

Constellation™

point-to-point

digital radio

**NEW! More
High System
Gain Options
and a 4xDS3
Interface!**

Constellation is a scalable low, medium, and high capacity digital radio that provides reliable transport from 8xDS1 to OC3, OC3c, 3xDS3 and STS3. Save money and shelter space with Constellation's new 4xDS3 interface, which provides greater capacity in the same footprint. This new interface is backwards-compatible, enabling operators to perform field upgrades and add another DS3 without adding another radio.

Constellation's interfaces offer a high system gain option, which lowers cost for additional antennas and monthly tower space rentals, and achieves greater path reliability. The high system gain option has been expanded to include 16xDS1 and 28xDS1/1xDS3 interfaces, giving even more network planning flexibility.

Designed for high-performance, low-cost networking applications, Constellation is the ideal solution for wireless carrier and private network operators. It is an affordable, flexible, compact and reliable package featuring convenient and robust operation, fast installation and easy maintenance.

Constellation provides the capability for field upgrades from low to high capacity. The 3xDS3 arrangement offers an optional 2xDS3 + 28xDS1 interface with an integrated multiplexer, providing DS1 access from a DS3 at terminals and add/drop repeaters with no need for external M13 multiplexers. The 4xDS3 arrangement offers an



optional 3xDS3 + 28xDS1 interface with Constellation's integrated multiplexer.

Antenna coupling unit options offer a wide variety of optimal RF transmission architectures as well as expansion ports that easily accommodate parallel paths for capacity expansion.

A rich feature set delivers maximum system gain, superior T/I values to facilitate frequency coordination, protection from far-end transmitter and antenna feeder system degradations through reverse channel switching, and security from fading effects and module degradations using powerful FEC, adaptive time domain and slope amplitude equalizers.

Flexible, versatile monitoring and control is provided through an embedded SNMP agent that is compatible with Harris' NetBoss, StarView and FarScan platforms. An easy-to-use craft interface is provided for convenient operation via a user's laptop computer or an optional keypad, allowing full network visibility to card level from a single site. Maintenance tasks are simplified with remote software download and inventorying capability, and easy module replacement with redundant configuration storage.



Interfaces

- 8/16/28 DS1 (integrated multiplexer), 1xDS3
- Multi-mode OC3, OC3c, STS3
Transmit -14 to -19 dBm; Receive -14 to -30 dBm
Center Wavelength = 1300 nm
Path Length up to 2 Km
Complies with FDDI PMD ATM/SONET standards
- Single-mode OC3, OC3c, STS3
Transmit -8 to -15 dBm; Receive -7 to -34 dBm
Center Wavelength = 1300 nm
Path length up to 15 Km
Complies with Bellcore (SONET OC3 / IR-1) and ITU-T G.957 STM1 / S.1.1
- 3xDS3, 2xDS3+28xDS1 (integrated multiplexer or ADM) arrangements.
- **NEW!** 4xDS3, 3xDS3 + 28xDS1.
- DS1 wayside channel for OC3, OC3c, STS3, 3xDS3, 2xDS3+28xDS1.

Standard Features

- Common platform for upgrade paths from 4xDS1 to OC3, 3xDS3, 4xDS3... no stranded investment.
- Auto-DADE... main and space diversity receiver signal delays are automatically equalized up to a diversity antenna spacing of 150 feet.
- Automatic Transmit Power Control (ATPC) facilitates coordination in high-density environments. ~2.5 to 10 dB ATPC range.
- Software Programmable Output Power Level: Local PA power adjustment via keypad... operate up to 10 dB below rated power with no need for attenuation pads
- Synthesized RF sources simplify sparing.
- Remote inventory management capability and software download.
- Both system and tributary BER measurement capability.
- Easy module replacement with redundant configuration storage.
- Individual DS1's programmable for line coding and line length.
- Eight programmable alarm dry contact relay outputs and eight opto-isolated alarm inputs.
- ACU expansion port accommodates parallel paths
- Standard interfaces for OEM equipment.

Optional Features

- High System Gain Option for OC3, 3xDS3, 2xDS3+28xDS1, 4xDS3, 3xDS3 + 28xDS1.
- **NEW!** High System Gain Option for 16xDS1, 28xDS1, 1xDS3.
- Paperless Chart Recorder diagnostic tool... tracks radio performance data versus time and presents it in a graphical format.
- Repeater with integrated ADM (to 16xDS1), 8/16/28xDS1 radios.
- Service Channel: 1 VF Orderwire and 1 Data Channel
- Space/frequency/hybrid diversity and "split transmitter" options.
- Keypad (VT-100 compatible).

Benefits

- Common platform provides field upgrade path from 8xDS1 through to 4xDS3.
- Optional repeater with integrated add/drop multiplexer; up to 16 x DS1 per direction for 8/16/28xDS1.
- Integrated add/drop multiplexer with 1:N protection.
- Open network management (SNMP and FarScan) interfaces.
- Easy maintenance, low investment in test equipment.
- Easy-to-use craft interface via laptop or optional; keypad, allowing full network visibility to card level from a single site.
- Antenna coupling unit expansion port allows addition of radios on existing antenna feeder systems.

NEW! 4xDS3 Interface

- No need for another radio to add the next DS3.
- Greater value for investment at new installations with more capacity in the same footprint.
- All Constellation radios can be upgraded. The fourth DS3 is accessed through an existing BNC connector on backplane.
- Perform a cost-effective capacity upgrade in the field simply by swapping components.
- 3xDS3 + 28xDS1 interface with integrated add/drop multiplexer.

Network Management Interfaces

- SNMP, FarScan, NetBoss, StarView, handheld keypad, dry contact alarms.

Recommended Test Equipment

- Digital multimeter (to test battery voltage and align antenna).
- Frequency counter (to adjust frequency of Tx or Rx).
- Power meter and power sensor (to check Tx power output).

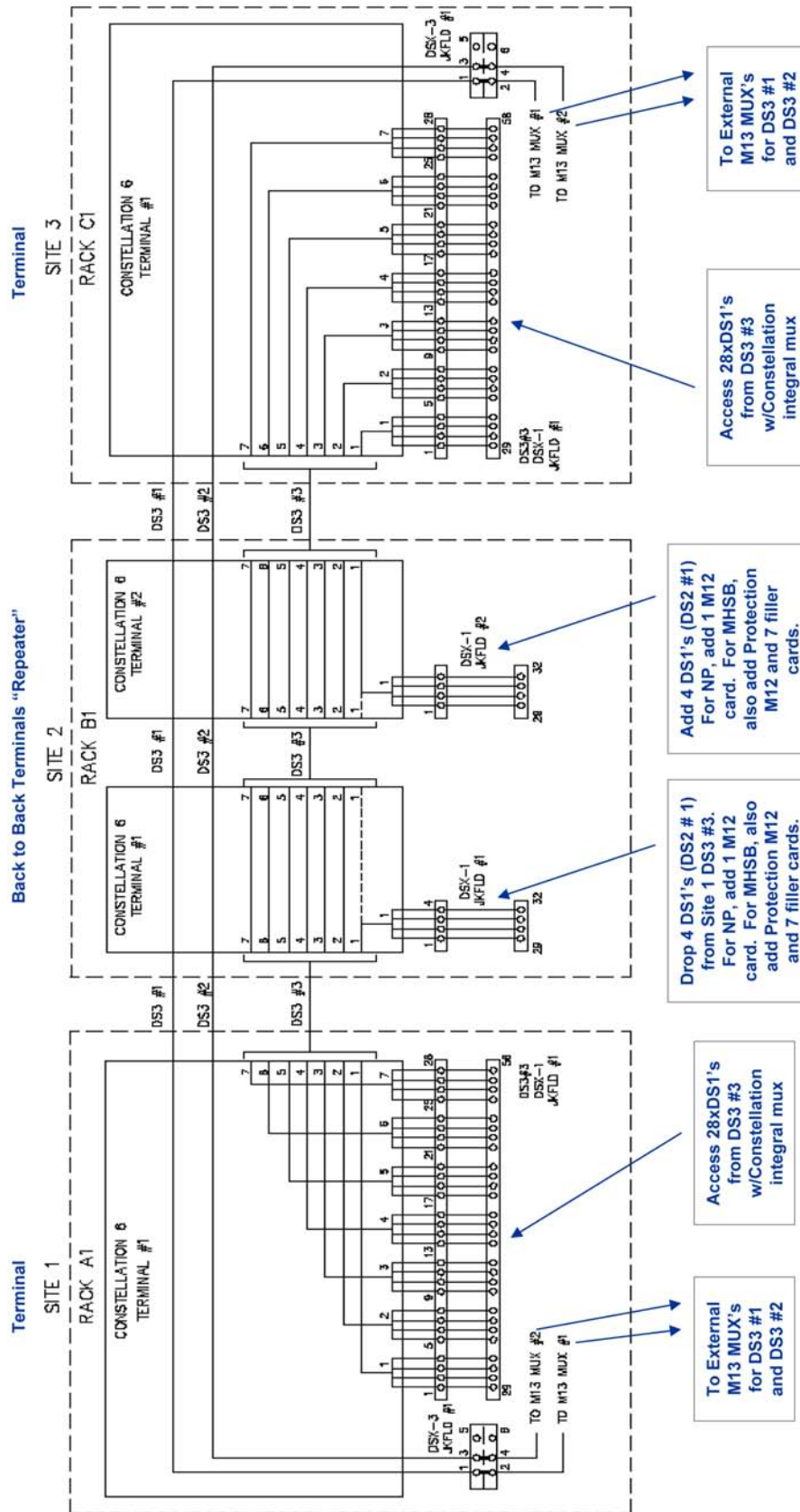
Convenient 2(or 3)xDS3 + 28xDS1 Interface

3xDS3 radio provides 2xDS3 + 28xDS1 interface by simply adding M12 cards. Select any one of the 3xDS3s for access to 28xDS1s. Similarly, 4xDS3 radio provides 3xDS3 + 28xDS1 interface, with any one of the first 3xDS3s selectable for access to 28xDS1s. No external M13 MUX is required. The same DS3 does not have to be selected from site to site.

An add-drop mode is provided in a back-to-back terminal arrangement. Features include:

- Up to 16 DS1s can be added/dropped in DS2 groups of 4 DS1s.
- The DS3 that is selected for add/drop is interconnected at the DS3 level. All non-dropped DS1s are passed through in the DS3.
- M12 cards are used only for DS1s that are added/dropped. The M12 Cards are 1:N protected.
- Non-dropped DS1s can pass through up to 8 consecutive add/drop hops before they are required to drop.
- DS3s can pass through 15 hops before they are required to drop.

2xDS3 + 28xDS1... Example Traffic Plan



M12 Cards are required only when DS1's are added or dropped!

No external M13 mux required!

A different DS3 can be selected from site to site!

Similarly, 4xDS3 provides add/drop capability for the first three DS3 channels.

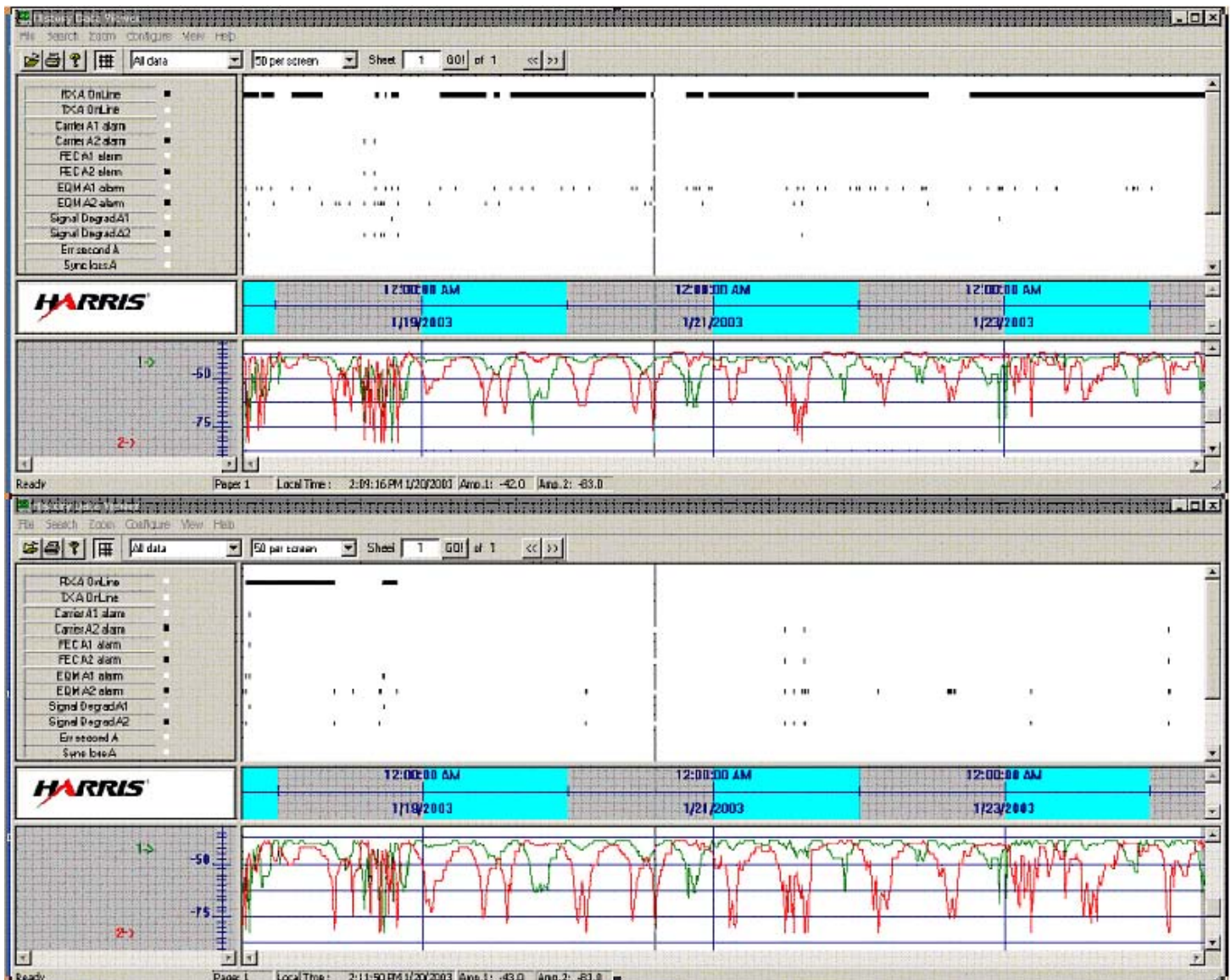
Optional Paperless Chart Recorder

Constellation's Paperless Chart Recorder (PCR) Option displays main (A1) and diversity or hot-standby (A2) receiver RSL's (receive signal levels) as well as alarm, Tx/Rx switching activity, and DS1/OC-3 tributary performance (ES, SES outage) history. Registers in Constellation's SPU Controller card store this data over weeks and months.

The PCR Data Loader program uploads these continuously collected data from each SPU Controller card at the radio or remotely from any site in a contiguous network. The PCR History Data Viewer can exhibit "All Data" over the current PCR data collection period, as seen below, or it can exhibit data for smaller time periods, such as a 1- or 2-day, a 1-, 3-, or 12-hour, or a 1- or 15-minute screen display along with A1 and A2 receiver RSL's for a much more detailed and exacting examination.

PCR is a powerful diagnostic tool that collects and displays each receiver's FEC, modem, signal degrade, and eye quality alarms, transmitter switching (on-line) due to RCS (reverse channel switch) and keypad commands, errorless receiver data switching (on line), and DS1 or OC-3 error performance (ES and SES outages). These events are easily correlated with selective, flat, and dispersive (spectrum-distorting) fade activity, interference, maintenance activity, and module behavior for total visibility over each Constellation link.

Following are two PCR History Data Viewer screens showing "All Data" (about 1 week) of main (A1) and diversity (A2) receiver fade activity, alarms, errorless data switching, and tributary DS1 errored seconds (0) and SES outages (0) uploaded from each direction of a heavy fading Constellation 10 GHz overwater link.



Regulatory Information

Jurisdiction	Frequency Range ¹ (MHz)	Channel Bandwidth Plans (MHz)
FCC	5925-6425 6525-6875 10550-10680 10700-11700	3.75, 5, 10, 30 3.75, 5, 10, 30 (3x10) 3.75, 5 3.75, 5, 10, 30, 40
Industry Canada	5850-5915 5925-6925 6425-6930 7125-7725 7725-8275 10550-10680 10700-11700	5, 10 (GL-34) 30 (SRSP 305.9) 10, 30 (SRSP 306.4) 5, 10, 30 ² (SRSP 307.1) 10, 30 (SRSP 307.7) 5 (SRSP 310.5) 30, 40 (SRSP 310.7)

¹ For radios covering U.S. Government bands, contact Harris.

² 30 MHz channels and frequency diversity permitted for electrical utilities.

FCC Information

Frequency Band	Capacity	Emission Designator	Equipment ID
6 GHz	8xDS1 16xDS1 28xDS1 3xDS3, OC-3 4xDS3	3M75D7W 5M0D7W 10M0D7W 30M0D7W 30M0D7W	HRS-CX-06G08D1 HRS-CX-06G16D1 ³ HRS-CX-06G28D1 ³ HRS-CX-06G155M ³ HRS-CX-06G4DS3 ³
7/8 GHz	8xDS1 16xDS1 28xDS1 3xDS3, OC-3 4xDS3	3M75D7W 5M0D7W 10M0D7W 30M0D7W 30M0D7W	HRS-CX-07G08D1 HRS-CX-07G16D1 ³ HRS-CX-07G28D1 ³ HRS-CX-07G155M ³ HRS-CX-07G4DS3 ³
10 GHz	8xDS1 16xDS1	3M75D7W 5M0D7W	HRS-CX-10G08D1 ³ HRS-CX-10G16D1 ³
11 GHz	8xDS1 16xDS1 28xDS1 3xDS3, OC-3 4xDS3	3M75D7W 5M0D7W 10M0D7W 30M0D7W 30M0D7W	HRS-CX-11G08D1 HRS-CX-11G16D1 ³ HRS-CX-11G28D1 ³ HRS-CX-11G155M ³ HRS-CX-11G4DS3 ³

For High System Gain Option, add "-H" to Equipment ID (for example, for 6 GHz: HRS-CX-06G155M-H)

Standards Compliance

- ANSI asynchronous interface standards
- FCC Part 15 standards, Subpart B for Class A devices

Thermal and Environmental Characteristics

DC Power: 22-60 Vdc, top of rack (wide mouth, auto polarity)

Thermal Ambience

Operating Temperature Range: 0 to +50° C

Storage and Transportation: -40 to +65° C

Humidity: to 95% non-condensing

Altitude: 0 to 5000 meters, AMSL

Power Consumption^{3,4}

Terminal (Watts)	6, 7/8 GHz		10/11 GHz	
	24V	48V	24V	48V
Non-protected (NP)	205	180	225	215
NP, Space Diversity Rx	315	270	360	335
Fully Protected	405	360	450	425

Measured values. 8/16/28 x DS1 repeater power consumption = 2 x terminal power consumption, less 5%. Add 3.5 W per M12 card. DS3, OC3, 3 or 4xDS3 use back-to-back terminals.

⁴ For the OC3, 3 or 4xDS3 high system gain option, add 4 watts per transmitter.

RF Bandwidth Efficiencies

Capacity	Channel BW	Modulation	Efficiency
155 (OC-3, 3xDS3, 2xDS3+28xDS1) ¹	30 MHz	128 TCM w/FEC	5.75 b/s/Hz ²
180 (4xDS3, 3xDS3+28xDS1)	30 MHz	256 TCM w/FEC	6.58 b/s/Hz ³
28 x DS1, DS3	10 MHz	64 QAM w/FEC	4.8 b/s/Hz
16 x DS1	5 MHz	128 QAM w/FEC	5.6 b/s/Hz
8 x DS1	3.75 MHz	32 QAM w/FEC	3.8 b/s/Hz

¹ With 1 DS1 wayside channel

² 172.56 Mbit/s data rate into a 30 MHz RF channel

³ 197.42 Mbit/s data rate into a 30 MHz RF channel

Radio Performance Specifications

Frequency Stability: ±0.0003%

Residual BER: <10⁻¹² per hop

Receiver Overload at 10⁻⁶: **6 GHz** -17 dBm **7/8 GHz** -17.5 dBm **10/11 GHz** -18.5 dBm

Dispersive Fade Margin: **10⁻³ BER** **T/I, dB**^{5,6}

8 x DS1	71.5 dB	25, -12
16 x DS1	68.5 dB	33, -4
16 x DS1 High Gain	61.0 dB	33, -4
28 x DS1, DS3	65.5 dB	29, -5
28 x DS1 High Gain	68.0 dB	29, -5
155 (OC3, 3xDS3)	50.0 dB	31, -14
180 (4xDS3)	45.0 dB	34, -11

⁵ Like interference for co-, adjacent channel

⁶ For T/I curves, see the SAI manual at <http://premier.harris.com/microwave>

Mechanical Dimensions⁷

	Height	Depth	Width
Terminal	24.5 in (622 mm)	11.8 in (300 mm)	Mounts in a standard 19" rack.
8/16/28 x DS1 repeaters	47.25 in (1200 mm)	11.8 in (300 mm)	

⁷ Dimensions include branching circulators, fully-configured ACU

Unless otherwise indicated, performance specifications given here are typical and apply to transmitters and receivers connected back-to-back, and must be confirmed before they become applicable to any specific system, contract or order.

Transmission Engineering Parameters ⁸

(For non-protected systems, measured at the antenna port)

TX Output (Guaranteed values set at factory and recommended for path calculations.)		8 x DS1		16 x DS1				28 x DS1, 1 x DS3				OC3, 3 x DS3				4 x DS3			
		NP	HS	NP		HS		NP		HS		NP		HS		NP		HS	
		Std Gain		Std Gain	High Gain	Std Gain	High Gain	Std Gain	High Gain	Std Gain	High Gain	Std Gain	High Gain	Std Gain	High Gain	Std Gain	High Gain	Std Gain	High Gain
6 GHz	Tx Output (dBm)	29.5	29.1	28.5	29.3	28.1	28.9	29.0	30.3	28.6	29.9	29.0	31.5	28.6	31.1	29.0	31.0	28.6	30.6
	Rx Input (dBm) 10 ⁻³ BER	-83.5	-82.5	-77.0	-79.0	-76.0	-78.0	-77.0	-79.5	-76.0	-78.5	-73.5	-73.5	-72.5	-72.5	-70.0	-70.0	-69.0	-69.0
	Rx Input (dBm) 10 ⁻⁶ BER	-82.0	-81.0	-75.5	-78.0	-74.5	-77.0	-75.5	-78.5	-74.5	-77.5	-72.0	-72.0	-71.0	-71.0	-69.0	-69.0	-68.0	-68.0
	System Gain (dB) 10 ⁻³ BER	113.0	111.6	105.5	108.3	104.1	106.9	106.0	109.8	104.6	108.4	102.5	105.0	101.1	103.6	99.0	101.0	97.6	99.6
	System Gain (dB) 10 ⁻⁶ BER	111.5	110.1	104.0	107.3	102.6	105.9	104.5	108.8	103.1	107.4	101.0	103.5	99.6	102.1	98.0	100.0	96.6	98.6
7/8 GHz	Tx Output (dBm)	27.5	27.1	26.5	27.0	26.1	26.6	27.0	28.0	26.6	27.6	27.5	30.0	27.1	29.6	27.5	30.0	27.1	29.6
	Rx Input (dBm) 10 ⁻³ BER	-82.5	-81.6	-76.0	-78.0	-75.1	-77.1	-76.0	-78.5	-75.1	-77.6	-73.0	-73.0	-72.2	-72.2	-69.5	-69.5	-68.7	-68.7
	Rx Input (dBm) 10 ⁻⁶ BER	-81.0	-80.1	-74.5	-77.0	-73.6	-76.1	-74.5	-77.5	-73.6	-76.6	-71.5	-71.5	-70.7	-70.7	-68.5	-68.5	-67.7	-67.7
	System Gain (dB) 10 ⁻³ BER	110.0	108.7	102.5	105.0	101.2	103.7	103.0	106.5	101.7	105.2	100.5	103.0	99.3	101.8	97.0	99.5	95.8	98.3
	System Gain (dB) 10 ⁻⁶ BER	108.5	107.2	101.0	104.0	99.7	102.7	101.5	105.5	100.2	104.2	99.0	101.5	97.8	100.3	96.0	98.5	94.8	97.3
10/11 GHz	Tx Output (dBm)	26.0	25.6	24.5	25.5	24.1	25.1	25.0	26.5	24.6	26.1	25.0	28.5	24.6	28.1	25.0	28.5	24.6	28.1
	Rx Input (dBm) 10 ⁻³ BER	-82.5	-81.5	-76.0	-78.0	-75.0	-77.0	-76.0	-78.5	-75.0	-77.5	-72.5	-72.5	-71.5	-71.5	-69.0	-69.0	-68.0	-68.0
	Rx Input (dBm) 10 ⁻⁶ BER	-81.0	-80.0	-74.5	-77.0	-73.5	-76.0	-74.5	-77.5	-73.5	-76.5	-71.0	-71.0	-70.0	-70.0	-68.0	-68.0	-67.0	-67.0
	System Gain (dB) 10 ⁻³ BER	108.5	107.1	100.5	103.5	99.1	102.1	101.0	105.0	99.6	103.6	97.5	101.0	96.1	99.6	94.0	97.5	92.6	96.1
	System Gain (dB) 10 ⁻⁶ BER	107.0	105.6	99.0	102.5	97.6	101.1	99.5	104.0	98.1	102.6	96.0	99.5	94.6	98.1	93.0	96.5	91.6	95.1

⁸ For guaranteed values for path calculations, reduce typical specifications by 1 dB/dBm

