Strata Transmitter

Operations Guide

Revision 3.0

May 2003

Microwave Radio Communications   101 Billerica Avenue, Bldg 6
(978) 671-5700   N. Billerica, MA 01862-1256

www.mrcbroadcast.com

Strata Operations Guide

Introduction

The Microwave Radio Communications (MRC) Strata system provides a reliable and highly flexible video microwave transport system. This operations guide provides basic system operations information and details for hands-on operation of this equipment.

System Description

Figure 1 below shows the overall Strata system architecture for a fully equipped system.
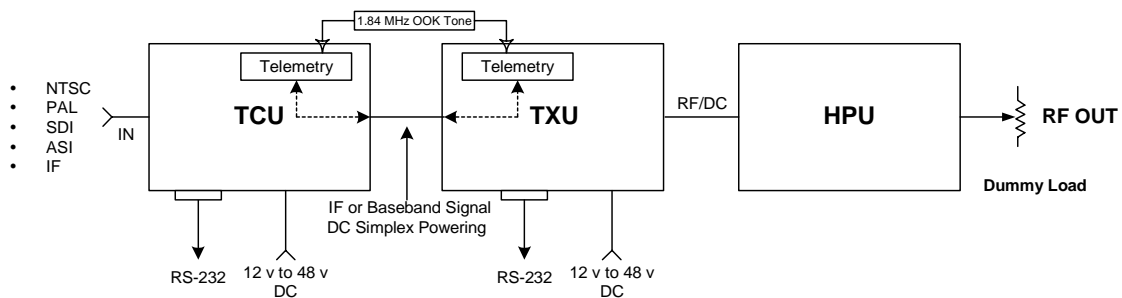

Figure 1 – Strata Transmitter System Architecture

The primary system features are:

- Lightweight, Modular, Multi-Unit Design
- Analog, Digital, or Analog/Digital Switchable
- MPEG Encoding (4:2:0, 4:2:2)
- COFDM Modulation with Selectable Guard Interval
- Digital Modulation for QPSK, 16QAM, and 64QAM
- NTSC or PAL Modulation with Audio (4 mono or 2 stereo)
- Tripod, Half Rack, or Full Rack Mounts
- Front Panel Remote Controlled
- Bands from 2 to 15 GHz
- Wide Choice of Antennas

Note that the TCU (Transmitter Control Unit) and the TXU (Transmitter Unit) may be operated in a stand-alone configuration depending on specific video transport applications.

TCU Description

The TCU component can accept a wide variety of signal formats and provide several different output signal formats. Figure 2 below shows the basic functions of the TCU.
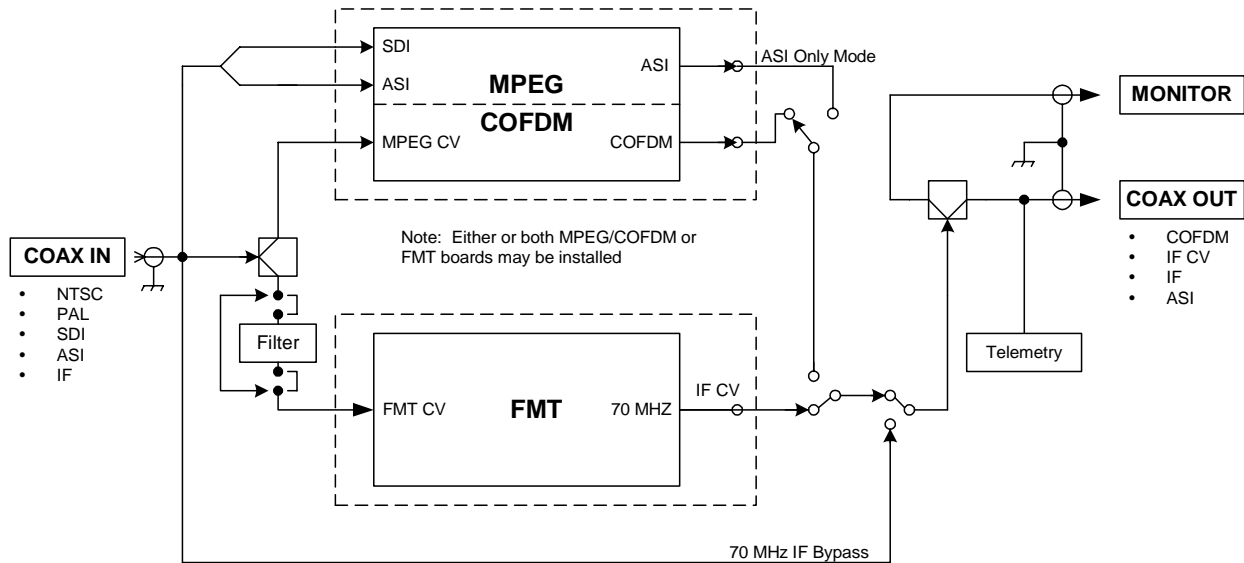
Strata Operations Guide

Figure 2 - Strata TCU Functional Diagram

Note: The TCU may be supplied with or without the MPEG/COFDM or FMT options.

TXU Description

Like the TCU component, the TXU can accept a wide variety of signal formats but includes an RF up-converter for use in transporting signals over a microwave radio link. Figure 3 below shows the basic functions of the TXU.
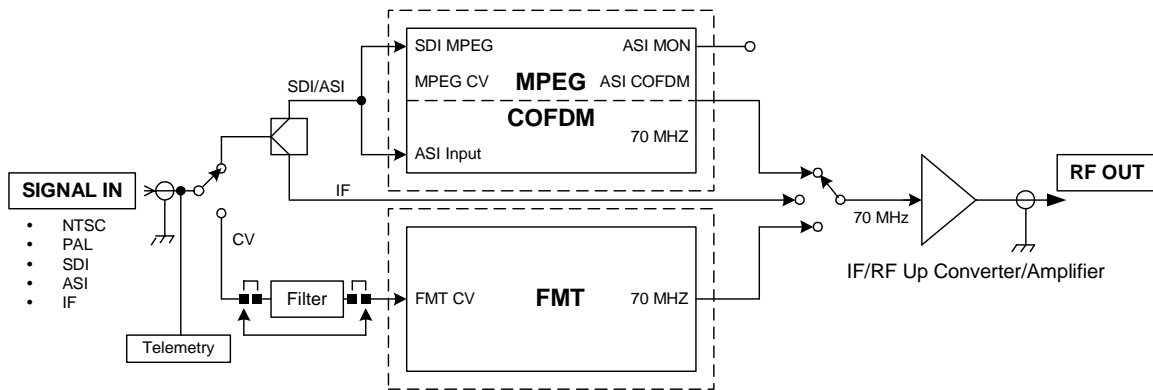

Figure 3 – Strata TXU Functional Diagram

Note: The TXU may be supplied with or without the MPEG/COFDM or FMT options.

Strata Operations Guide

HPU Description
For those applications requiring a higher RF output level, the HPU (High Power Unit) may be used to boost the signal level to between 2 and 12 watts of microwave output power depending on the modulation format used. Figure 4 below shows the functional architecture of the HPU device.
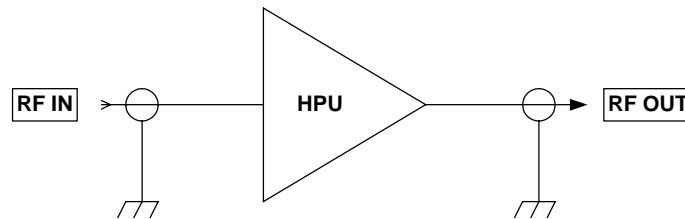

Figure 4 – HPU Functional Diagram

Theory of Operation
The Strata TX system is comprised of the following primary components:
- Command and Control Power Supply module
- Combiner Circuit
- MPEG encoder/COFDM modulator module (digital mode)
- FMT (FM Transmitter) (analog mode)
- IF/RF Unit
- HPU (High Power Unit)

Note that some or all of these components may be included in a fully functional Strata TX system depending on specific customer applications, e.g., switchable analog and digital transmitting system, etc. Where switchable analog and digital video transmission is required, the Strata TX system installs the digital and analog video modulator modules and the IF/RF module in separate housings. In this case a TCU (Transmitter Control Unit) houses the MPEG/COFDM, FMT and Combiner circuits with the IF/RF unit installed in a separate TXU (Transmitter Unit) housing. This arrangement also allows the video modulation components (TCU) to be physically separated from the IF/RF up-converter by up to 600 feet.

Command and Control Power Supply
The TCU and TXU Command and Control/Power Supply modules contain external and internal communications circuitry as well as supplying the necessary system voltages. The power supply portion accepts a wide range DC input voltage (+10.5 to +48 volts) and distributes appropriate output voltages to the various circuits. The command and control circuits handle inter-module communications and provide external RS-232 communications to external peripheral equipment, such as a remote control device (helicopter operation) or to a PC capable of running Windows based configuration software. An on-board microprocessor manages the system configuration and operation of all modules to which it is connected, i.e., MPEG/COFDM, FMT, IF/RF modules, etc. In addition, for those applications that employ both TCU and TXU housings, a communications link superimposed over the inter-connecting IF coaxial cable provides communications to all system modules. This ensures the TCU and TXU may control each other's operation, i.e., permit switching modes of operation, change system presets, etc.

Strata Operations Guide

Therefore, where both a TCU and TXU are used, total system control may be accomplished using front panel or remote control from either housing.

MPEG/COFDM Encoder/Modulator
This is the heart of the Strata TX digital mode circuitry. This versatile circuit may be configured to accept a wide range of digital or analog video and audio signal inputs and provide COFDM (70 MHz), IF (70 MHz) or ASI video signal outputs. When installed in a TCU housing, the various signal inputs and outputs are connected through the TCU Combiner circuit where the various signal inputs and outputs are switched using software controls.

FMT
The optional FMT module accepts standard NTSC or PAL analog video and audio signals and FM modulates these signals on a 70 MHz carrier. Using the MRC supplied configuration software, four different audio sub-carrier frequencies may be defined in which up to four standard audio signals may be transported with the associated video signal. Note that audio deviation levels are software controlled and must be provisioned at the MRC factory when ordering this option.

TCU
The TCU may house either or both digital and analog video modulation modules. Where a customer application might initially employ only analog video transmission but anticipates migrating to dual (switchable) analog and digital operation, the TCU may be upgraded to add the MPEG/COFDM module to provide this additional capability. Where only digital or analog video transmission is desired, the MPEG/COFDM or FMT modules may be installed in a TXU housing thereby eliminating the need for a TCU. Note that the Strata TX design does not permit splitting digital and analog video modulator modules between a TCU and TXU. A TCU configuration may also include a "stand-alone" option where either or both MPEG/COFDM and FMT modules may be used independent of the TXU. This arrangement permits using a TCU equipped with analog and/or digital video modulation modules for a variety of signal input and signal output configurations, including a digital option using NTSC or PAL composite video input and ASI (digital) signal output.

TXU
The TXU always houses the IF/RF module, which accepts either a 70 MHz COFDM, FMT IF, or external 70 MHz input signal and up-converts these signals to the appropriate RF band. The RF frequency synthesizer circuit included in the IF/RF unit, along with the command and control module, provide the means to channelize RF video and audio signals in the 2 GHz RF band. Standard U.S. FCC band plans, as well as customer created channel plans, may be accommodated using the Strata TX Windows based configuration software. As noted above, the TXU may also include either an MPEG/COFDM or FMT module (but not both) in which case the TXU serves as a stand-alone digital or analog video microwave transmission system.

HPU
The optional HPU (High Power Unit) is designed to work with a companion TXU in which case RF output signals from the TXU are connected to the RF input jack of the HPU. In the case of analog microwave transmission, the RF output of the TXU is amplified operating the HPU RF amplifier in the non-linear region (saturated) providing RF output levels at the 12 watt level (+41 dBm). In the case where COFDM RF signals are used, software controlled back-off attenuation is applied to operate the HPU RF amplifier in the linear region.

Strata Operations Guide

These back-off levels are carefully measured and configured as part of MRC factory adjustment procedures and ensure digital mode RF output signals provide optimum performance. Therefore, depending on what digital mode modulation format is selected, i.e., QPSK, 16 QAM or 64 QAM, or if an HPU is used, previously configured transmitter back-off levels are applied to ensure the Strata TX RF output signals operate with minimum Inter-Modulation Distortion (IMD). These carefully measured and configured transmitter back-off levels are stored in the TXU IF/RF unit and are applied depending on which particular operating mode is selected. Typical digital mode RF levels vary from 5 watts to 2 watts output depending mostly on the modulation format selected.

Overall Operational Details

The following details apply when operating the Strata system using either the TCU or TXU front panel controls:

1. When companion TXU or TCU devices are inter-connected via coaxial cables, an inter-unit telemetry link is established. This feature allows overall system operation and configuring to be accomplished from either the TCU or TXU devices if both are used. For example, the microwave transmitter may be keyed ON or OFF from either device.
2. A configuration software tool (Strata TX Configurator) may be used to review and modify certain system configuration options as described in this document.

Special Note: All radio systems leaving the MRC factory are adjusted per standard industry (default) settings, i.e., video and audio levels versus FM deviation (analog), as well as digital and analog IF and RF levels, etc. In addition, transmitter back-off (IMD) and analog audio levels are carefully adjusted using special software tools. Many of these settings are software controlled and cannot be adjusted in the field.

How to View Configuration Parameters and Control the TCU/TXU Units from the Front Panel

Figure 5 below shows the basic TCU/TXU control functionality using the front panel control switch:
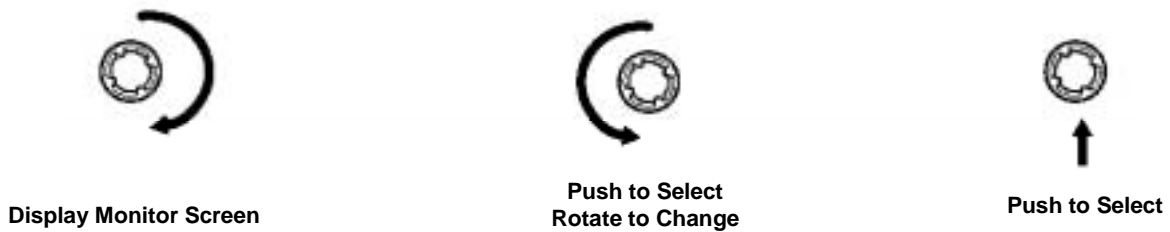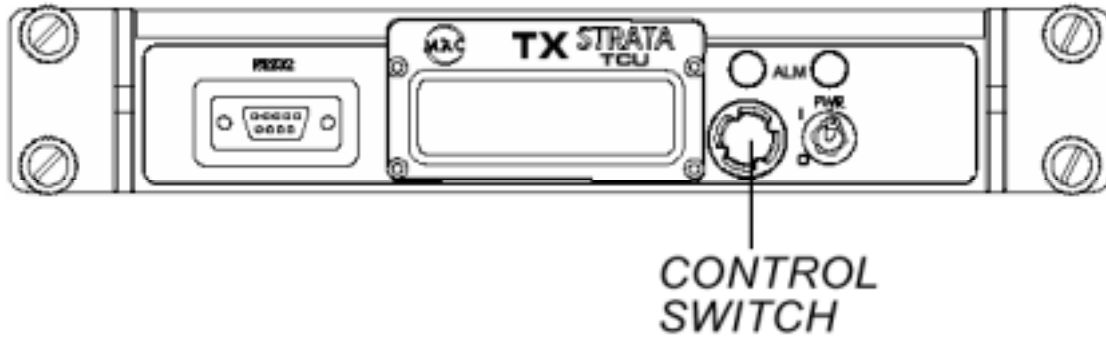
Figure 5 – Front Panel Switch Control

TCU/TXU Front Panel Control Settings
The front panel control switch is used to select a limited number of front panel control functions. Rotating the switch counterclockwise allows access to mode selection choices, while rotating the switch clockwise allows access to monitoring the current mode of operation. The plunger action of the switch is used to select the appropriate mode of operation. The TXU and associated HPU (High Power Unit), if equipped, is keyed ON or OFF by compressing and holding the front panel control switch for one second from any menu page. The Strata TX system is transmitting when the front panel blue "XMIT" LED is illuminated. When the menu display is inactive for more than 7 seconds, the display will revert back to the main menu.

The following front panel *control* selections are available:

- **Set RF Channel**
- **Change Preset –** Presets #1 to #9
- **Set Power Out –** HPU attenuation control
- **HPU Present**
- **75 Ohm Coax DC Power ON/OFF –** Coaxial cable DC power ON/OFF control

Note: The remainder of front panel selections allow *monitoring* previously configured parameters and system status, including alarm indications, power output, etc.

Details related to the use of Strata TX front panel controls are found on the following page.

Strata Operations Guide

RF Channel Select
The radio is pre-programmed with a number of RF channel frequencies associated with up to 9 preset configurations. Use this feature to monitor the currently configured RF frequencies. *Note: If these frequencies are known as part of a customer order, they may be factory set to customer requirements or added or modified per customer request.*

Select Preset Setting
Used to select a pre-configured configuration. Up to 9 different configurations may be stored and configured in conjunction with the Strata TX Configurator utility.

Set Attenuation Value (Transmitter Back Off Level)
Used to set the transmitter output power (and linear operating point) of the radio system. Adjustable from 0 to 31 dB in 1 dB increments. Push to select.

Note: Maximum power output occurs with 0 dB of attenuation applied.

---

75 Ohm Coax ON/OFF
Used to activate or de-activate DC powering a TCU or TXU through the inter-connecting IF coaxial cable.

Front Panel Transmitter Power Monitoring
The current TX output power reading available on the front panel may be used as a general reference and is accurate to within +/- 1 dB.
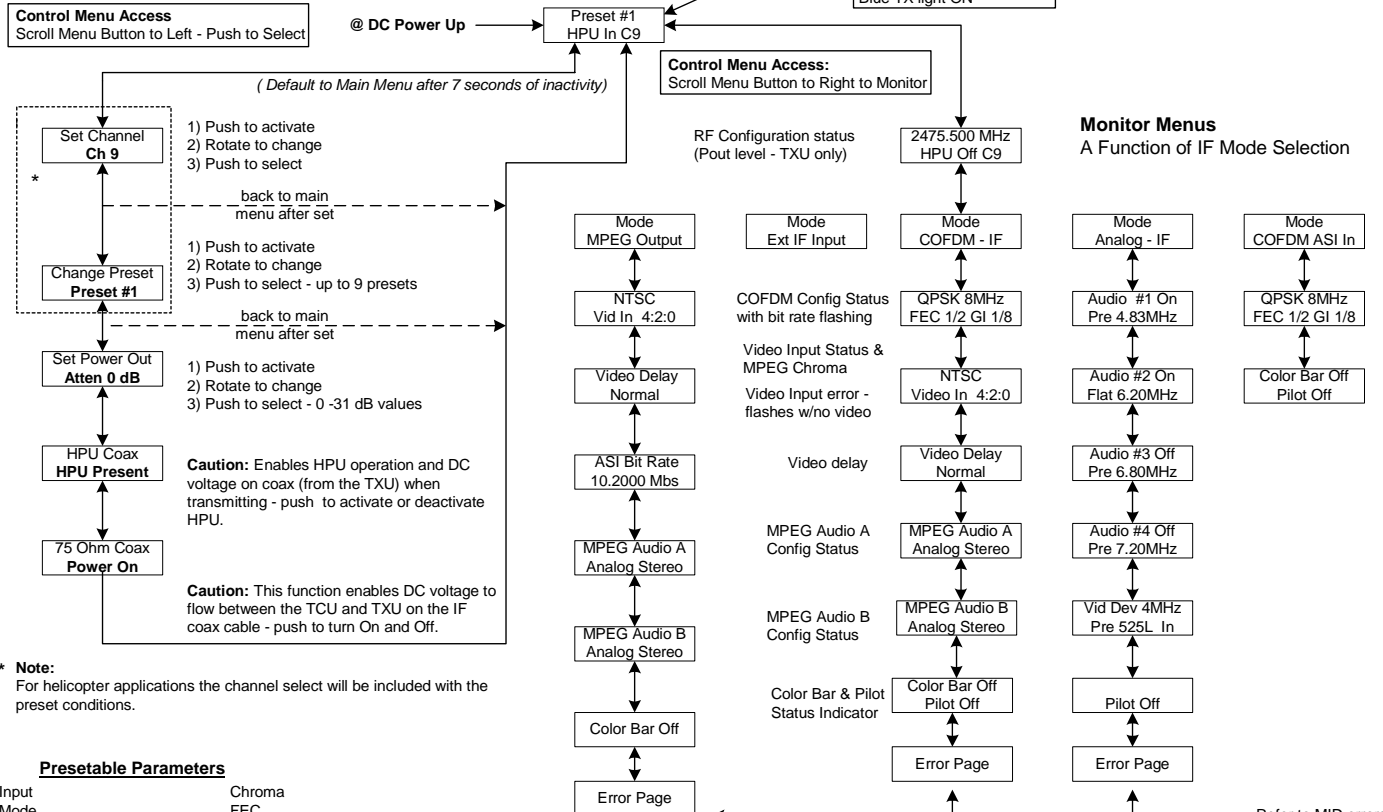
HPU Present
Identifies and configures use of the HPU option connected to the TXU device.

Please see the front panel menu guide on the following page for details related to front panel operation.

Strata Front Panel Operation

Turn Transmitter ON from any menu screen - Push menu button in for 1 second Blue TX light ON

Caution: DC ouput voltage from TXU is slaved to the blue light condition shown as the "HPU In" condition when transmitting.

Control Menu Access
Scroll Menu Button to Left - Push to Select

@ DC Power Up →

Preset #1
HPU In C9

(Default to Main Menu after 7 seconds of inactivity)

Control Menu Access:
Scroll Menu Button to Right to Monitor

Set Channel
Ch 9

1) Push to activate
2) Rotate to change
3) Push to select

*

back to main
menu after set

Change Preset
Preset #1

1) Push to activate
2) Rotate to change
3) Push to select - up to 9 presets

back to main
menu after set

Set Power Out
Atten 0 dB

1) Push to activate
2) Rotate to change
3) Push to select - 0 -31 dB values

HPU Coax
HPU Present

Caution: Enables HPU operation and DC voltage on coax (from the TXU) when transmitting - push to activate or deactivate HPU.

75 Ohm Coax
Power On

Caution: This function enables DC voltage to flow between the TCU and TXU on the IF coax cable - push to turn On and Off.

* Note:
For helicopter applications the channel select will be included with the preset conditions.

Presetable Parameters

Video Input	Chroma
Delay Mode	FEC
ASI Output	COFDM Bandwidth
BISS - On/Off	Guard Interval
BISS Key	Modulation
Audio Input Conditions A & B	VBI - On/Off
Audio Mode Conditions	
Color Bars/Pilot Condition - Service Name/Network Name	
IF Mode of Operation	
Analog Audio Subcarrier On/Off	
Analog Audio Subcarrier Frequency	

RF Configuration status
(Pout level - TXU only)

2475.500 MHz
HPU Off C9

Monitor Menus
A Function of IF Mode Selection

Mode
MPEG Output

Mode
Ext IF Input

Mode
COFDM - IF

Mode
Analog - IF

Mode
COFDM ASI In

NTSC
Vid In 4:2:0

COFDM Config Status with bit rate flashing

QPSK 8MHz
FEC 1/2 GI 1/8

Audio #1 On
Pre 4.83MHz

QPSK 8MHz
FEC 1/2 GI 1/8

Video Delay
Normal

Video Input Status & MPEG Chroma

Video Input error - flashes w/no video

NTSC
Video In 4:2:0

Audio #2 On
Flat 6.20MHz

Color Bar Off
Pilot Off

ASI Bit Rate
10.2000 Mbs

Video delay

Video Delay
Normal

Audio #3 Off
Pre 6.80MHz

MPEG Audio A
Analog Stereo

MPEG Audio A
Config Status

MPEG Audio A
Analog Stereo

Audio #4 Off
Pre 7.20MHz

MPEG Audio B
Analog Stereo

MPEG Audio B
Config Status

MPEG Audio B
Analog Stereo

Vid Dev 4MHz
Pre 525L In

Color Bar Off

Color Bar & Pilot Status Indicator

Color Bar Off
Pilot Off

Pilot Off

Error Page

Error Page

Error Page

Error Page

Refer to MID errors

Note: Last operational state will be saved on power down.

Strata Front Panel Guide Diagram

Supported Strata TX System Configuration Options

The following information may be used to identify which Strata TX system options may be used for specific customer applications.

TCU Supported Signal Options

Hardware Option	Signal Input	Signal Output	Monitor Out	Notes
* MPEG/COFDM Only	NTSC/PAL	ASI		Various formats
* MPEG/COFDM Only	SDI (525/625)	ASI		Various formats
* MPEG/COFDM Only	NTSC/PAL	COFDM - IF	COFDM	Various formats
* MPEG/COFDM Only	SDI (525/625)	COFDM - IF	COFDM	Various formats
* MPEG/COFDM Only	ASI	COFDM - IF	COFDM	Various formats
* MPEG/COFDM Only	IF	IF	IF	IF Bypass Mode
FMT Only	NTSC/PAL	IF CV	IF CV	NTSC/PAL CV IF
FMT Only	IF	IF	IF	IF Bypass Mode
* MPEG/COFDM + FMT	NTSC/PAL	ASI		Various formats
* MPEG/COFDM + FMT	SDI (525/625)	ASI		Various formats
* MPEG/COFDM + FMT	NTSC/PAL	COFDM - IF	COFDM	Various formats
* MPEG/COFDM + FMT	NTSC/PAL	IF CV	IF CV	NTSC/PAL IF
* MPEG/COFDM + FMT	SDI (525/625)	COFDM - IF	COFDM	Various formats
* MPEG/COFDM + FMT	ASI	COFDM - IF	ASI or COFDM	Various formats
* MPEG/COFDM + FMT	IF	IF	IF	IF Bypass Mode

Notes:
* = ASI output possible when TCU used in stand-alone (MPEG only) mode

TXU Supported Signal Options

Hardware Option	Signal Input	Signal Output	Notes
MPEG/COFDM Option	NTSC/PAL	COFDM - RF	Various formats
MPEG/COFDM Option	SDI (525/625)	COFDM - RF	Various formats
MPEG/COFDM Option	ASI	COFDM - RF	Various formats
MPEG/COFDM Option	IF	RF	Up-converted Channelized RF signal
FMT Option	NTSC/PAL	CV - RF	NTSC/PAL CV Channelized RF
FMT Option	IF	RF	Up-converted Channelized RF signal
No options installed	IF	RF	Up-converted Channelized RF signal

Note: TXU supports either MPEG/COFDM option or FMT option, but not both.

Strata Operations Guide

Configuring the Radio System using the TCU/TXU Serial Port and the "Strata TX Configurator" Software Utility

Basic Strata TX Configuration Details
The following basic system configuration settings may be administered using the Strata TX Configurator software utility.

- **COFDM IF Mode** – 70 MHz COFDM IF output from the internal COFDM/MPEG board supplied to output and monitor ports (to TXU if present).
- **IF Input** – 70 MHz IF input signal from input connector routed through TCU to TXU (if present).
- **ASI Input** – Bypasses internal MPEG encoder and routes an externally supplied ASI stream to the monitor and output connectors (to TXU if present).
- **MPEG ASI Output** – supplies a DVB ASI transport stream to the signal output connector and the monitor output connector. *Note: This mode is only accessed when the TCU is operated in a stand-alone configuration.*
- **Analog Audio/Video** – Routes 70 MHz FM output to TXU (if present). This mode is only supported with the FMT option installed.
- **DVB-S** – This operational mode uses a single carrier modulator scheme and supplies a 70 MHz IF output to the signal output connector and the monitor output connector, only operational for QPSK and 16 QAM. *Note: This mode is currently not supported in the current software release.*
- **RF Frequency**
  Used to select an RF frequency from 1.99 GHz – 2.50 GHz (up to 5 decimal places).
- **Modulation Type**
  Used to select each digital modulation mode for COFDM operation and DVB-S mode (when applicable) – QPSK, 16 QAM, 64 QAM. *Note: 64 QAM modulation may not be used in the DVB-S mode of operation.*
- **FEC Type**
  Used to select each FEC (Forward Error Correction) scheme to be used – (1/2, 2/3, 3/4, 5/6, 7/8).
- **COFDM Guard Interval**
  Used to select the individual Guard Interval for COFDM operation only – 1/32, 1/16, 1/8, 1/4.
- **COFDM Bandwidth**
  Used to select COFDM bandwidth operation – 6 MHz, 7 MHz, or 8 MHz.
- **Video Input**
  Used to select the necessary video input for the MPEG encoder from the following selections: NTSC composite video, PAL composite video, SDI – 525 line, SDI – 625 line.
- **Chroma**
  Used to select MPEG chroma profile – 4:2:0 (420 profile @ main level), 4:2:2 (422 profile @ main level).
- **Color bars**
  Used to turn the internal color bars generator ON, OFF or place in AUTO mode – (used in IF digital modes only). Color bars will display a user programmed *Service Name* parameter if applied. Video input is bypassed when ON. Auto mode will insert color bars when no video input is detected

Strata Operations Guide

Audio Input – A
Used to select the following audio operational modes for MPEG encoder A input:

- **OFF** – Audio transport stream is not generated and enabled
- **Test Tone** – An internal 800 Hz test tone is enabled.
- **Analog Mono** – Two independent mono audio channels are enabled.
- **Analog Stereo** – Left and right audio channels are enabled.
- **SDI Embedded Mono** – Unit expects an embedded audio stream from an SDI video source.
- **SDI Embedded Stereo** – Unit expects an embedded audio stream from an SDI video source.
- **AES/EBU Mono** – Unit expects a digital audio input stream.
- **AES/EBU Stereo** – Unit expects a digital audio input stream.

Audio Input – B
Used to select the following audio operational modes for MPEG encoder B input:

- **OFF** – Audio transport stream is not generated and enabled
- **Test Tone** – An internal 800 Hz test tone is enabled.
- **Analog Mono** – Two independent mono audio channels are enabled.
- **Analog Stereo** – Left and right audio channels are enabled.
- **SDI Embedded Mono** – Unit expects an embedded audio stream from an SDI video source.
- **SDI Embedded Stereo** – Unit expects an embedded audio stream from an SDI video source.
- **AES/EBU Mono** – Unit expects a digital audio input stream.
- **AES/EBU Stereo** – Unit expects a digital audio input stream.

Audio Notes:
   A) *48 KHz sampling is used for all audio (384 Kbits per stereo channel).*
   B) *When using Alteia IRD with Audio A ON and Audio B OFF, Audio A is duplicated on Audio B output XLR connectors.*
   C) *When using Alteia IRD and 4 audio signals, the preferred language setting for Audio B must differ from Audio A for decoding audio transport streams, e.g., set for Spanish.*

Frequency Control Modes
The Strata TX system permits two different frequency control modes. The two frequency control modes are:

> **Frequency-Locked-to-Presets**
> **Frequency-Unlocked-to-Presets**

<u>Definition of Frequency-Locked-to-Presets mode </u> - In this mode, each preset is assigned an operating frequency as channelized in a channel assignment table. The channel assignment table is normally populated with the standard U.S. 2 GHz standard band plan channels, i.e., channels versus frequency, but may have some or all channel assignments, e.g., channel +4, changed by the user to accommodate non-standard frequencies (so long as they are in the specified band and a multiple of the frequency synthesizer step frequency). Note that the user may modify the channel versus frequency table using the Strata TX Configurator software utility. Hence in this mode of operation, selection of any one of 9 presets may, and normally would, have an associated frequency (channel) locked to the selected preset.

Strata Operations Guide

NOTE: Even though each preset in a system configured to operate in the Frequency-Locked-to-Preset mode has a pre-assigned frequency, the user may temporarily dial in a new channel (frequency) from the front panel which will remain in effect until, (1) the unit is power-cycled, or (2) a new preset is selected. Either condition will automatically select the frequency associated with the current preset, i.e., revert back to the pre-assigned frequency associated with the current preset.

Definition of Frequency-Unlocked-to-Presets mode: In this mode, no channel (frequency) is associated with or locked to any preset. Regardless of all other preset configuration parameters, the last selected frequency (channel) will be the frequency used for all presets. To change the frequency (while any preset is selected), the front panel control is used to select a new (channelized) frequency. The last frequency selected will remain programmed as the current (default) frequency until changed by the user using the front panel control. Turning the system power off and back on or selecting a new preset will not change the currently selected frequency.

Remember, the selection of frequency control modes, i.e., frequency locked to presets, or frequency unlocked to presets, cannot be changed in the field.

Preparations
The following preparations should be completed prior to attempting to configure the Strata TX radio system using a serial data connection:

Establish serial data connections to and from the radio system. See the sketch below for details on how to connect a PC to the Strata TX radio system.

PC ⟷ Null Modem Connection ⟷ Strata TCU or TXU

Figure 5 – Serial Data Connection Details

Notes:
- A serial data connection may be made to either a TCU or TXU pair so long as the TCU and the TXU are inter-connected with a coaxial cable (enables system telemetry link and permits simplex powering of adjacent units). Both units must be powered ON.
- Use a standard 9 pin RS-232 serial data **"null"** modem connection (DTE-to-DTE configuration) between the PC and the radio unit(s) as shown in Figure 5. above. Recommended serial data cable length not to exceed 50 feet.
- The system being configured should be interconnected as it will be used, i.e., all units inter-connected properly with the appropriate RF termination connected to either the TXU or HPU RF output connector. Note that some applications may use a TCU or TXU in a "stand-alone" mode.

Strata Operations Guide
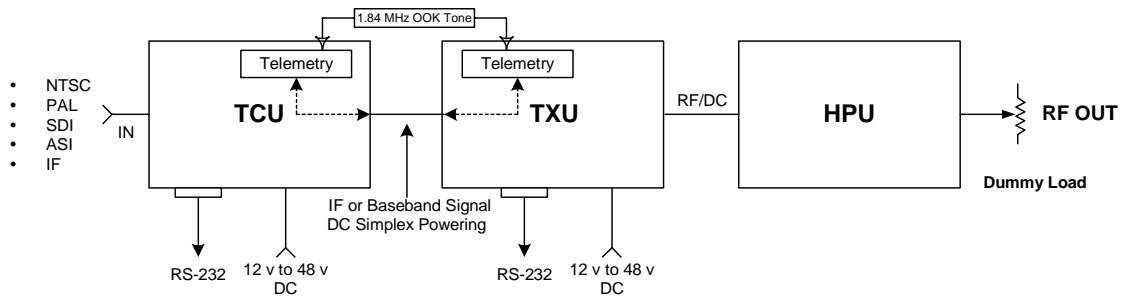
Typical Strata System Configuration Setup

Strata TX Powering Options and Cautions
Note the following recommended Strata system powering options and rules.

1. TCU stand-alone powering: +12 volts to + 48 volts DC.
2. TXU stand-alone powering: +12 volts to + 48 volts DC.
3. TCU and TXU adjacent: +12 volts to + 48 volts DC. *
4. TCU separated from TXU/HPU (TXU supplying power): +48 volts DC (for distances > 100 feet). **
5. TCU separated from TXU/HPU (TCU supplying power): +24 volts (minimum). ***

Notes:
* When powering adjacent TCU/TXU configurations, apply power to both TCU and TXU units.
** Special rules apply for longer distance separation applications depending on coaxial cable type, distance and whether an HPU is used.
*** Necessary to reduce current drain over IF coaxial cable – recommend +48 volts.

Strata Operations Guide

* * * CAUTION * * *

## DC Voltages Present on Coaxial Cable Center Conductors

---

Use Caution

For those Strata TX configurations that employ 2 or 3 modules, e.g., TCU + TXU + HPU, etc., the TCU and/or TXU may be used to power adjacent modules by superimposing DC voltage on the interconnecting coaxial cable center conductor. This feature is activated using the Strata TX front panel controls and remains in effect until subsequently modified by the user. The voltages involved range from + 12 to + 48 volts DC (DC input voltage).

To avoid damaging radio and test equipment input circuitry, be certain you either remove or isolate superimposed DC voltages from interconnecting coaxial cables where necessary to protect externally connected equipment.

In the case of the TXU-to-HPU RF coaxial cable connection, the center conductor will have DC voltages superimposed on the RF cable center conductor in order to power the HPU. If the TXU RF output is connected directly to an antenna or test equipment, be certain to disable the HPU On feature and therefore remove the DC voltage superimposed on the TXU RF output.

The Strata TCU "Signal In" BNC connector on the rear of the TCU module is susceptible to damage if DC is present on the center conductor. Take care that the TXU-to-TCU interconnecting coaxial cable (if used) is not inadvertently connected to the "Signal In" connector instead of the "Signal Out" connector. Please see the image on the following page for additional details.

Strata Operations Guide
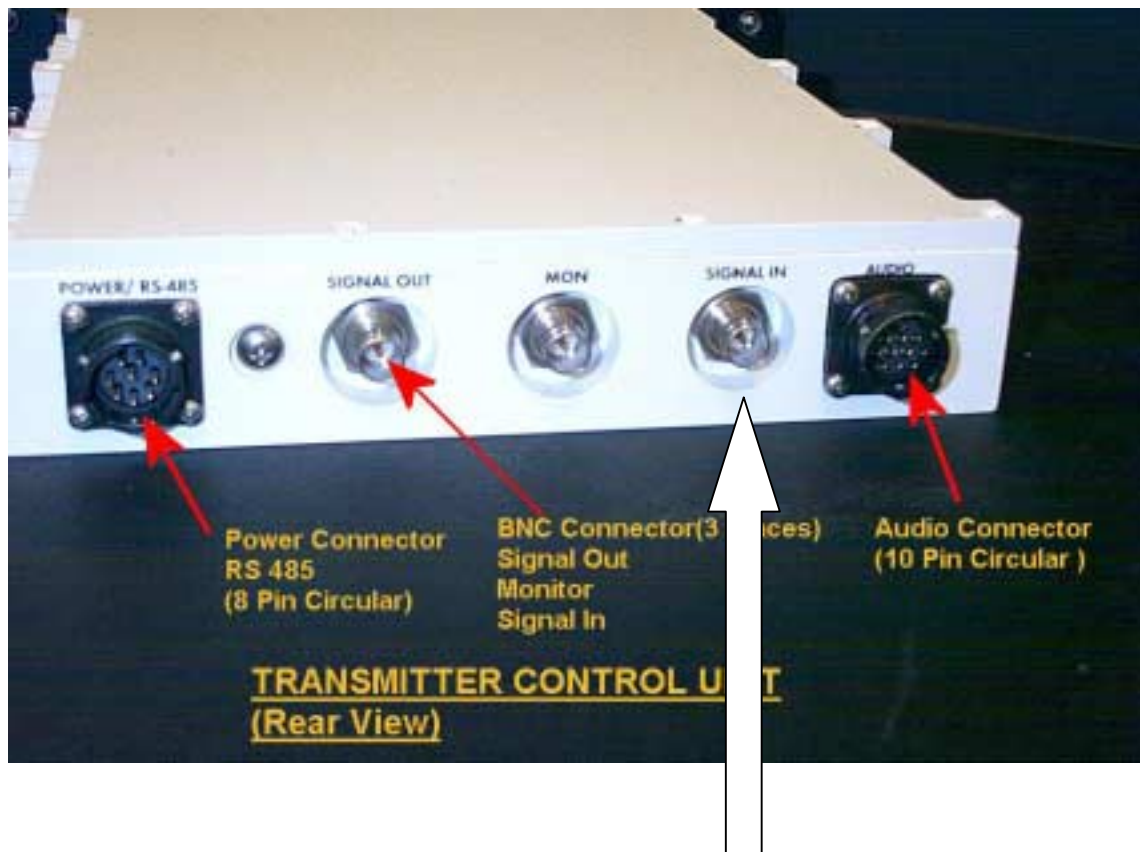
TCU "Signal In" Connection – not DC isolated

Note:
To minimize the potential for damaging the TCU signal input circuitry, the "Signal Out" jack rear panel BNC connector has been changed to a TNC type connector. Users are cautioned not to use a TNC-to-BNC adapter on the TCU "Signal Out" jack to circumvent this protection feature. Each Strata TX system that includes TXU and TCU modules is shipped with a short BNC-to-TNC coaxial cable assembly for interconnecting TXU and TCU modules. For those system applications that require separating the TXU and TCU over longer distances, users are advised to use a BNC "barrel" adapter on the BNC end of the supplied coaxial cable assembly.


Strata Operations Guide

Step-by-Step Procedure

Use the following Strata configuration procedure when verifying or configuring the Strata TX system using the **Strata TX Configurator** software over a local or remote serial data link.

1. Install the Strata Configurator software per instructions supplied with the software. This software is designed to operate properly on Windows 32 bit operating systems, e.g., Windows 98/NT/2000/ or XP operating systems.
2. Connect the PC serial port to the TCU or TXU per Figure 5. above. Apply the appropriate DC power to the Strata TX radio system and operate the front panel power switch(s) to ON.
3. Start the Strata Configurator application. You should see the following main menu appear:

4. Click on the "Connect to Radio" control. The following dialog is presented.

Strata Operations Guide
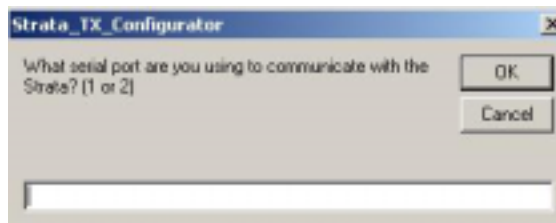
5. Enter **1** or **2** depending on which PC serial data (RS-232) COM port is being used.

Note: If the Strata TX Configurator application is unable to open a valid serial data port or an invalid number is entered, you will receive the following error dialog:

If you are unable to open a serial port or establish a valid serial port connection to a Strata TX radio system, exit the application and attempt to determine the difficulty and try again.

6. Assuming a valid serial data connection is established with a Strata TX radio system, you should see the main *Customer* screen display with all front panel controls activated as shown below.

7. Next use the **"Load Settings From Radio"** function to retrieve the current Strata TX radio configuration. It is recommended you store this configuration to a file using the **"Save Settings to File"** function especially when any modifications have been made to the current radio settings.
8. Access the Global, COFDM, MPEG Video, MPEG Audio, FMT and RF Settings menus by clicking on the appropriate menu tabs. The channel frequency settings found in the "Channel Plan" tab are only accessible for systems that do not include the "Frequencies Locked to Presets" option.

Strata Operations Guide

9. Select the correct configuration option or options for the intended application or applications. Please note that some configuration options may not apply depending on specific hardware options supplied and whether a unit being configured is connected to a companion unit, i.e., a TCU connected via a coaxial cable to a companion TXU, etc.
10. Next, use the **"Program Radio"** function to load the specified changes and settings into the Strata TX radio system. It is strongly recommended that you perform a **"Load Settings From Radio"** action to verify the desired settings were loaded into the Strata TX radio system.

Note: An active programming or configuration retrieval session requires approximately 2 minutes to complete. Do not disturb the radio system or serial data connections until an indication is received that the current operation has completed.

---

11. When the Strata system has been properly configured and the front panel monitoring control has been used to verify the desired configurations have been implemented, use the "**Save Settings to File**" option and save the current system configurations for future use, either for restoring the current system settings or for applying similar configuration parameters to another system. You may wish to enter a descriptive name for this particular configuration in the *Customer* screen "Description Information" field in addition to a unique file name to aid in identifying this particular system configuration.
12. When the current Strata TX system configuration action has been completed, remove the serial data connection to the Strata TX system.
13. Test and verify proper operation of the configured Strata system using the front panel controls as described elsewhere in this document.

This completes remote configuration of the Strata TX system.

Note: A limited number of Strata system configuration parameters may be modified using the front panel controls such as selecting pre-configured presets and powering adjacent units, etc. You may also effectively use the front panel controls to monitor proper operation and review current preset configurations, etc.

Basic System Operation

The following basic operational notes are supplied in an effort to ensure the Strata TX system is operating properly.

1. Always ensure you apply the proper DC input power, including a verification of the current handling capacity of the power source. Note that some applications require minimum DC power for proper operation, e.g., the case where a TCU is separated from the TXU over a long length of coaxial cable.

2. Be sure the front panel controls are set properly to supply power to either or both a TCU or HPU unit when DC power is supplied from the TXU. Note that the HPU obtains its DC operating power over the RF coaxial cable from the companion TXU.

Strata Operations Guide

3. When initially powering a Strata TX system, the power/error front panel LED will indicate an error condition (amber) for a few seconds prior to turning green. This is an indication that the Strata TX components have not completed software initialization. You will also note this condition when switching between digital and analog modes. Users will be prevented from operating the Strata transmitter until the front panel power/error LEDs have turned green.

4. You should not attempt to change presets while the transmitter is active. Turn OFF the Strata transmitter (hold front panel control knob in for 1 second) before changing presets. Before activating the transmitter after changing a preset or operating frequency, use the front panel control to ensure the selected operating frequency is the desired frequency.

5. Note that the front panel will not display the transmitter output power when an HPU is present. When using a TXU without the HPU option, the approximate RF output power will displayed on the front panel main menu display.

6. For those applications that require transmitting at lower output power, you may dial in additional IF attenuation (1 to 31 dB) using the front panel control. Note that any additional attenuation applied in this manner will be lost when changing presets or re-powering the system. For permanently installed additional attenuation values associated with a system preset number, you may configure these values using the supplied Strata TX Configurator utility. In this case the amount of additional attenuation will apply when the associated preset is selected but may be temporarily changed using the front panel control. Depending on the operating mode, and the characteristics of the radio components, added IF attenuation may not decrease RF output power on a 1:1 basis. If accurate RF output power setting is required, use an external RF power meter to ensure the desired amount of RF output power is obtained.

7. For those systems configured for **Frequency-locked-to-Presets**, you may temporarily change the transmitting frequency using the front panel control. Any channelized frequency entered in this manner is temporary and will be lost when changing presets or re-powering the system. For those systems configured for **Frequency-unlocked-to-Presets**, changing the current operating frequency will remain in effect until changed by the user.

8. Note that Strata TX systems must be configured at the MRC factory for the following options:

   - NTSC (default) or PAL composite video formats

   - Frequencies-locked-to-Presets (Helicopter operation)

   - Frequencies-not-locked-to-Presets (default option)

   - RF band, e.g., 1.9 GHz to 2.5 GHz (default) or 2.3 GHz to 2.7 GHz

   These options cannot be changed in the field.

9. Adjustment of FMT audio deviation levels cannot be accomplished in the field. There are no physical controls permitting this adjustment. The FMT audio deviation levels are adjusted with special software tools in the MRC factory for industry standard (+8 dBm input @ 75 kHz deviation) levels unless otherwise specified.
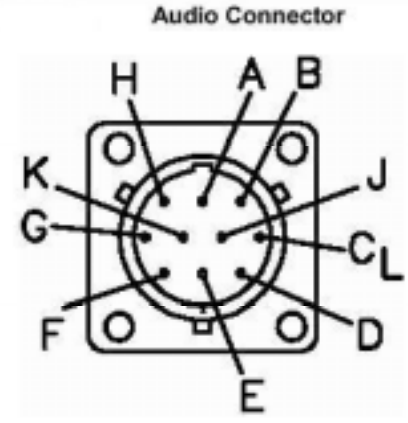

Every effort has been made to supply a state-of-the-art and reliable Strata TX design. Should you encounter any difficulty operating your Strata TX radio system, please contact Microwave Radio Communications for assistance.

Strata Operations Guide

Appendix

External Connection Information

Audio Connections

CONNECTION	DESCRIPTION	
A	(RETURN) RIGHT CH 1	Audio Connector
B	GND	
C	(LIVE) RIGHT CH 1	
D	(RETURN) LEFT CH 1	
E	(LIVE) LEFT CH 1	
F	(RETURN) RIGHT CH 2	
G	GND	
H	(LIVE) RIGHT CH 2	
J	(RETURN) LEFT CH 2	
K	(LIVE) LEFT CH 2	

Note: The MRC P/N for the external circular panel audio connector cable assembly is **907471-1**. This 3 foot long cable assembly includes the mating Amphenol connector and 4 each female XLR connectors. For customers who wish to construct their own external audio connection cable assembly, the mating Amphenol connector P/N is **MS3116F12-10S**.

MPEG Board	Function	Circular Connector	Wire Color	XLR
Analog Audio Input				
J11- 1	(return) Right chan 1	A	White	#1 – pin 3
J11- 2	GND	B	Black	#1 – pin 1
J11- 3	(live) Right chan 1	C	Red	#1 – pin 2
J11- 4	(return) Left chan 1	D	White	#2 – pin 3
J11- 5	GND	B	Black	#2 – pin 1
J11- 6	(live) Left chan 1	E	Red	#2 – pin 2
Analog Audio Input				
J12- 1	(return) Right chan 2	F	White	#3 – pin 3
J12- 2	GND	G	Black	#3 – pin 1
J12- 3	(live) Right chan 2	H	Red	#3 – pin 2
J12- 4	(return) Left chan 2	J	White	#4 – pin 3
J12- 5	GND	G	Black	#4 – pin 1
J12- 6	(live) Left chan 2	K	Red	#4 – pin 2

Strata Operations Guide

Digital Audio Input (AES-EBU)   <u>**XLR**</u>

J13 - 1 – Chan 2+   #1 Pin 3
J13 - 2 – GND   #1 Pin 1
J13 - 3 – Chan 2-   #1 Pin 2
J13 - 4 – Chan 1+   #2 Pin 3
J13 - 5 – GND   #2 Pin 1
J13 - 6 – Chan 1-   #2 Pin 2

Total of 4 each audio circuits

Notes:
1. In the case of digital audio connections, note that the GND (ground) connection is common to two audio circuits as opposed to the connections used for standard analog audio circuits. In the case of digital audio circuits then, a single XLR connector supplies two (2) each audio circuits instead of a single audio circuit in the case of standard analog audio connections.
2. Due to the variety of audio connection options available, either of two existing analog audio connections may be connected to J13 (digital audio). The circular panel pin out will change depending on which existing audio connection is used. See below for additional details.

Strata TX Digital and Analog Audio Options

Introduction
Due to the unique design of the Strata TX digital encoder circuit, a number of digital and analog audio input options may be accommodated. This brief memorandum describes the provisioning and use of these audio circuits.

Digital Encoder Audio Options
The current Strata TX system supports the following MPEG encoder audio input signals:

- Analog audio
- AES-EBU digital audio
- SDI Embedded digital audio

Note: SDI embedded digital audio is "embedded" within the SDI digital signal when the SDI video option is employed, i.e., an SDI video + audio signal is connected to the TCU or TXU "Signal Input" BNC connector. In this case the digital audio signals are not connected to the encoder via the circular panel audio connector.


Analog Audio Options

Up to 4 individual analog audio input signals may be transported over the COFDM transport signal. This accommodates the industry standard Channel 1 and Channel 2, Left and Right side audio circuits. Two on-board 6 pin audio connectors are wired to the Strata TX circular panel audio connectors for connection to customer supplied audio sources.

Note: Where an FMT is installed in a Strata TCU housing (digital + analog transmission), analog audio input signals may be bridged to one or both FMT audio inputs in addition to being connected to the MPEG encoder analog audio inputs. This option accommodates simultaneously distributing analog audio input signals to both FMT (analog) and MPEG encoder (digital) modules. The current Strata TX design handles impedance matching in the FMT module by terminating (FMT only) or bridging (FMT + MPEG encoder) audio input signals connected to the FMT module.

Depending on whether one or two analog audio channels are required for analog and/or digital mode operation, one or both audio input channels (two audio circuits per channel), all combinations of analog audio only operation can be accommodated by distributing the audio input signals to either or both FMT and MPEG encoder modules. See the sketch on the following page to view these options.
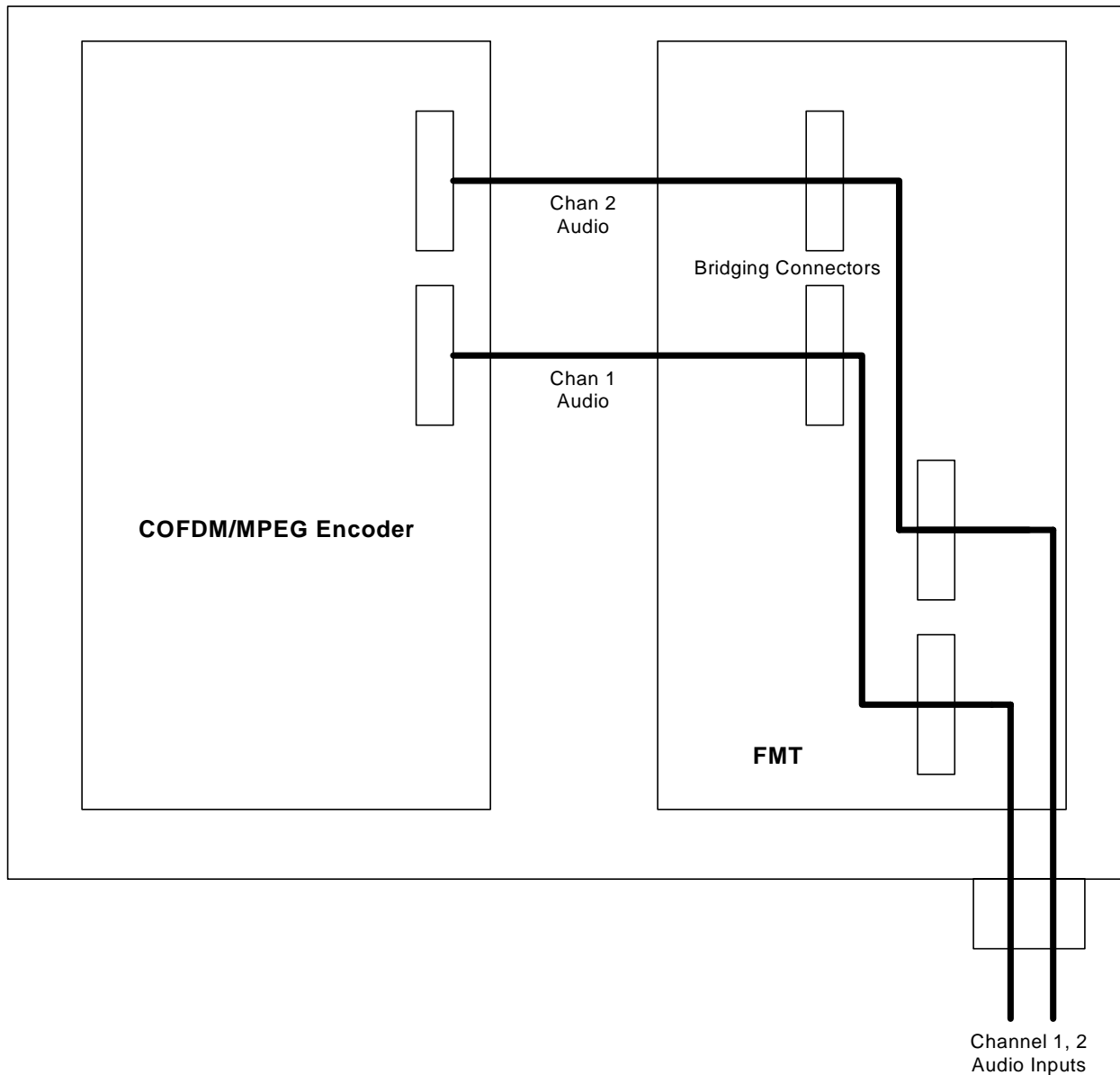
Connecting Analog Audio Input Signals to both FMT and MPEG Encoder Modules

Notes:
1. One or both analog audio input signals may be connected to an FMT module, an MPEG encoder module, or both.
2. When connecting analog audio input signals to both FMT and MPEG encoder modules, the FMT audio input circuit is optioned to "bridge" one or both audio channels to accommodate bridged connections to a co-located MPEG encoder module.
3. Analog audio input signals may be split between FMT and MPEG encoder modules by directly connecting one channel to each module.
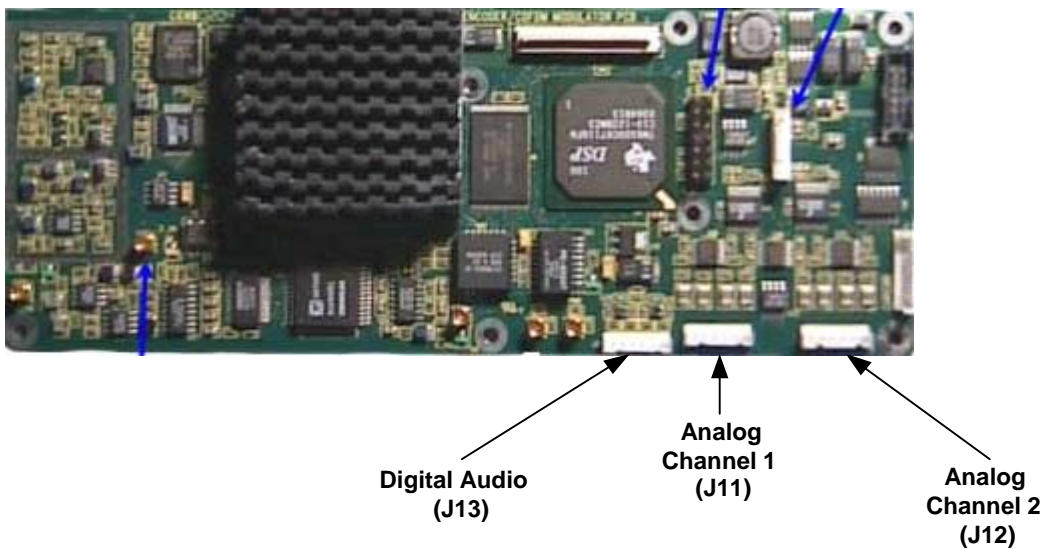
Strata Operations Guide

4. Any combination of one or two analog audio inputs to either or both FMT or MPEG encoder audio inputs is supported.

Digital Audio Options
The MPEG encoder digital audio on-board connector supports up to four each separate digital audio inputs. Currently the AES-EBU digital audio format is supported.

Note: Since digital audio connections, unlike analog audio connections, share a common ground connection between two audio circuits, digital audio wiring connections are able to accommodate twice the number of audio circuits over the same number of connecting wires (leads). Please refer to the MPEG encoder wiring pinout connections shown below for the differences between analog and digital wiring connections.

MRC 907386-1 COFDM/MPEG Encoder PWB

Digital Audio
(J13)

Analog
Channel 1
(J11)

Analog
Channel 2
(J12)

Strata Operations Guide

Analog Audio (Ch1)	J11	1 – R- 2 – GND 3 – R+ 4 – L- 5 – GND 6 – L+
Analog Audio (Ch2)	J12	1 – R- 2 – GND 3 – R+ 4 – L- 5 – GND 6 – L+
Digital Audio (Ch1 + Ch2)	J13	1 – Ch2+ 2 – GND 3 – Ch2- 4 – Ch1+ 5 – GND 6 – Ch1-

Summary of Digital and Analog Audio Connection Options

As can be seen from the description above, a total of four each analog audio and four each digital audio channels are supported. However, due to the limited number of pin connections on the circular panel connector, use of digital audio requires audio connection wiring for one analog audio channel. Therefore, whenever one of the circular panel audio connections is connected to the MPEG encoder digital audio input, only one analog channel may be connected to either or both FMT and MPEG encoder modules.

The various audio connection options are summarized in the table below:

Analog Audio	Digital Audio	Number of Channels	Option
X		2	FMT and/or MPEG
X		4	FMT and/or MPEG
	X	4	MPEG only
X	X	2 analog + 4 digital	FMT and MPEG

Strata Operations Guide

Strata Power Cables

TXU and TCU
These units use a KPT06F12-8S 8-pin female cable-mount power connector (MRC P/N = 52155-37). Pins A, B and C are the **Positive** (+) voltage input connection.   Pins D, E and F are the **Negative** (–) voltage connection. The current drain for these units at 28 volts DC is approximately 1 ampere each.   Please see the power cable-connector pin-out sketch below for connection details.
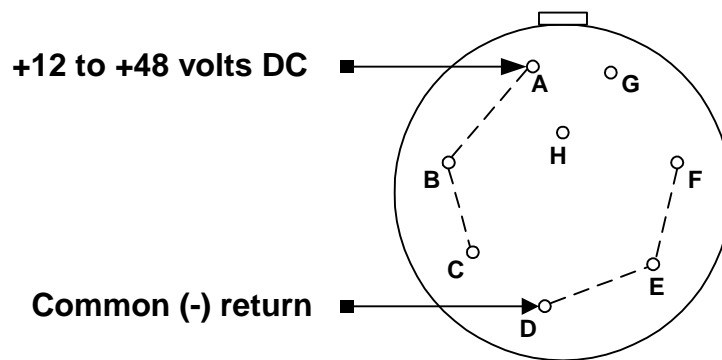
Strata TCU/TXU Power Cable Connector Pin-out (End View)

HPU
The HPU device is powered via the center conductor of the coaxial cable connection to the companion TXU (early version). The current drain for this unit at 28 volts DC is approximately 3 amperes when the transmitter is activated.
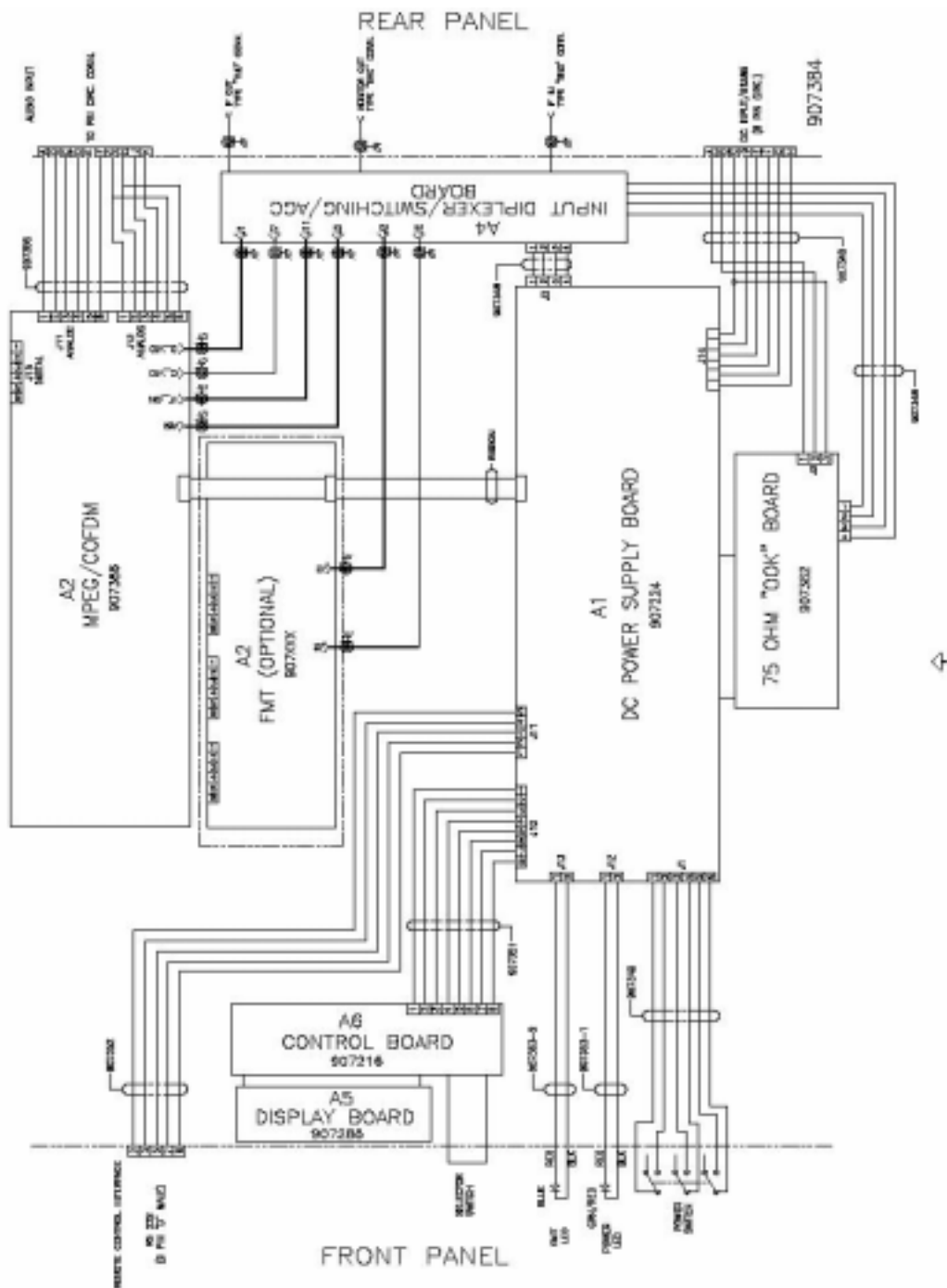
Strata Operations Guide

TCU Board Inter-connection Diagram

Strata Operations Guide

TXU Board Inter-connection Diagram

Strata Operations Guide

MICROWAVE RADIO
COMMUNICATIONS

IF COFDM

SDIo ASIo   MPEG CV FMT CV IF FMT J11   ASI   OOK
J1   J4   J7   J9   J6   J3   J10

OUT
FL1

FL1
Low Pass Filter

IN

907346 Baseband Combiner

J5   J2   J8

COAX IN   **MONITOR**   **COAX OUT**

J7
RS-232 Data

J12
Ch 2 Analog Audio

J11
Ch 1 Analog Audio

J13
Digital Audio

907386
COFDM/MPEG
Encoder

ASI x 2

D_VID

IF_ON

C_VID

IF Out Audio 3 Audio 1

907320 FMT

Audio 3, 4

Audio 1, 2

TP3

Audio 1, 2

Audio 3, 4

Video In

Audio 4 Audio 2
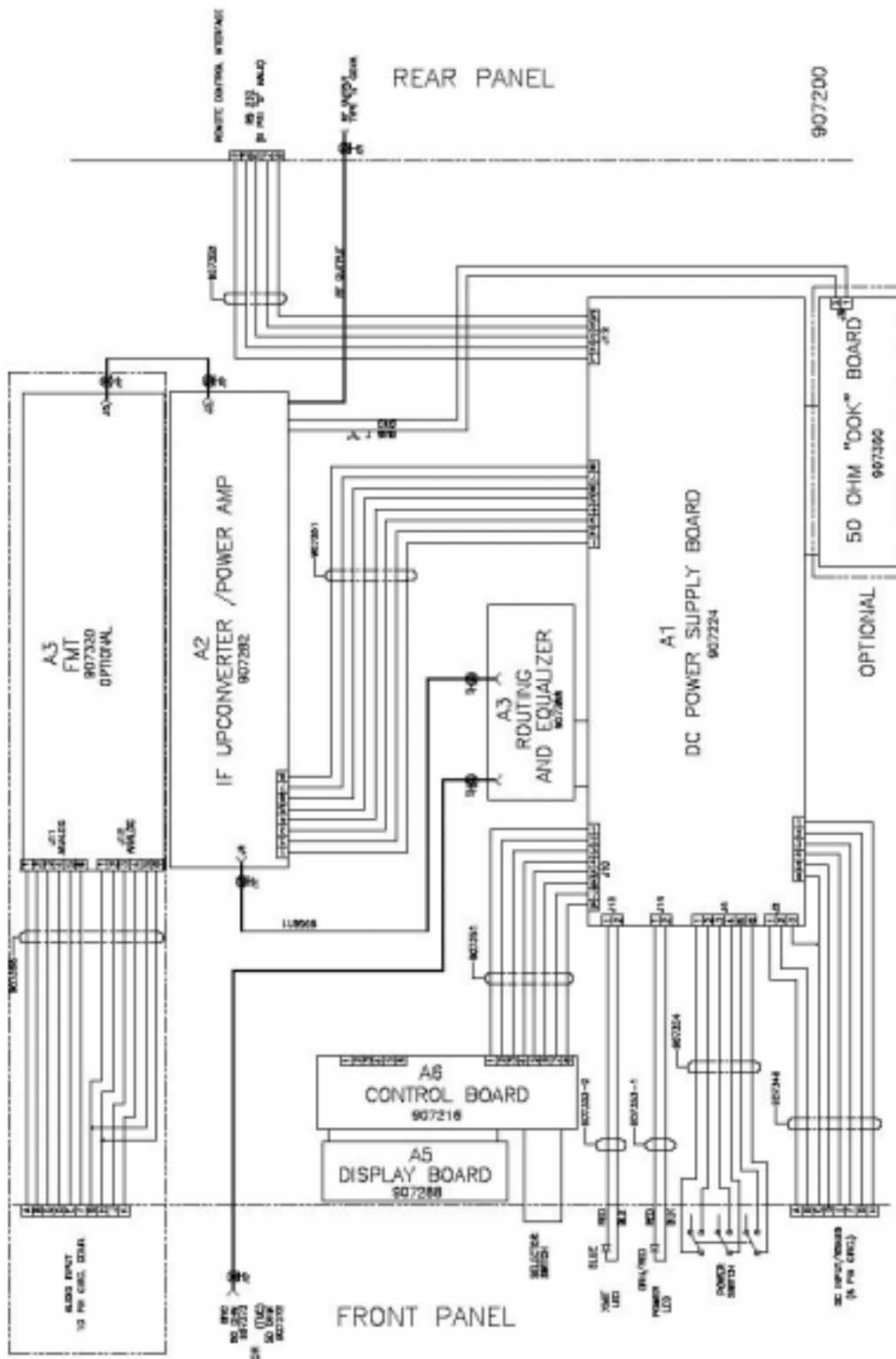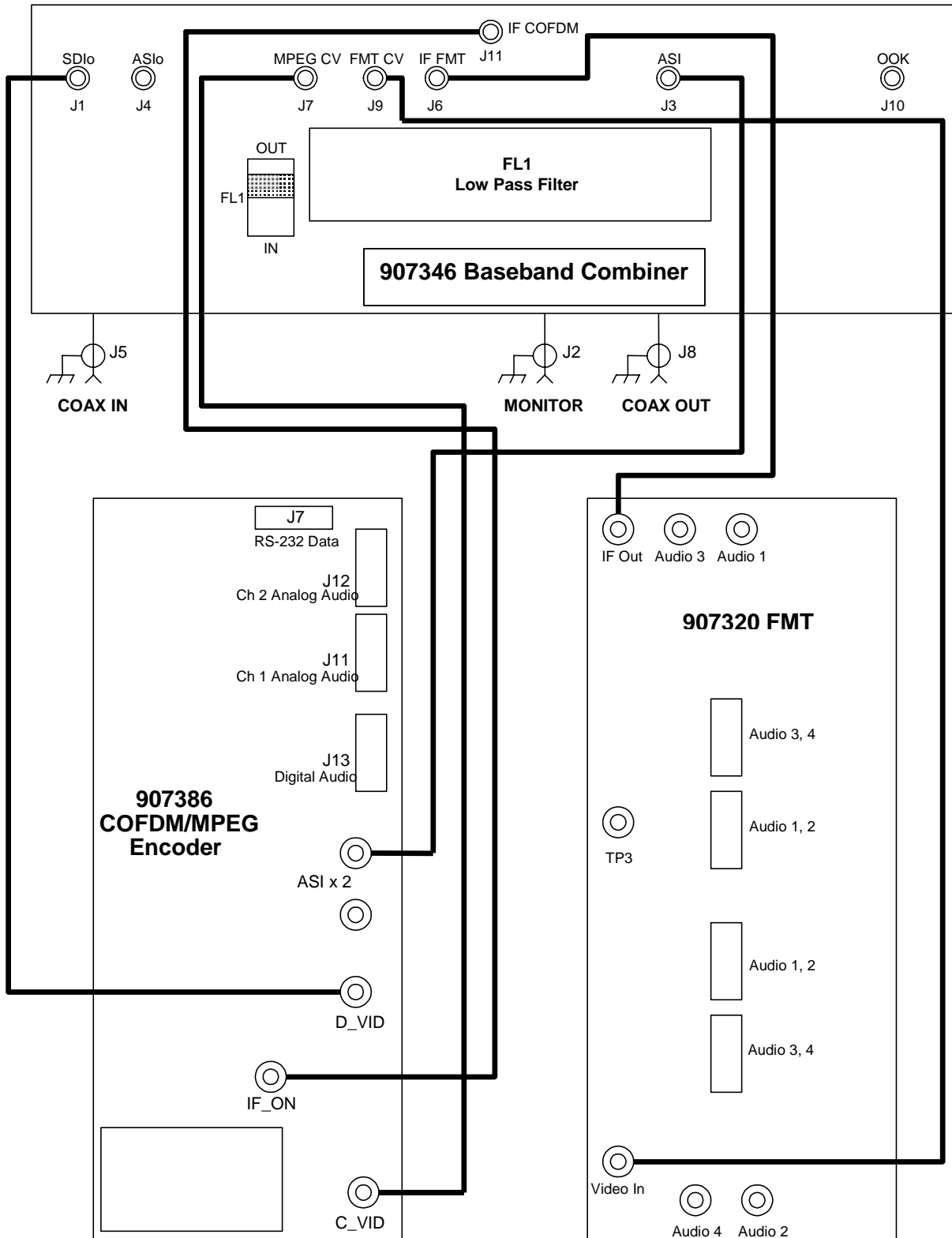
TCU Video and IF Coaxial Cable Interconnection Details

Strata Operations Guide

Strata TX Front Panel Error Code List

Rotating the front panel TCU or TXU control knob allows access to displayed error codes whenever the unit PWR LED color changes from green to amber. The list below references trouble conditions with displayed error codes.

Error Codes	MID
TXU IF FAULT	E020
TXU RF FAULT	E021
TXU PS 48 VOLT LINE	E030
TXU PS 5.5 VOLT LINE	E031
TXU PS 7 VOLT LINE	E032
TXU PS 11 VOLT LINE	E033
TXU PS TEMPERATURE	E034
TXU PS IF COAX CURRENT	E035
TXU PS IF COAX VOLTAGE	E036
TXU PS IF COAX WATTAGE	E037
TXU PS RF COAX CURRENT	E038
TXU PS RF COAX VOLTAGE	E039
TXU PS RF COAX WATTAGE	EP3A
TXU PS CKT CURRENT	EP3B
TXU PS CKT VOLTAGE	E0EC
TXU PS CKT WATTAGE	E03D
TXU PS DC BUS	E03E
TCU PS 48 VOLT LINE	E040
TCU PS 5.5 VOLT LINE	E041
TCU PS TEMPERATURE	E042
TCU PS COAX CURRENT	E043
TCU PS COAX VOLTAGE	E044
TCU PS COAX WATTAGE	E045
TCU PS CKT CURRENT	3046
TCU PSCKT VOLTAGE	E047
TCU PS CKT WATTAGE	E048
TCU PS DC BUS	E049

Strata Operations Guide

HPU PS 48 VOLT LINE	E060
HPU PS 5.5 VOLT LINE	E061
HPU PS 11 VOLT LINE	E062
HPU PS TEMPERATURE	E063
HPU PS COAX CURRENT	E064
HPU PS COAX VOLT	E065
HPU PS COAX WATTAGE	E066
HPU PS CKT CURRENT	E067
HPU PS CKT VOLTAGE	E068
HPU PS CKT WATTAGE	E069
HPU PS DC BUS	E06A
COFDM ENCODER COMM ERROR	E080
FMT VIDEO PLL UNLOCK	E0E0
FMT AUDIO1 PLL UNLOCK	E0E1
FMT AUDIO2 PLL UNLOCK	E0E2
FMT AUDIO3 PLL UNLOCK	E0E3
FMT AUDIO4 PLL UNLOCK	E0E4
SYSTEM_ERROR_SUMMARY	E400

Note: While the above front panel error codes indicate that portion of the system most likely affected, please contact MRC Technical Support for assistance should troubleshooting your Strata TX system become necessary.

Strata Operations Guide

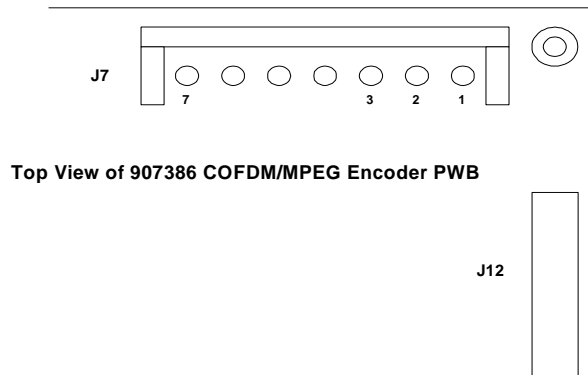# Strata Transmitter Wayside Data Channel Access

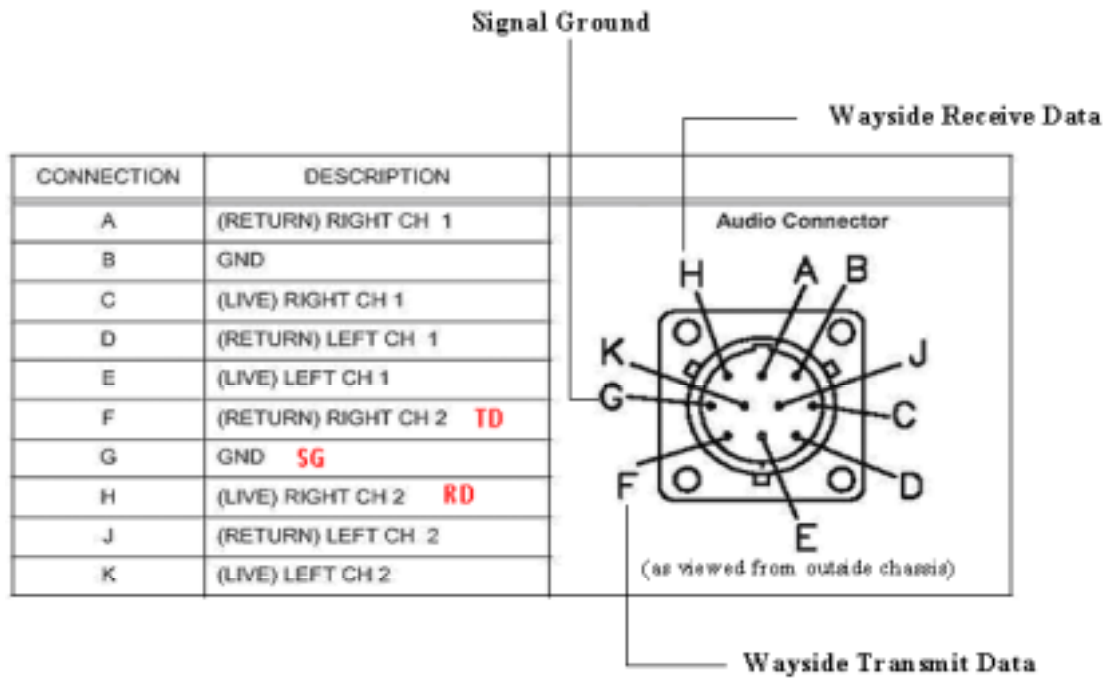## MRC 907386-1 COFDM/MPEG Encoder PWB Layout
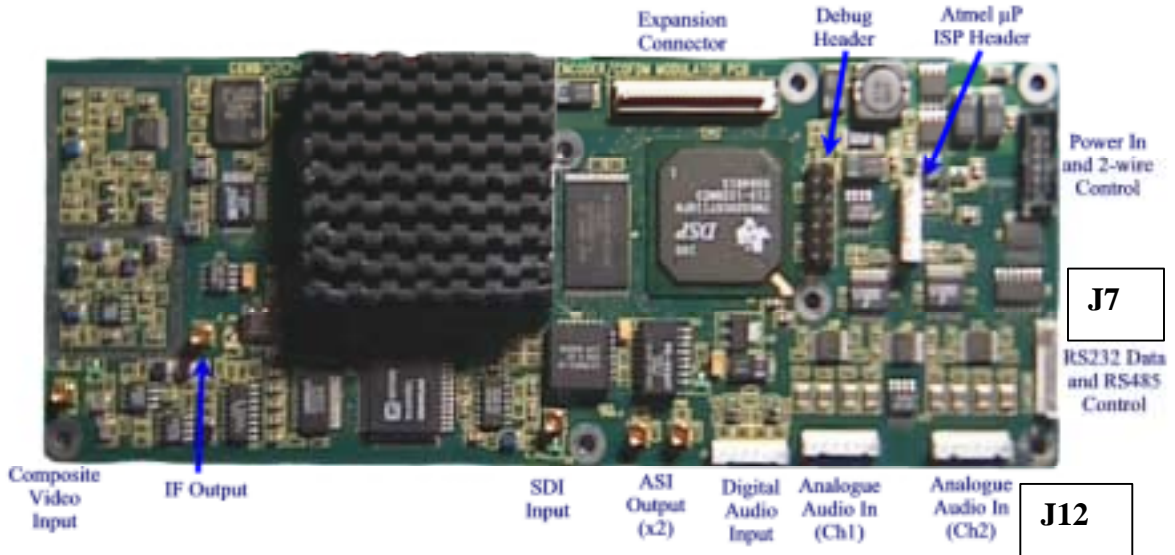
Note:

For Wayside data channel access, use analog audio channel 2 cable assembly **(J12)**. Audio pins F, G and H in the audio circular panel connector (corresponding to J12 pins 1, 2 and 3) are connected to **J7** pins 1, 2 and 3 per the pinout information shown below. Note that analog audio channel 2 **Right Side** channel connections are removed and not available when the Wayside data channel option is used.

RS232 Wayside Data	J7	1 – RS232TX (from encoder) 2 – RS232RX (to encoder) 3 – GND

Top View of 907386 COFDM/MPEG Encoder PWB

Strata Operations Guide

Signal Ground

Wayside Receive Data

CONNECTION	DESCRIPTION
A	(RETURN) RIGHT CH 1
B	GND
C	(LIVE) RIGHT CH 1
D	(RETURN) LEFT CH 1
E	(LIVE) LEFT CH 1
F	(RETURN) RIGHT CH 2 TD
G	GND SG
H	(LIVE) RIGHT CH 2 RD
J	(RETURN) LEFT CH 2
K	(LIVE) LEFT CH 2

Audio Connector

H   A   B
K   J
G   C
F   D
E

(as viewed from outside chassis)

Wayside Transmit Data

Strata Operations Guide

COFDM/MPEG Encoder PWB Connections

NAME	PCB DESIGNATION	COMMENTS
Expansion Port Header	J1	Details available on request
DSP debug header	J2	Engineering Use Only
Power Connector and 2-wire control interface	J3	Pin 1 - TXD (from encoder) Pin 2 - RXD (to encoder) Pins 3,4,5,6 - GND Pins 7,8,9,10 - +5.5V
ISP Connector for Atmel Processor	J4	Pin 1 - 5V Pin 2 - SDOUT Pin 3 - GND Pin 4 - RESET Pin 5 - SCLK Pin 6 - SDIN
70MHz IF Output	J5	50 Ohm
Composite Video Input	J6	Terminated at 75 Ohm
RS232 Data and RS485 Control	J7	**1 – RS232TX (from encoder)** **2 – RS232RX (to encoder)** **3 – GND** 4 – RS485 TX 5 – RS485 TX 6 – RS485 RX 7 – RS485 RX
SDI Input	J8	75 Ohm
ASI out	J9, J10	75 Ohm
Analog Audio (Ch1)	J11	1 – R- 2 – GND 3 – R+ 4 – L- 5 – GND 6 – L+
Analog Audio (Ch2)	J12	**1 – R-** **2 – GND** **3 – R+** 4 – L- 5 – GND 6 – L+
Digital Audio (Ch1 + Ch2)	J13	1 – Ch2+ 2 – GND 3 – Ch2- 4 – Ch1+ 5 – GND 6 – Ch1-
LED – Amber	IF_ON	Indicates IF Output is ON
LED – Green	C_VID	Indicates locked to input composite video
LED – Green	D_VID	Indicates locked to input SDI video
LED - Amber	HLTH	Heartbeat – flashing indicates software running

Strata Operations Guide

Note: The transmit data connection lead (TD) is used to support serial data flow control communications between the encoder circuit and a connecting data terminal (PC). Most applications do not use this capability.
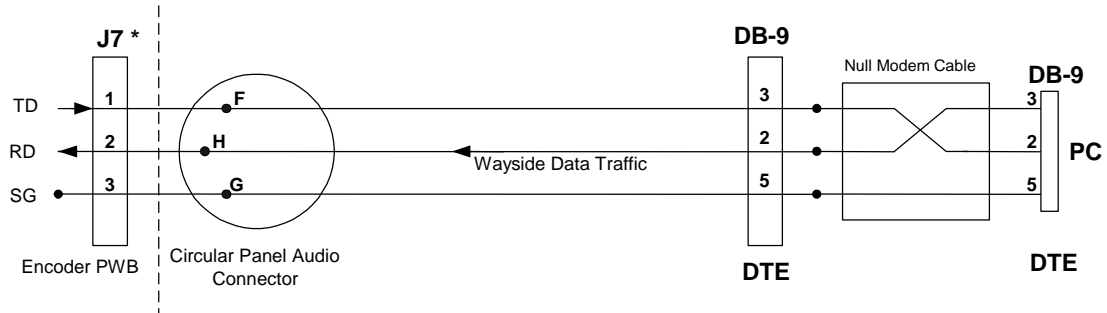
* Note: J7 pin 1 is nearest to long edge of COFDM/MPEG PWB

End of Strata TX Operations Guide Document

Strata Operations Guide