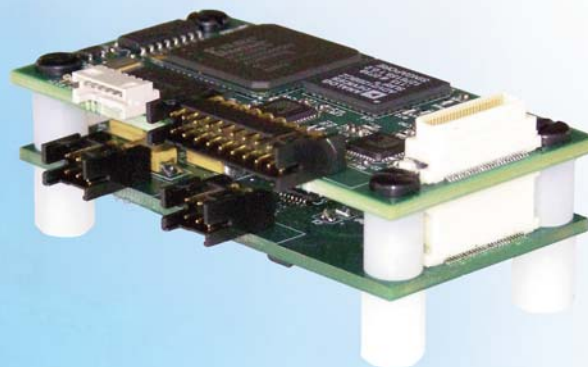


Telemetry & RF Products

DIGITAL MODEM SOLUTION

FOR UNMANNED SYSTEMS AND SECURITY SURVEILLANCE



JPEG2000 CODEC Solution for Secure Video, Audio and Data Transport

Video and Data Links for small Unmanned Systems and Security Surveillance applications continue to increase the demand for greater information throughput while at the same time frequency congestion, due to increased levels of Intelligence, Surveillance and Reconnaissance (ISR) missions, is driving the need to operate in reduced RF Channel Bandwidths. These seemingly opposing requirements can only be realized through innovation in digital transport systems.

The Digital Modem Solution (DMS), from L-3 Communications Southern California Microwave (L-3 SCM), enables highly efficient RF Bandwidth utilization through application of JPEG2000 video compression and Frame/Field decimation techniques, greatly increasing video and telemetry data throughput over typical RF communication links. The DMS provides reliable and secure video, audio, and data transport by encoding/decoding with Forward Error Correction (FEC) and basic 32-bit Key Encryption techniques.

The flexible features of the DMS enable it to meet the needs of most all Unmanned System or Security Surveillance applications. The high performance DMS is also designed to consume minimal operating power helping to maximize battery operational life.

KEY FEATURES

- JPEG2000 Video Compression
- High-Quality NTSC Color Video
- Multiple Audio & Data Channels
- Reliable & Secure Transport
- Highly User Configurable
- Increased Link Throughput
- Reduced RF Occupied Channel Bandwidths
- Extremely Compact Size
- Minimal Operating Power



Excellence You Can Measure

DMS Link Configuration

The basic DMS link configuration consists of a transmit Encoder Module and a receive Decoder Module as shown in Figure 1 for a typical UAV deployment. These highly integrated analog/digital modules are designed to transmit or receive simultaneous Video, Audio, and Data streams enabling the user to reliably and securely transport images and telemetry data. The DMS can combine one JPEG2000 compressed NTSC Analog Video channel with up to two Serial Digital Data Channels (115.2 kbps max), two high-quality single-ended Analog Audio Channels (>55 dB SNR), and one High Speed Data Channel up to 9 Mbps for demanding data-streaming applications. The combination of these capabilities is determined by the user selection of the video JPEG2000 compression ratio, the Frame/Field decimation rate, and the total channel bandwidth available. Ethernet connectivity is also available through an optional add-on interface board.

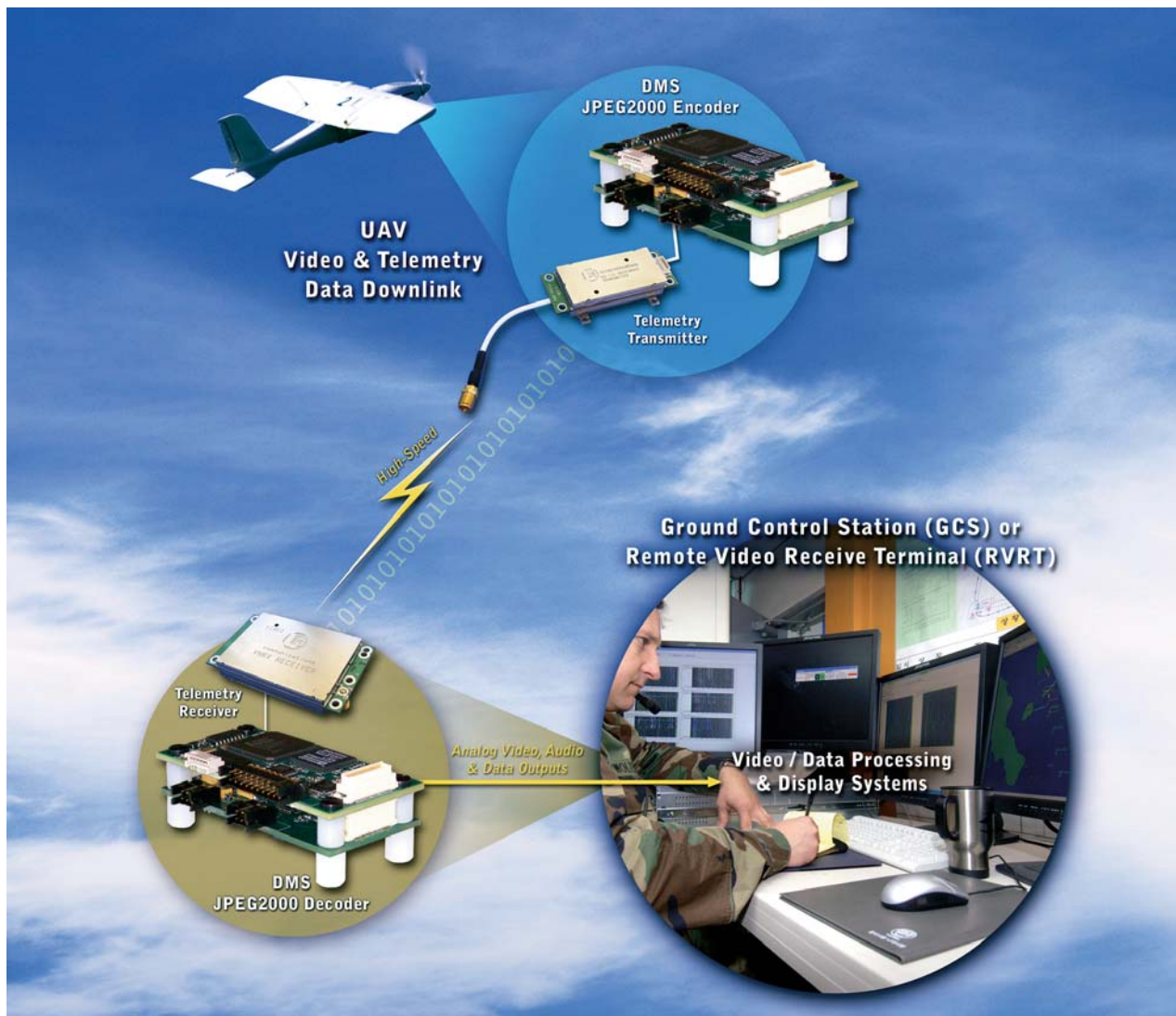


Figure 1: Typical UAV Application Using the DMS JPEG2000 Solution

Greater Connectivity in Narrow Occupied Bandwidths

The DMS is specifically designed to maximize bandwidth utilization, especially when mated with FM Transmitters and Receivers designed with narrow channel bandwidths. The DMS Encoder block diagram is shown coupled with the L-3 SCM TNTX Transmitter in Figure 2, and the DMS Decoder block diagram is shown coupled with the TNRX Receiver in Figure 3. In utilizing the wavelet-based JPEG2000 compression standard, visually clean full-motion video can be supported in an encoded data rate of less than a 5 Mbps (Frame Mode, ~19:1 compression, 30 Fps). If further encoded video bandwidth reduction is needed, higher JPEG2000 compression ratios and/or lower Field/Frame rates can be programmed into the DMS to meet the ISR mission objectives. The combination of advanced JPEG2000 compression, FEC and simple 32-bit Key Encryption also allow the DMS system to deliver secure, high-quality video, audio and data in a narrower bandwidth without compromising range performance of the RF link.

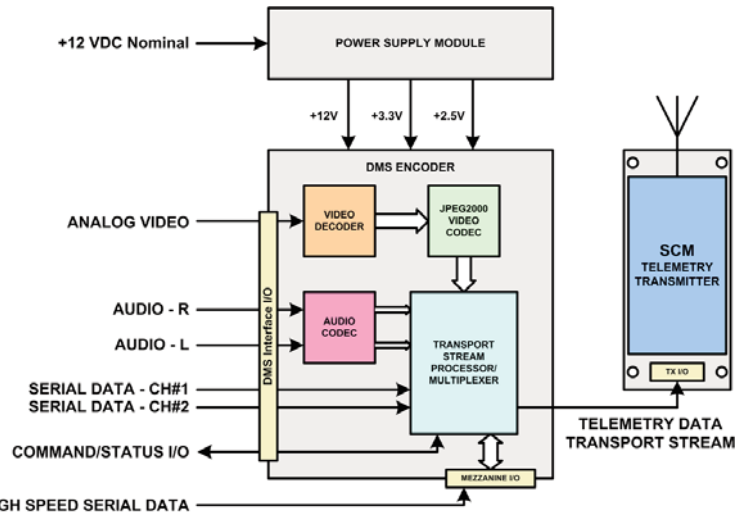


Figure 2: Block Diagram of Digital Modem Solution Encoder with a TNTX Telemetry Transmitter

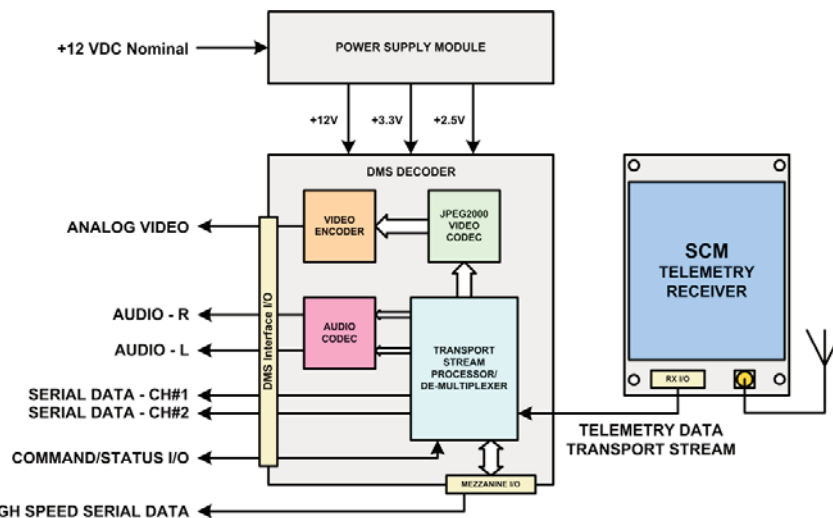


Figure 3: Block Diagram of Digital Modem Solution Decoder with a TNRX Telemetry Receiver

Video, Audio and Data Channels

The DMS JPEG2000 compression of a standard NTSC video source provides a complete, self-contained high-quality compressed image of every video frame. This capability is critical for image extraction and analysis, especially when used for evidence purposes in surveillance court cases.

The DMS is a highly flexible JPEG2000 Codec platform that can be operated in two different video compression modes: Frame Mode or Field Mode. Frame Mode compresses and encodes an entire Frame of de-interlaced Fields of video information at one time while Field Mode compresses and encodes a single interlaced Field (Field 0, Field 1) of the video Frame at a time. This capability provides flexibility in achieving the desired image quality for the target ISR mission objectives. Also, the video JPEG2000 compression ratio and the Frame/Field decimation rate are software selectable using the integrated DMS Configuration Command Menu accessed via a serial Remote Terminal connection. These settings enable the user to optimize the data transport stream content to fit within the available RF channel bandwidth, delivering unmatched versatility.

The number of Audio and Data channels that can be encoded with the compressed video data stream depends on the total available channel bandwidth, the analog video frame rate and compression ratio. For example, if the total transport bandwidth bit-rate is set at 5 Mbps (requiring ~8.5 MHz wide RF Occupied Channel Bandwidth) and the compressed video bit-rate is set at 3 Mbps, there are then 2 Mbps available for supporting a selection of Audio and/or Serial Data channels including the required FEC/Encryption and encoding framing overhead.

Optional High Speed Data Channel

A High Speed Data channel of up to 9 Mbps can be supported directly by the DMS through a serial interface daughter board connected to the DMS mezzanine connector. This capability provides for a secure digital channel for the latest digital sensor systems while operating within existing or reduced available system channel bandwidths.

Power and Size

The DMS operates off nominal +12 VDC power supplies and each DMS Encoder or Decoder module consumes ~1.8 Watts. When mated with L-3 SCM's Transmitters and Receivers, a highly compact and efficient solution is realized providing for extended battery life. The DMS modules are both 2.54" x 1.28" x 0.85" in size (excluding connectors) and weigh in at ~1 ounce. The small form factor is also optimized for use with L-3 SCM's TNTX Series Transmitters and TNRX Series Receivers.

Telemetry & RF Products

Digital Modem Solution

Table 1: Operating Conditions

Parameter	Minimum	Maximum	Unit
Supply Voltage	+11.5	+16	VDC
Supply Current, Encoder/Decoder	0.15 / 0.12	0.18 / 0.14	Amps
Power Dissipation, Encoder/Decoder	1.8 / 1.4	2.0 / 1.6	Watts
Operating Temperature Range	-40	+70	C

Table 2: DMS Specifications

Parameter	Specification
MULTIPLEXED TRANSPORT STREAM	
Compressed Analog Video:	1 Channel
Audio Channels:	2 Channels, Singled-Ended
Low-rate Serial Data Channels:	2 Channels
High Speed Serial Data Channel:	1 Channel, Additional Channels Available (Custom) (Requires Mezzanine Interface Board)
Forward Error Correction (FEC):	Reed Solomon
Encryption:	Simple 32-bit Key XOR Encryption
VIDEO CHANNEL	
Video Input Standards Supported:	NTSC M/J, NTSC 4.43
Future Video Standard Support:	PAL B/D/I/G/H, PAL 60, PAL M, PAL N, PAL Nc
Video Compression Method:	JPEG2000 Standard
Video Compression Ratio:	11:1 Minimum; 1219:1 Maximum
Video Field/Frame Rate:	Field Mode: 1 to 60 fps ; Frame Mode : 1 to 30 Fps
Video Channel Input Voltage:	1.5 Vp-p, Maximum
Video Channel Input/Output Impedance:	75Ω
AUDIO CHANNELS	
Audio Channel Frequency Response: 48.8 kHz Sampling Rate: 8.1 kHz Sampling Rate:	40 Hz to 15 kHz, Typical 40 Hz to 4.0 kHz, Typical
Audio Channel Signal-to-Noise Ratio: 48.8 kHz Sampling Rate: 8.1 kHz Sampling Rate:	55 dB SNR, Minimum 35 dB SNR, Minimum
Audio Channel I/O Impedance:	30 kΩ (Encoder Input); 10 kΩ (Decoder Output)
Audio Channel Input Voltage:	1 Vp-p, Typical; 1.5 Vp-p, Maximum
SERIAL DATA CHANNELS	
Serial Channel Data Rate:	9.6, 19.2, 57.6 or 115.2 kbaud.
Serial Data Channel Input Levels: Data Channel #1 (TX_0, RX_0): Data Channel #2 (TX_1, RX_1):	RS-232 Levels +3.3V LVTTTL, Single-Ended, Unprotected
HIGH SPEED SERIAL DATA CHANNEL	
HSD Channel Data Rate:	Up to 9 Mbps, Channel BW Dependent
HSD Channel Input Level:	+3.3V LVTTTL, Unprotected
TX & RX TELEMETRY INTERFACES	
Telemetry I/O Data Levels:	Single_Ended +3.3V LVTTTL or +5.0V TTL, or LVDS
MECHANICAL	
Size (Including Connectors):	1.52 X 2.54 X 0.92 inches
Volume (Including Connectors):	3.55 cubic inches
Weight:	1.0 ounce
CONNECTORS	
Signal & Control Interface:	20-pin Hirose DF11
Telemetry Transport Data Interface:	6-pin Hirose DF11
Power Supply Interface:	6-pin Hirose DF11

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