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TEST REPORT

ACCORDING TO: FCC 47CFR part 96

FOR:

Airspan Networks Inc.

LTE Base Station Radio

Model: AirSpeed 1000, 3.550-3.700 GHz (B48)

FCC ID:PIDAS1000

This report is in conformity with ISO/IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested.
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1 Applicant information

Client name: Airspan Networks Inc.
Address: 777 Yamato, Road Suite 310 Boca Raton, FL 33431, USA
Telephone: +1 561 893 8670
Fax: +1 561 893 8671
E-mail: zlevi@airspan.com
Contact name: Mr. Zion Levi

2 Equipment under test attributes

Product name: LTE Base Station Radio
Product type: Transceiver
Model(s): AirSpeed 1000 3.550-3.700 GHz (B48)
Serial number: DA5F27CD882A
Hardware version: C0
Software release: SR 16.00
Receipt date: 01-Oct-18

3 Manufacturer information

Manufacturer name: Airspan Networks Inc.
Address: 777 Yamato, Road Suite 310 Boca Raton, FL 33431, USA
Telephone: +1 561 893 8670
Fax: +1 561 893 8671
E-Mail: zlevi@airspan.com
Contact name: Mr. Zion Levi

4 Test details

Project ID: 31512
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 26-Sep-18
Test completed: 01-Nov-18
Test specification(s): FCC 47CFR part 96



5 Tests summary

Test	Status
Transmitter characteristics	
Section 96.41(b), Maximum EIRP and maximum power spectral density	Pass
Section 96.41(g), Peak-to- average power ratio	
Section 2.1049, Occupied bandwidth	Pass
Section 96.41(e), Emission mask	Pass
Section 96.41(e)(2), Radiated spurious emissions	Pass
Section 96.41(e)(3), Conducted spurious emissions	Pass
Section 2.1055, Frequency stability	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.

The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

This test report supersedes the previously issued test report identified by Doc ID:AIR RAD_FCC.31512_rev2.

	Name and Title	Date	Signature
Tested by:	Mr. S. Samokha, test engineer	November 1, 2018	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	December 30 , 2018	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	January 23, 2019	



6 EUT description

6.1 General information

The EUT, Mobile Digital station, AirSpeed 1000 3.55-3.7 GHz, (B48), is part of a LTE broadband fixed cellular wireless access system. The system provides a radio link between an end-user (a subscriber) and a network to give high-speed data access. The AirSpeed's transceiver/receiver (up to 64 QAM modulation, data rate up to 95 Mbps) equipped with a 20.5 dBi external antenna. The Advanced Antenna Techniques 2x2 MIMO are supported. The maximum RF output power (not including antenna gain) is 23.98 dBm for 20.5 dBi antenna gain and it can be reduced by software. The transmitter output signals are completely uncorrelated, antennas 1/2 is one sector and antennas 3/4 is another sector.

The AirSpeed is installed outdoors. The Subscriber transmits and receives traffic to and from the base station respectively. The transceiver provides subscribers with "always-on" Internet, high speed data only, or data and voice (VoIP) services and is configured with a unique base station reference number, preventing the LTE UE from relocating to another subscriber premises without authorization.

The AS1000 defined as Category B CBSD (Citizens Broadband Radio Service Device).

6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	DC power	EUT	AC/DC adapter	1	Unshielded	20
Signal	Ethernet	EUT	Laptop	1	Shielded	20
Signal*	Serial*	Not connected	Not connected	1	NA	NA

*for maintenance only

6.3 Support and test equipment

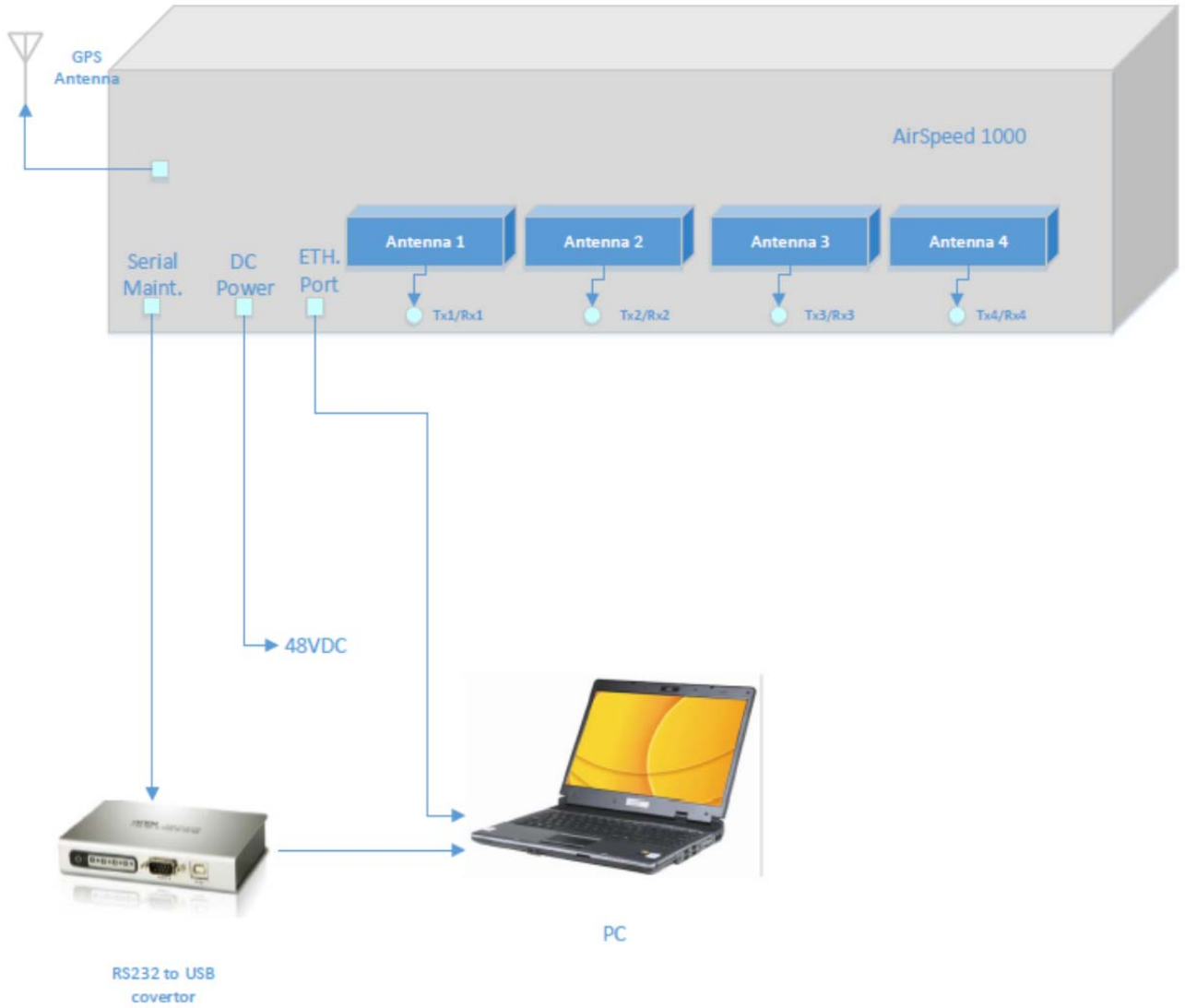
Description	Manufacturer	Model number	Serial number
Laptop	Dell	E7450	8TYRP32
USB to RS-232 convertor	ATEN	UC2324	NA
AC/DC adapter	DVE	DSA-96PFB-12 1 120750	P/N DSA-96PFB-12 1 120750-W25

6.4 Changes made in the EUT

No changes were implemented in the EUT during testing.



6.5 Test configuration





6.6 Transmitter characteristics

Type of equipment					
<input checked="" type="checkbox"/>	Stand-alone (Equipment with or without its own control provisions)				
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
	Plug-in card (Equipment intended for a variety of host systems)				
Intended use		Condition of use			
<input checked="" type="checkbox"/>	fixed	Always at a distance more than 2 m from all people			
	mobile	Always at a distance more than 20 cm from all people			
	portable	May operate at a distance closer than 20 cm to human body			
Assigned frequency range		3550.0 – 3700.0 MHz			
Operating frequency (full bands)		3555.0 – 3695.0 MHz			
RF channel spacing		10 MHz, 20 MHz			
Maximum rated output power		At transmitter 50 Ω RF output connector (per port) 23.98 dBm			
Is transmitter output power variable?		No			
		continuous variable			
		<input checked="" type="checkbox"/>	Yes	stepped variable with step size	0.25 dB
				minimum RF power	-30 dBm
			maximum RF power at antenna connector	dBm	
Antenna connection					
unique coupling	<input checked="" type="checkbox"/>	standard connector	Integral <input checked="" type="checkbox"/> with temporary RF connector without temporary RF connector		
Antenna/s technical characteristics					
Type	Manufacturer	Model number	Gain		
External	ALPHA Wireless Ltd.	AW3170	20.5 dBi		
External	ALPHA Wireless Ltd.	AW3014	18 dBi		
Transmitter aggregate data rate/s, Mbps					
Transmitter 26dBc power bandwidth		Type of modulation			
		QPSK	16QAM	64QAM	
10 MHz		10.7	22.7	47.3	
20 MHz		23.4	45.4	95	
Type of multiplexing		TDD			
Modulating test signal (baseband)		PRBS			
Maximum transmitter duty cycle in normal use		0.74			
Transmitter power source					
		Nominal rated voltage	Battery type		
<input checked="" type="checkbox"/>	DC	48 VDC			
	AC mains	Nominal rated voltage	Frequency		
Common power source for transmitter and receiver		<input checked="" type="checkbox"/>	yes no		



Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 55 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 96

7.1 Maximum EIRP and maximum power spectral density

7.1.1 General

This test was performed to measure the maximum EIRP and maximum spectral power density at the transmitter RF antenna connector. Specification test limits are given in Table 7.1.1, Table 7.1.2.

Table 7.1.1 Maximum EIRP limits

Assigned frequency range, MHz	EIRP	
	W/10 MHz	dBm/10 MHz
3550 - 3700	17.0	47.0

Table 7.1.2 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, MHz	Peak spectral power density, dBm
3550 - 3700	1.0	37.0

7.1.2 Test procedure

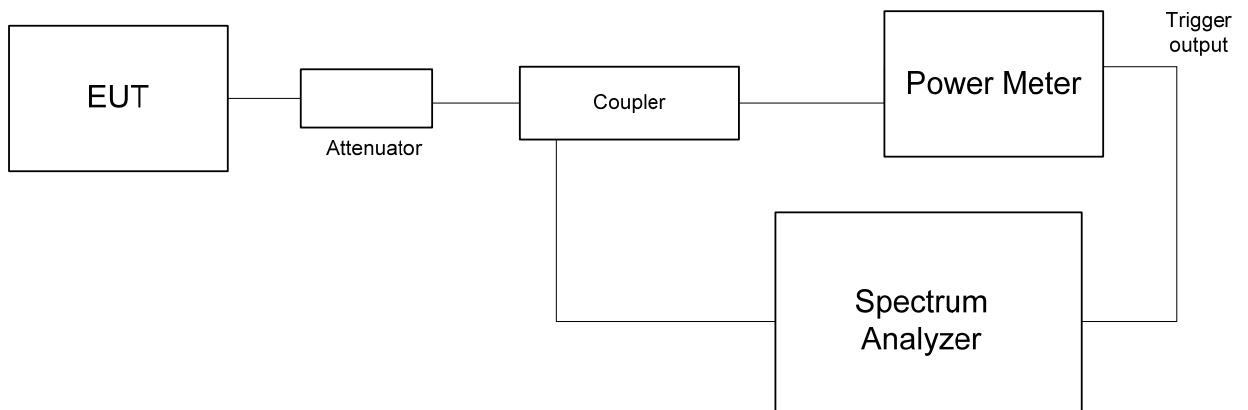
7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

7.1.2.2 The EUT was adjusted to produce maximum available to end user RF output power.

7.1.2.3 The frequency span of spectrum analyzer was set to capture the entire 6 dB band of the transmitter, in average mode with resolution bandwidth set to 1.0 MHz, video bandwidth wider than resolution bandwidth, sweep time and sufficient number of sweeps was allowed for trace stabilization.

7.1.2.4 Spectrum analyzer was set in average mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.1.3, Table 7.1.4 and the associated plots.

Figure 7.1.1 Maximum EIRP and power spectral density test setup





Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 55 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Table 7.1.3 Maximum EIRP test results

ASSIGNED FREQUENCY RANGE: 3550.0 – 3700.0 MHz
DETECTOR USED: Average (gated)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
NUMBER OF CHAINS: 2
ANTENNA GAIN: 20.5 dBi
CHANNEL SPACING: 10 MHz

ANTENNA CONFIGURATION: Antenna Chain RF #1 / #2

Frequency, MHz	RF Output power		Total RF power*, dBm	Antenna gain, dBi	EIRP**, dBm	Limit, dBm/10 MHz	Margin, dB	Verdict
	Chain RF#1, dBm	Chain RF#2, dBm						
Modulation QPSK								
3555.0	23.79	23.83	23.83	20.5	44.33	47.0	-2.67	Pass
3625.0	23.61	23.71	23.71	20.5	44.21	47.0	-2.79	Pass
3695.0	23.97	23.93	23.97	20.5	44.47	47.0	-2.53	Pass
Modulation 16QAM								
3555.0	23.93	23.88	23.93	20.5	44.43	47.0	-2.57	Pass
3625.0	23.83	23.75	23.83	20.5	44.33	47.0	-2.67	Pass
3695.0	23.97	23.90	23.97	20.5	44.47	47.0	-2.53	Pass
Modulation 64QAM								
3555.0	23.86	23.82	23.86	20.5	44.36	47.0	-2.64	Pass
3625.0	23.78	23.71	23.78	20.5	44.28	47.0	-2.72	Pass
3695.0	23.91	23.95	23.95	20.5	44.45	47.0	-2.55	Pass

* - Total RF power, dBm = Maximum result from Chain #1 or Chain #2

** EIRP (dBm)=Total RF power (dBm) + Antenna gain (dBi)

ANTENNA CONFIGURATION: Antenna Chain RF #3 / #4

Frequency, MHz	RF Output power		Total RF power*, dBm	Antenna gain, dBi	EIRP**, dBm	Limit, dBm/10 MHz	Margin, dB	Verdict
	Chain RF#3, dBm	Chain RF#4, dBm						
Modulation QPSK								
3555.0	23.91	23.73	23.91	20.5	44.41	47.0	-2.59	Pass
3625.0	23.95	23.69	23.95	20.5	44.45	47.0	-2.55	Pass
3695.0	23.89	23.64	23.89	20.5	44.39	47.0	-2.61	Pass
Modulation 16QAM								
3555.0	23.98	23.91	23.98	20.5	44.48	47.0	-2.52	Pass
3625.0	23.91	23.67	23.91	20.5	44.41	47.0	-2.59	Pass
3695.0	23.86	23.65	23.86	20.5	44.36	47.0	-2.64	Pass
Modulation 64QAM								
3555.0	23.96	23.93	23.96	20.5	44.46	47.0	-2.54	Pass
3625.0	23.96	23.89	23.96	20.5	44.46	47.0	-2.54	Pass
3695.0	23.98	23.86	23.98	20.5	44.48	47.0	-2.52	Pass

* - Total RF power, dBm = Maximum result from Chain #3 or Chain #4

** EIRP (dBm)=Total RF power (dBm) + Antenna gain (dBi)



Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 55 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Table 7.1.3 Maximum EIRP test results (continued)

ASSIGNED FREQUENCY RANGE: 3550.0 – 3700.0 MHz
DETECTOR USED: Average (gated)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
NUMBER OF CHAINS: 2
ANTENNA GAIN: 20.5 dBi

CHANNEL SPACING: 20 MHz
ANTENNA CONFIGURATION: Antenna Chain RF #1 / #2

Frequency, MHz	RF Output power		Total RF power*, dBm	Antenna gain, dBi	EIRP**, dBm	Limit, dBm/10 MHz	Margin, dB	Verdict
	Chain RF#1, dBm	Chain RF#2, dBm						
Modulation QPSK								
3560.0	23.86	23.87	23.87	20.5	44.37	47.0	-2.63	Pass
3625.0	23.78	23.46	23.78	20.5	44.28	47.0	-2.72	Pass
3690.0	23.94	23.89	23.94	20.5	44.44	47.0	-2.56	Pass
Modulation 16QAM								
3560.0	23.34	23.31	23.34	20.5	43.84	47.0	-3.16	Pass
3625.0	23.23	22.84	23.23	20.5	43.73	47.0	-3.27	Pass
3690.0	23.91	23.72	23.91	20.5	44.41	47.0	-2.59	Pass
Modulation 64QAM								
3560.0	23.77	23.64	23.77	20.5	44.27	47.0	-2.73	Pass
3625.0	23.78	23.54	23.78	20.5	44.28	47.0	-2.72	Pass
3690.0	23.95	23.68	23.95	20.5	44.45	47.0	-2.55	Pass

* - Total RF power, dBm = Maximum result from Chain #1 or Chain #2

** EIRP (dBm)=Total RF power (dBm) + Antenna gain (dBi)

ANTENNA CONFIGURATION: Antenna Chain RF #3 / #4

Frequency, MHz	RF Output power		Total RF power*, dBm	Antenna gain, dBi	EIRP**, dBm	Limit, dBm/10 MHz	Margin, dB	Verdict
	Chain RF#3, dBm	Chain RF#4, dBm						
Modulation QPSK								
3560.0	23.72	23.79	23.79	20.5	44.29	47.0	-2.71	Pass
3625.0	23.82	23.67	23.82	20.5	44.32	47.0	-2.68	Pass
3690.0	23.91	23.72	23.91	20.5	44.41	47.0	-2.59	Pass
Modulation 16QAM								
3560.0	23.97	23.95	23.97	20.5	44.47	47.0	-2.53	Pass
3625.0	23.98	23.03	23.98	20.5	44.48	47.0	-2.52	Pass
3690.0	23.96	23.63	23.96	20.5	44.46	47.0	-2.54	Pass
Modulation 64QAM								
3560.0	23.98	23.84	23.98	20.5	44.48	47.0	-2.52	Pass
3625.0	23.89	23.67	23.89	20.5	44.39	47.0	-2.61	Pass
3690.0	23.94	23.68	23.94	20.5	44.44	47.0	-2.56	Pass

* - Total RF power, dBm = Maximum result from Chain #3 or Chain #4

** EIRP (dBm)=Total RF power (dBm) + Antenna gain (dBi)



Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 55 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Table 7.1.4 Peak spectral power density test results

ASSIGNED FREQUENCY RANGE: 3550.0 – 3700.0 MHz
 DETECTOR USED: Average (gated)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 NUMBER OF CHAINS: 2
 ANTENNA CONFIGURATION: Antenna Chain RF #1

Frequency MHz	Band edge	SA reading over 1 chain, dBm	Total PSD*, dBm	Limit, dBm	Margin, dB	Verdict
Channel spacing 10 MHz						
3555.00	QPSK	16.71	19.71	37.0	-17.29	Pass
3625.00		16.98	19.98	37.0	-17.02	Pass
3695.00		16.64	19.64	37.0	-17.36	Pass
3555.00	16QAM	16.79	19.79	37.0	-17.21	Pass
3625.00		17.20	20.20	37.0	-16.80	Pass
3695.00		16.76	19.76	37.0	-17.24	Pass
3555.00	64QAM	17.03	20.03	37.0	-16.97	Pass
3625.00		17.27	20.27	37.0	-16.73	Pass
3695.00		16.78	19.78	37.0	-17.22	Pass
Channel spacing 20 MHz						
3560.00	QPSK	13.85	16.85	37.0	-20.15	Pass
3625.00		13.86	16.86	37.0	-20.14	Pass
3690.00		14.39	17.39	37.0	-19.61	Pass
3560.00	16QAM	13.92	16.92	37.0	-20.08	Pass
3625.00		13.82	16.82	37.0	-20.18	Pass
3690.00		14.56	17.56	37.0	-19.44	Pass
3560.00	64QAM	13.86	16.86	37.0	-20.14	Pass
3625.00		13.84	16.84	37.0	-20.16	Pass
3690.00		14.50	17.50	37.0	-19.50	Pass

* - Total PSD = SA reading + 10*log(N) = SA reading +3 dB

** - Margin = Total PSD, dBm – specification limit.

Reference numbers of test equipment used

HL 3868	HL 4275	HL 4355				
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Full description is given in Appendix A.



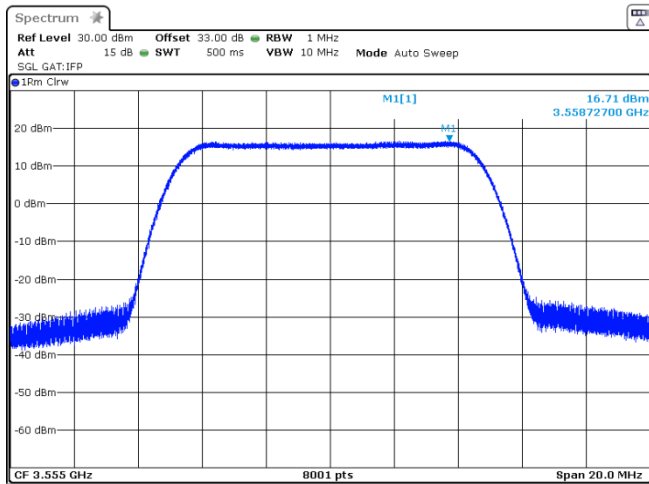
HERMON LABORATORIES

Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 55 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

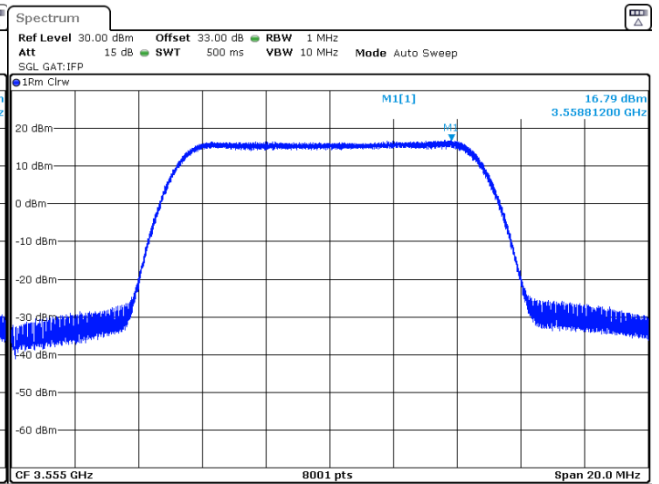
Plot 7.1.1 Peak spectral power density at low frequency

MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK

QPSK
10 MHz
1
Modulation: 16QAM

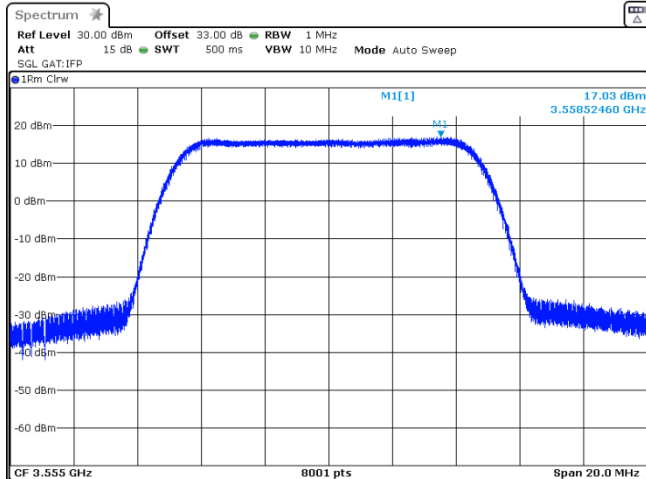


Date: 3.DEC.2018 03:46:16



Date: 3.DEC.2018 03:47:36

Modulation: 64QAM



Date: 3.DEC.2018 03:48:04



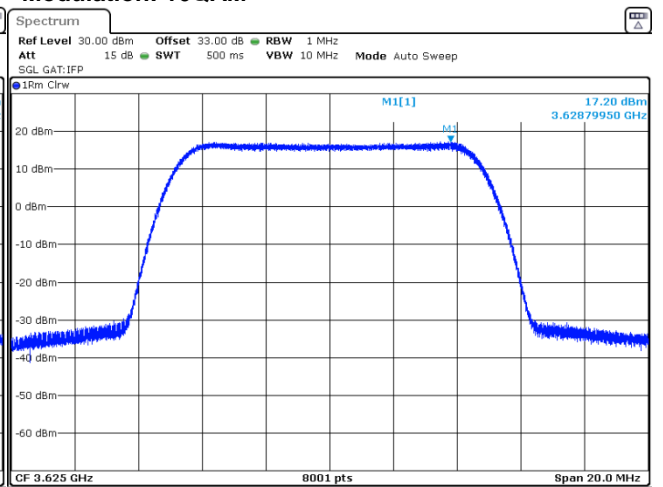
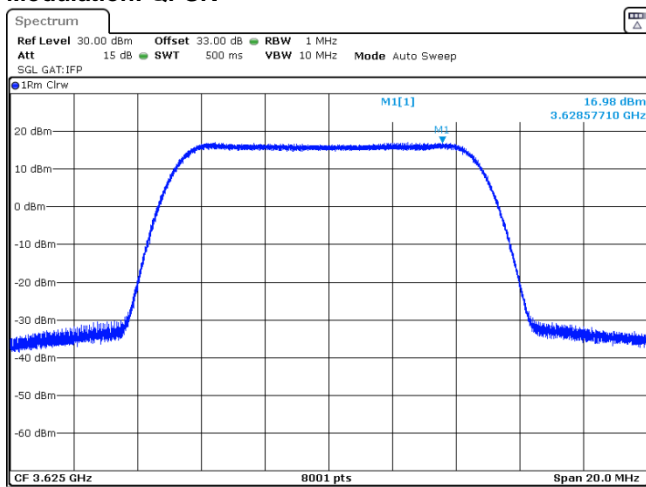
HERMON LABORATORIES

Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 55 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.2 Peak spectral power density at mid frequency

MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK

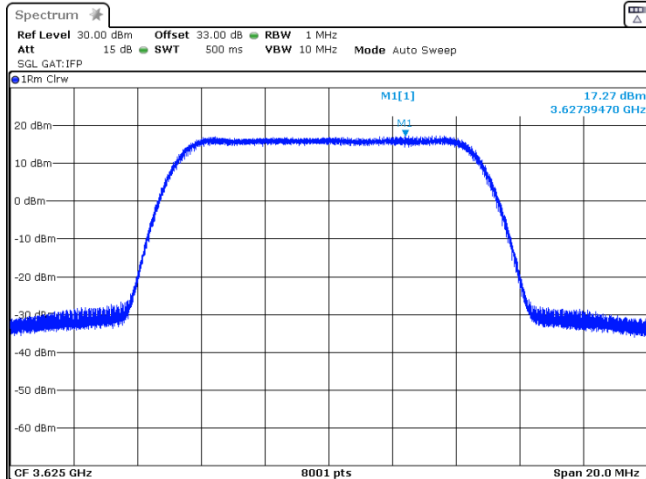
QPSK
10 MHz
1
Modulation: 16QAM



Date: 3.DEC.2018 03:51:08

Date: 3.DEC.2018 03:50:37

Modulation: 64QAM



Date: 3.DEC.2018 03:49:39



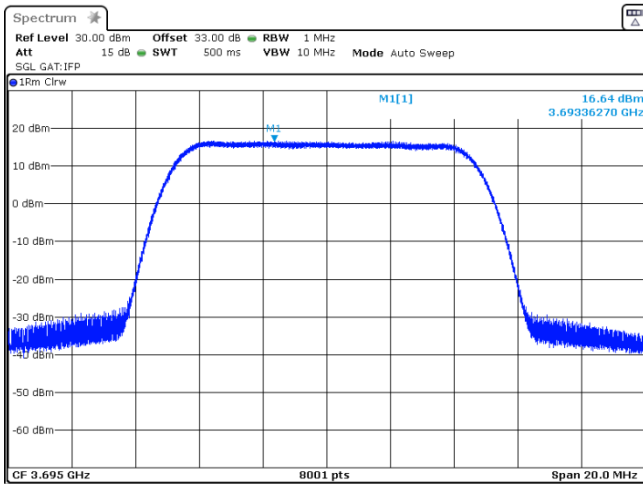
HERMON LABORATORIES

Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 55 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

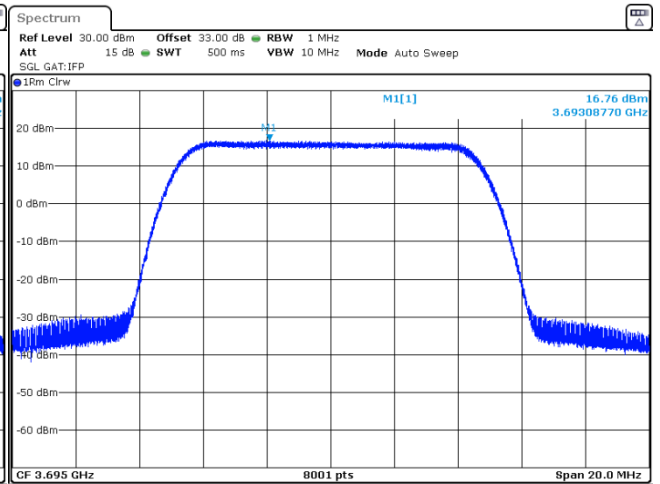
Plot 7.1.3 Peak spectral power density at high frequency

MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK

QPSK
10 MHz
1
Modulation: 16QAM

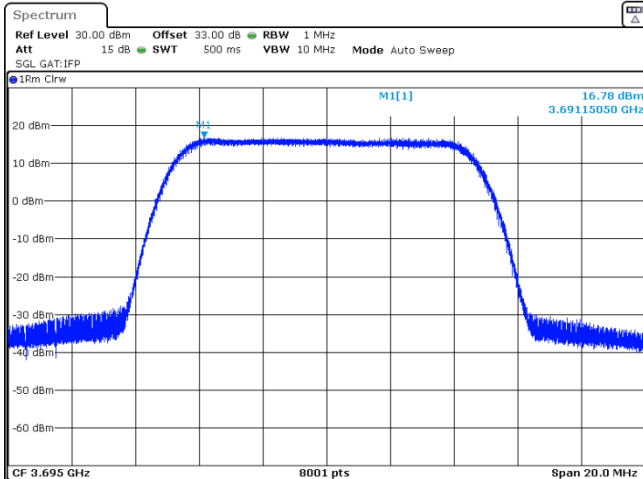


Date: 3.DEC.2018 03:52:02



Date: 3.DEC.2018 03:52:47

Modulation: 64QAM



Date: 3.DEC.2018 03:53:22



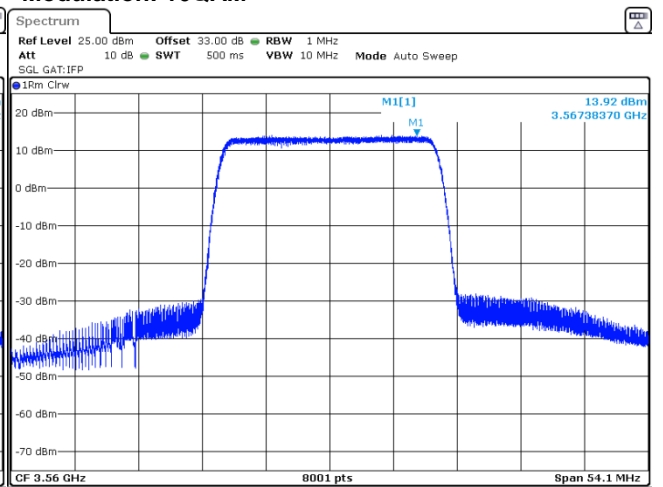
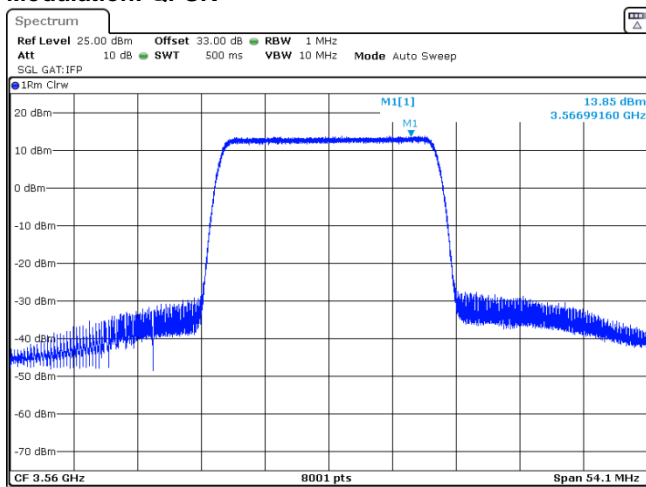
HERMON LABORATORIES

Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 55 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.4 Peak spectral power density at low frequency within

MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK

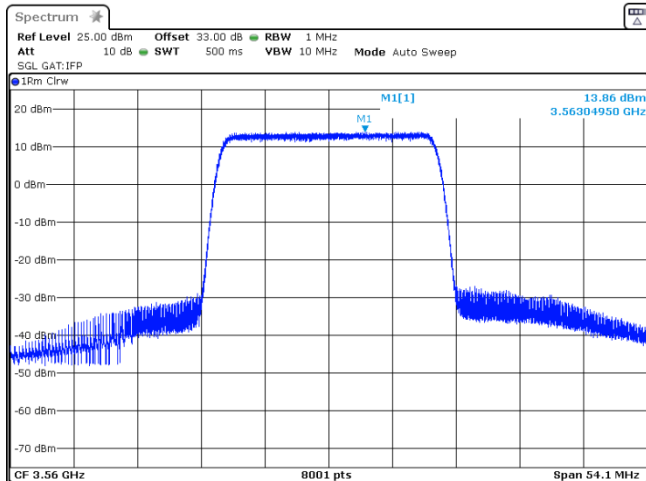
QPSK
20 MHz
1
Modulation: 16QAM



Date: 3.DEC.2018 03:25:02

Date: 3.DEC.2018 03:24:33

Modulation: 64QAM



Date: 3.DEC.2018 03:24:11



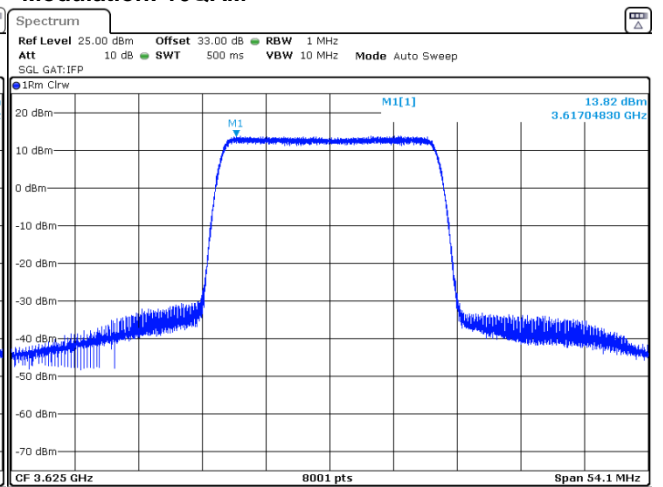
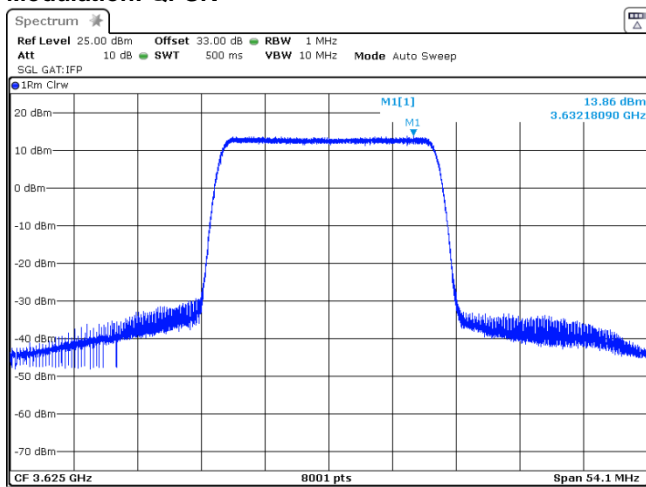
HERMON LABORATORIES

Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 55 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.5 Peak spectral power density at mid frequency

MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK

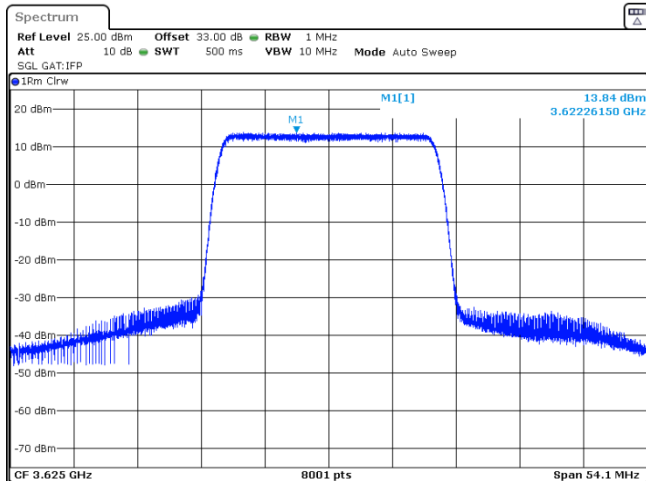
QPSK
20 MHz
1
Modulation: 16QAM



Date: 3.DEC.2018 03:22:04

Date: 3.DEC.2018 03:22:29

Modulation: 64QAM



Date: 3.DEC.2018 03:23:15



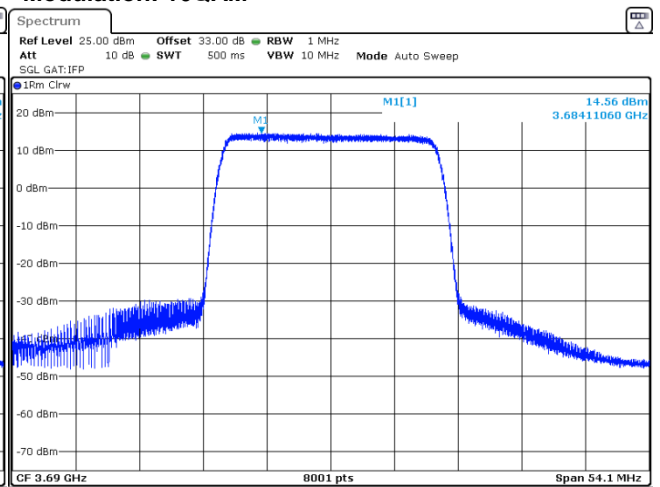
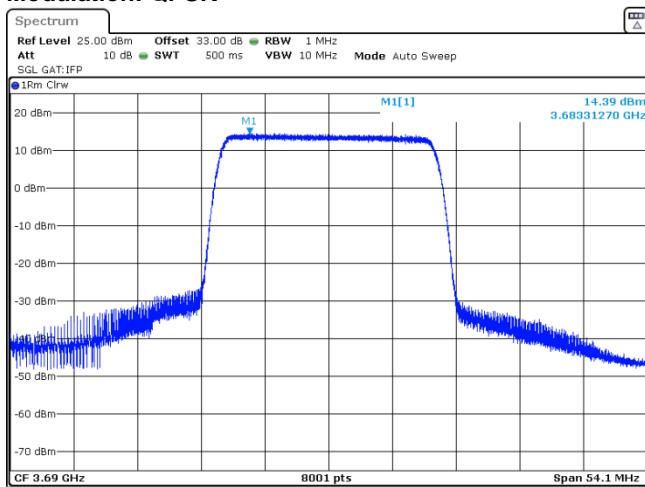
HERMON LABORATORIES

Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 55 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.6 Peak spectral power density at high frequency

MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK

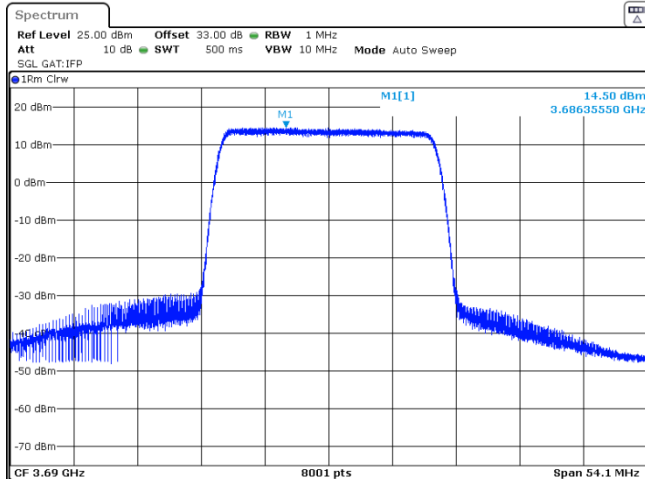
QPSK
20 MHz
1
Modulation: 16QAM



Date: 3.DEC.2018 03:21:14

Date: 3.DEC.2018 03:20:23

Modulation: 64QAM



Date: 3.DEC.2018 03:19:11



Test specification: Section 96.41(g), Peak-to- average power ratio			
Test procedure: Section 96.41(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 01-Nov-18			
Temperature: 24.3. °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

7.2 Peak-to-average power ratio (PAPR) test

7.2.1 General

This test was performed to measure the peak to average power ratio at RF antenna connector. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Peak-to-average power ratio limits

Assigned frequency range, MHz	Peak to average power ratio limit	
	Probability, %	dB
3550.0 – 3700.0	0.1	13.0

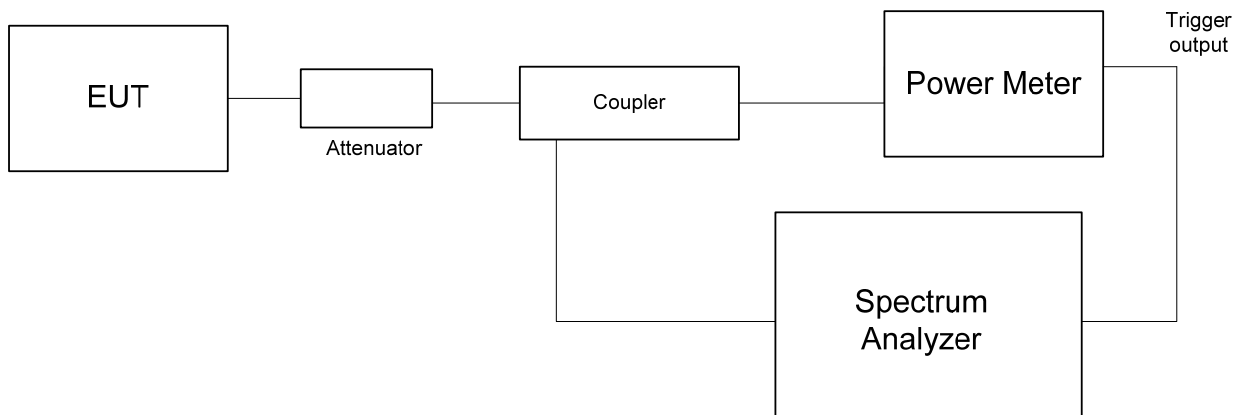
7.2.2 Test procedure

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 adjusted to produce maximum available to the end user RF output power.

7.2.2.3 The peak to average power ratio was measured with power meter as provided in Table 7.2.2 and the associated plots.

Figure 7.2.1 Peak-to-average power ratio test setup





Test specification: Section 96.41(g), Peak-to- average power ratio			
Test procedure: Section 96.41(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 01-Nov-18			
Temperature: 24.3. °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Table 7.2.2 Peak-to-average power ratio test results

OPERATING FREQUENCY RANGE: 3550 – 3700 MHz
 DETECTOR USED: Peak/Average
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Carrier frequency, MHz	Peak to average ratio, dB	Limit, dBm	Margin, dB	Verdict
Channel spacing 10 MHz				
Modulation QPSK				
3555.0	10.89	13.0	-2.11	Pass
3625.0	11.05	13.0	-1.95	Pass
3695.0	11.22	13.0	-1.78	Pass
Modulation 16QAM				
3555.0	10.49	13.0	-2.51	Pass
3625.0	10.57	13.0	-2.43	Pass
3695.0	10.64	13.0	-2.36	Pass
Modulation 64QAM				
3555.0	10.57	13.0	-2.43	Pass
3625.0	10.63	13.0	-2.37	Pass
3695.0	10.62	13.0	-2.38	Pass
Channel spacing 20 MHz				
Modulation QPSK				
3560.0	10.48	13.0	-2.52	Pass
3625.0	10.49	13.0	-2.51	Pass
3690.0	10.49	13.0	-2.51	Pass
Modulation 16QAM				
3560.0	10.57	13.0	-2.43	Pass
3625.0	10.54	13.0	-2.46	Pass
3690.0	10.53	13.0	-2.47	Pass
Modulation 64QAM				
3560.0	10.62	13.0	-2.38	Pass
3625.0	10.63	13.0	-2.37	Pass
3690.0	10.64	13.0	-2.36	Pass

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3787			
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Full description is given in Appendix A.



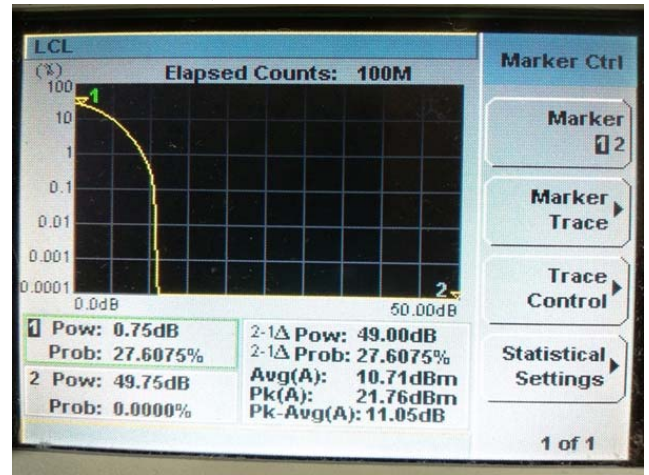
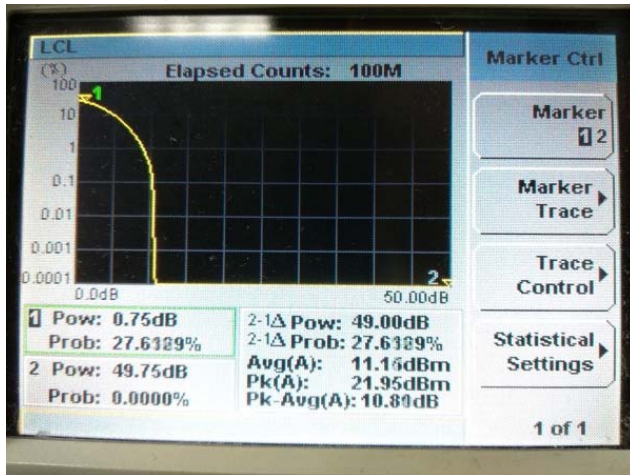
HERMON LABORATORIES

Test specification: Section 96.41(g), Peak-to- average power ratio			
Test procedure: Section 96.41(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 01-Nov-18			
Temperature: 24.3. °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

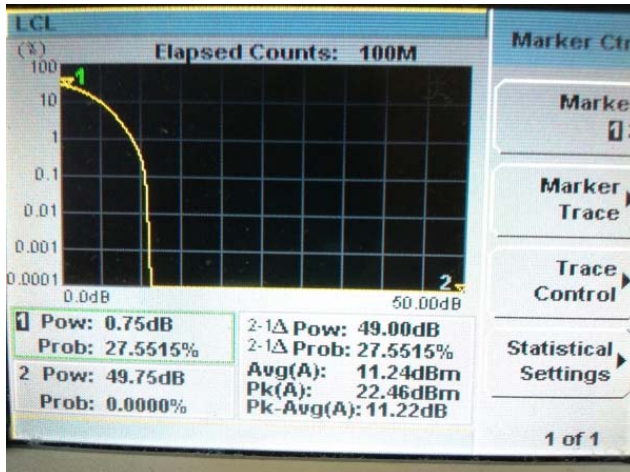
Plot 7.2.1 Peak-to-average power ratio test results at low frequency

CHANNEL SPACING:
ANTENNA PORT:
Modulation: QPSK

10 MHz
1
Modulation: 16QAM



Modulation: 64QAM





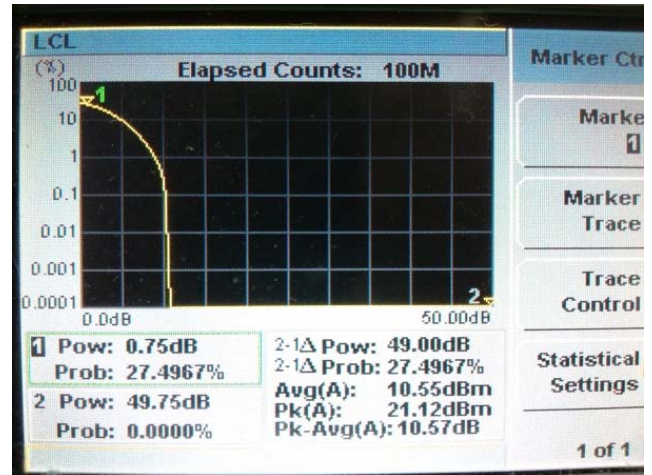
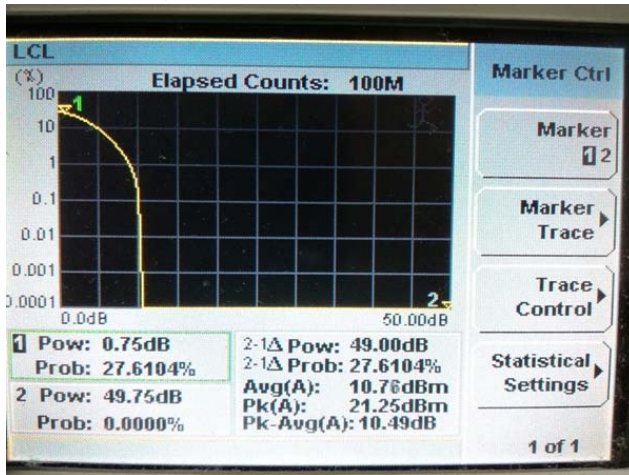
HERMON LABORATORIES

Test specification: Section 96.41(g), Peak-to- average power ratio			
Test procedure: Section 96.41(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 01-Nov-18			
Temperature: 24.3. °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

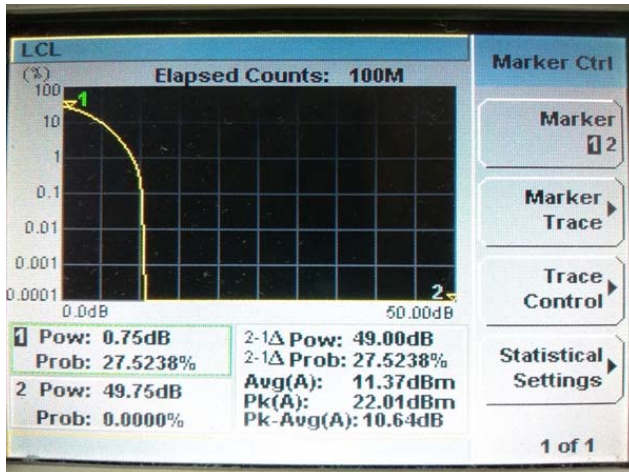
Plot 7.2.2 Peak-to-average power ratio test results at mid frequency

CHANNEL SPACING:
ANTENNA PORT:
Modulation: QPSK

10 MHz
1
Modulation: 16QAM



Modulation: 64QAM





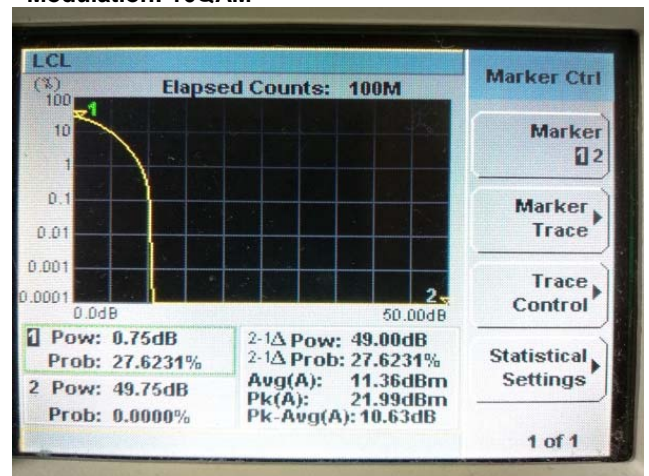
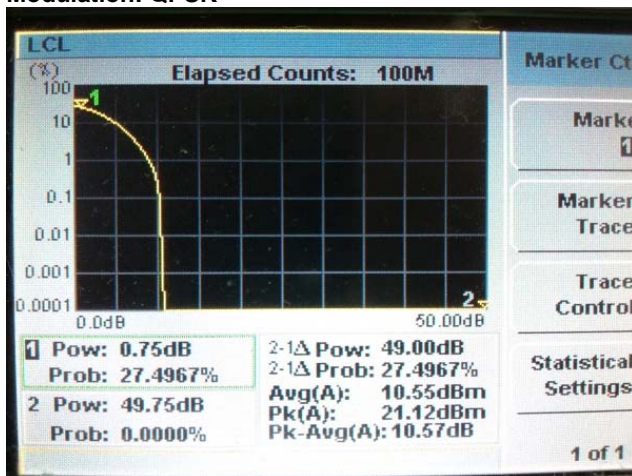
HERMON LABORATORIES

Test specification: Section 96.41(g), Peak-to- average power ratio			
Test procedure: Section 96.41(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 01-Nov-18			
Temperature: 24.3. °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

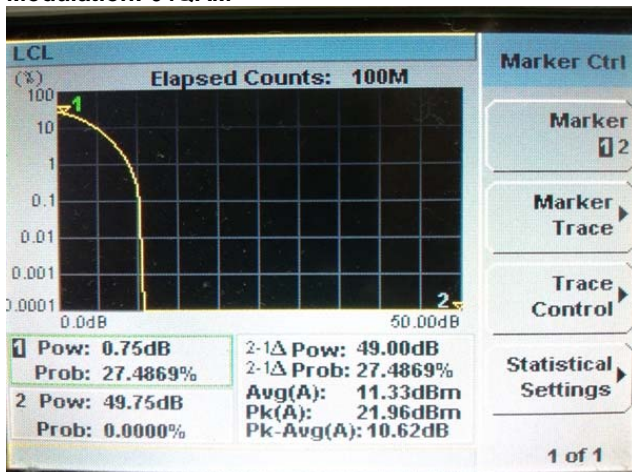
Plot 7.2.3 Peak-to-average power ratio test results at high frequency

CHANNEL SPACING:
ANTENNA PORT:
Modulation: QPSK

10 MHz
1
Modulation: 16QAM



Modulation: 64QAM





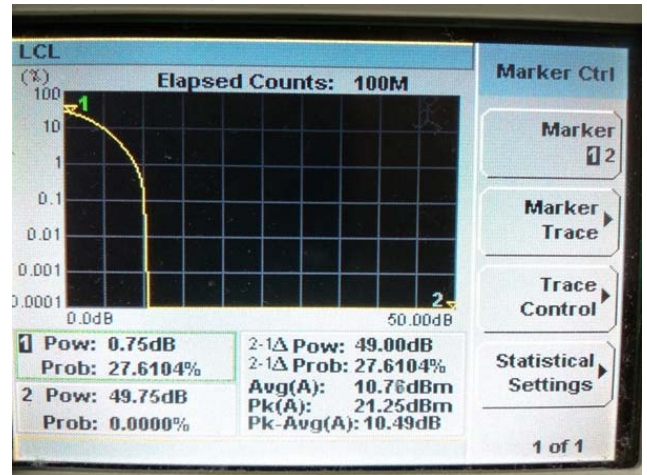
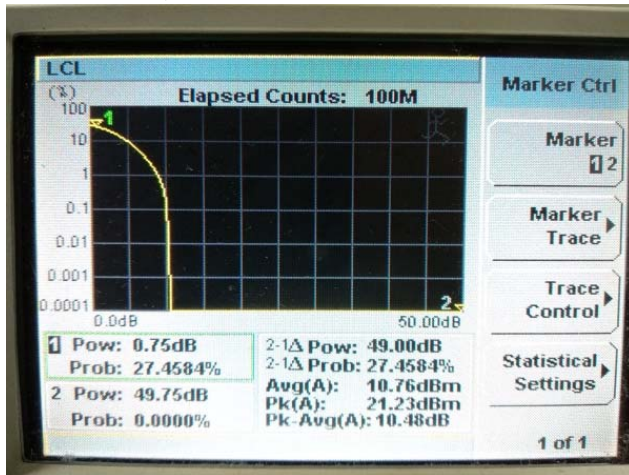
HERMON LABORATORIES

Test specification: Section 96.41(g), Peak-to- average power ratio			
Test procedure: Section 96.41(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 01-Nov-18			
Temperature: 24.3. °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

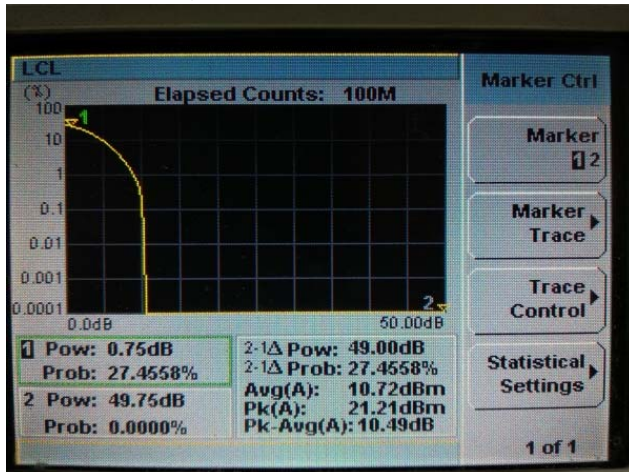
Plot 7.2.4 Peak-to-average power ratio test results at low frequency

CHANNEL SPACING:
ANTENNA PORT:
Modulation: QPSK

20 MHz
1
Modulation: 16QAM



Modulation: 64QAM





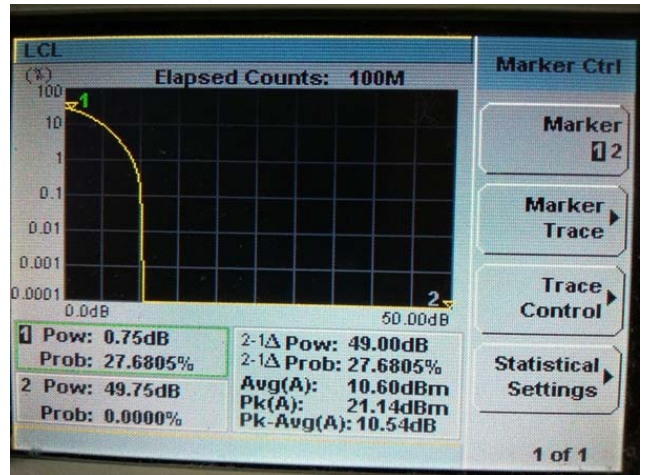
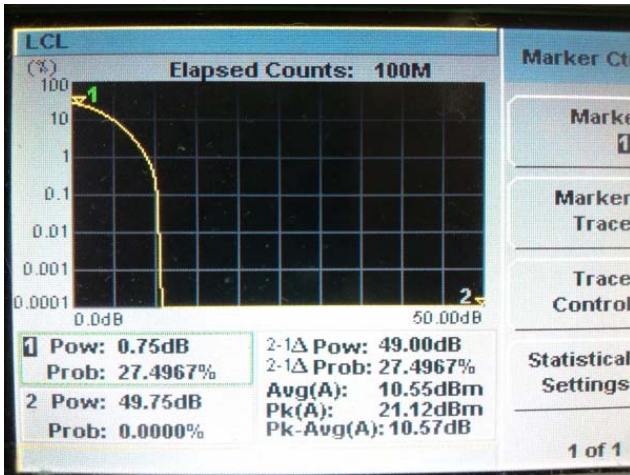
HERMON LABORATORIES

Test specification: Section 96.41(g), Peak-to- average power ratio			
Test procedure: Section 96.41(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 01-Nov-18			
Temperature: 24.3. °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

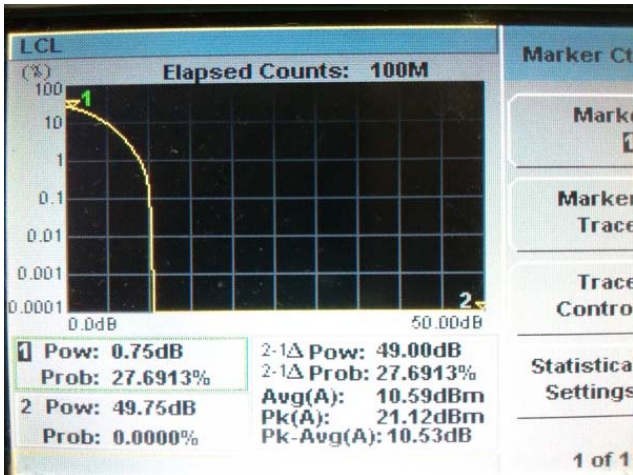
Plot 7.2.5 Peak-to-average power ratio test results at mid frequency

CHANNEL SPACING:
ANTENNA PORT:
Modulation: QPSK

20 MHz
1
Modulation: 16QAM



Modulation: 64QAM





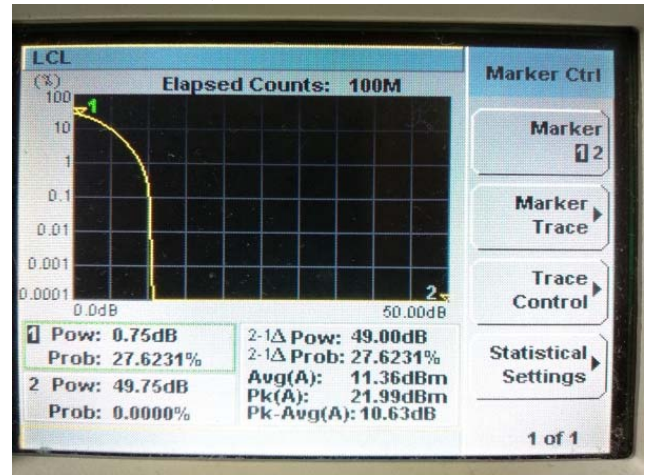
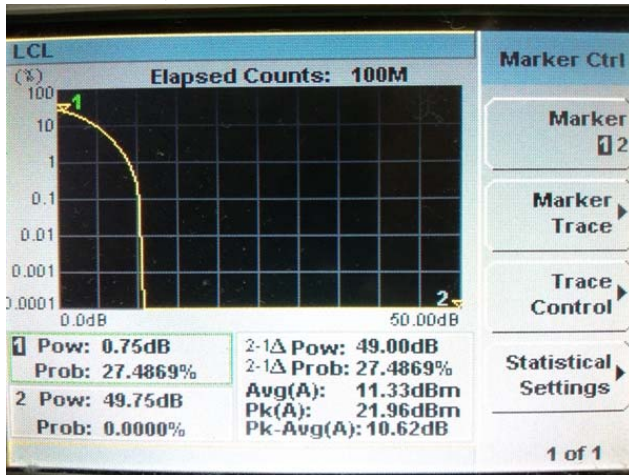
HERMON LABORATORIES

Test specification: Section 96.41(g), Peak-to- average power ratio			
Test procedure: Section 96.41(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 01-Nov-18			
Temperature: 24.3. °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

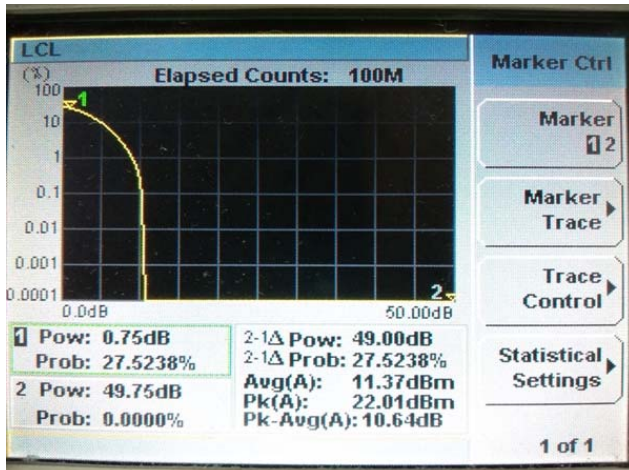
Plot 7.2.6 Peak-to-average power ratio test results at high frequency

CHANNEL SPACING:
ANTENNA PORT:
Modulation: QPSK

20 MHz
1
Modulation: 16QAM



Modulation: 64QAM





Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 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	10 / 20 MHz

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

7.3.2 Test procedure

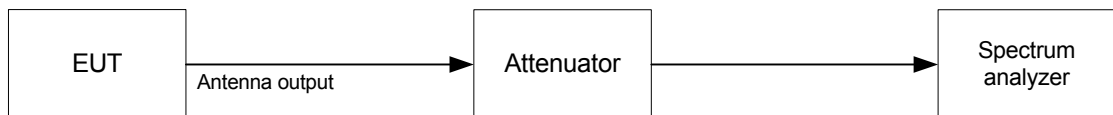
7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

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: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 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 10 MHz				
Modulation QPSK				
3555.0	8.9506	10.0	-1.0494	Pass
3625.0	8.9584	10.0	-1.0416	Pass
3695.0	8.9443	10.0	-1.0557	Pass
Modulation 16QAM				
3555.0	8.9462	10.0	-1.0538	Pass
3625.0	8.9396	10.0	-1.0604	Pass
3695.0	8.9342	10.0	-1.0658	Pass
Modulation 64QAM				
3555.0	8.9288	10.0	-1.0712	Pass
3625.0	8.9318	10.0	-1.0682	Pass
3695.0	8.9470	10.0	-1.0530	Pass
Channel spacing 20 MHz				
Modulation QPSK				
3560.0	17.8749	20.0	-2.1251	Pass
3625.0	17.8801	20.0	-2.1199	Pass
3690.0	17.8568	20.0	-2.1432	Pass
Modulation 16QAM				
3560.0	17.8495	20.0	-2.1505	Pass
3625.0	17.8480	20.0	-2.1520	Pass
3690.0	17.8555	20.0	-2.1445	Pass
Modulation 64QAM				
3560.0	17.8611	20.0	-2.1389	Pass
3625.0	17.8811	20.0	-2.1189	Pass
3690.0	17.8603	20.0	-2.1397	Pass

Reference numbers of test equipment used

HL 3787	HL 3818	HL 3903			
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Full description is given in Appendix A.



HERMON LABORATORIES

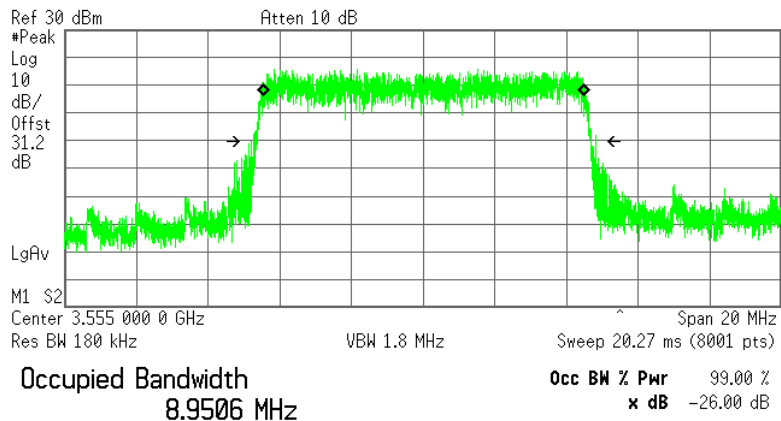
Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.1 Occupied bandwidth test result at low frequency

MODULATION: QPSK
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: 1

Agilent

R T



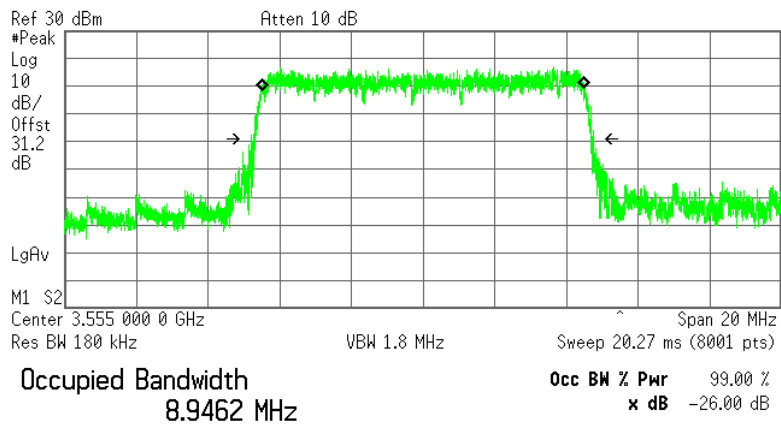
Transmit Freq Error 4.520 kHz
x dB Bandwidth 9.617 MHz

Plot 7.3.2 Occupied bandwidth test result at low frequency

MODULATION: 16QAM
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: 1

Agilent

R T



Transmit Freq Error 1.555 kHz
x dB Bandwidth 9.549 MHz



HERMON LABORATORIES

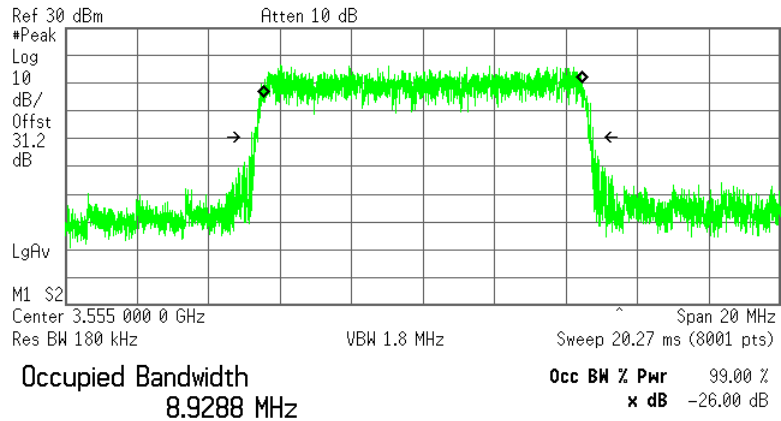
Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.3 Occupied bandwidth test result at low frequency

MODULATION: 64QAM
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: 1

Agilent

R T



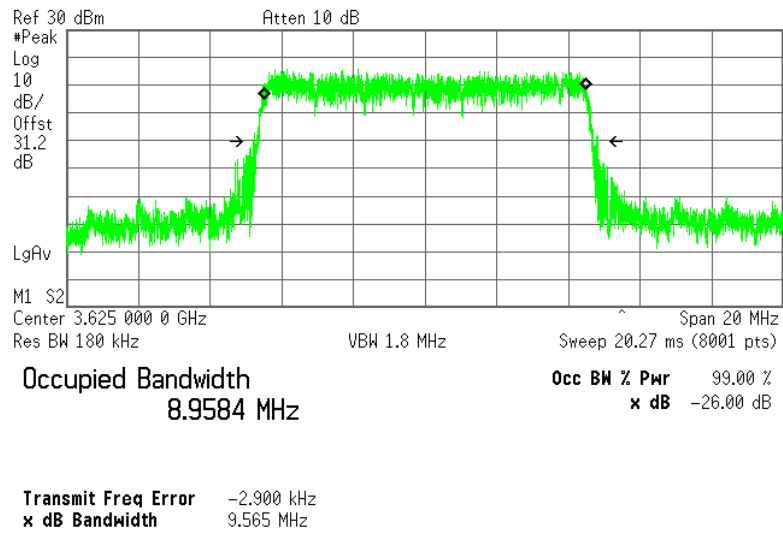
Transmit Freq Error -3.896 kHz
x dB Bandwidth 9.548 MHz



Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

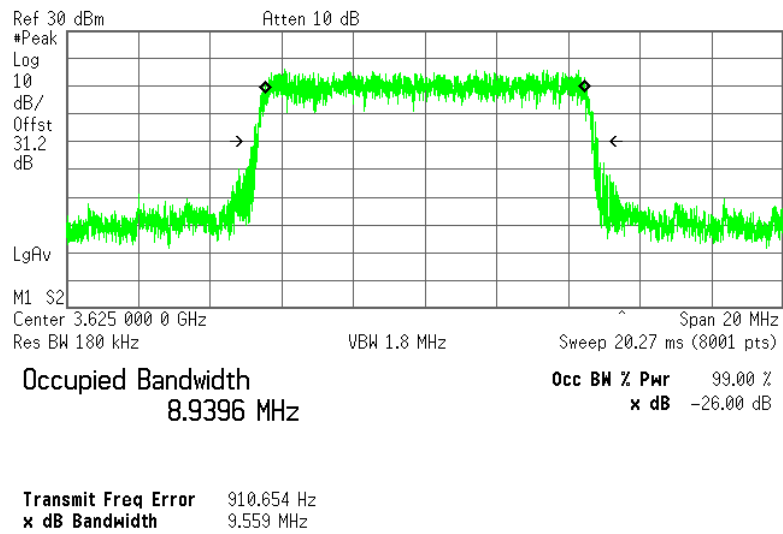
Plot 7.3.4 Occupied bandwidth test result at mid frequency

MODULATION: QPSK
 CHANNEL SPACING: 10 MHz
 ANTENNA CHAIN: 1
 Agilent R T



Plot 7.3.5 Occupied bandwidth test result at mid frequency

MODULATION: 16QAM
 CHANNEL SPACING: 10 MHz
 ANTENNA CHAIN: 1
 Agilent R T





HERMON LABORATORIES

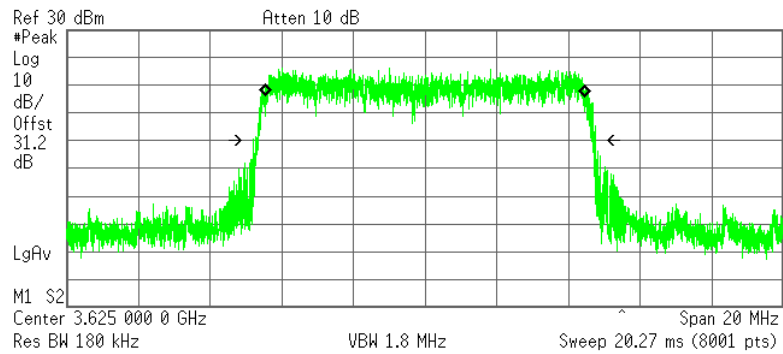
Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.6 Occupied bandwidth test result at mid frequency

MODULATION: 64QAM
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: 1

Agilent

R T



Occupied Bandwidth
8.9318 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 3.077 kHz
x dB Bandwidth 9.549 MHz

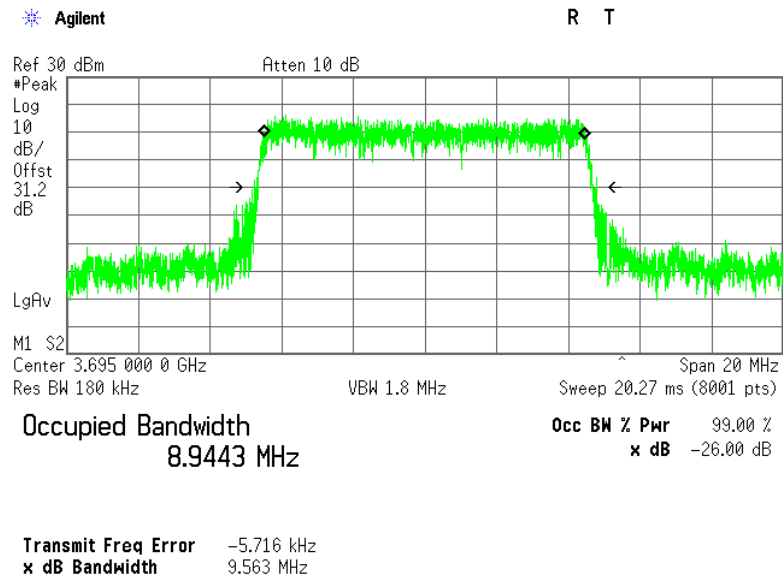


HERMON LABORATORIES

Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

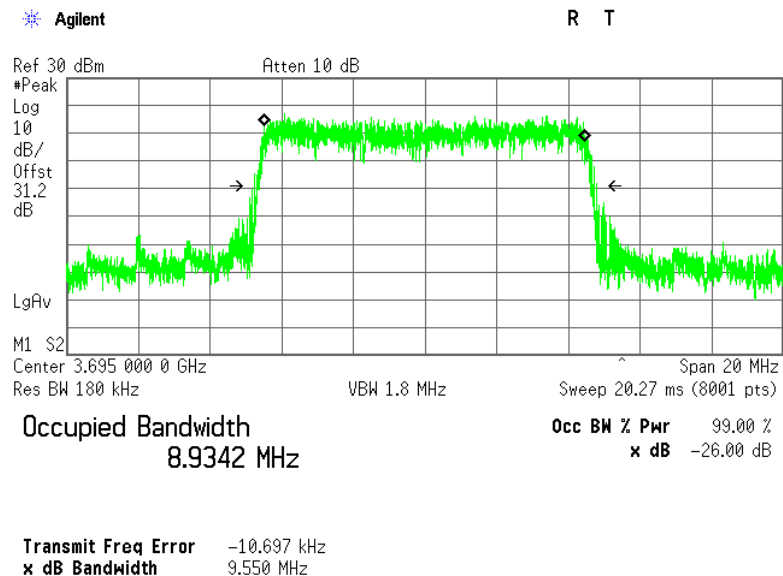
Plot 7.3.7 Occupied bandwidth test result at high frequency

MODULATION: QPSK
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: 1



Plot 7.3.8 Occupied bandwidth test result at high frequency

MODULATION: 16QAM
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: 1





HERMON LABORATORIES

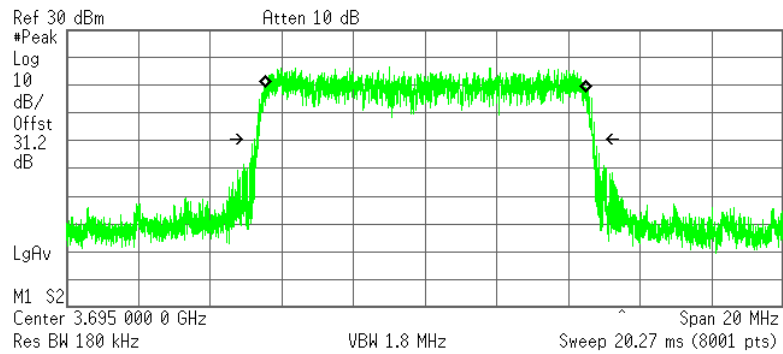
Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.9 Occupied bandwidth test result at high frequency

MODULATION: 64QAM
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: 1

Agilent

R T



Occupied Bandwidth
8.9470 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 3.343 kHz
x dB Bandwidth 9.478 MHz



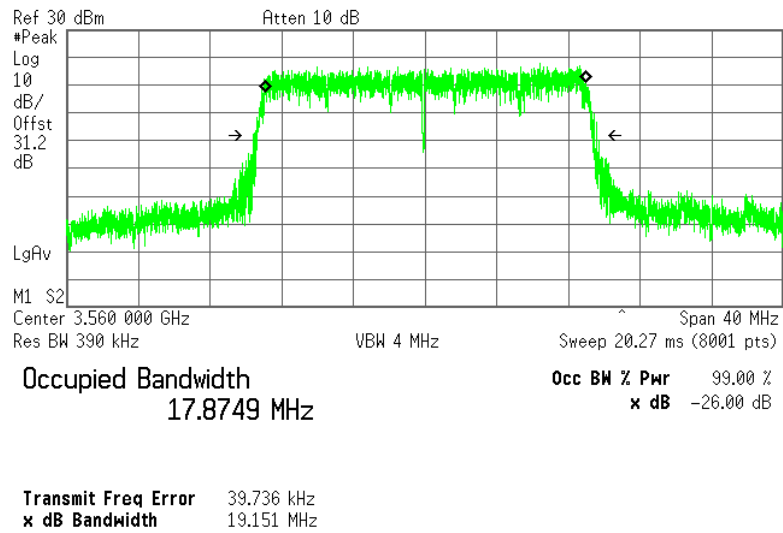
HERMON LABORATORIES

Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.10 Occupied bandwidth test result at low frequency

MODULATION: QPSK
 CHANNEL SPACING: 20 MHz
 ANTENNA CHAIN: 1

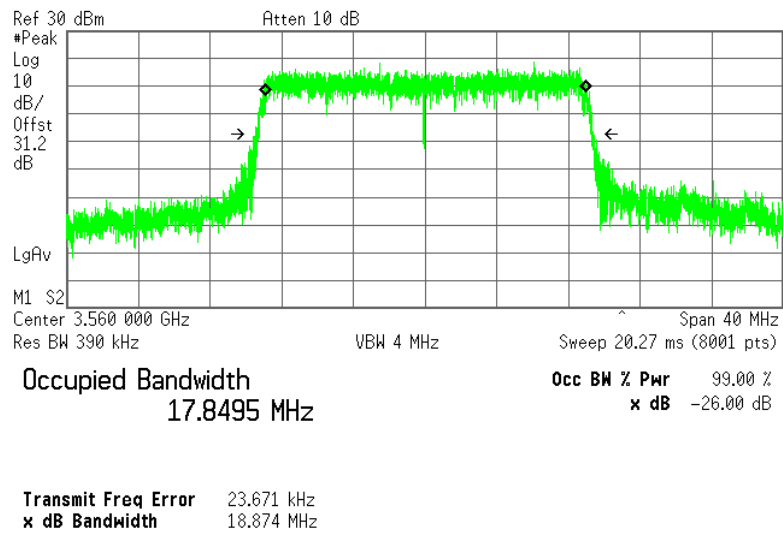
Agilent R T



Plot 7.3.11 Occupied bandwidth test result at low frequency

MODULATION: 16QAM
 CHANNEL SPACING: 20 MHz
 ANTENNA CHAIN: 1

Agilent R T





HERMON LABORATORIES

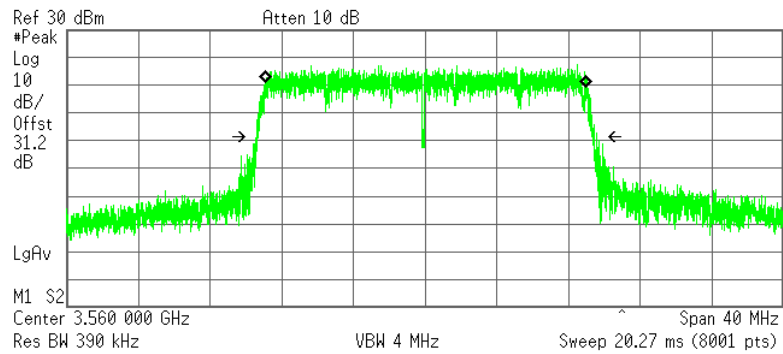
Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.12 Occupied bandwidth test result at low frequency

MODULATION: 64QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 1

Agilent

R T



Occupied Bandwidth
17.8611 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 45.242 kHz
x dB Bandwidth 18.972 MHz

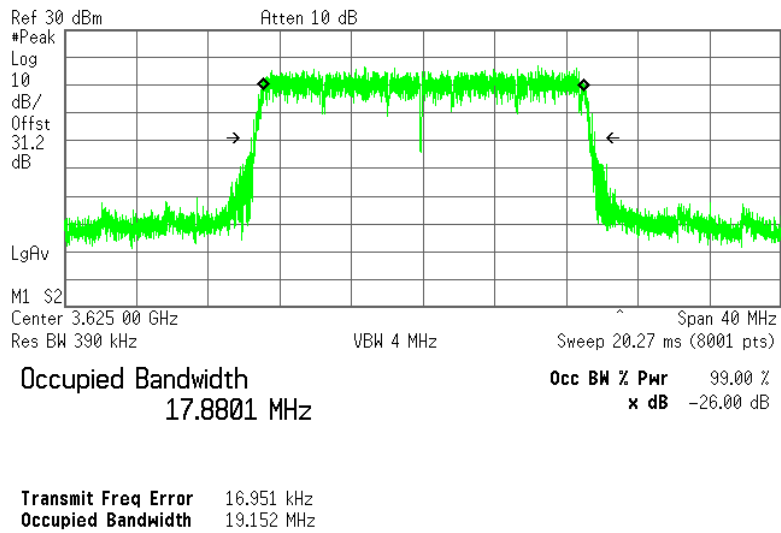


Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.13 Occupied bandwidth test result at mid frequency

MODULATION: QPSK
 CHANNEL SPACING: 20 MHz
 ANTENNA CHAIN: 1

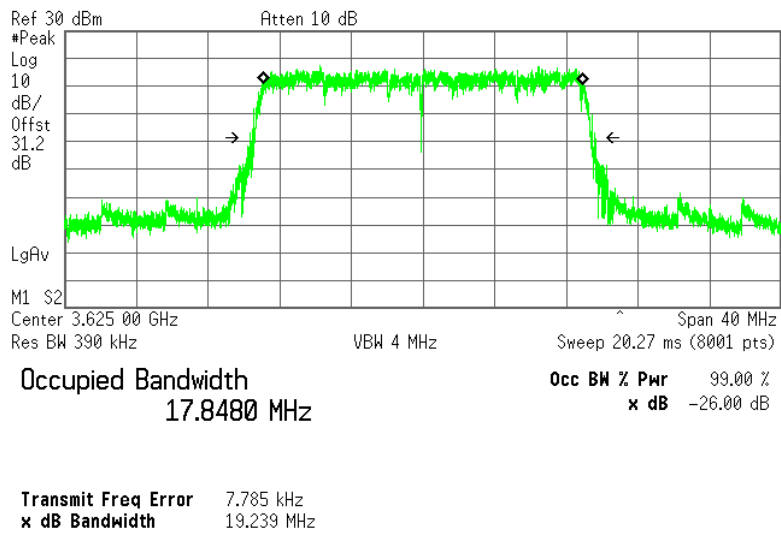
Agilent R T



Plot 7.3.14 Occupied bandwidth test result at mid frequency

MODULATION: 16QAM
 CHANNEL SPACING: 20 MHz
 ANTENNA CHAIN: 1

Agilent R T





HERMON LABORATORIES

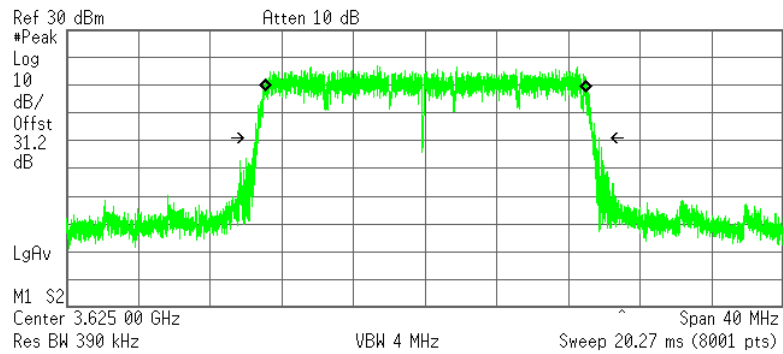
Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.15 Occupied bandwidth test result at mid frequency

MODULATION: 64QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 1

Agilent

R T



Occupied Bandwidth
17.8811 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 28.943 kHz
x dB Bandwidth 19.154 MHz



HERMON LABORATORIES

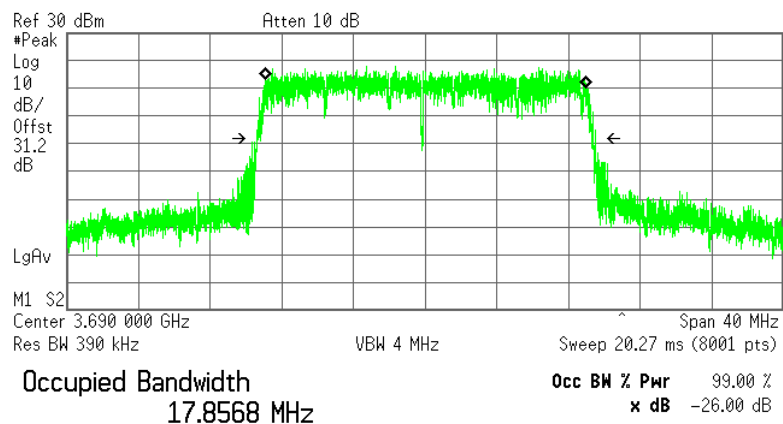
Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.16 Occupied bandwidth test result at high frequency

MODULATION: QPSK
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 1

Agilent

R T



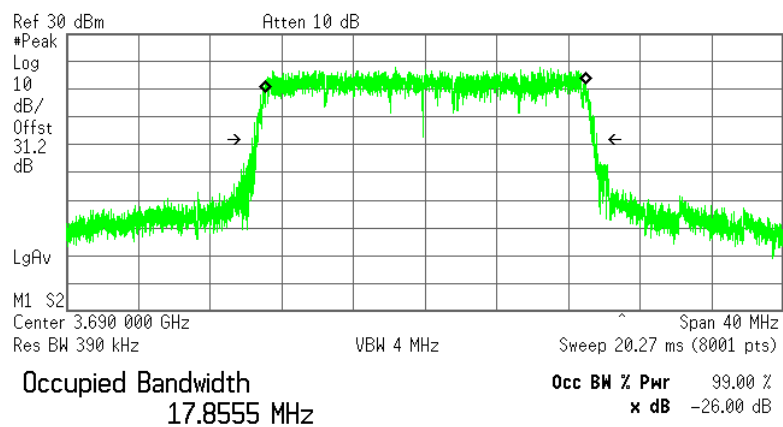
Transmit Freq Error 26.026 kHz
x dB Bandwidth 18.882 MHz

Plot 7.3.17 Occupied bandwidth test result at high frequency

MODULATION: 16QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 1

Agilent

R T



Transmit Freq Error 22.294 kHz
x dB Bandwidth 19.226 MHz



HERMON LABORATORIES

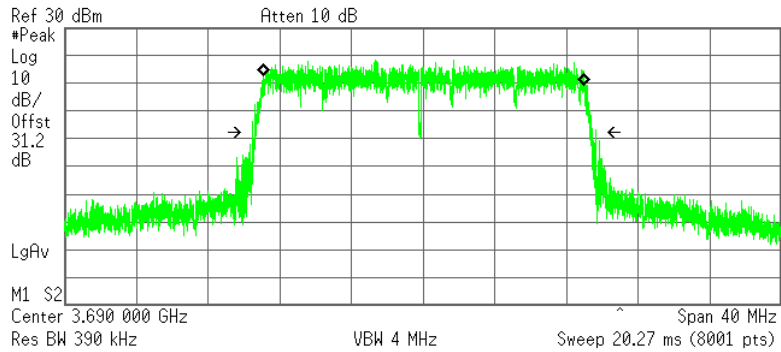
Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Oct-18 - 24-Oct-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.18 Occupied bandwidth test result at high frequency

MODULATION: 64QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 1

Agilent

R T



Occupied Bandwidth
17.8603 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 20.821 kHz
x dB Bandwidth 19.151 MHz



Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

7.4 Emission outside the fundamental test

7.4.1 General

This test was performed to measure Emission outside the fundamental at RF antenna connector. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Emission outside the fundamental limits

Frequency displacement from frequency block	Limit*, dBm/MHz	RBW, kHz
Channel Spacing 10 MHz		
0 – 1 MHz	- 13	100
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 20 MHz		
0 – 1 MHz	- 13	100
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

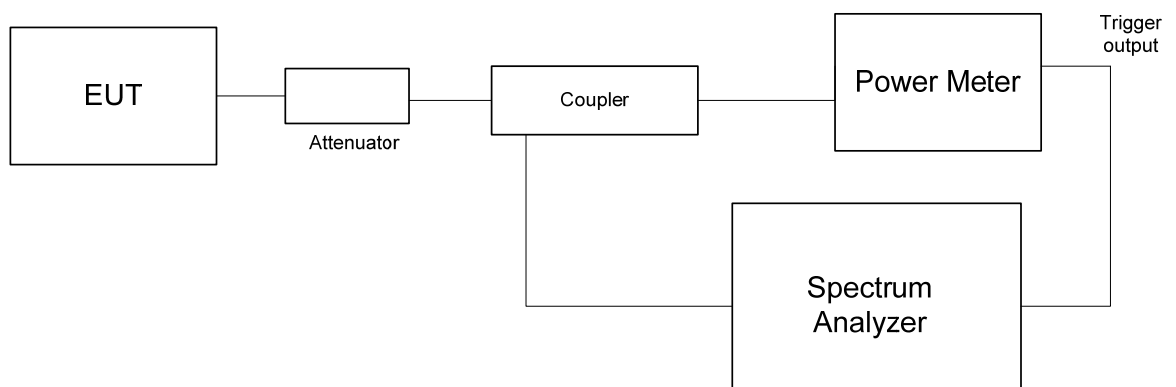
* - Limit at each antenna connector (amount of antennas N = 2)

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.

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): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 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
EBW: 10 MHz
NUMBER OF CHAINS: 2
ANTENNA PORT: #1

Frequency MHz	Band edge	SA reading over 1 chain, dBm	Total band edge*, dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK							
Low frequency 3555.0 MHz							
3550.00	Low	-26.41	-23.41	100	NA	-13.0	Pass
3530.00	Low	-49.74	-46.74	100	1000	-25.0	
3560.00	High	-27.16	-24.16	100	1000	-13.0	
3570.00	High	-43.91	-40.91	100	1000	-25.0	
Mid frequency 3625.0 MHz							
3620.00	Low	-28.99	-25.99	100	NA	-13.0	Pass
3610.00	Low	-44.64	-41.64	100	1000	-25.0	
3630.00	High	-29.03	-26.03	100	NA	-13.0	
3650.00	High	-44.08	-41.08	100	1000	-25.0	
High frequency 3695.0 MHz							
3690.00	Low	-27.10	-24.10	100	NA	-13.0	Pass
3680.00	Low	-45.68	-42.68	100	1000	-25.0	
3700.00	High	-28.80	-25.80	100	NA	-13.0	
3710.00	High	-46.52	-43.52	100	1000	-25.0	
16 QAM							
Low frequency 3555.0 MHz							
3550.00	Low	-32.85	-29.86	100	NA	-13.0	Pass
3530.00	Low	-48.70	-45.70	100	1000	-40.0	
3560.00	High	-29.67	-26.67	100	NA	-13.0	
3570.00	High	-41.37	-38.37	100	1000	-25.0	
Mid frequency 3625.0 MHz							
3620.00	Low	-28.45	-25.45	100	NA	-13.0	Pass
3610.00	Low	-44.97	-41.97	100	1000	-25.0	
3630.00	High	-32.56	-29.56	100	NA	-13.0	
3650.00	High	-44.15	-41.15	100	1000	-25.0	
High frequency 2680.0 MHz							
3690.00	Low	-29.25	.26.25	100	NA	-13.0	Pass
3680.00	Low	-43.18	-40.18	100	1000	-25.0	
3700.00	High	-28.23	-25.23	100	NA	-13.0	
3720.00	High	-50.02	-47.02	100	1000	-40.0	
64 QAM							
Low frequency 3555.0 MHz							
3550.00	Low	-27.80	-24.80	100	NA	-13.0	Pass
3530.00	Low	-51.16	-48.16	100	1000	-40.0	
3560.00	High	-24.21	-21.21	100	NA	-13.0	
3580.00	High	-44.97	-41.97	100	1000	-25.0	
Mid frequency 3625.0 MHz							
3620.00	Low	-26.87	-23.87	100	NA	-13.0	Pass
3610.00	Low	-43.86	-40.86	100	1000	-25.0	
3630.00	High	-25.50	-22.50	100	NA	-13.0	
3650.00	High	-44.08	-41.08	100	1000	-25.0	
High frequency 3695.0 MHz							
3690.00	Low	-23.82	-20.82	100	NA	-13.0	Pass
3689.50	Low	-28.03	-25.03	100	1000	-25.0	
3700.00	High	-25.05	-22.05	100	NA	-13.0	
3720.00	High	-50.12	-47.12	100	1000	-40.0	

* - Total band edge = SA reading + 10*log(N) = SA reading +3 dB



Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Table 7.4.3 Emission outside the fundamental test results

ASSIGNED FREQUENCY RANGE: 3550.0 –3700.0 MHz
 DETECTOR USED: Average (gated)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 EBW: 20 MHz
 NUMBER OF CHAINS: 2
 ANTENNA PORT: #1

Frequency MHz	Band edge	SA reading over 1 chain, dBm	Total band edge*, dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK							
Low frequency 3560.0 MHz							
3550.00	Low	-27.59	-24.59	100	NA	-13.0	Pass
3548.50	Low	-30.59	-27.59	100	1000	-25.0	
3570.00	High	-28.00	-25.00	100	NA	-13.0	
3580.00	High	-38.93	-35.93	100	1000	-25.0	
Mid frequency 3625.0 MHz							
3615.00	Low	-31.32	-28.32	100	NA	-13.0	Pass
3605.00	Low	-42.29	-39.29	100	1000	-25.0	
3635.00	High	-29.60	-26.60	100	NA	-13.0	
3645.00	High	-41.82	-38.82	100	1000	-25.0	
High frequency 3690.0 MHz							
3680.00	Low	-29.29	-26.29	100	NA	-13.0	Pass
3670.00	Low	-42.14	-39.14	100	1000	-25.0	
3700.00	High	-29.70	-26.70	100	NA	-13.0	
3710.00	High	-45.20	-42.20	100	1000	-25.0	
16 QAM							
Low frequency 3560.0 MHz							
3550.00	Low	-30.24	-27.24	100	NA	-13.0	Pass
3548.50	Low	-30.98	-27.98	100	1000	-13.0	
3570.00	High	-29.59	-26.59	100	NA	-13.0	
3571.50	High	-30.35	-27.35	100	1000	-13.0	
Mid frequency 3625.0 MHz							
3615.00	Low	-27.70	-24.70	100	NA	-13.0	Pass
3605.00	Low	-42.25	-39.25	100	1000	-25.0	
3635.00	High	-27.28	-24.28	100	NA	-13.0	
3645.00	High	-42.30	-39.30	100	1000	-25.0	
High frequency 3690.0 MHz							
3680.00	Low	-27.26	-24.26	100	NA	-13.0	Pass
3670.00	Low	-42.69	-39.69	100	1000	-25.0	
3700.00	High	-29.52	-26.52	100	NA	-13.0	
3710.00	High	-44.91	-41.91	100	1000	-25.0	



Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 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
EBW: 20 MHz
NUMBER OF CHAINS: 2
ANTENNA PORT: #1

Frequency MHz	Band edge	SA reading over 1 chain, dBm	Total band edge*, dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
64 QAM							
Low frequency 3560.0 MHz							
3550.00	Low	-27.10	-24.10	100	NA	-13.0	Pass
3540.00	Low	-43.72	-40.72	100	1000	-25.0	
3570.00	High	-28.57	-25.57	100	NA	-13.0	
3580.00	High	-39.47	-36.47	100	1000	-25.0	
Mid frequency 3625.0 MHz							
3615.00	Low	-27.91	-24.91	100	NA	-13.0	Pass
3605.00	Low	-43.37	-40.37	100	1000	-25.0	
3635.00	High	-26.05	-23.05	100	NA	-13.0	
3645.00	High	-43.42	40.42	100	1000	-25.0	
High frequency 3690.0 MHz							
3680.00	Low	-27.29	-24.29	100	NA	-13.0	Pass
3670.00	Low	-42.84	-39.84	100	1000	-25.0	
3700.00	High	-29.97	-26.97	100	NA	-13.0	
3710.00	High	-45.34	-42.34	100	1000	-25.0	

* - Total band edge = SA reading + 10*log(N) = SA reading +3 dB

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3818	HL 3868	HL 3903	
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Full description is given in Appendix A.



HERMON LABORATORIES

Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict:	PASS
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.1 Emission outside the fundamental test results at low carrier frequency

MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:

QPSK
10 MHz
1

Modulation:

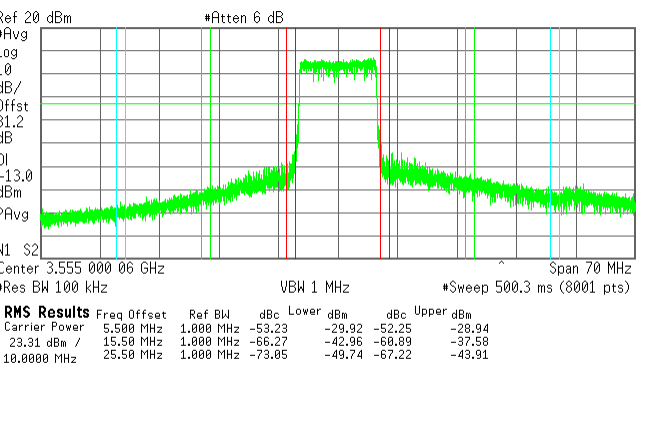
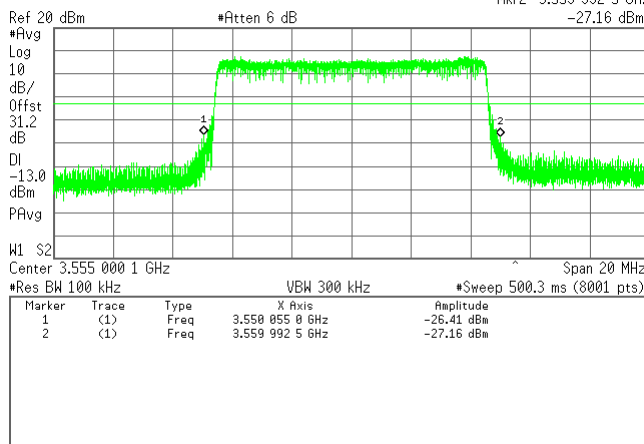
QPSK

Agilent

R T

Agilent

R T



Modulation:

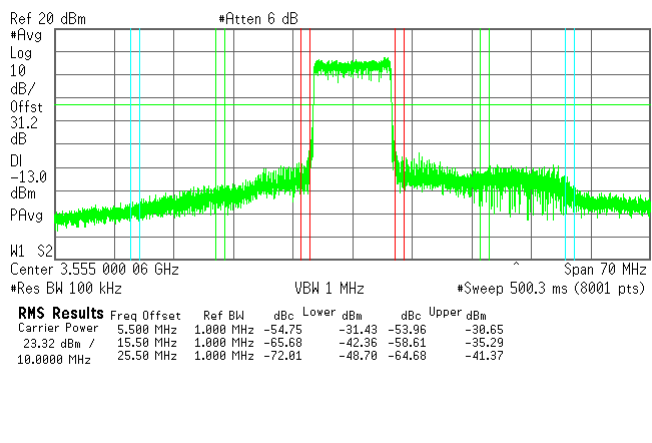
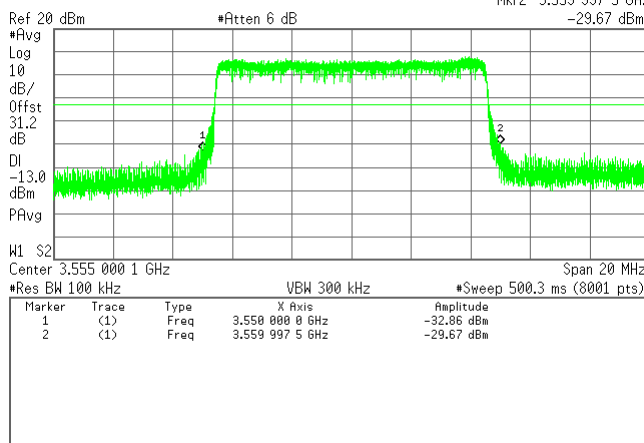
16QAM

Agilent

R T

Agilent

R T





HERMON LABORATORIES

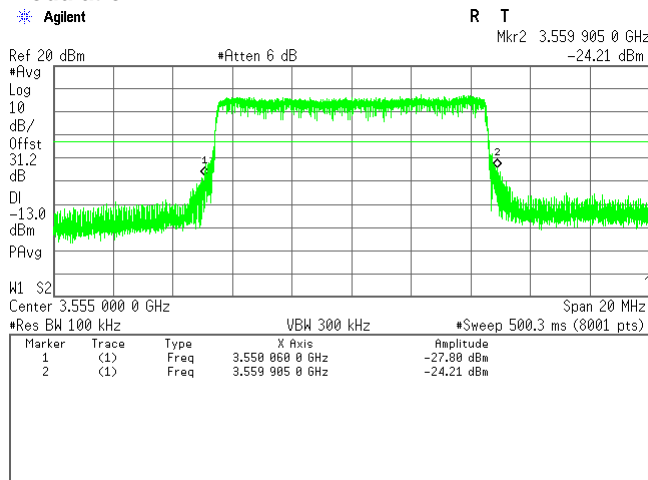
Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.2 Emission outside the fundamental test results at low carrier frequency

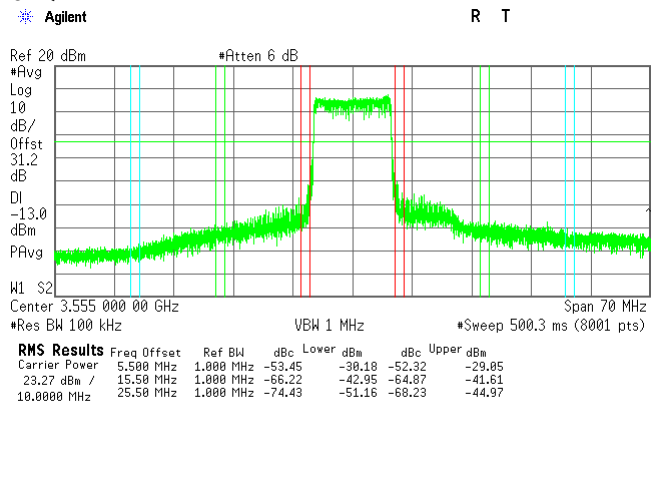
MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:

QPSK
10 MHz
1

Modulation:



64QAM





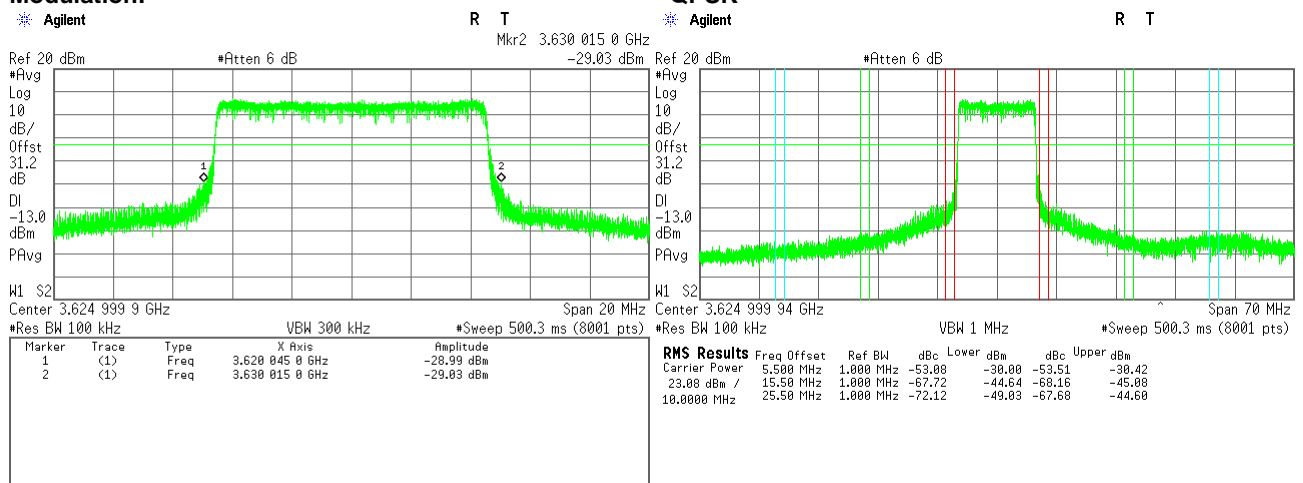
HERMON LABORATORIES

Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.3 Emission outside the fundamental test results at mid carrier frequency

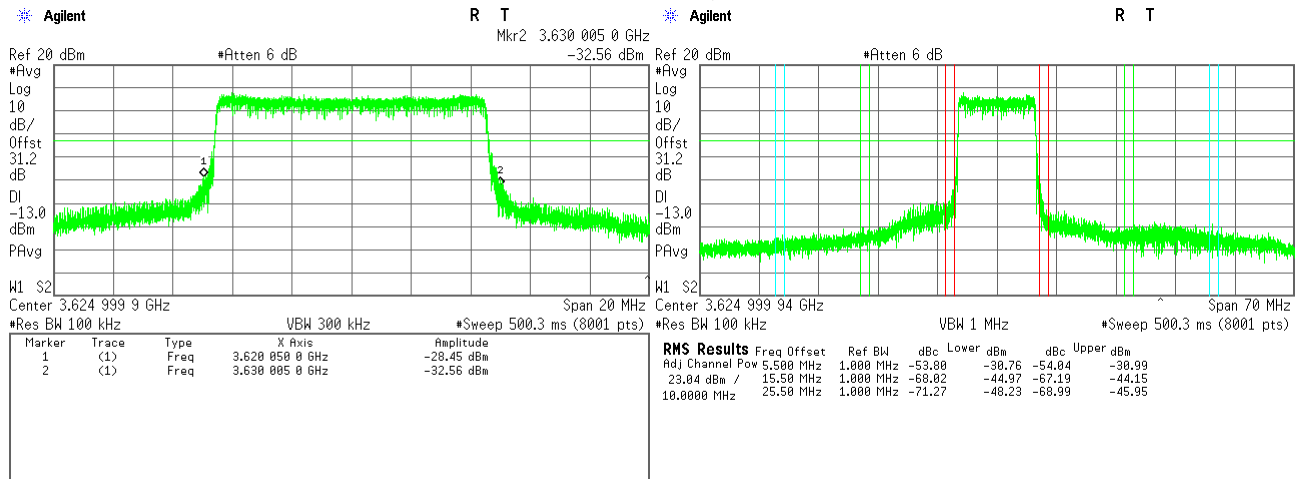
MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation:

QPSK
10 MHz
1
QPSK



Modulation:

16QAM





HERMON LABORATORIES

Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

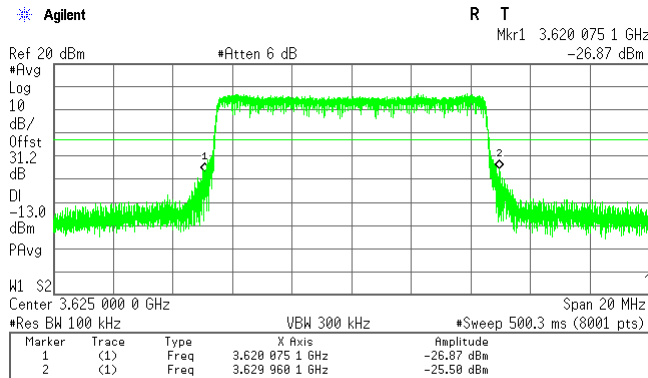
Plot 7.4.4 Emission outside the fundamental test results at mid carrier frequency

MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:

QPSK
10 MHz
1

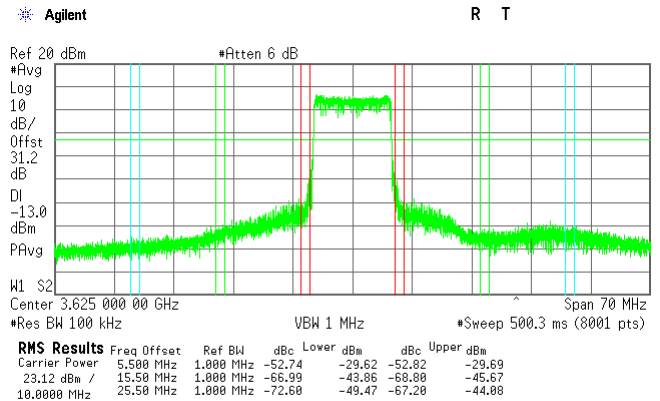
Modulation:

Agilent



64QAM

Agilent





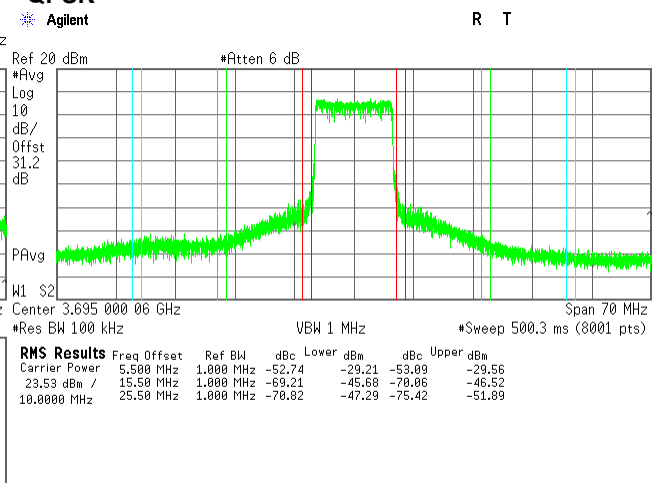
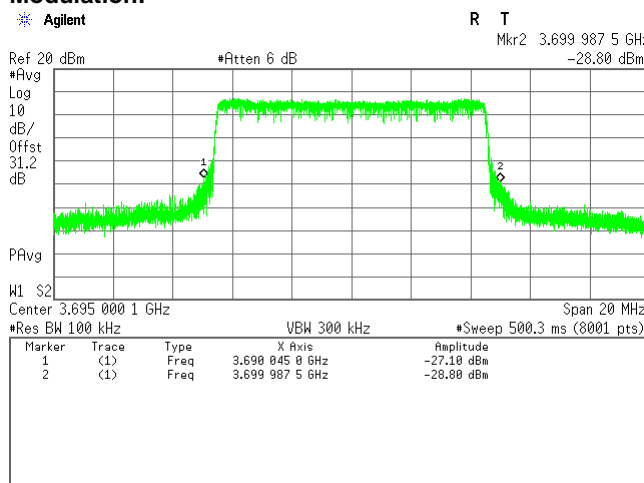
HERMON LABORATORIES

Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.5 Emission outside the fundamental test results at high carrier frequency

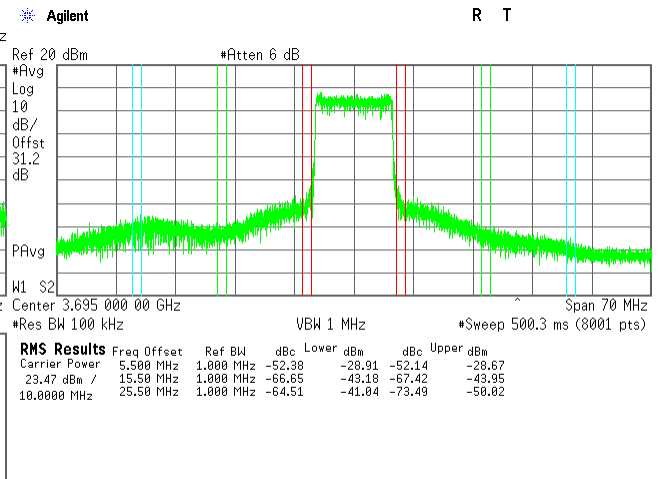
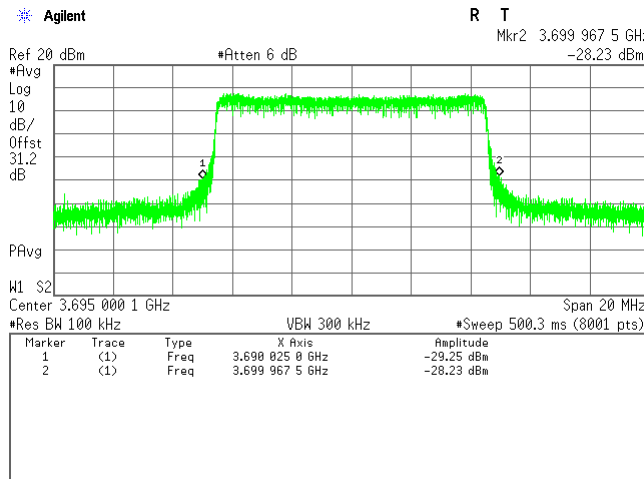
MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation:

QPSK
10 MHz
1
QPSK



Modulation:

16QAM





HERMON LABORATORIES

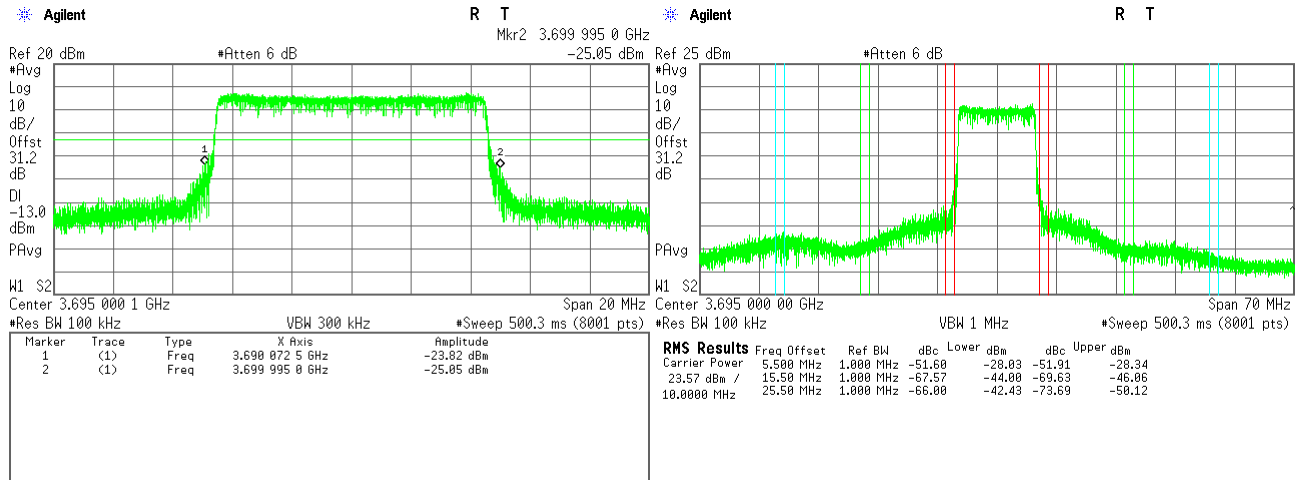
Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.6 Emission outside the fundamental test results at high carrier frequency

MODULATION: QPSK
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: 1

Modulation:

64QAM





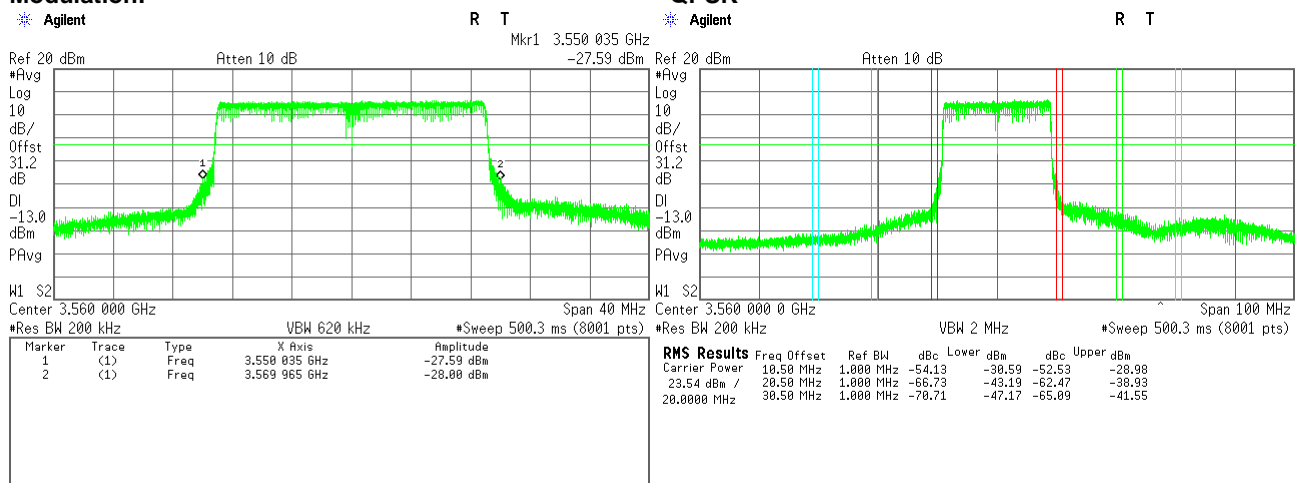
HERMON LABORATORIES

Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.7 Emission outside the fundamental test results at low carrier frequency

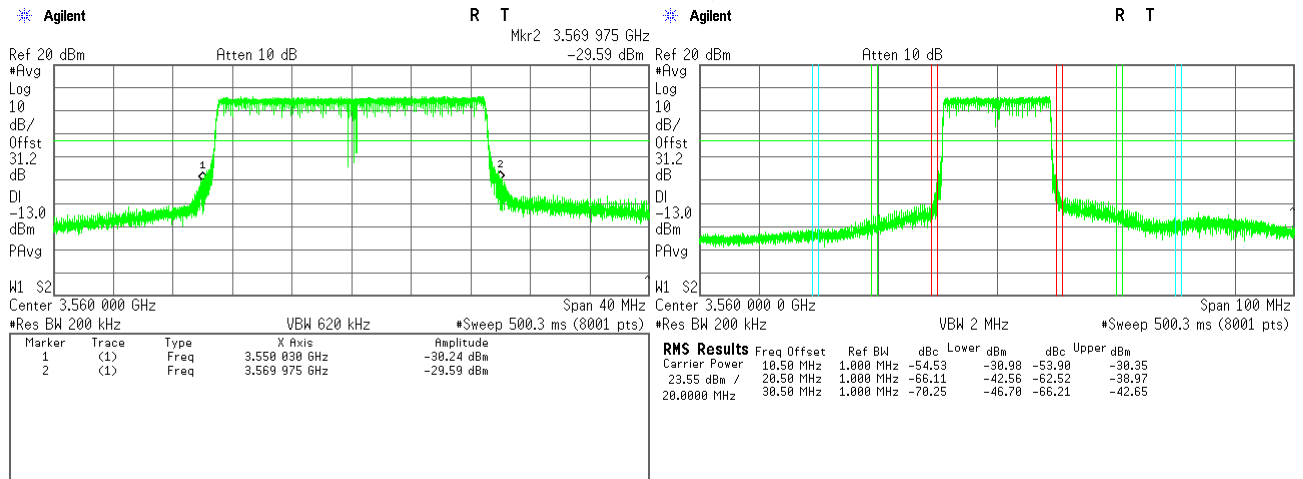
MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation:

QPSK
20 MHz
1
QPSK



Modulation:

16QAM





HERMON LABORATORIES

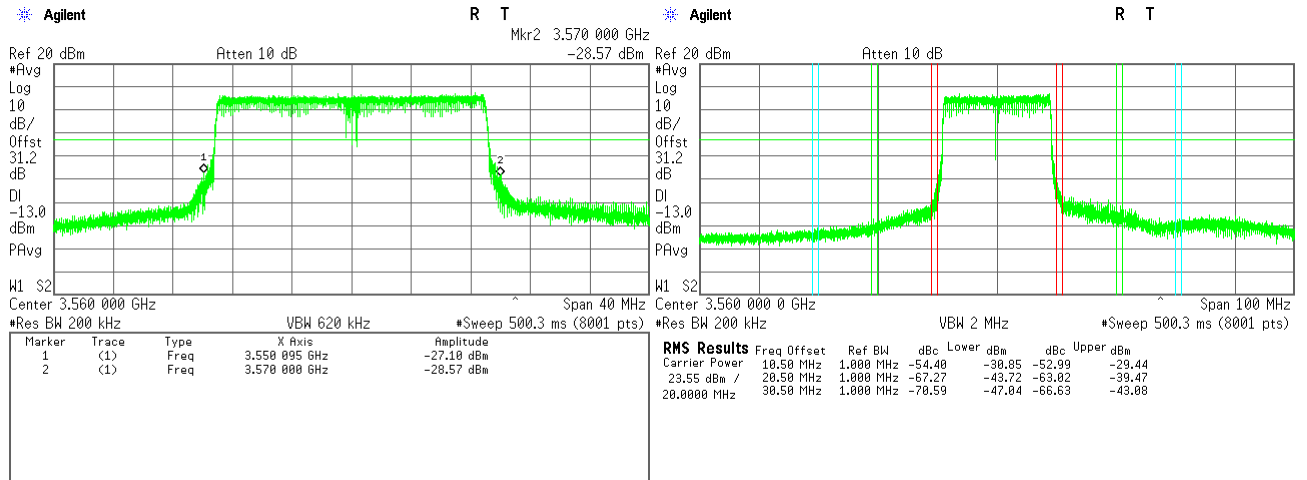
Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.8 Emission outside the fundamental test results at low carrier frequency

MODULATION: QPSK
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 1

Modulation:

64QAM





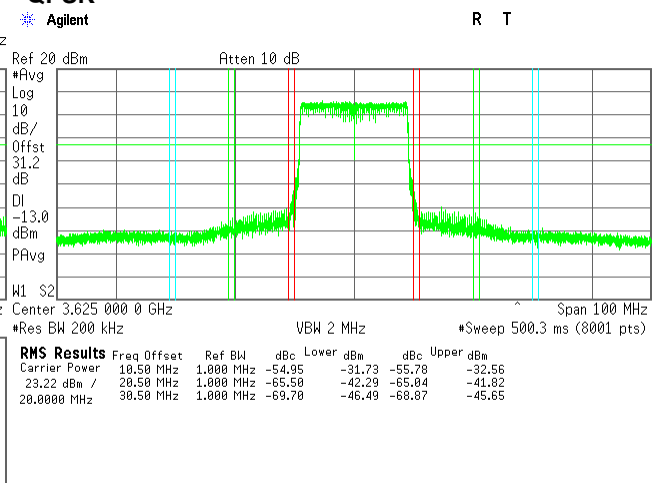
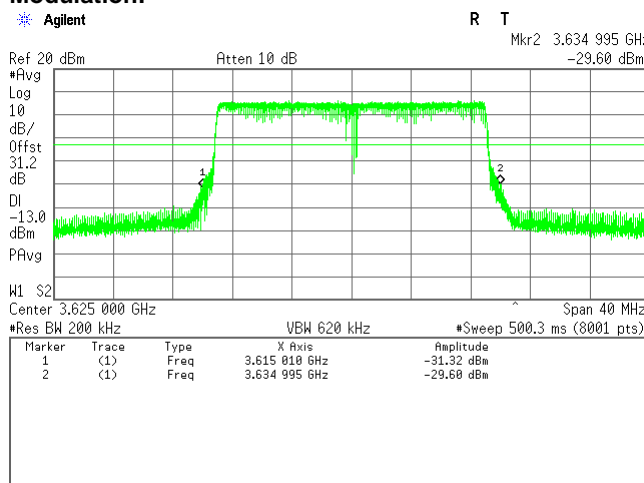
HERMON LABORATORIES

Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.9 Emission outside the fundamental test results at mid carrier frequency

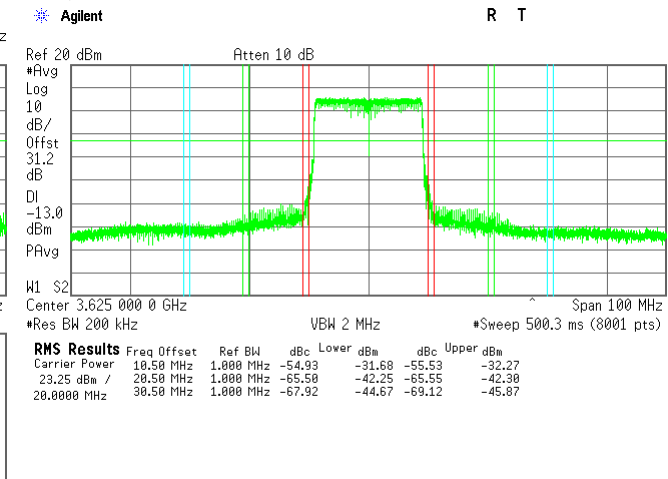
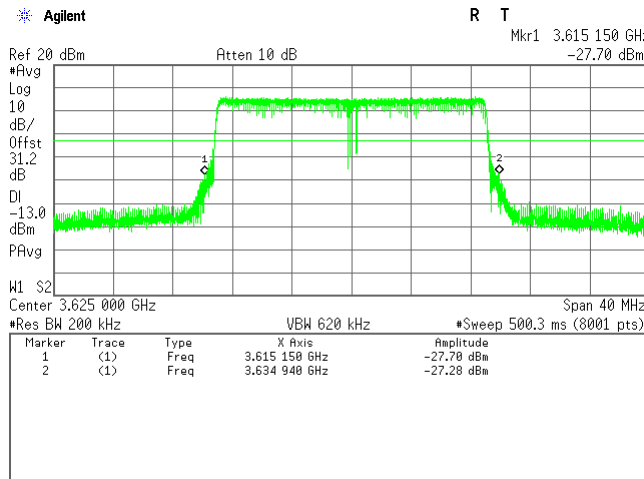
MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation:

QPSK
20 MHz
1
QPSK



Modulation:

16QAM





HERMON LABORATORIES

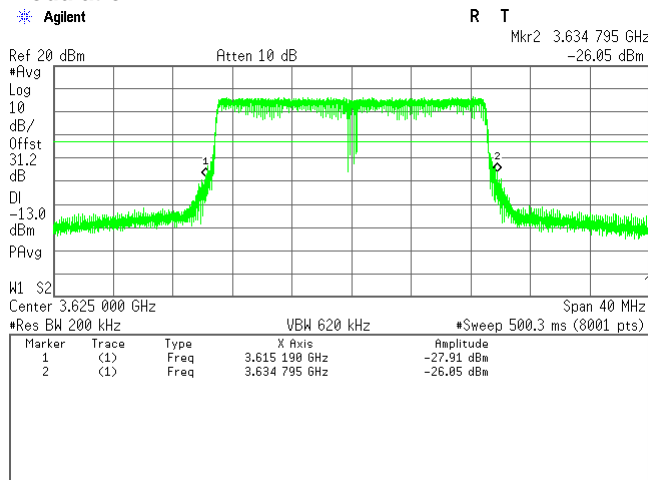
Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.10 Emission outside the fundamental test results at mid carrier frequency

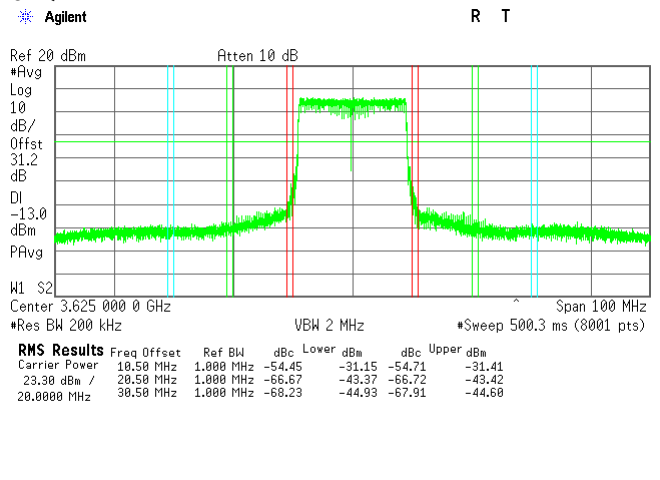
MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:

QPSK
20 MHz
1

Modulation:



64QAM





HERMON LABORATORIES

Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.11 Emission outside the fundamental test results at high carrier frequency

MODULATION:
CHANNEL SPACING:
ANTENNA CHAIN:

QPSK
20 MHz
1

Modulation:

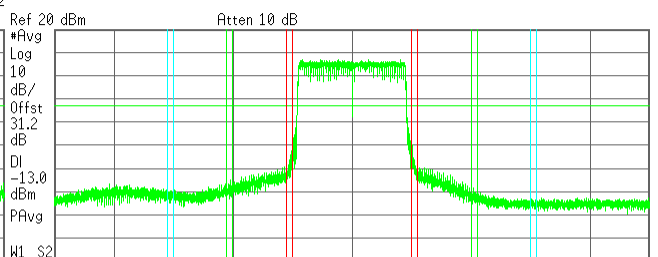
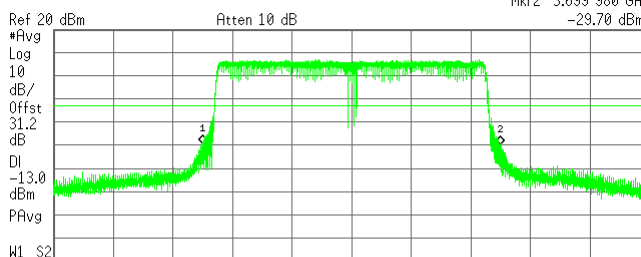
QPSK

Agilent

R T

Agilent

R T



Modulation:

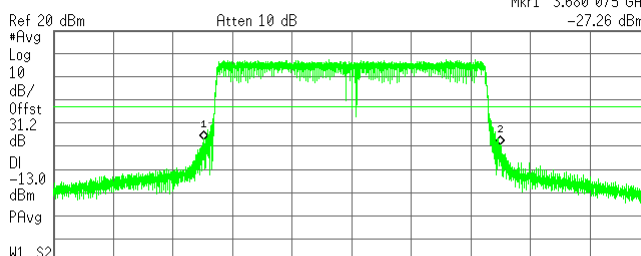
16QAM

Agilent

R T

Agilent

R T





HERMON LABORATORIES

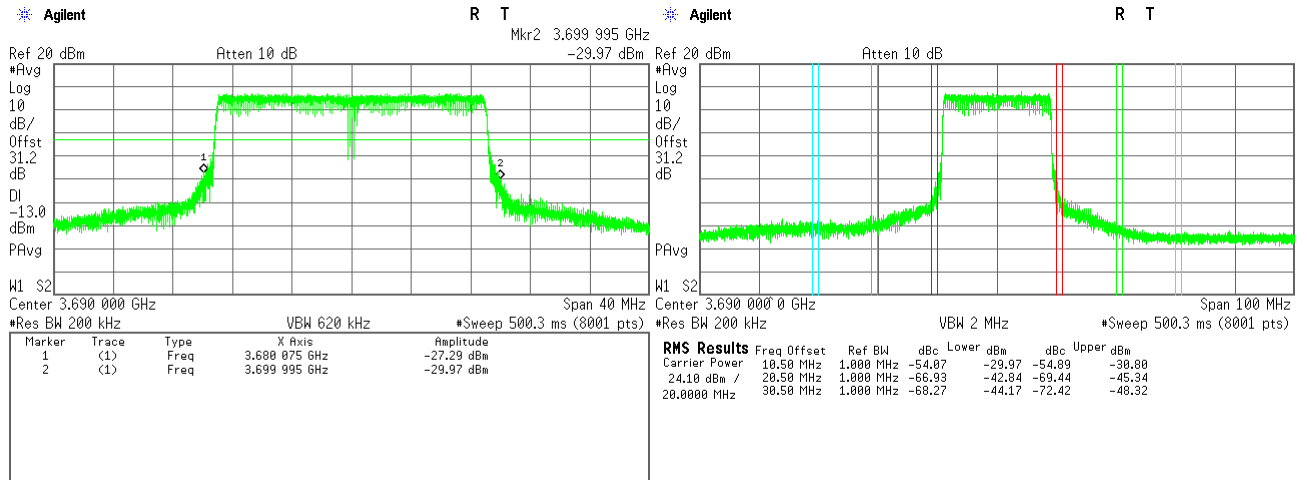
Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 28-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.12 Emission outside the fundamental test results at high carrier frequency

MODULATION: QPSK
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: 1

Modulation:

64QAM





Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

7.5 Radiated spurious emission measurements

7.5.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Radiated spurious emission test limits

Frequency, MHz	EIRP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μ V/m) ^{***}
0.09 – below 3530.0	-40.0	55.2
3720.0 – 10th harmonic*	-40.0	55.2

^{***} - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: $E = \sqrt{30 \times P \times 1.64} / r$, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

7.5.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and the performance check was conducted.

7.5.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

7.5.2.3 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

7.5.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.5.3.1 The EUT was set up as shown in Figure 7.5.2, energized and the performance check was conducted.

7.5.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

7.5.3.3 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

7.5.4 Test procedure for substitution EIRP measurements of spurious

7.5.4.1 The test equipment was set up as shown in Figure 7.5.3 and energized.

7.5.4.2 RF signal generator was set to the frequency of investigated spurious emission and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

7.5.4.3 The test antenna height was swept from 1 to 4 m to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

7.5.4.4 The above procedure was performed in both, horizontal and vertical, polarizations of the test and substitution antennas.

7.5.4.5 The EIRP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBi reduced by cable loss in dB.

7.5.4.6 The above procedure was repeated at the rest of investigated frequencies.

7.5.4.7 The worst test results (the lowest margins) were recorded in Table 7.5.3 and shown in the associated plots.



Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Figure 7.5.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

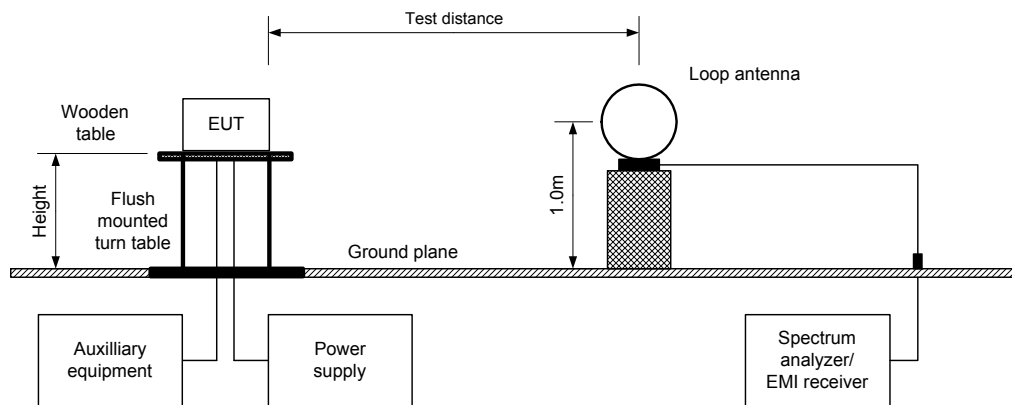
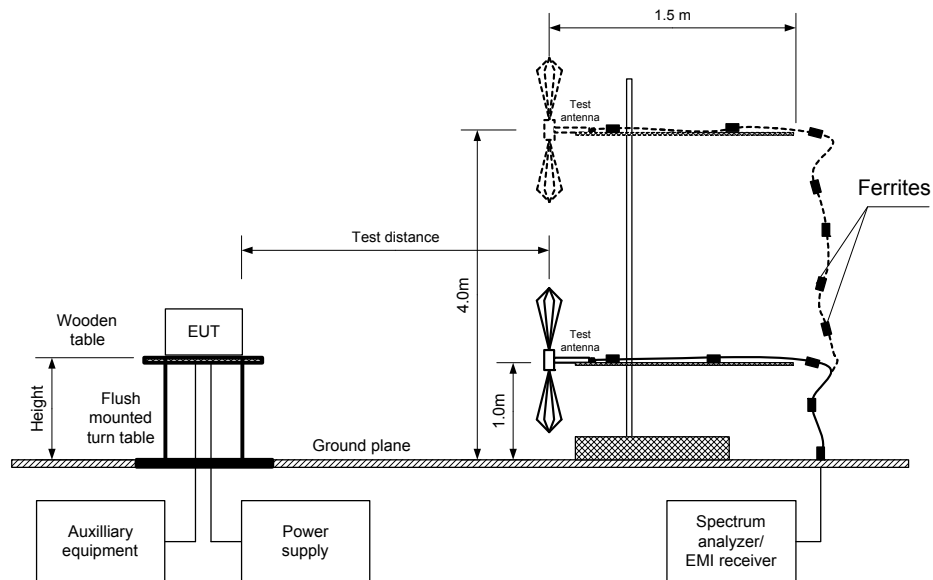


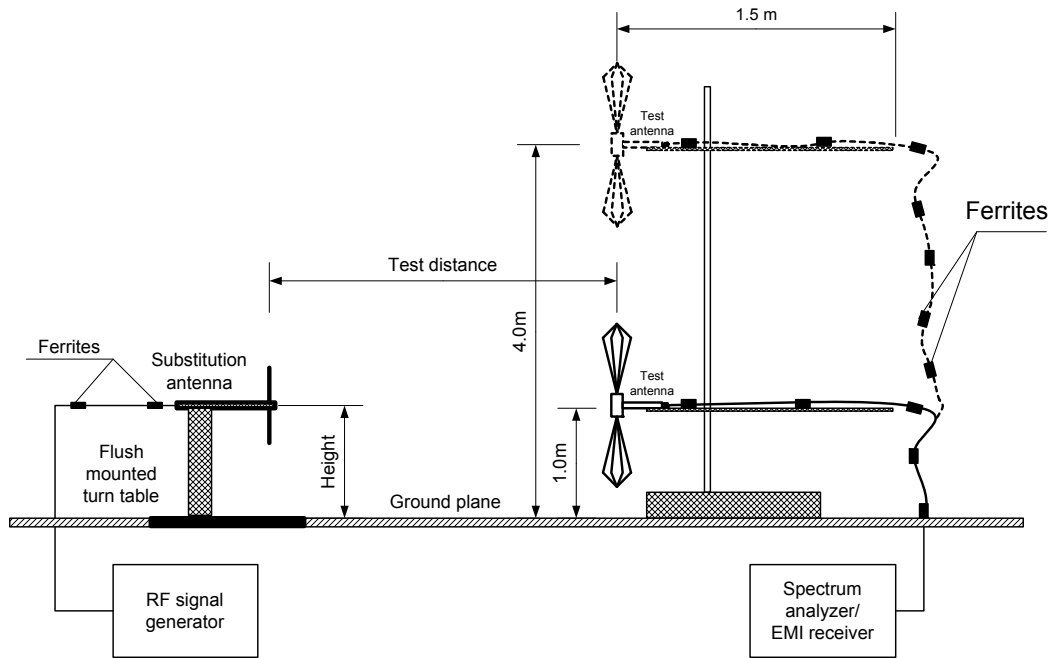
Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz





Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Figure 7.5.3 Setup for substitution EIRP measurements of spurious





Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Table 7.5.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 3550 - 3700 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Semi anechoic chamber
 INVESTIGATED FREQUENCY RANGE: 0.009 – 37000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: > Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)
 MODULATION: QPSK
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
113.084	43.32	55.2	-11.88	100	Vertical	104	38
127.536	51.04	55.2	-4.16	100	Vertical	100	109
140.511	46.82	55.2	-8.38	100	Vertical	102	55
168.888	41.95	55.2	-13.25	100	Vertical	102	180
325.013	41.08	55.2	-14.12	100	Vertical	176	-171
374.982	41.06	55.2	-14.14	100	Vertical	143	143

*- Margin = Field strength of spurious – calculated field strength limit.

** - EUT front panel refers to 0 degrees position of turntable.

Table 7.5.3 Substitution EIRP of spurious test results

ASSIGNED FREQUENCY RANGE: 3550 - 3700 MHz
 TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: > Resolution bandwidth
 SUBSTITUTION ANTENNA TYPE: Tunable dipole (30 MHz – 1000 MHz)

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBi	Cable loss, dB	EIRP, dBm	Limit, dBm/MHz	Margin, dB*	Verdict
113.084	43.32	100	Vertical	-52.81	0.85	0.6	-52.56	-40.0	-12.56	Pass
127.536	51.04	100	Vertical	-46.50	0.75	0.6	-46.35	-40.0	-6.35	Pass
140.511	46.82	100	Vertical	-49.19	0.55	0.7	-49.34	-40.0	-9.34	Pass
168.888	41.95	100	Vertical	-52.45	0.05	0.7	-53.10	-40.0	-13.10	Pass
325.013	41.08	100	Vertical	-55.25	1.65	1.1	-54.70	-40.0	-14.70	Pass
374.982	41.06	100	Vertical	-54.78	1.55	1.1	-54.33	-40.0	-14.33	Pass

*- Margin = EIRP – specification limit.

Reference numbers of test equipment used

HL 0030	HL 0446	HL 0614	HL 0661	HL 3903	HL 4278	HL 4360	HL 4933
HL 4956	HL 5111	HL 5288	HL 5405				

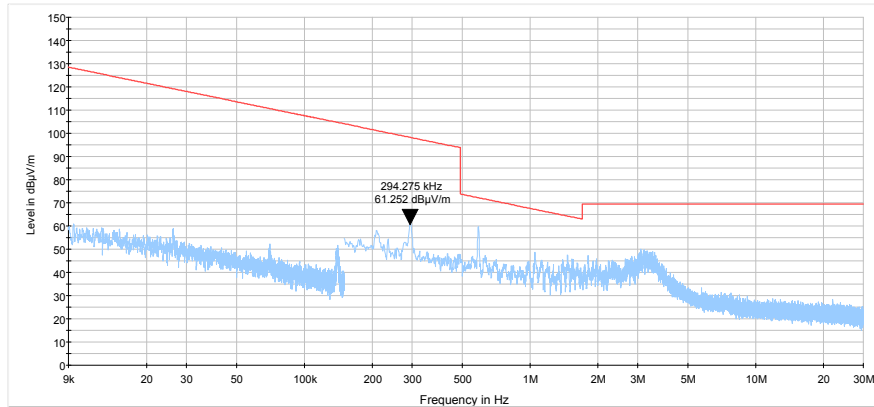
Full description is given in Appendix A.



Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

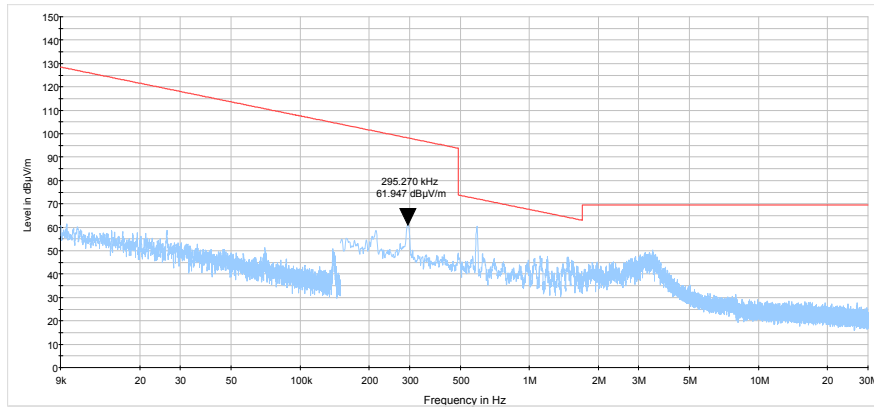
Plot 7.5.1 Radiated emission measurements in 9 kHz - 30 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Low
 TEST DISTANCE: 3 m



Plot 7.5.2 Radiated emission measurements in 9 kHz - 30 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Mid
 TEST DISTANCE: 3 m



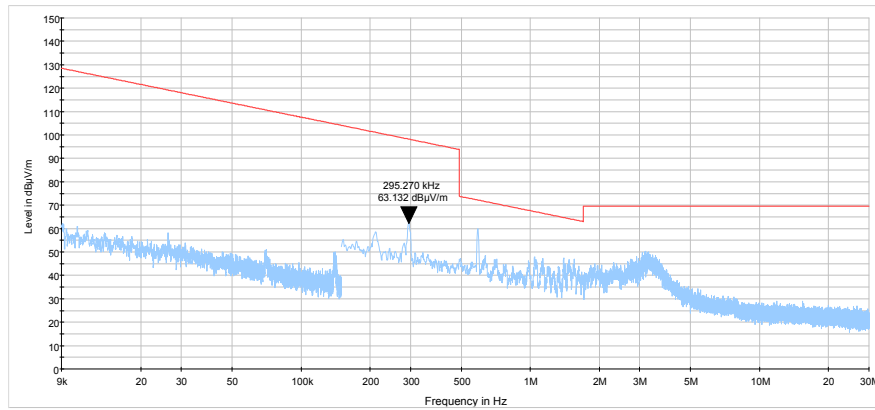


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Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.5.3 Radiated emission measurements in 9 kHz - 30 MHz range

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
TEST DISTANCE: 3 m



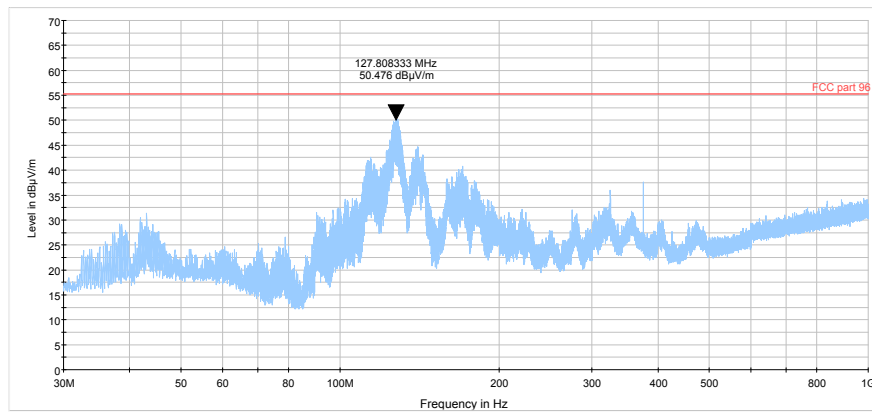


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Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

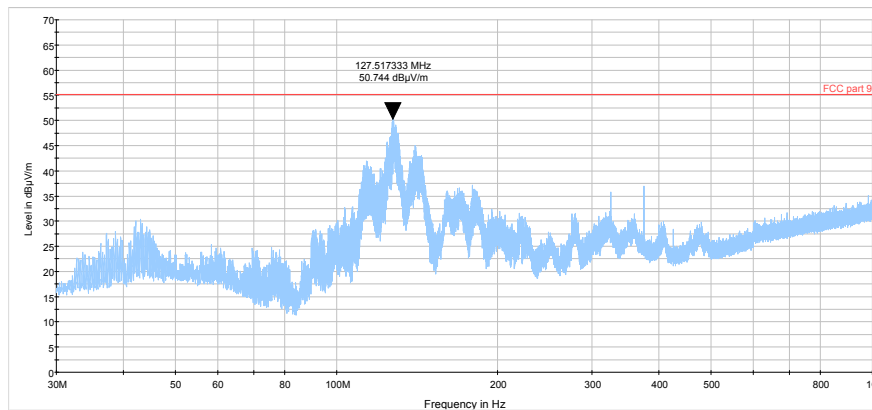
Plot 7.5.4 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Low
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Plot 7.5.5 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Mid
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m

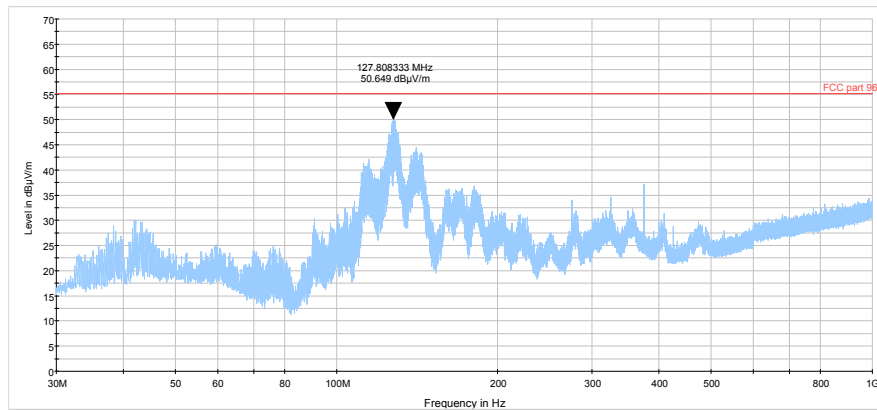




Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

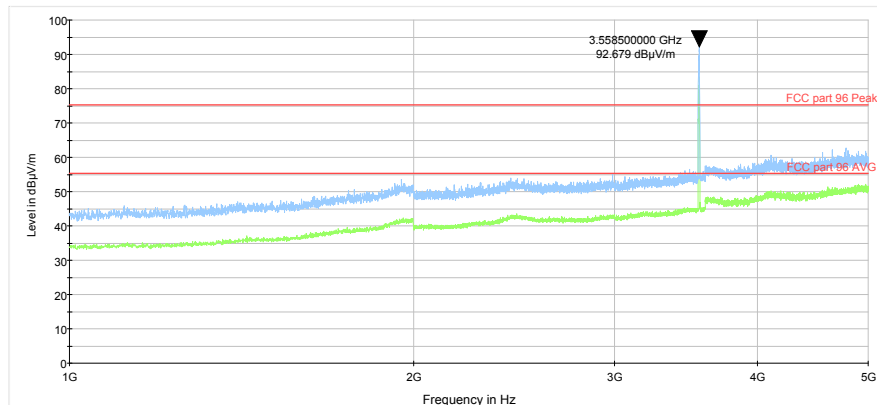
Plot 7.5.6 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: High
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Plot 7.5.7 Radiated emission measurements in 1000 – 5000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Low
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m

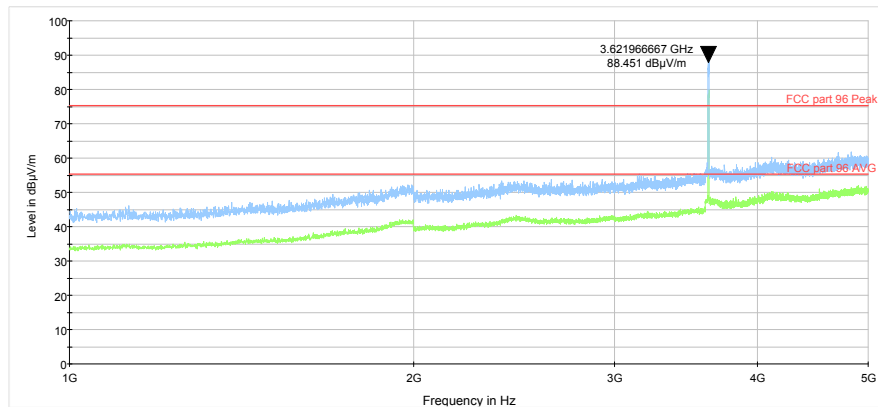




Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

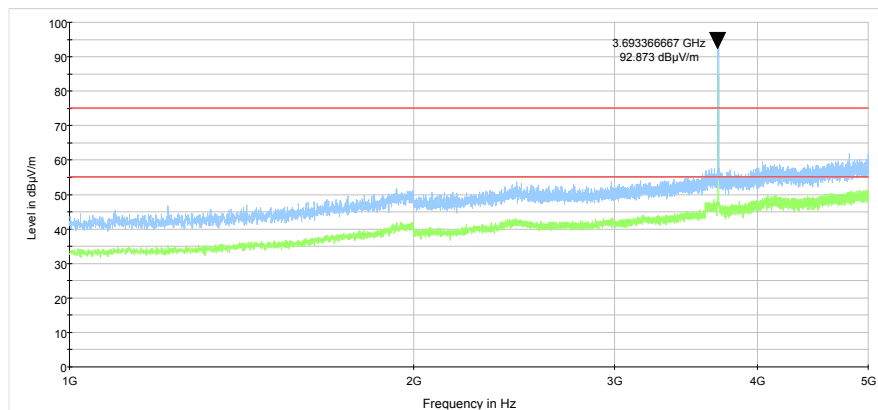
Plot 7.5.8 Radiated emission measurements in 1000 – 5000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Mid
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Plot 7.5.9 Radiated emission measurements in 1000 – 5000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: High
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



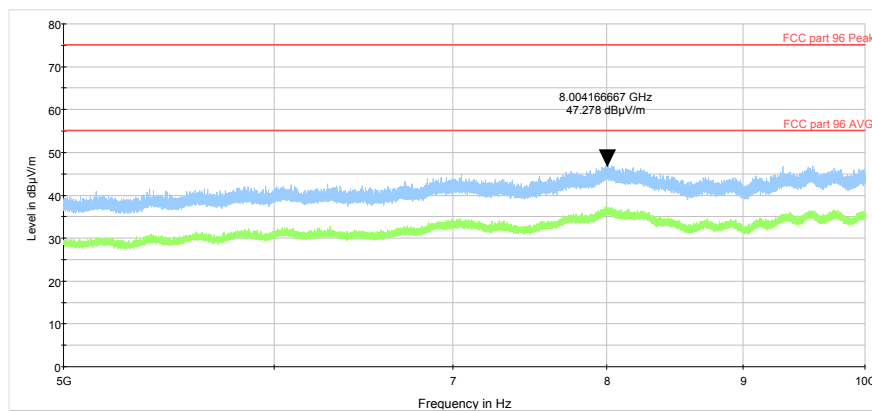


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Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

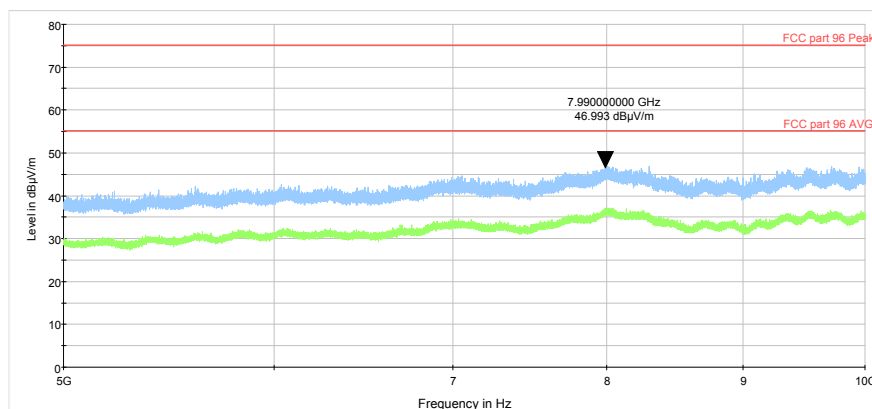
Plot 7.5.10 Radiated emission measurements in 5000 – 10000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Low
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Plot 7.5.11 Radiated emission measurements in 5000 – 10000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Mid
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m

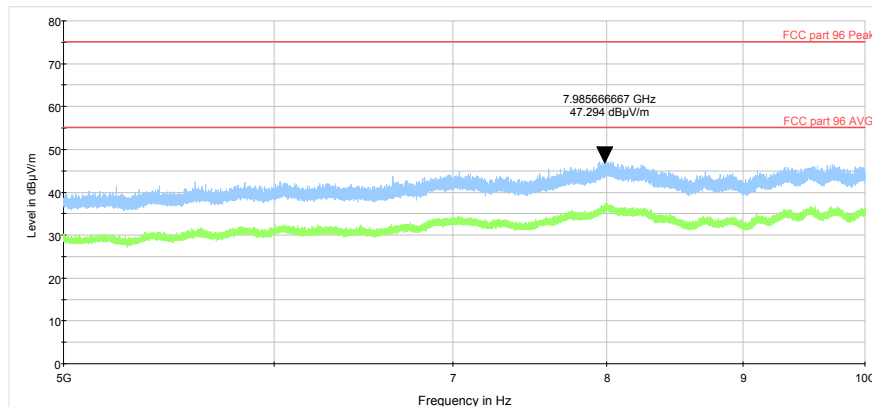




Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

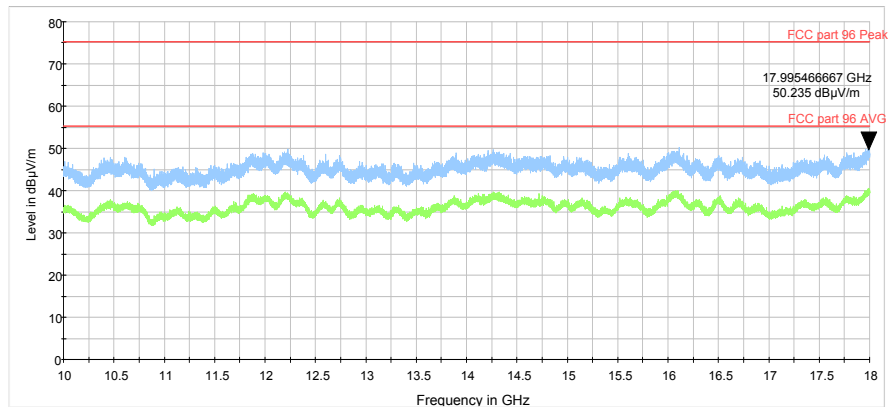
Plot 7.5.12 Radiated emission measurements in 5000 – 10000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: High
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Plot 7.5.13 Radiated emission measurements in 10000 – 18000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Low
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m

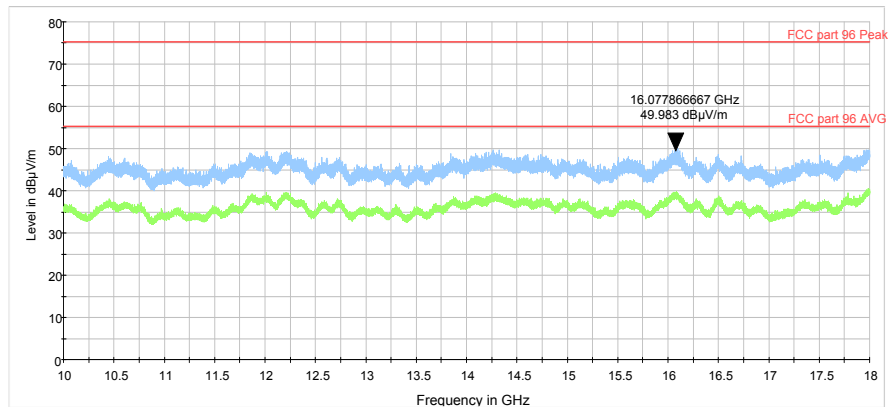




Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

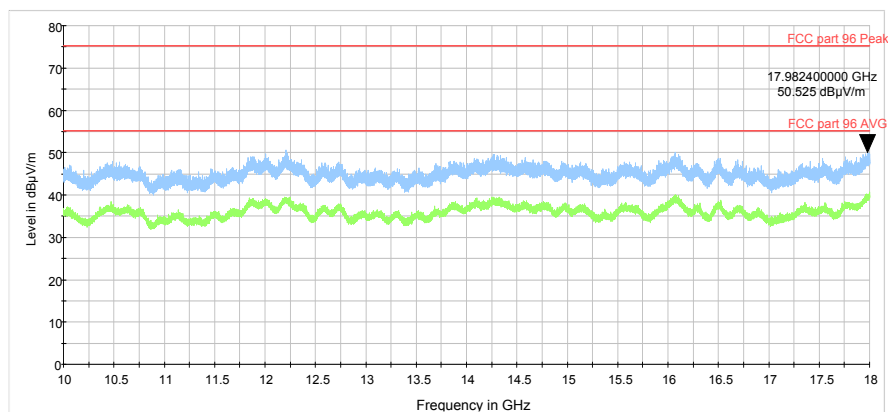
Plot 7.5.14 Radiated emission measurements in 10000 – 18000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Mid
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Plot 7.5.15 Radiated emission measurements in 10000 – 18000 MHz range

TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: High
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m

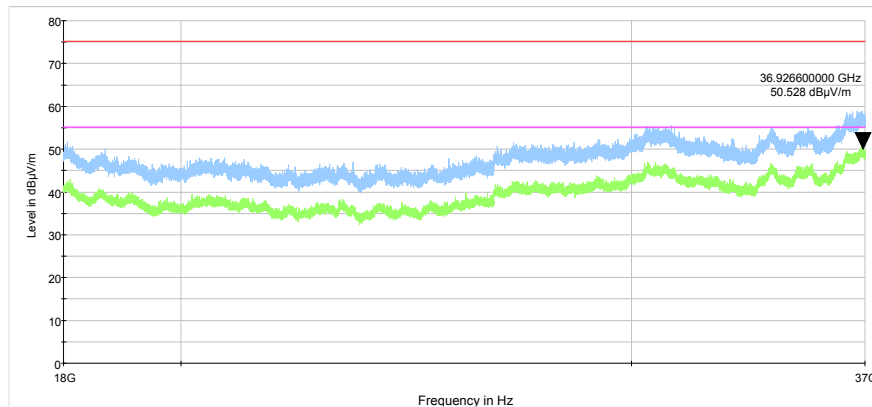




Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

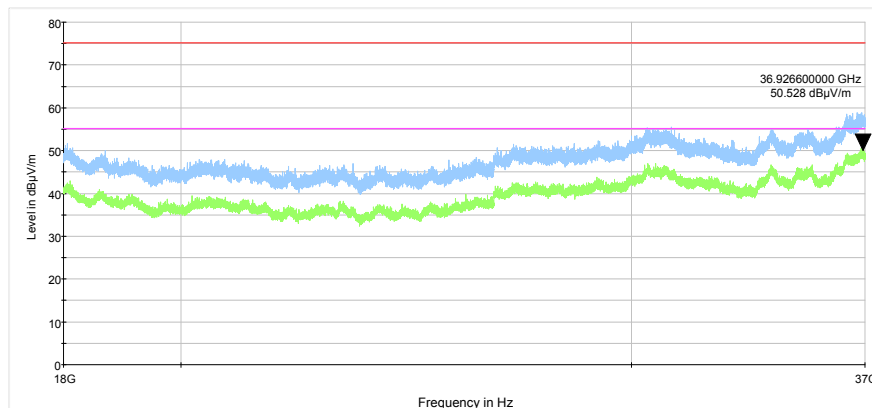
Plot 7.5.16 Radiated emission measurements in 18000 – 37000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.5.17 Radiated emission measurements in 18000 – 37000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m

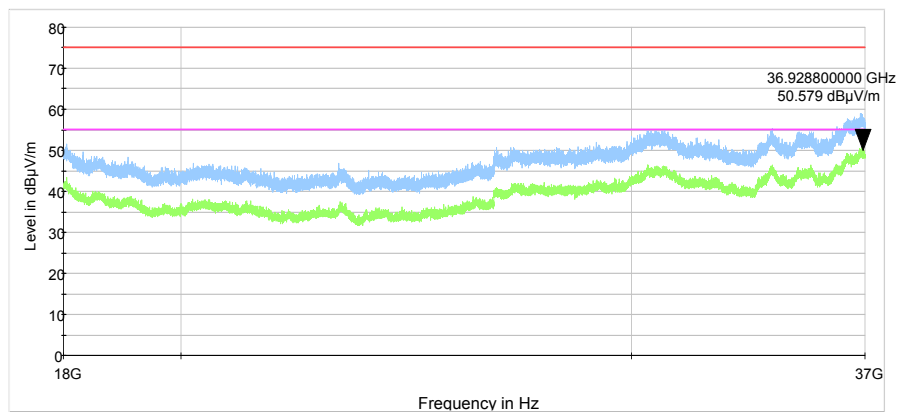




Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 26-Sep-18			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.5.18 Radiated emission measurements in 18000 – 37000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m





Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

7.6 Spurious emissions at RF antenna connector test

7.6.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Spurious emission limits

Frequency, MHz	Conducted power of spurious, dBm/MHz
0.10 – below 3530.0	-40.0
3720.0 – 10th harmonic*	-40.0

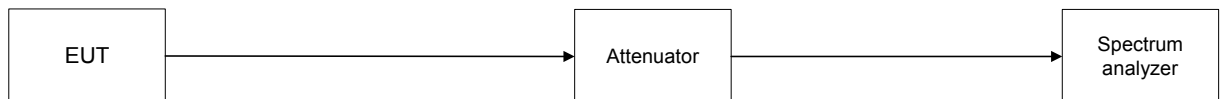
7.6.2 Test procedure

7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.

7.6.2.2 The EUT was adjusted to produce maximum available for end user RF output power.

7.6.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.6.2 and associated plots.

Figure 7.6.1 Spurious emission test setup





Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Table 7.6.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 3550 - 3700 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 37000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATION: QPSK
 MODULATING SIGNAL: PRBS
 CHANNEL SPACING: 10 MHz
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency 3555 MHz									
No emissions were found									Pass
Mid carrier frequency 3625 MHz									
No emissions were found									Pass
High carrier frequency 3695 MHz									
No emissions were found									Pass

*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

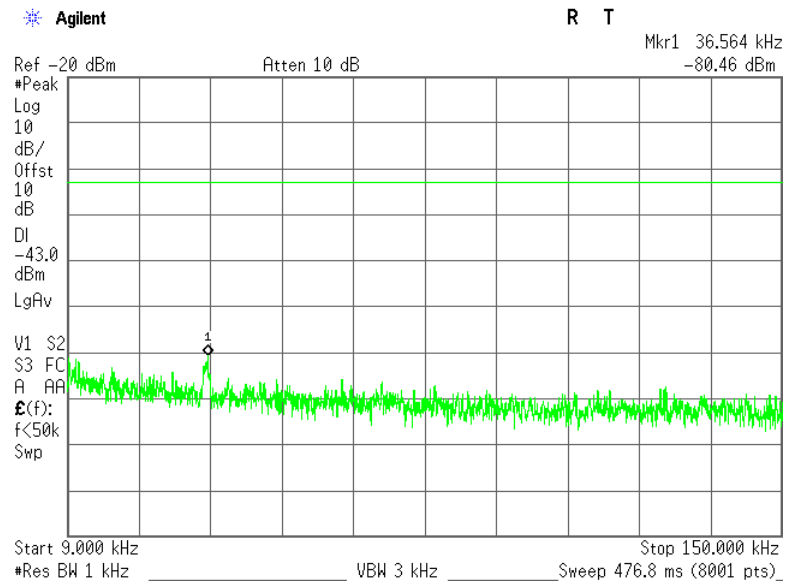
HL 3818	HL 3903	HL 4771	HL 3868	HL 3301	HL 3302
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Full description is given in Appendix A.

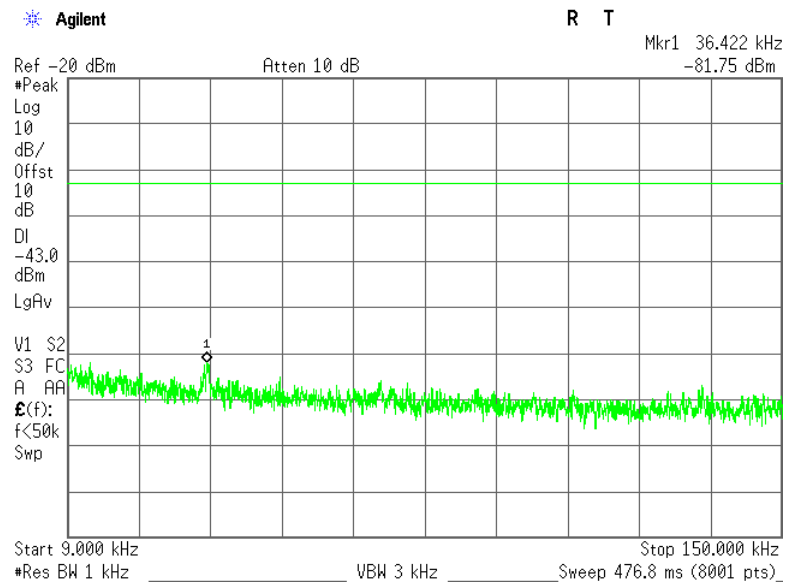


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.1 Spurious emission measurements in 9 - 150 kHz range at low carrier frequency



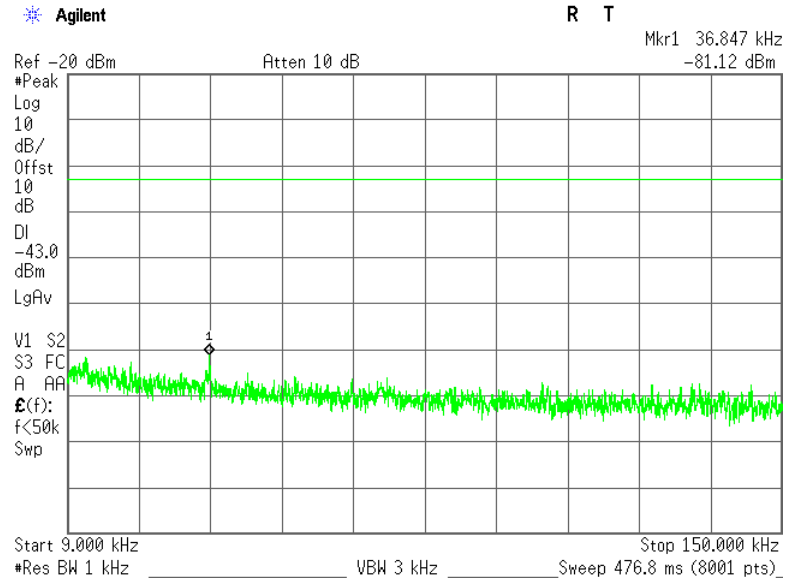
Plot 7.6.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency



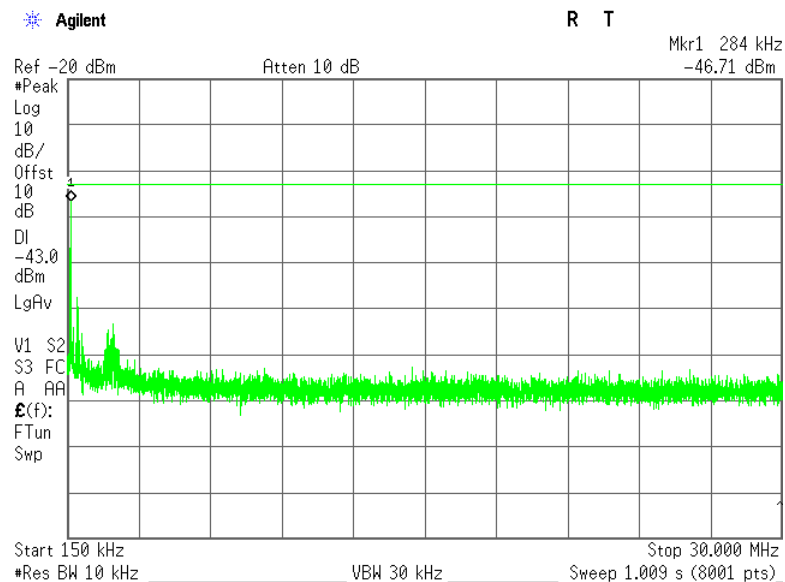


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.3 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency



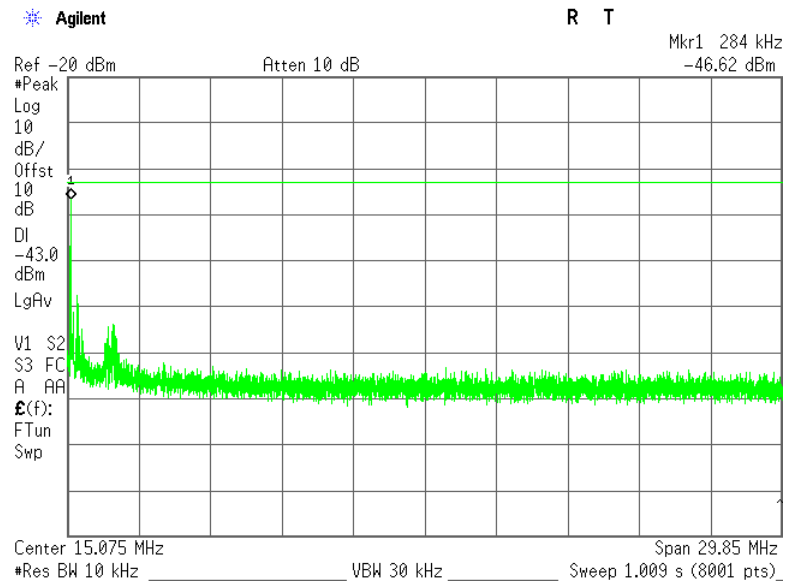
Plot 7.6.4 Spurious emission measurements in 0.15 - 30.0 MHz range at low carrier frequency



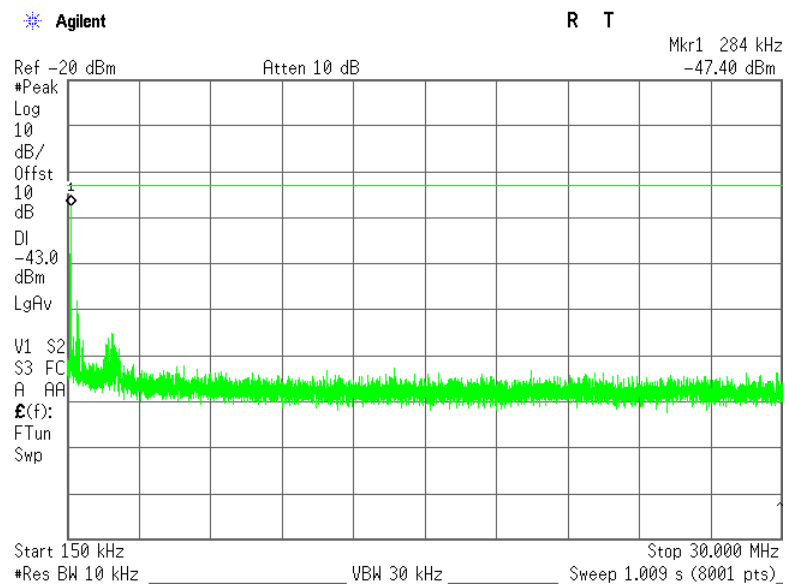


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.5 Spurious emission measurements in 0.15 - 30.0 MHz range at mid carrier frequency



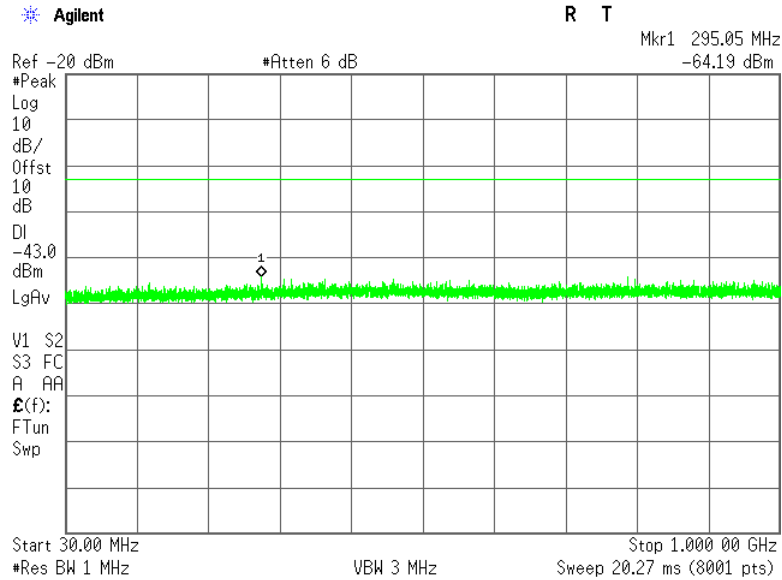
Plot 7.6.6 Spurious emission measurements in 0.15 – 30.0 MHz range at high carrier frequency



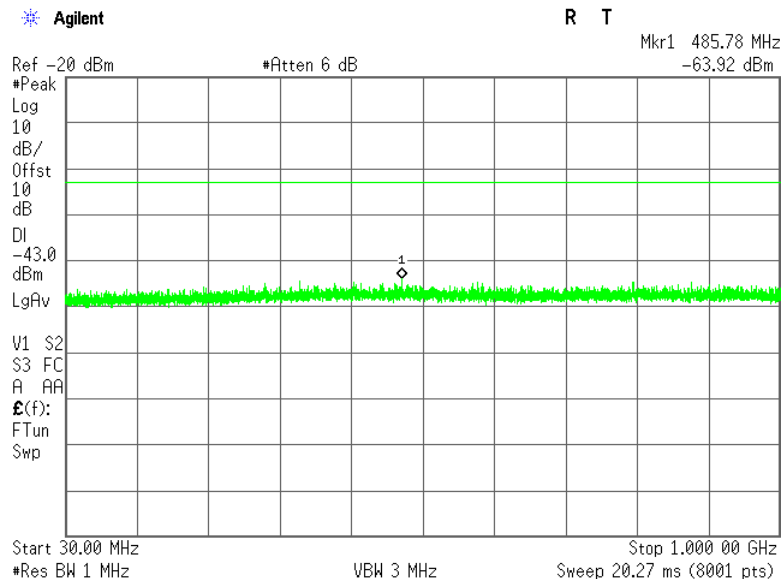


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.7 Spurious emission measurements in 30.0 - 1000 MHz range at low carrier frequency



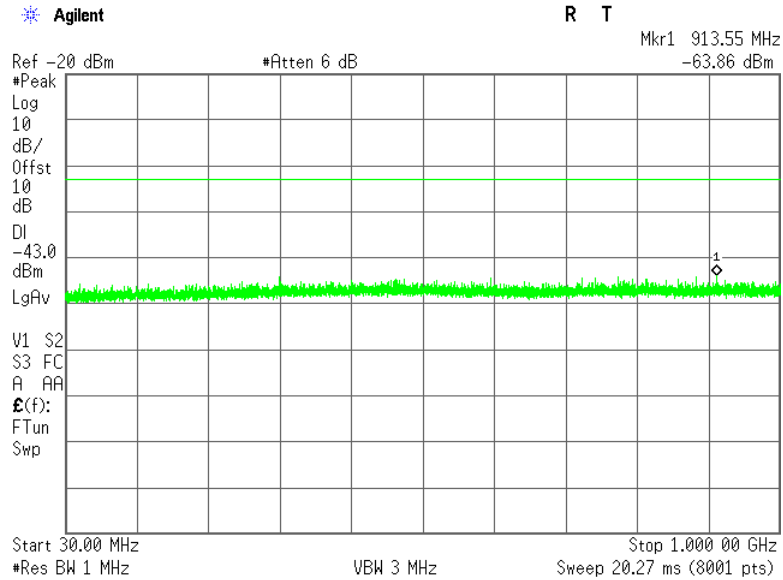
Plot 7.6.8 Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency



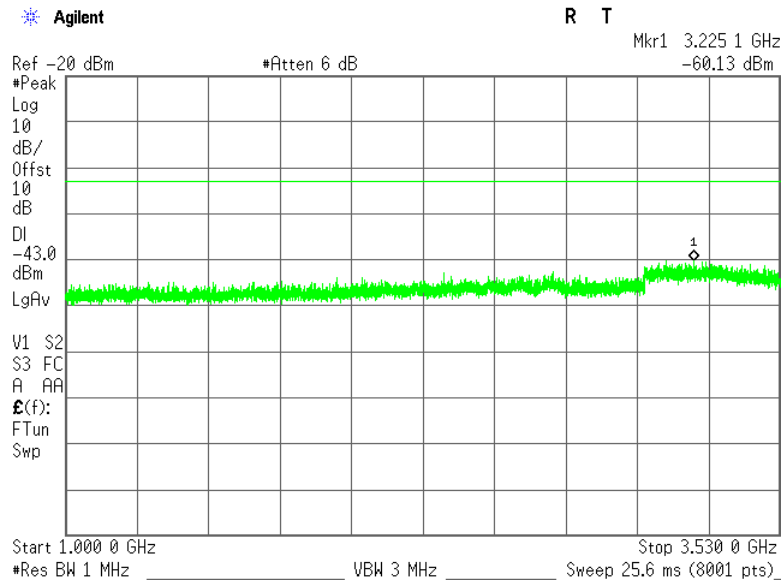


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.9 Spurious emission measurements in 30.0 - 1000 MHz range at high carrier frequency



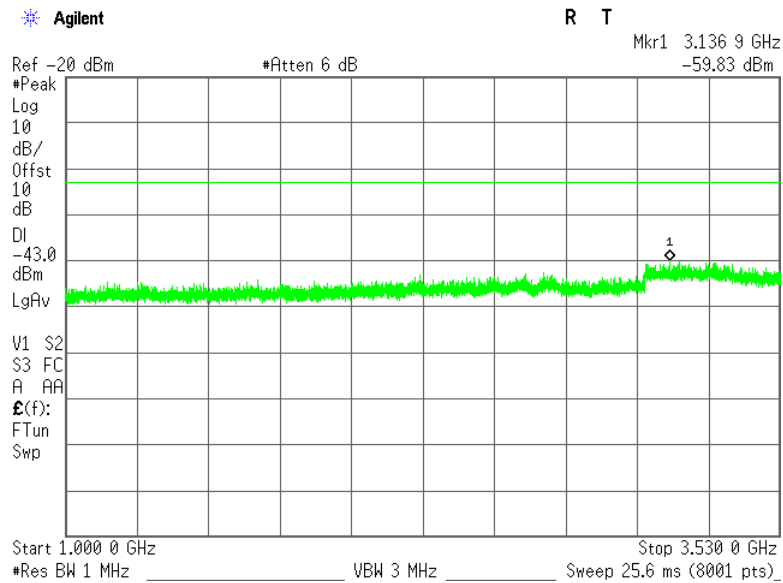
Plot 7.6.10 Spurious emission measurements in 1000 - 3530 MHz range at low carrier frequency



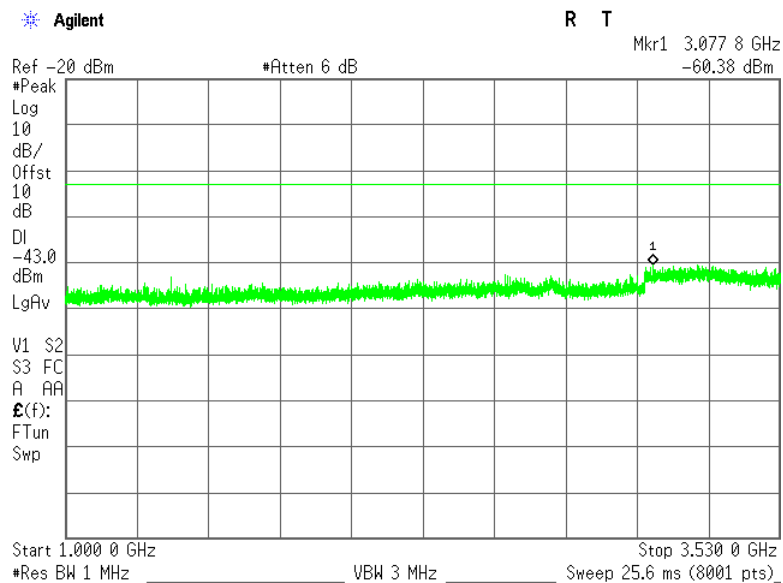


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.11 Spurious emission measurements in 1000 - 3530 MHz at mid carrier frequency



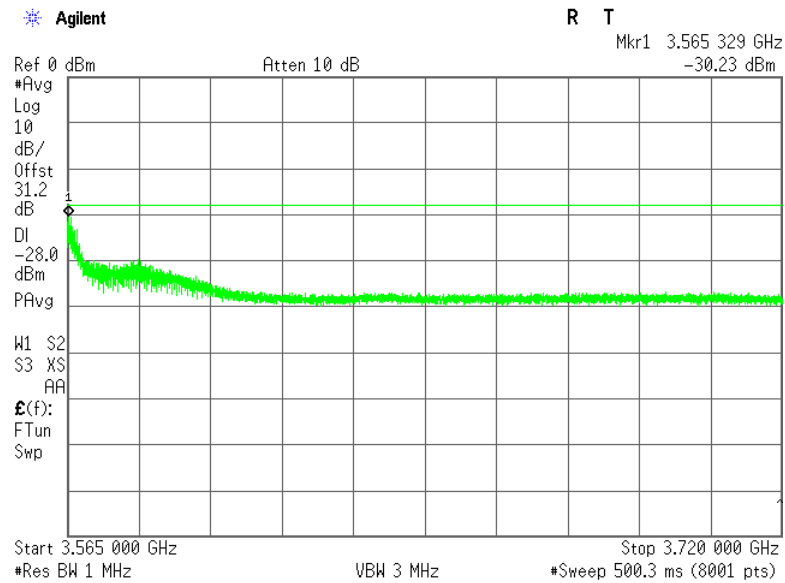
Plot 7.6.12 Spurious emission measurements in 1000 - 3530 MHz at high carrier frequency



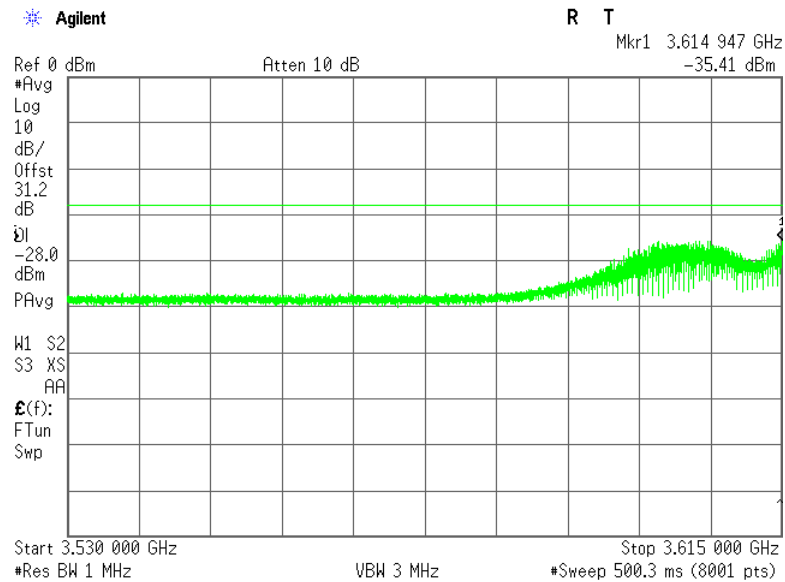


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.13 Spurious emission measurements in 3565 - 3720 MHz range at low carrier frequency



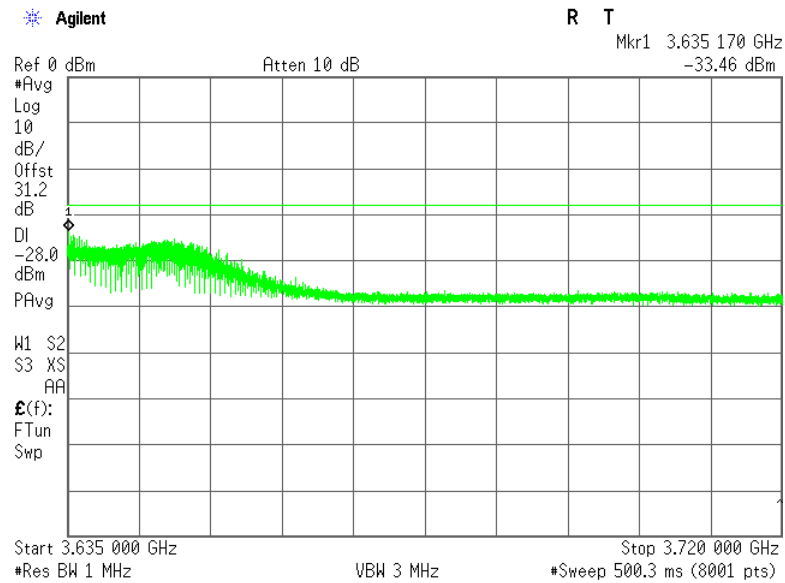
Plot 7.6.14 Spurious emission measurements in 3530 - 3615 MHz range at mid carrier frequency



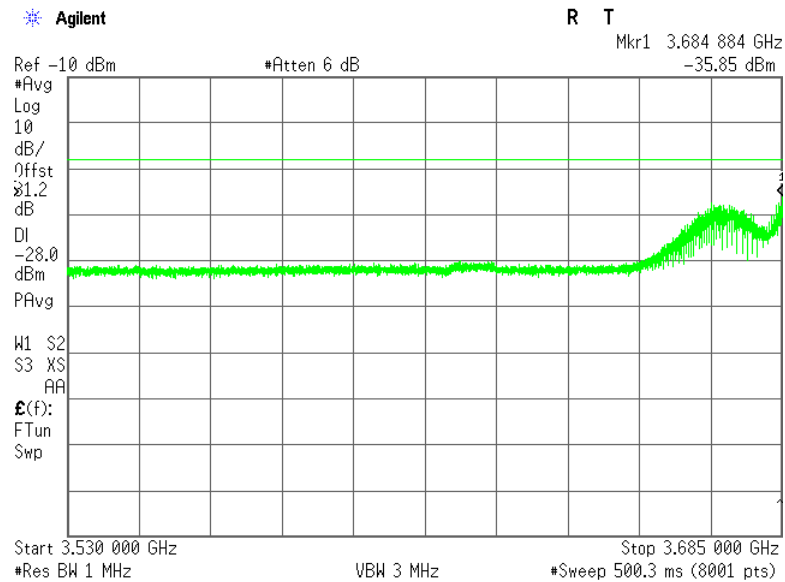


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.15 Spurious emission measurements in 3635 - 3700 MHz at mid carrier frequency



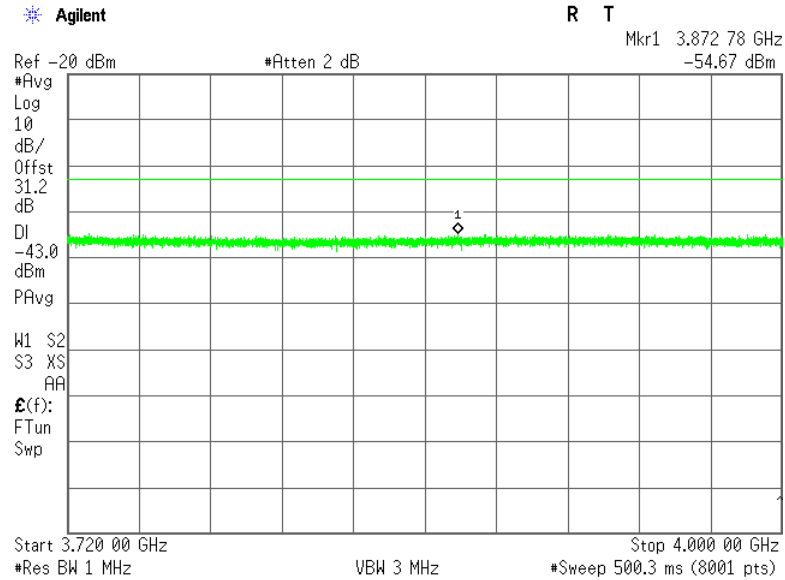
Plot 7.6.16 Spurious emission measurements in 3530 - 3685 MHz range at high carrier frequency



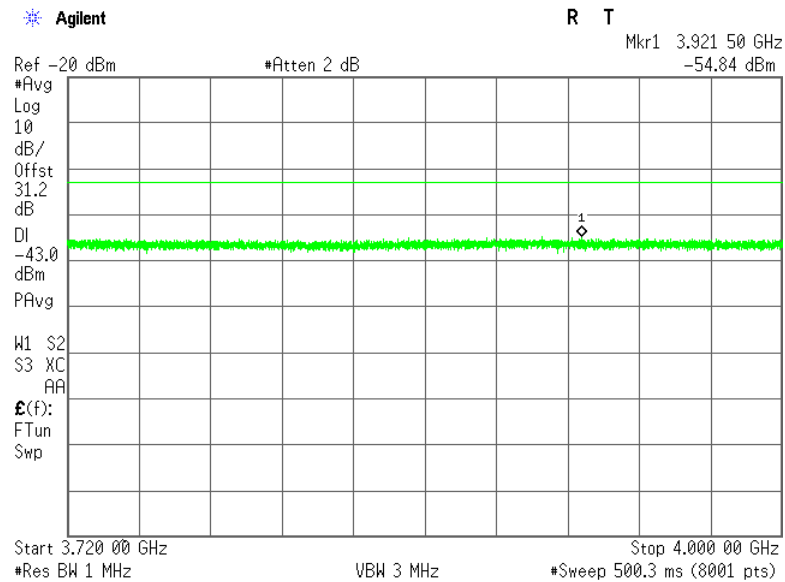


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.17 Spurious emission measurements in 3720 - 4000 MHz range at low carrier frequency



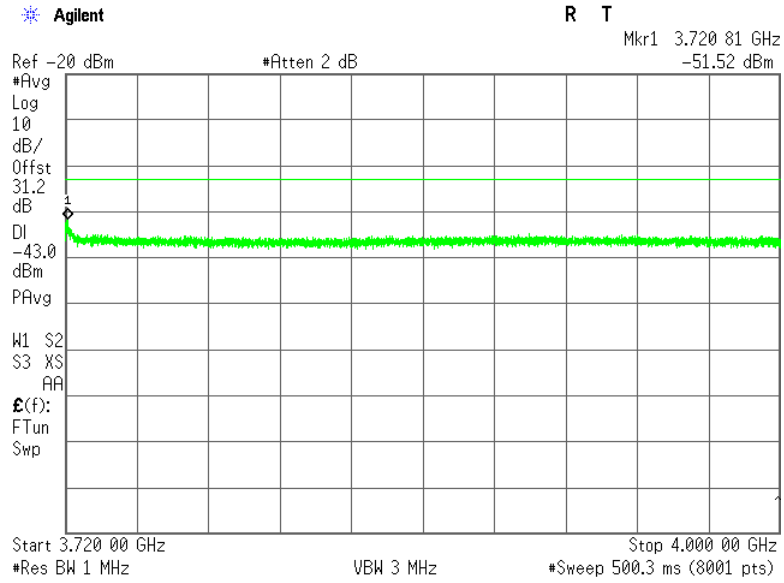
Plot 7.6.18 Spurious emission measurements in 3720 - 4000 MHz at mid carrier frequency





Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

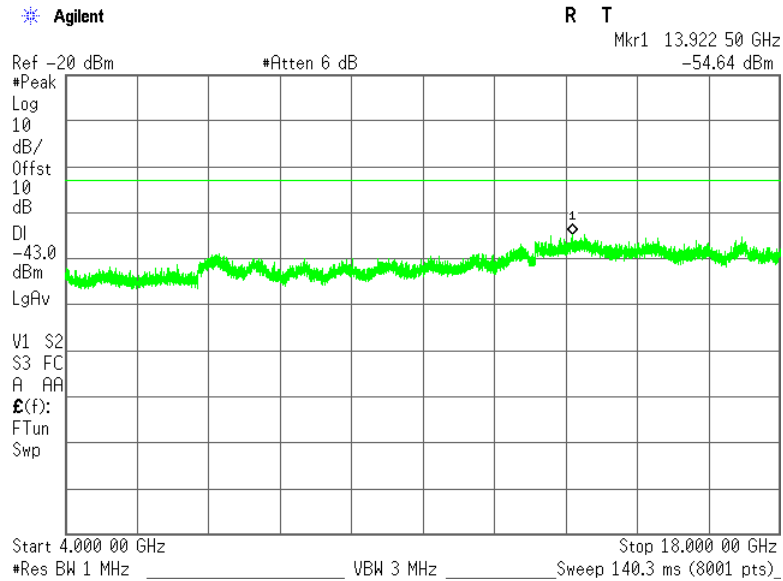
Plot 7.6.19 Spurious emission measurements in 3720 - 4000 MHz at high carrier frequency



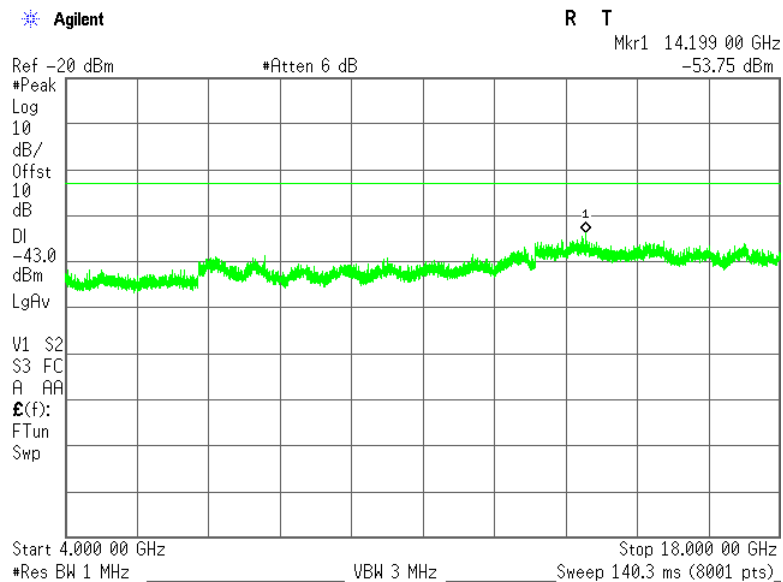


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.20 Spurious emission measurements in 4000 - 18000 MHz range at low carrier frequency



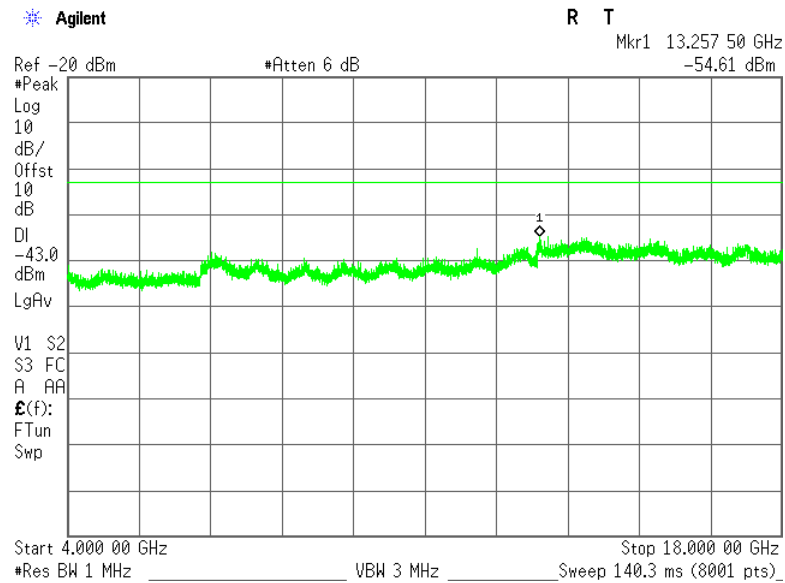
Plot 7.6.21 Spurious emission measurements in 4000 - 18000 MHz at mid carrier frequency



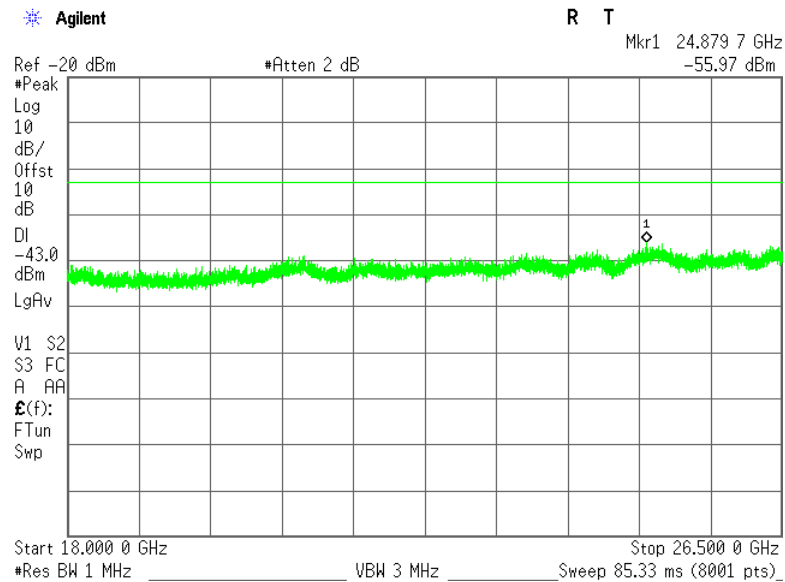


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.22 Spurious emission measurements in 4000 - 18000 MHz at high carrier frequency



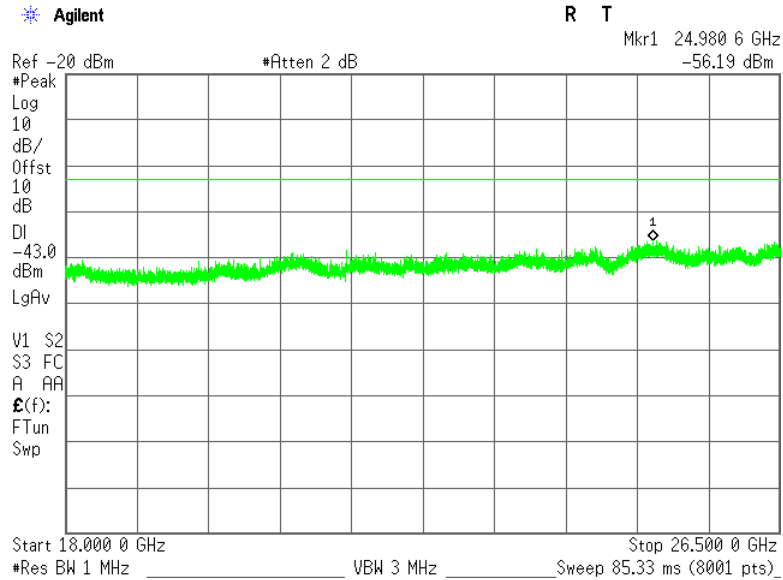
Plot 7.6.23 Spurious emission measurements in 18000 - 26500 MHz range at low carrier frequency



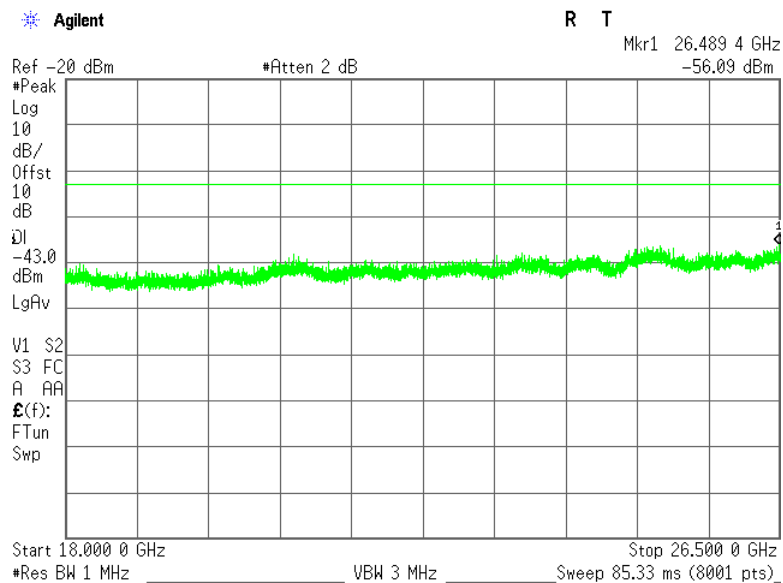


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.24 Spurious emission measurements in 18000 - 26500 MHz at mid carrier frequency



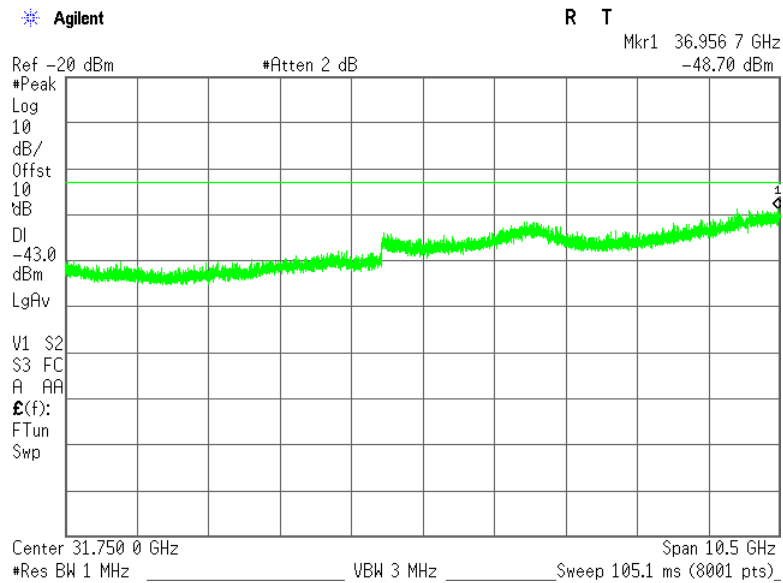
Plot 7.6.25 Spurious emission measurements in 18000 - 26500 MHz at high carrier frequency



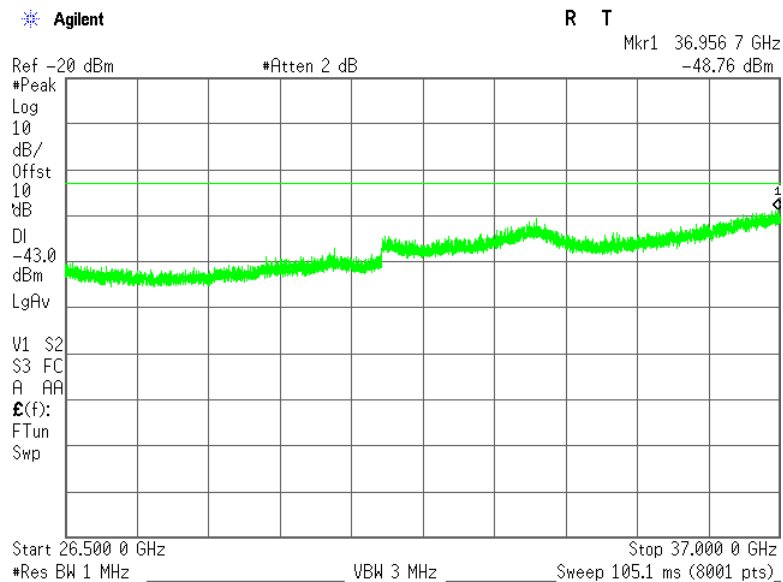


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.26 Spurious emission measurements in 26500 - 37000 MHz range at low carrier frequency



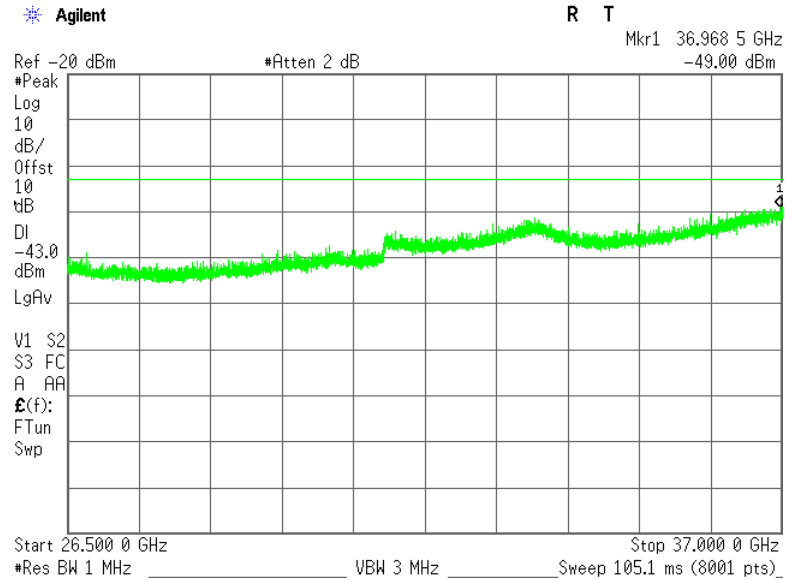
Plot 7.6.27 Spurious emission measurements in 26500 - 37000 MHz at mid carrier frequency





Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Oct-18 - 31-Oct-18			
Temperature: 24.1 °C	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.6.28 Spurious emission measurements in 26500 - 37000 MHz at high carrier frequency





Test specification: Section 2.1055, Frequency stability			
Test procedure: 47 CFR, Section 2.1055			
Test mode: Compliance		Verdict: PASS	
Date(s): 31-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

7.7 Frequency stability test

7.7.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.7.1.

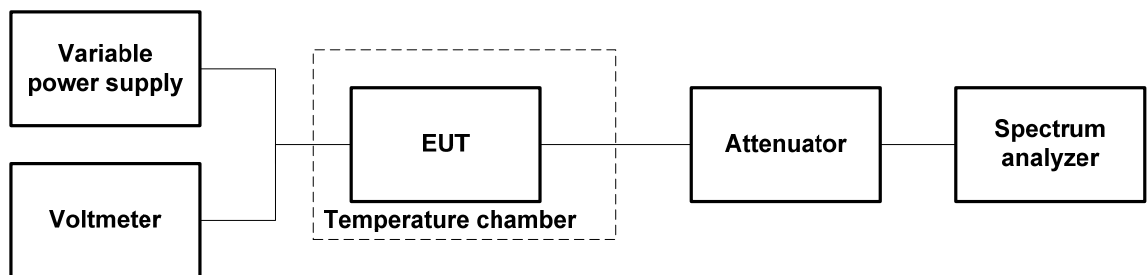
Table 7.7.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
3555.0		
3625.0		
3695.0		

7.7.2 Test procedure

- 7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized and its proper operation was checked.
- 7.7.2.2 The EUT power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.7.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.7.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.7.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.
- 7.7.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.7.2.

Figure 7.7.1 Frequency stability test setup





HERMON LABORATORIES

Test specification: Section 2.1055, Frequency stability			
Test procedure: 47 CFR, Section 2.1055			
Test mode: Compliance		Verdict: PASS	
Date(s): 31-Oct-18 - 01-Nov-18			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Table 7.7.2 Frequency stability test results

OPERATING FREQUENCY: 3550 – 3700 MHz
 NOMINAL POWER VOLTAGE: 56 VDC
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 1 kHz
 VIDEO BANDWIDTH: 3 kHz
 MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Verdict
		Start up	1 st min	2 nd min	3 rd min	4 th min	5 th min	10 th min	Positive	Negative	
Low frequency 3555.0 MHz											
-30	nominal	3555.000001	3554.999992	3554.999997	3554.999982	3554.999988	3554.999986	3554.999989	8	-11	Comply
-20	nominal	3554.999992	NA	NA	NA	NA	NA	3554.999997	4	-1	Comply
-10	nominal	3554.999997	NA	NA	NA	NA	NA	3554.999983	4	-10	Comply
0	nominal	3554.999984	3554.999991	3554.999995	3555.000001	3554.999997	3554.999976	3554.999991	8	-17	Comply
10	nominal	3554.999997	NA	NA	NA	NA	NA	3554.999994	4	0	Comply
20	+15%	3554.999989	NA	NA	NA	NA	NA	3554.999991	0	-4	Comply
20	nominal	3554.999995	NA	NA	NA	NA	NA	3554.999993	2	0	Comply
20	-15%	3554.999993	NA	NA	NA	NA	NA	3554.999994	1	0	Comply
30	nominal	3554.999985	3554.999986	3554.999999	3555.000001	3554.999987	3554.999985	3554.999984	8	-9	Comply
40	nominal	3554.999988	NA	NA	NA	NA	NA	3554.999995	2	-5	Comply
50	nominal	3554.999984	NA	NA	NA	NA	NA	3554.999992	0	-9	Comply
Mid frequency 3625.0 MHz											
-30	nominal	3624.999982	3625.000002	3624.999986	3624.999983	3624.999986	3624.999994	3624.999986	13	-7	Comply
-20	nominal	3624.999992	NA	NA	NA	NA	NA	3625.000021	32	0	Comply
-10	nominal	3624.999993	NA	NA	NA	NA	NA	3625.000001	12	0	Comply
0	nominal	3624.999993	3624.999998	3624.999997	3624.999991	3624.999988	3625.000005	3624.999994	16	-1	Comply
10	nominal	3624.999993	NA	NA	NA	NA	NA	3624.999989	4	0	Comply
20	+15%	3624.999999	NA	NA	NA	NA	NA	3624.999992	10	0	Comply
20	nominal	3624.999997	NA	NA	NA	NA	NA	3624.999989	8	0	Comply
20	-15%	3624.999994	NA	NA	NA	NA	NA	3624.999993	5	0	Comply
30	nominal	3624.999983	3625.000005	3625.000003	3624.999992	3625.000005	3624.999985	3624.999984	16	-6	Comply
40	nominal	3624.999993	NA	NA	NA	NA	NA	3624.999996	7	0	Comply
50	nominal	3624.999988	NA	NA	NA	NA	NA	3624.999989	0	-1	Comply
High frequency 3695.0 MHz											
-30	nominal	3694.999994	3695.000002	3694.999987	3695.000008	3694.999999	3694.999997	3694.999991	17	-4	Comply
-20	nominal	3695.000012	NA	NA	NA	NA	NA	3695.000022	31	0	Comply
-10	nominal	3695.000002	NA	NA	NA	NA	NA	3694.999997	11	0	Comply
0	nominal	3695.000001	3694.999983	3695.000003	3695.000006	3695.000007	3695.000006	3694.999988	16	-8	Comply
10	nominal	3694.999984	NA	NA	NA	NA	NA	3694.999995	4	-7	Comply
20	+15%	3694.999995	NA	NA	NA	NA	NA	3694.999988	4	-3	Comply
20	nominal	3694.999996	NA	NA	NA	NA	NA	3694.999991	5	0	Comply
20	-15%	3695.000004	NA	NA	NA	NA	NA	3694.999989	13	-2	Comply
30	nominal	3695.000006	3695.000007	3695.000007	3695.000004	3694.999989	3695.000008	3695.000006	17	-2	Comply
40	nominal	3695.000001	NA	NA	NA	NA	NA	3695.000002	11	0	Comply
50	nominal	3694.999996	NA	NA	NA	NA	NA	3694.999995	5	0	Comply

* - Reference frequency

Reference numbers of test equipment used

HL 0493	HL 2171	HL 3901	HL 4164	HL 4355		
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Full description is given in Appendix A.



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0030	Antenna, Dipole, Tunable, 30 - 200 MHz	Electro-Metrics	TDA-25/30	261	08-Feb-18	08-Feb-19
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	11-Feb-18	11-Feb-19
0493	Temperature Chamber -45...175 deg C	Thermotron	S-1.2 Mini-Max	14016	11-Jun-18	11-Jun-19
0614	Antenna, Dipole, Tunable, 200 - 500 MHz	Electro-Metrics	TDS-30-1	334	08-Feb-18	08-Feb-19
0661	Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm	Hewlett Packard	83640B	3614A00266	11-Jul-18	11-Jul-19
2171	Multimeter	Fluke	177	79960418	19-Jul-17	19-Jul-19
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY45101057	02-May-18	02-May-19
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY45240586	02-May-18	02-May-19
3787	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	10-Dec-18	10-Dec-19
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	28-May-18	28-May-19
3868	Directional coupler, 2 GHz to 8 GHz, 10 dB, SMA Female	Narda	4203-10	06978	21-May-18	21-May-20
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1225/2A	07-Feb-18	07-Feb-19
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1226/2A	07-Feb-18	07-Feb-19
4164	DC Power Supply, 60V, 5A	Standig	605D	NA	05-Nov-18	05-Nov-19
4278	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0755A	01-Aug-18	01-Aug-19
4355	Signal and Spectrum Analyzer, 9 kHz to 7 GHz	Rohde & Schwarz	FSV 7	101630	28-Jun-18	28-Sep-19
4360	EMI Test Receiver, 20 Hz to 40 GHz.	Rohde & Schwarz	ESU40	100322	26-Dec-17	26-Dec-18
4771	Tape-measure, 5m/16FT	FISCO	Tri-Matic	NA	03-Oct-18	03-Oct-19
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	04-Jan-18	04-Jan-19
4956	Active horn antenna, 18 to 40 GHz	Com-Power Corporation	AHA-840	105004	11-Jan-18	11-Jan-19
5111	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/11SK/11S K/5500M M	502493/2E A	09-Apr-18	09-Apr-19
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	21-Jan-18	21-Jan-19
5405	RF cable, 18 GHz, N-N, 6 m	Huber-Suhner	SF118/11 N(x2)	500023/118	01-Aug-18	01-Aug-19



9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±8%
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency error	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)
Transient frequency behaviour	187 Hz ± 13.9 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Unintentional radiator tests	
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB
Vertical polarization	Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.



10 APPENDIX C Test facility description

T Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for 1, 2, 15, 18 parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; registered by Industry Canada for electromagnetic emissions, file number IC 2186A-1 for OATS, certified by VCCI, Japan (the registration numbers are R-10808 for OATS, R-1082 for anechoic chamber, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 for conducted emissions at telecommunication ports).

The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

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11 APPENDIX D Specification references

FCC 47CFR part 96: 2017	Citizens Broadband Radio Service
FCC 47CFR part 1: 2017	Practice and procedure
FCC 47CFR part 2: 2017	Frequency allocations and radio treaty matters; general rules and regulations
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.



12 APPENDIX E Test equipment correction factors

Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446

Frequency, MHz	Magnetic antenna factor, dB	Electric antenna factor, dB
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.8
0.750	-41.9	9.7
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.2
4.000	-41.4	10.1
5.000	-41.5	10.1
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).



Antenna factor
Trilog antenna
Model ALX-8000E, Frankonia, S/N 00809, HL 5288, 30-1000 MHz

Frequency, MHz	Antenna factor, dB/m
30	14.96
35	15.33
40	16.37
45	17.56
50	17.95
60	16.87
70	13.22
80	10.56
90	13.61
100	15.46
120	14.03
140	12.23
160	12.67
180	13.34
200	15.40
250	16.42
300	17.28
400	19.98
500	21.11
600	22.90
700	24.13
800	25.25
900	26.35
1000	27.18

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.



Antenna factor
Active Horn Antenna,
Com-Power Corporation, model: AHA-118, s/n 701046, HL 4933

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
1000	-16.1
1500	-15.1
2000	-10.9
2500	-11.9
3000	-11.1
3500	-10.6
4000	-8.6
4500	-8.3
5000	-5.9
5500	-5.7
6000	-3.3
6500	-4.0
7000	-2.2
7500	-1.7
8000	1.1
8500	-0.8
9000	-1.5
9500	-0.2

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
10000	1.8
10500	1.0
11000	0.3
11500	-0.5
12000	3.1
12500	1.4
13000	-0.3
13500	-0.4
14000	2.5
14500	2.2
15000	1.9
15500	0.5
16000	2.1
16500	1.2
17000	0.6
17500	3.1
18000	4.2

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.



Antenna factor
Active Horn Antenna,
Com-Power Corporation, model: AHA-840, s/n 105004, HL 4956

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
18000	2.5
18500	0.5
19000	-1.0
19500	-2.4
20000	-2.5
20500	-2.2
21000	-2.0
21500	-2.7
22000	-3.7
22500	-3.8
23000	-3.7
23500	-5.0
24000	-4.5
24500	-5.0
25000	-4.7
25500	-4.4
26000	-4.3
26500	-5.6
27000	-4.3
27500	-4.9
28000	-5.2
28500	-4.4

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
29000	-2.7
29500	-2.6
30000	-1.4
30500	-1.5
31000	-1.0
31500	-2.6
32000	-3.3
32500	-3.3
33000	-5.1
33500	-5.2
34000	-1.5
34500	-5.4
35000	-3.3
35500	-4.2
36000	-2.8
36500	-2.6
37000	-1.0
38000	1.8
38500	2.8
39000	1.3
39500	1.3
40000	0.3

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.



Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 3.5 m, SMA-SMA, S/N 1225/2A
HL 3901

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.09	9500	4.29	21000	6.67
100	0.41	10000	4.40	22000	6.92
500	0.93	10500	4.52	23000	7.00
1000	1.33	11000	4.64	24000	7.18
1500	1.63	11500	4.76	25000	7.29
2000	1.90	12000	4.87	26000	7.55
2500	2.12	12500	4.99	27000	7.70
3000	2.33	13000	5.11	28000	7.88
3500	2.50	13500	5.20	29000	8.02
4000	2.67	14000	5.31	30000	8.15
4500	2.82	14500	5.42	31000	8.35
5000	2.99	15000	5.51	32000	8.40
5500	3.16	15500	5.58	33000	8.62
6000	3.32	16000	5.68	34000	8.73
6500	3.51	16500	5.78	35000	8.78
7000	3.65	17000	5.91	36000	8.94
7500	3.79	17500	5.99	37000	9.21
8000	3.92	18000	6.07	38000	9.37
8500	4.04	19000	6.36	39000	9.45
9000	4.18	20000	6.49	40000	9.52



Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 1.5 m, SMA-SMA, S/N 1226/2A
HL 3903

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	-0.02	9500	1.84	21000	2.98
100	0.15	10000	1.86	22000	3.07
500	0.38	10500	1.93	23000	3.13
1000	0.56	11000	1.99	24000	3.21
1500	0.69	11500	2.04	25000	3.26
2000	0.82	12000	2.10	26000	3.48
2500	0.90	12500	2.15	27000	3.44
3000	0.98	13000	2.21	28000	3.53
3500	1.06	13500	2.25	29000	3.59
4000	1.11	14000	2.29	30000	3.66
4500	1.17	14500	2.34	31000	3.70
5000	1.24	15000	2.36	32000	3.79
5500	1.32	15500	2.40	33000	3.88
6000	1.40	16000	2.45	34000	3.94
6500	1.50	16500	2.48	35000	3.91
7000	1.56	17000	2.56	36000	4.05
7500	1.62	17500	2.58	37000	4.22
8000	1.68	18000	2.60	38000	4.25
8500	1.74	19000	2.84	39000	4.27
9000	1.78	20000	2.88	40000	4.33



Cable loss
Test cable, Mini-Circuits, S/N 0755A, 18 GHz, 4.6 m, N/M - N/M
APC-15FT-NMNM+, HL 4278

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.24	4900	4.19	10000	6.47	15100	8.33
30	0.26	5000	4.25	10100	6.50	15200	8.35
50	0.34	5100	4.29	10200	6.52	15300	8.37
100	0.50	5200	4.32	10300	6.57	15400	8.40
200	0.72	5300	4.38	10400	6.59	15500	8.42
300	0.90	5400	4.41	10500	6.61	15600	8.46
400	1.06	5500	4.46	10600	6.64	15700	8.50
500	1.20	5600	4.51	10700	6.64	15800	8.52
600	1.32	5700	4.56	10800	6.65	15900	8.56
700	1.44	5800	4.59	10900	6.68	16000	8.61
800	1.54	5900	4.64	11000	6.68	16100	8.64
900	1.64	6000	4.69	11100	6.69	16200	8.66
1000	1.74	6100	4.72	11200	6.70	16300	8.70
1100	1.83	6200	4.77	11300	6.74	16400	8.73
1200	1.92	6300	4.80	11400	6.78	16500	8.74
1300	2.01	6400	4.83	11500	6.81	16600	8.75
1400	2.09	6500	4.89	11600	6.84	16700	8.78
1500	2.18	6600	4.90	11700	6.87	16800	8.79
1600	2.25	6700	4.95	11800	6.92	16900	8.81
1700	2.33	6800	5.01	11900	6.98	17000	8.85
1800	2.39	6900	4.99	12000	7.02	17100	8.90
1900	2.47	7000	5.04	12100	7.08	17200	8.95
2000	2.53	7100	5.11	12200	7.15	17300	8.99
2100	2.60	7200	5.14	12300	7.20	17400	9.03
2200	2.67	7300	5.21	12400	7.26	17500	9.07
2300	2.73	7400	5.29	12500	7.31	17600	9.11
2400	2.80	7500	5.33	12600	7.36	17700	9.15
2500	2.87	7600	5.38	12700	7.41	17800	9.19
2600	2.93	7700	5.46	12800	7.46	17900	9.24
2700	3.00	7800	5.52	12900	7.51	18000	9.28
2800	3.06	7900	5.58	13000	7.55		
2900	3.12	8000	5.64	13100	7.59		
3000	3.18	8100	5.69	13200	7.65		
3100	3.24	8200	5.75	13300	7.69		
3200	3.30	8300	5.80	13400	7.72		
3300	3.35	8400	5.84	13500	7.78		
3400	3.42	8500	5.90	13600	7.82		
3500	3.46	8600	5.97	13700	7.86		
3600	3.52	8700	5.99	13800	7.91		
3700	3.57	8800	6.04	13900	7.96		
3800	3.61	8900	6.10	14000	8.01		
3900	3.67	9000	6.13	14100	8.06		
4000	3.71	9100	6.17	14200	8.10		
4100	3.77	9200	6.23	14300	8.13		
4200	3.83	9300	6.27	14400	8.16		
4300	3.89	9400	6.30	14500	8.19		
4400	3.94	9500	6.35	14600	8.21		
4500	4.00	9600	6.37	14700	8.23		
4600	4.05	9700	6.40	14800	8.26		
4700	4.10	9800	6.44	14900	8.28		
4800	4.16	9900	6.45	15000	8.30		



Cable loss
RF Cable, Huber-Suhner, 40 GHz, 5.5 m, K type,
SF102EA/11SK/11SK/5500MM, S/N 502493/2EA
HL 5111

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
100	0.68	20500	10.17
200	0.97	21000	10.30
300	1.18	21500	10.43
500	1.52	22000	10.58
1000	2.14	22500	10.73
1500	2.62	23000	10.85
2000	3.03	23500	10.98
2500	3.39	24000	11.11
3000	3.72	24500	11.20
3500	4.03	25000	11.32
4000	4.32	25500	11.47
4500	4.59	26000	11.59
5000	4.84	26500	11.72
5500	5.09	27000	11.83
6000	5.32	27500	11.94
6500	5.55	28000	12.04
7000	5.77	28500	12.16
7500	5.99	29000	12.28
8000	6.19	29500	12.40
8500	6.40	30000	12.50
9000	6.60	30500	12.59
9500	6.79	31000	12.68
10000	6.98	31500	12.80
10500	7.16	32000	12.94
11000	7.34	32500	13.09
11500	7.51	33000	13.23
12000	7.68	33500	13.32
12500	7.84	34000	13.44
13000	8.00	34500	13.54
13500	8.15	35000	13.68
14000	8.31	35500	13.81
14500	8.46	36000	13.90
15000	8.62	36500	13.99
15500	8.76	37000	14.12
16000	8.91	37500	14.22
16500	9.06	38000	14.33
17000	9.21	38500	14.47
17500	9.35	39000	14.54
18000	9.49	39500	14.62
18500	9.62	40000	14.75
19000	9.76		
19500	9.90		
20000	10.05		



HERMON LABORATORIES

Cable loss
RF Cable, Huber-Suhner, 18 GHz, 6 m,
SF118/11N(x2), S/N 500023/118
HL 5405

5405

Specific Test Report



Frequency Range [GHz]	IL min S21 [dB]	IL min S12 [dB]	RL max S11 [dB]	RL max S22 [dB]
0.040 - 1.836	-1.431	-1.431	-37.037	-37.704
1.836 - 3.632	-2.062	-2.066	-33.573	-32.848
3.632 - 5.428	-2.576	-2.576	-28.548	-29.602
5.428 - 7.224	-3.013	-3.014	-30.738	-32.523
7.224 - 9.020	-3.415	-3.416	-33.728	-32.257
9.020 - 10.816	-3.772	-3.772	-29.302	-30.735
10.816 - 12.612	-4.138	-4.138	-28.768	-26.255
12.612 - 14.408	-4.456	-4.462	-27.109	-26.151
14.408 - 16.204	-4.786	-4.786	-26.056	-27.116
16.204 - 18.000	-5.113	-5.111	-27.762	-28.508

Type: SF118/11N/11N/6000MM
Sales no.: 10497130
Serial no.: 500023 /118
PA no.: 1956306
Ring no.:
Cable length: 6 m
Test length:
Connector 1: SF_11_N-656
Connector 2: SF_11_N-656
Cable: SUCOFLEX_118
Meas. System: N5230C,MY49001834,A.09.42.22
Time: 7:04:21 AM
Date: 6/6/2018
Inspected by: AZ /111
Start Freq.: 0.04000 GHz
Stop Freq.: 18.00000 GHz
Meas Points: 801
Source Power: -5 dBm



13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ A)	decibel referred to one microampere
dB Ω	decibel referred to one Ohm
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
ITE	information technology equipment
k	kilo
kHz	kilohertz
LISN	line impedance stabilization network
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere

END OF DOCUMENT