

SATELLITE MODEMS



Overview

Comtech EF Data's DMD2050 Satellite Modem is designed to comply with the widest possible range of U.S. Government and commercial standards, and is compatible with the largest number of satellite modems in the industry. It is fully compliant with MIL-STD-188-165A (all terminal types) and the IESS-308, IESS-309, IESS-310 IESS-315 & DVB-S commercial standards.

The DMD2050 provides highly advanced and bandwidth-efficient forward error correction (FEC). Advanced FEC options include Turbo Product Codes (TPCs) and Low Density Parity Check (LDPC). Legacy support for Viterbi, Trellis, Concatenated Viterbi Reed-Solomon, and Sequential FEC are also included. A complete range of modulation types is supported, including BPSK, QPSK, OQPSK, 8PSK, 8-QAM, and 16-QAM.

Advanced FEC and modulation capabilities are integrated with the revolutionary DoubleTalk[®] Carrier-in-Carrier[®] bandwidth compression allowing for maximum state-of-the-art performance under all conditions. This combination of advanced technologies enables multi-dimensional optimization, allowing satellite communications users to:

- Minimize required satellite bandwidth
- Maximize throughput without using additional transponder resources
- · Maximize availability (margin) without using additional transponder resources
- Enable use of a smaller BUC/HPA and/or antenna
- · Or, a combination of the above to meet specific mission needs

Data rates range from 2.4 kbps to 52 Mbps and symbol rates range from 4.8 ksps to 30 Msps. The modem provides a standard MIL-STD-188-114 (EIA-530 / RS-422) serial interface. It can optionally be configured with EIA-613 (HSSI), G.703 (T1/E1/T2/E2 & T3/E3), DVB ASI/SPI and 10/100/1000Base-T Ethernet interfaces. Drop & insert functionality is supported on the G.703 interface. A dual IF interface supports low IF (52-88, 104-176 MHz), and L-Band (950-2000 MHz) frequency ranges. Cost-effective, ultra-high reliable systems are enabled in conjunction with the RCS-11 1:1 redundancy switch, and/or the RCS-20 M:N redundancy switch.

Features

- Standards compliant: MIL-STD-188-165A (all modes), OM-73, IESS-308/309/310/314/315 and optional DVB-S per EN301-210 and EN300-421
- Standard MIL-STD-188-114 (EIA-530/RS-422) serial data interface
- Interface options include Ethernet 10/100/1000Base-T (GigE), Ethernet 10/100Base-T (Fast Ethernet), HSSI, G.703 T1/E1-T2/E2, G.703 T1/E1-T2/E2 & T3/E3, HSSI & Ethernet 10/100Base-T, HSSI & G.703 T1/E1-T2/E2, HSSI & G.703 T1/E1-T2/E2 & T3/E3, DVB ASI/SPI
- Ethernet flow control & Quality of Service (QoS)
- Integrated DoubleTalk Carrier-in-Carrier

- LPDC, TPC, Viterbi, Reed-Solomon, Trellis, Sequential, DVB-S FEC Code configuration, monitor and control features are fully user-programmable
- BPSK/QPSK/OQPSK/8PSK/16-QAM
- 2.4 kbps to 52 Mbps
- 70 ±18 MHz and 140 ± 36 MHz IF, and 950 to 2050 MHz L-Band in 1 Hz steps
- Drop and insert (G.703 interface)
- IDR, IBS
- DC input power 48 VDC option
- High-stability reference
- Asynchronous overhead
- Automatic Uplink Power Control (AUPC)



Typical Users

Government & Military

Common Applications

- Communications at-the-Pause
- Flyaway
 Communications
- Integrated Satellite Terminal Communications



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Compatibility

The DMD2050 is interoperable with the DMD20, DMD50, DMD15/15L SLM-5650/5650A, SLM-8650, SLM-7650, SLM-3650/3650A, SDM-300/300A, CLM-9600, CDM-625, CDM-600/600L, CDM-570/570L, CDM-700, CDM-Qx, and OM 73 satellite modems. The DMD2050 is compatible with competing modems that are compliant with MIL-STD-188-165A and/or open network IESS-308/-309-310.

Doubletalk Carrier-In-Carrier

DoubleTalk Carrier-in-Carrier, based on patented "Adaptive Cancellation" technology, allows transmit and receive carriers of a duplex link to share the same transponder space. Figure 1 shows the typical full duplex satellite link, where the two carriers are adjacent to each other. Figure 2 shows the typical DoubleTalk Carrier-in-Carrier operation, where the two carriers are overlapping, thus sharing the same spectrum.







Carrier 2

Composite

SPAN 2.000 MHz ST 2.791 sec

Carrier 1

DoubleTalk Carrier-in-Carrier is complementary to all advances in modem technology, including advanced FEC and modulation techniques. As these technologies approach theoretical limits of power and bandwidth efficiency, DoubleTalk Carrier-in-Carrier utilizes advanced signal processing techniques to provide a new dimension in bandwidth and power efficiency.

DoubleTalk Carrier-in-Carrier can be used to save transponder bandwidth and/or transponder power thereby allowing successful deployment in bandwidth-limited as well as power-limited scenarios.

The following example illustrates the typical process for implementing DoubleTalk Carrier-in-Carrier in a power-limited scenario:

The conventional link is using 8PSK, TPC 3/4:



Switching to LDPC and using a lower code rate – for example 8-QAM, LDPC 2/3 increases the total transponder bandwidth, while reducing the total transponder power:



Now using DoubleTalk Carrier-in-Carrier, the second carrier can be placed over the first carrier – thereby significantly reducing the total transponder bandwidth and total transponder power when compared to the original side-by-side 8PSK, TPC 3/4 carriers:



Carrier-in-Carrier[®] is a Registered Trademark of Comtech EF Data DoubleTalk[®] is a Registered Trademark of Raytheon Applied Signal Technology

Redundancy

Ultra-high reliability redundant configurations are supported in conjunction with Comtech EF Data's RCS-11 and RCS-20 redundancy switches. The RCS-11 can be configured to support 1:1 redundancy for any DMD-2050 configuration. The RCS-20 provides the same functionality for M:N redundant system architectures.

Flow Control & QoS

Pause Frame flow control is supported on the Ethernet interfaces. QoS is also supported, with both strict priority and fair weighted queuing options.

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Specifications

Modulation	BPSK, QPSK, OQPSK, 8PSK, 8-QAM and 16-QAM					
IF Tuning Range	70 ± 18 MHz and 140 ± 36 MHz in 1 Hz steps					
L-Band Tuning Range	1350 ± 400 MHz and 1500 ± 500 MHz in 1Hz steps					
Impedance	IF: 50 Ohm (75 Ohm optional) L-Band: 50 Ohm					
Connector	TNC: 50 Ohm SMA: 50 Ohm, L-Band					
VSWR	IF < 1.5:1, L-Band < 2.0:1					
Output Power	0 to -25 dBm					
Output Stability	IF: ±0.5 dB over frequency and temperature L-Band: ±.5 dB over frequency and temperature					
Output Spectrum	Selectable and meets MIL-188-165A or IESS- 308/309/310 power spectral mask (DVB-S optional)					
Spurious	-55 dBc In-band (50 to 90 MHz, 100 to 180 MHz, 950 to 2050 MHz) -45 dBc Out-of-band					
On/Off Power Ratio	>60 dB					
Scrambler	OM-73, CCITT V.35 or IBS					
FEC	Viterol, K = 7: 1/2, 3/4 and 7/8 Trellis: 2/3 Turbo Product Code (optional) BPSK 21/44 QPSK/OQPSK 21/44, 3/4, 7/8 8PSK/IG-QAM 3/4, 7/8 LDPC (optional) BPSK: 1/2 QPSK/OQPSK: 1/2, 2/3, 3/4 8PSK/8-QAM: 2/3, 3/4 16-QAM: 3/4					
Outer Encoder	Reed-Solomon: Intelsat, DVB, Custom (N, K)					
Data Clock Source	Internal external RX recovered					
Internal Stability	5 x 10 ⁻⁸					
Demodulator						
Demodulation	BPSK, QPSK, OQPSK, 8PSK, 8-QAM and 16-QAM					
IF Tuning Range	To \pm 18 MHz and 140 \pm 36 MHz in 1 Hz steps					
L-Band Tuning Range	1350 ± 400 MHz and 1500 ± 500 MHz in 1 Hz steps					
Impedance	IF: 50 Ohm (75 Ohm optional) L-Band: 50 Ohm					
Connector	TNC: 50 Ohm SMA: 50 Ohm, L-Band					
VSWR	IF < 1.5:1, L-Band < 2.0:1					
Spectrum	Selectable and meets MIL-188-165A or Intelsat IESS- 308/309/310 compliant					
Input Level	-55 to +10 dBm					
Total Input Power	+20 dBm or +40 dBc (the lesser)					
FEC	Viterbi, K = 7: 1/2, 3/4 and 7/8 Trellis: 2/3 Turbo Product Code (optional) BPSK 21/44 QPSK/OQPSK 21/44, 3/4, 7/8 BPSK/16-QAM 3/4, 7/8 LDPC (optional) BPSK: 1/2 QPSK/OQPSK: 1/2, 2/3, 3/4 8PSK/8-QAM: 2/3, 3/4 16-OAM: 3/4					
Outer Decoder Options	Reed-Solomon: Intelsat, DVB. Custom (N. K)					
Descrambler	OM-73, CCITT V.35 or IBS					
Acquisition Range	Programmable ± 1 kHz to ± 255 kHz					
Reacquisition Range	Programmable ± 1 Hz to 25 kHz					
Sweep Delay Value	100 ms to 9000 seconds in 100 ms steps					
Plesiochronous Ru	iffer					
Size	0 ms to 64 ms					
Centering	Automatic on overflow/underflow					
Contening	IBS: Integral number of frames					
Centering Modes	IDR: Integral number of maltes					
GIUCK	I Transmit, external, RA recovered of SCT (Internal)					

Monitor and Contr	ol				
Ethernet 10Base-T/Remo	te RS-485/Terminal RS-232, Web browser				
Terrestrial Interfac	es				
Standard Interface	MIL-STD-188-114 (EIA-530/RS-422)				
Optional Interfaces	Ethernet 10/100/100Base-T (GigE) Ethernet 10/100Base-T (Fast Ethernet)				
	G.703 T1/E1-T2/E2				
	G.703 T1/E1-T2/E2 & T3/E3 HSSI & Ethernet 10/100Base-T HSSI & G.703 T1/E1-T2/E2				
	HSSI & G.703 T1/E1-T2/E2 & T3/E3				
DMD2050 Drop an	d Insort				
Torrostrial Data	4 113 CT				
	AMI or P979 for T1 and UDP2 for E1				
Line Couling	D4 ESE and PCM30 (PCM 30C) or PCM31 (PCM 31C)				
Framing	for F1				
Time Slot Selection	n x 64 contiguous or arbitrary blocks for drop or insert				
D&I Open Network, satell	ite overhead 6.6%				
Time Slots	TS1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 30, 31				
Efficient D&I Closed Netw	vork, satellite overhead 0.4%				
Time Slots	1-31 Any combination				
IDR/ESC Interface					
G 703 T1 (DSY1)	1 544 Mbps 100 Obm balanced AMI and B87S				
0.700 11 (DOX1)	2 048 Mbps, 75 Obm unbalanced and 120 Obm				
G.703 E1	balanced HDB3				
	6.312 Mbps, 75 Ohm unbalanced and 110 Ohm				
G.703 12 (DSX2)	balanced, B8ZS and B6ZS				
G.703 E2	8.448 Mbps, 75 Ohm BNC, unbalanced, HDB3				
G.703 E3	34.368 Mbps, 75 Ohm BNC, unbalanced, HDB3				
IBS/Synchronous	Interface				
MIL-188-114A	All Rates, differential, clock/data, DCE				
RS-232	(DCE up to 200 kbps)				
Environmontal & E	Physical				
Drime Devue					
Prime Power	100 to 240 VAC, 50 to 60 Hz, 40 W maximum				
Operating Temperature					
operating remperature	-10 to +60°C, 95% humidity, non-condensing				
Storage Temperature	-20 to 70°C, 99% humidity, non-condensing				
Dimensions	1.75" x 19" x 19.25"				
(height x width x depth)	(4.45 x 48.26 x 48.89 cm)				
Weight	8.0 lbs (3.64 kg)				
Available Options					
How Enabled	Ontion				
	Option				
FASI	Data rates to 20, 52 Mbps				
FAST	8PSK, 8-QAM, 16-QAM				
Hardware / FAST	TPC to 20, 52 Mbps				
Hardware / FAST	LDPC to 20 Mbps				
Hardware / FAST	DoubleTalk Carrier-in-Carrier: 512 kbps – 52 Mbps				

G.703 drop & insert

10/100/1000Base-T Gigabit Ethernet interface 10/100Base-T Fast Ethernet interface

Sequential FEC

HSSI interface

G.703 Data interface

ASI/SPI Data interface -48 VDC prime power option

IBS & IDR

DVB-S

FAST

FAST

FAST

FAST

Hardware

Hardware Hardware

Hardware

Hardware

Hardware



SATELLITE MODEMS

BER Performance

Example Modes and Performance

Mod / FEC	Code	Eb/No Guaranteed (Typical)				Data Bata Banga [khna]		
WOU / FEC	Rate	10 ⁻⁵	10 ⁻⁶	10 ⁻⁷	10 ⁻⁸	Data Rate Range [RDp5]		
Legacy Modes								
BPSK VIT	1/2	5.5 (5.1)	6.1 (5.7)	6.7 (6.2)	7.4 (6.8)	2.4 – 14,100		
QPSK VIT	1/2	5.5 (5.1)	6.1 (5.7)	6.7 (6.2)	7.4 (6.8)	4.8 - 28,300		
QPSK VIT	3/4	6.8 (6.3)	7.6 (7.0)	8.3 (7.7)	8.9 (8.4)	7.2 - 42,400		
QPSK VIT	7/8	7.9 (7.2)	8.6 (7.9)	9.3 (8.6)	10.2 (9.4)	8.4 - 49,500		
QPSK VIT R-S	1/2	3.8 (3.4)	4.1 (3.6)	4.2 (3.8)	4.4 (4.0)	4.8 - 25,100		
QPSK VIT R-S	3/4	5.4 (4.7)	5.6 (4.9)	5.8 (5.1)	6.0 (5.3)	7.2 – 37,700		
QPSK VIT R-S	7/8	6.5 (6.0)	6.7 (6.4)	6.9 (6.7)	7.2 (7.1)	7.8 - 44,000		
QPSK SEQ	1/2	5.6 (5.1)	5.9 (5.4)	6.3 (5.8)	6.7 (6.2)	4.8 - 2,048		
QPSK SEQ	3/4	6.1 (5.6)	6.5 (6.1)	7.0 (6.5)	7.4 (6.9)	7.2 – 2,048		
QPSK SEQ	7/8	6.9 (6.4)	7.4 (6.9)	7.9 (7.4)	8.4 (7.9)	8.4 - 2,048		
8PSK TRE	2/3	8.2 (6.4)	9.0 (7.2)	9.8 (8.1)	10.4 (8.9)	9.6 - 52,000		
8PSK TRE R-S	2/3	6.3 (5.4)	6.5 (5.6)	6.7 (5.8)	6.9 (6.1	8.9 - 52,000		
TPC Modes								
BPSK TPC	21/44	2.7 (2.4)	2.9 (2.6)	3.1 (2.8)	3.3 (3.0)	2.4 – 13.506		
QPSK TPC	21/44	2.7 (2.4)	2.9 (2.6)	3.1 (2.8)	3.3 (3.0)	4.8 - 20,000		
QPSK TPC	3/4	3.6 (3.2)	3.8 (3.4)	4.1 (3.7)	4.4 (4.0)	7.2 – 20,000		
QPSK TPC	7/8	4.2 (3.9)	4.3 (4.0)	4.4 (4.1)	4.5 (4.2)	8.4 - 20,000		
8PSK TPC	3/4	6.0 (5.6)	6.3 (5.8)	6.5 (6.0)	6.7 (6.3)	10.8 – 20,000		
		7.1 (6.7)	7.2 (6.8)	7.3 (6.9)	7.4 (7.0)	20,000 – 52,000		
8PSK TPC	7/8	6.9 (6.5)	7.0 (6.6)	7.1 (6.7)	7.2 (6.8)	12.6 – 20,000		
		7.3 (6.9)	7.4 (7.0)	7.5 (7.1)	7.6 (7.2)	20,000 - 52,000		
16-QAM TPC	3/4	7.0 (6.7)	7.4 (7.1)	7.8 (7.5)	8.2 (7.9)	14.4 – 20,000		
		7.5 (7.1)	7.7 (7.4)	7.9 (7.6)	8.3 (8.0)	20,000 - 52,000		
16-QAM TPC	7/8	8.0 (7.6)	8.1 (7.7)	8.2 (7.8)	8.3 (7.9)	16.84 – 20,000		
LDPC Modes								
BPSK LDPC	1/2	2.0 (1.7)	2.1 (1.8)	2.2 (1.9)	2.3 (2.0)	2.4 – 13.506		
QPSK LDPC	1/2	2.0 (1.7)	2.1 (1.8)	2.2 (1.9)	2.3 (2.0)	4.8 - 20,000		
QPSK LDPC	2/3	2.3 (2.0)	2.4 (2.1)	25(2.2)	2.6 (23)	6.4 - 20,000		
QPSK LDPC	3/4	3.0 (2.6)	3.1 (2.7)	3.2 (2.8)	3.3 (3.0)	7.2 – 20,000		
8-QAM LDPC	2/3	4.6 (4.2)	4.7 (4.3)	4.8 (4.4)	4.9 (4.5)	9.6 - 20,000		
8-QAM LDPC	3/4	5.6 (5.2)	5.7 (5.3)	5.8 (5.4)	5.9 (5.5)	10.8 - 20,000		
16-QAM LDPC	3/4	6.8 (6.2)	6.9 (6.4)	7.0 (6.6)	7.1 (6.8)	14.4 – 20,000		





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