Messenger 2 Transmitter Enhanced (M2TE)

The most important thing we build is trust.

Applications

- Audio/Video Surveillance
- UAV/UGV
- Broadcast/Entertainment
- Airborne/Ground Surveillance

Key System Features

- Ultra-Low End to End System Latency (down to ˜44 mS)*
- AVC HD/SD Encoder (Up to 1080p 60FPS)
- Supports Dual Audio/Video/Data programs
  - Multi-Camera Support
  - 3D Support
- COFDM Modulation (DVB-T 2 K or *4 K Carriers)
- Bandwidths DVB-T 6,7,& 8 MHz (STD) & 12, 14 & 16 MHz (4 K*)
- Output Frequency: 0.9 to 7 GHz (In-Bands)
- Dual L/S Band Capability
- Dual 3Gbps HD-SDI/SDI and Analog SD Video Input Interfaces Option
- Dual HDMI & and Analog SD Video Input Interfaces Option*[P3]
- Analog Audio and Embedded Audio
- Transport Stream Streaming via LAN or ASI or Serial Interface
- Time Correlated KLV Meta Data handling*[P5]
- Secure – *BCRYPT AES 128/256 Encryption
- Control via local panel or remote LAN Web Server or Serial Interface

The Messenger 2 Transmitter Enhanced (M2TE) is a second generation AVC HD/SD transmitter that combines all the features and capabilities of Cobham Surveillance's (CS's) Messenger 2 AVC HD/SD Transmitter with the additional features listed in the Key System Features above. All of this is included in a smaller housing (8.6 cu inches. Key features include optional Dual Audio/Video/Data processing with end to end system-level latencies of down to ˜44 mS when used with CS Receiver/Decoders.

The Ultra-low system latency greatly enhances real-time operating when the link is used in time critical situations like piloting Unmanned Aerial Vehicles (UAVs) or Unmanned Ground Vehicles (UGVs) or in threat response. Dual

video processing enables 3D content collection which provides depth perception and greater control for UGV applications requiring fine spatial operations like explosive device de-arming. The M2TE's 3D capability also enhances Entertainment, Sports, and ENG applications.

The M2TE can optionally provide time-correlated KLV-1 and KLV-2 META data processing*[P5] that is used in Airborne Surveillance Applications and Geospatial determination. The META data can be extracted from the SDI/HD-SDI video's ancillary data space or input on a separate RS-422 interface.

The M2 Series "Messenger Two Series" product line incorporated AVC / H.264 compression technology with ultra-low delay that covers all the SD and HD formats up to 1080P. AVC compression provides dramatically increased compression efficiency over MPEG-2 which allows our link to provide superior coverage over a wider operating range!

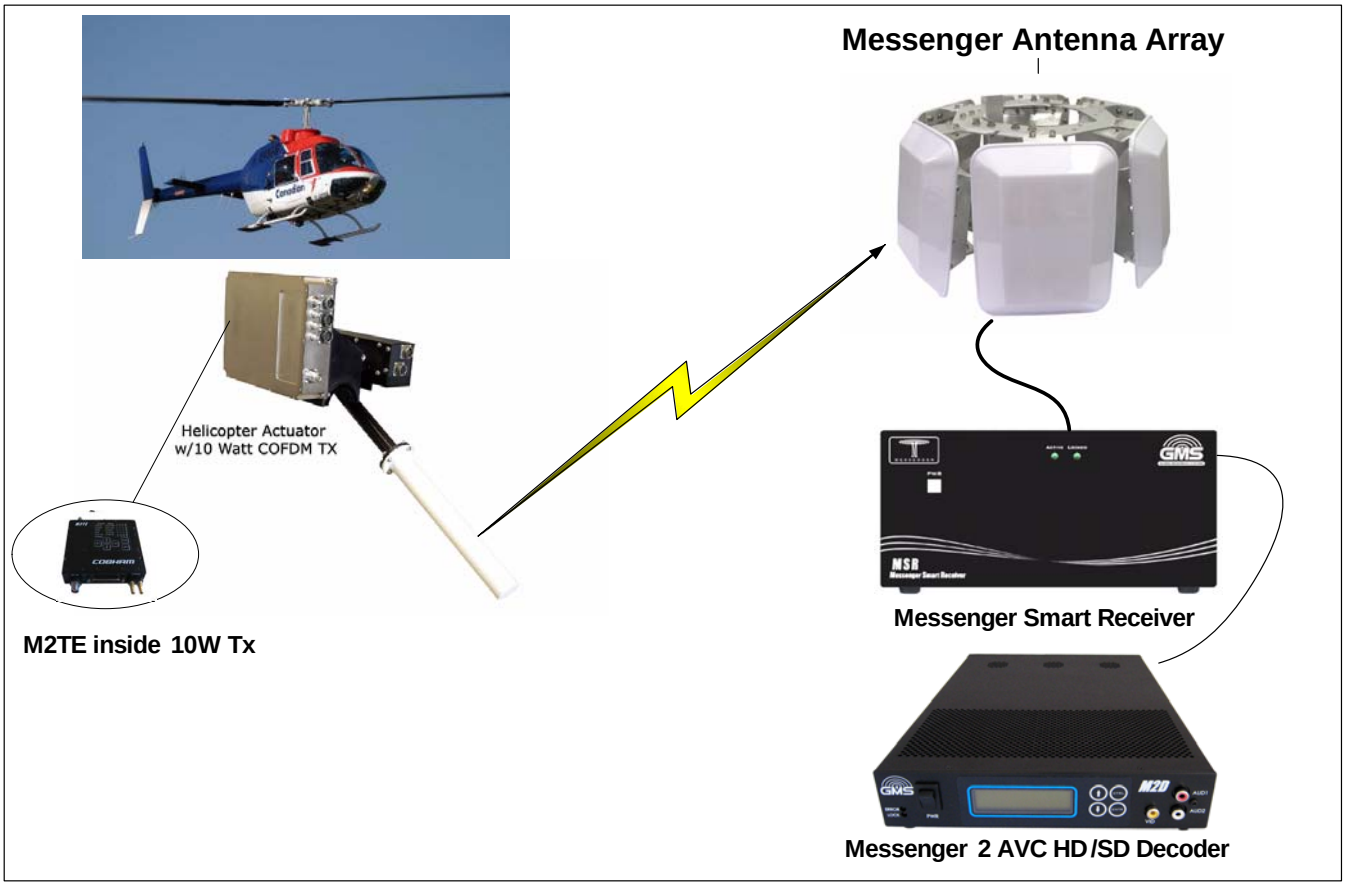
There are two core hardware configurations for M2TE. The SDI/HD-SDI configuration accepts up to two Standard Definition (SD) or High Definition (HD) 4:2:2 Digital Video (SDI/HD SDI) or analog composite Video and Analog Stereo Audio Inputs (Mic or Line Level) and/or optional Embedded Audio (up to a total of two stereo pairs or four mono channels) sets or programs. Mic bias is also provided. In the HDMI configuration*[P3], the SDI/HD-SDI interfaces are replaced with two HDMI interfaces that accept both digital video and audio. Dual SD Composite Video inputs are also provided with the HDMI configuration.

Both Video programs can be compressed according to the Advanced Video Compression (AVC) / H.264 (HD/SD) specification with the same or different frame resolutions, rates and formats. The low-latency AVC Encoder supports the Baseline Profile with extensions with resolutions from 480 to 1080 with support for either interlaced or progressive formats. The Audio is compressed using MPEG-1 Layer 2 compression. Low rate user data up to 115 KBaud can be optionally supported. Both programs Audio, Video and User Data Packets PES Streams are multiplexed with Basic Service Data to indicate their respective Service Names. If two programs are active, the two transport streams are multiplexed into a single multi-program stream. The stream can be optionally scrambled with AES scrambling system to provide protection in sensitive applications. User selections for all transport stream ID numbers and service names are provided.

The M2TE is a complete system with Audio/Video encoders/compressors and all the required processing to transmit the modulated signal with up to 200mW of RF over a wide variety of RF bands. External Power Amplifiers are available to boost the signal to up to 15W (band dependent). CS' COFDM wireless equipment provides standard a robust digital modulation system known as Coded Orthogonal Frequency Division Multiplexed (COFDM) that provides frequency diversity and powerful Forward Error Correction (FEC) algorithms. This modulation is ideas for transmitting over water or into urban environments which typically have high multi-path interference. Product development plans include the ability to switch via a command to single carrier modulations for Line of Sight (LOS) applications and compatibility with other surveillance systems.

Our Messenger Receivers include an option for Spatial Maximal Ratio Pre-Detect Diversity Combining to combat multipath reflections found in indoor/urban environments. CS' Messenger six or eight channel receivers with associated Messenger Antenna Arrays (MAAs) provide wide reception range without the hassle and cost of an auto tracking antenna system. The Messenger series Tx/Rx products provide a robust wireless link that is effective against the multipath interference experienced by analog systems and provides reliable data transmission in the most difficult of terrains.

Messenger 2 Wireless Airborne Camera Link



COFDM 2K Carrier Mode

In 2K Mode the M2TE uses standard DVB-T coding and modulation. DVB-T stands for Digital Video Broadcasting — Terrestrial; it is the DVB European-based consortium standard for the broadcast transmission of digital terrestrial television that was first broadcast in the UK in 1997. This system transmits compressed digital audio, video and other data in an MPEG transport stream, using coded orthogonal frequency-division multiplexing (COFDM or OFDM) modulation.

The OFDM scheme works by splitting the digital data stream into a large number of slower digital streams each of which digitally modulate a set of closely spaced adjacent carrier frequencies. COFDM goes a step further by using a "Coding" scheme to map the data onto the multiple carriers in a way that maximizes recovery from link errors. This coding includes Forward Error Correction with Convolution Interleaves' and Reed Solomon encoding along with careful distribution of the data onto the multiple carriers. COBHAM CS has chosen to use 2K carrier in which 1,705

carriers actually carry the payload that are approximately 4KHz apart. DVB-T offers three different modulation schemes (QPSK, 16QAM, 64QAM).

4K Carrier Mode

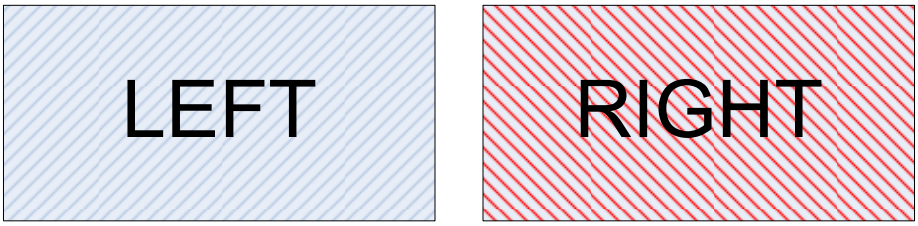
The 4K HIGH-THROUGHPUT OPTION enables user-selectable options to set bandwidths from 6 MHz to 16 MHz and to double the throughput of our standard M2T (Up to 63 Mbps!). In 2K carrier mode the system would need to operate in 64-QAM to support dual program/video operations. Using 4K carriers and the 16 MHz bandwidth, the link can support dual program/video HD operation using 16 QAM. This increases link robustness and provides an additional 13.5 dB of gain with a link margin increase greater than 4.7 x in operating range! for the same throughput rate in a standard HD MPEG-2 DVB-T system! With the 4 K HIGH-THROUGHPUT OPTION you can run with fully DVB-T compliant 2K carriers and bandwidths of 6, 7, or 8 MHz. When you switch to 4K carriers you can select 12, 14 or 16 MHz bandwidth.

LAN/IP Port

The M2TE contain a 10/100BaseT LAN interface that can be used both for Control & Status monitoring and for Transport Stream (TS) streaming in and out of the device. The MAC address can be assigned automatically via a DHCP server or via manual settings. Control & Status monitoring is accomplished via a WEB browser application that launches from the device. TSs can be sent out or in via UDP/IP transfer protocols.

3D Support

3D is a very new area in the Broadcast industry. From a content collection standpoint it is normally accomplished with two separate cameras that are GEN-LOCKED together outputting two separate Video signals.



Content Collection Format

The encoder maintains a frame by frame synchronization as it goes through its processing.

AES Scrambling

The AES Scrambling option can be used to add security to your data transmission. The system scrambles the payload portion of the TS packets. Only the TS header remains unscrambled to enable operation with standard DVB-T receivers. The 128 bit-scrambling key is entered through the M2TE's control interface. The user can enable or disable the scrambling as well as choosing if the key is stored within the Tx or not via CS' Microsoft Windows control program. Encryption on/off is also available from the local control panel.

Local Control Panel

The M2TE includes a simple local control panel that allows the selection of up to 20 set-up configurations, Encryption Enable/Disable, switch between Mic and Line Level inputs and selection of 4 output power levels. Status indicators are provided for the presence of input Audio, Video and RF output. Each of these set-up configurations can independently control every programmable parameter in the TX including RF Frequency, Modulation Mode, Compression Modes and Video Resolution to name a few. These Set-Up Groups can be configured by Administrative Personnel using the CS M.S. Window's Control Application prior to fielding the equipment.

Notes

* When used in Ultra-Low Latency mode (Intra-Refresh) with Cobham NA Messenger 2 Decoders and Receiver Decoders.
** With 4K High-Throughput Option on M2TE or Encoder Mode
*** Latency Delay is Decoder dependent
**** Frequency Band Dependant
*^{P3} Development Phase 3 Implementation
*^{P4} Development Phase 4 Implementation
*^{P5} Development Phase 5 Implementation
*^{P6} Development Phase 6 Implementation

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Specifications

RF Output

Output Frequency: 1 to 7 GHz (In-Bands)
Frequency Resolution****: 100 KHz or 1 MHz
Frequency Accuracy: (+/-) 2.5 ppm (High-G Crystal Optional)
Bandwidth: Selectable
6, 7, 8 MHz Standard
12, 14, 16 MHz Optional
RF Output Power: ≤ 20 mW to 200 mW, Adjustable
Output Impedance: 50 Ohms with VSWR <1.5:1
Connector: SMA-F

Video Encoding (HD)

Video Processing Capability: Single Video input, Dual Video Inputs (processing of each input can be independently set for all encoder parameters)
3D Modes: Content collection (Separate inputs from two cameras that are GENLOCKed)
Interfaces: Dual HD-SDI/SDI or Dual HDMI (Option)
HD-SDI Standards: SMPTE-292M, -296M, -274M, -424M
HD-SDI SDI Connectors: 1.0/2.3 mm (75 Ohm) 3Gbps
Compression Standard: AVC / H.264
(Per ISO/IEC 14496-10 with interlaced extensions)
Motion Est. Range: (+/-) 192 Horiz., (+/-) 128 Vert.
Video formats/resolutions supported:

Format	Resolution @ Frame Rate
1080i 1080PsF	1920x1080@23.98/24/25/29.97/30 fps 1920x1080 @ 23.98/24/25/29.97/30 fps
1080p	1920x1080@23.98/24/25/29.97/3050/ 59.94/60 fps
720p	1280x720 @ 50/59.94/60 fps

Variable GOP Structure: I-only and IP
PsF supported with INTERLACED FORMAT
Profiles supported: BP@HL with interlaced extensions
HDMI Version: Optional*[P3]
**Video bit rates: HDTV to 50 Mbps
***System Latency: down to <44 mS (Ultra-Low Latency Mode)

Video Encoding (SD)

Video Processing Capability: Single Video input, Dual Video Inputs (processing of each input can be independently set for all encoder parameters)
3D Modes: Content collection (Separate inputs from two cameras that are GENLOCKed)
Interfaces: Dual SDI and Dual Composite or Dual HDMI and Dual Composite (Option)
SDI Standards: SMPTE-259M
SDI/ Composite Connector: 1.0/2.3 mm (75 Ohm) [Same as HD-SDI connector]
HDMI Version: Optional*[P3]

Compression Standard: AVC / H.264
(Per ISO/IEC 14496-10 with interlaced extensions)
Motion Est. Range: (+/-)192 Horiz., (+/-) 128 Vert.
Video format standards: NTSC or PAL

Format	Resolution @ Frame Rate (frames per second)
576i	720x576 @ 25/29.97 fps (PAL)
480i	720x480 @ 25/29.97 fps (NTSC)

Variable GOP Structure: I-only and IP
Profiles: BP@ML with interlaced extensions
**Video bit rates: to 25 Mbps
***System Latency: down to <44 mS (Ultra-Low Mode)

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Audio Encoding

Analog Audio Inputs:
Qty 4 Total, Two Dual, Line-Level and Dual Mic-Level, Single-Ended or Differential, Clip Level 12 dB
Mic Bias: 5 V
Input Impedance: 100K Ohms
Standards: SMPTE-272M, -299M
Digital Audio: Dual Embedded (2-channel) per Video input
Embedded Audio Format: SMPTE 299M
Compression Standard: MPEG-1 Layer 2
Bit rates: 256 Kbit/s per channel.
Sampling Frequency: 32 KHz, 44.1 KHz, or 48 KHz
THD: < 0.1 % max.
Response: 20 Hz to 12 KHz, (+/-) 0.25 dB
Crosstalk: >55 dB min
S/N: >50 dB RMS
Connector: P/O Multipin Connector

Transport Stream

Standard: per ISO/IEC 13818-1
Packet Size: 188 Byte
Format: AVC / H.264/ MPEG-4 Part 10 encapsulated into an MPEG Transport Stream
Specification: ITU-T Rec. H.222.0 Amendment 3
Bit Rate: Automatically set from active service settings.
ASI Output
Connector: 1.0/2.3 mm (75 Ohm)

Modulation

Modulation Type: COFDM w/QPSK, 16-QAM, or 64-QAM

Standard: DVB-T compliant

FEC: 1/2, 2/3, 3/4, 7/8
Guard Intervals: 1/32, 1/16,1/8,1/4
COFDM Carriers: 2K Carriers

High Throughput Option

FEC: 1/2, 2/3, 3/4, 7/8
Guard Intervals: 1/32, 1/16, 1/8, 1/4
COFDM Carriers: 4K Carriers

Program Identification

The unit allows the user to set-up a unique Provider Name and Service Name for each active program.

Scrambling Option

Type: 128/256 Bit Advanced Encryption Standard (AES)
Key Storage: User Controlled, volatile or non-volatile

User Data Option

Protocol: RS-232C, Asynchronous, 8 Bits, No Parity, 1 Stop Bit
Data Rate: Selectable, Up to 115 KBaud
User Data PID: Selectable
Connector: P/O Multipin Connector

Video Adjustments

The digital Video processing provides adjustment for; Brightness, Contrast, Saturation and Hue.

Time Stamping*[P5]

Processes External VANC extracted UTC#1 and SMPTE-12M time stamps from the digitized Video stream input of the HD-SDI/SDI input interface. The secondary UTC#2 is also generated using an external 1PPS signal and EIA-232/422 serial configuration commands.

Key Length Value (KLV) Metadata*[P5]

Implementation of the KLV Metadata meets standards set **by the National Geospatial-Intelligence Agency (NGA)** Motion Imagery Standards Board (MISB). The KLV Metadata is input into the M2TE either via embedding it in the VANC space of the HD-SDI/SDI input interface and/or the separate serial RS-422 interface.

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Time Stamp Processing*[P5]

The Picture Timing SEI messages allow each Video frame to be assigned a time value. This time can represent time of origin, capture or alternative ideal display. As such, it can be used to navigate to a frame with a particular time.

The H.264 format, specified in ISO/IEC 14496-10 provides for an optional time stamp to be defined in the Supplemental Enhanced Information (SEI) message. The picture timing SEI message (pic_timing) specified HH:MM:SS:FF IAW RP 0604 page 5. Additionally, the standard allows for user data to be associated with a particular Video frame using the User Data Unregistered SEI Message. The primary M2TE time stamp UTC#1 is inserted into the pic_timing SEI element of the NAL packets in the H.264's output stream. The secondary M2TE time stamp UTC#2 is a 64 bit value indicating the number of microseconds since August 23rd 1999 and is inserted into the unregistered user data SEI element.

Output Requirements

Serial Output*[P5]

The M2TE outputs MPEG-2 TS data with the following format:

- EIA-422 SSI Synchronous Serial Interface IAW EN 50083-9
- Output Video data rate from 128kbps to 10.7 Mbps 1 kbps resolution.
- The M2TE outputs an MPEG-2 compliant Transport Stream (TS) that not only contains H.264 compressed motion imagery, but also contains time-synchronized metadata and compressed Audio.
- The MPEG-2 TS output of either EIA-422 (constant bit rate) or Ethernet format operates at a bit rate ranging from 128 kbps to 10.7Mbps adjustable in 1 kbps increments.
- The M2TE is able to operate with an external clock input from the RF communications data link as well as with its own internal clock source.

Ethernet Streaming

The M2TE contains an IEEE 802.3u 10/100Base-TX Ethernet interface. The MPEG-2 TS can be encapsulated in UDP/IP packets IAW RFC 3984. The M2TE is configurable to send Multicast IP packets without receiving a join request.

RTP is a packetization protocol that may be used in conjunction with the User Datagram Protocol (UDP) to transport real-time multimedia data across networks that use the Internet Protocol (IP). UDP is preferable to the Transmission Control Protocol (TCP) for real-time applications because it offers low-latency transport across IP networks.

Physical

Dimensions: 3.6" x 3.12" x 0.767"
(8.61 cu Inches)
9.14 cm x 7.92 cm x 1.91 cm
(13.83 cu cms)

Environmental:
Operational Temperature: -10˚C to +70˚C
(EXTERNAL COOLING REQUIRED)
Humidity: Up to 95% non-condensing
Weight: 8 oz. (227 grams)

DC Power

DC Voltage Range: 9 -32 VDC
Power Consumption: ˜14 to ˜16 Watts
(Operating mode & Band Dependant)

Control Local – Easy to use local control and status panel allows up to 20 user-defined operating modes covering most programmable parameters including Center Frequency, 4 Range Settings (defined modulation settings), Mic/Line Level Audio, Encryption ON/OFF, and status of Video In and RF Out.

Remote Control & Status – M2TE can be controlled through its USB control port via an optional MS Windows

based Control Application. Additionally, a WEB server is provided through the LAN interface.