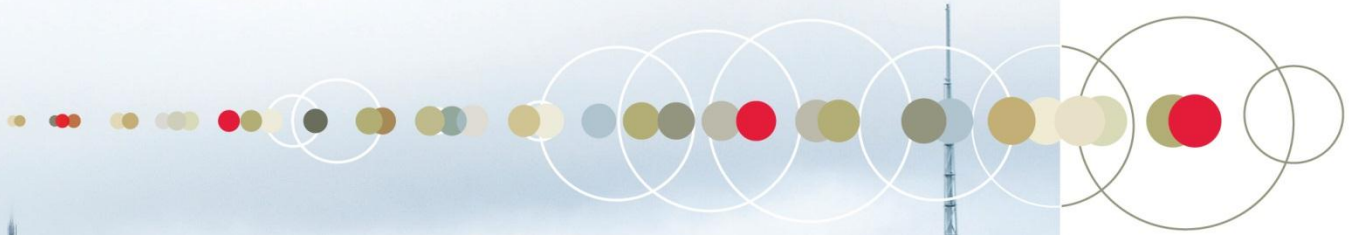


CERAGON



Data Sheet

Release 7.9

FibeAir[®] IP-20C

Compact All-Outdoor Node



Data
Sheet

FibeAir® IP-20C

Compact All-Outdoor Multi-Core Node

FibeAir IP-20C sets a new standard in microwave transmission combining multi-core radio technology and LoS 4X4 MIMO for ultra-high capacity along with a rich set of Carrier Ethernet advanced services. Compact, all-outdoor design allows deployment anywhere while remote upgradability protects investment.

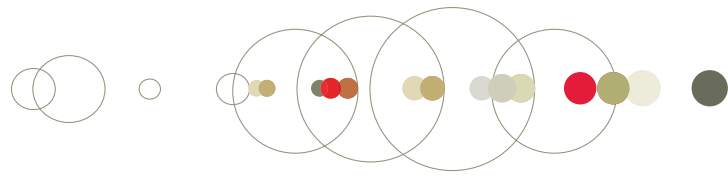
FibeAir IP-20C breaks capacity barriers offering a virtual fiber solution in licensed 6-42 GHz frequencies - 1Gbps in a box. Its versatility makes it ideal for a wide variety of cost-effective deployment scenarios including macrocell backhaul, small-cell aggregation and multi-carrier trunks. As a software-defined radio, it can be remotely configured to quadruple capacity, double link distance and reduce power consumption ensuring long-term, cost-efficient operation as needs change. It is easily and quickly deployable compared with fiber, allowing operators to achieve much faster time to new revenue streams, lower total cost of ownership and long-term peace of mind.

FibeAir IP-20C is future-proof, ready for upgrade from 1+0 to 2+0, doubling the capacity, from day one. Activating the second transceiver is accomplished remotely without a site visit. A complete solution, it offers a rich set of Carrier Ethernet advanced services, providing a wide range of new capabilities that address the diverse needs of mobile operators, ISPs, utilities, large enterprises and private networks.

FibeAir IP-20C's unique multi-core architecture is based on an advanced parallel radio processing engine built around Ceragon's in-house baseband modem and RFIC chipsets. The result is superior radio performance with reduced power consumption and form-factor. It can be deployed either as an all-outdoor node or as a multi-core radio unit in a split-mount configuration with another IP-20 platform indoor node.

Compact All-Outdoor Multi-Core Node

- Multi-core radio solution delivering multi-Gbps anywhere
 - Remote activation of the 2nd TRX - future upgrades without additional site visits
- Multi-gigabits radio capacity with high spectral efficiency
 - Virtual fiber in licensed frequencies – 1Gbps in a box
 - LoS 4X4 MIMO and up to 2048 QAM modulation
- High service granularity enables rollout of new business models
 - Intelligent service-centric management utilizing Hierarchical QoS and advanced OAM capabilities
 - Integrated Ethernet switch, MEF Carrier Ethernet 2.0-compliant and MPLS-TP-ready
- Common OS & software-defined engine simplify network modernization
 - Unified CeraOS across entire IP-20 platform
 - Powered by programmable network processor

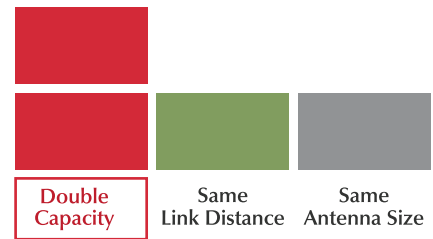


Ceragon FibeAir IP-20C: Software-Defined Radio

FibeAir IP-20C is the most versatile radio available in the market today. Thanks to its innovative multi-core technology, it can be configured for optimized performance in any deployment scenario. Flexibility is the key.

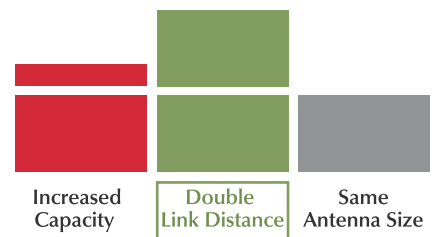
Doubling the capacity

FibeAir IP-20C's multi-core technology allows it to start with a single core and provides the capability to turn on the second core remotely, instantaneously doubling link capacity with single or dual polarization.



Doubling the link distance

The second radio core can be utilized to double the link distance. FibeAir IP-20C splits the bitstream between its two cores using Multi-carrier Adaptive Bandwidth Control, thus lowering the modulation scheme and significantly increasing system gain (both Tx power and Rx sensitivity). This results in longer link spans – up to double the distance.



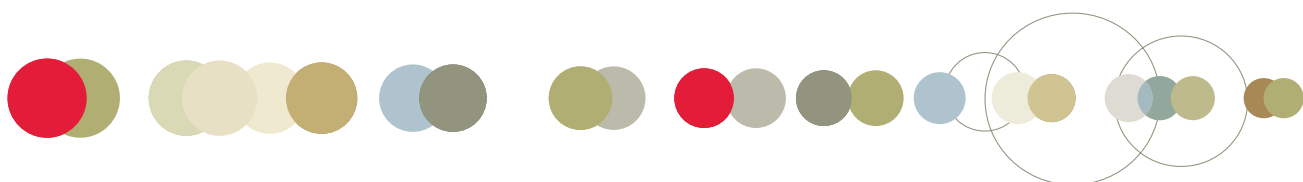
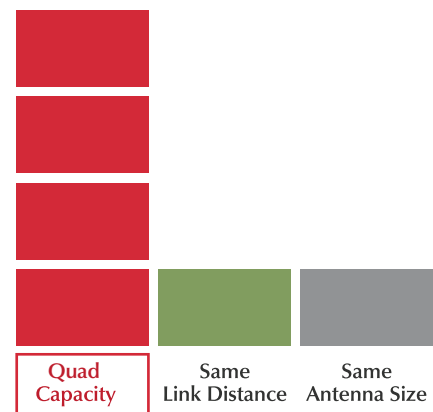
Halving the antenna size

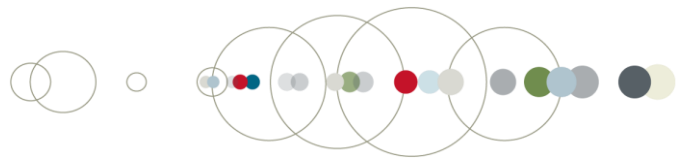
FibeAir IP-20C's superior system gain can be leveraged to reduce antenna size lowering installation costs significantly. Antenna-size reductions of 50% can be achieved.



Quadrupling the capacity

In the 4X4 LoS MIMO configuration, quadrupling of capacity is achievable using the same channel bandwidth. A new record in microwave spectral efficiency!





Radio

Supported Frequency Range

- 6-42 GHz

Configurations

- 1+0 to 4+0, 1+1/2+2, E/W

Radio Features

- Multi-Carrier Adaptive Bandwidth Control (up to 2+0)
- Protection: 1+1 HSB/2+2 HSB
- High spectral utilization: QPSK to 2048 QAM w/ACM
- XPIC
- 2x2 / 4x4 LoS MIMO

Ethernet

Ethernet Interfaces

- Traffic Interfaces – 1 x 10/100/1000Base-T (RJ-45) and 2x1000base-X (Optical SFP) or 10/100/1000Base-T (Electrical SFP)
- Management Interface - 1 x 10/100 Base-T (RJ-45)
- SFP Types - Optical 1000Base-LX (1310 nm) or SX (850 nm)

Note: SFP devices must be of industrial grade (-40°C to +85°C)

Ethernet Features

- MTU – 9600 Bytes
- Quality of Service
 - Multiple Classification criteria (VLAN ID, p-bits, IPv4 DSCP, IPv6 TC, MPLS EXP)
 - 8 priority queues
 - Deep buffering (configurable up to 64 Mbit per queue)
 - WRED
 - Hierarchical QoS – high service granularity *
 - P-bit marking/remarking
- 4K VLANs
- VLAN add/remove/translate
- Frame Cut Through – controlled latency and PDV for delay sensitive applications
- Header DeDuplication – Capacity boosting by eliminating inefficiency in all layers (L2, MPLS, L3, L4, Tunneling – GTP for LTE, GRE)
- Ethernet OAM – EFM (IEEE 802.3ah), CFM (IEEE 802.1ag), ITU-T Y.1731*

Synchronization

Synchronization Distribution

- Sync Distribution over any traffic interface (GE/FE)
- SyncE (ITU-T G.8261, G.8262)
- SSM/ESMC Support for ring/mesh applications (ITU-T G.8264)
- SyncE Regenerator mode, providing PRC grade (ITU-T G.811) performance for smart pipe applications.

IEEE-1588

- Optimized Transport for reduced PDV
- IEEE-1588 TC*

Standards

MEF

- Carrier Ethernet 2.0 (CE 2.0)**

Supported Ethernet Standards

- 10/100/1000base-T/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

Standards Compliance

- 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 2.3

Technical Specifications

Mechanical Specifications

- Dimensions – 230mm(H), 233mm(W), 98mm(D), 6.5kg
- Pole Diameter Range (for Remote Mount Installation) – 8.89 cm – 11.43 cm

Environmental Specifications

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

Power Input Specifications

- Standard Input: -48 VDC
- DC Input range: -40 to -60 VDC

Power Consumption Specifications

- Maximum Power Consumption (Multi-Core Operation) –6 GHz: 65W; 7-8 GHz: 75W; 11 GHz: 65W; 13-15 GHz: 55W; 18-24 GHz: 48W; 26-42 GHz: 55W
- Maximum Power Consumption (1+0 Operation) –6 GHz: 40W; 7-8 GHz: 50W; 11 GHz: 53W; 13-15 GHz: 41W; 18-24 GHz: 39W; 26-42 GHz: 41W

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

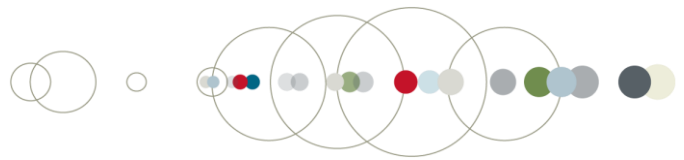
- Standard Input: -48 or +24 VDC (Optional)
- DC Input range: ±(18/40.5 to 60) VDC (+18VDC extended range is supported as part of the nominal +24VDC support)

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 ±(18-60)V is available)

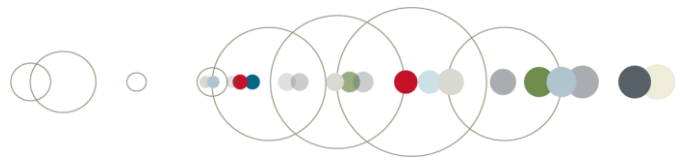
* Planned for future release.

** Certification pending.



Transmit Power (dBm) (Standard)	Freq. (GHz)	6	7	8	10-11	13-15	18	23	24 UL	26	28-38	42
QPSK		26	25	25	24	24	22	20	0	21	18	15
8 QAM		26	25	25	24	24	22	20	0	21	18	15
16 QAM		25	24	24	23	23	21	20	0	20	17	14
32 – 128 QAM		24	23	23	22	22	20	20	0	19	16	13
256 QAM		24	23	21	22	22	20	18	0	17	14	11
512 QAM		22	21	21	21	20	18	18	0	17	14	11
1024 QAM		22	21	21	20	20	18	17	0	16	13	10
2048 QAM		20	19	19	18	18	16	16	0	15	12	9
Transmit Power (dBm) (High Power)	Freq. (GHz)											
QPSK – 8 QAM		29	28	28	27							
16 QAM		28	27	27	26							
32 – 128 QAM		27	26	26	25							
256 QAM		27	26	24	25							
512 QAM		25	24	24	24							
1024 QAM		25	24	24	23							
2048 QAM		23	22	22	21							

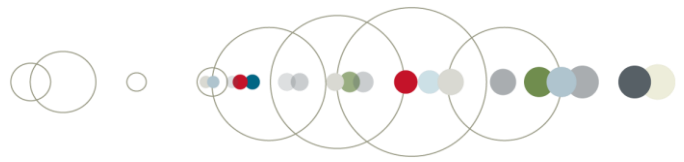
	Capacity (Mbps)	Capacity De-Dup	Capacity (Mbps)	Capacity De-Dup	Capacity (Mbps)	Capacity De-Dup
	7 MHz		14 MHz		28 MHz (ACCP)	
QPSK	8-10	9-32	19-24	20-74	40-49	42-153
8 PSK	13-16	13-48	29-36	31-112	60-74	63-229
16 QAM	18-22	19-69	40-49	42-153	82-101	86-313
32 QAM	24-30	26-92	53-65	56-203	108-132	114-412
64 QAM	30-37	32-114	66-80	69-249	134-163	140-508
128 QAM	36-44	38-137	79-97	83-301	161-196	169-611
256 QAM	42-51	44-158	90-110	95-344	183-224	192-696
512 QAM	45-54	47-169	100-122	105-380	202-247	212-768
1024 QAM Strong	48-58	50-182	106-129	111-402	215-262	225-817
1024 QAM Light	51-62	53-193	112-137	118-426	228-279	239-867
2048 QAM					244-299	257-931
	28 MHz (ACAP)		40 MHz (ACCP)		56 MHz (ACCP)	
QPSK	43-52	45-162	58-71	61-220	83-101	87-314
8 PSK	62-76	65-236	86-105	90-328	123-150	129-468
16 QAM	87-107	92-332	117-143	123-446	167-205	176-637
32 QAM	115-140	121-437	154-189	162-588	220-269	231-838
64 QAM	141-173	149-538	190-232	199-722	270-331	284-1000
128 QAM	170-208	179-648	229-280	241-873	327-400	343-1000
256 QAM	196-239	206-745	247-301	259-939	374-457	393-1000
512 QAM	209-255	219-794	270-330	284-1000	406-496	426-1000
1024 QAM Strong	228-278	239-866	306-375	322-1000	441-540	464-1000
1024 QAM Light	241-295	253-917	325-398	342-1000	469-573	492-1000
2048 QAM	263-321	276-1000	352-430	370-1000	508-621	534-1000



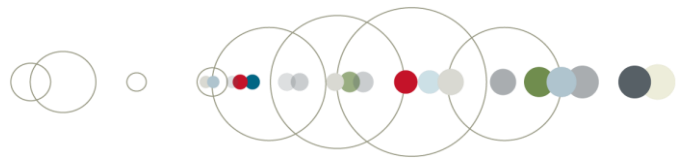
	Capacity (Mbps)		Capacity De-Dup	
	56 MHz (ACAP)		80 MHz	
QPSK	87-106	91-331	114-140	120-435
8 PSK	127-155	133-482	162-198	170-617
16 QAM	176-215	185-670	230-283	243-880
32 QAM	232-283	243-881	302-371	319-1000
64 QAM	284-348	299-1000	369-454	390-1000
128 QAM	344-420	361-1000	435-536	461-1000
256 QAM	397-485	416-1000	501-618	531-1000
512 QAM	426-521	448-1000	551-679	583-1000
1024 QAM Strong	464-567	487-1000	599-738	634-1000
1024 QAM Light	493-602	517-1000		
2048 QAM	534-653	561-1000		

Note: For LTE-Optimized Header De-Duplication, the capacity figures are for LTE packets encapsulated inside GTP tunnels with IPv4/UDP encapsulation and double VLAN tagging (QinQ). Capacity for IPv6 encapsulation is higher.

Receiver Threshold (RSL) (dBm @ BER = 10 ⁻⁶)															
Frequency (GHz)	6	7	8	10	11	13	15	18	23	24UL	26	28-31	32	38	42
7 MHz ACCP															
QPSK	-93.5	-93.0	-93.0	-92.5	-93.5	-92.5	-91.5	-93.0	-92.0	-91.5	-91.5	-91.5	-91.0	-91.0	-90.5
8 PSK	-87.5	-87.0	-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
16 QAM	-87.0	-86.5	-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
32 QAM	-83.5	-83.0	-83.0	-82.5	-83.5	-82.5	-81.5	-83.0	-82.0	-81.5	-81.5	-81.5	-81.0	-81.0	-80.5
64 QAM	-80.5	-80.0	-80.0	-79.5	-80.5	-79.5	-78.5	-80.0	-79.0	-78.5	-78.5	-78.5	-78.0	-78.0	-77.5
128 QAM	-77.5	-76.5	-76.5	-76.5	-77.5	-76.0	-75.5	-76.5	-76.0	-75.5	-75.5	-75.0	-75.0	-74.5	-74.0
256 QAM	-74.0	-73.5	-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
512 QAM	-72.0	-71.5	-71.5	-71.0	-72.0	-71.0	-70.0	-71.5	-70.5	-70.0	-70.0	-70.0	-69.5	-69.5	-69.0
1024 QAM Strong	-68.5	-68.0	-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 Light	-68.0	-67.0	-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
14 MHz ACCP															
QPSK	-90.5	-90.0	-90.0	-89.5	-90.5	-89.5	-88.5	-90.0	-89.0	-88.5	-88.5	-88.5	-88.0	-88.0	-87.5
8 PSK	-84.5	-84.0	-84.0	-83.5	-84.5	-83.5	-82.5	-84.0	-83.0	-82.5	-82.5	-82.5	-82.0	-82.0	-81.5
16 QAM	-83.5	-83.0	-83.0	-82.5	-83.5	-82.5	-81.5	-83.0	-82.0	-81.5	-81.5	-81.5	-81.0	-81.0	-80.5
32 QAM	-80.5	-79.5	-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	-76.5	-77.5	-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	-73.5	-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	-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	-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	-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	-64.0	-65.0	-63.5	-63.0	-64.0	-63.5	-63.0	-63.0	-62.5	-62.5	-62.0	-61.5



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



Frequency (GHz)	6	7	8	10	11	13	15	18	23	24UL	26	28-31	32	38	42
56 MHz ACCP															
QPSK	-84.0	-83.5	-83.5	-83.0	-84.0	-83.0	-82.0	-83.5	-82.5	-82.0	-82.0	-82.0	-81.5	-81.5	-81.0
8 PSK	-80.0	-79.5	-79.5	-79.0	-80.0	-79.0	-78.0	-79.5	-78.5	-78.0	-78.0	-78.0	-77.5	-77.5	-77.0
16 QAM	-77.5	-77.0	-77.0	-76.5	-77.5	-76.5	-75.5	-77.0	-76.0	-75.5	-75.5	-75.5	-75.0	-75.0	-74.5
32 QAM	-74.5	-73.5	-73.5	-73.5	-74.0	-73.0	-72.5	-73.5	-72.5	-72.0	-72.5	-72.0	-72.0	-71.5	-71.0
64 QAM	-71.0	-70.5	-70.5	-70.0	-71.0	-70.0	-69.0	-70.5	-69.5	-69.0	-69.0	-69.0	-68.5	-68.5	-68.0
128 QAM	-68.5	-67.5	-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
256 QAM	-65.0	-64.5	-64.5	-64.0	-65.0	-64.0	-63.0	-64.5	-63.5	-63.0	-63.0	-63.0	-62.5	-62.5	-62.0
512 QAM	-63.0	-62.5	-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 Strong	-59.5	-59.0	-59.0	-58.5	-59.5	-58.5	-57.5	-59.0	-58.0	-57.5	-57.5	-57.5	-57.0	-57.0	-56.5
1024 QAM Light	-58.5	-58.0	-58.0	-57.5	-58.5	-57.5	-56.5	-58.0	-57.0	-56.5	-56.5	-56.5	-56.0	-56.0	-55.5
2048 QAM	-54.0	-53.5	-53.5	-53.0	-54.0	-53.0	-52.0	-53.5	-52.5	-52.0	-52.0	-52.0	-51.5	-51.5	-51.0
56 MHz ACAP															
QPSK	-84.5	-84.0	-84.0	-83.5	-84.5	-83.0	-82.5	-84.0	-83.0	-82.5	-82.5	-82.5	-82.0	-81.5	-81.5
8 PSK	-80.0	-79.0	-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	-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	-73.0	-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	-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	-67.0	-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	-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	-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	-58.5	-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	-57.5	-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	-54.5	-55.0	-54.0	-53.5	-54.5	-53.5	-53.0	-53.5	-53.0	-53.0	-52.5	-52.0
Frequency (GHz)	6H	11													
80 MHz															
QPSK	-83.5	-83.0													
8 PSK	-78.5	-78.5													
16 QAM	-76.5	-76.5													
32 QAM	-73.0	-72.5													
64 QAM	-70.0	-70.0													
128 QAM	-67.5	-67.0													
256 QAM	-64.5	-64.5													
512 QAM	-61.5	-61.5													
1024 QAM	-59.0	-58.5													