Overview

The DMD50 Universal Satellite Modem breaks new ground in flexibility, operation and cost. With standards including IESS-308, IESS-309, IESS-310, IESS–315 & DVB-S, and covering data rates up to 52 Mbps, this 1RU duplex modem covers many satellite IP, telecom, video and Internet applications.

The DMD50 provides highly advanced and bandwidth-efficient forward error correction (FEC). Advanced FEC options include Turbo Product Code (TPC) 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 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 (50-90, 100-180 MHz), and L-Band (950-2050 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.

Typical Users

- Telecom Service Providers
- Internet Service Providers
- Government & Military

Common Applications

- G.703 Trunking
- IP Trunking
- Terminal Communications

Features

- Standards compliant: IESS-308/309/310/314/315 and optional DVB-S per EN301-210 and EN300-421
- Standard 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
- 50 to 90 MHz and 100 to 180 MHz IF, and 950 MHz 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)

Compatibility

The DMD50 is interoperable with the DMD20, DMD2050, 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 DMD50 is compatible with competing modems that are compliant with 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.
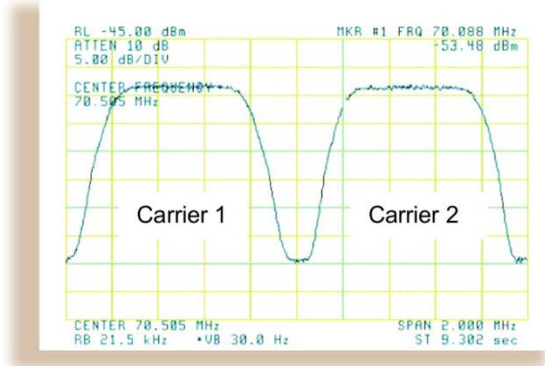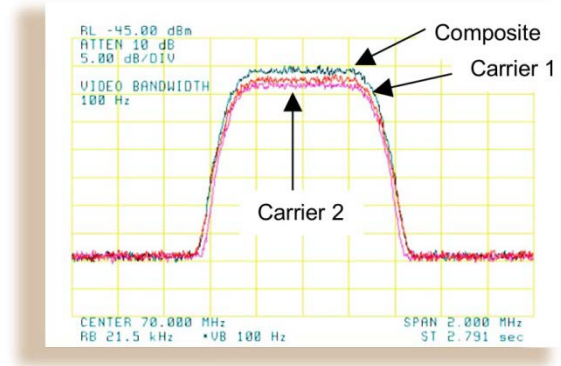

Figure 1

Figure 2

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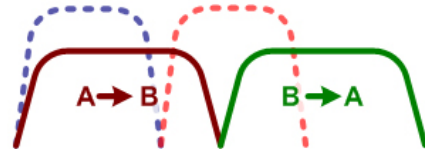
DoubleTalk Carrier-in-Carrier can be used to save transponder bandwidth and/or transponder power thereby allowing successful deployment in bandwidth-limited as well as power-limited scenarios.

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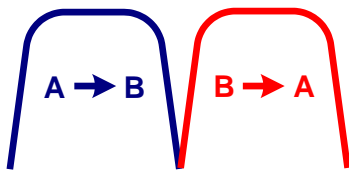
Switching to LDPC and using a lower code rate – for example 8-QAM, LDPC 2/3 increases the total transponder bandwidth, while reducing the total transponder power:

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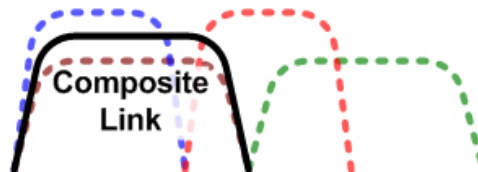
Carrier-in-Carrier[®] is a Registered Trademark of Comtech EF Data
DoubleTalk[®] is a Registered Trademark of Raytheon Applied Signal Technology

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 DMD50 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.

Specifications

Modulation	BPSK, QPSK, OQPSK, (8PSK, 8-QAM and 16-QAM optional)
IF Tuning Range	50 to 90 and 100 to180 MHz in 1 Hz steps 1 Hz steps
L-Band Tuning Range	950 to 2050 MHz in 1 Hz steps
Impedance	IF: 75 Ohm (50 Ohm optional) L-Band: 50 Ohm
Connector	BNC: 75 Ohm (50 Ohm optional) SMA: 50 Ohm, L-Band
Return Loss	IF: 14 db min., L-Band: 10 dB min.
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	Meets IESS- 308/309/310/DVB-S power spectral mask
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	CCITT V.35 or IBS (others optional)

FEC	Viterbi, K = 7: 1/2, 3/4 and 7/8
	Trellis: 2 /3
	Turbo Product Code (optional)
	  BPSK 5/16, 21/44
	  QPSK/OQPSK 21/44, 3/4, 7/8
	  8PSK/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-QAM: 3/4

Outer Encoder	Reed-Solomon: Intelsat, DVB, Custom (N, K)
Data Clock Source	Internal, external, RX recovered
Internal Stability	1×10^{-6} typical (optional to 5×10^{-8})

Demodulator

Demodulation	BPSK, QPSK, OQPSK, (8PSK, 8-QAM and 16-QAM optional)
IF Tuning Range	50 to 90 and 100 to180 MHz in 1 Hz steps
L-Band Tuning Range	950 to 2050 MHz in 1 Hz steps
Impedance	IF: 75 Ohm (50 Ohm optional) L-Band: 50 Ohm
Connector	BNC: 75 Ohm (50 Ohm optional) SMA: 50 Ohm, L-Band
Return Loss	IF: 14 db min., L-Band: 10 dB min.
Spectrum	IESS-308/309/310/DVB-S 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 5/16, 21/44
	  QPSK/OQPSK 21/44, 3/4, 7/8
	  8PSK/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-QAM: 3/4

Outer Decoder Options	Reed-Solomon: Intelsat, DVB, Custom (N, K)
Descrambler	CCITT V.35 or IBS (others optional)
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 Buffer

Size	0 ms to 64 ms
Centering	Automatic on overflow/underflow
Centering Modes	IBS: Integral number of frames IDR: Integral number of multi-frames
Clock	Transmit, external, RX recovered or SCT (internal)

Monitor and Control

Ethernet 10Base-T/Remote RS-485/Terminal RS-232, Web browser

Terrestrial Interfaces

Standard Interface	EIA-530 / RS-422
Optional Interfaces	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

DMD50 Drop and Insert (Optional)

Terrestrial Data	1.544 Mbps or 2.048 Mbps, G.732/733
Line Coding	AMI or B8ZS for T1 and HDB3 for E1
Framing	D4, ESF and PCM30 (PCM 30C) or PCM31 (PCM 31C) for E1
Time Slot Selection	n x 64 contiguous or arbitrary blocks for drop or insert
D&I Open Network, satellite overhead 6.6%	
Time Slots	TS1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 30, 31
Efficient D&I Closed Network, satellite overhead 0.4%	
Time Slots	1-31 Any combination

IDR/ESC Interface

G.703 T1 (DSX1)	1.544 Mbps, 100 Ohm balanced, AMI and B8ZS
G.703 E1	2.048 Mbps, 75 Ohm unbalanced and 120 Ohm balanced, HDB3
G.703 T2 (DSX2)	6.312 Mbps, 75 Ohm unbalanced and 110 Ohm 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

EIA-530/RS-422	All Rates, differential, clock/data, DCE
RS-232	(DCE up to 200 kbps)

Environmental & Physical

Prime Power	100 to 240 VAC, 50 to 60 Hz, 60 W maximum 48 VDC (optional)
Operating Temperature	0°to +50°C, 95% humidity, non-condensing
Storage Temperature	-20 to 70°C, 99% humidity, non-condensing
Dimensions (height x width x depth)	1.75" x 19" x 19.25" (4.45 x 48.26 x 48.89 cm)
Weight	8.0 lbs (3.64 kg)

Available Options

How Enabled	Option
FAST	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
FAST	G.703 drop & insert
FAST	IBS & IDR
FAST	Sequential FEC
FAST	DVB-S
Hardware	High Stability Reference
Hardware	10/100/1000Base-T Gigabit Ethernet interface
Hardware	10/100Base-T Fast Ethernet interface
Hardware	HSSI interface
Hardware	G.703 Data interface
Hardware	ASI/SPI Data interface
Hardware	-48 VDC prime power option

BER Performance

Example Modes and Performance

Mod / FEC	Code Rate	Eb/No Guaranteed (Typical)				Data Rate Range [kbps]
		10^{-5}	10^{-6}	10^{-7}	10^{-8}	
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	5/16	2.5 (2.3)	2.7 (2.5)	2.9 (2.7)	3.1 (2.9)	2.4 – 8,844
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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