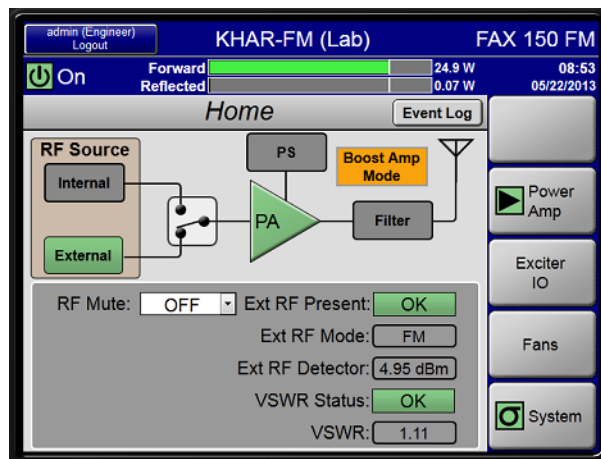
**STEP 2:** To set the power into the FAX requires the Flexstar to be set in the Stand Alone mode. This will allow the power output to be set with the APC having no effect. On the Flexstar go to SETUP>OUTPUT and change the TX TYPE to Stand Alone.

**STEP 3** On the Flexstar press the NEXT button. Set the power for the mode of operation (FM+HD or HD) to 3.25 Watts, See Figure 1-11. 3.25 Watts is +35 dBm, with the 30 dB attenuator between the Flexstar and the FAX gives approximately +5 dBm input to the FAX. The FAX RF input range is 0 to +10 dBm (absolute Max).

**STEP 4:** Ensure that the FAX Boost Amp is OFF.

**STEP 5:** Turn the BE transmitter on, there should be no power out of the Boost Amp or transmitter but the Flexstar should put out 3.25 Watts.

**STEP 6:** Connect computer to FAX Boost Amp via Ethernet. See FAX manual Section 3 for details on connecting to the Ethernet port. When connected the Home screen should look like Figure 1-12



**Figure 1-12 FAX Boost Amp GUI Home Screen**

**STEP 7:** On the Home screen of the FAX the EXT RF DETECTOR power should be +5 dbm  $\pm$ 0.5 dBm. If outside these limits adjust the Flexstar power until it is in range. See Step 3 of this section.

**STEP 8:** On the FAX, press ON (from this step on the FAX should remain ON); and on the LCD go to SETUP>TX CONTROL>EXT APC GAIN, highlight it and using the UP/DOWN buttons(not Raise/Lower) adjust the power until the BE transmitter is at TPO. Be careful when holding the UP button as it is easy to overshoot and damage the transmitter Amplifiers.

**⇒ NOTE:**

If the TPO cannot be reached, **lower the EXT RF GAIN back to 0**, raise the RF GAIN number by 1, then raise EXT RF GAIN to TPO.

**STEP 9** After setting TPO, the EXT APC GAIN number should be in the 50 to 75 % range. It may be necessary change the RF GAIN number by 1 (higher or lower) and try again. Raising the RF GAIN number will lower the EXT APC GAIN number. Make sure to set the EXT RF GAIN to 0 prior to changing the RF GAIN number.

**STEP 10:**At transmitter TPO, the FAX power out should be close to the power out of the FXi exciter recorded in Step 1 of Section 1.2. The OUTPUT LED on the FAX may be red, ignore it for now.

**STEP 11:**On the FAX GUI go to EXCITER IO>NEXT>SCALING. The UC ATTENUATION voltage should be in the range of 2.0 to 4.0 VDC

**STEP 12:**On the Flexstar set the Transmitter Type back to the correct BE transmitter model per Table 1-1 page 1-10. The transmitter should stay at the correct TPO.

**STEP 13:**On the SCALING screen set the FORWARD POWER field to match the power out of the FAX Boost Amp. This will set the USER Remote Control analog output to 4 VDC=x Watts.

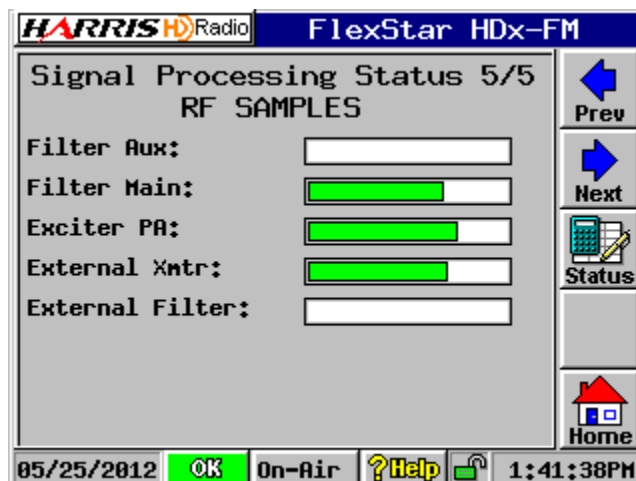
**STEP 14:**Press the transmitter Raise Power button on the BE FMi transmitter and verify that the power out is still capable of the level obtained in Section 1. Step 2. If not, in the box on the Flexstar home screen (lower left corner), raise the power until the transmitter is at TPO + 10 %.

**STEP 15:**Set the transmitter back to the correct TPO.

**STEP 16:**On the FAX LCD go to SETUP>TX CONFIGURE>TPO PWR, highlight it, set it to match the FAX power output and press Enter. The OUTPUT LED should be green and the Bargraph on the GUI should be at 100 %.

**STEP 17:**Let the transmitter run for 30 minutes, verify the UC ATTENUATION voltage is still within 2.0 to 4.0 VDC.

**STEP 18:** Verify the RTAC level by pressing SIGNAL PROCESSING button on front panel then press PREV. The Filter Main, Exciter PA and External Xmtr bars should be at approximately 2/3 full scale. If the setup in Section 1.2 could not be completed, and the bargraph is too low it may be necessary to remove the 10 dB pad. If the bargraph is still too high more pad will be required to obtain the 2/3 full scale.



**STEP 19:** On the Home screen of the exciter the NL FM+HD should say ADAPT. Verify that the transmitter output spectrum is meeting the mask.

**STEP 20:** Let transmitter run for at least 30 minutes, reverify that the transmitter still meets the spectral mask and TPO is stable.

End of procedure.

