Broadcast Electronics

HD Radio™

XPi 10esp Exporter
Quick Installation Guide

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Revision C
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XPi 10esp Exporter
Quick Installation Guide

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This warranty shall exclude the following products, component parts and/or assemblies:

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Under no circumstances shall BE be responsible for indirect, incidental or consequential damages, including, but not limited to transportation costs, non-authorized repair or service costs, downtime costs, costs for substituting equipment or loss of anticipated profits or revenue, incurred by Purchaser, whether based in contract, tort or for negligence or breach of statutory duty or otherwise. The terms of the foregoing warranty shall be null and void if the equipment has been altered or repaired without specific written authorization from BE, or if not installed according to BE's instruction manuals, including, but not limited to, the absence of proper grounding, surge (TVSS) protection on the AC circuit panel or proper lightning protection/grounding on all output circuits, or if equipment is operated under environmental conditions or circumstances other than those specifically described in BE's product literature or instruction manual which accompany the equipment. **The warranty shall be voided if the product or subassembly is equipped with a tamper seal and that tamper seal is broken.** BE shall not be liable for any expense of any nature whatsoever

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When delivering the equipment to you, the truck driver or carriers' agent will present a receipt for your signature. Do not sign it until you have:

1) Inspected the containers for visible signs of damage and 2) Counted the containers and compared with the amount shown on the shipping papers. If a shortage or evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. Claims for loss or damage will not be honored without proper notification of inspection by the carrier.

RF PRODUCT TECHNICAL ASSISTANCE, REPAIR SERVICE, PARTS -

Technical assistance is available from Broadcast Electronics by letter, prepaid telephone or E-mail. Equipment requiring repair or overhaul should be sent by common carrier, prepaid, insured, and well protected. If proper shipping materials are not available, contact the RF Technical Services Department for a shipping container. Do not mail the equipment. We can assume no liability for inbound damage, and necessary repairs become the obligation of the shipper. Prior arrangement is necessary. Contact the RF Technical Services Department for a Return Authorization.

Emergency and warranty replacement parts may be ordered from the following address. Be sure to include the equipment model number, serial number, part description, and part number. Non-emergency replacement parts may be ordered directly from the Broadcast Electronics stock room at the number shown below.

RF TECHNICAL SERVICES

Telephone: +1 (217) 224-9617
E-Mail: rfservice@bdcast.com
Fax: +1 (217) 224-6258

FACILITY CONTACTS

Broadcast Electronics, - Quincy Facility
4100 N. 24th St. P.O. BOX 3606
Quincy, Illinois 62305
Telephone: +1 (217) 224-9600
Fax: +1 (217) 224-6258
General E-Mail: bdcast@bdcast.com
Web Site: www.bdcast.com

PARTS

Telephone: +1 (217) 224-9617
E-Mail: parts@bdcast.com

RETURN, REPAIR, AND EXCHANGES

Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. All returned merchandise must be sent freight prepaid and properly insured by the customer.

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Broadcast Electronics, reserves the right to modify the design and specifications of the equipment in this manual without notice. Any modifications shall not adversely affect performance of the equipment so modified.

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SAFETY PRECAUTIONS

PLEASE READ AND OBSERVE ALL SAFETY PRECAUTIONS

ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TUBES, POWER TRANSISTORS, OR EQUIPMENT WHICH UTILIZES SUCH DEVICES MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. EXERCISE EXTREME CARE AROUND SUCH PRODUCTS. UNINFORMED OR CARELESS OPERATION OF THESE DEVICES CAN RESULT IN POOR PERFORMANCE, DAMAGE TO THE DEVICE OR PROPERTY, SERIOUS BODILY INJURY, AND POSSIBLY DEATH.
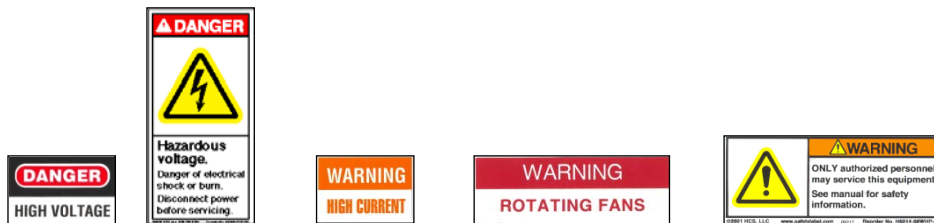
DANGEROUS HAZARDS EXIST IN THE OPERATION OF POWER TUBES AND POWER TRANSISTORS

The operation of power tubes and power transistors involves one or more of the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel.

    A. HIGH VOLTAGE - Normal operating voltages can be deadly. Additional information follows.

    B. RF RADIATION - Exposure to RF radiation may cause serious bodily injury possibly resulting in Blindness or death. Cardiac pacemakers may be affected. Additional information follows.

    C. HOT SURFACES - Surfaces of air-cooled radiators and other parts of tubes can reach temperatures of several hundred degrees centigrade and cause serious burns if touched. Additional information follows.

    D. RF BURNS - Circuit boards with RF power transistors contain high RF potentials. Do not operate an RF power module with the cover removed.

HIGH VOLTAGE

Many power circuits operate at voltages high enough to kill through electrocution. Personnel should always break the primary AC Power when accessing the inside of the transmitter.

RADIO FREQUENCY RADIATION

Exposure of personnel to RF radiation should be minimized, personnel should not be permitted in the vicinity of open energized RF generating circuits, or RF transmission systems (waveguides, cables, connectors, etc.), or energized antennas. It is generally accepted that exposure to "high levels" of radiation can result in severe bodily injury including blindness. Cardiac pacemakers may be affected.

The effect of prolonged exposure to "low level" RF radiation continues to be a subject of investigation and controversy. It is generally agreed that prolonged exposure of personnel to RF radiation should be limited to an absolute minimum. It is also generally agreed that exposure should be reduced in working areas where personnel heat load is above normal. A 10 mW/cm^2 per one tenth hour average level has been adopted by several U.S. Government agencies including the Occupational Safety and Health Administration (OSHA) as the standard protection guide for employee work environments. An even stricter standard is recommended by the American National Standards Institute which recommends a 1.0 mW/cm^2 per one tenth hour average level exposure between 30 Hz and 300 MHz as the standard employee protection guide (ANSI C95.1-1982).

RF energy must be contained properly by shielding and transmission lines. All input and output RF connections, such as cables, flanges and gaskets must be RF leak proof. Never operate a power tube without a properly matched RF energy absorbing load attached. Never look into or expose any part of the body to an antenna or open RF generating tube or circuit or RF transmission system while energized. Monitor the tube and RF system for RF radiation leakage at regular intervals and after servicing.

HOT SURFACES

The power components in the transmitter are cooled by forced-air and natural convection. When handling any components of the transmitter after it has been in operation, caution must always be taken to ensure that the component is cool enough to handle without injury.

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Figures

1   HD Radio™ System Architecture

The function of the XPi 10esp Exporter within the HD Radio™ System Architecture is to receive audio and data from an Importer and/or other audio processing equipment, compress this audio and data, and deliver via Ethernet to an Exgine card in the system's exciter. The Exgine card receives the compressed Ethernet audio and data, and creates OFDM data carriers for HD Radio™. FM signals are then added to the OFDM carriers by the Exciter for reception by HD receivers.

The XPi 10esp Exporter is normally installed at the studio site along with any of the audio processing equipment. Under this configuration, the Studio to Transmitter Link may be uni-directional.

When an Importer is utilized in the system, the XPi 10esp Exporter along with the audio processing equipment may be installed at the transmitter site only if the Studio to Transmitter Link between the Importer and the XPi 10esp Exporter is BI-DIRECTIONAL. The Importer must support HD v4.3.2 or later, see the appropriate Importer documentation for upgrading.

For additional details regarding these configurations, see Typical HD Radio™ System Connection Diagrams - Figures 2 thru 5. Figures 2 thru 4 should be referenced for alternate audio processor configurations that can also be used with an XPi 10 esp Exporter located at the transmitter site.
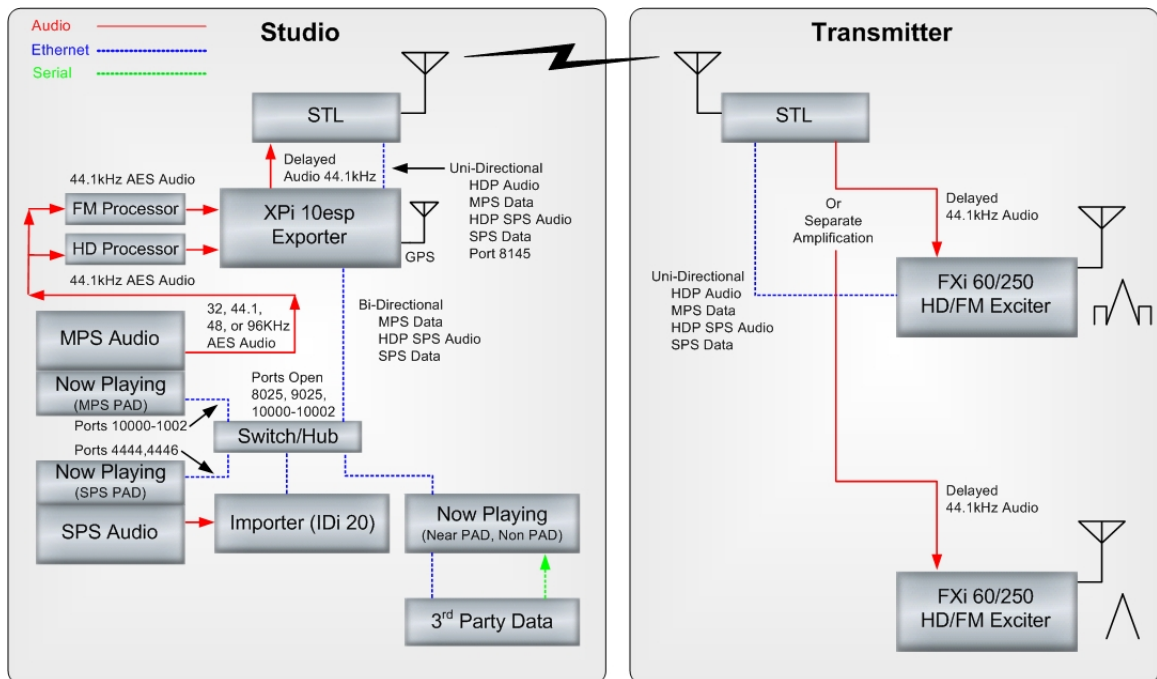

Figure 1 HD Radio™ System Architecture (Typical Installation)

2   Prepare for Installation of the FXi 60/250 Exciter (w/Exgine) and the XPi 10esp Exporter

2.1   System Cabling (What is Supplied by B.E. and What is NOT)

The installation kit for the XPi 10esp Exporter contains the basic necessary System Interconnect Cables for all necessary Audio Paths. For more complex system configurations, this basic install kit does not include an AES splitter and may not contain enough cabling. In this case, please read through this document, determine the desired quantity and approximate length of each additional cable, and contact BE for purchasing information.

Basic installation kits do not contain the following required system cabling: networking equipment (ethernet cables, switches, hubs), RF output cables, GPS antenna(s), or adapters for specific audio processors and/or Studio-Transmitter Links.

2.2   Verify XPi 10esp Exporter Shipping Contents

NOTE: All items are Qty (1) unless noted otherwise.

Package:
☐ 909-6100-001 XPi-10esp Exporter
☐ 979-6100 Installation Kit, XPi 10esp Exporter (see below)
☐ 979-6000-002 Binder, XPi 10esp Exporter
    ☐ Quick Installation Guide (this document)
    ☐ Operation Manual

Install Kit Miscellaneous Items:
☐ 418-1550-008, Connector Plug, 8 Pin Cage Clamp - Qty (5)
☐ 420-0007, Screw, 12-24 X .75", SST, Truss Head - Qty (4)
☐ 420-0710, Screw, 10-32 X .625", SST, Truss Head - Qty (4)
☐ 421-0002, Speed Nut, 12-24, Qty (4)
☐ 682-0001, AC Line Cord
☐ 682-0003, AC Line Cord, European, Right Angle
☐ 849-0902, Cable Assembly, RS232 9-Pin Male to 9-pin Female

Install Kit System Interconnect Cables:
☐ 949-0544-111, Cable Assembly, AES/EBU 10ft
☐ 949-0544-112, Cable Assembly, AES/EBU 10ft
☐ 949-0544-113, Cable Assembly, AES/EBU 10ft
☐ 949-0600-104, Cable Assembly, AES/EBU 10ft

2.3   Required Information

☐ JAVA Runtime Environment from www.java.com.
☐ Exgine/Exciter IP information (this includes IP Address, Gateway Address, Subnet Mask, and MAC Address)
Refer to Exgine/Exciter documentation for a description of how to find or update this information.

2.4　Tools/Items Required for Installation (not supplied by B.E.)

☐ Ethernet Cable(s)
☐ Switches, Hubs, or substitute crossover cabling for direct connections
☐ PC with the latest version of Java installed
☐ If changing RGUI IP or password-related settings, access to a computing device with a serial communications port (i.e. a laptop) and an installed RS232 command line interfacing program such as Hyper Terminal
Note: If access to a serial communications device cannot be secured for this purpose, it is the responsibility of the customer to acquire an RS232 to USB adapter.

Optional:
☐ 809-0383 GPS Antenna with TNC Connector (sold separately)
☐ 809-0830 AES Splitter (sold separately)
☐ HD receiver with split audio mode capability
☐ Dual RCA Connector Cable (for utilization of FM/HD-split-mode-receiver feedback) – may be included with split-mode receiver
☐ Ty-raps
☐ Headphones
☐ RG-58 Coaxial Cables with BNC Connectors
☐ Chassis-to-Rack Grounding Cable, Ring Terminal Connector Recommended

For Non-standard/Custom Installations:
☐ XLR connectors
☐ AES/EBU Cable
☐ Wire Strippers
☐ Soldering Iron

2.5　Estimated Time for Installation

It takes approximately 30 minutes to install and setup the XPi 10esp.

3　HD Radio™ System Connection Diagrams

The HD Radio™ System Connection Diagrams at the end of the Installation Guide illustrate a number of basic 2nd Generation HD Radio™ System Architectures.

Figures 2 thru 4 show detailed configurations for no audio processors, a single audio processor, and dual audio processors for an in-studio installation.

Figure 5 shows a detailed configuration for a single audio processor installed at the transmitter site (note that a BI-DIRECTIONAL LINK is required for this system configuration).

The additional audio processor options detailed in Figures 2 and 3 can also be used by similarly substituting this part of the system between the STL and the XPi 10esp (rather than between the Importer/AES Audio Source and the XPi 10esp).

 NOTE: Cables are supplied in the installation kits for these basic system architectures. There may be several unused cables after installation.

4 Installation

It is recommended to keep the XPi 10 esp in its packaging until arrival at the installation site, either the studio site or transmitter site (the studio site is the most common location). Follow the procedure below to establish hardware connections. Reference the HD Radio™ System Configuration Diagrams (Section 3 of this document) for connection and cabling details.

Audio inputs have a wide range of acceptable sample rate inputs. All outputs, however, have a sample rate of 44.1kHz.

4.1 Essential System Inputs and Outputs

Numbering in Figure 6 below corresponds to the procedure in the next section.
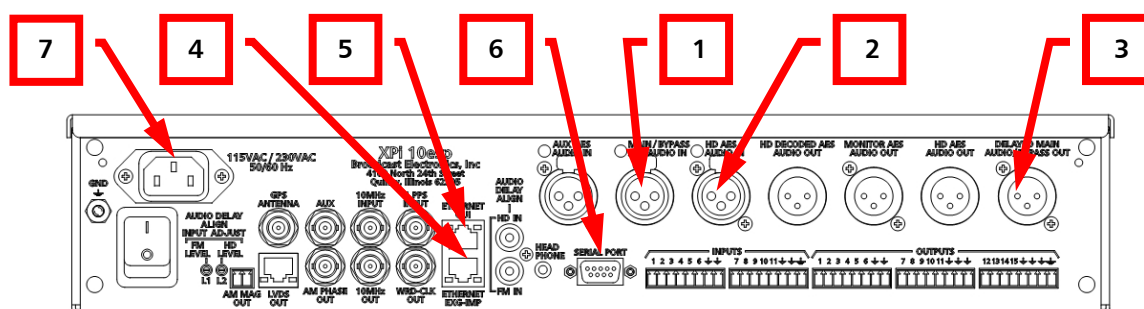
Figure 2 – Essential Connectors

No.	Feature	Description
1.	MAIN/BYPASS AES AUDIO INPUT	Audio must be routed to this XLR input for use as the analog (FM) MPS audio signal.
2.	HD AES AUDIO INPUT	Audio must also be routed to this XLR input for use as the digital (HD) MPS signal.
3.	DELAYED MAIN AUDIO/BYPASS OUTPUT	During normal operation, the appropriate MPS audio feed that is to be used as FM broadcast is formatted, delayed, and sent out this XLR output. If the bypass relay is active, audio going in the MAIN/BYPASS input is simply routed straight through the system to this output.
4.	ETHERNET EXG-IMP	This RJ45 port is used for exchanging Exgine and Importer data and must be connected to proper networking equipment.
5.	Remote GUI Ethernet Port	If the data port is to be isolated on its own local network separated from Remote GUI access, this RJ45 port must also be connected to networking equipment.
6.	SERIAL PORT	This 9-pin connection is for RS232 standard serial command line interfacing. Either a serial to serial cable or RS232 serial to USB adapter must be used to connect to the system command line. Note: do not use null model cables.
7.	POWER INPUT	A standard power cable connects here.

4.2   Essential Connection Procedure

Refer to Figure 6 above.

1. Connect the male end of Cable 949-0544-111 to MAIN/BYPASS AES AUDIO IN.

    Connect the female end of this same cable to FM Output on the appropriate audio processor, or the AES splitter if audio processing is not utilized.

2. Connect the male end of Cable 949-0544-112 to HD AES AUDIO IN.

    Connect the female end of this cable to HD Output on the appropriate audio processor, or the AES splitter if audio processing is not utilized.

3. Connect the female end of Cable 949-0544-104 to DELAYED MAIN AUDIO/BYPASS OUT.

    Connect the male end of this cable to the STL if located at the studio site, or the FM AES Input on the Exciter if located at the transmitter site.

4. Connect an Ethernet cable to the Data Port labeled ETHERNET EXG-IMP. This cable should be connected to an isolated network if traffic is a major concern, otherwise it can be connected to a local area network and utilized as both the Exgine/Importer link and the RGUI access link. For access over the internet, a virtual private network (VPN) is recommended.

5. If utilizing the second Ethernet port to isolate the broadcast system from other networking, connect a network cable to the RGUI port labeled ETHERNET GUI. This second port can be enabled or disabled through the serial port or the RGUI program.

6. Connect the male end of Cable 849-0902 to the SERIAL PORT. For setup, the other end should be made accessible for connection to a serial communications device (typically a laptop).

7. Connect the appropriate power cord, 682-0001 or 682-0003, that corresponds to standard outlets utilized at the location of the XPi 10 esp.

4.3   Additional/Optional System Inputs and Outputs

If only setting up for basic operation, skip to the next section. If a connector is not detailed either here or in the previous diagram, it is not currently utilized in the system.
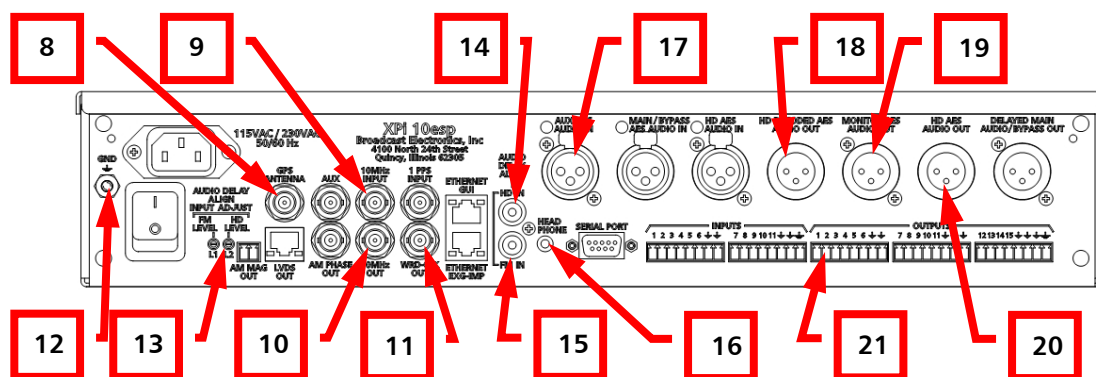

Figure 3 – Additional/Optional Connectors

No.	Feature	Description
8.	GPS ANTENNA	Connect an antenna to this TNC connector if GPS synchronization is desired.
9.	10MHz INPUT	A 10MHz clock signal should be connected to this BNC connection if and only if that signal is to be used in the system.
10.	10MHz OUTPUT	This BNC connector outputs the utilized 10MHz clock (externally inputted, GPS generated, or internally generated).
11.	WRD-CLK Output	The BNC connector outputs a Word Clock signal that is utilized by Importers under some system configurations.
12.	GND Stud	This stud can be utilized for chassis to rack grounding.
13.	FM/HD Potentiometers	This is a hardware control used for fine-tuning Audio Delay Alignment feedback levels.
14.	HD Feedback Input	An RCA plug for inputting the HD MPS signal from a receiver that is locked in split mode.
15.	FM Feedback Input	An RCA plug for inputting the FM MPS signal from a receiver that is locked in split mode.
16.	HEADPHONE Output	Allows a standard 3.5mm headphone to be connected for easy monitoring of an audio signal.
17.	AUX AES AUDIO Input	This XLR input allows an additional audio feed and some extra flexibility in how the system operates and handles faults.
18.	HD DECODED AES AUDIO Output	MPS audio that is fed to the HD Input is coded and then decoded using the same algorithms utilized by the Exgine. This audio is then fed through this XLR Output for monitoring and/or distortion correction.
19.	MONITOR AES AUDIO Output	This XLR output can be routed in the same way as headphone and allows AES monitoring of system audio feeds.
20.	HD AES AUDIO Output	The HD channel MPS audio that is fed into the HD Input is sample rate converted to 44.1k and sent back out this XLR connection for monitoring and/or distortion correction.
21.	Remote Station Control Interface	Connectors can be attached here to allow for a convenient mechanically connected remote control logic system.

5   System Setup

Once essential hardware connections have been established, a number of steps must be taken to ready the XPi 10esp for basic operation.

Note: Before using the Serial Command Line interface for programming, you must connect the XPI 10esp to an active network via an Ethernet cable. It needs to be connected to the Ethernet EXG-IMP port. If this is not done, programming will be difficult and hyper-terminal will continually give a port error message.

5.1   Set the IP Information

The XPi 10esp system has options for a single or dual Ethernet network port use. Connections and data transfer may become unstable in extremely high traffic environments, and the broadcast system itself generates a large amount of Ethernet traffic. If traffic in general is a concern, dual ports are recommended. In a dual port setup, Remote GUI and software update services are made available on the top port only while all other connections, such as Importer or Exgine, are always kept on the data port.

Further, if the default IP setup for the remote GUI port is not to be used or if password protection of RGUI access is desired, the RS232 command line interface must be accessed.

PC With Hyperterm

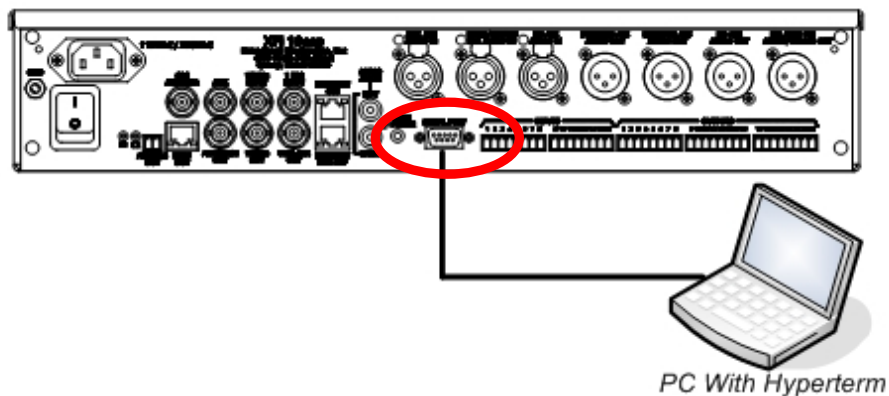**Figure 4 – PC-Serial Connections**

1. Set the command line software connection to:
   a. Baud Rate – 115200
   b. Data Bits – 8
   c. Stop Bits – 1
   d. Parity – No

If desired, enable local echo to see what characters have been entered.

Figure 5 – Serial Communications Screen

To query current RGUI Port Settings, enter "ipconfig1" and return. For an overview of Remote GUI port setting commands, enter "ipconfig1 –h" and return.

2. Change the RGUI Port IP Address by using the "ipconfig1 –i" command followed by one space and the IP address with "." separations only (no need to fill with 0's), for example "ipconfig1 –i 192.168.1.5" and return.

3. Repeat this procedure with the "ipconfig1 –s" and "ipconfig1 –g" commands to set the subnet mask and default gateway address respectively. If only one port is to be used for RGUI access as well as all data connections, the subnet and gateway setting for both the RGUI port and data port must be equivalent and the IP must be on the same subnet.

4. If password protection is desired, enter "reqpw 1" and return. To undo this enter "reqpw 0".

5. To set the Remote GUI password, enter "setpw " followed by the new password and return.

6. For a list of additional commands, enter "help" and return. Available commands are subject to change, and Figure 9 above does not necessarily reflect the current list of commands.

7. Restart the Exporter by toggling the power switch or by triggering the remote control interface input for any IP settings changes to take effect.

5.2   Login

The XPi 10 esp Remote Graphical User Interface can be downloaded from the BE Website. Navigate to http://www.bdcast.com/products/rf-transmission-products/hd-radio and access the XPi 10 esp product page under "FM HD Radio", and "FM HD Radio Signal Generators". Click the link to Downloads (must be a registered user to access downloads).

NOTE: The XPi 10esp Remote Graphical User Interface is provided as an executable Java file (.jar). This file requires that you have the Java runtime engine installed on your computer. You can download the latest version of Java from www.java.com. The Java site will automatically detect your operating system and will allow you to download the proper version of Java.

Once the RGUI JAR file has been downloaded, simply execute the jar to start the program. After a brief splash screen, the Login Screen shown in Figure 10 loads. Follow the procedure below to log in and setup a system for the first time.
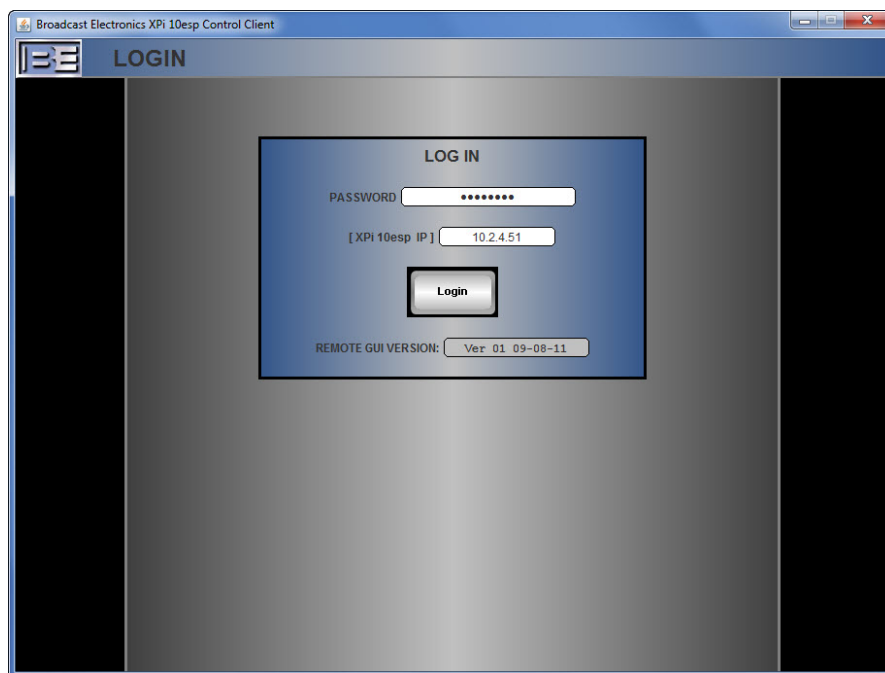
Figure 6 – Login Screen

1. Enter the RGUI port IP address in the "XPi 10 esp IP" field.
2. If password protection has been turned on, enter the correct password in the "PASSWORD" field.
3. With the cursor still in the password field, press enter. Alternatively, click on the Login button to trigger a login attempt.

Prompts in the upper right corner of the program will display appropriate status prompt messages. If the IP address is incorrect, the connect attempt will simply time out.

Upon successfully logging in, the Main Menu loads.
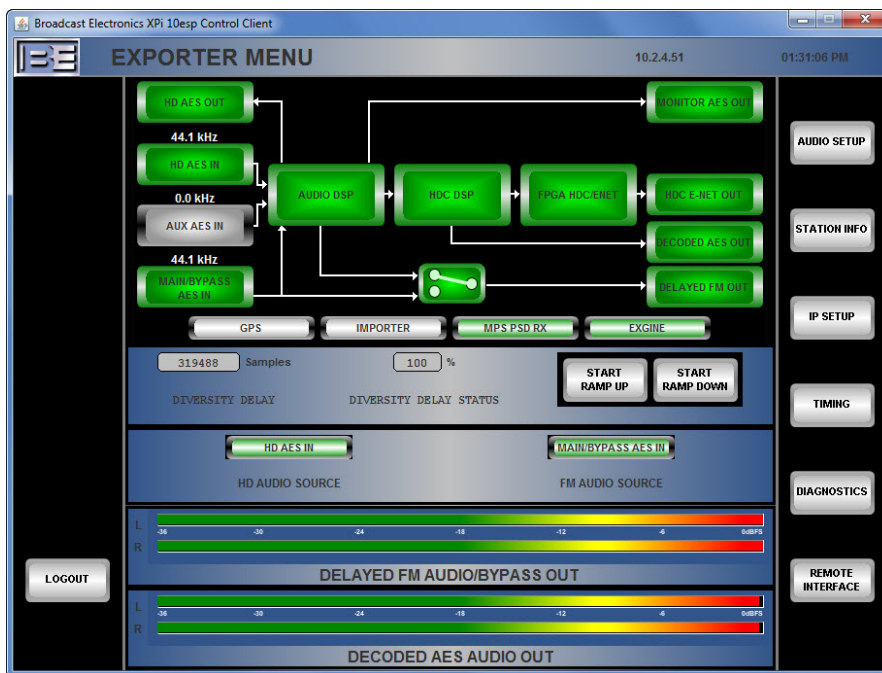
Figure 7 – Main Menu Screen

5.3   Configure the Data Port

The XPi 10esp Exporter is configured at the factory to be in the same I.P. family as the IDi 20 Importer and FXi 60/250 Exciter (w/Exgine). If the HD system network has been changed from the original factory setting, the data port IP information must be changed to match. Follow the steps below.

1.   If not logged in, do so (see Section 5.2 above)
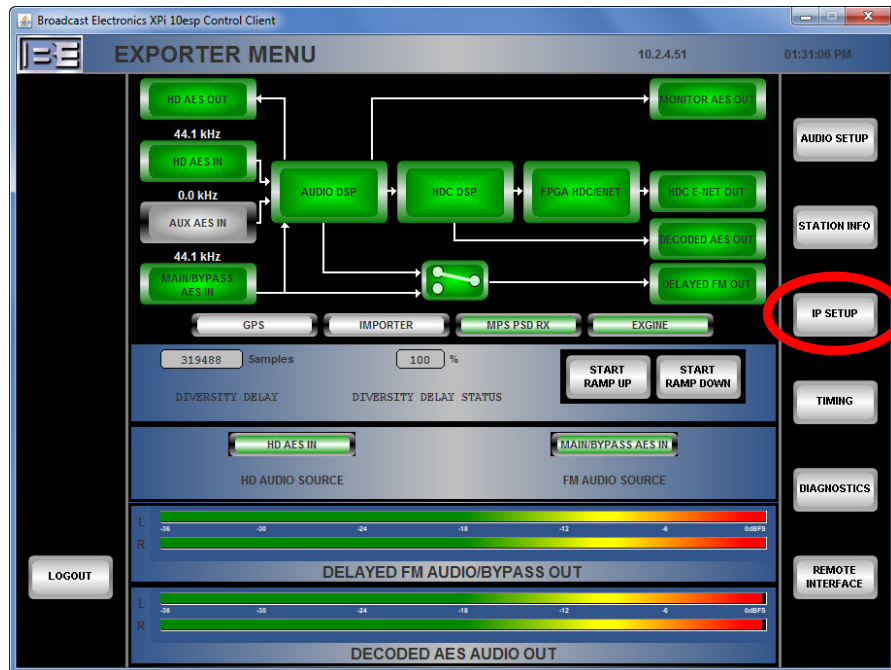
Figure 8 – IP Setup Screen Navigation

2. Click the button labeled "IP SETUP" to navigate to the screen.
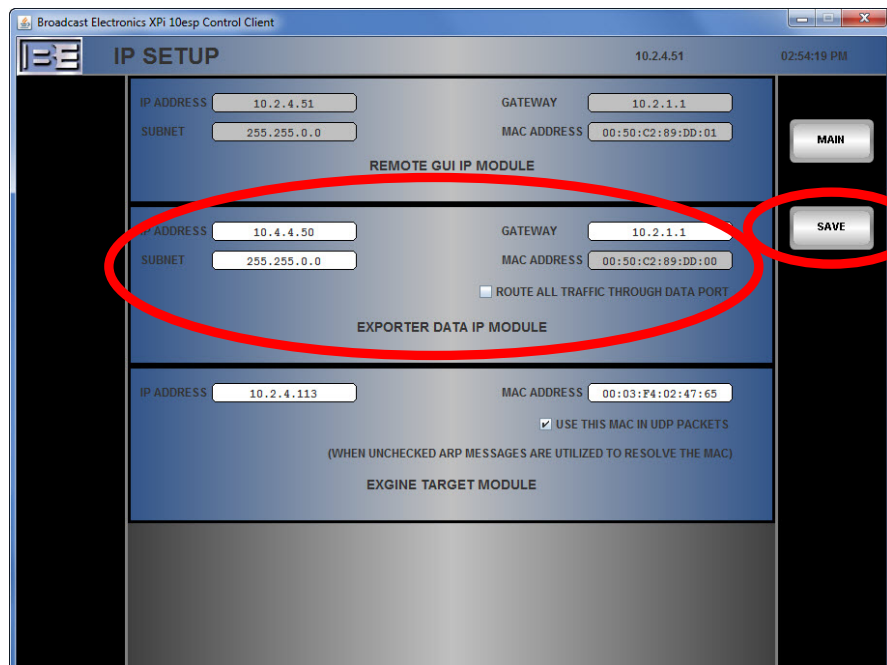
Figure 9 – Data Port Settings

3. Enter the desired static IP Address in the "IP ADDRESS" field, the default gateway in the "GATEWAY" field, and the subnet mask in the "SUBNET" field.

The XPi 10esp has an option for separating the Remote GUI (and software update) port from the data port utilized by the Exgine and Importer communications. This allows isolation of the large amount of data that the broadcast system is constantly moving to a separate sub-network. To enable use of the Remote GUI port on a different sub-network:

4. Click the checkbox labeled ROUTE ALL TRAFFIC THROUGH DATA PORT to uncheck the setting.

5. Click the "SAVE" button when all changes are complete. The Exporter must be manually reset for these changes to take effect.

5.4 Point to the Exgine

1. If not already at the IP Setup Screen, Login and navigate to the IP Setup Screen (see Section 5.2 and Section 5.3 above respectively).
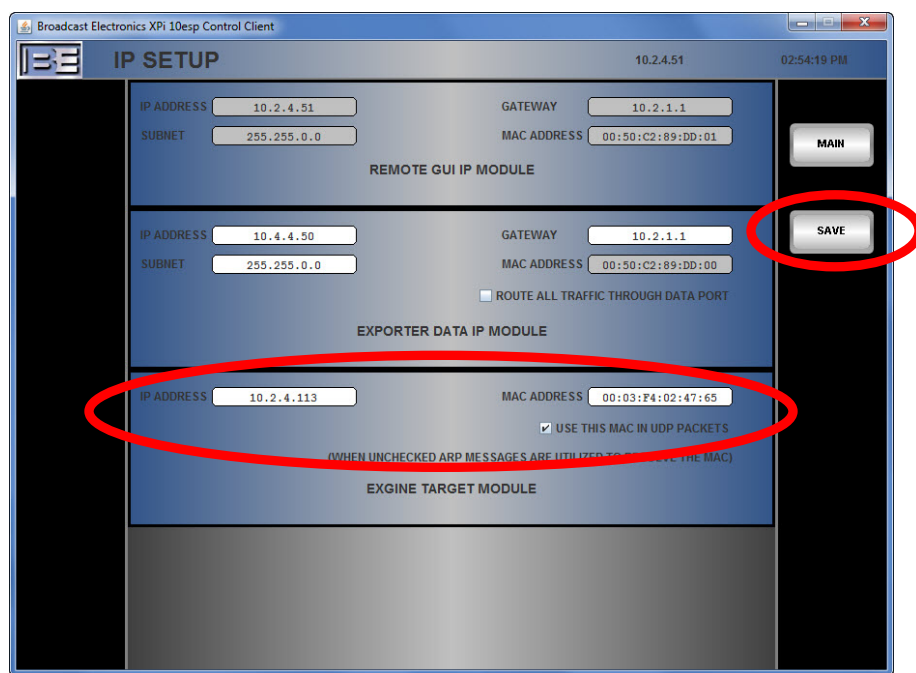
Figure 10 – Exgine Target Settings

2. Enter the Exciter/Exgine's IP Address in the "IP ADDRESS" field, and the Exgine's MAC Address in the "MAC ADDRESS" field. For Exporter-in-studio applications, check the box below the MAC Address field. Otherwise, the system will self-verify the link.

   If there are multiple Exgine targets in the network that utilize this Exporter, enter the subnet followed by 255's (ie 10.2.255.255), "FF:FF:FF:FF:FF:FF" in the MAC field, and check the box below the MAC field.

3. Click the "SAVE" button when complete to persist any changes in text fields.

4. Click the "MAIN" button to navigate back to the Main Menu Screen.

5.5   Essential Station Information

1.   If not already logged in, do so (see Section 5.2 above).
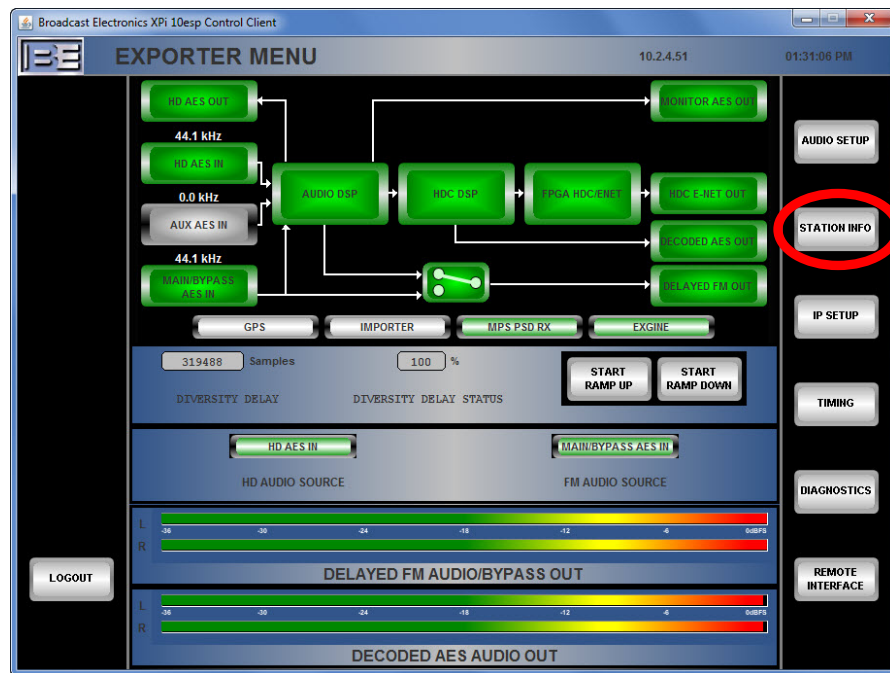
Figure 11 – Station Information Screen Navigation

2.   Click the "STATION INFO" button to navigate to the Station Information Setup Screen.

Figure 12 – Call Sign Settings

3. Enter your station's call sign in the "CALL SIGN STANDARD" field. If the call sign display that shows at receivers should show –FM after, for example "WBEI-FM", check the "APPEND "-FM"" checkbox.

Figure 13 – FCC ID Settings

4. Enter your station's FCC ID number in the field labeled "FCC ID".

5. Click the "SAVE" button to save any modifications.

6. Click the "MAIN" button to navigate back to the Main Menu Screen.

5.6   Set Local Time

1. If not already logged in, do so (see Section 5.2 above).
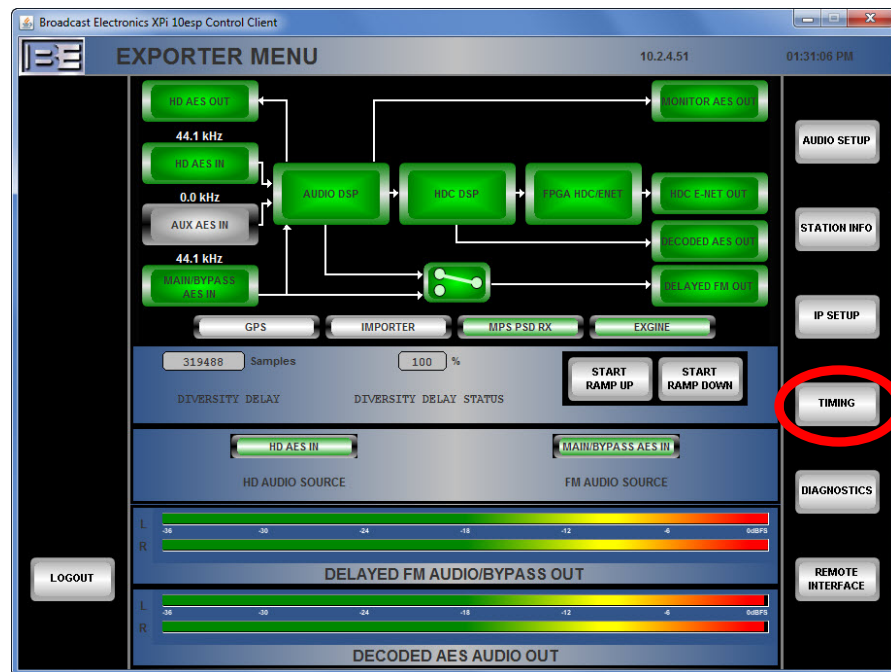
Figure 14 – Timing Screen Navigation

2. Click the "TIMING" button to navigate to the Timing Setup Screen.
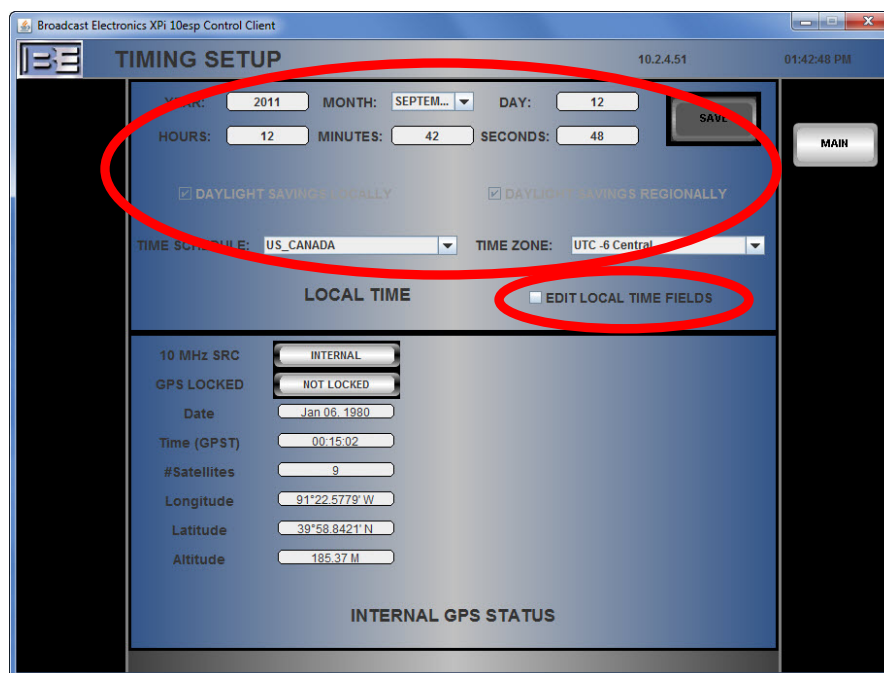
Figure 15 – Local Time Settings

3. Click the "EDIT LOCAL TIME FIELDS" to interrupt the time tracking and allow editing the local time.
4. Select the time zone, daylight savings status (check when active, typically in the summer), year, month, day, hour (not including daylight savings), minute, second.
5. Click the "SAVE" button to save any changes and begin tracking time again.
6. Click the "MAIN" button to navigate back to the Main Menu Screen.

5.7 Restart the System

If the procedures above have been followed, all necessary settings required to use the XPi 10 esp Exporter in a working HD system should be set. To finalize all IP and Station Information settings, simply reset the exporter using the power switch; cycle OFF then ON.

6   Optional Features

The sections below detail features that are included with the XPi 10 esp that are not entirely essential to operation. They provide additional levels of automation, precision, and/or convenience when utilized as intended.

6.1   Automatic Audio Delay Alignment Feedback

The XPi 10 esp comes with a built-in FM Audio (the analog MPS signal that feeds out of the delayed output) delay control system for keeping the analog and digital MPS signals time-aligned. This feature requires an HD receiver with split FM/HD mode output and a path to convey the audio channels to RCA connectors on the XPi 10 esp.

1. Connect RCA plugs from the split-mps receiver to the HD and FM Feedback Inputs on the back panel. The HD channel corresponds to Left (white) while the FM channel corresponds to Right (red).

In order to tune the system to your receiver, the two signals must first be manually aligned:

2. If not already logged in, do so (see Section 5.2 above).
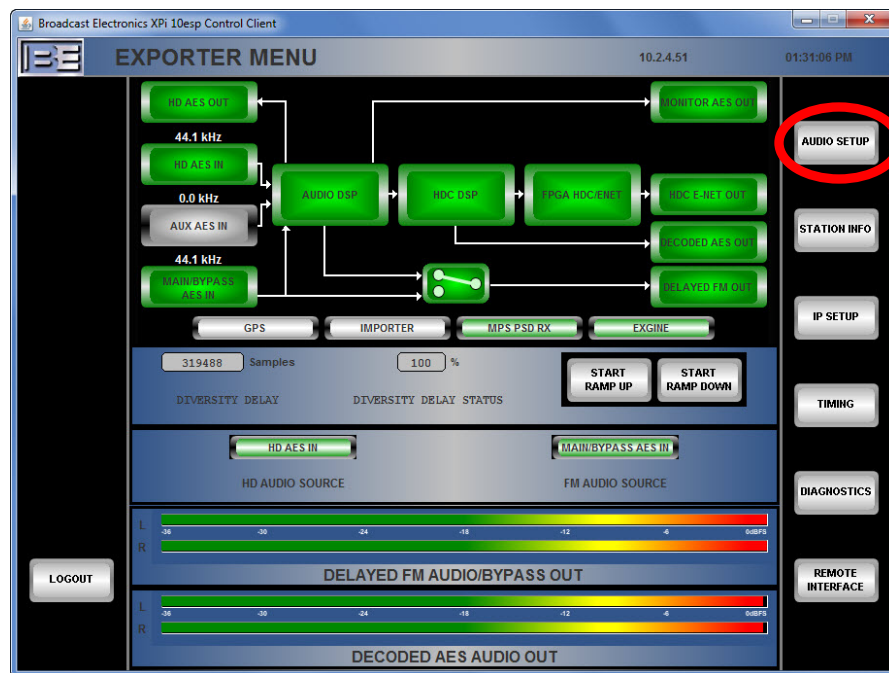
Figure 16 – Audio Setup Screen Navigation

3. Click the "AUDIO SETUP" button to navigate to the Audio Setup Screen.

Figure 17 – Audio Delay Setup Screen Navigation

4. Click the "DELAY SETUP" button to navigate to the Audio Delay Setup Screen.
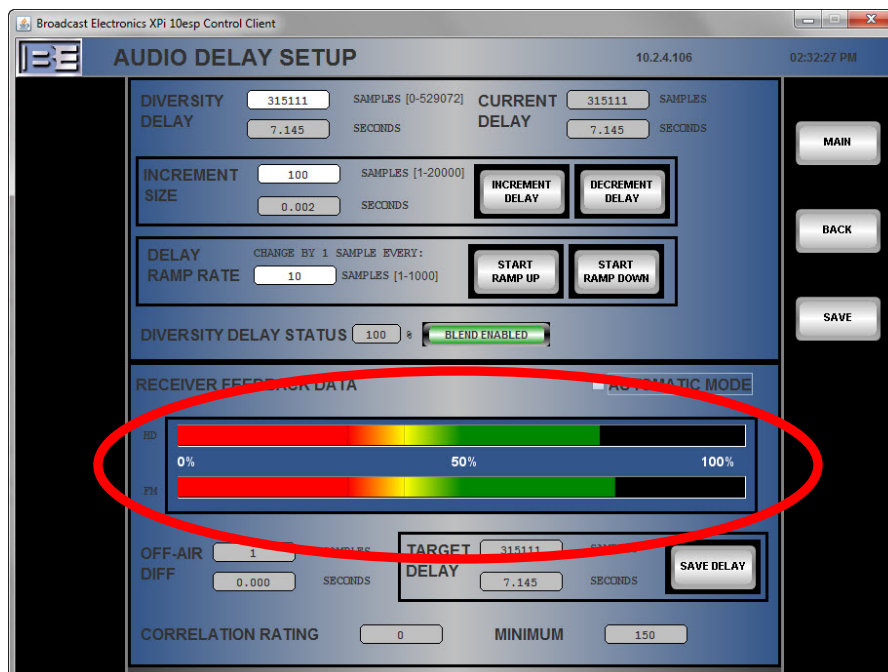
Figure 18 – Delay Feedback Meters

5. While watching the receiver HD and FM feedback peak holds meters (under RECEIVER FEEDBACK DATA), adjust L1 and L2 on the back panel (lower left, see Figure 7 tag 13) using a small flat-head screwdriver. The peak holds should both be at the same level and between 90% and 95% as much as possible. In general, the highest signal possible peak holds that do not clip is best. Signals that are too low may contain noise that prevents high enough correlations, and signals that are too high may give false positives due to clipping that effectively creates identical sections of audio when there actually is no real correlation.

6. Finally, click the AUTOMATIC MODE checkbox to instantly put the system into automatic delay control mode.

If the algorithm consistently fails to yield a correlation rating above the minimum threshold (even when the signals have been manually aligned to within a second) then one of the audio phases may be inverted. See the section titled "Set Audio Input Phase" under the Operation section in the XPi 10esp Exporter Operation Manual.

6.2   GPS Synchronization

All XPi 10esp Exporters are fitted with a GPS receiver. Utilizing this feature greatly increases the reliability of logic clock signals in various parts of the HD system. The most important of which is the 10MHz signal that is used in the phase lock loop to control digital audio signal processing.

Installations without an existing GPS Receiver or existing Master GPS antenna require an external GPS Antenna (BE part number 809-0383) and desired length of antenna cable. Please contact Broadcast Electronics for pricing and availability.

6.3   Remote Control Connections

The XPi 10esp is equipped with remote control input and output pins. Once the hardware connections are made, logical settings should be calibrated. See your remote interfacing system's documentation for specifics regarding how to program around the set behaviors listed below in order to suit the needs of your system configuration.

Inputs are "active" when brought low via connection to a local ground terminal on any of the input blocks. Input behavior response varies from pin to pin, and most respond to a high to low edge on a single momentary event.

Outputs approximately range from high +5V to low 0V. Duration and behavior of the output varies from case to case.

6.4   Logic Clocks

10 MHz In, 10 MHz Out, and Word Clock Out are all working logic timing clock signal inputs/outputs.

There are two available sources for a 10MHz system clock. An external 10 MHz signal is given the highest priority, so if a clock signal is detected at the Input it is automatically used. If no external clock source is present, the internal GPS receiver is utilized. The internal receiver utilizes a Temperature-compensated crystal oscillator. When not locked, timing relies entirely on this oscillator. If the GPS receiver establishes a lock (an antenna is required - see section 6.2) the already small errors are reduced even more. Because of the level of precision

that is standard with the XPi 10esp, an external source is only recommended if a central timing reference is desired. Otherwise timing precision in the system may actually be reduced.

The 10 MHz clock output is tied to the currently active 10 MHz clock signal. This also allows the XPi 10 esp to be used as a clock source and also allows daisy chain configurations.

The Word Clock output is generated using the active 10 MHz signal. This signal maintains synchronous timing between the Exporter and the Importer to prevent bitrate errors that can result from oscillator drift in either sub-system.

7 Software Upgrades

The latest **XPi 10esp Exporter** software upgrade instructions are available on the Broadcast Electronics Customer Service website at http://www.bdcast.com/information-center/application-guides/. To limit this search to relevant material, select "FM HD Radio Signal Generators" under the product group branches "RF Transmission Products", "HD Radio", and "FM HD Radio".

8 Terms and Definitions

AES/EBU	Audio Engineers Society/European Broadcast Union Standard Audio
FM	Frequency Modulation
FXi	Broadcast Electronics' Digital Exciter Product Line
GPS	Global Positioning System
GUI	Graphical User Interface
IDi	Broadcast Electronics' Importer Product Line
IP	Internet Protocol
MPS	Main Program Service
OFDM	Orthogonal Frequency-Division Multiplexing
RGUI	Remote Graphical User Interface
RF	Radio Frequency
SIS	Station Information Service
XPi	Broadcast Electronics' Digital Exporter Product Line

9 RF Technical Services Contact Information

RF Technical Services -
Telephone: (217) 224-9617
E-Mail: rfservice@bdcast.com
Fax: (217) 224-6258
www.bdcast.com

10 Drawings

The following pages present the XPi esp system drawings.

FIGURE 2 – *XPi 10 esp* at Studio Site

Studio Site

STL (Studio Site)

STL May Be Uni-Directional

Ethernet / HDC Audio

AES/EBU
949-0544-104

Studio Site Antenna Tower

Transmitter Site Antenna Tower

* Aux AES/EBU Audio Source

XPi 10esp
Broadcast Electronics, Inc
4100 North 24th Street
Quincy, Illinois 62305

949-0544-113

949-0544-111

949-0544-112

Ethernet / HDC Audio

Transmitter Site

* STL (Transmitter Site)

Ethernet / HDC Audio
(crossover cable if direct connection like shown)

AES/EBU

949-0600-101

* **FM/HD Audio Processor**

(FM) Output 1   (HD) Output 2   Ext. Sync In
Input

NOTE: Audio Processor MUST be set-up for External Sync.

AES/EBU

Note: either HD AES OUT or HD DECODED AES OUT may be used for audio processor feedback depending on audio processing desired.

FXi 60/250
With Exgine Card

RF Output

949-0613

LAN (If Used)

AES/EBU, In 1
AES/EBU, In 2
AES/EBU, In 3

* IDi 20 & XPi 10esp GUI Screens

IDi 20

* FM+HD or HD Only To Linear Transmitter

Gigabit Ethernet Switch

Keyboard Mouse Monitor

Ethernet

AES/EBU, Out 4
AES/EBU, Out 3
AES/EBU, Out 2
AES/EBU, Out 1
Word Clock In

NOTE: Category 6 Ethernet Cables and Gigabit Ethernet Switches or Hubs are recommended for all Studio & Transmitter Site Ethernet / HDC Audio connections.

LAN / Ethernet Feeds

* **AudioVAULT** GUI Screen

AudioVAULT

Keyboard Mouse Monitor

Ethernet

- Cable Legend -

Supplied in XPi 10 esp Installation Kit (979-6100)

Supplied in Other Product Installation Kits (Subject to Change)

STL, GPS, Networking Cables/Equipment Supplied by the Customer

Broadcast Electronics, Inc.
IDi 20 Importer with *MPS & 3 SPS Channels*
Single Audio Processor
XPi 10esp Exporter
FXi 60/250 Exciter (w/**Exgine**)

DRAWING NOT TO SCALE
©2011 BROADCAST ELECTRONICS, INC.

* : Equipment may not be manufactured by Broadcast Electronics, Inc.

Studio Site

STL (Studio Site) *

STL May Be Uni-Directional

Ethernet / HDC Audio

AES/EBU
949-0544-104

Studio Site Antenna Tower *

Transmitter Site Antenna Tower *

Transmitter Site

* Aux AES/EBU Audio Source

115VAC / 230VAC 50/60 Hz

XPi 10esp
Broadcast Electronics, Inc.
4100 North 24th Street
Quincy, Illinois 62305

AUDIO DELAY ALARM INPUT ADJUST
GPS ANTENNA AUX 10MHz INPUT 1 PPS INPUT WORD-CLK OUT ETHERNET EDGE IMP HD IN

AM MAG OUT LVDS OUT AM PHASE OUT 10MHz OUT WORD-CLK OUT

HEAD PHONE SERIAL PORT ETHERNET EDGE IMP FM IN

AUX AES AUDIO IN MAIN / BYPASS AES AUDIO IN HD AES AUDIO IN HD DECODED AES AUDIO OUT MONITOR AES AUDIO OUT HD AES AUDIO OUT DELAYED MAIN / BYPASS AES OUT

INPUTS OUTPUTS

STL (Transmitter Site) *

Ethernet / HDC Audio (crossover cable if direct connection like shown)

AES/EBU

949-0600-101

Ethernet / HDC Audio

949-0544-111

949-0544-112

949-0544-113

* AES Monitor

AES Splitter (Sold Separately) 809-0830

*

FXi 60/250 With Exgine Card

RF Output

949-0613

LAN (If Used)

AES/EBU, In 1
AES/EBU, In 2
AES/EBU, In 3

IDi 20 & XPi 10esp GUI Screens *

*

Gigabit Ethernet Switch

Keyboard Mouse Monitor

Ethernet

IDi 20

* FM+HD or HD Only To Linear Transmitter

NOTE: Category 6 Ethernet Cables and Gigabit Ethernet Switches or Hubs are recommended for all Studio & Transmitter Site Ethernet / HDC Audio connections.

FIGURE 3 – *XPi 10 esp* at Studio Site

AES/EBU, Out 4
AES/EBU, Out 3
AES/EBU, Out 2
AES/EBU, Out 1
Word Clock In

LAN / Ethernet Feeds

* AudioVAULT GUI Screen

Keyboard Mouse Monitor

AudioVAULT

Ethernet

- Cable Legend -

Supplied in XPi 10 esp Installation Kit (979-6100)

Supplied in Other Product Installation Kits (Subject to Change)

STL, GPS, Networking Cables/Equipment Supplied by the Customer

Broadcast Electronics, Inc.
IDi 20 Importer with *MPS & 3 SPS Channels*
XPi 10esp Exporter
FXi 60/250 Exciter (w/**Exgine**)

DRAWING NOT TO SCALE
©2011 BROADCAST ELECTRONICS, INC.

* : Equipment may not be manufactured by Broadcast Electronics, Inc.

Studio Site

* STL (Studio Site)

STL May Be Uni-Directional

Ethernet / HDC Audio

AES/EBU
949-0544-104

* Studio Site Antenna Tower

* Transmitter Site Antenna Tower

Transmitter Site

* Aux AES/EBU Audio Source

XPi 10esp
Broadcast Electronics, Inc.
4100 North 24th Street
Quincy, Illinois 62305

115VAC / 230VAC 50/60 Hz

AUDIO DELAY ALARM INPUT ADJUST
GPS ANTENNA
AUX
1 PPS INPUT
10MHz INPUT
1 PPS OUT
WBD-CLK OUT
ETHERNET STL/LAN
HD IN
AUX AES AUDIO IN
MAIN / BYPASS AES AUDIO IN
HD AES AUDIO IN
HD DECODED AES AUDIO OUT
MONITOR AES AUDIO OUT
HD AES AUDIO OUT
DELAYED MAIN AUDIO/BYPASS OUT

AM MAG OUT
LVDE OUT
AM PHASE OUT
10MHz OUT
WBD-CLK OUT
ETHERNET EXIG-INP
HEAD PHONE
SERIAL PORT
INPUTS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 + - L R
OUTPUTS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 + - L R

* STL (Transmitter Site)

Ethernet / HDC Audio (crossover cable if direct connection like shown)

AES/EBU

949-0600-101

Ethernet / HDC Audio

* AES Monitor

949-0544-111
949-0544-113
949-0544-112

* **HD Audio Processor**
Input   Output 1
└ AES/EBU ┘

Note: Standalone FM Audio Processor may be located on either side of the XPi10esp (by using the configuration shown or by intercepting DELAYED MAIN AUDIO/BYPASS OUT)
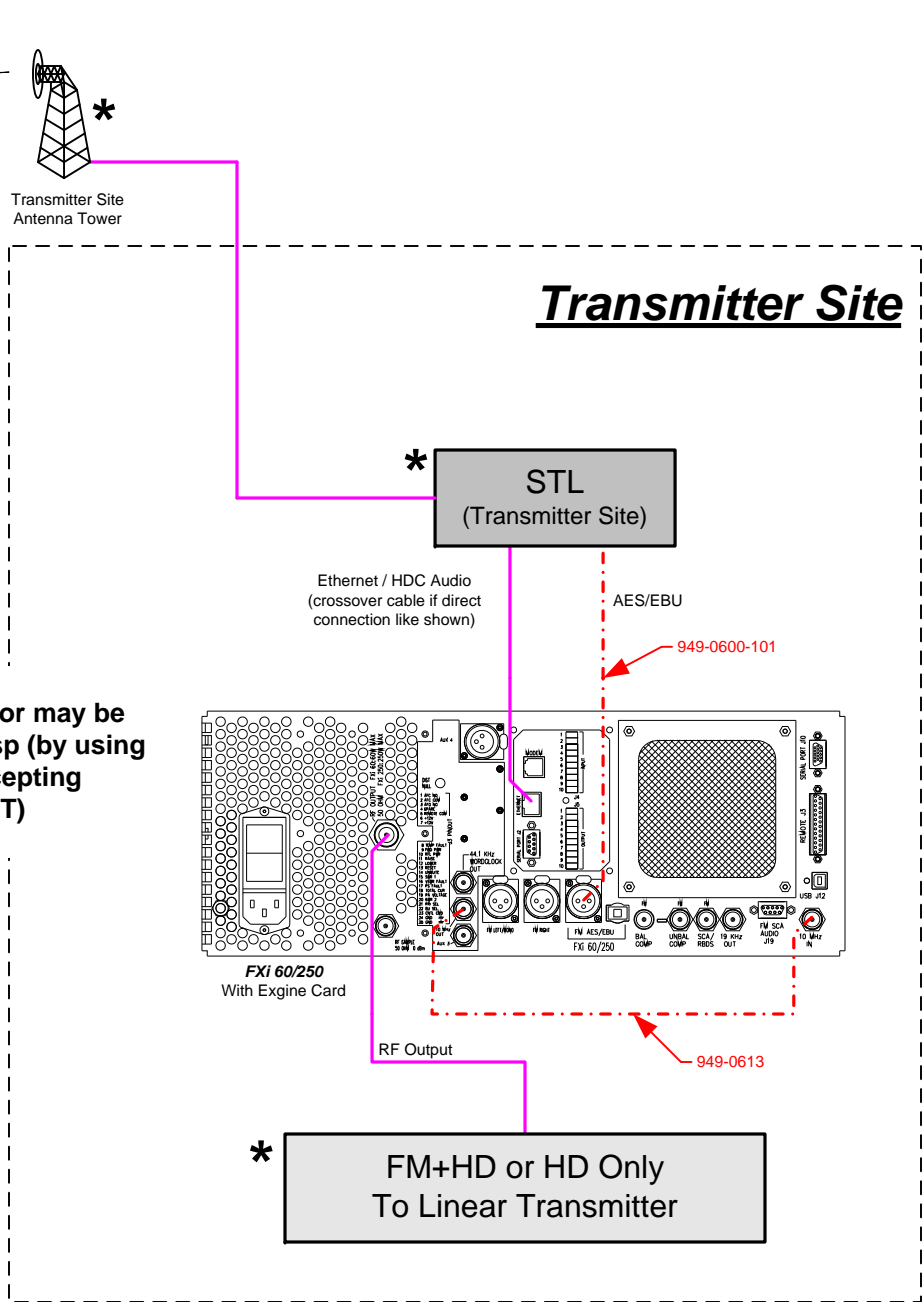
* **FM Audio Processor**
Input   Output
└ AES/EBU ┘

AES Splitter (Sold Separately) 809-0830

FXi 60/250
With Exgine Card

RF Output

949-0613

LAN (If Used)

AES/EBU, In 1
AES/EBU, In 2
AES/EBU, In 3

* IDi 20 & XPi 10esp GUI Screens

* FM+HD or HD Only To Linear Transmitter

* Gigabit Ethernet Switch

IDi 20

Keyboard Mouse Monitor
Ethernet

AES/EBU, Out 4
AES/EBU, Out 3
AES/EBU, Out 2
AES/EBU, Out 1
Word Clock In

* **AudioVAULT** GUI Screen

LAN / Ethernet Feeds

AudioVAULT

Keyboard Mouse Monitor
Ethernet

NOTE: Category 6 Ethernet Cables and Gigabit Ethernet Switches or Hubs are recommended for all Studio & Transmitter Site Ethernet / HDC Audio connections.
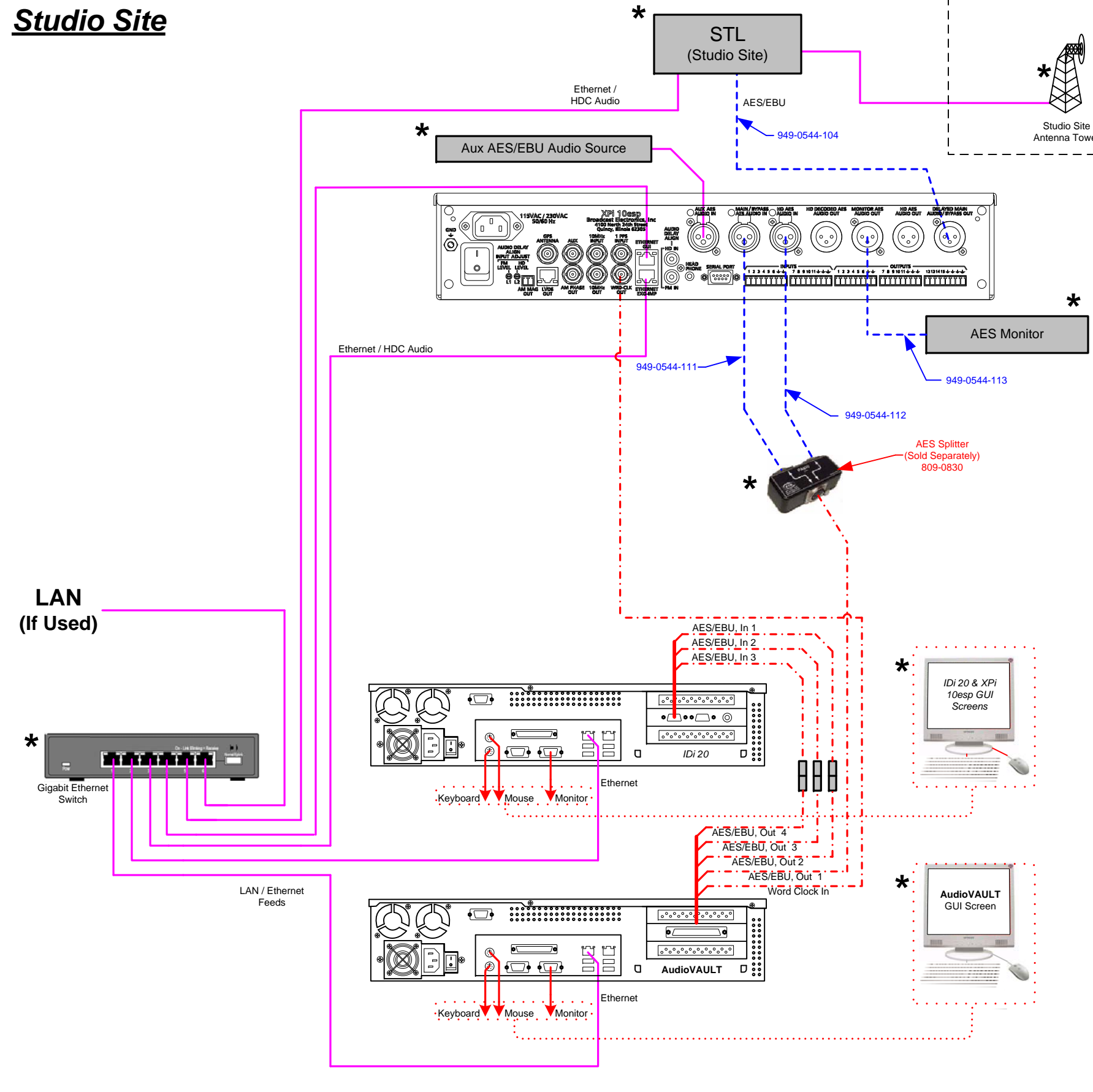
FIGURE 4 – *XPi 10 esp* at Studio Site

- Cable Legend -

Supplied in XPi 10 esp Installation Kit (979-6100) — – – –
Supplied in Other Product Installation Kits (Subject to Change) —·—·—
STL, GPS, Networking Cables/Equipment Supplied by the Customer ———

Broadcast Electronics, Inc.
IDi 20 Importer with *MPS & 3 SPS Channels*
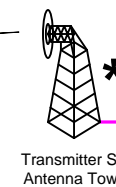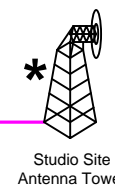*Dual Audio Processors*
XPi 10esp Exporter
FXi 60/250 Exciter (w/**Exgine**)

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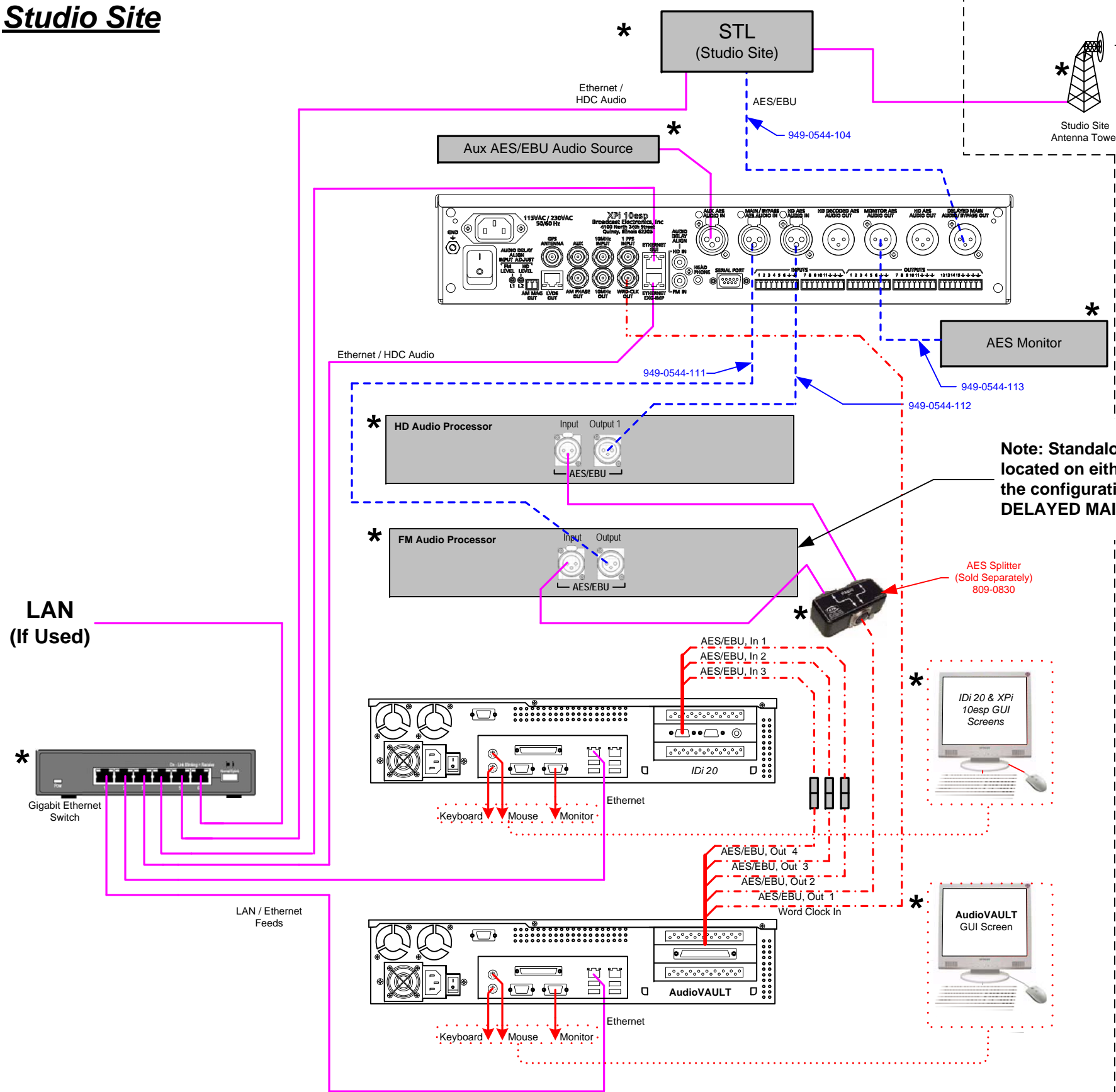* : Equipment may not be manufactured by Broadcast Electronics, Inc.

Studio Site

Transmitter Site

STL **MUST** Be Bi-Directional

* STL

* Studio Site
Antenna Tower

* Transmitter Site
Antenna Tower

* STL

Ethernet / HDC Audio

AES/EBU

949-0600-101

LAN
(If Used)

* GPS
Time/Frequency
Unit

Antenna IN

* Studio Site
GPS Antenna

* Transmitter Site
GPS Antenna

*

* FM/HD Audio Processor

NOTE:
Audio Processor MUST
be set-up for External Sync.

Input   (FM)   (HD)   Ext.
       Output 1 Output 2 Sync In

AES/EBU

* Gigabit Ethernet
Switch

949-0544-113

Gigabit Ethernet
Switch

949-0544-111

949-0544-112

*

*

LAN / Ethernet
Feeds

Auxiliary AES Audio Source

10MHz OUT

GPS 10MHz IN

* GPS
AES Reference Generator

Word Clock OUT

AES/EBU, In 1
AES/EBU, In 2
AES/EBU, In 3

* IDi 20 & XPi
10esp GUI
Screens

XPi 10esp
Broadcast Electronics, Inc.

IDi 20

Keyboard Mouse Monitor

Ethernet

AES/EBU, Out 4
AES/EBU, Out 3
AES/EBU, Out 2
AES/EBU, Out 1
Word Clock In

* AudioVAULT
GUI Screen

Ethernet / HDC Audio

AES Audio

949-0600-104

AudioVAULT

Keyboard Mouse Monitor

Ethernet

FXi 60/250
With Exgine Card

RF Output

* FM+HD or HD Only
To Linear Transmitter

NOTE: Category 6 Ethernet Cables and Gigabit Ethernet Switches or Hubs are recommended
for all Studio & Transmitter Site Ethernet / HDC Audio connections.
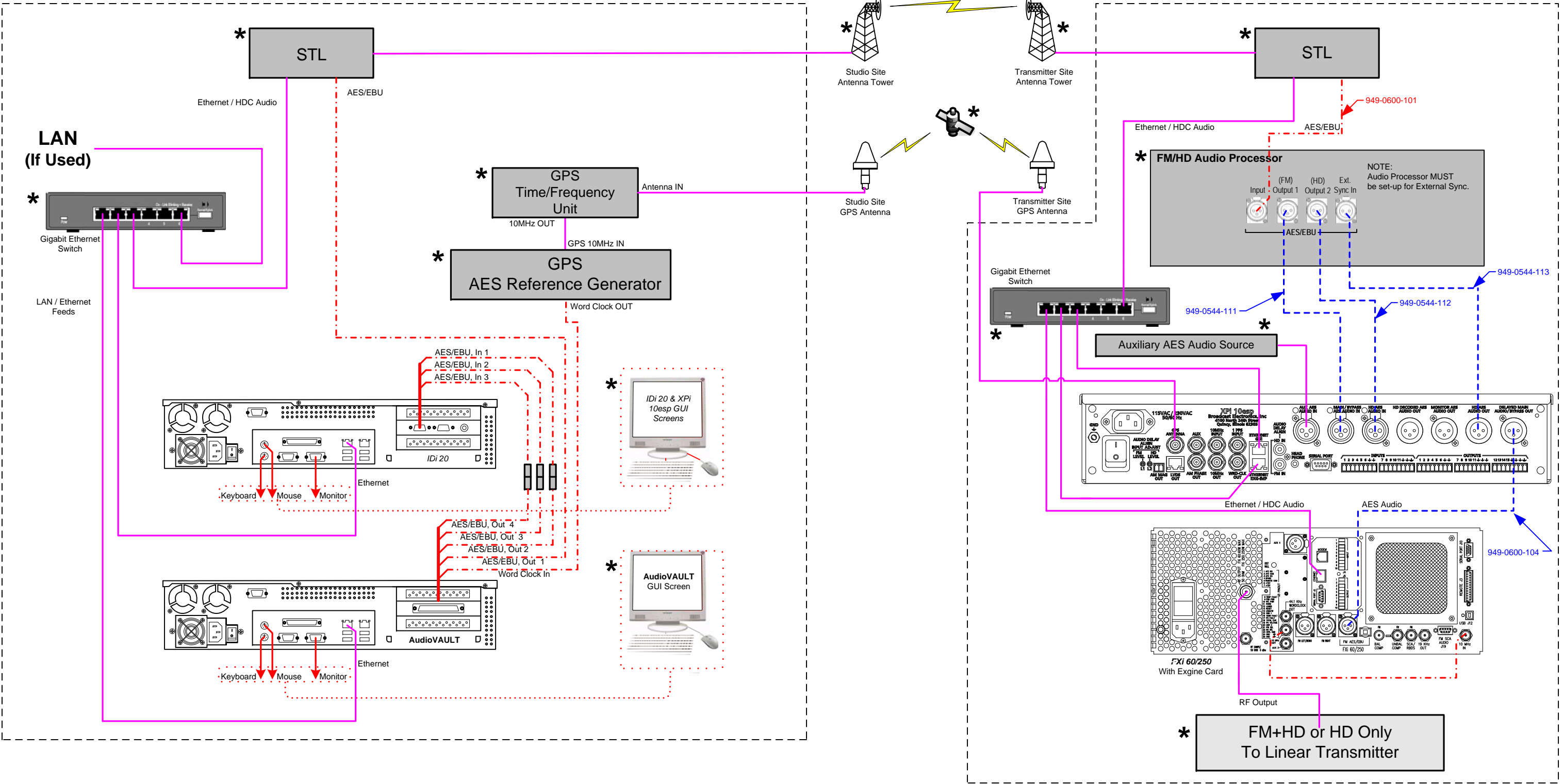
- Cable Legend -

Supplied in XPi 10 esp
Installation Kit (979-6100)   - - - - - - -

Supplied in Other Product
Installation Kits (Subject to Change) - · - · - · -

STL, GPS, Networking Cables/Equipment
Supplied by the Customer ———————

* : Equipment may not be manufactured by Broadcast Electronics, Inc.

FIGURE 5 – *XPi 10 esp*
at Transmitter Site

Broadcast Electronics, Inc.
IDi 20 Importer with *MPS & 3 SPS Channels*
single Audio Processor
XPi 10esp Exporter
FXi 60/250 Exciter (w/**Exgine**)

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