



HERMON LABORATORIES

Test specification:		Section 90.1215, Maximum output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
26-Dec-23			
Temperature: 24 °C	Relative Humidity: 39 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.18 Peak spectral power density at mid frequency

CHANNEL SPACING:

50 MHz

ANTENNA CHAIN:

1

Modulation:

16QAM





HERMON LABORATORIES

Test specification:		Section 90.1215, Maximum output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
26-Dec-23			
Temperature: 24 °C	Relative Humidity: 39 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.19 Peak spectral power density at mid frequency

CHANNEL SPACING:

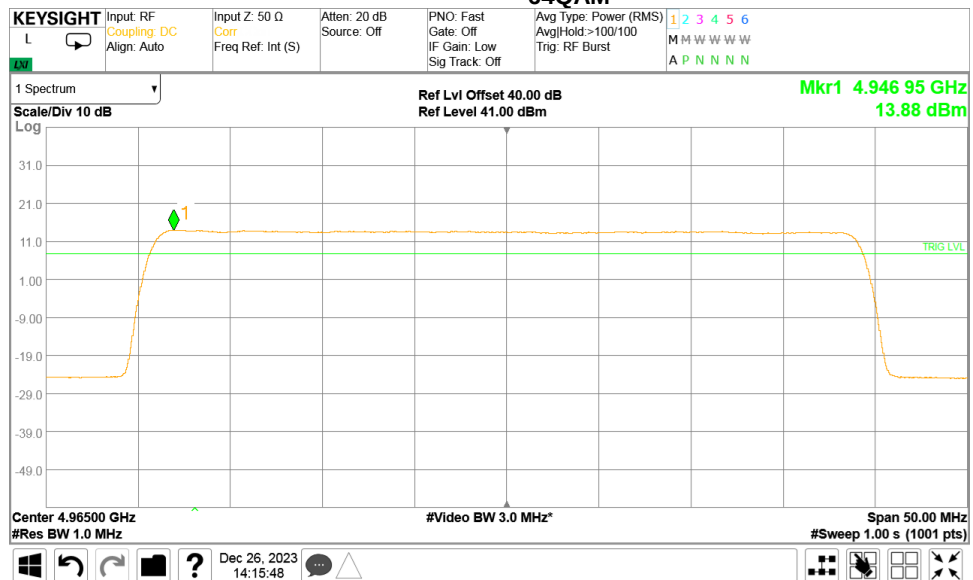
50 MHz

ANTENNA CHAIN:

1

Modulation:

64QAM





HERMON LABORATORIES

Test specification:		Section 90.1215, Maximum output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
26-Dec-23			
Temperature: 24 °C	Relative Humidity: 39 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.20 Peak spectral power density at mid frequency

CHANNEL SPACING:

50 MHz

ANTENNA CHAIN:

1

Modulation:

256QAM





HERMON LABORATORIES

Test specification: Section 90.1215, Maximum output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Dec-23			
Temperature: 24 °C	Relative Humidity: 39 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.21 Peak spectral power density at mid frequency

CHANNEL SPACING:

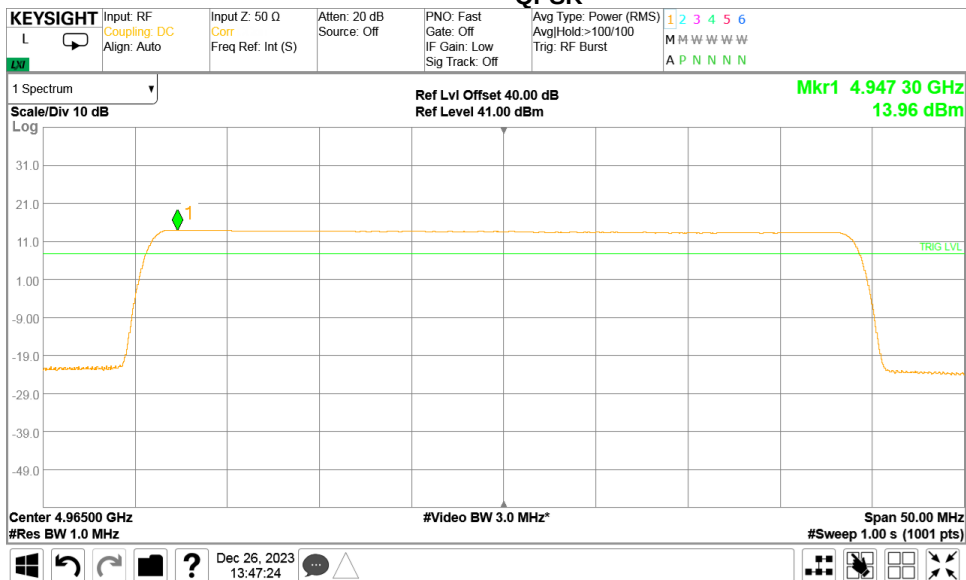
50 MHz

ANTENNA CHAIN:

2

Modulation:

QPSK





HERMON LABORATORIES

Test specification:		Section 90.1215, Maximum output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
26-Dec-23			
Temperature: 24 °C	Relative Humidity: 39 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.22 Peak spectral power density at mid frequency

CHANNEL SPACING:

50 MHz

ANTENNA CHAIN:

2

Modulation:

16QAM





HERMON LABORATORIES

Test specification:		Section 90.1215, Maximum output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
26-Dec-23			
Temperature: 24 °C	Relative Humidity: 39 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.23 Peak spectral power density at mid frequency

CHANNEL SPACING:

50 MHz

ANTENNA CHAIN:

2

Modulation:

64QAM





HERMON LABORATORIES

Test specification:		Section 90.1215, Maximum output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
26-Dec-23			
Temperature: 24 °C	Relative Humidity: 39 %	Air Pressure: 1018 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.24 Peak spectral power density at mid frequency

CHANNEL SPACING:

50 MHz

ANTENNA CHAIN:

2

Modulation:

256QAM





Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1. The test results are provided in Table 7.2.2 and the associated plots.

Table 7.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, %	Maximum allowed bandwidth, MHz
4940.0 – 4990.0	99	10, 20, 40 MHz

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

7.2.2 Test procedure

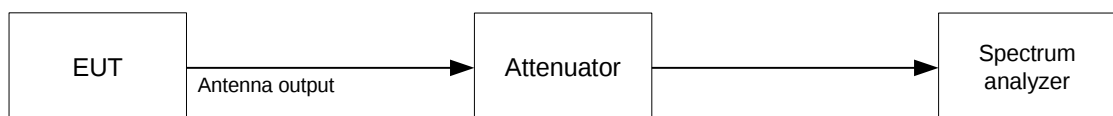
7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

7.2.2.2 The EUT was set to transmit the unmodulated carrier and the reference peak power level was measured.

7.2.2.3 The EUT was set to transmit the normally modulated carrier.

7.2.2.4 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.2.2 and the associated plots.

Figure 7.2.1 Occupied bandwidth test setup





Test specification:		Section 90.209, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Verdict: PASS	
Date(s):			
28-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Table 7.2.2 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 10 MHz				
Modulation QPSK				
4945.0	8.623	NA	NA	Pass
4965.0	8.628	NA	NA	Pass
4985.0	8.638	NA	NA	Pass
Modulation 16QAM				
4945.0	8.643	NA	NA	Pass
4965.0	8.640	NA	NA	Pass
4985.0	8.645	NA	NA	Pass
Modulation 64QAM				
4945.0	8.639	NA	NA	Pass
4965.0	8.645	NA	NA	Pass
4985.0	8.643	NA	NA	Pass
Modulation 256QAM				
4945.0	8.627	NA	NA	Pass
4965.0	8.624	NA	NA	Pass
4985.0	8.626	NA	NA	Pass

Carrier frequency, MHz	Occupied bandwidth, MHz	Limit, MHz	Margin, MHz	Verdict
Channel spacing 25 MHz				
Modulation QPSK				
4952.5	18.390	NA	NA	Pass
4967.5	18.382	NA	NA	Pass
4977.5	18.371	NA	NA	Pass
Modulation 16QAM				
4952.5	18.432	NA	NA	Pass
4967.5	18.434	NA	NA	Pass
4977.5	18.416	NA	NA	Pass
Modulation 64QAM				
4952.5	18.439	NA	NA	Pass
4967.5	18.429	NA	NA	Pass
4977.5	18.430	NA	NA	Pass
Modulation 256QAM				
4952.5	18.393	NA	NA	Pass
4967.5	18.384	NA	NA	Pass
4977.5	18.378	NA	NA	Pass



Test specification:		Section 90.209, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Verdict: PASS	
Date(s):			
28-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Table 1.1.7.2.3 Occupied bandwidth test results (continuation)

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 50 MHz				
Modulation QPSK				
4965.0	38.277	NA	NA	Pass
Modulation 16QAM				
4965.0	38.331	NA	NA	Pass
Modulation 64QAM				
4965.0	38.327	NA	NA	Pass
Modulation 256QAM				
4965.0	38.302	NA	NA	Pass

Reference numbers of test equipment used

HL 5376	HL 5933					
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Full description is given in Appendix A



HERMON LABORATORIES

Test specification:		Section 90.209, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		28-Dec-23	
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.1 Occupied bandwidth test result at low frequency

CHANNEL SPACING:

ANTENNA PORT:

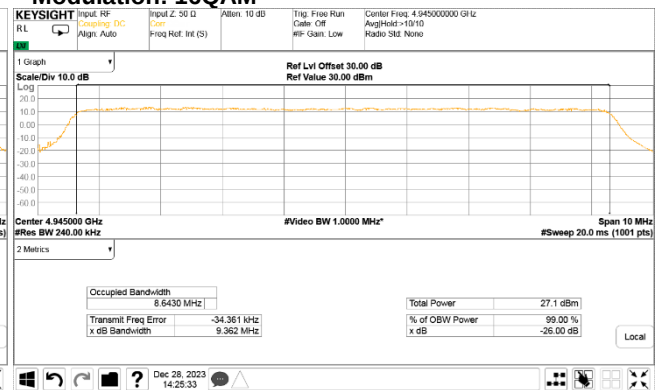
Modulation: QPSK



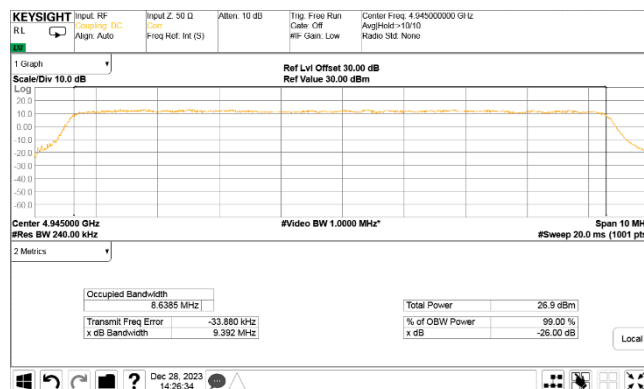
10 MHz

1

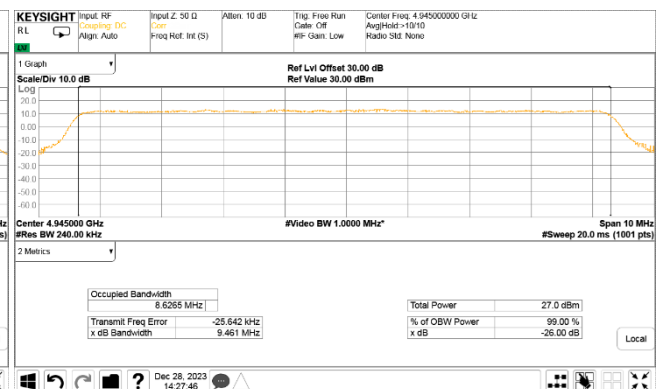
Modulation: 16QAM



Modulation: 64QAM



Modulation: 256QAM





HERMON LABORATORIES

Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.2 Occupied bandwidth test result at mid frequency

CHANNEL SPACING:

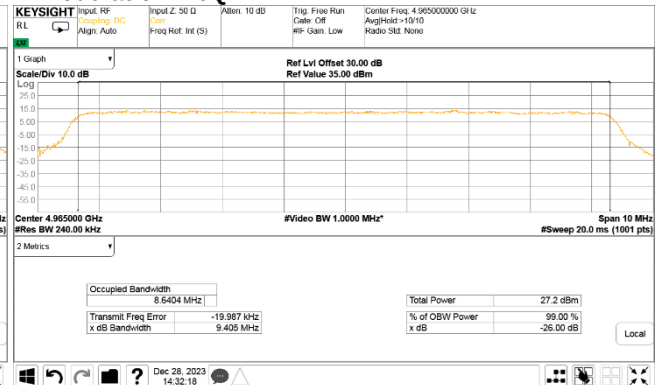
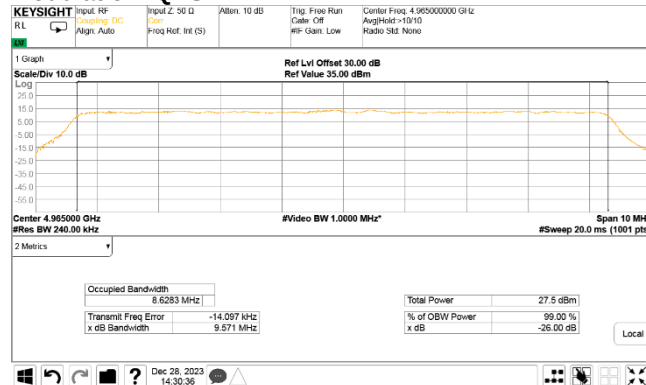
10 MHz

ANTENNA PORT:

1

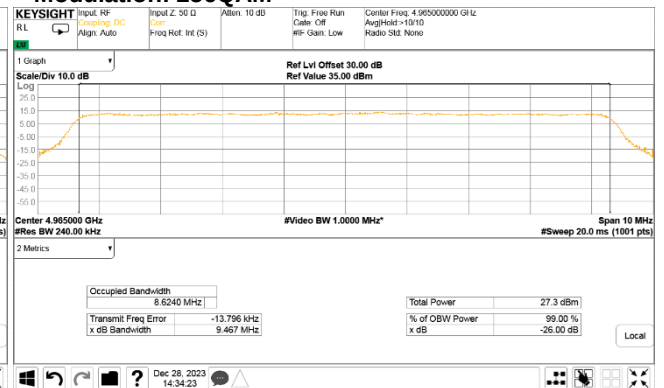
Modulation: QPSK

Modulation: 16QAM



Modulation: 64QAM

Modulation: 256QAM



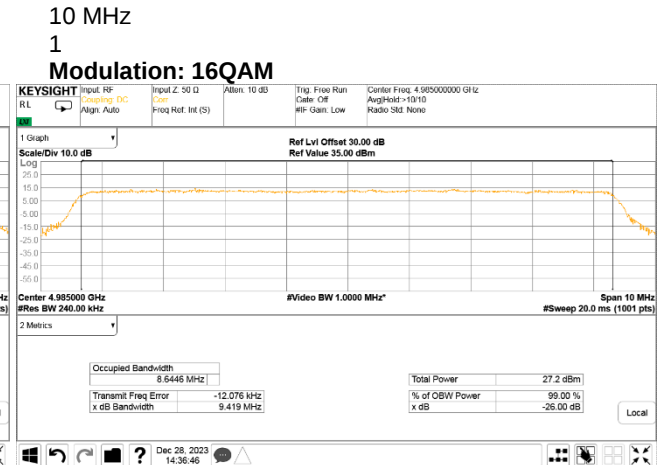


HERMON LABORATORIES

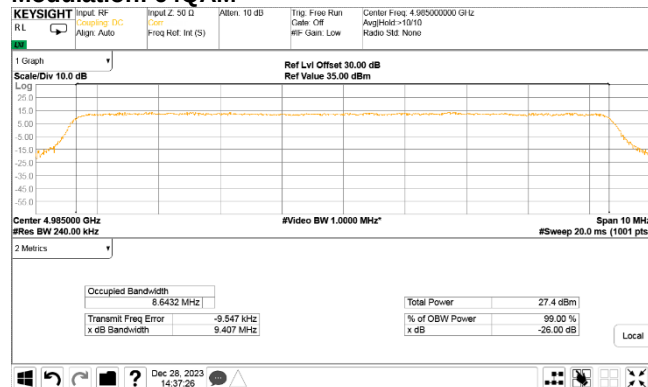
Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.3 Occupied bandwidth test result at high frequency

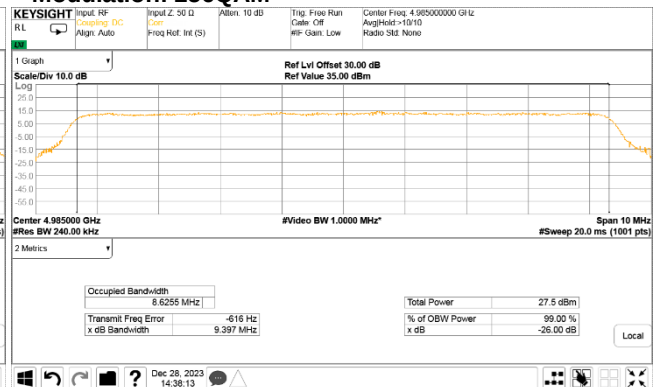
CHANNEL SPACING:
ANTENNA PORT:
Modulation: QPSK



Modulation: 64QAM



Modulation: 256QAM



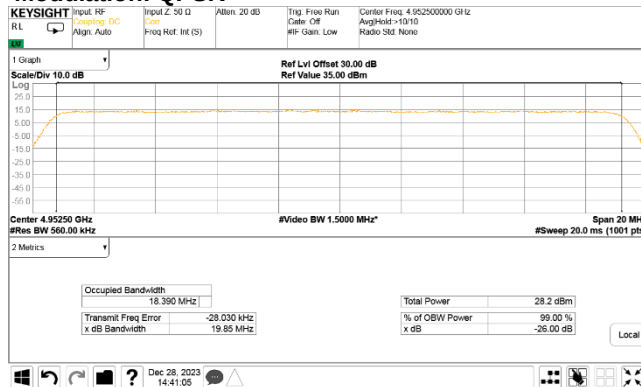


HERMON LABORATORIES

Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.4 Occupied bandwidth test result at low frequency

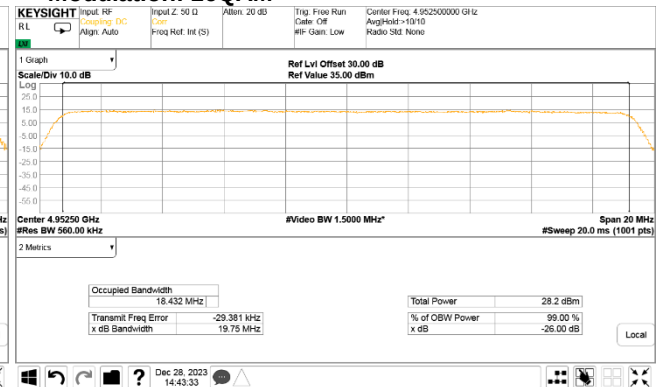
CHANNEL SPACING:
ANTENNA PORT:
Modulation: QPSK



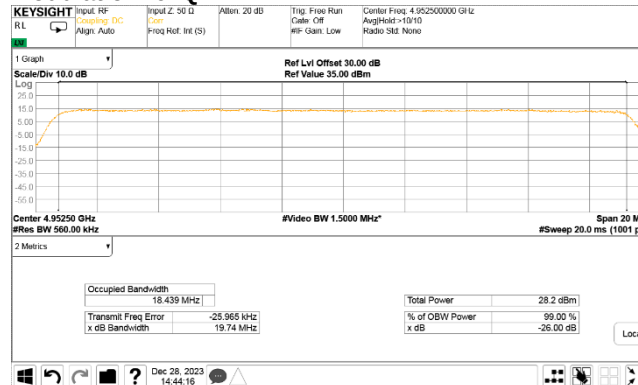
25 MHz

1

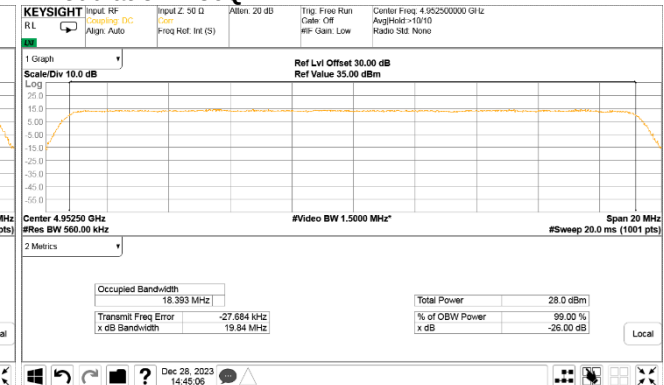
Modulation: 16QAM



Modulation: 64QAM



Modulation: 256QAM





HERMON LABORATORIES

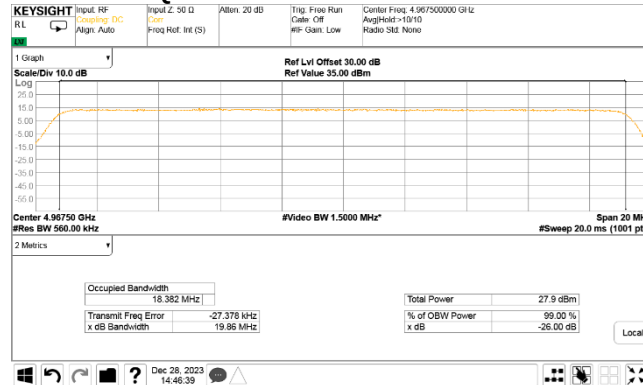
Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.5 Occupied bandwidth test result at mid frequency

CHANNEL SPACING:

ANTENNA PORT:

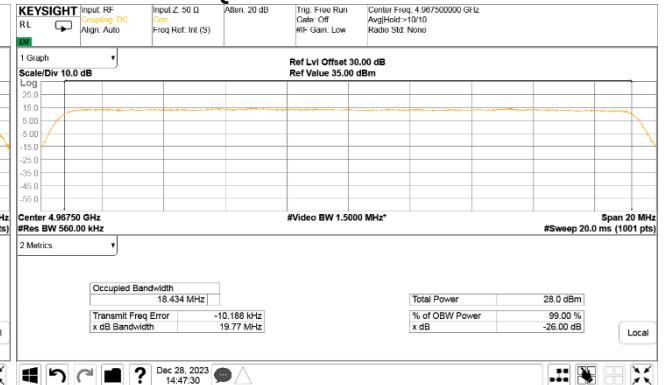
Modulation: QPSK



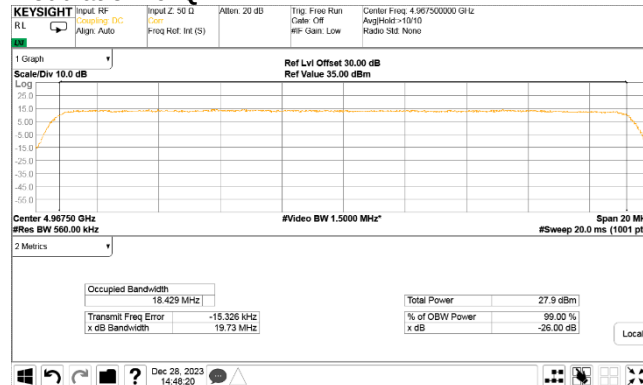
25 MHz

1

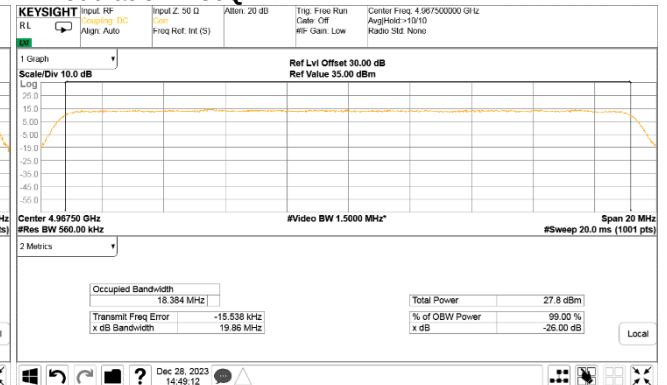
Modulation: 16QAM



Modulation: 64QAM



Modulation: 256QAM



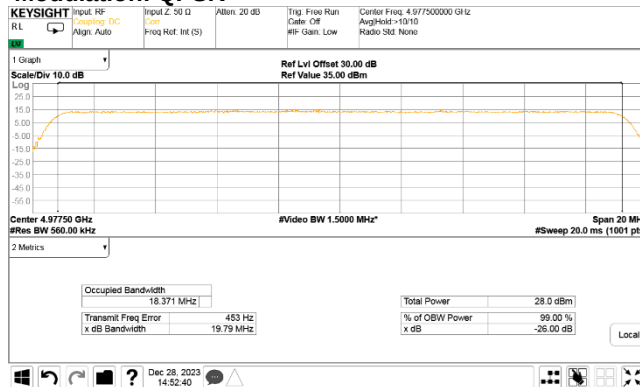


HERMON LABORATORIES

Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

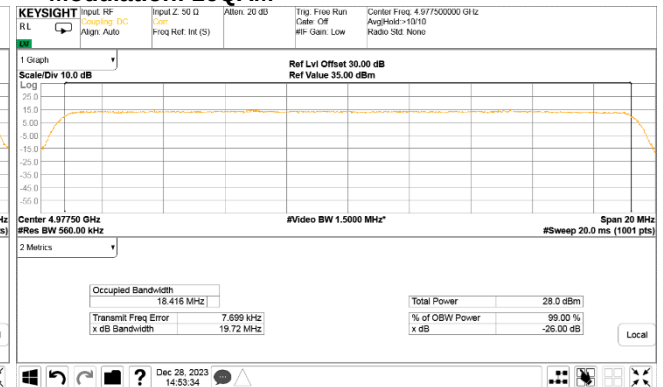
Plot 7.2.6 Occupied bandwidth test result at high frequency

CHANNEL SPACING:
ANTENNA PORT:
Modulation: QPSK

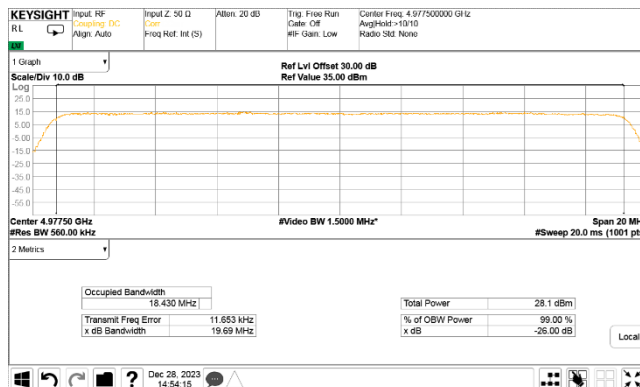


25 MHz
1

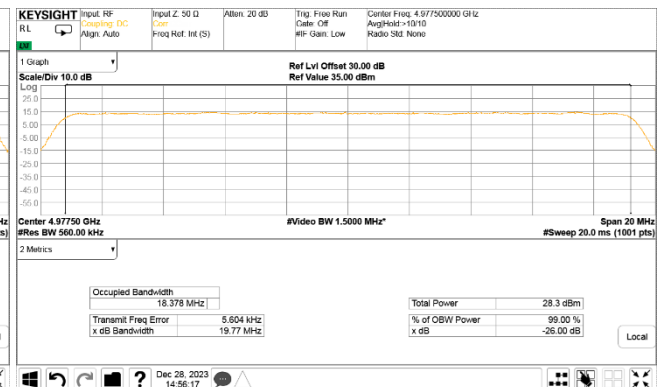
Modulation: 16QAM



Modulation: 64QAM



Modulation: 256QAM





HERMON LABORATORIES

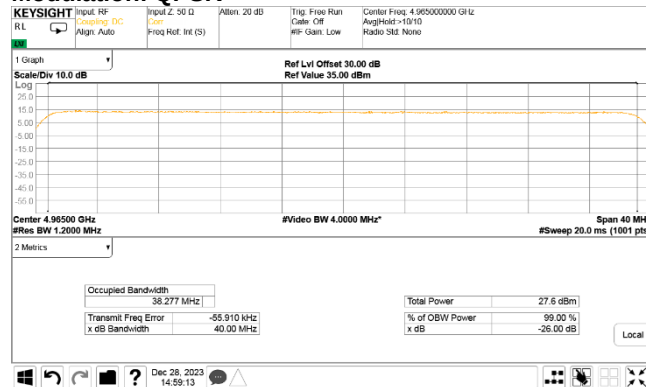
Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.7 Occupied bandwidth test result at mid frequency

CHANNEL SPACING:

ANTENNA PORT:

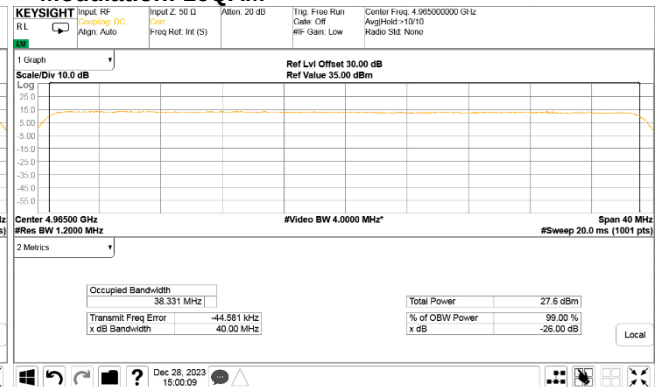
Modulation: QPSK



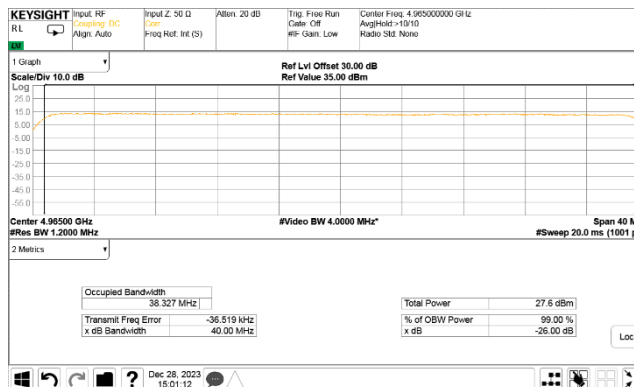
50 MHz

1

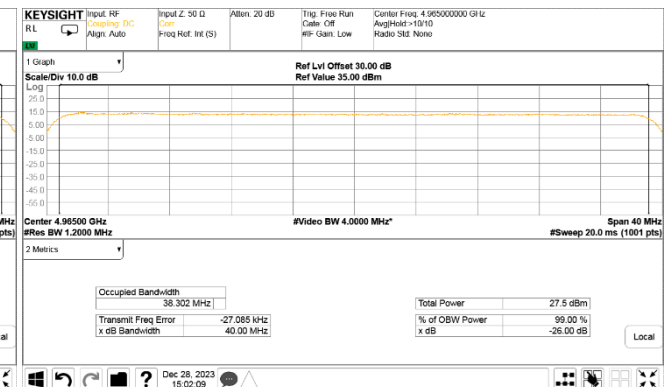
Modulation: 16QAM



Modulation: 64QAM



Modulation: 256QAM





Test specification: Section 90.210, Emission mask			
Test procedure: 47 CFR, Sections 2.1051, 2.1047 and 90.210(m)			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1014 hPa	Power: 48 VDC
Remarks:			

7.3 Emission mask test

7.3.1 General

This test was performed to measure emission mask at RF antenna connector. Specification test limits are given in Table 7.3.1 and Table 7.3.2 and Table 7.3.3.

Table 7.3.1 Emission mask limits for 10 MHz channel bandwidth

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask M (Occupied bandwidth 10 MHz)	
0 – 4.5 MHz	0***
4.5 – 5.0 MHz	$568\log(F^*/4.5)$
5.0 – 5.5 MHz	$26+145\log(F^*/5.0)$
5.5 – 10.0 MHz	$32+31\log(F^*/5.5)$
10.0 – 15.0 MHz	$40+57\log(F^*/10.0)$
More than** 15.0 MHz	50

* - F – frequency in MHz removed from center

** - emission mask includes carrier modulation envelope within $\pm 150\%$ of the authorized bandwidth; the frequency range removed beyond $\pm 150\%$ of the authorized bandwidth from carrier was investigated as spurious emission

*** - Zero dB reference measured relative to the highest average power of the fundamental emission measured across designated channel bandwidth

Table 7.3.2 Emission mask limits for 25 MHz channel bandwidth

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask M (Occupied bandwidth 20 MHz)	
0 – 11.25 MHz	0***
11.25 – 12.50 MHz	$568\log(F^*/4.5)$
12.50 – 13.75 MHz	$26+145\log(F^*/5.0)$
13.75 – 25.00 MHz	$32+31\log(F^*/5.5)$
25.00 – 37.50 MHz	$40+57\log(F^*/10.0)$
More than** 37.50 MHz	50

* - F – frequency in MHz removed from center

** - emission mask includes carrier modulation envelope within $\pm 150\%$ of the authorized bandwidth; the frequency range removed beyond $\pm 150\%$ of the authorized bandwidth from carrier was investigated as spurious emission

*** - Zero dB reference measured relative to the highest average power of the fundamental emission measured across designated channel bandwidth



Test specification: Section 90.210, Emission mask			
Test procedure: 47 CFR, Sections 2.1051, 2.1047 and 90.210(m)			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1014 hPa	Power: 48 VDC
Remarks:			

Table 7.3.3 Emission mask limits for 50 MHz channel bandwidth

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask M (Occupied bandwidth 40 MHz)	
0 – 22.50 MHz	0***
22.50 – 25.00 MHz	568log(F*/4.5)
25.00 – 27.50 MHz	26+145log(F*/5.0)
27.50 – 50.00 MHz	32+31log(F*/5.5)
50.00 – 75.00 MHz	40+57log(F*/10.0)
More than** 75.00 MHz	50

* - F – frequency in MHz removed from center

** - emission mask includes carrier modulation envelope within $\pm 150\%$ of the authorized bandwidth; the frequency range removed beyond $\pm 150\%$ of the authorized bandwidth from carrier was investigated as spurious emission

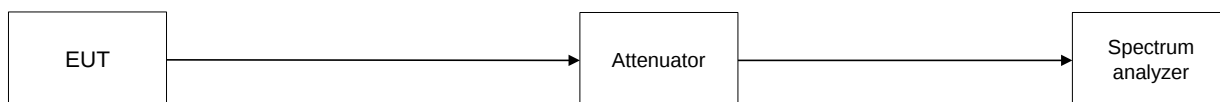
*** - Zero dB reference measured relative to the highest average power of the fundamental emission measured across designated channel bandwidth

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 emission mask was measured with spectrum analyzer with RBW set to 1% of emission bandwidth and VBW = 30 kHz as provided in the associated plots. The test results are provided in the associated plots.

Figure 7.3.1 Emission mask test setup





Test specification:		Section 90.210, Emission mask	
Test procedure:		47 CFR, Sections 2.1051, 2.1047 and 90.210(m)	
Test mode:		Verdict: PASS	
Date(s):			
27-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1014 hPa	Power: 48 VDC
Remarks:			

Table 7.3.4 Emission mask test results at 10 MHz channel bandwidth

Carrier frequency, MHz	Limit	Verdict
4945.0	Emission mask M	Pass
4965.0		
4985.0		

Table 7.3.5 Emission mask test results at 25 MHz channel bandwidth

Carrier frequency, MHz	Limit	Verdict
4952.5	Emission mask M	Pass
4967.5		
4977.5		

Table 7.3.6 Emission mask test results at 50 MHz channel bandwidth

Carrier frequency, MHz	Limit	Verdict
4965.0	Emission mask M	Pass

Reference numbers of test equipment used

HL 5637	HL 5376	HL 5933						
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Full description is given in Appendix A.



HERMON LABORATORIES

Test specification: Section 90.210, Emission mask			
Test procedure: 47 CFR, Sections 2.1051, 2.1047 and 90.210(m)			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1014 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.1 Emission mask test results at low, mid, high carrier frequency, 10 MHz CBW

OPERATING FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA CHAIN

4945.0 – 4985.0 MHz

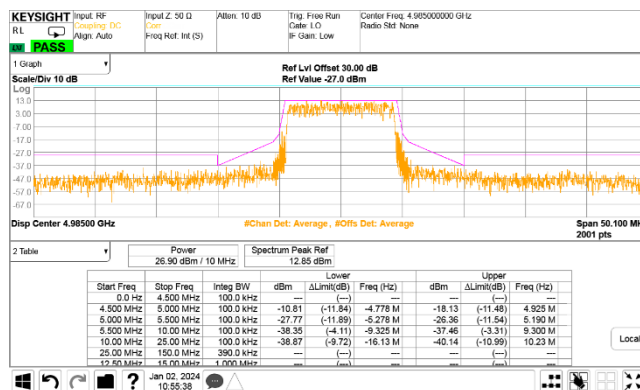
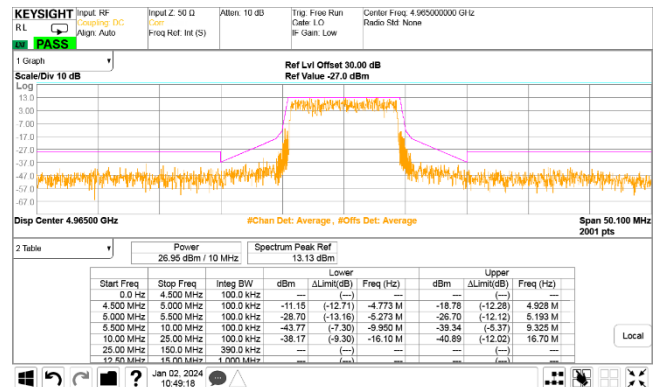
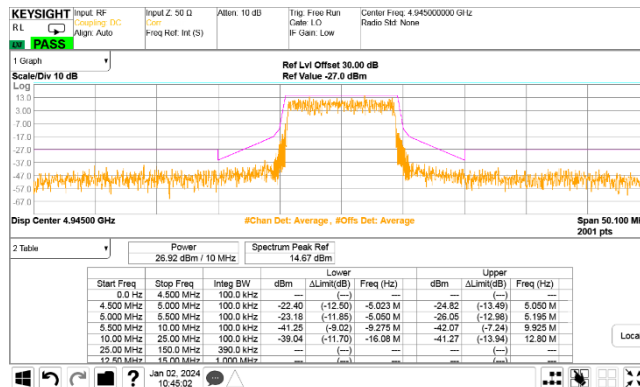
Peak

QPSK

PRBS

Maximum

1





HERMON LABORATORIES

Test specification: Section 90.210, Emission mask			
Test procedure: 47 CFR, Sections 2.1051, 2.1047 and 90.210(m)			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-Dec-23			
Temperature: 23 °C	Relative Humidity: 47 %	Air Pressure: 1014 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.2 Emission mask test results at low, mid, high carrier / frequency, 10 MHz CBW

OPERATING FREQUENCY RANGE:

4945.0 – 4985.0 MHz

DETECTOR USED:

Peak

MODULATION:

16QAM

MODULATING SIGNAL:

PRBS

TRANSMITTER OUTPUT POWER SETTINGS:

Maximum

ANTENNA CHAIN

1

