



Applications

- Video Signal Distribution in HFC CATV and FTTP nodes
- Supports CATV, QAM, and DBS Signal Carriage
- Replacement for Externally Modulated Transmitters

Features

- Dual Redundant Power Supplies
- SNMP Network Interface
- Dual RF Inputs for CATV and DBS
- Available on 100 GHz Spaced ITU DWDM C-band Channels
- Optimized RF Intergration of Predistorter, Amplifiers, and Laser
- Complete, Efficient Laser Bias and TEC Control Circuitry
- OEM/ODM Opportunities Available through EMCORE
- Fiber Length Selectable Via Front Panel Control
- RoHS Compliant

Direct Modulation, DWD, Low Distortion, Wideband

EMCORE's Model DM8000-U is a directly modulated (DM) DWDM optical transmitter specifically designed for wideband applications that require both CATV and DBS signals to be carried over up to 30km length of fiber. This facilitates networks designs that may use a single transmitter to carry multiple signals.

The DM8000-U supports full 79-channel NTSC analog signal and or a combination of QAM, DBS with reduced channel analog CATV. The DM8000-U can be selected as fix fiber length option to support a fix length from 0 – 10km, 5 – 15km, 10 – 20km and 15 – 25km with 18dBm SBS suppression maximum, or it can be ordered as the fiber length selectable option. This option allows the user to set the DM8000-U for best optimized CSO at any fiber length from 0 – 30km with 1km increment. At the selected fiber length for the fiber length selectable option, the unit can perform within specification with the fiber length tolerant of ± 3 km. The selectable fiber length option has maximum SBS suppression of 20dBm.

The DM8000 family of transmitter products is designed to support various CATV transmitter applications with a common platform. A 75 Ω CATV RF video input supports frequencies up to 1002 MHz. Integrated within the transmitter design are EMCORE'S low chirp control, noise suppression circuitry, and patented predistortion technology to provide outstanding performance with any of EMCORE'S wide range of cooled broadband lasers. A second 75 Ω RF input supports frequencies up to 2700 MHz for FTTP, L-Band satellite, and wireless applications.

Performance Highlights

| | Min | Typ | Max | Units |
|--|------|-----|------|-------|
| Operating Temperature Range | 0 | 25 | 50 | °C |
| Wavelength (100 GHz ITU Options) | 1530 | - | 1560 | nm |
| Optical Power (Fixed fiber length option) | 7 | - | - | dBm |
| (Selectable fiber length option) | 10 | - | - | |
| Frequency Response (75 Ω CATV Port) | 47 | - | 1002 | MHz |
| (75 Ω L-Band Port) | 950 | - | 2700 | |
| CNR (79ch, NTSC, 10 – 20km) | 50.5 | - | - | dB |
| CSO (79ch, NTSC) | - | - | -58 | dBc |
| CTB (79ch, NTSC) | - | - | -65 | dBc |
| IMD3 (3 rd order C/I, 950 – 2600 MHz) | - | - | -60 | dBc |

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

| Parameter | Symbol | Min | Max | Unit |
|---------------------------------|-------------|-----|-----|----------|
| Storage Temperature (power off) | T_{stg} | -40 | 85 | °C |
| 75ohm CATV RF Input Level | Manual Mode | - | -10 | dBm |
| | AGC Mode | - | -5 | |
| L-Band RF Input Level | - | - | +5 | dBm |
| AC Input Range | V_{AC} | 90 | 265 | V_{AC} |
| AC Input Frequency Range | f_{AC} | 50 | 60 | Hz |
| Power Consumption | P | - | 50 | W |

Optical Characteristics

| Parameter | Condition | Min | Typ | Max | Unit |
|----------------------------------|---|-------------|-----|-----|------|
| Optical Output Power | DM8000 with selectable fiber length | 10 | - | - | dBm |
| | DM8000 with fiber fix option | 7 | - | - | |
| SBS Threshold | DM8000 with fix fiber length option | - | - | 18 | dBm |
| | DM8000 (selectable fiber length option) | - | - | 20 | dBm |
| Wavelength | - | ITU Channel | | | nm |
| Side Mode Suppression Ratio | - | 30 | - | - | dB |
| Optical Return Loss ¹ | APC style connector | 40 | - | - | dB |

1. In order to prevent reflection-induced distortion, the laser must be connected to an optical cable having a return loss of at least 55 dB for discrete reflections and 30 dB for distributed reflections.

RF Characteristic

The following specifications are reference at 25C. The CATV test receiver is the EMCORE receiver, model 7820A, with responsivity of 0.95 A/W (at 1550 nm). Test fiber is single mode, Corning SMF-28 (or equivalent) with 0.25dB/km maximum loss (at 1550 nm). In order to prevent reflection-induced distortion, the transmitter subassembly must be connected to an optical cable with discrete reflections < -55 dB and distributed reflections < -30 dB.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--|---------------------------|--|-----|-----|------|---------|
| Operating Temperature Range | T _{op} | Note 1 | 0 | - | 50 | °C |
| CATV Response Flatness | S _{21-CATV} | 47MHz - 1002MHz, Peak to Valley | - | - | 1.5 | dB |
| CATV Test Port Response Flatness | S _{21-TP-CATV} | Relative to CATV Input 47 MHz – 1002 MHz, 75Ω | -1 | - | 1 | dB |
| CATV Input Return Loss | S _{11-CATV} | 47 MHz – 1002 MHz, 75Ω | 16 | - | - | dB |
| CATV Test Port Return Loss | S _{11-TP-CATV} | 47 MHz – 1002 MHz, 75Ω | 16 | - | - | dB |
| CATV Input RF Level | P _{in-CATV} | See CATV 75 ohm Input Option Table | | | | dBmV/ch |
| CATV RF Test Point Level | P _{out-TP-CATV} | Relative to CATV Input, 75Ω | -21 | -20 | -19 | dBm |
| AGC Range | - | Perform to specification | -3 | | +3 | dB |
| CATV Input Power Detection Range | - | Note 1 Relative to nominal CATV input power level | -5 | - | +5 | dB |
| L-Band Input RF Level Composite | P _{in-Lband} | 36ch BSCS-IF at 83.2 dBuV/ch | - | - | -10 | dBm |
| L-Band Input Power Detection Range | - | Note 2 Relative to nominal L-Band input power level | -5 | - | +5 | dB |
| L-Band Response Flatness | S _{21-Lband} | 950MHz – 2700 MHz, Peak to valley, 75Ω | - | - | 3.5 | dB |
| L-Band RF Test Port Response Flatness | S _{21-TP-Lband} | Relative to L-Band Input 950MHz – 2700 MHz, 75Ω | -2 | - | +2 | dB |
| L-Band Return Loss | S _{11-Lband} | 950MHz – 2700 MHz, 75Ω | 10 | - | - | dB |
| L-Band Test Port Return Loss | S _{11-TP-Lband} | 950MHz – 2700 MHz, 75Ω | 10 | - | - | dB |
| L-Band Test Port Level | P _{out-TP-Lband} | Relative to L-Band Input, 75Ω | -21 | -20 | -19 | dBm |
| L-Band Input, IMD3 (3 rd Order C/I) | C/I _{Lband} | F1=2000MHz, F2=2000.5MHz 2-tone @ -13dBm/tone Rx Opt Power = 0dBm CATV Input with Loading specified in CATV 75Ω Input Option | - | - | -60 | dBc |
| Relative Intensity Noise | RIN | Opt RL > 40dB Note 3 | - | - | -155 | dB/Hz |

1. Detects and display RF power of CATV input port. The total input power is defined in section 3.10 and 3.11.
2. Detects and display RF power of the L-Band input port.
3. Guaranteed by design.

Noise and Distortion Characteristics for CATV Input

Fix Fiber Length Option:

| CATV 75Ω Input Option | RF Level/ch (dBmV) | Composite (dBm) | BER ⁽⁵⁾ | CNR ^(1,2) (dB) | CSO ^(1,3,6) (dBc) | CTB ^(1,3,6) (dBc) |
|--|--------------------------------|-----------------|--------------------|---------------------------|------------------------------|------------------------------|
| 79ch NTSC ⁽⁴⁾ 0-10km, 5-15km, 10-20km 15-25km | 15 | -14.77 | - | 50.5 50 | -58 | -65 |
| 79ch NTSC + 75ch QAM @ -6dB ⁽⁴⁾ 0-10km, 5-15km, 10-20km 15-25km | 79ch = 15 75ch QAM = 9 | -13.84 | 10 ⁻⁵ | 50 49 | -58 | -65 |
| 42ch CENELEC ⁽⁴⁾ 0-10km, 5-15km, 10-20km 15-25km | 17.75 | -14.77 | - | 50.5 50 | -58 | -65 |
| 60ch PAL ⁽⁴⁾ 0-10km, 5-15km, 10-20km 15-25km | 16.2 | -14.77 | - | 50.5 50 | -58 | -65 |
| JCTEA: 57ch Analog + 40ch QAM @ -10dB ⁽⁷⁾ 0-10km, 5-15km, 10-20km 15-25km | 57ch = 16.2 40ch QAM = 6.2 | -14.70 | - | 46 45 | -58 | -65 |
| JCTEA: 11ch Analog + 80ch QAM @ -10dB ⁽⁸⁾ 0-10km, 5-15km, 10-20km 15-25km | 11ch = 21.2 80ch QAM = 11.2 | -14.76 | - | 46 45 | -58 | -65 |

1. Test fiber length is based on the model. For example: 20km option is tested with 3m, 10km and 20km of SMF28 fiber; 25km option is tested with 3m, 15km and 25km of SMF28 fiber.
2. CNR may degrade **up** to 0.5dB over the operating temperature range.
3. CSO and CTB may degrade up to 1.5dB over the temperature range.
4. Test with EDFA, **-0dBm** received optical power.
5. QAM format = 256-QAM, ITU-T J.83 Annex C, Analog channels are modulated.
6. L-band input is injected with 2 tones, F1 = 2000MHz, F2 = 2000.5MHz with -13dBm/tone.
7. Test with EDFA, **-6dBm** received optical power, QAM format = 64-QAM. 2 tones, F1 = 2000MHz, F2 = 2000.5MHz, applied to L-Band port with -13dB/tone.
8. Test with EDFA, **-8dBm** received optical power, QAM format = 64-QAM. 2 tones, F1 = 2000MHz, F2 = 2000.5MHz, applied to L-Band port with -13dB/tone.

Selectable Fiber Length Option (DM8000-U-SEL):

| CATV 75Ω Input Option | RF Level/ch (dBmV) | Composite (dBm) | BER ⁽⁵⁾ | CNR ^(1,2) (dB) | CSO ^(1,3,6) (dBc) | CTB ^(1,3,6) (dBc) |
|--|--------------------------------|-----------------|--------------------|---------------------------|------------------------------|------------------------------|
| 79ch NTSC ⁽⁴⁾ 0 – 15km 15km – 25km 25km – 30km | 15 | -14.77 | - | 50.5 50 49 | -58 | -65 |
| 79ch NTSC + 75ch QAM @ -6dB ⁽⁴⁾ 0 – 15km 15km – 25km 25km – 30km | 79ch = 15 75ch QAM = 9 | -13.84 | 10 ⁻⁵ | 49.5 49 48.5 | -58 | -65 |
| 42ch CENELEC ⁽⁴⁾ 0 – 15km 15km – 25km 25km – 30km | 17.75 | -14.77 | - | 50.5 50 49 | -58 | -65 |
| 60ch PAL ⁽⁴⁾ 0 – 15km 15km – 25km 25km – 30km | 16.2 | -14.77 | - | 50.5 50 49 | -58 | -65 |
| JCTEA: 57ch Analog + 40ch QAM @ -10dB ⁽⁷⁾ 0 – 15km 15km – 25km 25km – 30km | 57ch = 16.2 40ch QAM = 6.2 | -14.70 | - | 46 45 44.5 | -58 | -65 |
| JCTEA: 11ch Analog + 80ch QAM @ -10dB ⁽⁸⁾ 0 – 15km 15km – 25km 25km – 30km | 11ch = 21.2 80ch QAM = 11.2 | -14.76 | - | 46 45 44.5 | -58 | -65 |

1. Test fiber is SMF28.
2. CNR may degrade **up** to 0.5dB over the operating temperature range.
3. CSO and CTB may degrade up to 1.5dB over the temperature range.
4. Test with EDFA, **-0dBm** received optical power.
5. QAM format = 256-QAM, ITU-T J.83 Annex C, Analog channels are modulated.
6. L-band input is injected with 2 tones, F1 = 2000MHz, F2 = 2000.5MHz with -13dBm/tone.
7. Test with EDFA, **-6dBm** received optical power, QAM format = 64-QAM. 2 tones, F1 = 2000MHz, F2 = 2000.5MHz, applied to L-Band port with -13dB/tone.
8. Test with EDFA, **-8dBm** received optical power, QAM format = 64-QAM. 2 tones, F1 = 2000MHz, F2 = 2000.5MHz, applied to L-Band port with -13dB/tone.

Package Characteristics

| Parameter | Dimension | Unit |
|-----------|---------------------------------|------|
| Height | 1.72, 1RU | Inch |
| Width | 19 | Inch |
| Depth | 14.617 with fans and connectors | Inch |
| Weight | 8.5 | lbs |

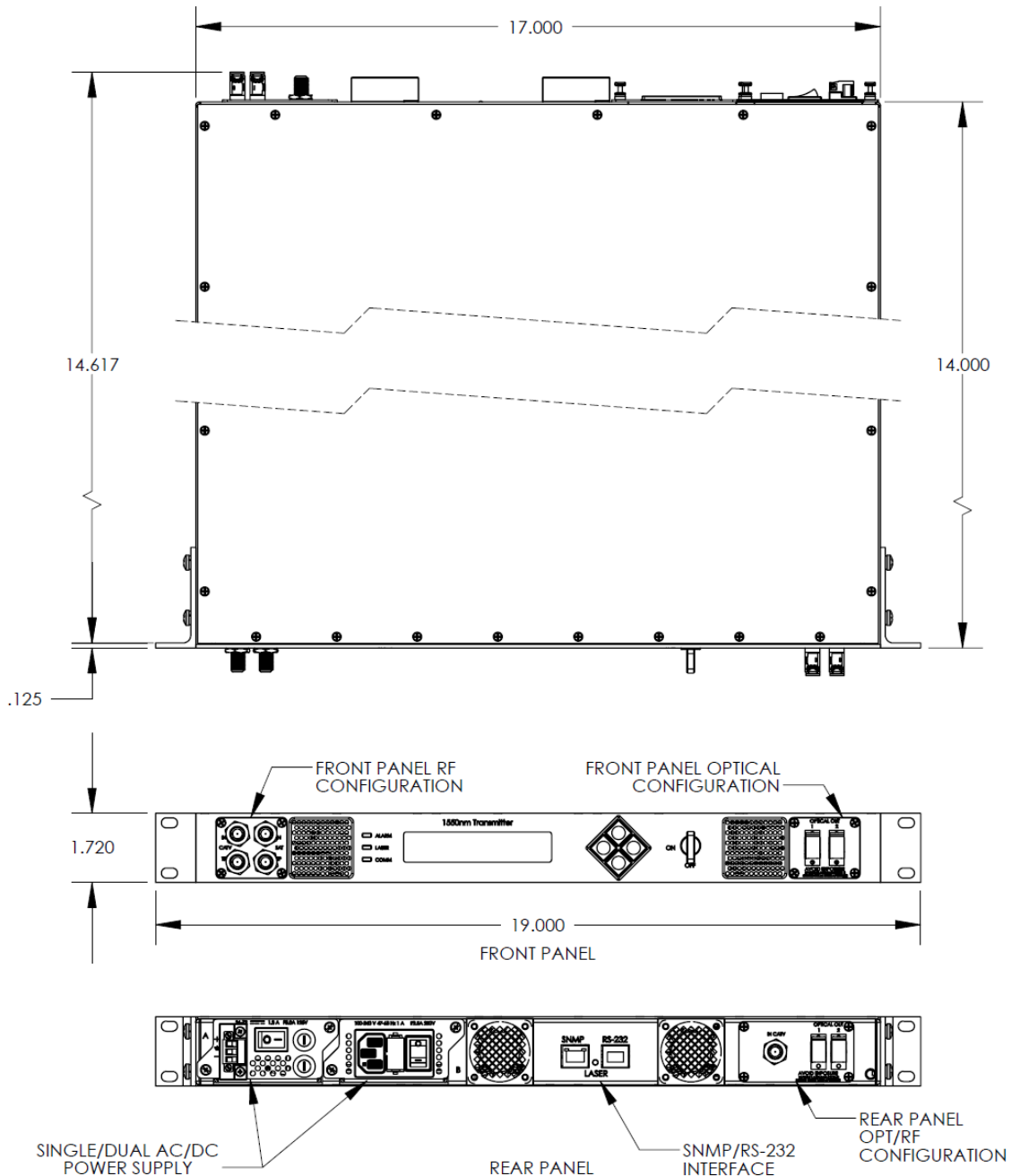
ITU Channel Numbering

| Channel | Wavelength |
|---------|------------|
| 62 | 1527.99 |
| 61 | 1528.77 |
| 60 | 1529.55 |
| 59 | 1530.33 |
| 58 | 1531.12 |
| 57 | 1531.90 |
| 56 | 1532.68 |
| 55 | 1533.47 |
| 54 | 1534.25 |
| 53 | 1535.04 |
| 52 | 1535.82 |
| 51 | 1536.61 |
| 50 | 1537.40 |
| 49 | 1538.19 |
| 48 | 1538.98 |

| Channel | Wavelength |
|---------|------------|
| 47 | 1539.77 |
| 46 | 1540.56 |
| 45 | 1541.35 |
| 44 | 1542.14 |
| 43 | 1542.94 |
| 42 | 1543.73 |
| 41 | 1544.53 |
| 40 | 1545.32 |
| 39 | 1546.12 |
| 38 | 1546.92 |
| 37 | 1547.72 |
| 36 | 1548.51 |
| 35 | 1549.32 |
| 34 | 1550.12 |
| 33 | 1550.92 |

| Channel | Wavelength |
|---------|------------|
| 32 | 1551.72 |
| 31 | 1552.52 |
| 30 | 1553.33 |
| 29 | 1554.13 |
| 28 | 1554.94 |
| 27 | 1555.75 |
| 26 | 1556.56 |
| 25 | 1557.36 |
| 24 | 1558.17 |
| 23 | 1558.98 |
| 22 | 1559.79 |
| 21 | 1560.61 |
| 20 | 1561.42 |
| 19 | 1562.23 |
| 18 | 1563.05 |

Outline Drawing (dimensions are in inches)



Ordering Information – Model Number Options

DM8000-U-vvv-www-xxx-yy-zzz-aa-pp

Fiber Length

vvv = 010, 0 – 10km, fixed fiber length, CSO is optimized at 5km

vvv = 015, 5 – 15km, fixed fiber length, CSO is optimized at 10km

vvv = 020, 10 – 20km, fixed fiber length, CSO is optimized at 15km

vvv = 025, 15 – 25km, fixed fiber length, CSO is optimized at 20km

vvv = SEL, Selectable fiber length, CSO is optimized at the selected fiber length

CATV Channel Plan

www = 079, 79ch NTSC

www = 79Q, 79ch NTSC + 75ch QAM (256QAM format)

www = 042, 42ch CENELEC

www = 060, 60ch PAL

www = 11J, JCTEA, 11ch Analog + 80ch QAM (64QAM format)

www = 57J, JCTEA, 57ch Analog + 40ch QAM (64QAM format)

Input Option

xxx = C75, CATV input only.

xxx = L75, CATV input + 75Ω L-band input

ITU Grid Wavelength (Consult the factory for the available ITU)

See **Appendix 1.0** for the standard list of wavelengths.

yy = 00, Non-ITU grid

yy = 21, Channel 21, 1560.61 nm

.....

yy = 40, Channel 40, 1545.32 nm

Optical Output Option

zzz = 110: Single Optical Output, 10dBm (10mW)

zzz = 107: Single Optical Output, 7dBm (5mW)

Optical Connector

aa = FA, FC/APC

aa = SA, SC/APC

aa = E2, E2000/APC

Power Supply

pp = AA: Dual AC Power Supply

zz = AD: One AC and One DC Power Supply

zz = DD: Dual DC Power Supply

Example:

DM8000-U-010-079-L75-21-107-SA-AA, 1550nm DFB direct modulation transmitter, 0 to 10km, 79ch NTSC, CATV input + 75 ohm L-band input, ITU ch21, single output 7dBm, SC/APC connector, dual AC power supply

Laser Safety Information

This product meets the appropriate standard in Title 21 of the Code of Federal Regulations (CFR). FDA/CDRH Class IIIb laser product. A supplemental FDA application has been filed and it is anticipated that the accession number for this product will be 0220309 since this accession number is from a similar product family.

Single-mode fiber pigtail with SC/APC connectors (standard).

Wavelength = 1.5 μm .

Maximum power = 30 mW.

Caution: Use of controls, adjustments and procedures other than those specified herein may result in hazardous laser radiation exposure.

