MCED-100 Embedding Device
MCDD-100 Detecting Device

Modems

Overview

Building on our leadership in providing equipment to optimize the quality of satellite links, we are introducing the MetaCarrier® Carrier Identification embedding and detecting devices, the MetaCarrier Embedding Device (MCED-100) and the MetaCarrier Detecting Device (MCDD-100). The MCED-100 places the MetaCarrier Carrier Identification on the referenced carrier, and the MCDD-100 receives it. These patent-pending products use spread spectrum technology for a complete MetaCarrier embedding and decoding solution.

The MCED-100 embeds a unique carrier identification sequence for a transmission carrier. The MCDD-100 decodes an embedded unique carrier identification sequence for a transmission carrier. In a typical network, there can be as many MCED-100s as there are modulating devices, and a smaller number of MCDD-100s to verify the presence of the MetaCarrier on each carrier. In an interference situation, the MCDD-100 may be used to decode the MetaCarrier of an interfering carrier that may not be part of one's own transmission network, as long as the interfering carrier has a MetaCarrier embedded.

The MCED-100 and the MCDD-100 can operate in both non-interfered and interfered conditions, and are ideally suited for SCPC, MCPC and video satellite carrier transmissions. By using the MetaCarrier concept, a low-speed data sequence containing information about the transmission carrier is spread using Direct Sequence Spread Spectrum (DSSS), and then combined with the transmission "desired" carrier to produce a composite carrier with an embedded CID.

Typical Users

- Satellite Service Providers
- Mobile Operators
- Internet Service Providers
- Government & Military
- Broadcasters
- Offshore & Maritime
- Enterprise

Common Applications

- Reduction of interference in SCPC, MCPC and Video Satellite Carrier Transmissions

MCED-100 Key Features

- Provides inline embedding of the MetaCarrier for any modulator with L-Band (950 MHz to 2150 MHz) or IF (50 MHz to 180 MHz) output
- Common modulation types and symbol rates are supported regardless of FEC (forward error correction) type
- Both hardware and firmware options are available – contact us to determine the best option for your network
  - Hardware option – external device that is attached to the IF of the modulator or modem that is to be identified
  - Firmware option – functionality is in the FPGA of the modulator or modem (Comtech's or a third-party's)

Feature	Hardware Option	Firmware Option
Embeds the Carrier ID on an SCPC or video carrier	✓	✓
No user configuration required; set once	✓	✓
Automatically determines center frequency of original carrier and configures an appropriate sized MetaCarrier	✓	✓
Connects inline between modulator and up converter / amplifier at earth station, IF or L-Band	✓	
Fail-to-wire design	✓	
External GPS connection or connection to GPS antenna; MCED-100 includes an internal GPS receiver, only requires a GPS antenna	✓	
Remote Control via RS-232 and LAN; one Ethernet port for management (Firmware version; in modem or modulator management)	✓	✓

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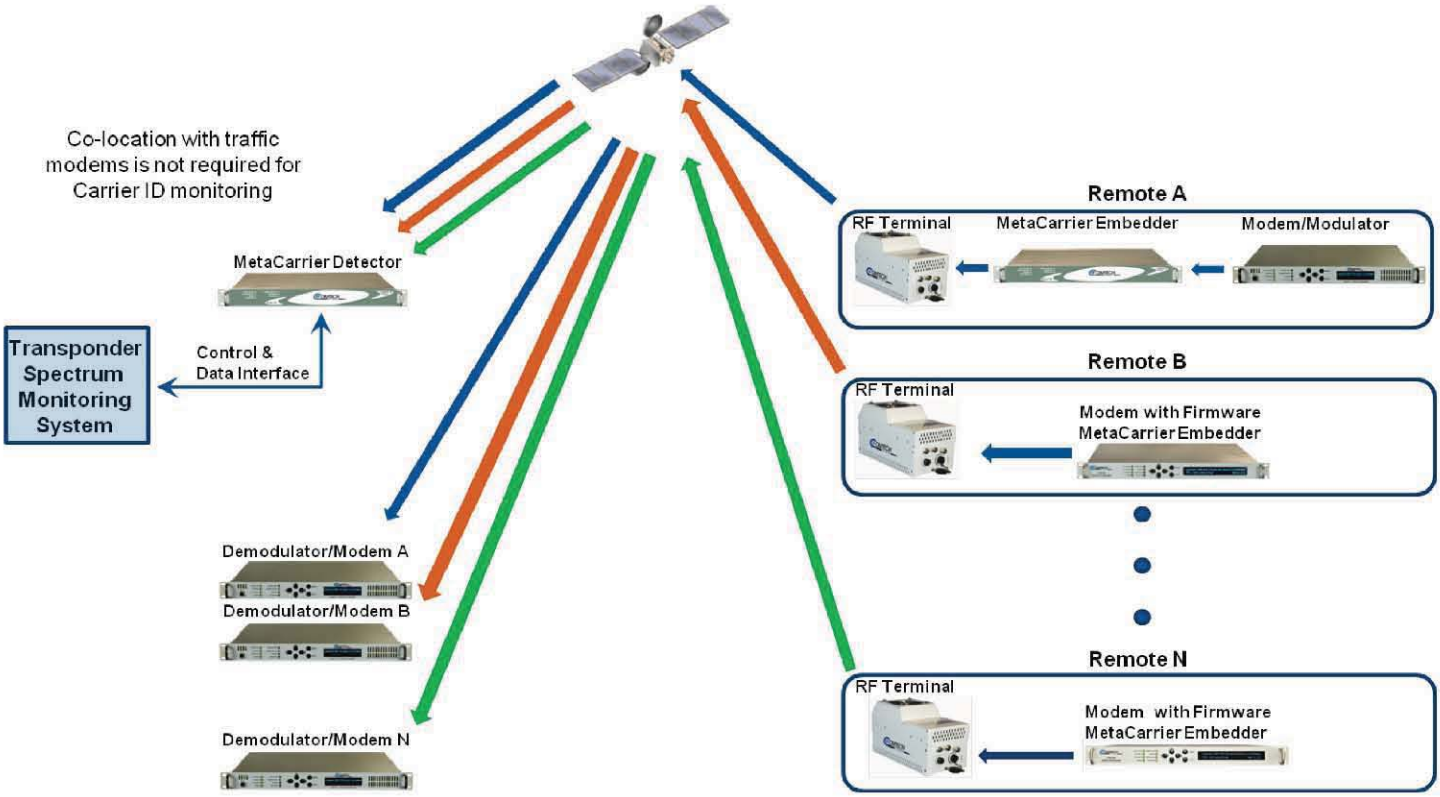


MCDD-100 Key Features

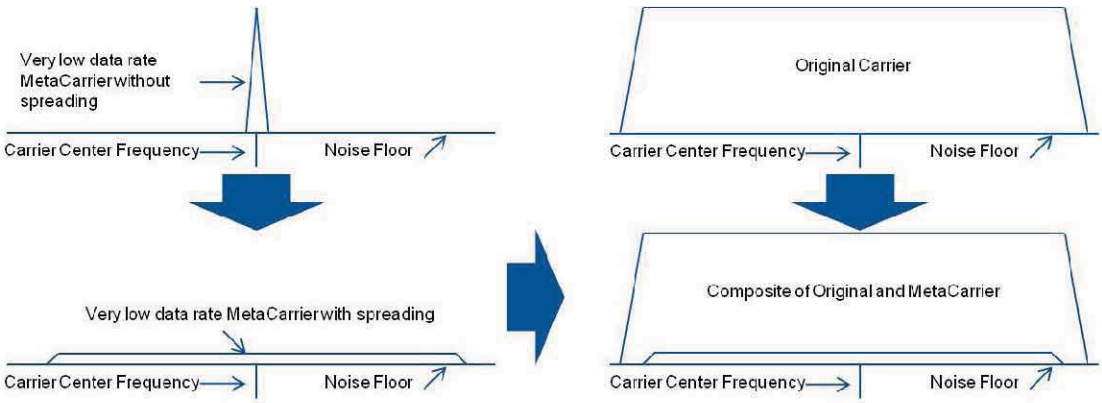
- Supports L-Band (950 MHz to 2150 MHz) or IF (50 MHz to 180 MHz) input for decoding and demodulating the MetaCarrier sequence
- Can detect multiple carriers per transponder and resolve their MetaCarriers via external center frequency and bandwidth input
- Remote control via Ethernet management
- Can be commanded via SNMP by an external carrier monitoring system

MetaCarrier Technology

We developed the MetaCarrier technology, which is used to embed and detect Carrier ID on video and data satellite carriers. The MetaCarrier name is derived from the method of providing transmission information via metadata. This is accomplished by spread spectrum modulation of a very low data rate carrier (containing metadata information about the referenced carrier) over a portion of the referenced carrier. A large spreading factor is used that results in spreading the meta-carrier's energy over a significantly large amount of bandwidth – many orders of magnitude of the original metadata rate. The resulting energy becomes a miniscule amount of noise being added to the referenced carrier spectrum. This also results in a coding gain that is used to extract and separate the MetaCarrier from its reference carrier.

MetaCarrier Carrier Identification has a minimal effect on the carrier quality and the quality of the carrier's content. It can be read in the clear, by an MCDD, even if the referenced carrier is transmitted with conditional access or is otherwise encrypted. The MetaCarrier embedding can be used on any static carrier, SCPC, Video or other.

The MetaCarrier technology overlays the very low data rate Carrier ID data in a spread spectrum carrier, onto the carrier that it is referencing. In the below depiction, the MetaCarrier is placed 22 dB below the peak of the carrier it is identifying, at the center frequency of the carrier.



Specifications

MCED-100

Frequency	50-180 MHz or 950-1250 MHz (±1.0 ppm) in 100 Hz steps
Impedance	
L-Band	50 Ω
70/140 MHz	75 Ω
Meta-Carrier Spectral Mask	35%
Connector	
L-Band	Type N female
70/140 MHz	BNC
Return Loss	
L-Band	Minimum 13 dB
70/140 MHz	Minimum 15 dB
Insertion Loss	
L-Band	Maximum 3 dB
70/140 MHz	Maximum 2 dB
Output Power (Main carrier/metacarrier)	-22 dBc ±2 dBc relative to input carrier
Output Power Stability	±0.5 dBc from room temperature set point over the specified temperature and at constant frequency
Composite Output Carrier Flatness	<1 dB within any 64 MHz band
Harmonics and Spurious	
L-Band	-60 dBc/4 kHz relative to uplink carrier, measured from 250 MHz to 2500 MHz
70/140 MHz	-60 dBc/4 kHz relative to uplink carrier, measured from 10 MHz to 250 MHz
Integrated Phase Noise	2° rms maximum, double sideband, 10 Hz to 1 MHz
Carrier Null	25 dB below an unmodulated carrier
Single Sideband Suppression	N/A
BUC, 10 MHz and FSK	Transparent pass-through, supports up to 4.17 amps 24 V DC or 3.125 amps at 48 V DC
FEC	(112,70) BCH Code
Input Symbol Rate	128 Ksps to 64 Msps
Meta-Carrier Symbol Rate	1/4096 of the chip rate
Chip Rate	112 Kcps, 224 Kcps
Spreading Ratio	4096
Maximum Packet Size (including FEC)	122 bits, 32 packets (maximum) per message

Data Rate	**Chip Rate**	**Spreading Ratio**	**Data Rate (bps)**
≥ 128 Ksps to <256 Ksps	112 Kcps	4096	28.00
≥ 256 Ksps	224 Kcps	4096	56.00

Meta-Carrier Mute	Unit mutes Meta-Carrier unless CF, symbol rate, and input carrier power are successfully determined
Test Modes	CW; Alt-1,0; Test IDF; normal; Meta-Carrier frequency offset
Optional Embedded GPS Device Support	Unit provides a DE-09P EIA-232 serial input and a Type SMA female connector for both receiving GPS information and an optional embedded GPS device

MCDD-100

Frequency	50-180 MHz or 950-1250 MHz (±0.06 ppm) in 100 Hz steps
Impedance	
L-Band	50 Ω, 14 dB minimum return loss
70/140 MHz	50 Ω or 75 Ω, 18 dB minimum return loss
Connector	
L-Band	Type N female
70/140 MHz	BNC
Input Power Range	
950 – 2150 MHz band	-130 + 10log (symbol rate) to -80 + 10log (symbol rate) dBm
50 – 180 MHz band	-105 + 10log (symbol rate) to -70 + 10log (symbol rate) dBm
Maximum Composite Operating Level	
950 – 2150 MHz band	102 – 10log (symbol rate, desired carrier) dBc, + 10 dBm maximum; within ±10 MHz of the desired carrier, composite power is ≤ +30 dBc
50 – 180 MHz band	94 – 10log (symbol rate, desired carrier) dBc, +10 dBm maximum; within ±10 MHz of the desired carrier, composite power is ≤ +30 dBc
Absolute Maximum, no damage	+20 dBm
Acquisition Range	±10% of true carrier symbol rate (normal operation); ±30 Ksps narrow range
Return Loss	12 dB min. (typical 15 dB)
FEC Mode	(112, 70) BCH code
Modulation	BPSK
Chip Rate	112 Kcps, 224 Kcps

Data Rate	**Chip Rate**	**Spreading Ratio**	**Data Rate (bps)**
≥ 128 Ksps to <256 Ksps	112 Kcps	4096	28.00
≥ 256 Ksps	224 Kcps	4096	56.00

Redundancy	N/A

Environmental and Physical (MCED-100 and MCDD-100)

Temperature	
Operating	32° to 122°F (0° to 50°C)
Storage	-4° to 158°F (–20° to 70°C)
Humidity	
Operating	95% maximum, non-condensing
Storage	99% maximum, non-condensing
Vibration	Per MIL-STD-810F Method 514.5 Category 4a
Dimensions (1RU) (height x width x depth)	1.7" x 19" x 16.2" (44 x 483 x 411 mm)
AC Power Supply	Rear panel-installed module includes on/off switch
AC Operating Voltage	100 V – 240 V AC, +6%/-10% autosensing (Total absolute maximum range is 90 V – 254 V AC)
DC Power Supply	Includes on/off switch and an input filter per PL-0000551 & PL/10312-1 kits
DC Operating Voltage	48 V nominal (total range is 36 – 60 V)

MCDD-100 & MCED-100 for Hardware Interfaces

MCED Interface	
1:1 Control	Control for external 1:1 Redundancy, IEEE 1394 9-pin
Ethernet management	1 port 10/100 auto-sensing full/half duplex Ethernet, RJ-45
GPS Antenna	SMA
GPS Serial Interface	RS-232 serial interface, 9-pin D-sub (male)
IF Interfaces	
L-Band Input	950 – 2150 MHz BUC Power, 10 MHz, FSK, N-Type, F
70/140 MHz Input	50 – 180 MHz, BNC-F
L-Band Output	950 – 2150 MHz L-Band pass through output BUC power, 10 MHz, FSK pass through output, N-Type, F
70/140 MHz Output	50 – 180 MHz IF pass through output
MCDD Interface	
Ethernet management	1 port 10/100 auto-sensing full/half duplex Ethernet, RJ-45
IF Interfaces	
L-Band Input	950 – 2150 MHz L-Band input, N-Type, F
70/140 MHz Input	50 – 180 MHz IF input, BNC-F

MCED-100 Back Panel

MCDD-100 Back Panel