PhoeniX G2/G2+

DATASHEET

V.1.24

PhoeniX G2 split mount system is designed to fit in a classic telecom architecture with a radio located outdoors (or indoors) and a sheltered indoor unit. It's IDU is available in modular half rack version (PhoeniX G2) and full rack 2U fanless version with front panel monitor and optionally integrated ASI or E1/T1 ports (PhoeniX G2+). Notably, the PhoeniX G2 series excels in versatility, operating as Long-haul or better. Ideal for both long-distance communication and challenging environments, this system guarantees unmatched performance. All SAF's PhoeniX G2 series radios are compatible with both G2 and G2+ IDU versions.

TECHNICAL SPECIFICATION

		G2	G2+
General			
Form factor		Split Mount (IDU + ODU) or Full indoor (IDU + IRFU)	
Capacity		Up to 1.8 Gbps in 2+0 aggregation mode	
Max modulation		2048 QAM*	
Configurations		1+0, 1+1 HSB/SD/FD, 1+0 Dual, 1+0 Star (Repeater), 2+0 (Layer 1 aggregation), 2+0 XPIC, 2+2 aggregation/protection (with two IDUs)	
ATPC		Yes	
ACM		Hitless Adaptive Code Modulation. Variable TX power mode supported	
Channel bandwidth	ETSI	from 1.75 MHz, up to 112 MHz*	
	FCC	from 5 MHz, up to 80 MHz	
Modifications		IDU with external extension modules (up to 4x ASI and/or E1/T1 modules)	IDU w/o extensions, IDU w 4x ASI, IDU w 8x ASI, IDU w 16E1/T1, IDU w 4x ASI and 16E1/T1. More extension modules can be added externally (two to four depending on HW modification)
Ports			
Ethernet traffic	RJ-45	3x 10/100/1000 Base-T for traffic and/or management access	
	SFP	4x 1000Base-SX/LX for traffic, 2x also work as Extension/Protection ports	
ASI (optional)	BNC	Available on external extension module	up to 8x unbalanced, 75 ohm native ASI channels for ASI I/O
E1/T1 (optional)	RJ-45	Available on external extension module	up to 16x G.703-E1 balanced 120ohm for E1mode; G.703-E1 unbalanced 75 ohm for E1 mode; T1.102-T1/100 ohm for T1 mode
STM-1 (Optional)	SFP	up to 2x STM-1/OC-3** optical interfaces; ITU-T Rec. G.811	
Alarm Port (Optional)	DB-9/ B08-XASK-1	2x Alarm In; 2x Alarm Out	
IDU <-> ASI/E1/T1 jumper connection (if applicable)	SFP	Available on external extension module	1x 1000Base-SX (proprietary GigE protocol) for embedded ASI and/or E1/T1 module connection
Additional module connection (if applicable)	SFP	Available on external extension module	1x 1000Base-SX (proprietary GigE protocol) for additional ASI and/or E1/T1 module connection
Outband Ethernet Management Access	RJ-45	1x 10/100/1000Base-T	
Serial port for configuration	USB Mini-B	USB Mini-B (alternative IP port)	
Flash memory port	USB-A	1x for log files export	
Display service port	USB Mini-B	-	1x for display maintenance
ODU port	2x N-Type Female	2x for radio connection	
DC power port	Single block 4 pole	Up to 2x DC power ports for power supply redundancy	

*Please contact SAF sales representative for more information
**Licensed feature

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Ethernet	
Switch type	Managed Gigabit Ethernet Layer 2
Max frame size	64 to 2048 bytes, up to 16300 bytes for Jumbo mode
MAC table	8192 entries; automatic learning and aging
Packet buffer	0.125 MB , non-blocking store&forward
Flow control	802.3x
VLAN support	802.1Q, up to 4096 VLANs
QinQ (Double tagging)	Yes, transparent
QoS	IPv4 64 level DiffServ (DSCP) or 8 level 802.1p mapped in 4 prioritization queues with VLAN support, IPv6 Traffic Class
Synchronization	PTP 1588v2**
Encryption	AES128/256***
SyncE	G.8261; G.8262

Management features	
Protocols	via WEB GUI (HTTP****/HTTPS), CLI (Telnet/SSH), NMS (SNMP v1 (traps only)/v2c/v3), Serial interface (USB IP port)
Access	In-band (via port grouping) Out-of-band
SNMP	Yes, SNMP traps, MIB, SNMP v1/v2c/3
Element Management System (EMS)	Web based, HTTP****/HTTPS
Performance monitoring	Received signal spectrum, constellation diagram, performance graphs, counters and event logs

Mechanical and electrical		
Temperature Range / Humidity	-5 °C to +45 °C / 23 °F to 113 °F / 0% to 95%	
Cooling	3-mode Fans built-in: On, Off, Auto (controlled by internal temperature)	Fanless
Dimensions: HxWxD	½ width 1U (44 x 220 x 240 mm) / (1.73 x 8.66x 9.45 in)	19” 2U (90 x 430 x 265 mm) / (3.54 x 16.93 x 10.43 in)
Weight	2.2 kg / 4.9 lb	<5.3 kg / 11.7 lb
Max power consumption	IDU only: <30W IDU + 2xODU: <180W	IDU only w/o ASI or E1/T1: <30W, 4xASI: <9W, 16xE1/T1: <9W. IDU + 2xODU: < IDU + <150W
IDU-ODU connection	Maximum permissible IF cable attenuation at frequency 350 MHz = 15dB, N-Type connectors	
DC port	Nominal voltage -48V DC (-40.5V to -57V DC, conforms to ETSI EN 300 132-2)	

***Phoenix G2/G2+ is FIPS 197 (Federal Information Processing Standards) validated and placed on validated product list, Validation No.: A3040 https://csrc.nist.gov/projects/cryptographic-algorithm-validation-program/validation-search. AES is licensed feature

****HTTP will be automatically redirected to HTTPS

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IDU compliance	
Operation	ETSI EN 300 019, Part 1-3, Class 3.2
Storage	ETSI EN 300 019, Part 1-1, Class 1.2
Transportation	ETSI EN 300 019, Part 1-2, Class 2.3
Power	EN 300 132-2
Radio frq., IDU+ODU	EN 302 217-2
EMC	EN 301 489-1, EN 301 489-4
Safety	EN 60950-1, EN 62368-1

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PHOENIX G2/G2+ IDU EXTERNAL MODULES

ASI extension module

General	
4x ASI	Native ASI channels, no IP Encapsulation. Unbalanced, 75 ohm
Scalability	Cascading up to four (total) modules
Ports	
IDU connection	1x SFP port 1000Base-SX (proprietary GigE protocol)
Connection to next external module	1x SFP port 1000Base-SX (proprietary GigE protocol)
ASI ports	4x BNC
DC port	Industrial power connector
Mechanical & electrical	
Dimensions: HxWxD	½ width 1U (45 x 210 x 240 mm) / (1.77 x 8.27 x 9.45 in)
Weight	1.3 kg / 2.87 lb
Max power consumption	ASI module: <9 W
DC port	Nominal voltage: -24V DC or -48V DC (-20V to -57V DC)

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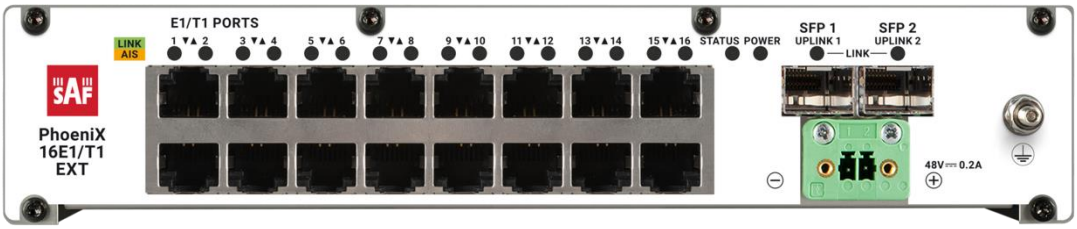
E1/T1 EXTENSION MODULE



General	
16x E1/T1	G.703-E1 balanced 120 ohm for E1 mode G.703-E1 unbalanced 75 ohm for E1 mode T1.102-T1/100 ohm for T1 mode
Scalability	Cascading up to four (total) modules
Ports	
IDU connection	1x SFP port 1000Base-SX (proprietary GigE protocol)
Connection to next external module	1x SFP port 1000Base-SX (proprietary GigE protocol)
E1/T1 ports	16x RJ-45
DC port	Industrial power connector
Mechanical & electrical	
Dimensions: HxWxD	½ width 1U (45 x 210 x 240 mm) / (1.77 x 8.27 x 9.45 in)
Weight	1.3 kg / 2.87 lb
Max power consumption	E1/T1 module: <9 W
DC port	Nominal voltage: -24V DC or -48V DC (-20V to -57V DC)

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PHOENIX G2 ODU AND IRFU

General parameters

SP/HP ODU

VHP ODU

IRFU (A)

IRFU (B)

Ports	SP ODU	HP ODU	VHP ODU	IRFU
Antenna	N-Type or flange			A) N-Type or flange B) SMA Tx and Rx ports
IF to IDU	N-Type			SMA
RSSI	BNC			2-port for multi-meter
Power	Over IF port			2-pin power port (alternative to IF port)
Mechanical & Electrical				
Operational use	Conforms to ETSI EN 300 019 Class 4.1. IP67. NEMA 6		Conforms to ETSI EN 300 019 Class 4.1. IP66. NEMA 4	Conforms to ETSI EN 300 019 Class 3.1E. IP20. NEMA 1
Temperature range	-33°C to +55°C			-5°C to +55°C
Dimensions: HxWxD / weight	288x288x80 mm / 3.5 kg		280x437x110 mm / 7.5 kg	19" 2U rack 90x430x260 / 5.8 kg
IF port surge protection	Conforms to ETSI EN 301 489-1; EN 61000-4-5; IEC 61000-4-5			
Frequency stability	+/- 10 ppm			
Input DC voltage	-40.5V to -57V DC (conforms to ETSI EN 300 132-2)			
Max power consumption	13-27 W	21-39 W	39-75 W	SP: 13-27 W; HP: 21-39 W; VHP: 39-75 W

G2 ODU and IRFU waveguide flange sizes

	2 GHz	U4 GHz	L6, U6 GHz	7, 8 GHz	10, 11 GHz	13 GHz	15 GHz	18, 23 GHz	26 GHz	38 GHz
ODU SP and HP	-	N-type	N-type	SAF2R	SAF2R	SAF2R	SAF2	SAF2	SAF2	SAF2
ODUVHP	N-type		SAF2R	SAF2R	SAF2R	SAF2R	SAF2	SAF2	-	-
IRFU (w/o diplexer)	2xSMA Rx / Tx							-	-	-
IRFU (w diplexer)	N-type			UBR84	UBR100	UBR140		-	-	-

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Frequency bands

Band	Frequency range	Duplex offset*
2 GHz	1.9 – 2.5 GHz	45 MHz 50MHz 175 MHz 189 MHz
U4 GHz	4.4 – 5.0 GHz	100 MHz. 300 MHz. 312 MHz
L6 GHz	5.725 – 6.425 GHz	95 MHz, 252.04 MHz. 266 MHz
U6 GHz	6.425 – 7.125 GHz	160 MHz. 170 MHz. 200 MHz. 340 MHz 75 MHz, 100 MHz, and 150 MHz for Full Indoor Broadcasting applications
7 GHz	7.110 – 7.900 GHz	154 MHz. 161 MHz. 168 MHz. 196 MHz. 245 MHz. 300MHz
8 GHz	7.725 – 8.5 GHz	119 MHz. 126 MHz. 151.614 MHz. 154 MHz. 160 MHz. 208 MHz. 266 MHz. 300 MHz. 310 MHz. 311.32 MHz. 525 MHz. 550 MHz
11 GHz	10.7 – 11.7 GHz	490 MHz. 500 MHz. 530 MHz
13 GHz	12.75 – 13.25 GHz	225 MHz. 266 MHz 75 MHz, 100 MHz, and 150 MHz for Full Indoor Broadcasting applications
15 GHz	14.4 – 15.35 GHz	420 MHz. 475 MHz. 490 MHz.
18 GHz	17.7 – 19.7 GHz	1008 MHz. 1010 MHz. 1560 MHz
23 GHz	21.2 – 23.6 GHz	1008 MHz. 1036 MHz. 1200 MHz. 1232 MHz
38 GHz	37.0 – 40.0 GHz	1260 MHz

*Please visit SAF Tehnika Online Radio Guide https://saftehnika.com/en/radio_guide for more information (partner login required).

Max Tx output power [dBm]

Modulation	2 GHz (VHP)	U4 GHz (HP)	L6,U6 GHz (HP/VHP)	7 GHz (HP/VHP)	8 GHz (HP/VHP)	11 GHz (HP/VHP)	13 GHz (HP/VHP)	15 GHz (VHP)	18 GHz (SP/VHP)	23 GHz (SP/VHP)	38 GHz (SP)
4QAM	+36	+33	+27/+33	+27/+32	+27/+31	+25/+29	+25/+28	+25	+19/+26	+19/24	+17
16QAM	+35	+32	+26/+32	+26/+31	+26/+30	+24/+28	+24/+27	+24	+18/+25	+18/23	+16
32QAM	+34	+31	+25/+31	+25/+30	+25/+29	+23/+27	+23/+26	+23	+17/+24	+17/22	+15
64QAM	+33	+30	+24/+30	+24/+29	+24/+28	+22/+26	+22/+25	+22	+16/+23	+16/21	+14
128QAM	+33	+30	+24/+30	+24/+29	+24/+28	+22/+26	+22/+25	+22	+16/+23	+16/21	+14
256QAM	+32	+29	+23/+29	+23/+28	+23/+27	+21/+25	+21/+24	+21	+15/+22	+15/20	+13
512QAM	+31	+28	+22/+28	+22/+27	+22/+26	+20/+24	+20/+23	+20	+14/+21	+14/19	+12
1024QAM	+28	+25	+19/+25	+19/+24	+19/+23	+17/+21	+17/+20	+17	+11/+18	+11/16	+9

Min Tx output power [dBm]

Modulation	2 GHz (VHP)	U4 GHz (HP)	L6,U6 GHz (HP/VHP)	7 GHz (HP/VHP)	8 GHz (HP/VHP)	11 GHz (HP/VHP)	13 GHz (HP/VHP)	15 GHz (VHP)	18 GHz (SP/VHP)	23 GHz (SP/VHP)	38 GHz (SP)
Min Tx power	+16	+14	+8/+13	+8/+12	+8/+11	+6/+9	+6/+8	+6	0/+6	0/+5	-3

For all IRFU w/o duplexer (except 2GHz) the Tx power is 1dB higher

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Thresholds and Capacity for ETSI channels

		2GHz	U4GHz	L6GHz	U6GHz	7GHz	8GHz	11GHz	13GHz	15GHz	18GHz	23GHz	*38GHz	Capacity, Mbps
Bandwidth, MHz	**Modulation**	**Guaranteed RSL Threshold, dBm**												
3.5	4QAM	-95	-94.5	-93	-94.5	-93.5	-93	-90.5	-91.5	-91.5	-93	-	-	5
	16QAM	-88.5	-88.5	-86	-86.5	-86	-86	-83.5	-85	-85	-86	-	-	10
	32QAM	-85.5	-85.5	-85	-82.5	-82.5	-82.5	-80.5	-80.5	-80.5	-81.5	-	-	13
	64QAM	-82	-82	-80	-79	-78.5	-79	-76	-74	-74	-78	-	-	16
7	4QAM	-92	-92	-89.5	-90.5	-87.5	-88.5	-88.5	-89	-89	-89	-90	-86	10
	16QAM	-86	-86	-82.5	-84	-82	-82	-82.5	-82	-82	-82.5	-83.5	-79.5	21
	32QAM	-83	-83	-80	-81.5	-79	-79	-79	-79	-79	-79	-80.5	-76.5	26
	64QAM	-80	-80	-77	-78	-76	-76.5	-76	-75.5	-75.5	-76	-77.5	-73.5	32
	128QAM	-77	-76.5	-74	-74.5	-73.5	-73	-73	-71	-71	-72.5	-71.5	-67	37
	256QAM	-	-70	-70	-	-69.5	-69.5	-68	-70.5	-70.5	-68	-69	-	42
12	4QAM	-90	-90	-87.5	-87.5	-88	-87	-86	-87.5	-87.5	-87	-88.5	-84.5	18
	16QAM	-83	-83.5	-81	-81.5	-81.5	-81	-79.5	-81	-81	-80	-82	-78	36
	32QAM	-80.5	-81	-78	-78.5	-78	-78	-76.5	-78	-78	-77	-78.5	-74.5	46
	64QAM	-77.5	-77.5	-75	-75.5	-75	-75	-73.5	-75	-75	-75	-75.5	-71.5	55
	128QAM	-74.5	-75	-71.5	-73	-72	-72	-70.5	-72	-72	-72	-72.5	-68.5	64
	256QAM	-71.5	-71.5	-68.5	-69.5	-69	-68.5	-68	-68.5	-68.5	-68.5	-68	-64	73
	512QAM	-	-66	-64.5	-	-63.5	-63.5	-63	-64	-64	-63	-64	-60	82
14	4QAM	-89.5	-89	-87	-87.5	-85	-87	-87	-86.5	-86.5	-87	-87.5	-83.5	21
	16QAM	-83	-82.5	-80.5	-81	-80	-79.5	-80	-80.5	-80.5	-80	-81	-77	42
	32QAM	-80	-79.5	-77.5	-78	-76.5	-77	-77	-77.5	-77.5	-77.5	-78	-74	53
	64QAM	-77	-76.5	-74.5	-75.5	-74	-74	-74	-74	-74	-74.5	-75	-71	63
	128QAM	-74.5	-73.5	-71.5	-72.5	-71	-71	-71.5	-71.5	-71.5	-71.5	-72	-68	74
	256QAM	-71	-70.5	-69	-69.5	-68.5	-67.5	-68	-68	-68	-68.5	-69	-65	85
	512QAM	-	-65	-64	-	-63.5	-63.5	-	-64	-64	-63	-64	-	96
20	4QAM	-86.5	-87.5	-85.5	-86	-84	-85	-85.5	-85	-85	-85	-86	-82	30
	16QAM	-81	-81.5	-79	-79.5	-79	-78	-79	-78.5	-78.5	-78.5	-79.5	-75.5	61
	32QAM	-78.5	-78.5	-76	-77	-75.5	-76	-75.5	-76	-76	-75.5	-76.5	-72.5	77
	64QAM	-75.5	-75.5	-73	-74	-72.5	-72.5	-73	-72.5	-72.5	-72.5	-73	-69	92
	128QAM	-72.5	-72	-70	-71	-69.5	-69.5	-69.5	-70	-70	-69.5	-70	-66	107
	256QAM	-69	-69	-67	-68.5	-66.5	-66.5	-66.5	-66.5	-66.5	-67	-67	-63	123
	512QAM	-66	-66	-64	-65	-63.5	-62.5	-64	-63	-63	-63.5	-63	-59	138
	1024QAM	-63	-63	-61.5	-61	-61	-59.5	-60.5	-60	-60	-59.5	-57.5	-53.5	154
28	4QAM	-86	-86	-84	-84.5	-83.5	-84	-84	-84	-84	-83.5	-84	-80	43
	16QAM	-79.5	-79.5	-77.5	-78	-78	-77	-77.5	-77	-77	-77.5	-78	-74	87
	32QAM	-77	-76.5	-74.5	-75.5	-75	-74	-74	-74	-74	-74.5	-75	-71	108
	64QAM	-74	-74	-71.5	-72.5	-72	-71	-71.5	-71.5	-71.5	-71.5	-72	-68	130
	128QAM	-71	-70.5	-69	-69.5	-69	-68	-68.5	-68.5	-68.5	-68.5	-69	-65	152
	256QAM	-68	-68	-66	-66.5	-66	-64	-65.5	-65.5	-65.5	-65.5	-66	-62	174
	512QAM	-65	-64.5	-62.5	-63.5	-62.5	-60.5	-62.5	-62	-62	-62	-62.5	-58.5	196
	1024QAM	-61	-62	-60	-60	-59.5	-58	-59	-59	-59	-59	-58.5	-54.5	217
40	4QAM	-	-84.5	-82.5	-83	-82	-82	-82	-82	-82	-82	-83	-79	61
	16QAM	-	-78	-76	-76.5	-76	-75.5	-75.5	-76	-76	-75.5	-76	-72	123
	32QAM	-	-75.5	-73	-73.5	-73	-72.5	-72.5	-73	-73	-72.5	-73	-69	154
	64QAM	-	-72.5	-70.5	-71	-70	-69.5	-69.5	-70	-70	-69.5	-70	-66	184
	128QAM	-	-69.5	-67.5	-68	-67	-66	-66.5	-67	-67	-66.5	-67.5	-63.5	215
	256QAM	-	-66.5	-64.5	-65	-64.5	-62.5	-63.5	-64	-64	-63.5	-64	-60	246
	512QAM	-	-63.5	-61	-62	-60.5	-59.5	-60.5	-60	-60	-60.5	-61	-57	277
	1024QAM	-	-60.5	-58	-58	-58	-56	-57.5	-57	-57	-57	-57.5	-53.5	308
56	4QAM	-	-83	-81	-81.5	-81	-80	-81	-80.5	-80.5	-80.5	-80.5	-76.5	87
	16QAM	-	-76.5	-74.5	-75	-74.5	-74	-74	-74	-74	-74	-74.5	-70.5	175
	32QAM	-	-74	-72	-72	-71.5	-71	-71	-71	-71	-71	-71.5	-67.5	219
	64QAM	-	-71	-69	-69	-68.5	-68	-68	-68	-68	-68.5	-68.5	-64.5	263
	128QAM	-	-68	-66	-66.5	-65.5	-64.5	-65	-65.5	-65.5	-65	-65.5	-61.5	307
	256QAM	-	-65	-63	-63.5	-63	-61	-62	-62	-62	-61.5	-62.5	-58.5	351
	512QAM	-	-61.5	-60	-60.5	-59.5	-57.5	-58.5	-58.5	-58.5	-58.5	-59	-55	395
	1024QAM	-	-58.5	-56	-56.5	-56.5	-54	-55.5	-55.5	-55.5	-55.5	-55	-51	438

*Preliminary data
All data with Strong FEC

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Thresholds and Capacity for FCC channels

		2GHz	U4GHz	L6GHz	U6GHz	7GHz	8GHz	11GHz	13GHz	*15GHz	18GHz	23GHz	*38GHz	Capacity, Mbps
Bandwidth, MHz	**Modulation**	**Guaranteed RSL Threshold, dBm**												
5	4QAM	-93.5	-94.5	-92	-91.5	-91	-89	-89	-90.5	-90.5	-90.5	-92.5	-88.5	6
	16QAM	-87	-87.5	-85.5	-84.5	-84	-83	-80	-83.5	-83.5	-84.5	-85.5	-80.5	13
	32QAM	-84	-84.5	-82.5	-81.5	-80.5	-80	-78	-80	-80	-80.5	-82.5	-78.5	17
	64QAM	-81	-81.5	-78.5	-78.5	-77.5	-77	-74.5	-76	-76	-75.5	-78	-72.5	20
	128QAM	-77	-76.5	-74.5	-	-73.5	-71	-72	-71	-71	-71.5	-	-	26
10	4QAM	-90	-90.5	-88	-88.5	-88	-87	-88.5	-90.6	-90.6	-90.5	-90.5	-87.5	14
	16QAM	-83	-84.5	-82	-82.5	-82	-81	-81	-83.7	-83.7	-80.5	-83	-78.5	28
	32QAM	-80.5	-81.5	-78.5	-79.5	-78.5	-78	-77.5	-81	-81	-78.5	-80	-75.5	36
	64QAM	-77	-77.5	-75	-76.5	-76	-75	-74.5	-78	-78	-75.5	-77	-72.5	43
	128QAM	-74.5	-73.5	-72	-73.5	-72	-71	-71.5	-72.9	-72.9	-71.5	-74	-69.5	50
	256QAM	-	-70.5	-69	-	-69	-69	-68.5	-69.5	-69.5	-68.5	-70	-64.5	61
20	4QAM	-86.5	-87.5	-85.5	-86	-84	-85	-85.5	-85	-85	-85	-86	-82	30
	16QAM	-81	-81.5	-79	-79.5	-79	-78	-79	-78.5	-78.5	-78.5	-79.5	-75.5	61
	32QAM	-78.5	-78.5	-76	-77	-75.5	-76	-75.5	-76	-76	-75.5	-76.5	-72.5	77
	64QAM	-75.5	-75.5	-73	-74	-72.5	-72.5	-73	-72.5	-72.5	-72.5	-73	-69	92
	128QAM	-72.5	-72	-70	-71	-69.5	-69.5	-69.5	-70	-70	-69.5	-70	-66	107
	256QAM	-69	-69	-67	-68.5	-66.5	-66.5	-66.5	-66.5	-66.5	-67	-67	-63	123
	512QAM	-66	-66	-64	-65	-63.5	-62.5	-64	-63	-63	-63.5	-63	-59	138
	1024QAM	-63	-63	-61.5	-61	-61	-59.5	-60.5	-60	-60	-59.5	-57.5	-53.5	154
25	4QAM	-85.5	-86.5	-85	-85	-83.5	-84.5	-84.5	-84.5	-84.5	-84	-84.5	-80.5	37
	16QAM	-80	-80.5	-78	-79	-78	-78	-78	-78	-78	-78	-78	-74	75
	32QAM	-77	-77.5	-75	-75.5	-75	-75	-75.5	-75	-75	-75	-75.5	-71.5	93
	64QAM	-74.5	-74.5	-72	-73	-72	-72	-72	-72	-72	-71.5	-72.5	-68.5	112
	128QAM	-72	-71.5	-70	-70	-69.5	-69	-69	-69	-69	-69	-69.5	-65.5	131
	256QAM	-68	-68.5	-66.5	-67	-66.5	-64.5	-66	-66	-66	-66	-66.5	-62.5	150
	512QAM	-65	-65.5	-63.5	-64	-63	-61.5	-63	-62.5	-62.5	-63	-63	-59	168
	1024QAM	-62.5	-62.5	-60.5	-61	-60	-58.5	-59.5	-59.5	-59.5	-59.5	-58.5	-54.5	187
30	4QAM	-85.5	-85.5	-83.5	-84	-82.5	-83.5	-83	-83.5	-83.5	-83.5	-84	-80	46
	16QAM	-79	-79.5	-77	-78	-77.5	-76.5	-76.5	-77	-77	-77	-77.5	-73.5	92
	32QAM	-76.5	-76.5	-74.5	-75	-74	-73.5	-74	-74	-74	-74.5	-74.5	-70.5	115
	64QAM	-73.5	-73.5	-71.5	-72	-71.5	-71	-71	-71	-71	-70.5	-71.5	-67.5	138
	128QAM	-71	-70.5	-68.5	-69.5	-68.5	-68	-68	-68	-68	-68	-69	-65	161
	256QAM	-67.5	-67.5	-65.5	-66	-66	-63.5	-64.5	-65	-65	-64.5	-65.5	-61.5	184
	512QAM	-65	-64.5	-62.5	-63	-61.5	-60.5	-61.5	-61.5	-61.5	-61.5	-62.5	-58.5	208
	1024QAM	-61	-61.5	-59	-59.5	-59.5	-57.5	-58.5	-58.5	-58.5	-59	-58	-54	231
40	4QAM	-	-84.5	-82.5	-83	-82	-82	-82	-82	-82	-82	-83	-79	61
	16QAM	-	-78	-76	-76.5	-76	-75.5	-75.5	-76	-76	-75.5	-76	-72	123
	32QAM	-	-75.5	-73	-73.5	-73	-72.5	-72.5	-73	-73	-72.5	-73	-69	154
	64QAM	-	-72.5	-70.5	-71	-70	-69.5	-69.5	-70	-70	-69.5	-70	-66	184
	128QAM	-	-69.5	-67.5	-68	-67	-66	-66.5	-67	-67	-66.5	-67.5	-63.5	215
	256QAM	-	-66.5	-64.5	-65	-64.5	-62.5	-63.5	-64	-64	-63.5	-64	-60	246
	512QAM	-	-63.5	-61	-62	-60.5	-59.5	-60.5	-60	-60	-60.5	-61	-57	277
	1024QAM	-	-60.5	-58	-58	-58	-56	-57.5	-57	-57	-57	-57.5	-53.5	308
50	4QAM	-	-83.5	-81.5	-82	-81.5	-81	-81	-81	-81	-81	-81.5	-77.5	76
	16QAM	-	-77.5	-75	-75.5	-75	-74.5	-74.5	-74.5	-74.5	-74.5	-75	-71	152
	32QAM	-	-74.5	-72	-73	-72	-71	-71.5	-72	-72	-71.5	-72	-68	190
	64QAM	-	-71.5	-69.5	-70	-69	-68.5	-68.5	-69	-69	-68.5	-69	-65	229
	128QAM	-	-68.5	-66.5	-67	-66	-65	-65.5	-66	-66	-65.5	-66.5	-62.5	267
	256QAM	-	-65.5	-63.5	-64	-63.5	-61.5	-62.5	-63	-63	-62.5	-63	-59	305
	512QAM	-	-62.5	-60.5	-61	-60	-58.5	-59.5	-59.5	-59.5	-59.5	-60	-56	343
	1024QAM	-	-59.5	-57	-57	-56.5	-55	-56.5	-56	-56	-56.5	-55.5	-51.5	381
60	4QAM	-	-82.5	-80.5	-81	-80.5	-79.5	-81	-80	-80	-80.5	-80.5	-76.5	91
	16QAM	-	-76.5	-74	-74	-74	-73	-74	-73.5	-73.5	-73.5	-74	-70	182
	32QAM	-	-73.5	-71.5	-71.5	-71	-70	-71	-70	-70	-70.5	-71.5	-67.5	227
	64QAM	-	-70.5	-68.5	-68.5	-68	-67.5	-67.5	-67.5	-67.5	-68	-69	-65	273
	128QAM	-	-67.5	-65.5	-63.5	-65	-64	-64.5	-65	-65	-65	-65.5	-61.5	318
	256QAM	-	-65	-62.5	-62.5	-62.5	-60.5	-62	-61.5	-61.5	-61.5	-62.5	-58.5	364
	512QAM	-	-61.5	-59.5	-59.5	-59	-57.5	-58.5	-58	-58	-58.5	-59	-55	410
	1024QAM	-	-58.5	-56	-56.5	-56	-53.5	-55.5	-55	-55	-55.5	-54.5	-50.5	455
80	4QAM	-	-78	-81	-79.5	-78.5	-80	-77.5	-79	-79	-80	-81	-76.5	111
	16QAM	-	-71.5	-74.5	-73	-72.5	-72.5	-71.5	-72	-72	-73.5	-74	-70	223
	32QAM	-	-69	-70.5	-70.5	-69.5	-69	-68.5	-69	-69	-70.5	-71	-67	279
	64QAM	-	-66.5	-67.5	-67	-66.5	-66	-65.5	-66.5	-66.5	-67.5	-68	-64	335
	128QAM	-	-63.5	-64.5	-64.5	-63.5	-63	-62.5	-63.5	-63.5	-64.5	-65.5	-61	391
	256QAM	-	-61.5	-60.5	-61	-60.5	-59.5	-59.5	-60.5	-60.5	-61	-62	-58	447
	512QAM	-	-57.5	-57.5	-58	-55.5	-57	-56.5	-57	-57	-58	-58.5	-54.5	503
	1024QAM	-	-	-54.5	-	-50.5	-	-	-53.5	-53.5	-	-	-	559

*Preliminary data
All data with Strong FEC

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