

# Phoenix G2/G2+

## DATASHEET



**V.1.08**

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+). All SAF's Phoenix G2 series radios are compatible with both G2 and G2+ IDU versions.

# TECHNICAL SPECIFICATION

## G2

## G2+

<b>General</b>			
Form factor	Split Mount (IDU + ODU) or Full indoor (IDU + IRFU)		
Frequency bands	2GHz, 2.3 GHz FCC, U4GHz, L6GHz, U6GHz, 7GHz, 8GHz, 11GHz, 13GHz, 15GHz 18GHz, 23GHz, 26GHz*, 38GHz		
Capacity	Up to 1 Gbps in 2+0 aggregation mode		
Max modulation	1024 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) **		
ACM and ATPC	Yes		
Channel bandwidth	ETSI	from 3.5 MHz, up to 56 MHz	
	FCC	from 5 MHz, up to 60 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)	
<b>Ports</b>			
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 up to 8x unbalanced, 75 ohm native ASI channels for ASI I/O	
ASI (optional)	BNC	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
E1/T1 (optional)	RJ-45	Available on external extension module	
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	1x for input power source connection	

\*Please contact SAF sales representative for more information

\*\*Not available with Phoenix G2 V ODU's

\*\*\* 80MHz BW available on request. Please contact SAF

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24a Ganibu Dambis, Riga LV-1005, Latvia



## Ethernet

Switch type	Managed Gigabit Ethernet Layer 2
Max frame size	64 to 2048 bytes, up to 10240 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***

## 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 Element	Yes, SNMP traps, MIB, SNMP v1/v2c/3
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: <150W	IDU only w/o ASI or E1/T1: <30W, 4xASI: <9W, 16xE1/T1: <9W. IDU + 2xODU: < IDU + 120W
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 and PTP1588v2 are licensed features  
\*\*\*\*HTTP will be automatically redirected to HTTPS

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## IDU compliance

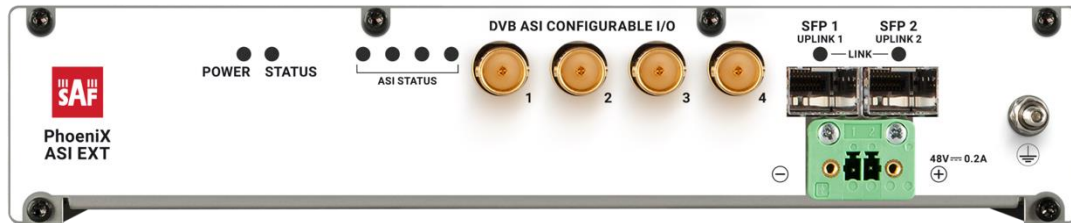
Operation	ETSI EN 300 019, Part 1-3, Class 3.2
Storage	ETSI EN 300 019, Part 1-1, Class 1.2
Transportation	ETSI EN 300 019, Part 1-2, Class 2.3
Power	EN 300 132-2
Radio frq., IDU+ODU	EN 302 217-2
EMC	EN 301 489-1, EN 301 489-3
Safety	EN 60950-1, EN 62368-1

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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: ½ width 1U (45 x 210 x 240 mm) / (1.77 x 8.27 x 9.45 in)

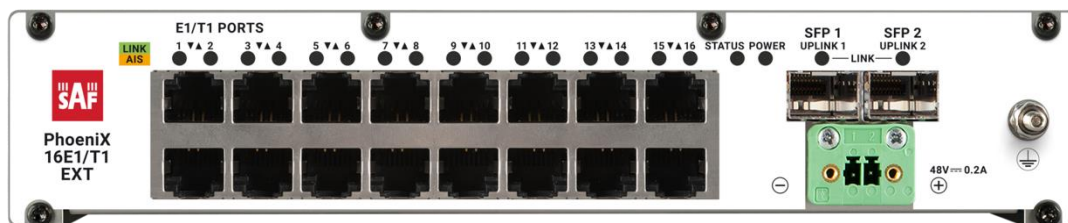
HxWxD

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)

# 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  
 $\frac{1}{2}$  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)

# 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)
<b>Mechanical &amp; Electrical</b>				
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	39-60 W	SP: 13-27 W; HP: 21-39 W; VHP: 39-60W

## 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
<b>ODU SP and HP</b>	-	N-type	N-type	SAF2R	SAF2R	SAF2R	SAF2	SAF2	SAF2	SAF2
<b>ODUVHP</b>	N-type		SAF2R	SAF2R	SAF2R	SAF2R	-	SAF2	-	-
<b>IRFU (w/o diplexer)</b>	2xSMA Rx / Tx							-	-	-
<b>IRFU (w diplexer)</b>	N-type			UBR84	UBR100	UBR140		-	-	-

# Frequency bands

Band	Frequency range	Duplex offset*
2 GHz	1.9 – 2.37 GHz	45 MHz. 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](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 (HP)	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 (HP)	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

\*Preliminary data

For IRFU w/o diplexer the Tx power is 1dBm higher





# 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	20
	32QAM	-83	-83	-80	-81.5	-79	-79	-79	-79	-79	-79	-80.5	-76.5	25
	64QAM	-80	-80	-77	-78	-76	-76.5	-76	-75.5	-75.5	-76	-77.5	-73.5	30
	128QAM	-77	-76.5	-74	-74.5	-73.5	-73	-73	-71	-71	-72.5	-71	-67	35
	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
14	512QAM	-	-66	-64.5	-	-63.5	-63.5	-63	-64	-64	-63	-64	-60	82
	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	-74.5	-71	63
	128QAM	-74.5	-73.5	-71.5	-72.5	-71	-71	-71.5	-71.5	-71.5	-71.5	-72	-68	74
20	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
	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	-76	-75.5	-72.5	76
	64QAM	-75.5	-75.5	-73	-74	-72.5	-72.5	-73	-72.5	-72.5	-72.5	-73	-69	91
28	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	122
	512QAM	-66	-66	-64	-65	-63.5	-62.5	-64	-63	-63	-63.5	-63	-59	137
	1024QAM	-63	-63	-61.5	-61	-61	-59.5	-60.5	-60	-60	-59.5	-57.5	-53.5	152
	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	86
40	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	129
	128QAM	-71	-70.5	-69	-69.5	-69	-68	-68.5	-68.5	-68.5	-68.5	-69	-65	151
	256QAM	-68	-68	-66	-66.5	-66	-64	-65.5	-65.5	-65.5	-65.5	-66	-62	172
	512QAM	-65	-64.5	-62.5	-63.5	-62.5	-60.5	-62.5	-62	-62	-62	-62.5	-58.5	194
	1024QAM	-61	-62	-60	-60	-59.5	-58	-59	-59	-59	-59	-59	-58.5	-54.5
56	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	122
	32QAM	-	-75.5	-73	-73.5	-73	-72.5	-72.5	-73	-73	-72.5	-73	-69	152
	64QAM	-	-72.5	-70.5	-71	-70	-69.5	-69.5	-70	-70	-69.5	-70	-66	183
	128QAM	-	-69.5	-67.5	-68	-67	-66	-66.5	-67	-67	-66.5	-67.5	-63.5	214
	256QAM	-	-66.5	-64.5	-65	-64.5	-62.5	-63.5	-64	-64	-63.5	-64	-60	244
56	512QAM	-	-63.5	-61	-62	-60.5	-59.5	-60.5	-60	-60	-60.5	-61	-57	275
	1024QAM	-	-60.5	-58	-58	-58	-56	-57.5	-57	-57	-57	-57.5	-53.5	305
	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	174
	32QAM	-	-74	-72	-72	-71.5	-71	-71	-71	-71	-71	-71.5	-67.5	217
	64QAM	-	-71	-69	-69	-68.5	-68	-68	-68	-68	-68.5	-68.5	-64.5	261
56	128QAM	-	-68	-66	-66.5	-65.5	-64.5	-65	-65.5	-65.5	-65	-65.5	-61.5	304
	256QAM	-	-65	-63	-63.5	-63	-61	-62	-62	-62	-61.5	-62.5	-58.5	348
	512QAM	-	-61.5	-60	-60.5	-59.5	-57.5	-58.5	-58.5	-58.5	-58.5	-59	-55	392
	1024QAM	-	-58.5	-56	-56.5	-56.5	-54	-55.5	-55.5	-55.5	-55.5	-55	-51	435

\*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
16QAM	-87		-87.5	-85.5	-84.5	-84	-83	-80	-83.5	-83.5	-84.5	-84.5	-80.5	15
32QAM	-84		-84.5	-82.5	-81.5	-80.5	-80	-78	-80	-80	-80.5	-82.5	-78.5	18
64QAM	-81		-81.5	-78.5	-78.5	-77.5	-77	-74.5	-76	-76	-75.5	-76.5	-72.5	22
10	128QAM	-77	-76.5	-74.5	-	-73.5	-71	-72	-71	-71	-71.5	-	-	26
	4QAM	-90	-90.5	-88	-88.5	-88	-87	-88.5	-90.6	-90.6	-90.5	-91.5	-87.5	15
	16QAM	-83	-84.5	-82	-82.5	-82	-81	-81	-83.7	-83.7	-80.5	-82.5	-78.5	30
	32QAM	-80.5	-81.5	-78.5	-79.5	-78.5	-78	-77.5	-81	-81	-78.5	-79.5	-75.5	38
	64QAM	-77	-77.5	-75	-76.5	-76	-75	-74.5	-78	-78	-75.5	-76.5	-72.5	45
	128QAM	-74.5	-73.5	-72	-73.5	-72	-71	-71.5	-72.9	-72.9	-71.5	-73.5	-69.5	53
20	256QAM	-	-70.5	-69	-	-69	-69	-68.5	-69.5	-69.5	-68.5	-68.5	-64.5	61
	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	76
	64QAM	-75.5	-75.5	-73	-74	-72.5	-72.5	-73	-72.5	-72.5	-72.5	-73	-69	91
	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	122
	512QAM	-66	-66	-64	-65	-63.5	-62.5	-64	-63	-63	-63.5	-63	-59	137
25	1024QAM	-63	-63	-61.5	-61	-61	-59.5	-60.5	-60	-60	-59.5	-57.5	-53.5	152
	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	74
	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	111
	128QAM	-72	-71.5	-70	-70	-69.5	-69	-69	-69	-69	-69	-69.5	-65.5	130
	256QAM	-68	-68.5	-66.5	-67	-66.5	-66	-66.5	-66	-66	-66	-66.5	-62.5	148
	512QAM	-65	-65.5	-63.5	-64	-63	-63	-61.5	-63	-62.5	-62.5	-63	-59	167
30	1024QAM	-62.5	-62.5	-60.5	-61	-60	-58.5	-59.5	-59.5	-59.5	-59.5	-58.5	-54.5	186
	4QAM	-85.5	-85.5	-83.5	-84	-82.5	-83.5	-83	-83.5	-83.5	-83.5	-84	-80	45
	16QAM	-79	-79.5	-77	-78	-77.5	-76.5	-76.5	-77	-77	-77	-77.5	-73.5	91
	32QAM	-76.5	-76.5	-74.5	-75	-74	-73.5	-74	-74	-74	-74.5	-74.5	-70.5	114
	64QAM	-73.5	-73.5	-71.5	-72	-71.5	-71	-71	-71	-71	-70.5	-71.5	-67.5	137
	128QAM	-71	-70.5	-68.5	-69.5	-68.5	-68	-68	-68	-68	-68	-69	-65	160
	256QAM	-67.5	-67.5	-65.5	-66	-66	-63.5	-64.5	-65	-65	-64.5	-65.5	-61.5	183
	512QAM	-65	-64.5	-62.5	-63	-61.5	-60.5	-61.5	-61.5	-61.5	-61.5	-62.5	-58.5	206
40	1024QAM	-61	-61.5	-59	-59.5	-59.5	-57.5	-58.5	-58.5	-58.5	-59	-58	-54	229
	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	122
	32QAM	-	-75.5	-73	-73.5	-73	-72.5	-72.5	-73	-73	-72.5	-73	-69	152
	64QAM	-	-72.5	-70.5	-71	-70	-69.5	-69.5	-70	-70	-69.5	-70	-66	183
	128QAM	-	-69.5	-67.5	-68	-67	-66	-66.5	-67	-67	-66.5	-67.5	-63.5	214
	256QAM	-	-66.5	-64.5	-65	-64.5	-62.5	-63.5	-64	-64	-63.5	-64	-60	244
	512QAM	-	-63.5	-61	-62	-60.5	-59.5	-60.5	-60	-60	-60.5	-61	-57	275
50	1024QAM	-	-60.5	-58	-58	-58	-56	-57.5	-57	-57	-57	-57.5	-53.5	305
	4QAM	-	-83.5	-81.5	-82	-81.5	-81	-81	-81	-81	-81	-81.5	-77.5	75
	16QAM	-	-77.5	-75	-75.5	-75	-74.5	-74.5	-74.5	-74.5	-74.5	-74.5	-71	151
	32QAM	-	-74.5	-72	-73	-72	-71	-71.5	-72	-72	-71.5	-72	-68	189
	64QAM	-	-71.5	-69.5	-70	-69	-68.5	-68.5	-69	-69	-68.5	-69	-65	227
	128QAM	-	-68.5	-66.5	-67	-66	-65	-65.5	-66	-66	-65.5	-66.5	-62.5	265
	256QAM	-	-65.5	-63.5	-64	-63.5	-61.5	-62.5	-63	-63	-62.5	-63	-59	303
	512QAM	-	-62.5	-60.5	-61	-60	-58.5	-59.5	-59.5	-59.5	-59.5	-60	-56	341
60	1024QAM	-	-59.5	-57	-57	-56.5	-55	-56.5	-56	-56	-56.5	-55.5	-51.5	379
	4QAM	-	-82.5	-80.5	-81	-80.5	-79.5	-81	-80	-80	-80.5	-80.5	-76.5	90
	16QAM	-	-76.5	-74	-74	-74	-73	-74	-73.5	-73.5	-73.5	-74	-70	180
	32QAM	-	-73.5	-71.5	-71.5	-71	-70	-71	-70	-70	-70.5	-71.5	-67.5	226
	64QAM	-	-70.5	-68.5	-68.5	-68	-67.5	-67.5	-67.5	-67.5	-68	-69	-65	271
	128QAM	-	-67.5	-65.5	-63.5	-65	-64	-64.5	-65	-65	-65	-65.5	-61.5	316
	256QAM	-	-65	-62.5	-62.5	-62.5	-60.5	-62	-61.5	-61.5	-61.5	-62.5	-58.5	361
	512QAM	-	-61.5	-59.5	-59.5	-59	-57.5	-58.5	-58	-58	-58.5	-59	-55	407
80	1024QAM	-	-58.5	-56	-56.5	-56	-53.5	-55.5	-55	-55	-55.5	-54.5	-50.5	452
	4QAM	-	-78	-81	-79.5	-78.5	-80	-77.5	-79	-79	-80	-80.5	-76.5	111
	16QAM	-	-71.5	-74.5	-73	-72.5	-72.5	-71.5	-72	-72	-73.5	-74	-70	222
	32QAM	-	-69	-70.5	-70.5	-69.5	-69	-68.5	-69	-69	-70.5	-71	-67	277
	64QAM	-	-66.5	-67.5	-67	-66.5	-66	-65.5	-66.5	-66.5	-67.5	-68	-64	333
	128QAM	-	-63.5	-64.5	-64.5	-63.5	-63	-62.5	-63.5	-63.5	-64.5	-65	-61	388
	256QAM	-	-61.5	-60.5	-61	-60.5	-59.5	-59.5	-60.5	-60.5	-61	-62	-58	444
	512QAM	-	-57.5	-57.5	-58	-55.5	-57	-56.5	-57	-57	-58	-58.5	-54.5	500
1024QAM	-	-	-54.5	-	-50.5	-	-	-	-	-	-	-	556	

\*Preliminary data  
All data with Strong FEC

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