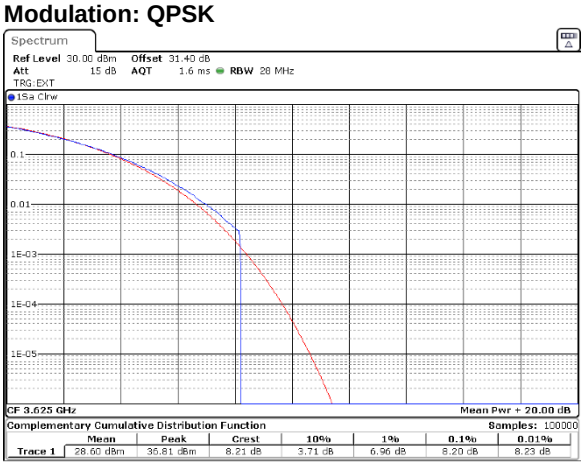
Test specification:	Section 96.41(g), Peak-to- average power ratio		
Test procedure:	Section 96.41(g)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

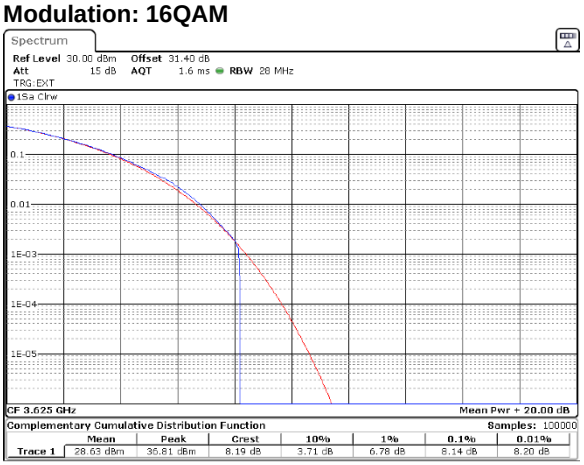
Plot 7.2.2 Peak-to-average power ratio test results at mid frequency

CHANNEL SPACING: 20 MHz
ANTENNA PORT: 4

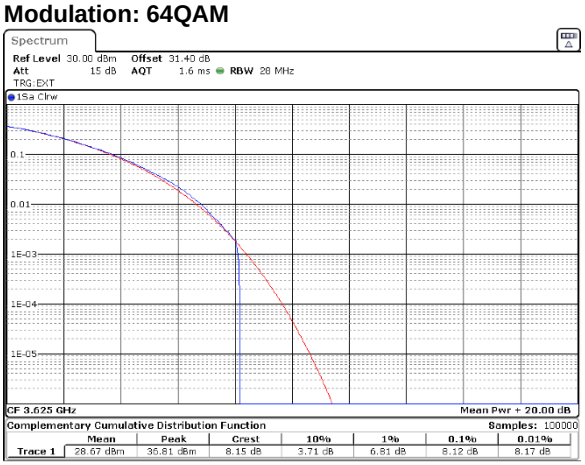
Modulation: QPSK



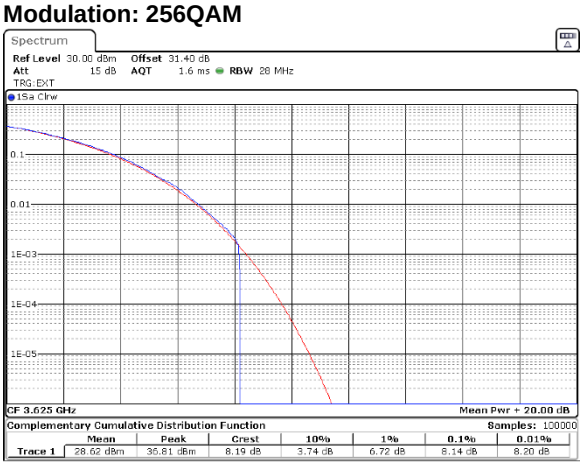
Modulation: 16QAM



Modulation: 64QAM



Modulation: 256QAM

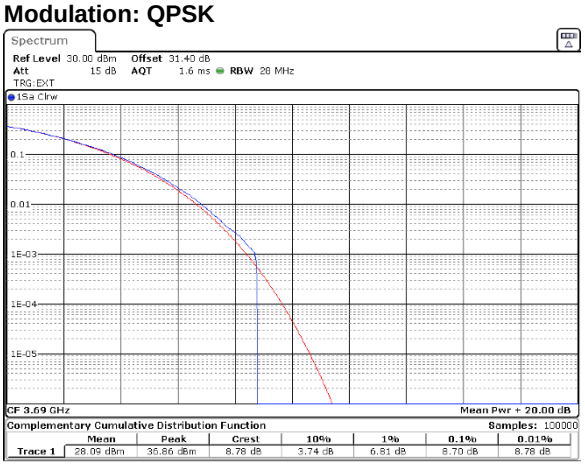


Test specification:	Section 96.41(g), Peak-to- average power ratio		
Test procedure:	Section 96.41(g)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

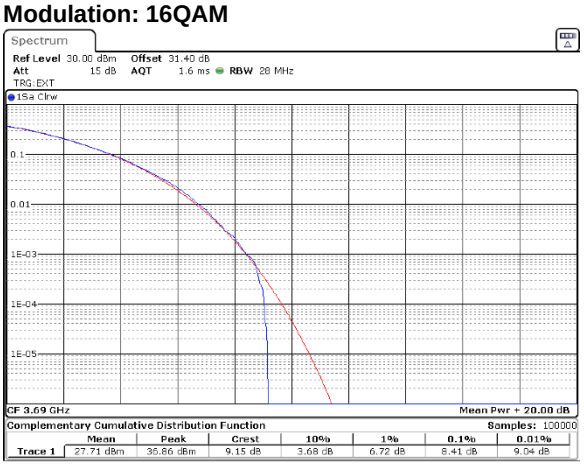
Plot 7.2.3 Peak-to-average power ratio test results at high frequency

CHANNEL SPACING: 20 MHz
ANTENNA PORT: 4

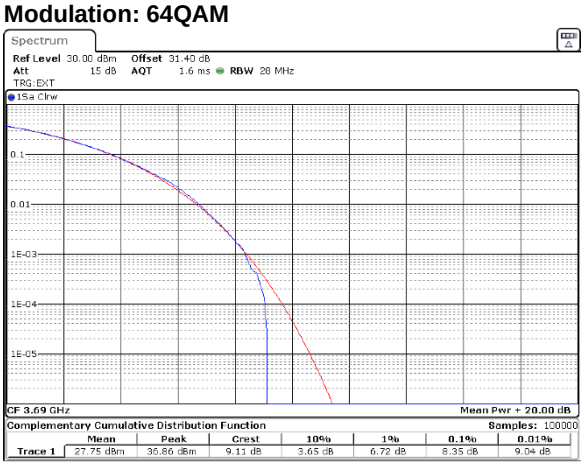
Modulation: QPSK



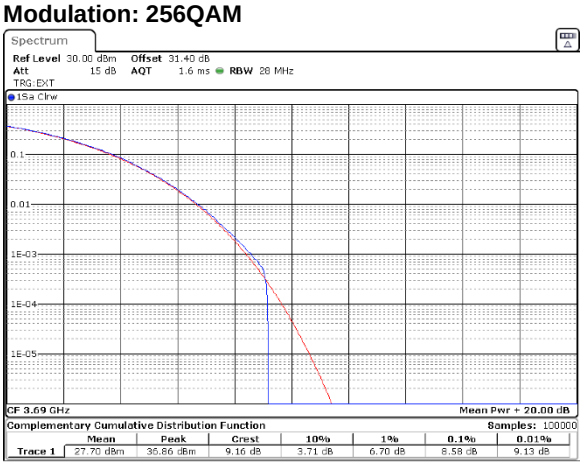
Modulation: 16QAM



Modulation: 64QAM



Modulation: 256QAM

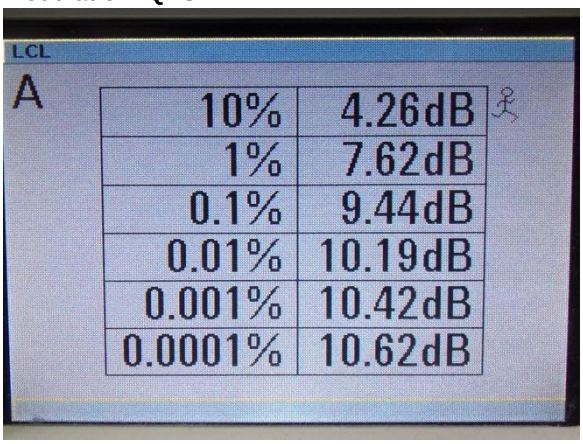


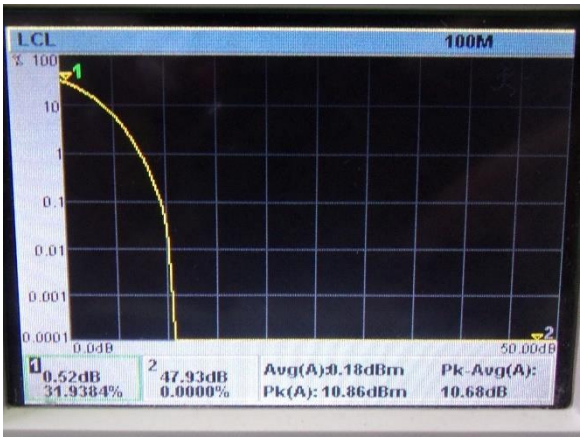
Test specification:	Section 96.41(g), Peak-to- average power ratio		
Test procedure:	Section 96.41(g)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.4 Peak-to-average power ratio test results at low frequency

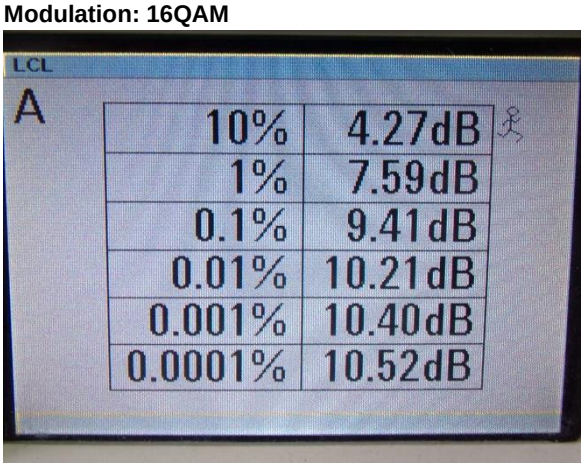
CHANNEL SPACING: 40 MHz
ANTENNA PORT: 4

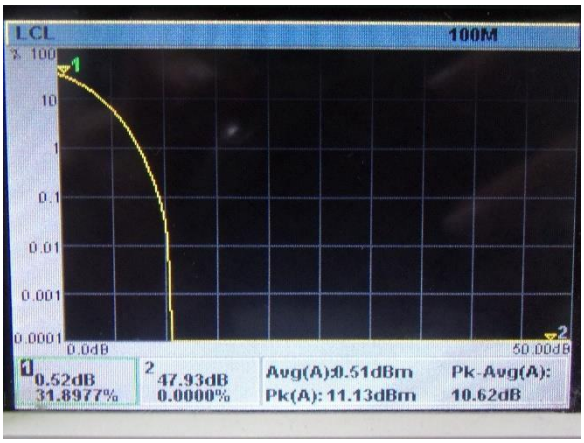
Modulation: QPSK



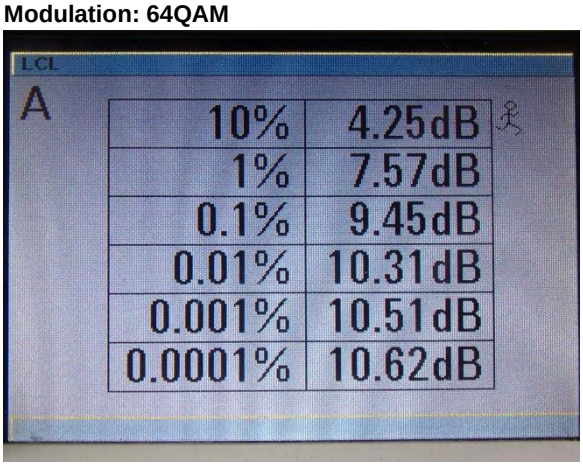


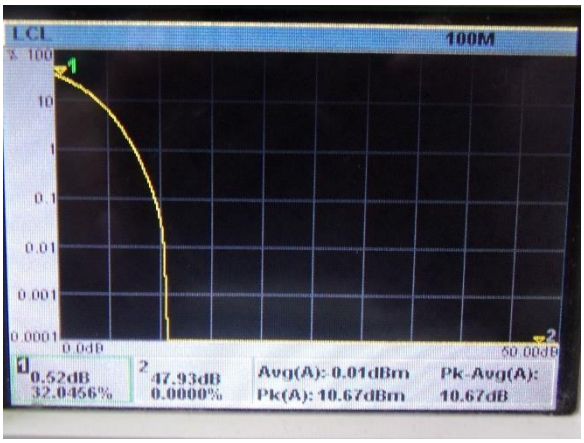
Modulation: 16QAM





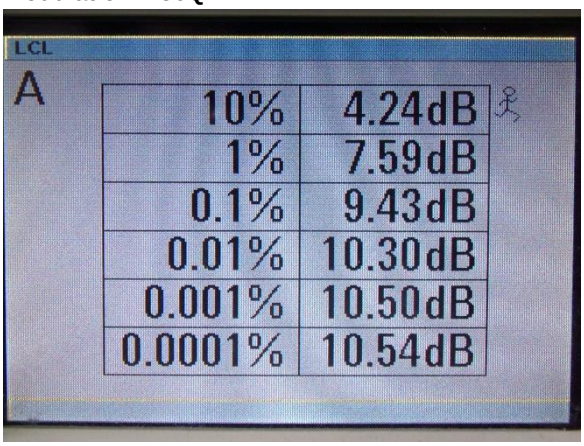
Modulation: 64QAM

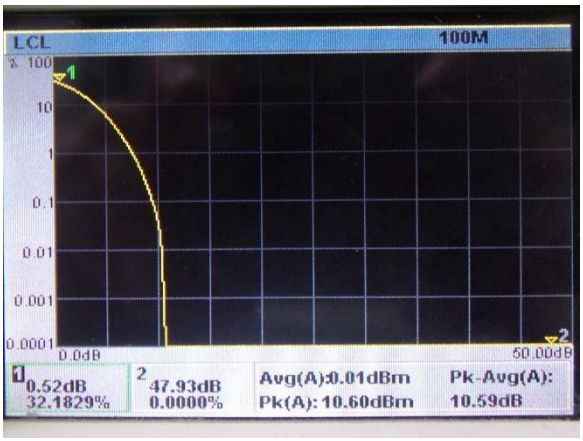




Test specification:	Section 96.41(g), Peak-to- average power ratio		
Test procedure:	Section 96.41(g)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Modulation: 256QAM



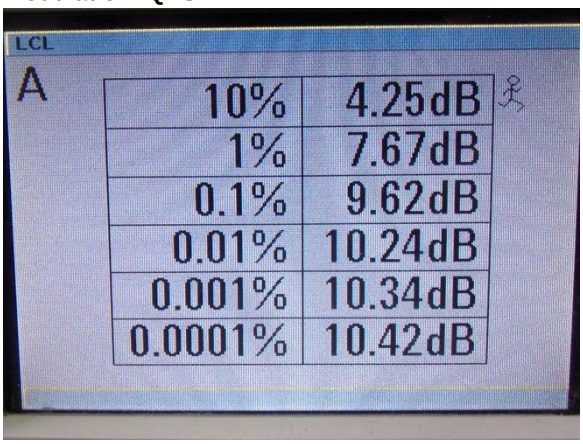


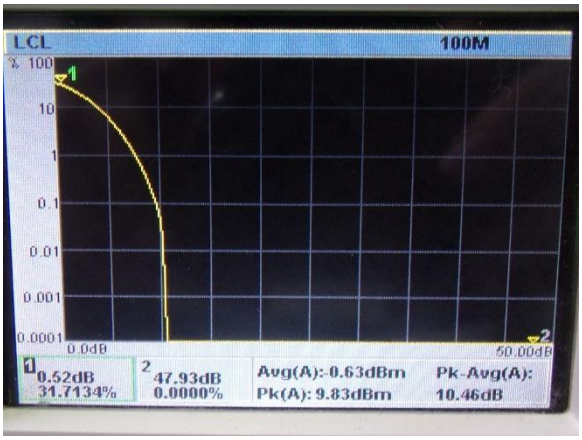
Test specification:	Section 96.41(g), Peak-to- average power ratio		
Test procedure:	Section 96.41(g)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.5 Peak-to-average power ratio test results at mid frequency

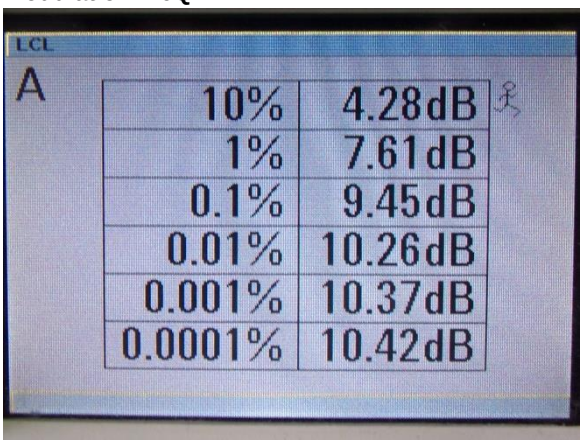
CHANNEL SPACING: 40 MHz
ANTENNA PORT: 4

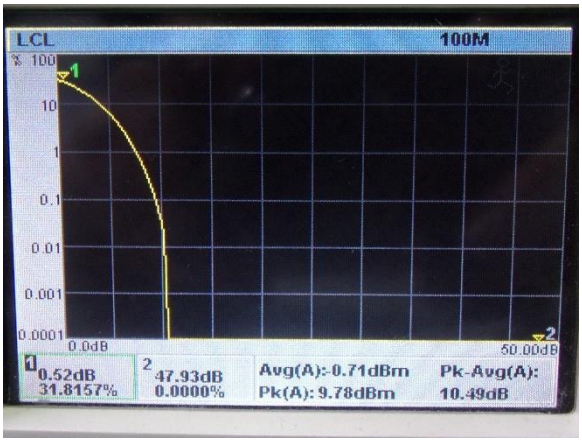
Modulation: QPSK



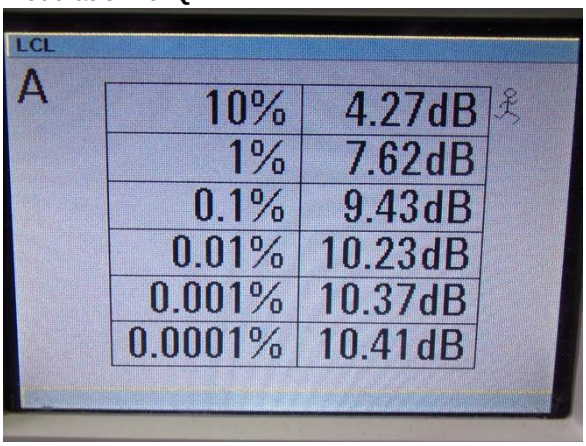


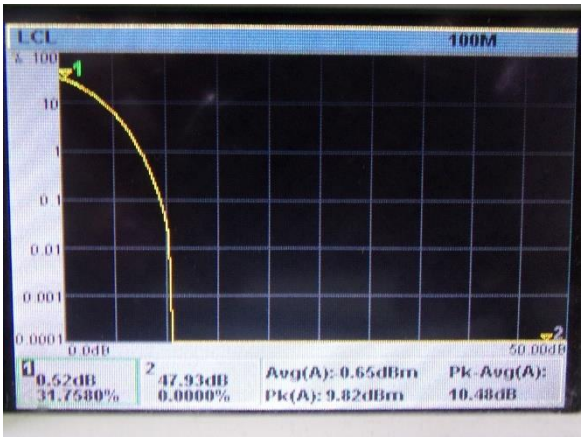
Modulation: 16QAM





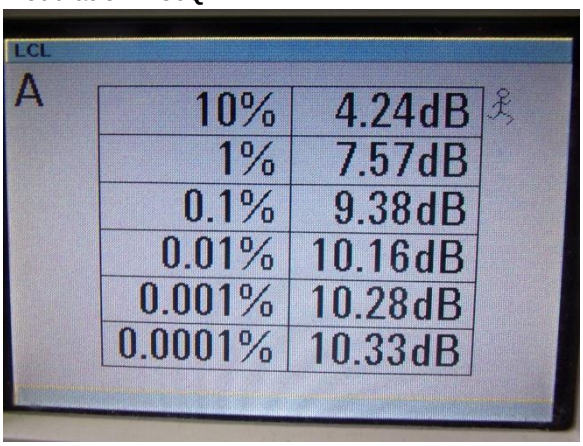
Modulation: 64QAM

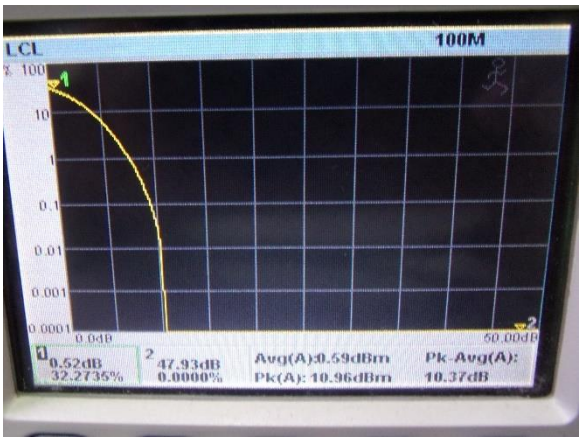




Test specification:	Section 96.41(g), Peak-to- average power ratio		
Test procedure:	Section 96.41(g)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Modulation: 256QAM



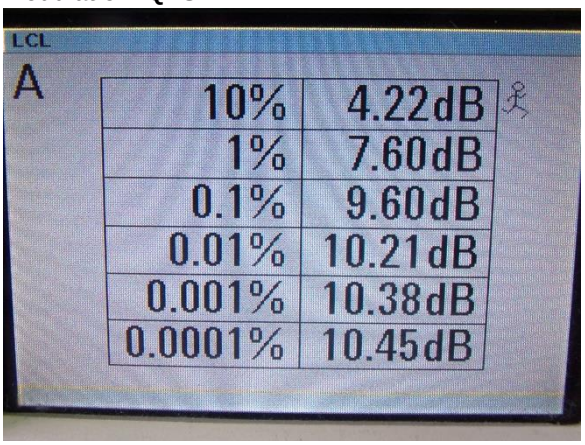


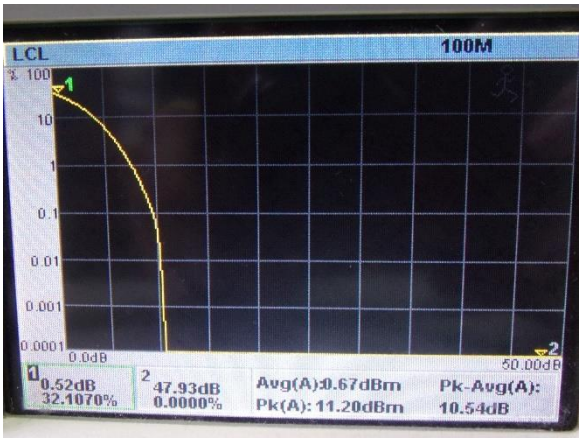
Test specification:	Section 96.41(g), Peak-to- average power ratio		
Test procedure:	Section 96.41(g)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.6 Peak-to-average power ratio test results at high frequency

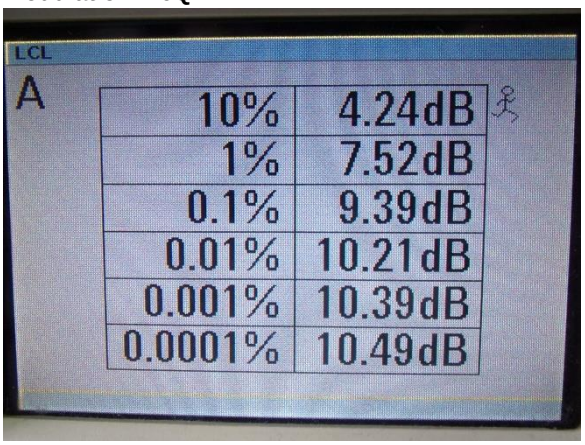
CHANNEL SPACING: 40 MHz
ANTENNA PORT: 4

Modulation: QPSK

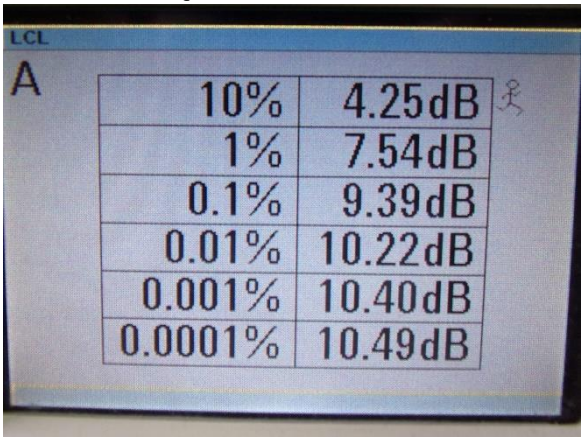


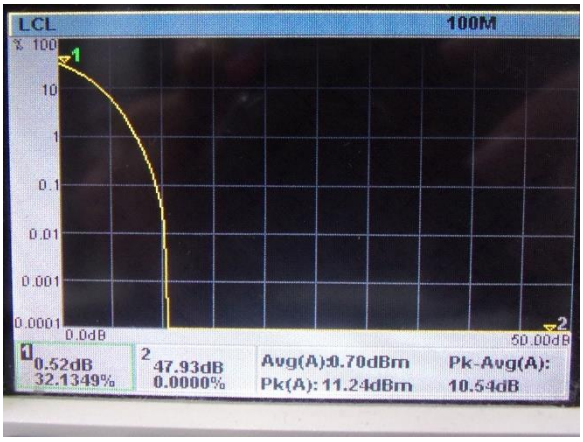


Modulation: 16QAM



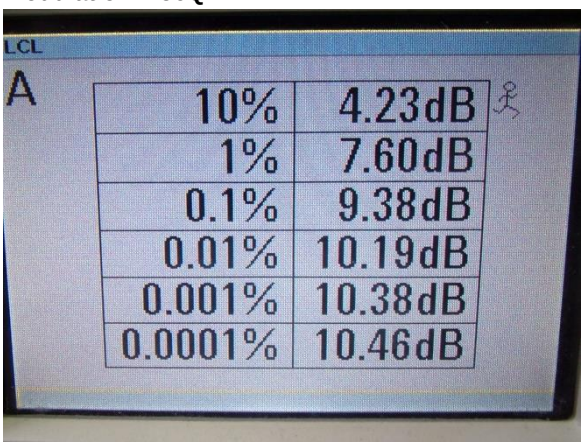
Modulation: 64QAM

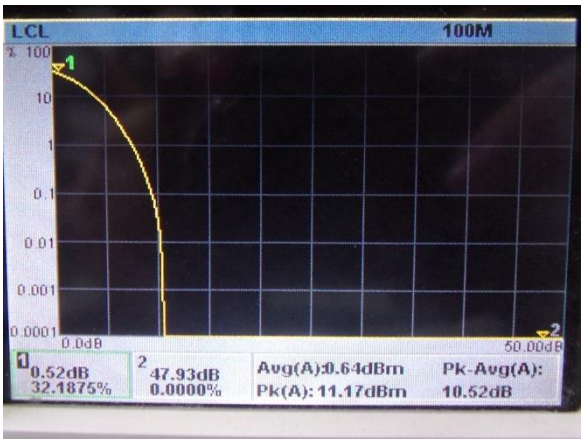




Test specification:	Section 96.41(g), Peak-to- average power ratio		
Test procedure:	Section 96.41(g)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	07-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Modulation: 256QAM





Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

7.3 Occupied bandwidth test

7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Occupied bandwidth limits

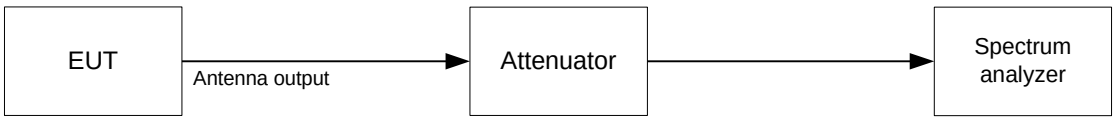
Assigned frequency, MHz	Modulation envelope reference points*, %	Maximum allowed bandwidth, MHz
3550 - 3700	99	20 / 40 MHz

* - Modulation envelope reference points are provided in terms of attenuation below the unmodulated carrier.

7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.
7.3.2.2 The EUT was set to transmit the unmodulated carrier and the reference peak power level was measured.
7.3.2.3 The EUT was set to transmit the normally modulated carrier.
7.3.2.4 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.3.2 and the associated plots.

Figure 7.3.1 Occupied bandwidth test setup



Test specification:	**Section2.1049, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	**Relative Humidity:** 54 %	**Air Pressure:** 1010 hPa	**Power:** 48 VDC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 1 – 5% of the OBW
VIDEO BANDWIDTH: > RBW
MODULATION ENVELOPE REFERENCE POINTS: 99%

Carrier frequency, MHz	Occupied bandwidth, MHz	Limit, MHz	Margin, MHz	Verdict
Channel spacing 20 MHz				
Modulation QPSK				
3560.0	18.2027	20.0000	-1.7973	Pass
3625.0	18.2077	20.0000	-1.7923	Pass
3690.0	18.2127	20.0000	-1.7873	Pass
Modulation 16QAM				
3560.0	18.2227	20.0000	-1.7773	Pass
3625.0	18.2477	20.0000	-1.7523	Pass
3690.0	18.2727	20.0000	-1.7273	Pass
Modulation 64QAM				
3560.0	18.2427	20.0000	-1.7573	Pass
3625.0	18.2577	20.0000	-1.7423	Pass
3690.0	18.2327	20.0000	-1.7673	Pass
Modulation 256QAM				
3560.0	18.1627	20.0000	-1.8373	Pass
3625.0	18.1772	20.0000	-1.8228	Pass
3690.0	18.1877	20.0000	-1.8123	Pass

Test specification:	**Section2.1049, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	**Relative Humidity:** 54 %	**Air Pressure:** 1010 hPa	**Power:** 48 VDC
Remarks:			

Table 7.3.3 Occupied bandwidth test results

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 1 – 5% of the OBW
VIDEO BANDWIDTH: > RBW
MODULATION ENVELOPE REFERENCE POINTS: 99%

Carrier frequency, MHz	Occupied bandwidth, MHz	Limit, MHz	Margin, MHz	Verdict
Channel spacing 40 MHz				
Modulation QPSK				
3570.0	37.7652	40.0	-2.2348	Pass
3625.0	37.8052	40.0	-2.1948	Pass
3680.0	37.7652	40.0	-2.2348	Pass
Modulation 16QAM				
3570.0	37.7752	40.0	-2.2248	Pass
3625.0	37.7952	40.0	-2.2048	Pass
3680.0	37.7852	40.0	-2.2148	Pass
Modulation 64QAM				
3570.0	37.7552	40.0	-2.2448	Pass
3625.0	37.7752	40.0	-2.2248	Pass
3680.0	37.7652	40.0	-2.2348	Pass
Modulation 256QAM				
3570.0	37.7352	40.0	-2.2648	Pass
3625.0	37.7752	40.0	-2.2248	Pass
3680.0	37.7852	40.0	-2.2148	Pass

Reference numbers of test equipment used

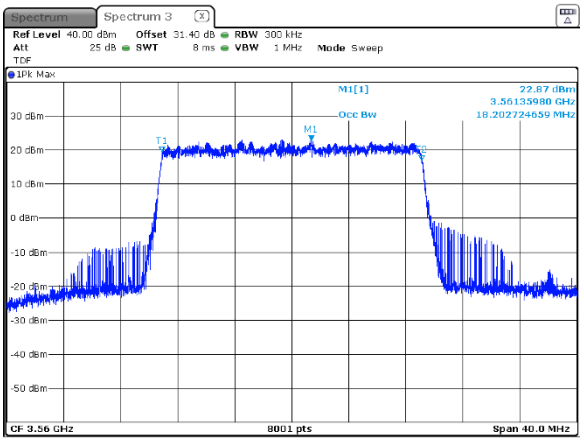
HL 3301	HL 4355	HL 5409					

Full description is given in Appendix A.

Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

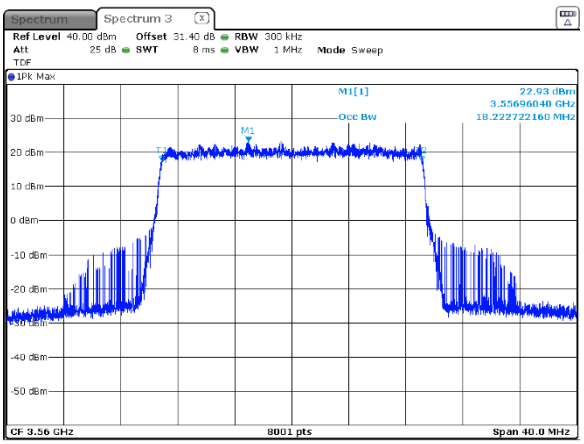
Plot 7.3.1 Occupied bandwidth test result at low frequency

MODULATION: QPSK
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Plot 7.3.2 Occupied bandwidth test result at low frequency

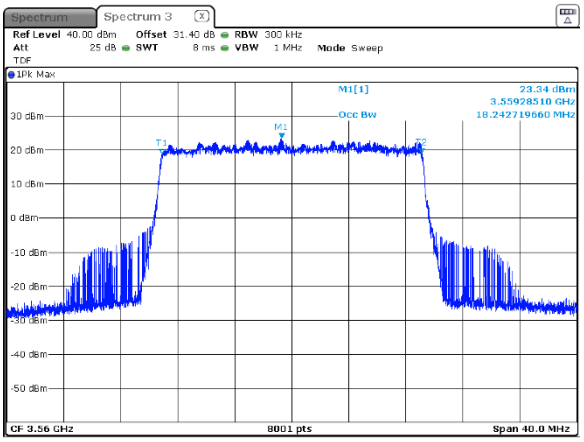
MODULATION: 16QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

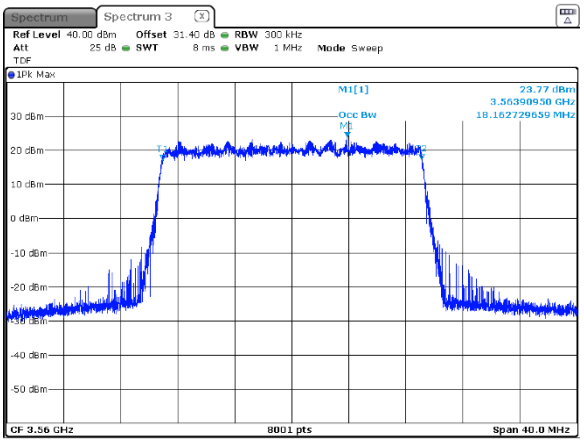
Plot 7.3.3 Occupied bandwidth test result at low frequency

MODULATION: 64QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Plot 7.3.4 Occupied bandwidth test result at low frequency

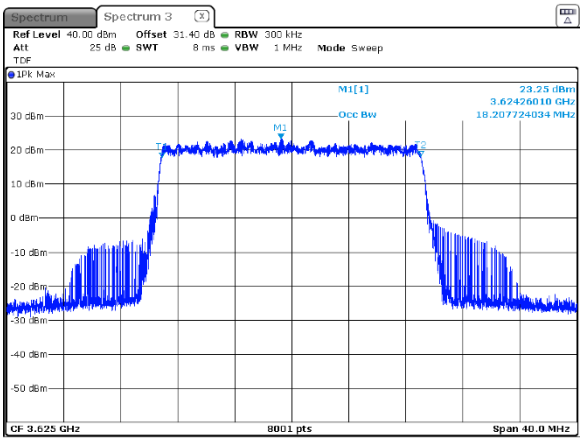
MODULATION: 256QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

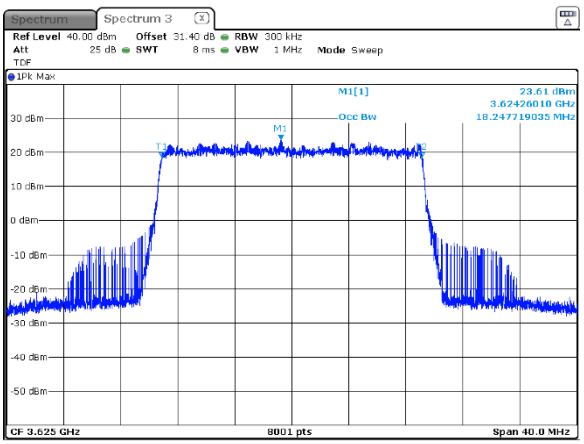
Plot 7.3.5 Occupied bandwidth test result at mid frequency

MODULATION: QPSK
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Plot 7.3.6 Occupied bandwidth test result at mid frequency

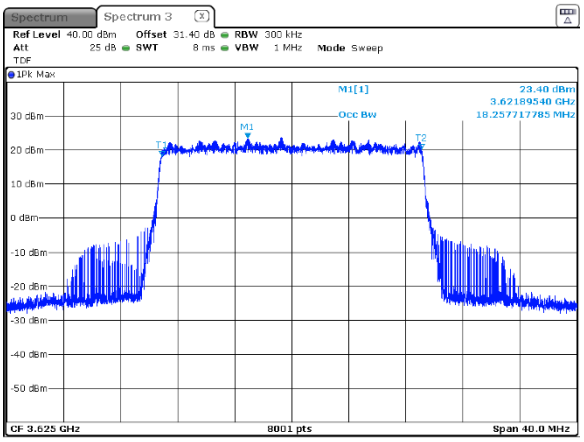
MODULATION: 16QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

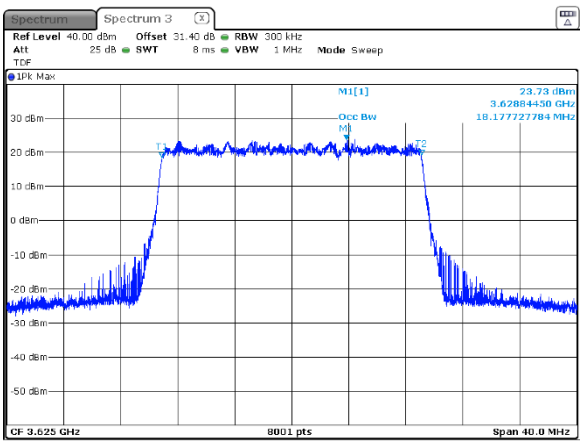
Plot 7.3.7 Occupied bandwidth test result at mid frequency

MODULATION: 64QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Plot 7.3.8 Occupied bandwidth test result at mid frequency

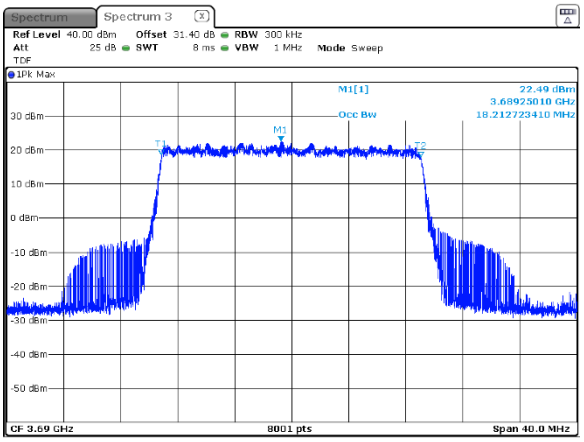
MODULATION: 256QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

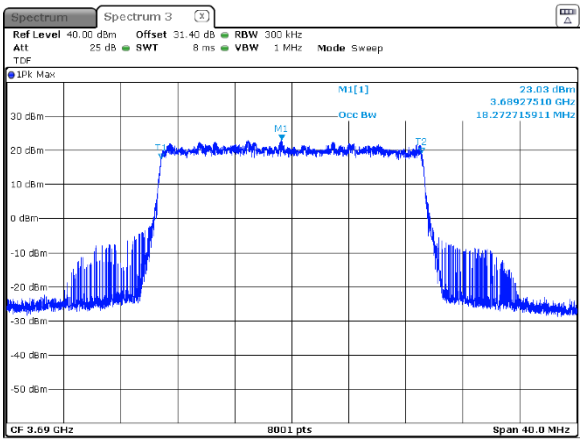
Plot 7.3.9 Occupied bandwidth test result at high frequency

MODULATION: QPSK
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Plot 7.3.10 Occupied bandwidth test result at high frequency

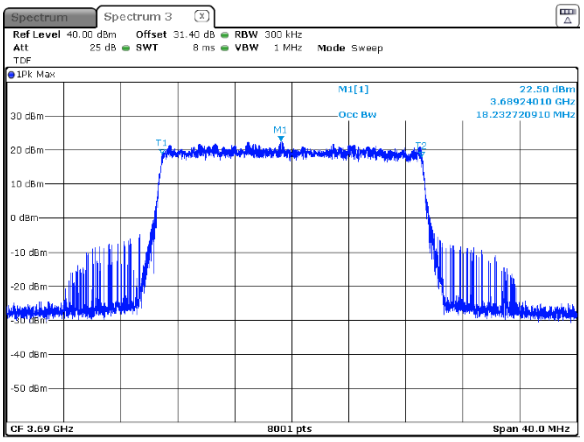
MODULATION: 16QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

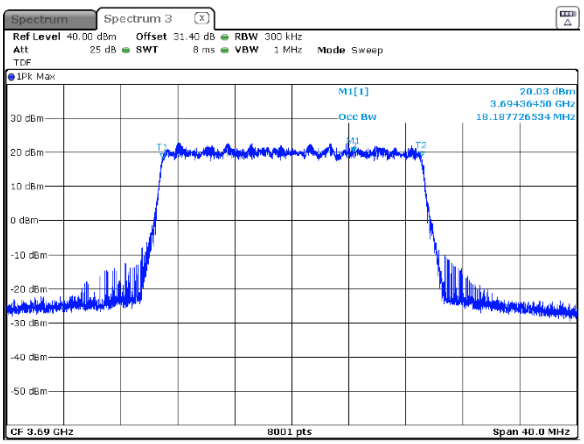
Plot 7.3.11 Occupied bandwidth test result at high frequency

MODULATION: 64QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Plot 7.3.12 Occupied bandwidth test result at high frequency

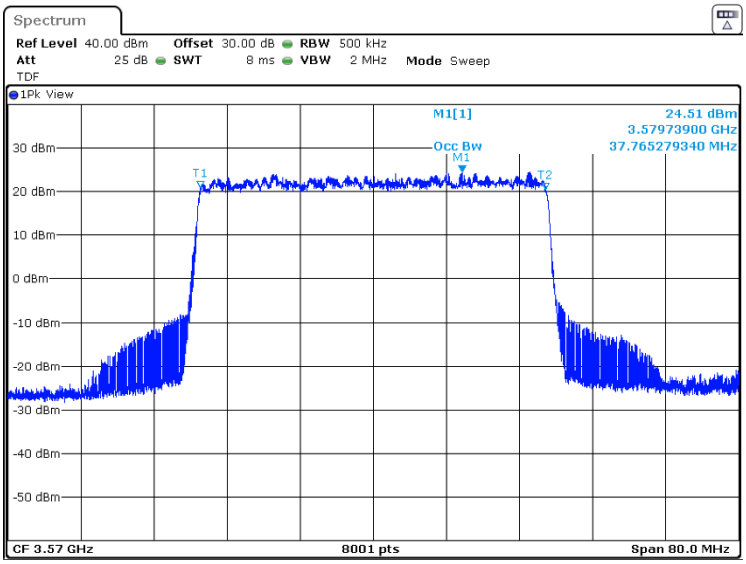
MODULATION: 256QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

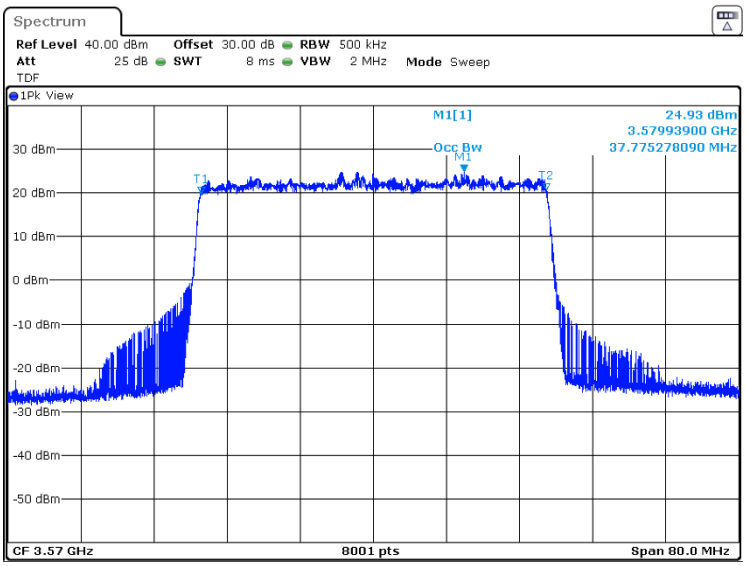
Plot 7.3.13 Occupied bandwidth test result at low frequency

MODULATION: QPSK
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Plot 7.3.14 Occupied bandwidth test result at low frequency

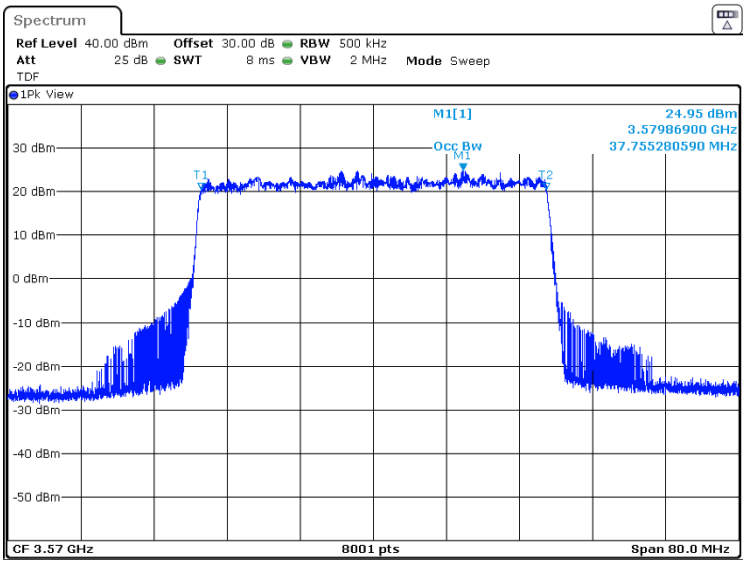
MODULATION: 16QAM
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

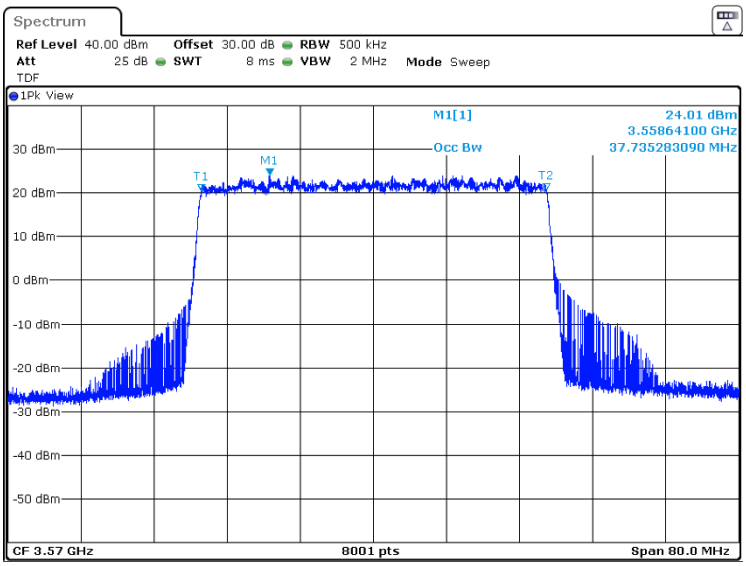
Plot 7.3.15 Occupied bandwidth test result at low frequency

MODULATION: 64QAM
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Plot 7.3.16 Occupied bandwidth test result at low frequency

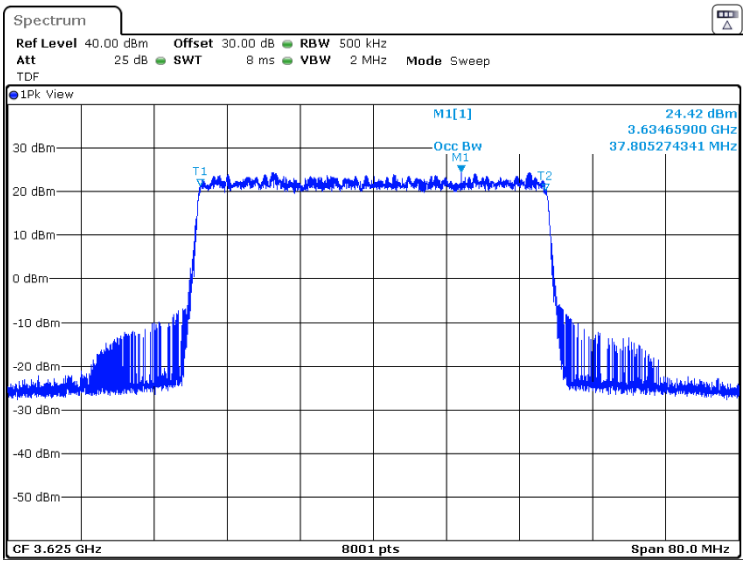
MODULATION: 256QAM
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

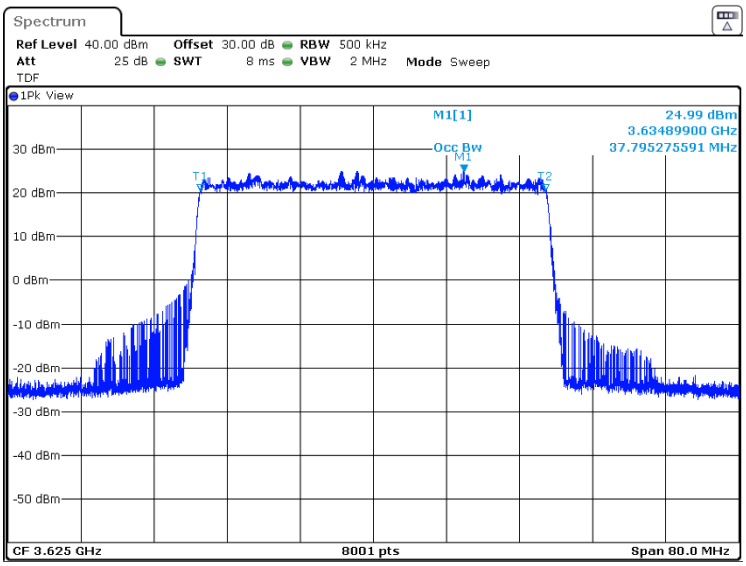
Plot 7.3.17 Occupied bandwidth test result at mid frequency

MODULATION: QPSK
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Plot 7.3.18 Occupied bandwidth test result at mid frequency

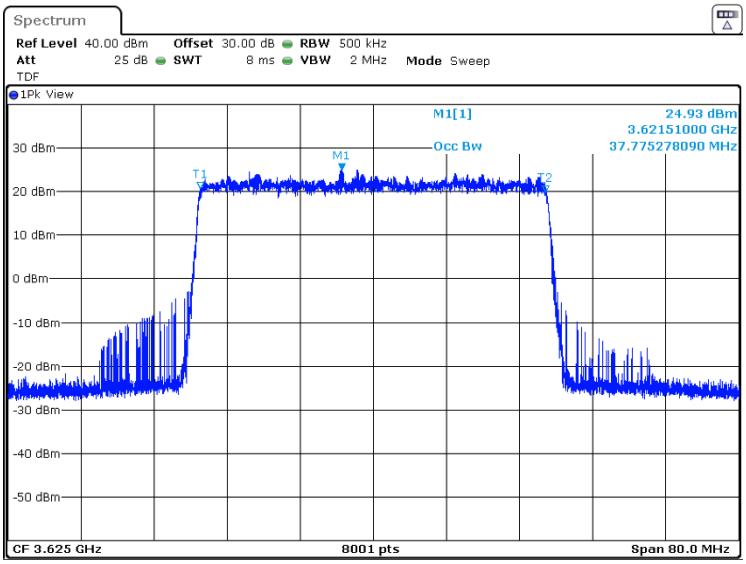
MODULATION: 16QAM
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

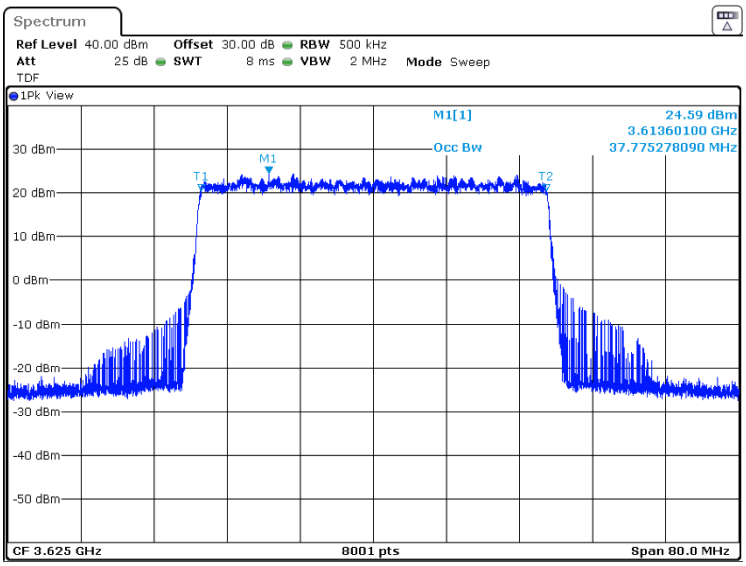
Plot 7.3.19 Occupied bandwidth test result at mid frequency

MODULATION: 64QAM
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Plot 7.3.20 Occupied bandwidth test result at mid frequency

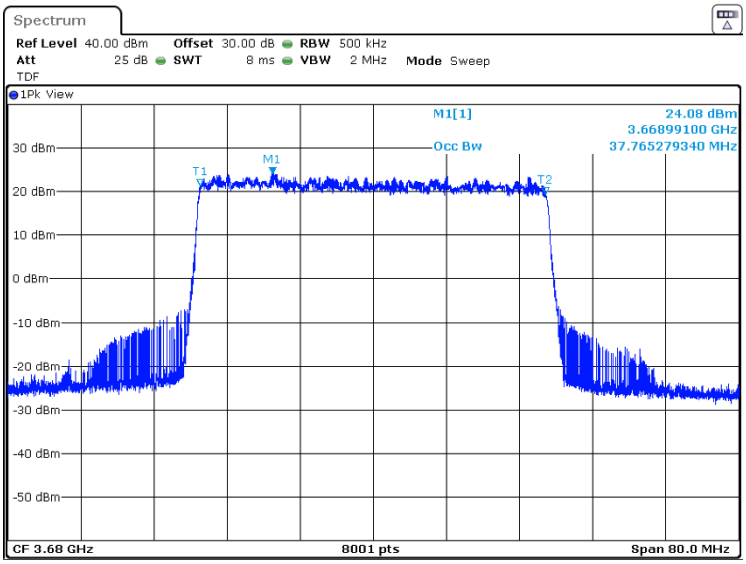
MODULATION: 256QAM
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

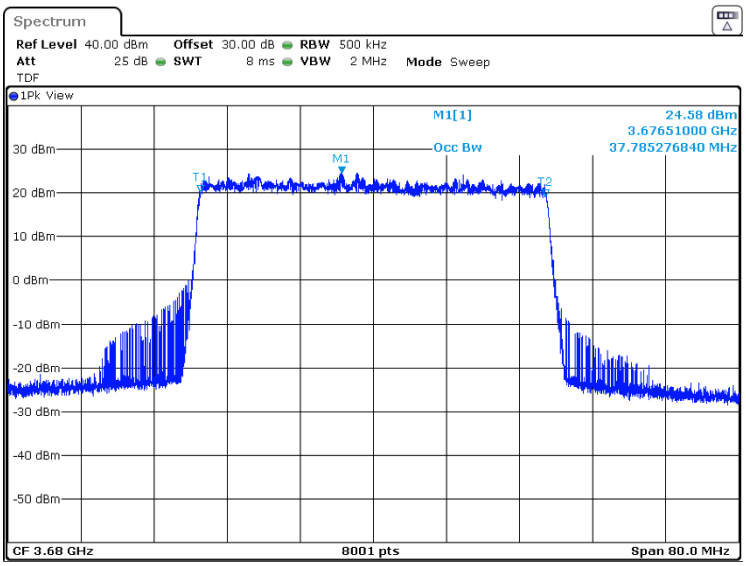
Plot 7.3.21 Occupied bandwidth test result at high frequency

MODULATION: QPSK
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Plot 7.3.22 Occupied bandwidth test result at high frequency

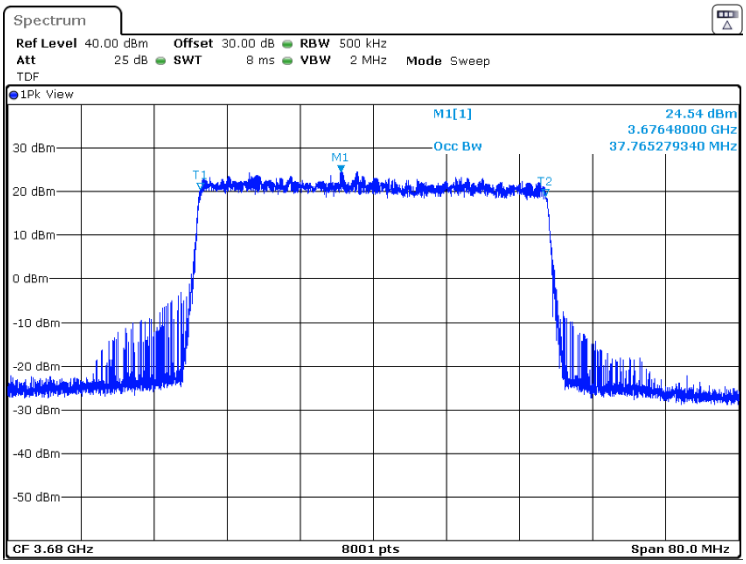
MODULATION: 16QAM
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Test specification:	Section2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

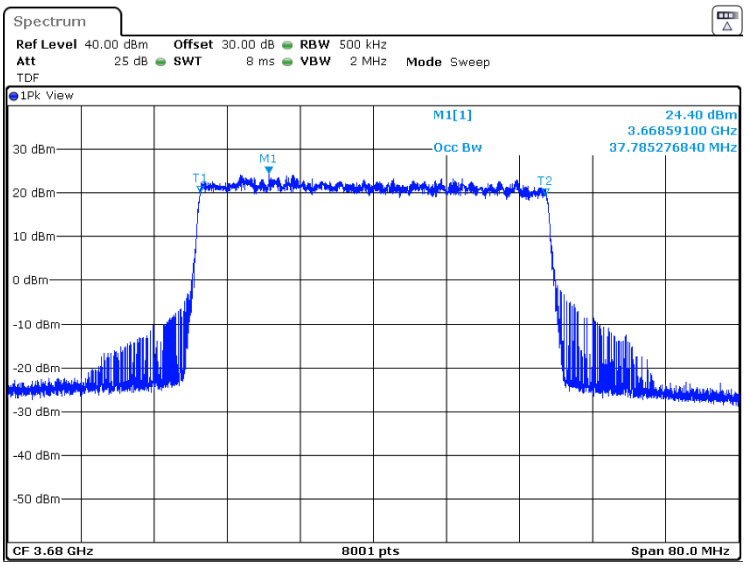
Plot 7.3.23 Occupied bandwidth test result at high frequency

MODULATION: 64QAM
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Plot 7.3.24 Occupied bandwidth test result at high frequency

MODULATION: 256QAM
CHANNEL SPACING: 40 MHz
ANTENNA CHAIN: 4



Test specification:	**Section 96.41(e), Emission mask**		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	15-Nov-21		
Temperature: 25 ºC	**Relative Humidity:** 54 %	**Air Pressure:** 1011 hPa	**Power:** 48 VDC
Remarks:			

7.4 Emission mask test

7.4.1 General

This test was performed to measure emission mask at RF antenna connector. Specification test limits are given in Table 7.4.1. The test results are provided in the associated plots.

Table 7.4.1 Emission mask limits

Frequency displacement from frequency block	Limit*, dBm/MHz	RBW, kHz
Channel Spacing 20 MHz		
0 – 1 MHz	- 13	200
0 – 10 MHz	- 13	1000
10 – 20 MHz	- 25	1000
Above 3530 MHz and below 3720 MHz	- 25	1000
Below 3530 MHz and above 3720 MHz	- 40	1000
Channel Spacing 40 MHz		
0 – 1 MHz	- 13	400
0 – 10 MHz	- 13	1000
10 – 20 MHz	- 25	1000
Above 3530 MHz and below 3720 MHz	- 25	1000
Below 3530 MHz and above 3720 MHz	- 40	1000

* - Limit at each antenna connector (amount of antennas N = 4)

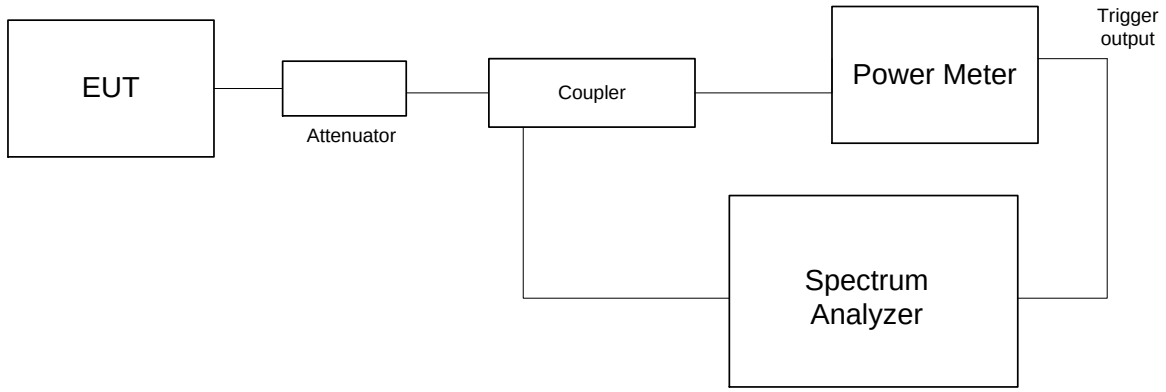
7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and its proper operation was checked.

7.4.2.2 The Emission outside the fundamental was measured with spectrum analyzer as provided in Table 7.4.2, Table 7.4.3 and the the associated plots.

Test specification:	Section 96.41(e), Emission mask		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	15-Nov-21		
Temperature: 25 ºC	Relative Humidity: 54 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Figure 7.4.1 Emission outside the fundamental test setup



Test specification:	**Section 96.41(e), Emission mask**		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	15-Nov-21		
Temperature: 25 ºC	**Relative Humidity:** 54 %	**Air Pressure:** 1011 hPa	**Power:** 48 VDC
Remarks:			

Table 7.4.2 Emission outside the fundamental test results

ASSIGNED FREQUENCY RANGE: 3550.0 –3700.0 MHz
DETECTOR USED: Average (gated)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
NUMBER OF CHAINS: 4
ANTENNA PORT: Worst case
CHANEL SPACING: 20MHz

Frequency MHz	Band edge	SA reading over 1 chain, dBm	Total band edge*, dBm	RBW, kHz	Limit, dBm	Margin, dB	Verdict
QPSK							
Low frequency 3560.0 MHz							
3530.00	Low	-49.54	-43.54	1000	-40	-3.54	Pass
3540.00	Low	-34.55	-28.55	1000	-25	-3.55	
3549.00	Low	-22.82	-16.82	1000	-13	-3.82	
3550.00	Low	-25.18	-19.18	200	-13	-6.18	
3590.00	High	-24.82	-18.82	200	-13	-5.82	
3571.00	High	-23.17	-17.17	1000	-13	-4.17	
3580.00	High	-31.59	-25.59	1000	-25	-0.59	
3720.00	High	-51.00	-45.00	1000	-40	-5.00	
Mid frequency 3625.0 MHz							
3530.00	Low	-51.31	-45.31	1000	-40	-5.31	Pass
3605.00	Low	-31.10	-25.10	1000	-25	-0.10	
3614.00	Low	-22.90	-16.90	1000	-13	-3.90	
3615.00	Low	-24.61	-18.61	200	-13	-5.61	
3635.00	High	-24.49	-18.49	200	-13	-5.49	
3636.00	High	-22.98	-16.98	1000	-13	-3.98	
3645.00	High	-31.88	-25.88	1000	-25	-0.88	
3720.00	High	-51.12	-45.12	1000	-40	-5.12	
High frequency 3690.0 MHz							
3530.00	Low	-51.36	-45.36	1000	-40	-5.36	Pass
3670.00	Low	-29.66	-23.66	1000	-25	1.34	
3679.00	Low	-23.75	-17.75	1000	-13	-4.75	
3680.00	Low	-24.08	-18.08	200	-13	-5.08	
3700.00	High	-24.93	-18.93	200	-13	-5.93	
3701.00	High	-25.16	-19.16	1000	-13	-6.16	
3710.00	High	-32.66	-26.66	1000	-25	-1.66	
3720.00	High	-46.18	-40.18	1000	-40	-0.18	

Test specification:	**Section 96.41(e), Emission mask**		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	15-Nov-21		
Temperature: 25 ºC	**Relative Humidity:** 54 %	**Air Pressure:** 1011 hPa	**Power:** 48 VDC
Remarks:			

Table 7.4.3 Emission outside the fundamental test results (continued)

ASSIGNED FREQUENCY RANGE: 3550.0 –3700.0 MHz
DETECTOR USED: Average (gated)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
NUMBER OF CHAINS: 4
ANTENNA PORT: Worst case
CHANEL SPACING: 20MHz

Frequency MHz	Band edge	SA reading over 1 chain, dBm	Total band edge*, dBm	RBW, kHz	Limit, dBm	Margin, dB	Verdict
256 QAM							
Low frequency 3560.0 MHz							
3530.00	Low	-50.09	-44.09	1000	-40	-4.09	Pass
3540.00	Low	-35.13	-29.13	1000	-25	-4.13	
3549.00	Low	-23.25	-17.25	1000	-13	-4.25	
3550.00	Low	-26.13	-20.13	200	-13	-7.13	
3570.00	High	-23.90	-17.90	200	-13	-4.90	
3571.00	High	-23.47	-17.47	1000	-13	-4.47	
3580.00	High	-31.51	-25.51	1000	-25	-0.51	
3720.00	High	-50.88	-44.88	1000	-40	-4.88	
Mid frequency 3625.0 MHz							
3530.00	Low	-51.24	-45.24	1000	-40	-5.24	Pass
3605.00	Low	-33.10	-27.10	1000	-25	-2.10	
3614.00	Low	-22.74	-16.74	1000	-13	-3.74	
3615.00	Low	-24.44	-18.44	200	-13	-5.44	
3635.00	High	-25.79	-19.79	200	-13	-6.79	
3636.00	High	-24.32	-18.32	1000	-13	-5.32	
3645.00	High	-32.72	-26.72	1000	-25	-1.72	
3720.00	High	-50.74	-44.74	1000	-40	-4.74	
High frequency 3690.0 MHz							
3530.00	Low	-51.24	-45.24	1000	-40	-5.24	Pass
3670.00	Low	-32.43	-26.43	1000	-25	-1.43	
3679.00	Low	-25.51	-19.51	1000	-13	-6.51	
3680.00	Low	-26.04	-20.04	200	-13	-7.04	
3700.00	High	-24.92	-18.92	200	-13	-5.92	
3701.00	High	-26.66	-20.66	1000	-13	-7.66	
3710.00	High	-35.24	-29.24	1000	-25	-4.24	
3720.00	High	-46.22	-40.22	1000	-40	-0.22	

* - SA Reading over 1 chain = Max SA reading (Chains #1&2 and #3&4)
** - Total band edge = Maximum SA Reading over 1 chain + 10*log(N) = SA reading +6 dB
*** - Margin = Total band edge – Specification limit