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.

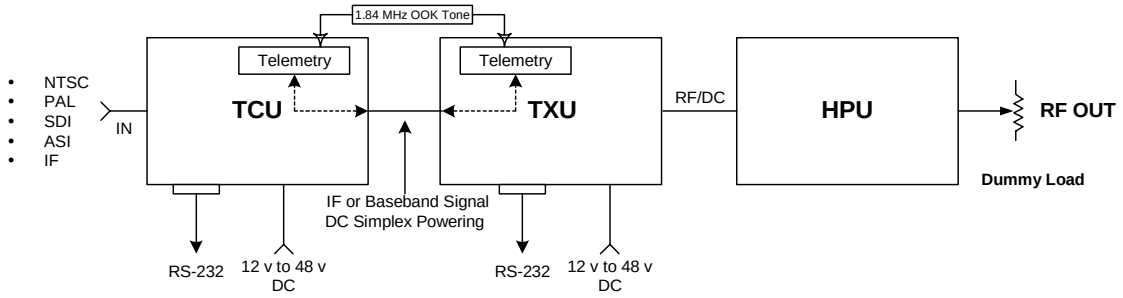

Figure 1 – Strata Transmitter System Architecture

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.

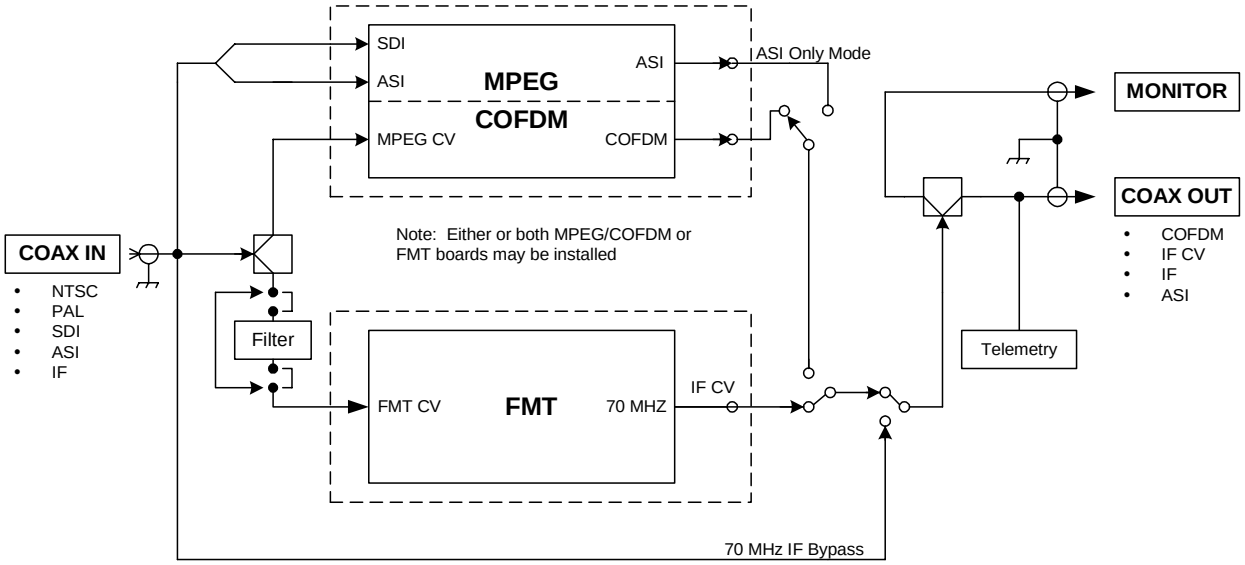

Figure 2 - Strata TCU Functional Diagram

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.

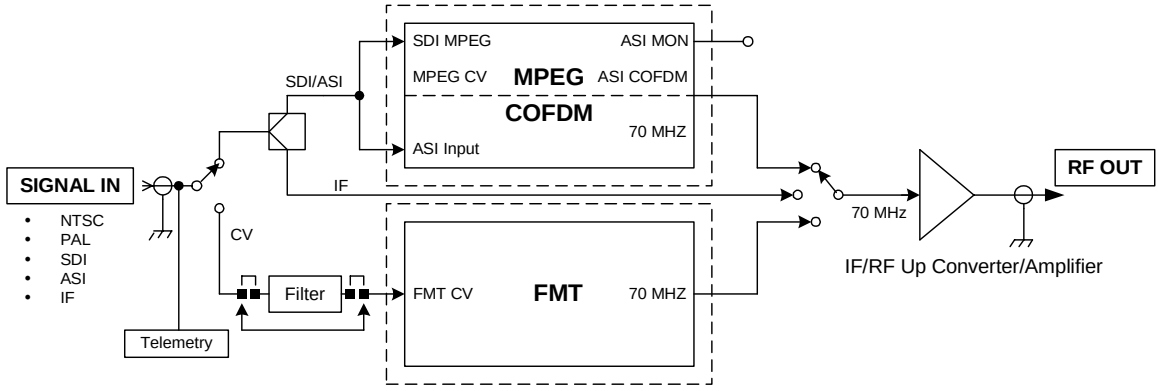

Figure 3 – Strata TXU Functional Diagram

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

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.

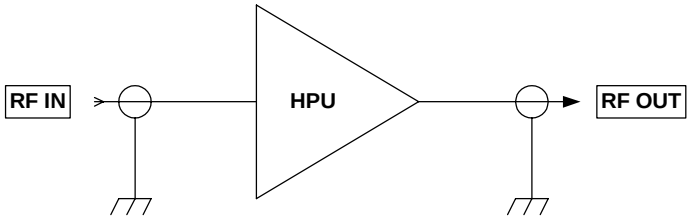

Figure 4 – HPU Functional Diagram

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.

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.

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: