



Datasheet

IP-50C

Rev A.11 | May 2020

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Note: For feature availability, check the Release Notes for the CeraOS version you are using.

Radio

Supported Frequency Range

6-42 GHz

Radio Configurations

1+0 up to 4+0 Single/Dual Polarization, 1+1/2+2 HSB, 1+1/2+2 HSB-SD, 2+0 XPIC, 2x2+0 East/West Single/Dual Polarization

Radio Features

Enhanced Multi-Carrier ABC (up to 2+0)

Protection: 1+1 HSB/2+2 HSB, 1+1 HSB-SD

High spectral utilization: BPSK to 4096 QAM w/ACM

Channel bandwidth: 14 to 224 MHz

XPIC

2x2/4x4 LoS MIMO

Advanced Frequency Reuse (AFR)

Advanced Space Diversity (ASD)

Dualband (with IP-50C, IP-20S, IP-20C, third-party MW radio)

Multiband (with IP-20E or IP-50E)

Ethernet

Ethernet Interfaces

Port 1:

- DC Port

Port 2:

- RJ-45 - Electric MultiRate 1/10 Gbps traffic interface/PoE port

Port 3:

- SFP – 1/2.5G Dualband port

Port 4:

- SFP – 1/10GE traffic interface/MIMO extension port (SFP+)

Port 5:

- SFP – 1/10GE traffic interface (SFP+)

Port 6:

- RJ-45 – Management/Protection interface - 100 Base-T

Notes: SFP and SFP+ devices must be of industrial grade (-40°C to +85°C, -40°F to +185°F)

Ethernet Features

MTU – 9612 Bytes

Up to 1024 Ethernet services, plus one pre-defined management service

MAC address learning with 64K MAC addresses

Quality of Service:

- Multiple Classification criteria (VLAN ID, P-bits, IPv4 DSCP, IPv6 TC, MPLS EXP)
- 8 CoS queues per port
- Deep buffering (configurable up to 64 Mbit per queue)
- WRED
- P-bit marking/remarking

VLAN add/remove

Y.1731 Ethernet OAM

Y.1731 Ethernet Bandwidth Notification (ETH-BN)

Y.1731 Ethernet Bandwidth Notification (EBN)

Management Protocols

SNMP

REST

SDN Support:

- NETCONF/YANG

Synchronization Protocols

Enhanced Ethernet Equipment Clock (eEEC) Specification (G.8262.1)

PTP Telecom Boundary Clock (T-BC) and Time Slave Clock (T-TSC) Specification (G.8273.2)

PTP Telecom Transparent Clock (T-TC) Specification (G.8273.3)

Enhanced SyncE Network Limits (G.8261, clause 9.2.1)

Enhanced PTP Network Limits (G.8271.1)

Ethernet Synchronization Messaging Channel (ESMC) (G.8264, clause 11)

PTP Telecom Profile for Time (Full Timing Support) (G.8275.1)



Standards

MEF

Carrier Ethernet 2.0 (CE 2.0)

Supported Ethernet Standards

10/100/1000base-T/X (IEEE 802.3)

Optical 10Gbase-X (IEEE 802.3)

Ethernet VLANs (IEEE 802.3ac)

Virtual LAN (VLAN, IEEE 802.1Q)

Class of service (IEEE 802.1p)

Provider bridges (QinQ – IEEE 802.1ad)

Link aggregation (IEEE 802.3ad)

Auto MDI/MDIX for 1000baseT

RFC 1349: IPv4 TOS

RFC 2474: IPv4 DSCP

RFC 2460: IPv6 Traffic Classes

Security

Secured protocols:

- HTTPS
- SNMPv3
- SSH
- SFTP

RADIUS authentication and authorization

TACACS+ Authentication, Authorization, and Accounting (session-based)

Standards Compliance

Radio Spectral Efficiency: EN 302 217-2-2

EMC: EN 301 489-1, EN 301 489-4, Class B (Europe), FCC 47 CFR, part 15, class B (US), ICES-003, Class B (Canada), TEC/EMI/TEL-001/01, Class B (India)

Surge: EN61000-4-5, Class 4 (for PWR and ETH1/PoE ports)

Safety: EN 60950-1, IEC 60950-1, UL 60950-1, CSA-C22.2

No.60950-1, EN 60950-22, UL 60950-22, CSA C22.2.60950-22

Storage: ETSI EN 300 019-1-1 Class 1.2

Transportation: ETSI EN 300 019-1-2 Class 2.

Technical Specifications

Mechanical Specifications

Dimensions (Direct Mount HW) –

322mm(H), 227/270mm(W), 86mm(D), 6kg

12.67”(H), 8.93”/10.62”(W), 3.38”(D), 13.2 lbs.

Pole Diameter Range (for Remote Mount Installation)

8.89cm – 11.43cm; 3.5” – 4.5”

Environmental Specifications

-33°C to +55°C (-45°C to +60°C extended)

-27°F to +131°F (-49°F to +140°F extended)

Power Input Specifications

Standard Input: -48 VDC

DC Input range: -40.5 to -60 VDC

Power Consumption Specifications

Active (Multicore operation) – 90W

PoE Injector Mechanical Specifications

Dimensions – 134mm(H), 190mm(W), 62mm(D), 1 kg

PoE Injector Environmental Specifications

-33°C to +55°C (-45°C to +60°C extended)

PoE Injector Power Input Specifications

Standard Input: -48 or +24 VDC (Optional)

DC Input range: $\pm(18/40.5$ to 60) VDC (+18VDC extended range is supported as part of the nominal +24VDC support)

PoE Injector Interfaces

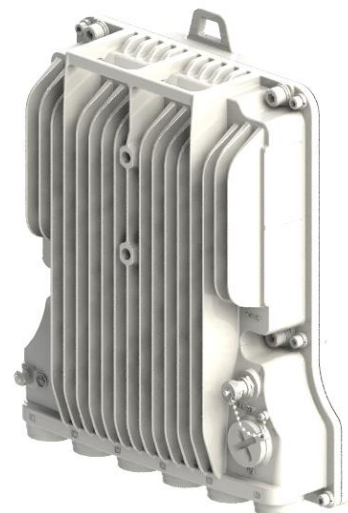
GbE Data Port supporting 10/100/1000Base-T

Power-Over-Ethernet (PoE) Port

DC Power Port –40V to -60V (a PoE supporting two redundant DC feeds each supporting $\pm(18-60)$ V is available)

Product Images

IP-50C



Radio Specifications

Capacity [Mbps]

Modulation	14 MHz	20 MHz	25 MHz	28/30 MHz	40 MHz
BPSK	6-8	11-13	14-18	18-23	25-33
QPSK	16-21	25-30	32-42	39-51	54-70
8 QAM	26-34	38-47	49-65	58-76	81-107
16 QAM	37-48	54-66	68-89	83-109	112-147
32 QAM	50-65	72-88	91-119	110-144	149-195
64 QAM	62-81	89-109	113-147	136-179	183-240
128 QAM	75-98	108-133	136-178	165-216	223-292
256 QAM	86-113	124-151	156-204	190-249	239-314
512 QAM	95-125	135-165	172-225	203-265	263-344
1024 QAM Strong	101-132	144-176	183-240	221-289	298-391
1024 QAM Light	107-141	153-187	195-255	234-307	317-415
2048 QAM	–	–	209-274	256-335	343-449
4096 QAM	–	–	226-296	273-357	363-475
	50 MHz	56/60 MHz	80 MHz	112 MHz	
BPSK	33-40	39-52	54-70	78-103	
QPSK	68-83	83-108	110-144	161-211	
8 QAM	106-130	122-160	157-205	240-315	
16 QAM	145-177	170-223	225-294	328-429	
32 QAM	183-224	225-295	296-388	432-566	
64 QAM	237-290	277-363	363-475	531-695	
128 QAM	277-339	335-439	429-562	642-841	
256 QAM	329-402	388-508	495-648	734-962	
512 QAM	357-437	417-546	544-712	797-1044	
1024 QAM Strong	389-475	454-594	592-775	865-1133	
1024 QAM Light	413-505	482-632	628-823	919-1203	
2048 QAM	446-545	523-684	665-871	991-1298	
4096 QAM	460-596	538-704	–	–	

Transmit Power [dBm]

Notes: The values listed in this section are typical. Actual values may differ in either direction by up to 1 dB.

Modulation	Frequency (GHz)	6	7	8	11	13	15	18	23	26	28-32	38	42
BPSK – QPSK		29	27	27	29	27	24	24	24	24	21	22	15
8 QAM		29	27	27	29	27	24	24	24	24	21	22	15
16 QAM		29	27	27	29	26	24	24	24	24	20	21	14
32 QAM		28	26	26	29	25	24	24	24	24	19	21	13
64 QAM		28	26	26	27	24	24	23	24	24	19	20	13
128 QAM		27	26	26	26	23	24	23	24	24	19	20	13
256 QAM		27	26	26	25	22	22	23	23	23	17	19	11
512 QAM		27	25	25	25	22	22	22	22	22	17	19	11
1024 QAM		25	24	24	24	20	20	21	21	21	16	18	10
2048 QAM		25	24	24	23	19	20	20	20	20	15	18	9
4096 QAM		23	22	22	22	17	18	19	19	19	–	17	–



Receive Level Threshold [dBm@10E-6]

14 MHz	Frequency	6	7-8	10	11	13	15	18	23	24	26	28-31	32	38	42
BPSK		-91.5	-91.0	-90.5	-91.5	-90.5	-89.5	-91	-90.0	-89.5	-89.5	-89.5	-89.0	-89.0	-88.5
QPSK		-90.5	-90.0	-89.5	-90.5	-89.5	-88.5	-90	-89.0	-88.5	-88.5	-88.5	-88.0	-88.0	-87.5
8 PSK		-84.5	-84.0	-83.5	-85.5	-83.5	-82.5	-84	-83.0	-82.5	-82.5	-82.5	-82.0	-82.0	-81.5
16 QAM		-83.5	-83.0	-82.5	-83.5	-82.5	-81.5	-83	-82.0	-81.5	-81.5	-81.5	-81.0	-81.0	-80.5
32 QAM		-80.5	-79.5	-79.5	-80.5	-79.0	-78.5	-79.5	-79.0	-78.5	-78.5	-78.0	-78.0	-77.5	-77.0
64 QAM		-77.5	-76.5	-76.5	-77.0	-76.0	-75.5	-76.5	-76.0	-75.5	-75.5	-75.0	-75.0	-74.5	-74.0
128 QAM		-74.0	-73.5	-73.0	-74.0	-73.0	-72.0	-73.5	-72.5	-72.0	-72.0	-72.0	-71.5	-71.5	-71.0
256 QAM		-71.5	-70.5	-70.5	-71.0	-70.0	-69.5	-70.5	-69.5	-69.0	-69.5	-69.0	-69.0	-68.5	-68.0
512 QAM		-68.5	-68.0	-67.5	-68.5	-67.5	-66.5	-68.0	-67.0	-66.5	-66.5	-66.5	-66.0	-66.0	-65.5
1024 QAM Strong		-65.5	-65.0	-64.5	-65.5	-64.5	-63.5	-65.0	-64.0	-63.5	-63.5	-63.5	-63.0	-63.0	-62.5
1024 QAM Light		-65.0	-64.0	-64.0	-64.5	-63.5	-63.0	-64.0	-63.5	-63.0	-63.0	-62.5	-62.5	-62.0	-61.5
20 MHz															
BPSK		-91.5	-91.5	-91.0	-92.0	-91.0	-90.0	-91.5	-90.5	-87.0	-90.0	-90.0	-89.5	-89.0	-
QPSK		-88.5	-88.5	-88.5	-89.5	-88.0	-87.5	-88.5	-88.0	-84.0	-87.5	-87.0	-87.0	-86.5	-
8 PSK		-83.5	-83.5	-83.0	-84.0	-83.0	-82.0	-83.5	-82.5	-79.0	-82.0	-82.0	-81.5	-81.0	-
16 QAM		-82.0	-82.0	-81.5	-82.5	-81.5	-80.5	-82.0	-81.0	-77.5	-80.5	-80.5	-80.0	-79.5	-
32 QAM		-78.0	-78.0	-78.0	-79.0	-77.5	-77.0	-78.0	-77.5	-73.5	-77.0	-76.5	-76.5	-76.0	-
64 QAM		-75.5	-75.5	-75.0	-76.0	-75.0	-74.0	-75.5	-74.5	-71.0	-74.0	-74.0	-73.5	-73.0	-
128 QAM		-72.5	-72.5	-72.0	-73.0	-71.5	-71.0	-72.5	-71.5	-68.0	-71.0	-71.0	-70.5	-70.0	-
256 QAM		-69.0	-69.0	-69.0	-70.0	-68.5	-68.0	-69.0	-68.5	-64.5	-68.0	-67.5	-67.5	-67.0	-
512 QAM		-67.0	-67.0	-66.5	-67.5	-66.0	-65.5	-67.0	-66.0	-62.5	-65.5	-65.5	-65.0	-64.5	-
1024 QAM Strong		-64.0	-64.0	-64.0	-65.0	-63.5	-63.0	-64.0	-63.5	-59.5	-63.0	-62.5	-62.5	-62.0	-
1024 QAM Light		-63.0	-63.0	-63.0	-64.0	-62.5	-62.0	-63.0	-62.5	-58.5	-62.0	-61.5	-61.5	-61.0	-
25 MHz															
BPSK		-88.5	-87.5	-87.5	-88.0	-87.0	-86.5	-87.5	-86.5	-83.0	-86.5	-86.0	-86.0	-85.0	-
QPSK		-87.5	-86.5	-86.5	-87	-86.0	-85.5	-86.5	-85.5	-82.0	-85.5	-85.0	-85.0	-84.0	-
8 PSK		-82.5	-82.0	-81.5	-82.5	-81.5	-80.5	-82.0	-81.0	-77.5	-80.5	-80.5	-80.0	-79.5	-
16 QAM		-80.5	-80.0	-79.5	-80.5	-79.5	-78.5	-80.0	-79.0	-75.5	-78.5	-78.5	-78.0	-77.5	-
32 QAM		-77.5	-77.0	-76.5	-77.5	-76.0	-75.5	-77.0	-76.0	-72.5	-75.5	-75.5	-75.0	-74.5	-
64 QAM		-74.5	-74.0	-73.5	-74.5	-73.5	-72.5	-74.0	-73.0	-69.5	-72.5	-72.5	-72.0	-71.5	-
128 QAM		-71.5	-71.0	-70.5	-71.5	-70.5	-69.5	-71.0	-70.0	-66.5	-69.5	-69.5	-69.0	-68.5	-
256 QAM		-68.5	-67.5	-67.5	-68.5	-67.0	-66.5	-67.5	-67.0	-63.0	-66.5	-66.0	-66.0	-65.5	-
512 QAM		-66.0	-65.0	-65.0	-66.0	-64.5	-64.0	-65.0	-64.5	-60.5	-64.0	-63.5	-63.5	-63.0	-
1024 QAM Strong		-63.0	-62.5	-62.0	-63.0	-61.5	-61.0	-62.5	-61.5	-58.0	-61.0	-61.0	-60.5	-60.0	-
1024 QAM Light		-62.5	-61.5	-61.5	-62.5	-61.0	-60.5	-61.5	-61.0	-57.0	-60.5	-60.0	-60.0	-59.5	-
2048 QAM		-58.5	-58.0	-57.5	-58.5	-57.0	-56.5	-58.0	-57.0	-53.5	-56.5	-56.5	-56.0	-55.5	-
4096 QAM		-55.5	-55.0	-54.5	-55.5	-54.0	-53.5	-55.0	-	-	-	-	-	-	-



28 MHz	Frequency	6	7-8	10	11	13	15	18	23	24	26	28-31	32	38	42
BPSK		-88.5	-88.0	-87.5	-88.5	-87.5	-86.5	-88.0	-87.0	-86.5	-86.5	-86.5	-86.0	-86.0	-85.5
QPSK		-87.5	-87.0	-86.5	-87.5	-86.5	-85.5	-87.0	-86.0	-85.5	-85.5	-85.5	-85.0	-85.0	-84.5
8 PSK		-83.0	-82.5	-82.0	-83.0	-82.0	-81.0	-82.5	-81.5	-81.0	-81.0	-81.0	-80.5	-80.5	-80.0
16 QAM		-81.0	-80.5	-80.0	-81.0	-79.5	-79.0	-80.5	-79.5	-79.0	-79	-79.0	-78.5	-78.0	-78.0
32 QAM		-77.5	-77.0	-76.5	-77.5	-76.0	-75.5	-77.0	-76.0	-75.5	-75.5	-75.5	-75.0	-74.5	-74.5
64 QAM		-74.5	-74.0	-73.5	-74.5	-73.0	-72.5	-74.0	-73.0	-72.5	-72.5	-72.5	-72.0	-71.5	-71.5
128 QAM		-71.5	-70.5	-70.5	-71.0	-70.0	-69.5	-70.5	-69.5	-69.0	-69.5	-69.0	-69.0	-68.5	-68.0
256 QAM		-68.5	-67.5	-67.5	-68.0	-67.0	-66.5	-67.5	-66.5	-66.0	-66.5	-66.0	-66.0	-65.5	-65.0
512 QAM		-66.0	-65.0	-65.0	-66.0	-64.5	-64.0	-65.0	-64.5	-64.0	-64.0	-63.5	-63.5	-63.0	-62.5
1024 QAM Strong		-63.0	-62.5	-62.0	-63.0	-61.5	-61.0	-62.5	-61.5	-61.0	-61.0	-61.0	-60.5	-60.0	-60.0
1024 QAM Light		-62.0	-61.5	-61.0	-62.0	-60.5	-60.0	-61.5	-60.5	-60.0	-60.0	-60.0	-59.5	-59.0	-59.0
2048 QAM		-58.5	-58.0	-57.5	-58.5	-57.0	-56.5	-58.0	-57.0	-56.5	-56.5	-56.5	-56.0	-55.5	-55.5
4096 QAM		-55.5	-55.0	-54.5	-55.5	-54.0	-53.5	-55.0	-	-	-	-	-	-	-
30 MHz															
BPSK		-88.5	-88.0	-87.5	-88.5	-87.0	-86.5	-88.0	-87.0	-83.5	-86.5	-86.5	-86.5	-86.0	-
QPSK		-87.5	-87.0	-86.5	-87.5	-86.0	-85.5	-87.0	-86.0	-82.5	-85.5	-85.5	-85.5	-85.0	-
8 PSK		-82.5	-81.5	-81.5	-82.5	-81.0	-80.5	-81.5	-81.0	-77.0	-80.5	-80.0	-80.0	-79.5	-
16 QAM		-81.0	-80.0	-80.0	-80.5	-79.5	-79.0	-80.0	-79.0	-75.5	-79.0	-78.5	-78.5	-78.0	-
32 QAM		-77.0	-76.5	-76.0	-77.0	-76.0	-75.0	-76.5	-75.5	-72.0	-75.0	-75.0	-75.0	-74.5	-
64 QAM		-74.5	-73.5	-73.5	-74.0	-73.0	-72.5	-73.5	-72.5	-69.0	-72.5	-72.0	-72.0	-71.5	-
128 QAM		-71.0	-70.5	-70.0	-71.0	-70.0	-69.0	-70.5	-69.5	-66.0	-69.0	-69.0	-69.0	-68.5	-
256 QAM		-68.0	-67.5	-67.0	-68.0	-67.0	-66.0	-67.5	-66.5	-63.0	-66.0	-66.0	-66.0	-65.5	-
512 QAM		-66.0	-65.5	-65.0	-66.0	-64.5	-64.0	-65.5	-64.5	-61.0	-64.0	-64.0	-64.0	-63.5	-
1024 QAM Strong		-63.0	-62.0	-62.0	-62.5	-61.5	-61.0	-62.0	-61.0	-57.5	-61.0	-60.5	-60.5	-60.0	-
1024 QAM Light		-62.0	-61.0	-61.0	-62.0	-60.5	-60.0	-61.0	-60.5	-56.5	-60.0	-59.5	-59.5	-59.0	-
2048 QAM		-58.0	-57.5	-57.0	-58.0	-56.5	-56.0	-57.5	-56.5	-53.0	-56.0	-56.0	-56.0	-55.5	-
4096 QAM		-55.0	-54.5	-54.0	-55.0	-53.5	-53.0	-54.5	-	-	-	-	-	-	-
40 MHz															
BPSK		-87.0	-86.5	-86.0	-87.0	-86.0	-85.0	-86.5	-85.5	-85.0	-85.0	-85.0	-84.5	-84.5	-84.0
QPSK		-86.0	-85.5	-85.0	-86.0	-85.0	-84.0	-85.5	-84.5	-84.0	-84.0	-84.0	-83.5	-83.5	-83.0
8 PSK		-81.0	-80.5	-80.0	-81.0	-79.5	-79.0	-80.5	-79.5	-79.0	-79.0	-79.0	-78.5	-78.0	-78.0
16 QAM		-79.5	-79.0	-78.5	-79.5	-78.0	-77.5	-79.0	-78.0	-77.5	-77.5	-77.5	-77.0	-76.5	-76.5
32 QAM		-76.0	-75.0	-75.0	-75.5	-74.5	-74.0	-75.0	-74.0	-73.5	-74.0	-73.5	-73.5	-73.0	-72.5
64 QAM		-73.0	-72.0	-72.0	-73.0	-71.5	-71.0	-72.0	-71.5	-71.0	-71.0	-70.5	-70.5	-70.0	-69.5
128 QAM		-70.0	-69.0	-69.0	-70.0	-68.5	-68.0	-69.0	-68.5	-68.0	-68.0	-67.5	-67.5	-67.0	-66.5
256 QAM		-67.0	-66.0	-66.0	-66.5	-65.5	-65.0	-66.0	-65.0	-64.5	-65.0	-64.5	-64.5	-64.0	-63.5
512 QAM		-64.0	-63.5	-63.0	-64.0	-62.5	-62.0	-63.5	-62.5	-62.0	-62.0	-62.0	-61.5	-61.0	-61.0
1024 QAM Strong		-61.5	-61.0	-60.5	-61.5	-60.0	-59.5	-61.0	-60.0	-59.5	-59.5	-59.5	-59.0	-58.5	-58.5
1024 QAM Light		-60.5	-60.0	-59.5	-60.5	-59.5	-58.5	-60.0	-59.0	-58.5	-58.5	-58.5	-58.0	-58.0	-57.5
2048 QAM		-58.0	-57.0	-57.0	-58.0	-56.5	-56.0	-57.0	-56.5	-56.0	-56.0	-55.5	-55.5	-55.0	-54.5
4096 QAM		-55.0	-54.0	-54.0	-55.0	-53.5	-53.0	-54.0	-	-	-	-	-	-	-



50 MHz	Frequency	6	7-8	10	11	13	15	18	23	24	26	28-31	32	38	42
BPSK		-86.5	-85.5	-85.5	-86.0	-85.0	-84.5	-85.5	-84.5	-81.0	-84.5	-84.0	-84.0	-83.5	-
QPSK		-85.5	-84.5	-84.5	-85.0	-84.0	-83.5	-84.5	-83.5	-80.0	-83.5	-83.0	-83.0	-82.5	-
8 PSK		-80.0	-79.5	-79.0	-80.0	-79.0	-78.0	-79.5	-78.5	-75.0	-78.0	-78.0	-78.0	-77.5	-
16 QAM		-78.5	-77.5	-77.5	-78.0	-77.0	-76.5	-77.5	-76.5	-73.0	-76.5	-76.0	-76.0	-75.5	-
32 QAM		-74.5	-74.0	-73.5	-74.5	-73.5	-72.5	-74.0	-73.0	-69.5	-72.5	-72.5	-72.5	-72v	-
64 QAM		-71.5	-70.5	-70.5	-71.5	-70.0	-69.5	-70.5	-70.0	-66.0	-69.5	-69.0	-69.0	-68.5	-
128 QAM		-68.5	-68.0	-67.5	-68.5	-67.5	-66.5	-68.0	-67.0	-63.5	-66.5	-66.5	-66.5	-66.0	-
256 QAM		-66.0	-65.0	-65.0	-66.0	-64.5	-64.0	-65.0	-64.5	-60.5	-64.0	-63.5	-63.5	-63.0	-
512 QAM		-63.5	-63.0	-62.5	-63.5	-62.0	-61.5	-63.0	-62.0	-58.5	-61.5	-61.5	-61.5	-61.0	-
1024 QAM Strong		-60.0	-59.5	-59.0	-60.0	-58.5	-58	-59.5	-58.5	-55.0	-58.0	-58.0	-58.0	-57.5	-
1024 QAM Light		-59.0	-58.0	-58.0	-59.0	-57.5	-57.0	-58.0	-57.5	-53.5	-57.0	-56.5	-56.5	-56.0	-
2048 QAM		-57.0	-56.0	-56.0	-56.5	-55.5	-55.0	-56.0	-55.0	-51.5	-55.0	-54.5	-54.5	-54.0	-
4096 QAM		-54.0	-53.0	-53.0	-53.5	-52.5	-52.0	-	-	-	-	-	-	-	-
56 MHz															
BPSK		-85.5	-85.0	-84.5	-85.5	-84.0	-83.5	-85.0	-84.0	-83.5	-83.5	-83.5	-83.0	-82.5	-82.5
QPSK		-84.5	-84.0	-83.5	-84.5	-83.0	-82.5	-84.0	-83.0	-82.5	-82.5	-82.5	-82.0	-81.5	-81.5
8 PSK		-80.0	-79.0	-79.0	-79.5	-78.5	-78.0	-79.0	-78.0	-77.5	-78.0	-77.5	-77.5	-77.0	-76.5
16 QAM		-77.5	-77.0	-76.5	-77.5	-76.0	-75.5	-77.0	-76.0	-75.5	-75.5	-75.5	-75.0	-74.5	-74.5
32 QAM		-74.0	-73.0	-73.0	-73.5	-72.5	-72.0	-73.0	-72.0	-71.5	-72.0	-71.5	-71.5	-71.0	-70.5
64 QAM		-70.5	-70.0	-69.5	-70.5	-69.5	-68.5	-70.0	-69.0	-68.5	-68.5	-68.5	-68.0	-68.0	-67.5
128 QAM		-68.0	-67.0	-67.0	-67.5	-66.5	-66.0	-67.0	-66.0	-65.5	-66.0	-65.5	-65.5	-65.0	-64.5
256 QAM		-64.5	-64.0	-63.5	-64.5	-63.5	-62.5	-64.0	-63.0	-62.5	-62.5	-62.5	-62.0	-62.0	-61.5
512 QAM		-62.5	-62.0	-61.5	-62.5	-61.5	-60.5	-62.0	-61.0	-60.5	-60.5	-60.5	-60.0	-60.0	-59.5
1024 QAM Strong		-59.0	-58.5	-58.0	-59.0	-58.0	-57.0	-58.5	-57.5	-57.0	-57.0	-57.0	-56.5	-56.5	-56.0
1024 QAM Light		-58.0	-57.5	-57.0	-58.0	-57.0	-56.0	-57.5	-56.5	-56.0	-56.0	-56.0	-55.5	-55.5	-55.0
2048 QAM		-55.5	-54.5	-54.5	-55.0	-54.0	-53.5	-54.5	-53.5	-53.0	-53.5	-53.0	-53.0	-52.5	-52.0
4096 QAM		-52.5	-51.5	-51.5	-52.0	-51.0	-50.5	-51.5	-	-	-	-	-	-	-
60 MHz															
BPSK		-86.0	-85.0	-84.5	-85.5	-84.0	-83.5	-85.0	-84.0	-83.5	-83.5	-83.5	-83.0	-82.5	-
QPSK		-85.0	-84.0	-83.5	-84.5	-83.0	-82.5	-84.0	-83.0	-82.5	-82.5	-82.5	-82.0	-81.5	-
8 PSK		-80.5	-79.0	-79.0	-79.5	-78.5	-78.0	-79.0	-78.0	-77.5	-78.0	-77.5	-77.5	-77.0	-
16 QAM		-78.0	-77.0	-76.5	-77.5	-76.0	-75.5	-77.0	-76.0	-75.5	-75.5	-75.5	-75.0	-74.5	-
32 QAM		-74.5	-73.0	-73.0	-73.5	-72.5	-72.0	-73.0	-72.0	-71.5	-72.0	-71.5	-71.5	-71.0	-
64 QAM		-71.5	-70.0	-69.5	-70.5	-69.5	-68.5	-70.0	-69.0	-68.5	-68.5	-68.5	-68.0	-68.0	-
128 QAM		-69.0	-67.0	-67.0	-67.5	-66.5	-66.0	-67.0	-66.0	-65.5	-66.0	-65.5	-65.5	-65.0	-
256 QAM		-65.5	-64.0	-63.5	-64.5	-63.5	-62.5	-64.0	-63.0	-62.5	-62.5	-62.5	-62.0	-62.0	-
512 QAM		-63.5	-62.0	-61.5	-62.5	-61.5	-60.5	-62.0	-61.0	-60.5	-60.5	-60.5	-60.0	-60.0	-
1024 QAM Strong		-60.0	-58.5	-58.0	-59.0	-58.0	-57.0	-58.5	-57.5	-57.0	-57.0	-57.0	-56.5	-56.5	-
1024 QAM Light		-59.0	-57.5	-57.0	-58.0	-57.0	-56.0	-57.5	-56.5	-56.0	-56.0	-56.0	-55.5	-55.5	-
2048 QAM		-56.5	-54.5	-54.5	-55.0	-54.0	-53.5	-54.5	-53.5	-53.0	-53.5	-53.0	-53.0	-52.5	-
4096 QAM		-53.5	-51.5	-51.5	-52.0	-51.0	-50.5	-	-	-	-	-	-	-	-



80 MHz														
BPSK	-85.0	-85.0	-84.5	-85.5	-84.5	-83.5	-85.0	-84.0	-83.5	-83.5	-83.5	-83.0	-83.5	-82.5
QPSK	-82.5	-82.5	-82.5	-83.0	-82.0	-81.5	-82.5	-81.5	-81.0	-81.5	-81.0	-81.0	-81.0	-80.0
8 PSK	-79.0	-79.0	-78.5	-79.5	-78.5	-77.5	-79.0	-78.0	-77.5	-77.5	-77.5	-77.0	-77.5	-76.5
16 QAM	-76.0	-76.0	-75.5	-76.5	-75.0	-74.5	-76.0	-75.0	-74.5	-74.5	-74.5	-74.0	-74.0	-73.5
32 QAM	-72.5	-72.5	-72.0	-73.0	-71.5	-71.0	-72.5	-71.5	-71.0	-71.0	-71.0	-70.5	-70.5	-70.0
64 QAM	-69.0	-69.0	-69.0	-70.0	-68.5	-68.0	-69.0	-68.5	-68.0	-68.0	-68.0	-67.5	-67.5	-66.5
128 QAM	-66.5	-66.5	-66.0	-67.0	-66.0	-65.0	-66.5	-65.5	-65.0	-65.0	-65.0	-64.5	-65.0	-64.0
256 QAM	-63.5	-63.5	-63.0	-64.0	-63.0	-62.0	-63.5	-62.5	-62.0	-62.0	-62.0	-61.5	-62.0	-61.0
512 QAM	-61.0	-61.0	-61.0	-62.0	-60.5	-60.0	-61.0	-60.5	-60.0	-60.0	-60.0	-59.5	-59.5	-58.5
1024 QAM Strong	-58.0	-58.0	-57.5	-58.5	-57.5	-56.5	-58.0	-57.0	-56.5	-56.5	-56.5	-56.0	-56.5	-55.5
1024 QAM Light	-57.0	-57.0	-57.0	-58.0	-56.5	-56.0	-57.0	-56.5	-56.0	-56.0	-56.0	-55.5	-55.5	-54.5
2048 QAM	-54.5	-54.5	-54.5	-55.5	-54.0	-53.5	-54.5	-54.0	-53.5	-53.5	-53.0	-53.0	-	-
112 MHz														
BPSK	-82.0	-81.5	-81.0	-82.0	-80.5	-80.0	-81.5	-80.5	-80.0	-80.0	-80.0	-79.5	-79.0	-79.0
QPSK	-81.0	-80.5	-80.0	-81.0	-79.5	-79.0	-80.5	-79.5	-79.0	-79.0	-79.0	-78.5	-78.0	-78.0
8 PSK	-76.5	-75.5	-75.5	-76.0	-75.0	-74.5	-75.5	-74.5	-74.0	-74.5	-74.0	-74.0	-73.5	-73.0
16 QAM	-74.0	-73.5	-73.0	-74.0	-72.5	-72.0	-73.5	-72.5	-72.0	-72.0	-72.0	-71.5	-71.0	-71.0
32 QAM	-70.5	-69.5	-69.5	-70.0	-69.0	-68.5	-69.5	-68.5	-68.0	-68.5	-68.0	-68.0	-67.5	-67.0
64 QAM	-67.0	-66.5	-66.0	-67.0	-66.0	-65.0	-66.5	-65.5	-65.0	-65.0	-65.0	-64.5	-64.5	-64.0
128 QAM	-64.5	-63.5	-63.5	-64.0	-63.0	-62.5	-63.5	-62.5	-62.0	-62.5	-62.0	-62.0	-61.5	-61.0
256 QAM	-61.0	-60.5	-60.0	-61.0	-60.0	-59.0	-60.5	-59.5	-59.0	-59.0	-59.0	-58.5	-58.5	-58.0
512 QAM	-59.0	-58.5	-58.0	-59.0	-58.0	-57.0	-58.5	-57.5	-57.0	-57.0	-57.0	-56.5	-56.5	-56.0
1024 QAM Strong	-55.5	-55.0	-54.5	-55.5	-54.5	-53.5	-55.0	-54.0	-53.5	-53.5	-53.5	-53.0	-53.0	-52.5
1024 QAM Light	-54.5	-54.0	-53.5	-54.5	-53.5	-52.5	-54.0	-53.0	-52.5	-52.5	-52.5	-52.0	-52.0	-51.5
2048 QAM	-52.0	-51.0	-51.0	-51.5	-50.5	-50.0	-51.0	-50.0	-49.5	-5.00	-49.5	-49.5	-	-
224 MHz														
BPSK	-85.0	-84.5	-84.0	-85.0	-83.5	-83.0	-84.5	-83.5	-83.0	-83.0	-83.0	-82.5	-82.0	-82.0
QPSK	-84.0	-83.5	-83.0	-84.0	-82.5	-82.0	-83.5	-82.5	-82.0	-82.0	-82.0	-81.5	-81.0	-81.0
8 PSK	-79.5	-78.5	-78.5	-79.0	-78.0	-77.5	-78.5	-77.5	-77.0	-77.5	-77.0	-77.0	-76.5	-76.0
16 QAM	-77.0	-76.5	-76.0	-77.0	-75.5	-75.0	-76.5	-75.5	-75.0	-75.0	-75.0	-74.5	-74.0	-74.0
32 QAM	-73.5	-72.5	-72.5	-73.0	-72.0	-71.5	-72.5	-71.5	-71.0	-71.5	-71.0	-71.0	-70.5	-70.0
64 QAM	-70.0	-69.5	-69.0	-70.0	-69.0	-68.0	-69.5	-68.5	-68.0	-68.0	-68.0	-67.5	-67.5	-67.0
128 QAM	-67.5	-66.5	-66.5	-67.0	-66.0	-65.5	-66.5	-65.5	-65.0	-65.5	-65.0	-65.0	-64.5	-64.0
256 QAM	-64.0	-63.5	-63.0	-64.0	-63.0	-62.0	-63.5	-62.5	-62.0	-62.0	-62.0	-61.5	-61.5	-61.0
512 QAM	-62.0	-61.5	-61.0	-62.0	-61.0	-60.0	-61.5	-60.5	-60.0	-60.0	-60.0	-59.5	-59.5	-59.0
1024 QAM Strong	-58.5	-58.0	-57.5	-58.5	-57.5	-56.5	-58.0	-57.0	-56.5	-56.5	-56.5	-56.0	-56.0	-55.5
1024 QAM Light	-57.5	-57.0	-56.5	-57.5	-56.5	-55.5	-57.0	-56.0	-55.5	-55.5	-55.5	-55.0	-55.0	-54.5
2048 QAM	-55.0	-54.0	-54.0	-54.5	-53.5	-53.0	-54.0	-53.0	-52.5	-52.5	-52.5	-52.5	-	-

