

TEST REPORT

ACCORDING TO: FCC 47CFR part 27

FOR:

Airspan Networks Inc.
Base station module
Model: AirUnity 540 eNB B41
FCC ID:PIDAU540ENB25

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

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Contact name: Mr. Zion Levi

2 Equipment under test attributes

Product name: LTE Base station module
Product type: Transceiver
Model(s): AirUnity 540 eNB B41
Serial number: B4EA06CD0428
Hardware version: A
Software release: 6.4.0.3
Receipt date 05-Jun-16

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: 28457
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 05-Jun-16
Test completed: 09-Jun-16
Test specification(s): FCC 47CFR part 27

5 Tests summary

Test	Status
Transmitter characteristics	
Section 27.50(h)(2), Peak output power at RF antenna connector	Pass
Section 2.1049, Occupied bandwidth	Pass
Section 27.53(m)(4), Band edge emissions at RF antenna connector	Pass
Section 27.53(m)(4), Spurious emissions at RF antenna connector	Pass
Section 27.53(m)(4), Radiated spurious emissions	Pass
Section 27.54, Frequency stability	Pass
Section 2.1091, 27.52, RF safety	Pass, exhibit provided in Application for certification

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.

	Name and Title	Date	Signature
Tested by:	Mr. K. Zushchuk, test engineer Mr. S. Samokha, test engineer	June 9, 2016	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	July 7, 2016	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	July 17, 2016	

6 EUT description

6.1 General information

The EUT, Mobile Digital station module, AirUnity 2.5GHz (B41), 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 AirUnity's transceiver/receiver (Up to 64 QAM modulation, data rate up to 95 Mbps) equipped with a 9dBi External antenna. The maximum total RF output power (not including antenna gain) is 23.9 dBm for 9 dBi and it can be reduced by software.

The AirUnity is installed indoors. 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.

6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	DC Power	EUT	Power supply	1	Unshielded	3
Telecom	Ethernet1	EUT	Laptop	1	FTP	10
Telecom	Ethernet2	EUT	Use for maintenance	1	NA	NA
RF	RF Link (Tx/Rx)	EUT	Attenuator 30 dB	4	Coax	3
Signal	Serial*	EUT	Not connected	1	NA	NA

* For maintenance only

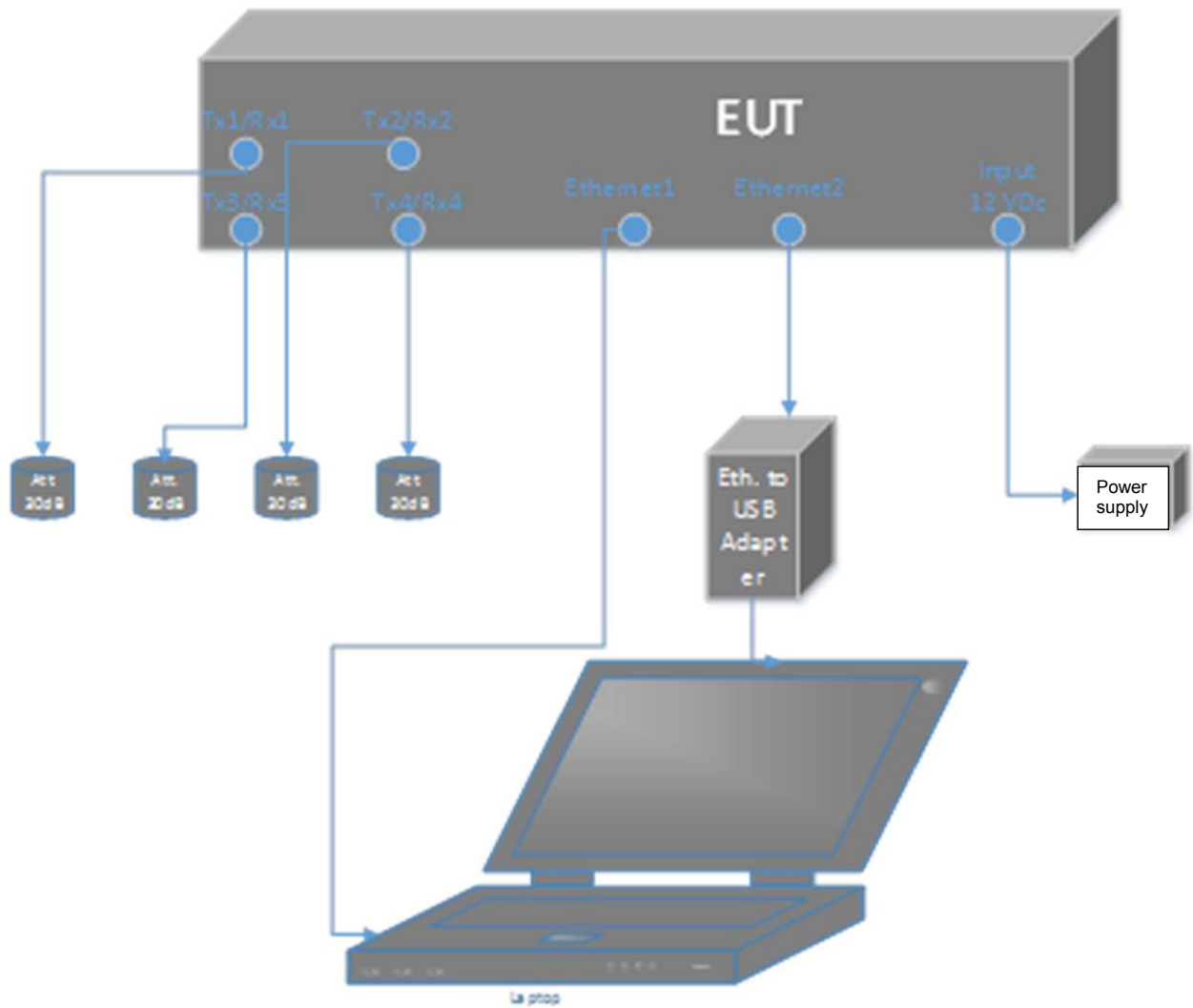
6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Laptop	Dell	E7450	8TYRP32
Ethernet to USB Adapter	STLab	1450881138	NA

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			
☒	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	
☐	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		2496.0 – 2690.0 MHz	
Operating frequency		2506.0 – 2680.0 MHz	
RF channel spacing		20 MHz	
Maximum rated output power		At transmitter 50 Ω RF output connector (aggregate power of both RF chains) 23.9 dBm	
Is transmitter output power variable?		☐ No	
		☒ Yes	☐ continuous variable
			☒ stepped variable with step size 0.25 dB
			minimum RF power -30 dBm
		maximum RF power at antenna connector 23.9 dBm	
Antenna connection			
☐ unique coupling	☒ standard connector	☐ Integral	☐ with temporary RF connector ☐ without temporary RF connector
Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
External	ALPHA Wireless Ltd	AW3509-1	9 dBi
External	ALPHA Wireless Ltd	AW3509-2	9 dBi
Transmitter aggregate data rate/s, MBps			
Transmitter 26dBc power bandwidth 20 MHz		Type of modulation	
		QPSK 23.4 Mbps	16QAM 45.4 Mbps 64QAM 95.0 Mbps
Type of multiplexing		TDD	
Modulating test signal (baseband)		PRBS	
Maximum transmitter duty cycle in normal use		75%	
Transmitter power source			
☐	☐ DC	Nominal rated voltage	☐ Battery type
☒	☒ AC mains	Nominal rated voltage 120VAC	Frequency
Common power source for transmitter and receiver		☒ yes	☐ no

Test specification: Section 27.50(h)(2), Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 05-Jun-16			
Temperature: 24 °C	Relative Humidity: 40 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 27

7.1 Peak output power test

7.1.1 General

This test was performed to measure the peak output power at RF antenna connector. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Peak output power limits

Transmitter type	Assigned frequency range, MHz	Maximum peak output power, EIRP	
		W	dBm
Mobile stations	2496 – 2690	2.0	33.0

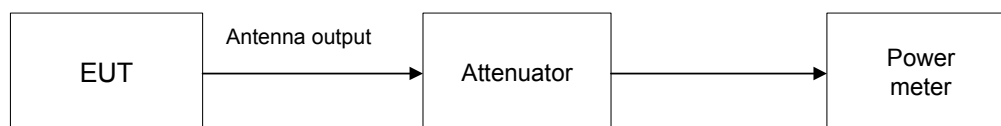
7.1.2 Test procedure

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 the end user RF output power.

7.1.2.3 The peak output power was measured with power meter as provided in Table 7.1.2.

Figure 7.1.1 Peak output power test setup





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Test specification: Section 27.50(h)(2), Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 05-Jun-16			
Temperature: 24 °C	Relative Humidity: 40 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

Table 7.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 2496.0 – 2690.0 MHz
 TEST METHOD: Wideband power meter
 DETECTOR USED: Average within Tx burst
 MODULATING SIGNAL: PRBS
 DEDICATED ANTENNA: 9.0 dBi
 ANTENNA CHAINS: N = 2

Carrier frequency, MHz	Pmeas #1, dBm	Pmeas #2, dBm	Antenna gain, dBi	Total EIRP*, dBm	Limit, dBm	Margin**, dB	Verdict
MODULATION: QPSK							
2506.00	20.95	20.73	9.00	32.85	33.00	-0.15	Pass
2624.00	20.86	20.71	9.00	32.80	33.00	-0.20	Pass
2680.00	20.89	20.68	9.00	32.80	33.00	-0.20	Pass
MODULATION: 16QAM							
2506.00	20.90	20.75	9.00	32.84	33.00	-0.16	Pass
2624.00	20.87	20.84	9.00	32.87	33.00	-0.13	Pass
2680.00	20.92	20.66	9.00	32.80	33.00	-0.20	Pass
MODULATION: 64QAM							
2506.00	20.91	20.74	9.00	32.84	33.00	-0.16	Pass
2624.00	20.88	20.70	9.00	32.80	33.00	-0.20	Pass
2680.00	20.87	20.91	9.00	32.90	33.00	-0.10	Pass

* - Total EIRP, dBm = $10 \cdot \log[10^{(P_{\text{meas \#1}}/10)} + 10^{(P_{\text{meas \#2}}/10)}] + \text{Antenna gain, dB}$

** - Margin, dB = Total EIRP - Limit

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3433	HL 3787	HL 3818	HL 4068	HL 4366	
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Full description is given in Appendix A.

Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 05-Jun-16			
Temperature: 24 °C	Relative Humidity: 40 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
2496.0 – 2690.0 MHz	26	NA

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

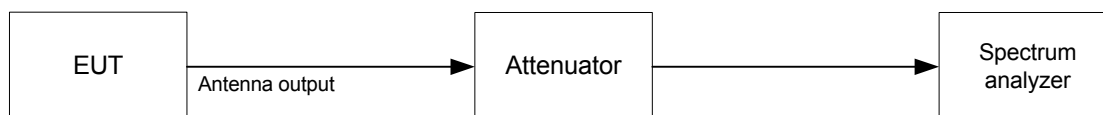
7.2.2 Test procedure

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

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

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

Figure 7.2.1 Occupied bandwidth test setup





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Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 05-Jun-16			
Temperature: 24 °C	Relative Humidity: 40 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

ASSIGNED FREQUENCY RANGE: 2496.0 – 2690.0 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 300 kHz (0.5-2% of OBW)
 VIDEO BANDWIDTH: 3000 kHz
 MODULATION ENVELOPE REFERENCE POINTS: 26 dBc

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
MODULATION: QPSK				
2506.0	18.490	NA	NA	Pass
2624.0	18.666	NA	NA	Pass
2680.0	18.682	NA	NA	Pass
MODULATION: 16QAM				
2506.0	18.508	NA	NA	Pass
2624.0	18.646	NA	NA	Pass
2680.0	18.517	NA	NA	Pass
MODULATION: 64QAM				
2506.0	18.612	NA	NA	Pass
2624.0	18.656	NA	NA	Pass
2680.0	18.568	NA	NA	Pass

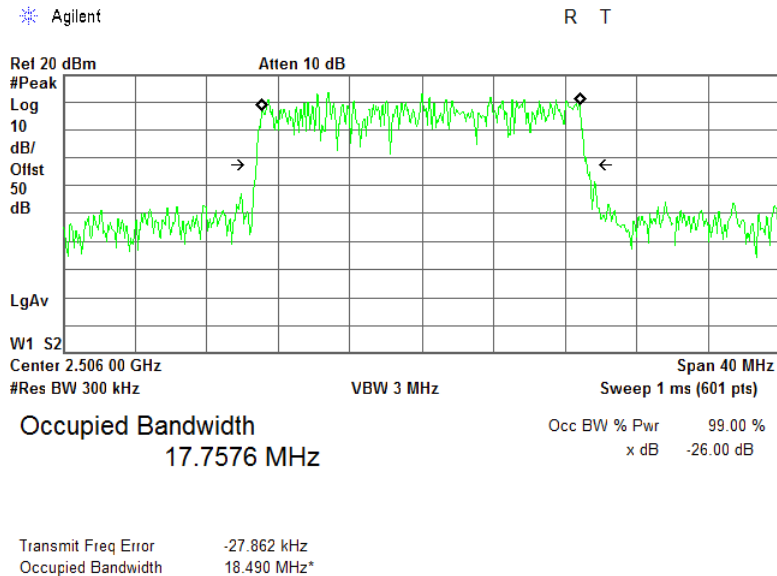
Reference numbers of test equipment used

HL 3301	HL 3302	HL 3433	HL 3787	HL 3818	HL 4068	HL 4366	
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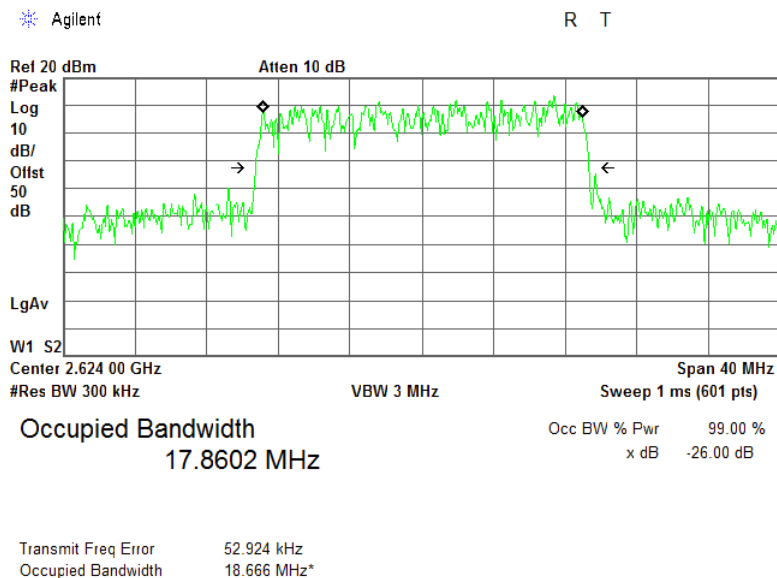
Full description is given in Appendix A.

Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 05-Jun-16			
Temperature: 24 °C	Relative Humidity: 40 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.2.1 Occupied bandwidth test result at low frequency, QPSK

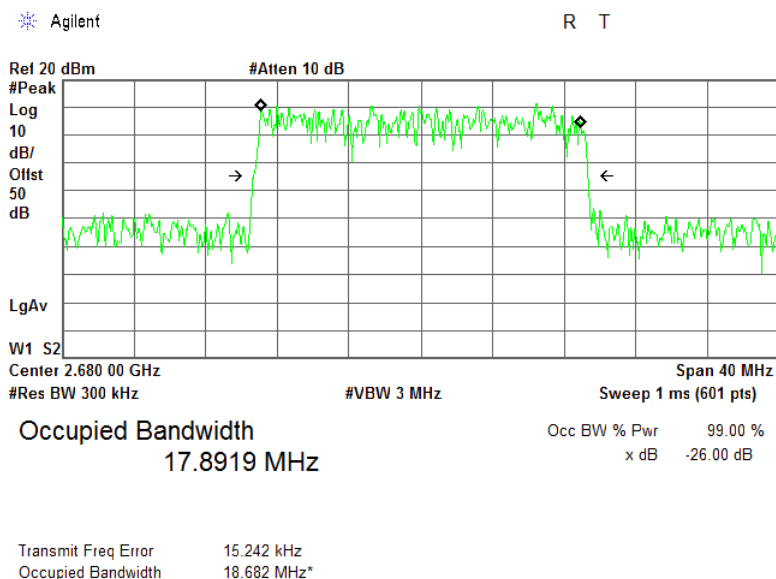


Plot 7.2.2 Occupied bandwidth test result at mid frequency, QPSK

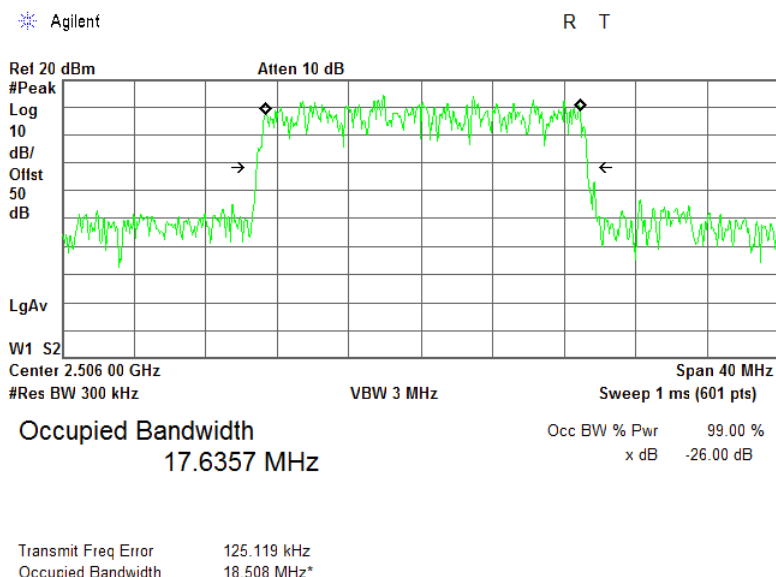


Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 05-Jun-16			
Temperature: 24 °C	Relative Humidity: 40 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.2.3 Occupied bandwidth test result at high frequency, QPSK

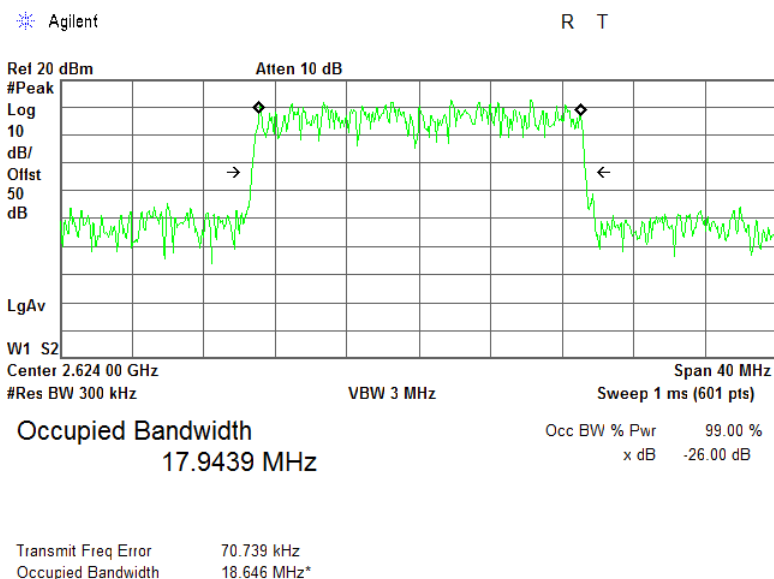


Plot 7.2.4 Occupied bandwidth test result at low frequency, 16QAM

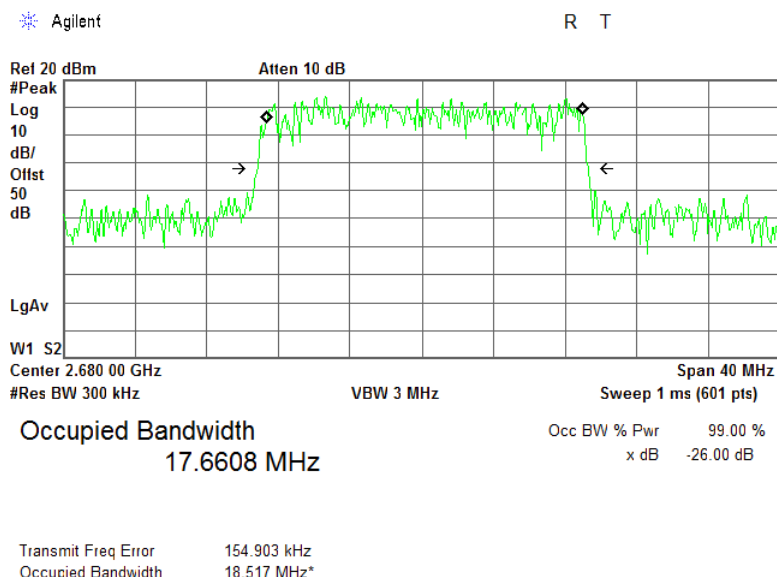


Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 05-Jun-16			
Temperature: 24 °C	Relative Humidity: 40 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.2.5 Occupied bandwidth test result at mid frequency, 16QAM

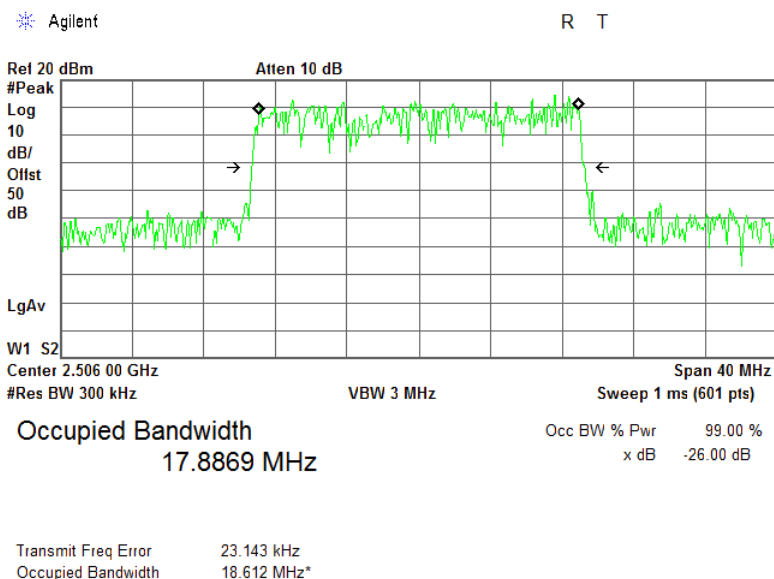


Plot 7.2.6 Occupied bandwidth test result at high frequency, 16QAM

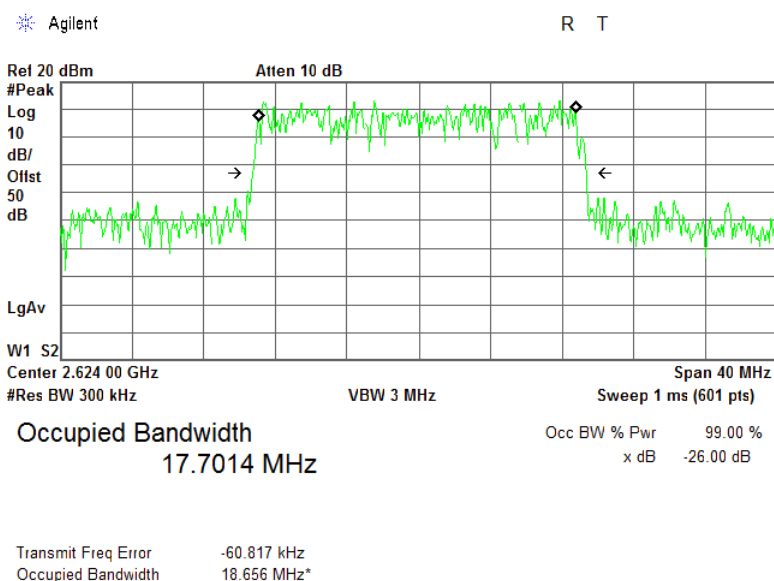


Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 05-Jun-16			
Temperature: 24 °C	Relative Humidity: 40 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.2.7 Occupied bandwidth test result at low frequency, 64QAM



Plot 7.2.8 Occupied bandwidth test result at mid frequency, 64QAM

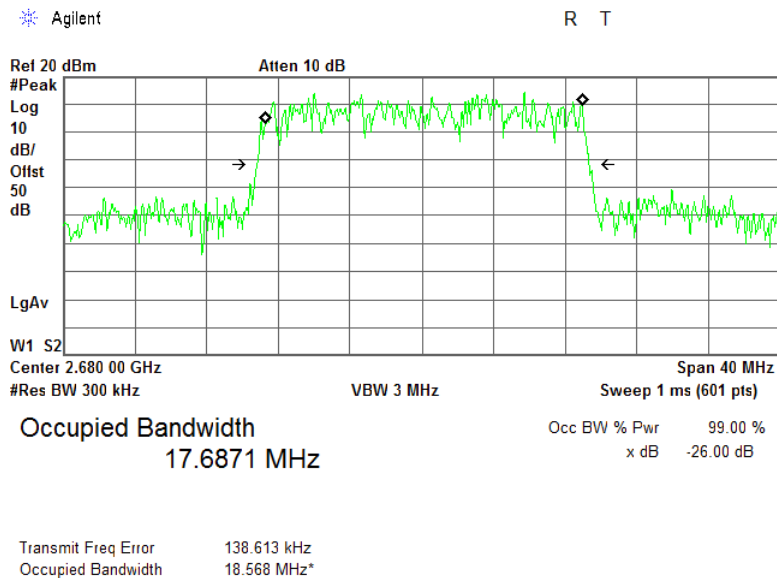




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Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 05-Jun-16			
Temperature: 24 °C	Relative Humidity: 40 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.2.9 Occupied bandwidth test result at high frequency, 64QAM



Test specification: Section 27.53(m)(4), Band edge emissions			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-C, Section 2.2.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

7.3 Band edge emissions at RF connector test

7.3.1 General

This test was performed to measure spurious emissions at the channel edge at the RF antenna connector. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Spurious emission limits at band edges

Channel, MHz	Frequency range, MHz	Attenuation below carrier, dBc
Channel bandwidth 20 MHz		
2506.0 (2496 – 2518.5)	2490.5 – 2496.0	43 + 10*Log (P*)
	Below 2490.5 & Above 2537.0	55 + 10*Log (P*)
	2518.5 – 2523.5	40 + 10*Log (P*)
	2523.5 – 2537.0	43 + 10*Log (P*)
2624.0 (2614 - 2635)	Below 2595.5 & Above 2653.5	55 + 10*Log (P*)
	2595.5 – 2609.0 & 2640.0 – 2653.5	43 + 10*Log (P*)
	2609.0 – 2614.0 & 2635.0 – 2640.0	40 + 10*Log (P*)
2680.0 (2668 - 2690)	Below 2649.5 & Above 2708.5	55 + 10*Log (P*)
	2649.5 – 2663.0 & 2695.0 – 2708.5	43 + 10*Log (P*)
	2663.0 – 2668.0 & 2690.0 – 2695.0	40 + 10*Log (P*)

* - P is transmitter output power in Watts

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 spurious emission was measured with spectrum analyzer as provided in Table 7.3.2 and the associated plots.

Figure 7.3.1 Spurious emission test setup for single output





Test specification: Section 27.53(m)(4), Band edge emissions			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-C, Section 2.2.13			
Test mode:	Compliance	Verdict: PASS	
Date(s):	06-Jun-16		
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Table 7.3.2 Spurious emission at the low band edge test results

ASSIGNED FREQUENCY RANGE: 2496.0 – 2690.0 MHz
 DETECTOR USED: Average (gated)
 RESOLUTION BANDWIDTH: 100 KHz
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 EBW: 20 MHz

Frequency MHz	Frequency offset, ± MHz	Low band edge dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK						
2506.0	10.5	-29.20+3.00	100	1000	-13.00	Pass
	16.0	-32.78+3.00	100	1000	-25.00	
2624.0	10.5	-29.27+3.0	100	1000	-10.00	Pass
	15.5	-32.11+3.0	100	1000	-13.00	
2680.0	29.0	-33.63+3.0	100	1000	-25.00	Pass
	13.5	-30.02+3.0	100	1000	-10.00	
	17.5	-30.96+3.0	100	1000	-13.00	
	31.0	-32.14+3.0	100	1000	-25.00	
64QAM						
2506.0	10.5	-29.40+3.0	100	1000	-13.00	Pass
	17.0	-32.73+3.0	100	1000	-25.00	
2624.0	10.5	-28.94+3.0	100	1000	-10.00	Pass
	15.5	-31.76+3.0	100	1000	-13.00	
	30.0	-33.11+3.0	100	1000	-25.00	
2680.0	12.5	-32.41+3.0	100	1000	-10.00	Pass
	17.5	-33.19+3.0	100	1000	-13.00	
	31.0	-34.05+3.0	100	1000	-25.00	



Test specification: Section 27.53(m)(4), Band edge emissions			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-C, Section 2.2.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Table 7.3.3 Spurious emission at the high band edge test results

ASSIGNED FREQUENCY RANGE: 2496.0 – 2690.0 MHz
 DETECTOR USED: Average (gated)
 RESOLUTION BANDWIDTH: 100 KHz
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 EBW: 20 MHz

Frequency MHz	Frequency offset, ± MHz	High band edge dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK						
2506.0	13.0	-29.50+3.0	100	1000	-10.00	Pass
	19.0	-31.63+3.0	100	1000	-13.00	
	31.5	-33.28+3.0	100	1000	-25.00	
2624.0	11.5	-30.58+3.0	100	1000	-10.00	Pass
	16.5	-31.16+3.0	100	1000	-13.00	
	30.0	-32.70+3.0	100	1000	-25.00	
2680.0	10.5	-27.32+3.0	100	1000	-10.00	Pass
	15.5	-30.67+3.0	100	1000	-13.00	
	29.0	-33.36+3.0	100	1000	-25.00	
64QAM						
2506.0	13.0	-30.51+3.0	100	1000	-10.00	Pass
	18.0	-30.76+3.0	100	1000	-13.00	
	31.5	-33.46+3.0	100	1000	-25.00	
2624.0	11.5	-30.58+3.0	100	1000	-10.00	Pass
	17.5	-31.28+3.0	100	1000	-13.00	
	30.0	-31.84+3.0	100	1000	-25.00	
2680.0	10.5	-29.63+3.0	100	1000	-10.00	Pass
	15.5	-32.06+3.0	100	1000	-13.00	
	30.0	-33.27+3.0	100	1000	-25.00	

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3433	HL 3787	HL 3818	HL 4068	HL 4366	
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Full description is given in Appendix A.

Test specification: Section 27.53(m)(4), Band edge emissions			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-C, Section 2.2.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.3.1 Spurious emission at band edges test results at low carrier frequency

ASSIGNED FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

Low band edge

2496 – 2690 MHz

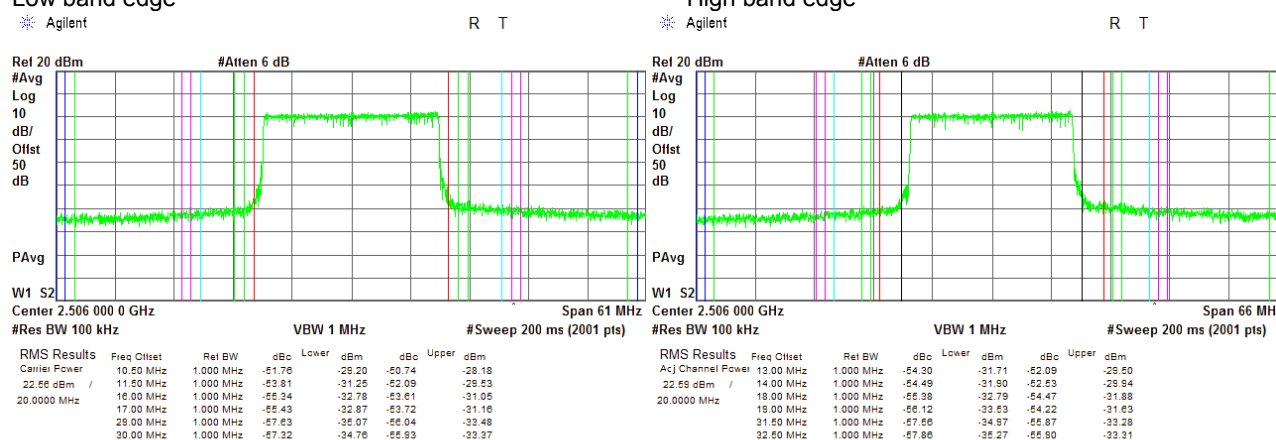
Average

QPSK

PRBS

Maximum

High band edge



Plot 7.3.2 Spurious emission at band edges test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

Low band edge

2496 – 2690 MHz

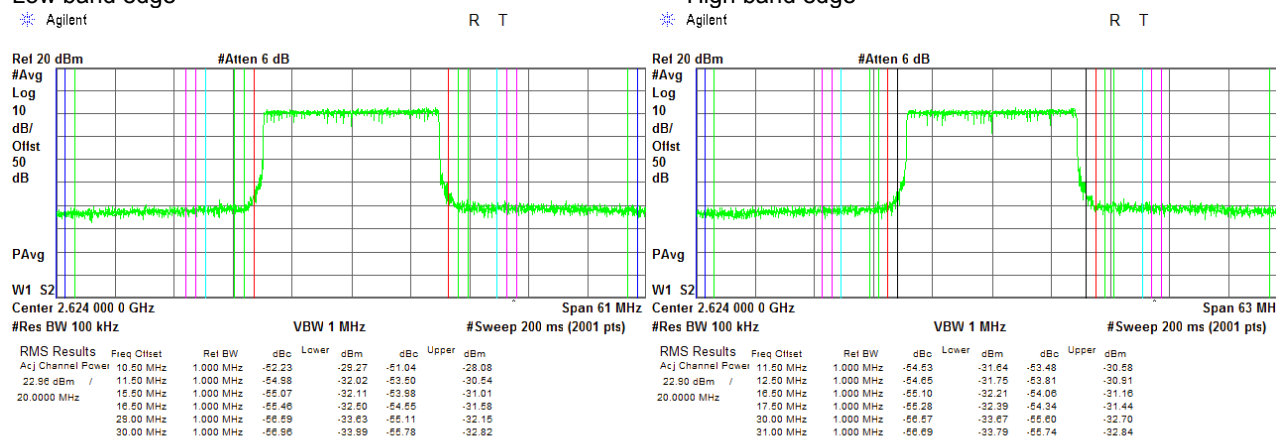
Average

QPSK

PRBS

Maximum

High band edge



Test specification:		Section 27.53(m)(4), Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-C, Section 2.2.13	
Test mode:		Verdict: PASS	
Date(s):			
06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.3.3 Spurious emission at band edges test results at high carrier frequency

ASSIGNED FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

Low band edge

2496 – 2690 MHz

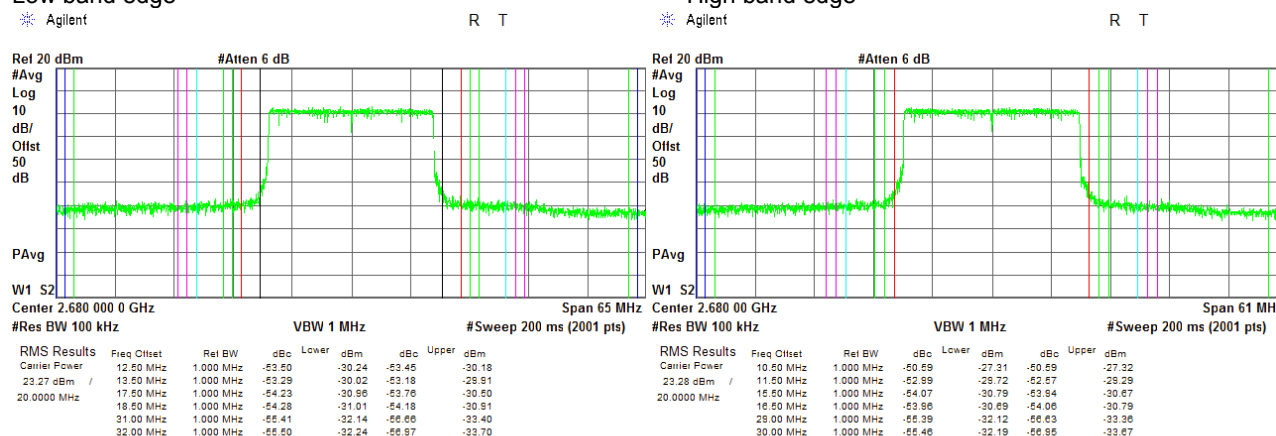
Average

QPSK

PRBS

Maximum

High band edge



Plot 7.3.4 Spurious emission at band edges test results at low carrier frequency

ASSIGNED FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

Low band edge

2496 – 2690 MHz

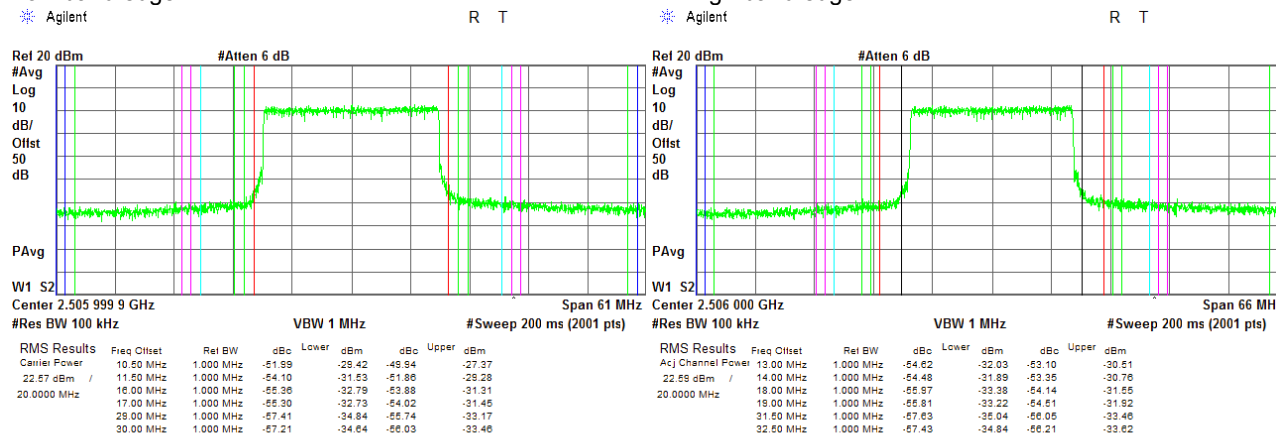
Average

64QAM

PRBS

Maximum

High band edge



Test specification: Section 27.53(m)(4), Band edge emissions			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-C, Section 2.2.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.3.5 Spurious emission at band edges test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE:

2496 – 2690 MHz

DETECTOR USED:

Average

MODULATION:

64QAM

MODULATING SIGNAL:

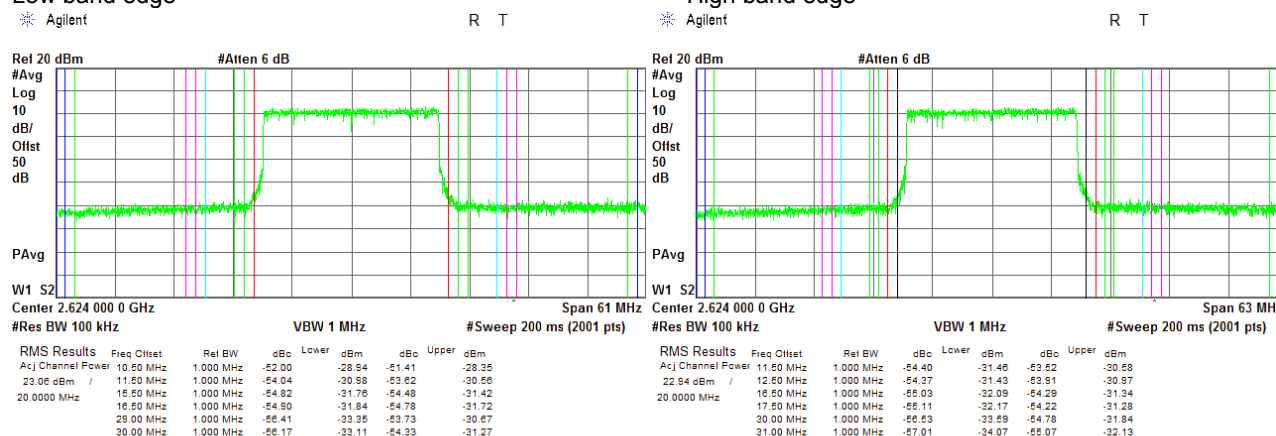
PRBS

TRANSMITTER OUTPUT POWER SETTINGS:

Maximum

Low band edge

High band edge



Plot 7.3.6 Spurious emission at band edges test results at high carrier frequency

ASSIGNED FREQUENCY RANGE:

2496 – 2690 MHz

DETECTOR USED:

Average

MODULATION:

64QAM

MODULATING SIGNAL:

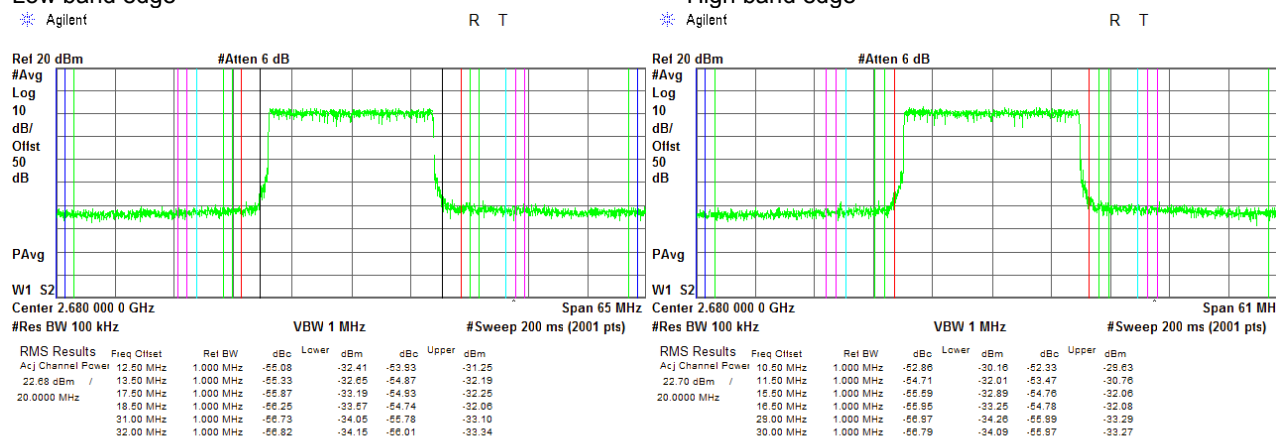
PRBS

TRANSMITTER OUTPUT POWER SETTINGS:

Maximum

Low band edge

High band edge



Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

7.4 Spurious emissions at RF antenna connector test

7.4.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Spurious emission limits

Frequency, MHz	Attenuation below carrier, dBc	Spurious emissions, dBm
Mobile stations		
0.009 – 10th harmonic*	55+10logP(W)**	-25.0

* - spurious emission limits do not apply to the channel edge emission investigated in course of band edge emission testing

** - P is transmitter output power in watts

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

7.4.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.4.2 and associated plots.

Figure 7.4.1 Spurious emission test setup, single output





Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode:	Compliance	Verdict: PASS	
Date(s):	06-Jun-16		
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Table 7.4.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 2496-2690 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 27000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATION: 64QAM
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	SA reading, dBm	Attenuation, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency								
No emissions were found								
Mid carrier frequency								
No emissions were found								
High carrier frequency								
No emissions were found								

Verdict: Pass

*- Margin = Spurious emission – specification limit.

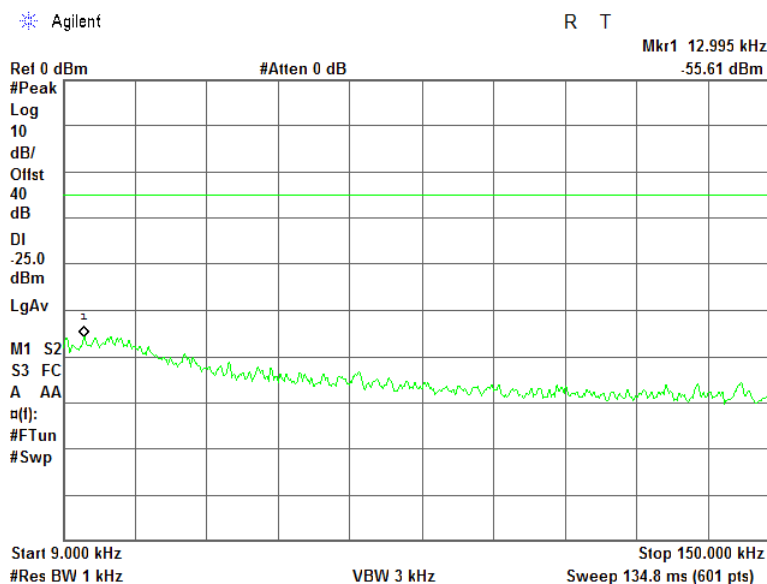
Reference numbers of test equipment used

HL 3301	HL 3302	HL 3433	HL 3787	HL 3818	HL 4068	HL 4366	
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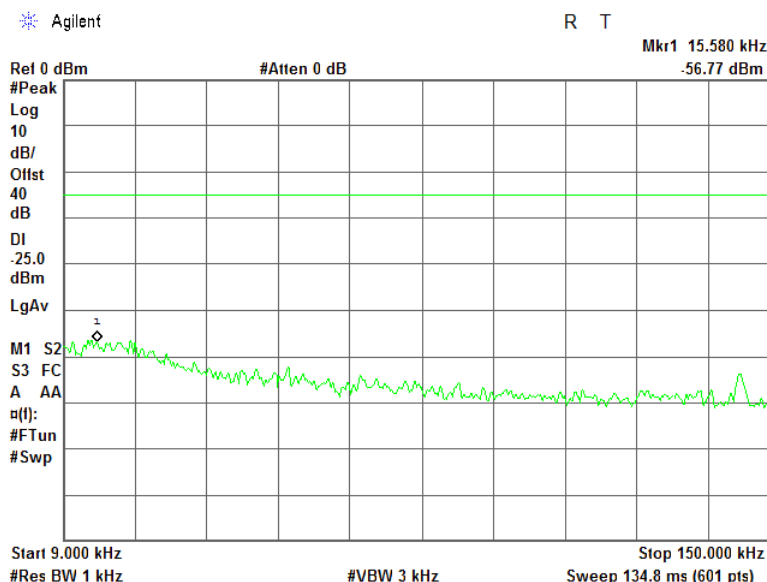
Full description is given in Appendix A.

Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.4.1 Spurious emission measurements in 9 - 150 kHz range at low carrier frequency

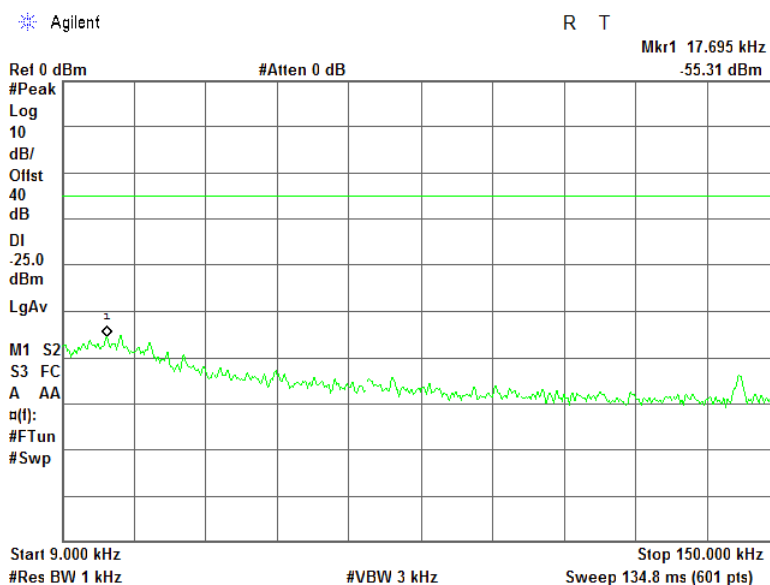


Plot 7.4.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency

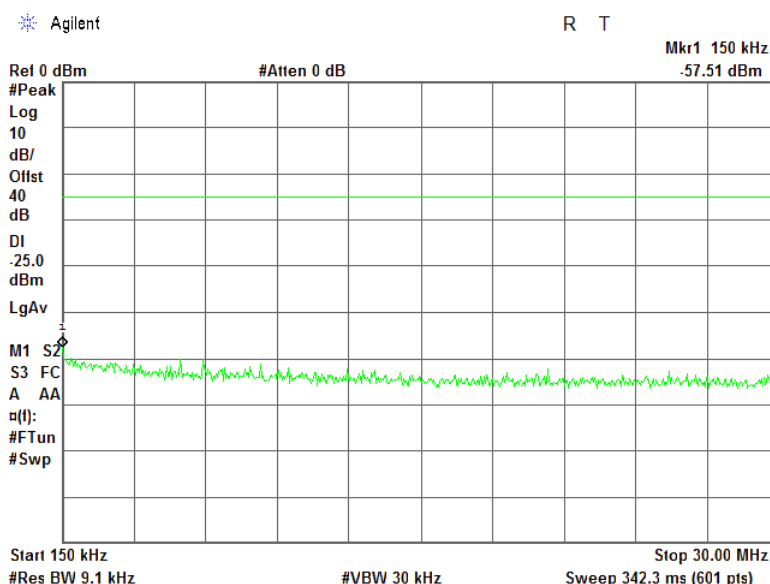


Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.4.3 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency

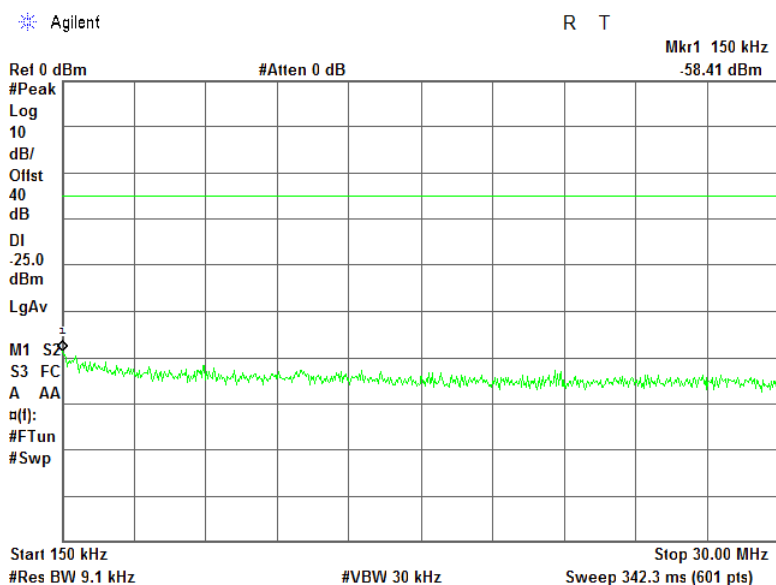


Plot 7.4.4 Spurious emission measurements in 0.15 - 30.0 MHz range at low carrier frequency

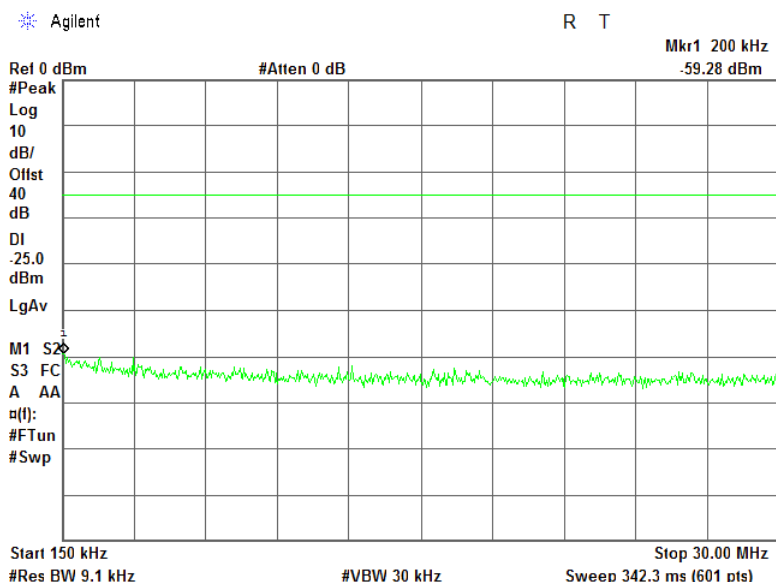


Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.4.5 Spurious emission measurements in 0.15 - 30.0 MHz range at mid carrier frequency

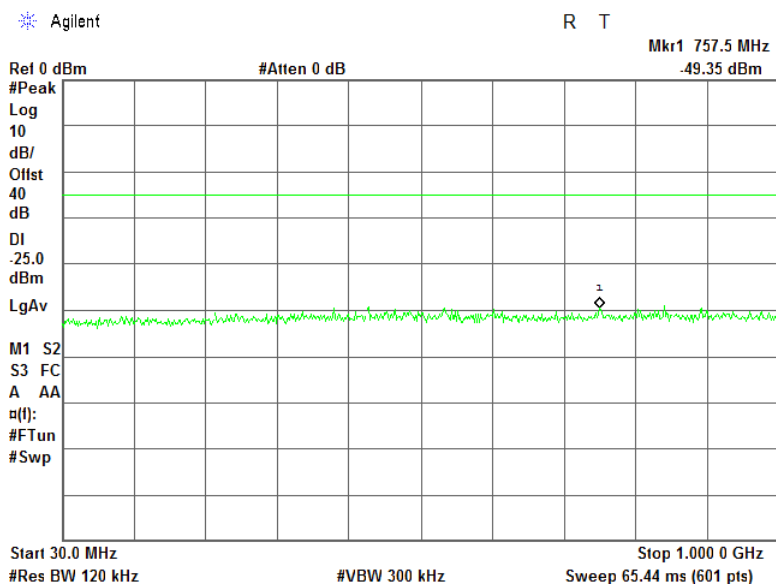


Plot 7.4.6 Spurious emission measurements in 0.15 - 30.0 MHz range at high carrier frequency

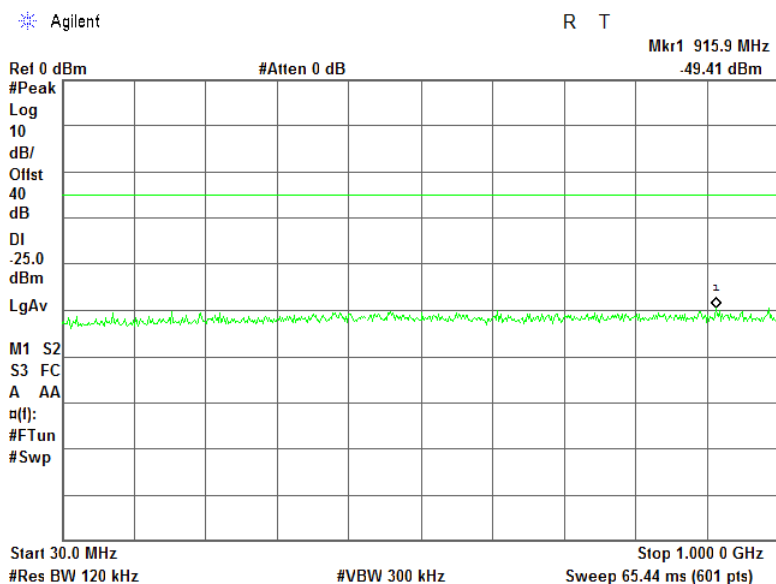


Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.4.7 Spurious emission measurements in 30 - 1000 MHz range at low carrier frequency

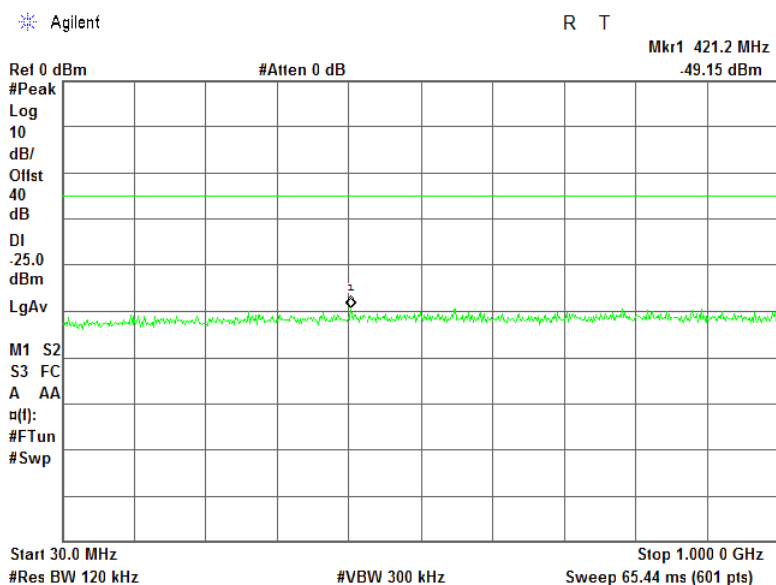


Plot 7.4.8 Spurious emission measurements in 30 - 1000 MHz range at mid carrier frequency

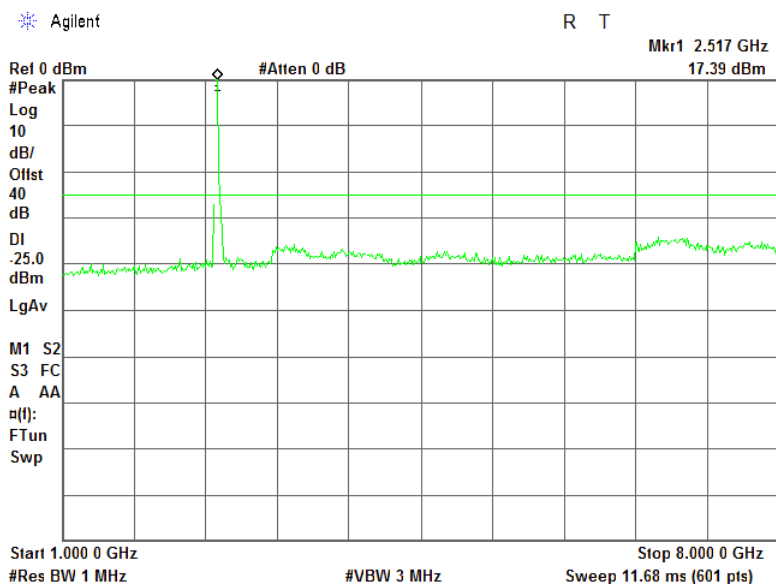


Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.4.9 Spurious emission measurements in 30 - 1000 MHz range at high carrier frequency

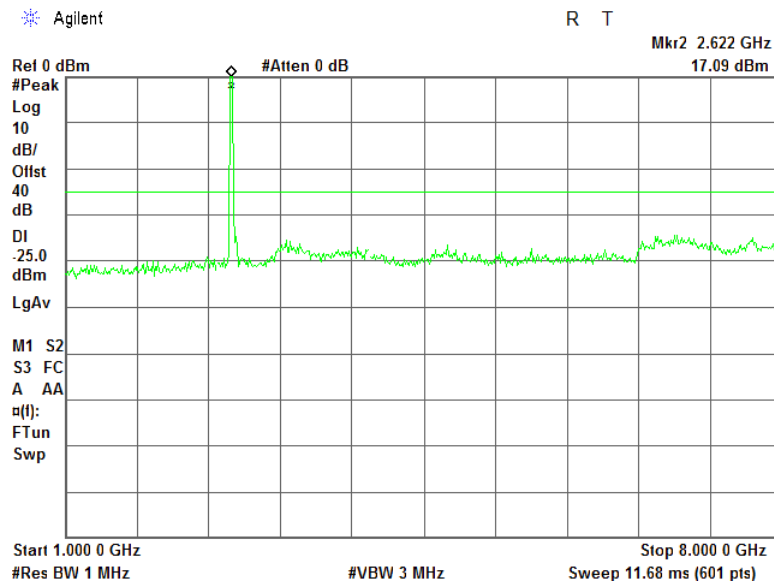


Plot 7.4.10 Spurious emission measurements in 1000 - 8000 MHz range at low carrier frequency

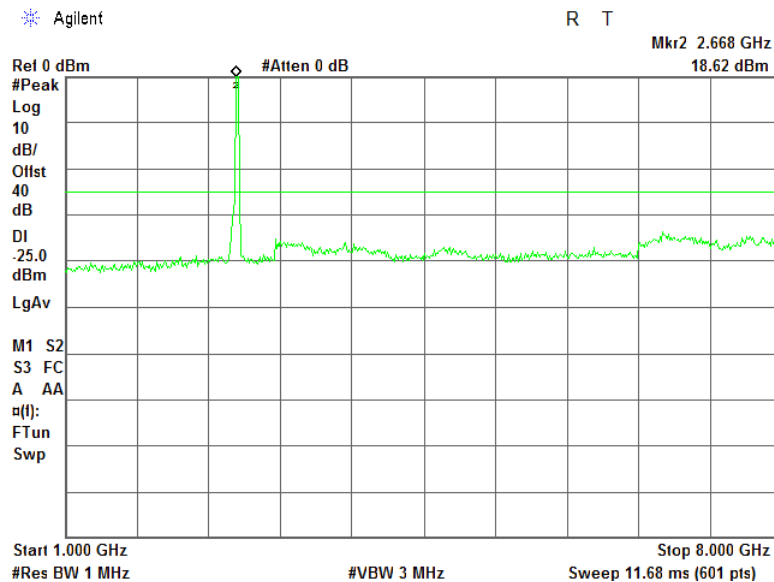


Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.4.11 Spurious emission measurements in 1000 - 8000 MHz range at mid carrier frequency

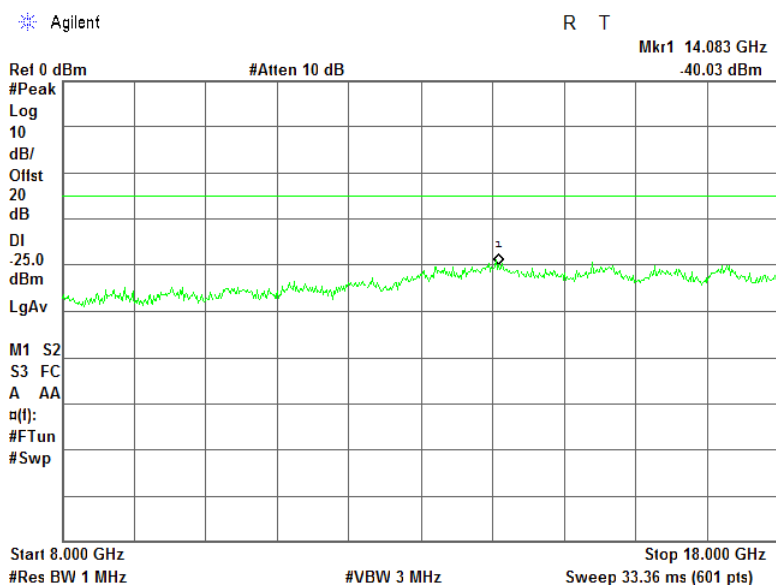


Plot 7.4.12 Spurious emission measurements in 1000 - 8000 MHz range at high carrier frequency

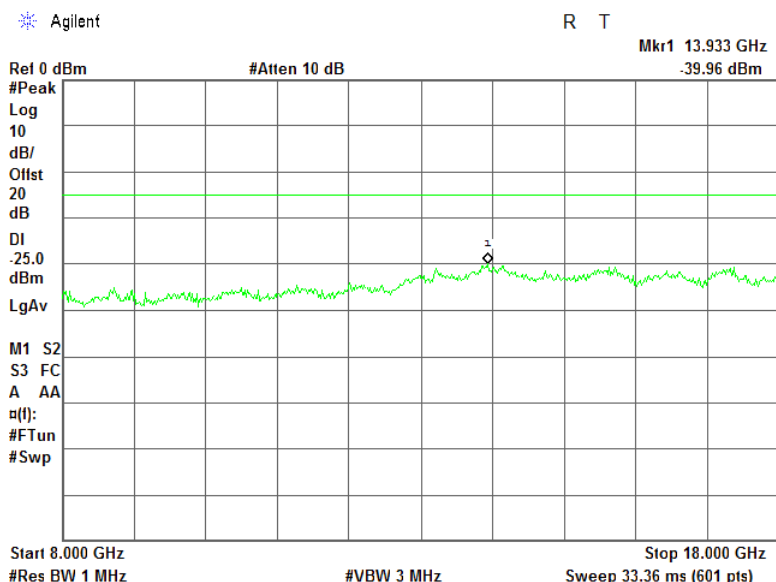


Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.4.13 Spurious emission measurements in 8000 - 18000 MHz range at low carrier frequency

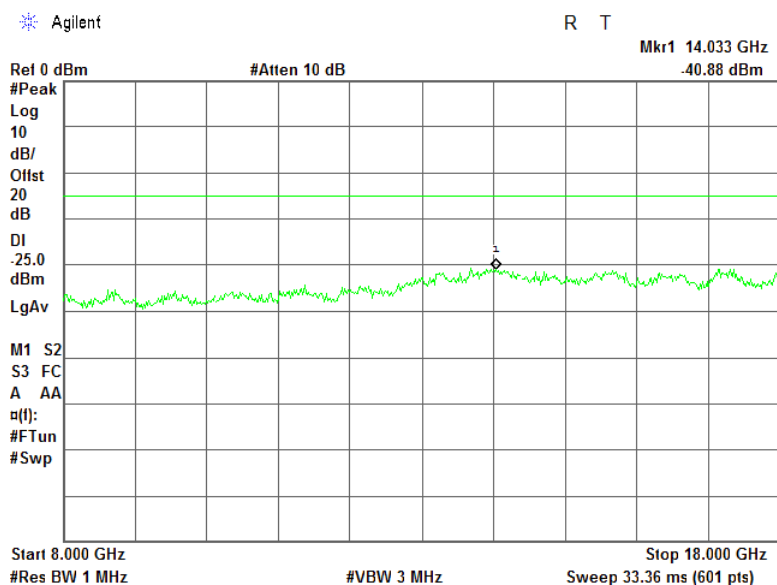


Plot 7.4.14 Spurious emission measurements in 8000 - 18000 MHz at mid carrier frequency

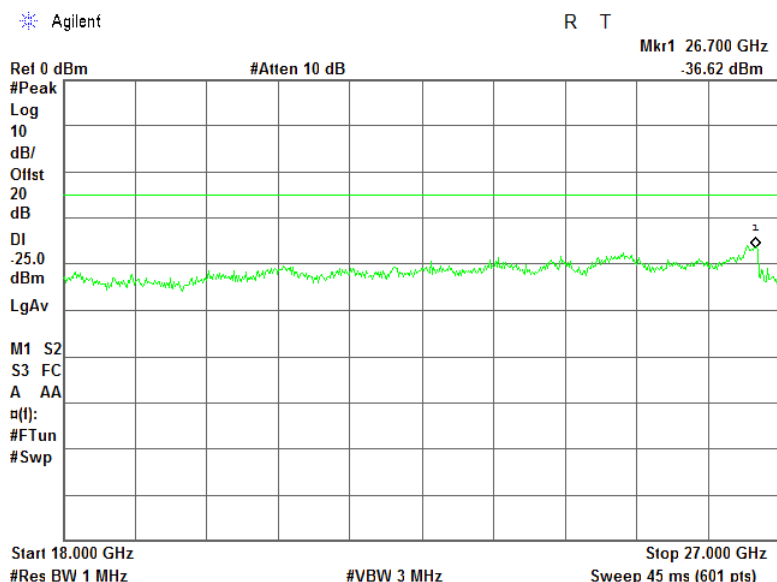


Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.4.15 Spurious emission measurements in 8000 - 18000 MHz at high carrier frequency

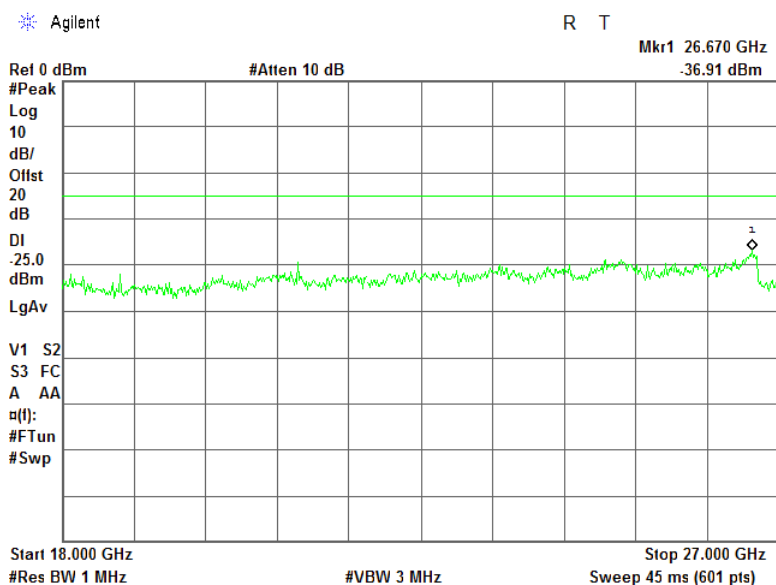


Plot 7.4.16 Spurious emission measurements in 18000 - 27000 MHz range at low carrier frequency

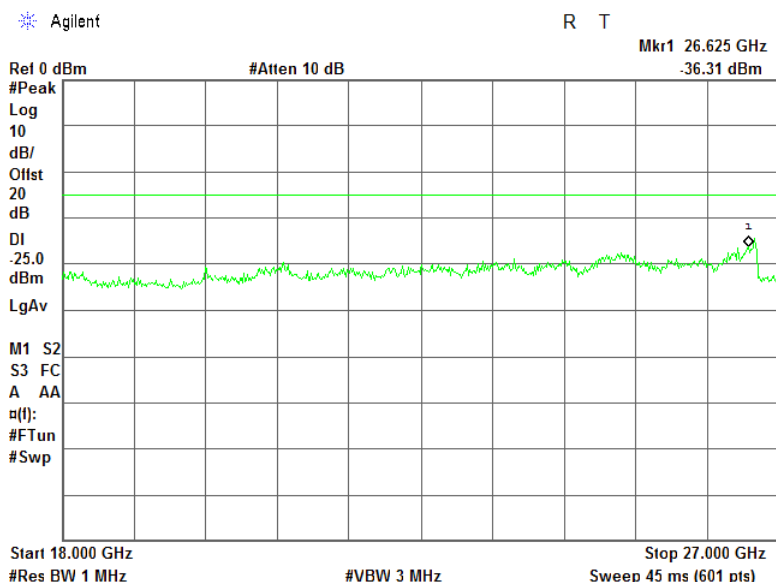


Test specification: Section 27.53(m)(4), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 06-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.4.17 Spurious emission measurements in 18000 - 27000 MHz at mid carrier frequency



Plot 7.4.18 Spurious emission measurements in 18000 - 27000 MHz at high carrier frequency





Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 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	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10th harmonic*	55+10logP** mobile	-25	72.4

* - Excluding the band emission

** - P is transmitter output power in Watts

*** - 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.

Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

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

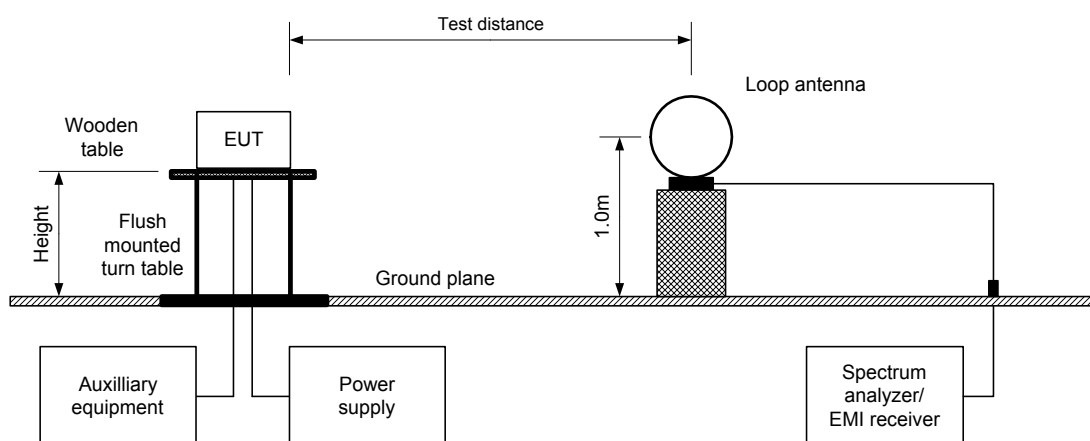
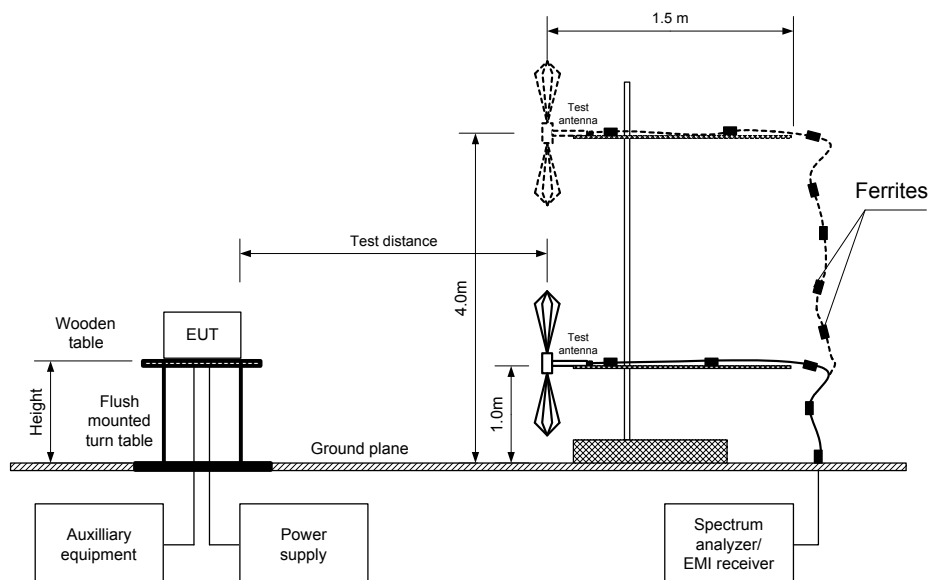


Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz





Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

Table 7.5.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 2496-2690 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Semi anechoic chamber
 EUT HEIGHT: 0.8 m
 INVESTIGATED FREQUENCY RANGE: 0.009 – 27500 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: 64QAM
 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
Low carrier frequency							
No emissions were found							
Mid carrier frequency							
No emissions were found							
High carrier frequency							
No emissions were found							

Verdict: Pass

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

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

Reference numbers of test equipment used

HL 0446	HL 0521	HL 0604	HL 2780	HL 3818	HL 3901	HL 4278	HL 4338
HL 4353	HL 4916	HL 4933	HL 4956				

Full description is given in Appendix A.

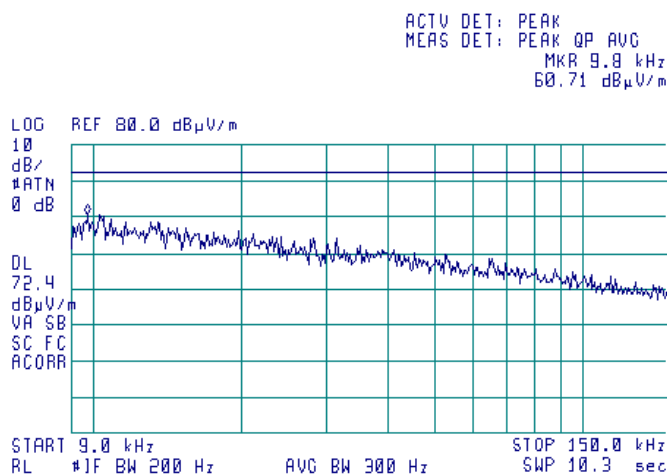


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Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

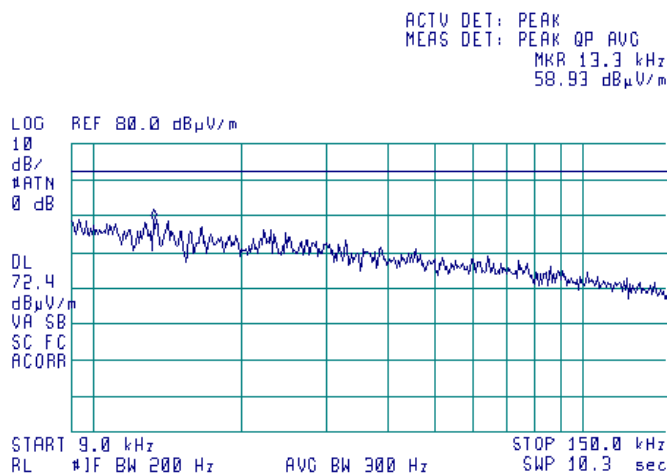
Plot 7.5.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.5.2 Radiated emission measurements in 9 - 150 kHz range

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



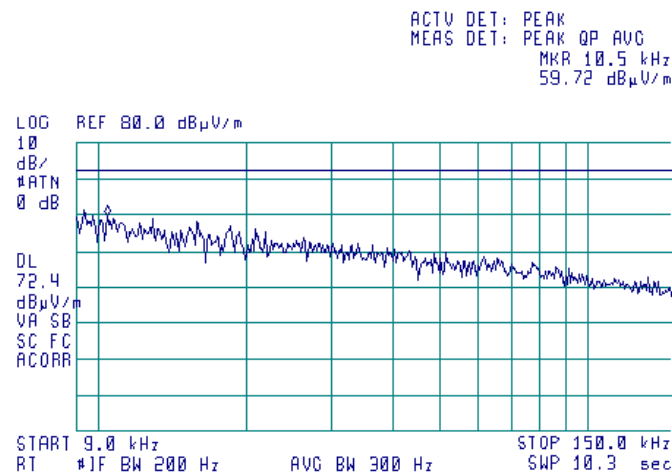


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Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

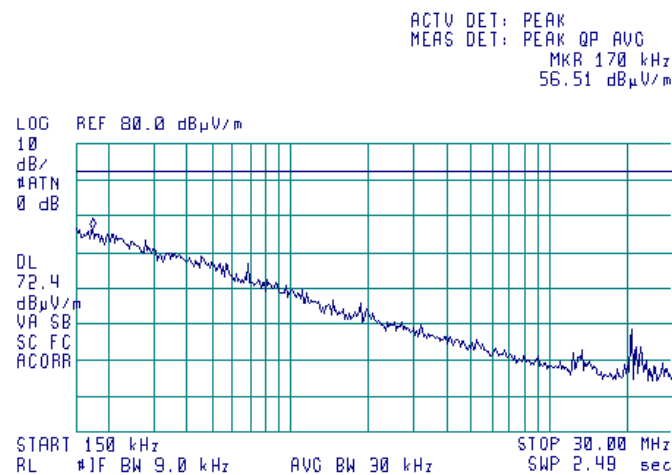
Plot 7.5.3 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.5.4 Radiated emission measurements in 0.15 - 30 MHz range

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



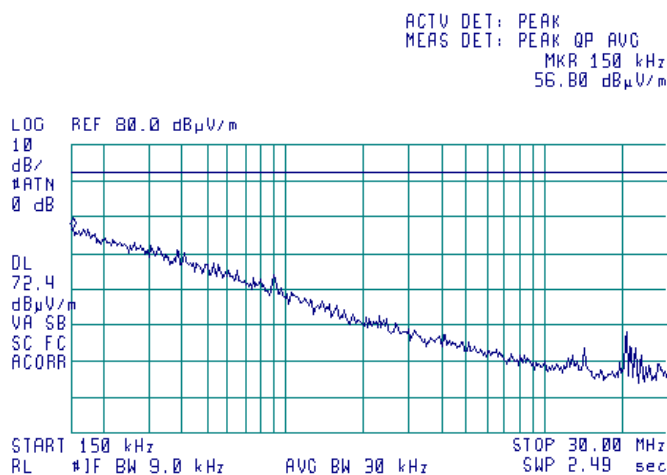


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Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

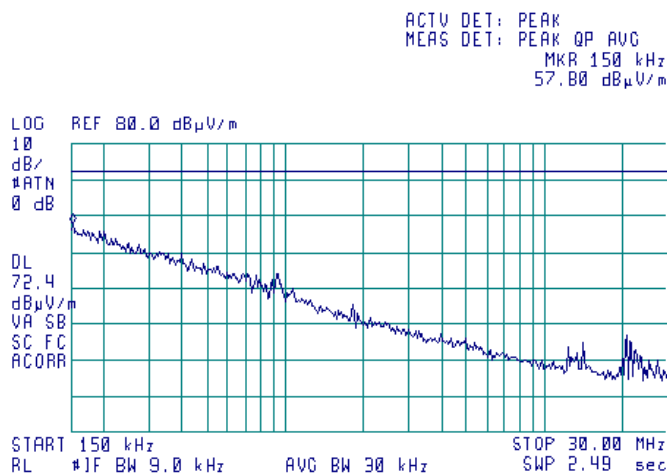
Plot 7.5.5 Radiated emission measurements in 0.15 - 30 MHz range

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



Plot 7.5.6 Radiated emission measurements in 0.15 - 30 MHz range

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



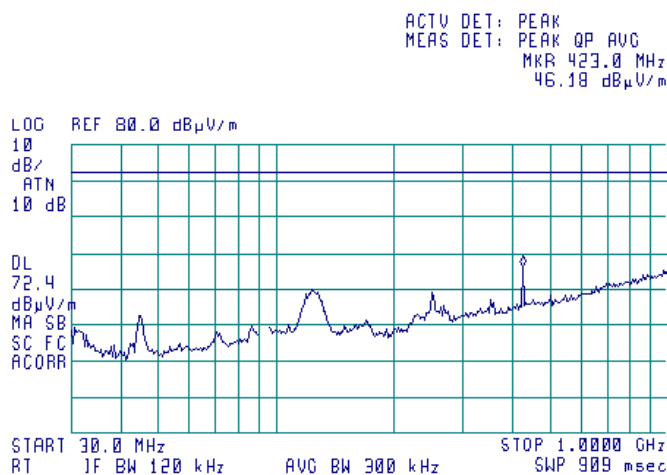


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Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

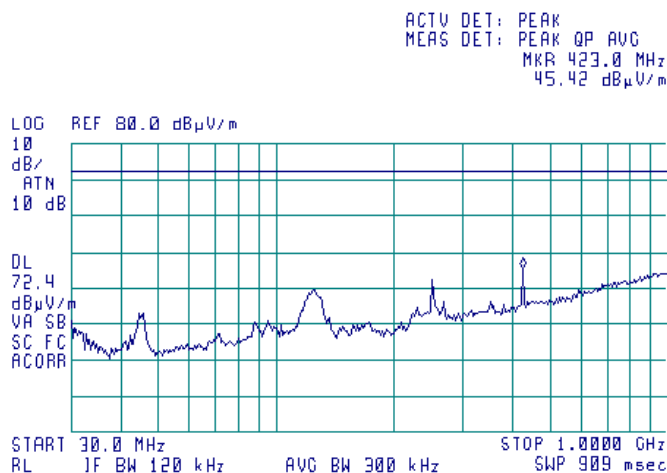
Plot 7.5.7 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.5.8 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





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Date of Issue: 18-Jul-16

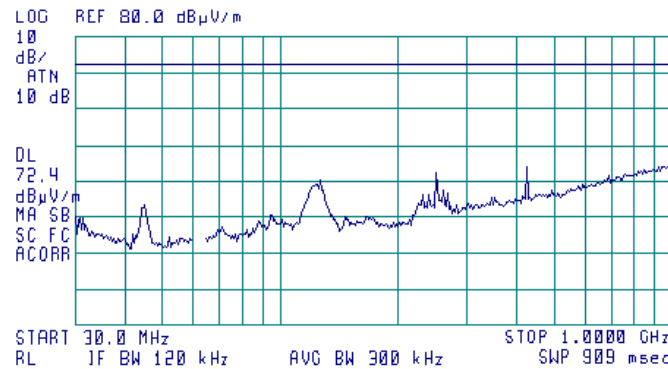
Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.5.9 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



ACTV DET: PEAK
 MEAS DET: PEAK QP AVG
 MKR 1.0000 GHz
 44.34 dB μ V/m

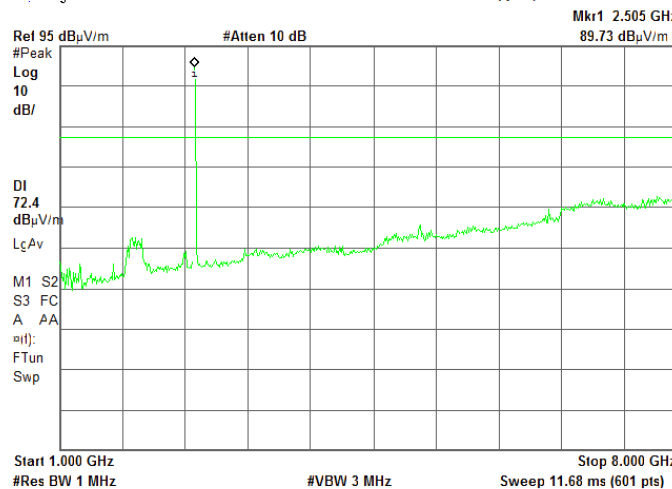


Plot 7.5.10 Radiated emission measurements in 1000 – 8000 MHz range

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

Agilent

R T

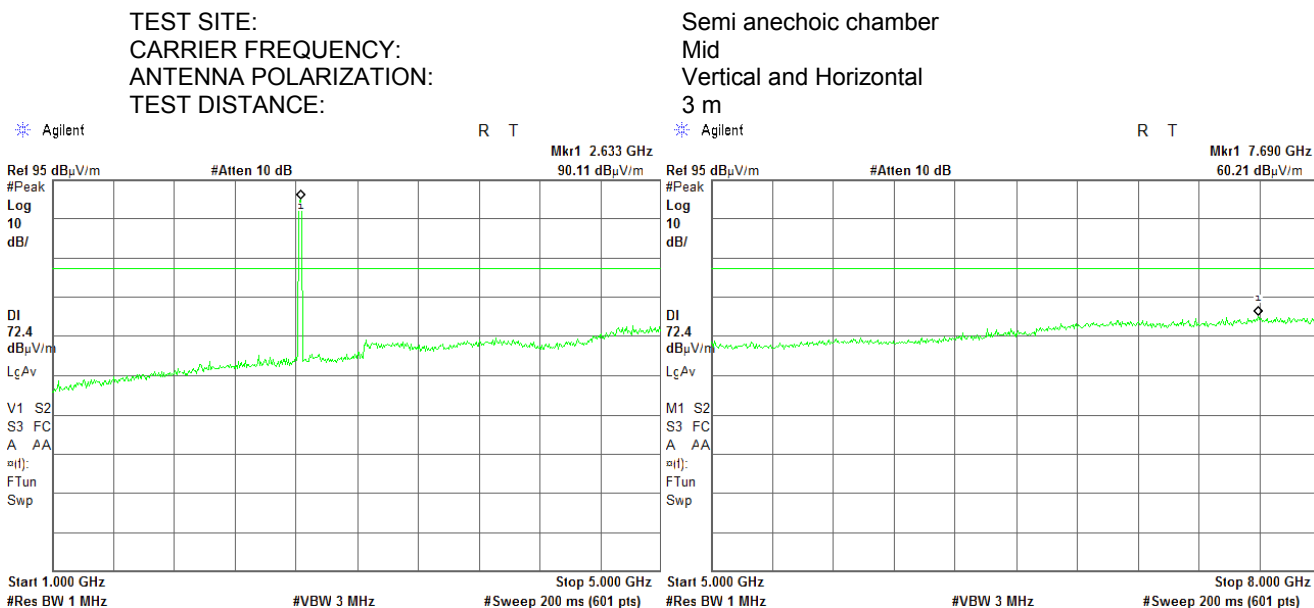




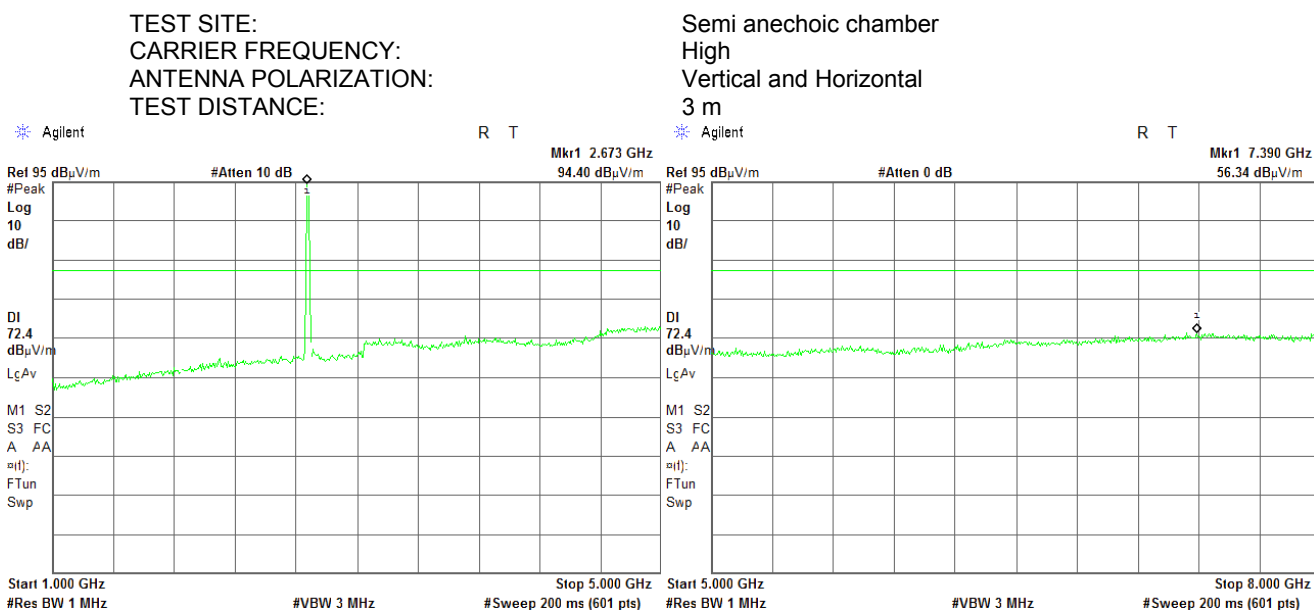
HERMON LABORATORIES

Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.5.11 Radiated emission measurements in 1000 – 8000 MHz range



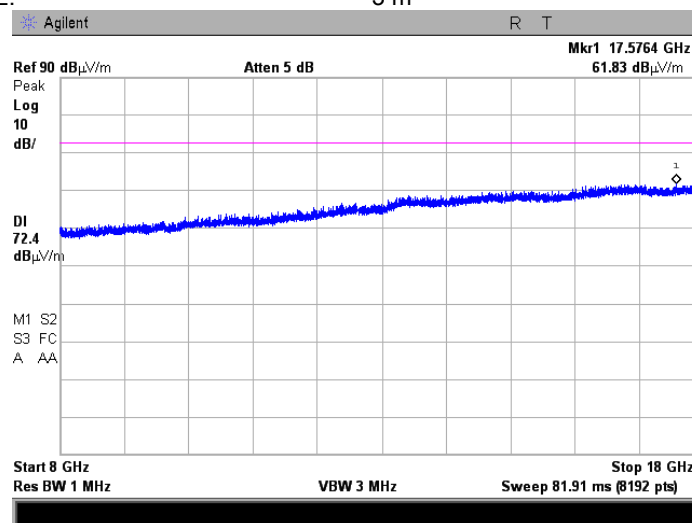
Plot 7.5.12 Radiated emission measurements in 1000 – 8000 MHz range



Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

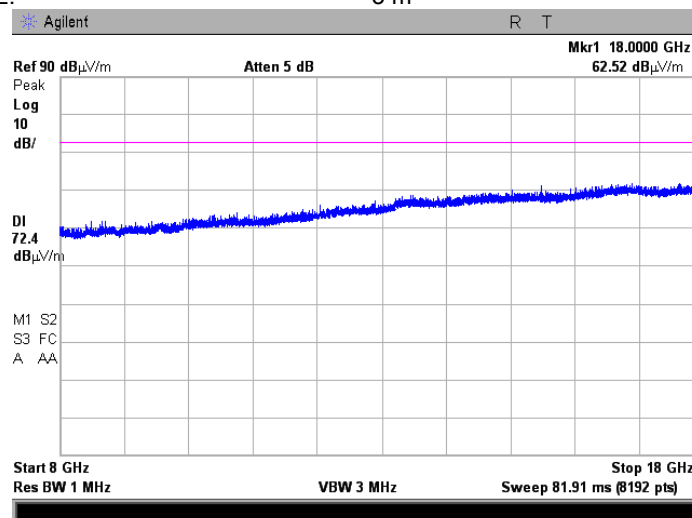
Plot 7.5.13 Radiated emission measurements in 8000 – 18000 MHz range

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



Plot 7.5.14 Radiated emission measurements in 8000 – 18000 MHz range

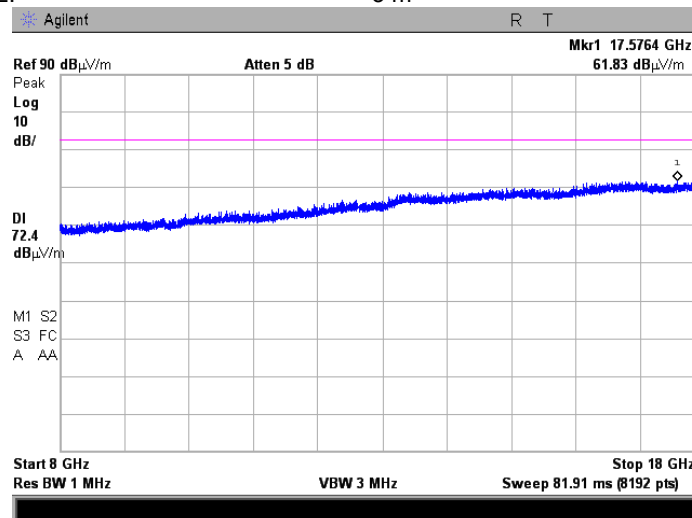
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

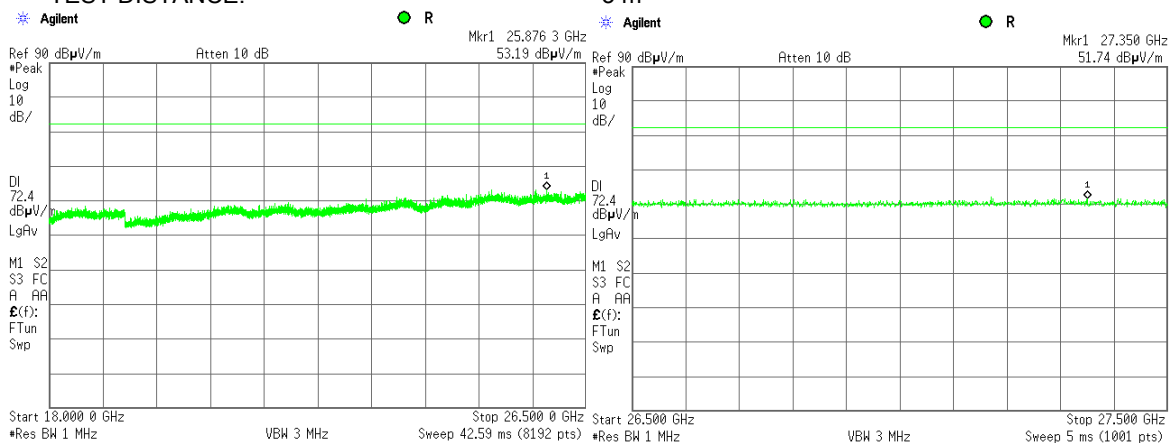
Plot 7.5.15 Radiated emission measurements in 8000 – 18000 MHz range

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



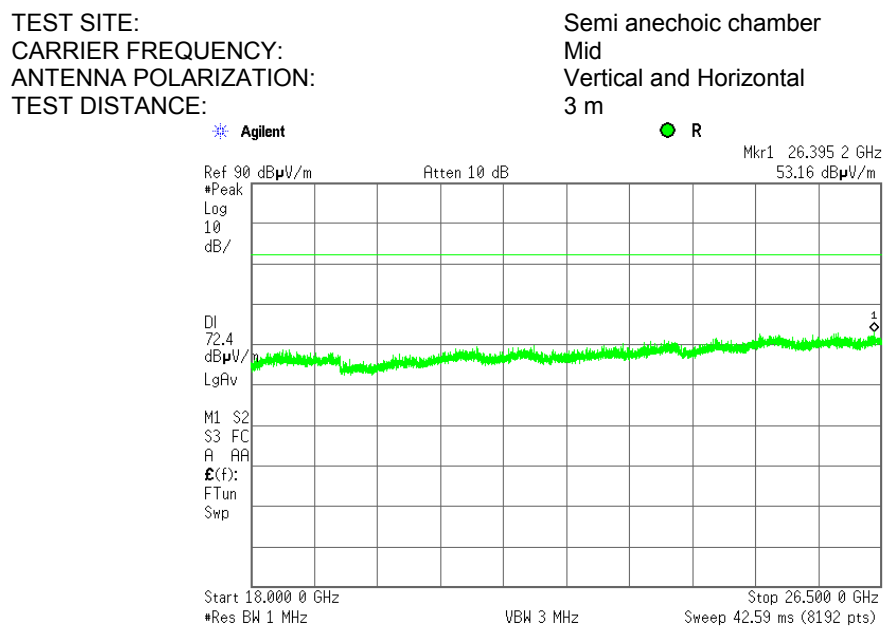
Plot 7.5.16 Radiated emission measurements in 18000 – 27500 MHz range

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

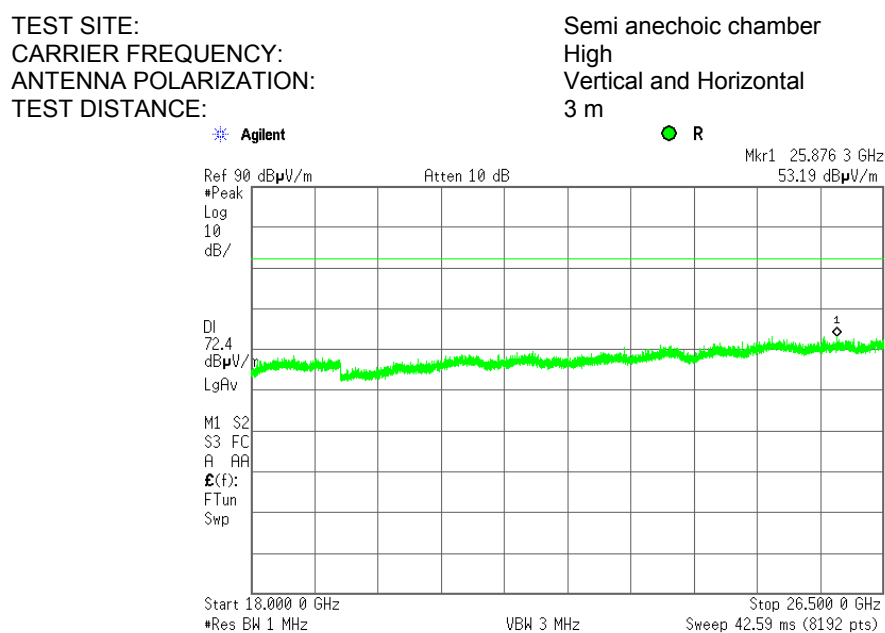


Test specification: Section 27.53(m)(4), Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 08-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1003 hPa	Power Supply: 12 VDC
Remarks:			

Plot 7.5.17 Radiated emission measurements in 18000 – 26500 MHz range



Plot 7.5.18 Radiated emission measurements in 18000 – 26500 MHz range



Test specification: Section 27.54, Frequency stability			
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 09-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

7.6 Frequency stability test

7.6.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.6.1.

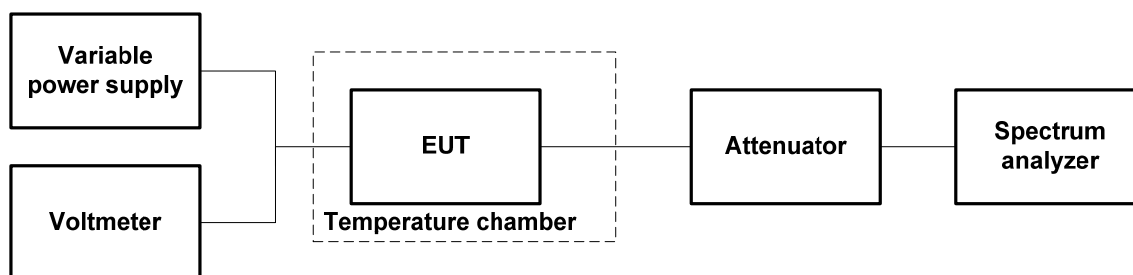
Table 7.6.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement
2496.0 – 2690.0	The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

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 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.
- 7.6.2.3 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.
- 7.6.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.6.2.5 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.
- 7.6.2.6 Frequency displacement was calculated and provided in Table 7.6.2.
- 7.6.2.7 The test results provided in Table 7.6.3.

Figure 7.6.1 Frequency stability test setup



Test specification: Section 27.54, Frequency stability			
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 09-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

Table 7.6.2 Frequency stability test results

OPERATING FREQUENCY: 2496.0 – 2690.0 MHz
 NOMINAL POWER VOLTAGE: 12 V
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: On
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 200 kHz
 VIDEO BANDWIDTH: 1000 kHz
 MODULATION: 64QAM

T, °C	Voltage, V	Bandedge side	Frequency, MHz							Max bandedge drift, MHz
			Start up	1 st min	2 nd min	3 rd min	4 th min	5 th min	10 th min	
Low carrier frequency, 2506 MHz										
-30	nominal	Lower	2496.565	2496.550	2496.565	2496.535	2496.580	2496.580	2496.580	2496.535
		Upper	2515.585	2515.585	2515.530	2515.615	2515.600	2515.570	2515.590	2515.615
-20	nominal	Lower	2496.475	NA	NA	NA	NA	NA	2496.505	2496.475
		Upper	2515.720	NA	NA	NA	NA	NA	2515.720	2515.720
-10	nominal	Lower	2496.550	NA	NA	NA	NA	NA	2496.490	2496.490
		Upper	2515.540	NA	NA	NA	NA	NA	2515.690	2515.690
0	nominal	Lower	2496.430	2496.325	2496.325	2496.425	2496.520	2496.475	2496.490	2496.325
		Upper	2515.855	2515.765	2515.805	2515.745	2515.630	2515.780	2515.675	2515.855
10	nominal	Lower	2496.505	NA	NA	NA	NA	NA	2496.505	2496.505
		Upper	2515.720	NA	NA	NA	NA	NA	2515.720	2515.720
20	15%	Lower	2496.550	NA	NA	NA	NA	NA	2496.550	2496.550
		Upper	2515.525	NA	NA	NA	NA	NA	2515.525	2515.525
20	nominal	Lower	2496.565	NA	NA	NA	NA	NA	2496.570	2496.565
		Upper	2515.525	NA	NA	NA	NA	NA	2515.570	2515.570
20	-15%	Lower	2496.550	NA	NA	NA	NA	NA	2496.550	2496.550
		Upper	2515.525	NA	NA	NA	NA	NA	2515.585	2515.585
30	nominal	Lower	2496.459	2496.444	2496.444	2496.504	2496.520	2496.445	2496.430	2496.430
		Upper	2515.585	2515.540	2515.585	2515.555	2515.585	2515.570	2515.600	2515.585
40	nominal	Lower	2496.459	NA	NA	NA	NA	NA	2496.459	2496.459
		Upper	2515.585	NA	NA	NA	NA	NA	2515.585	2515.585
50	nominal	Lower	2496.430	NA	NA	NA	NA	NA	2496.430	2496.430
		Upper	2515.570	NA	NA	NA	NA	NA	2515.555	2515.570
Mid carrier frequency, 2624 MHz										
-30	nominal	Lower	2614.400	2614.460	2614.520	2614.520	2614.490	2614.490	2614.460	2614.400
		Upper	2633.585	2633.525	2633.570	2633.580	2633.585	2633.585	2633.580	2633.585
-20	nominal	Lower	2614.460	NA	NA	NA	NA	NA	2614.400	2614.400
		Upper	2633.660	NA	NA	NA	NA	NA	2633.585	2633.660
-10	nominal	Lower	2614.445	NA	NA	NA	NA	NA	2614.450	2614.445
		Upper	2633.495	NA	NA	NA	NA	NA	2633.500	2633.500
0	nominal	Lower	2614.550	2614.520	2614.520	2614.535	2614.490	2614.490	2614.565	2614.490
		Upper	2633.690	2633.690	2633.555	2633.650	2633.530	2633.530	2633.540	2633.690
10	nominal	Lower	2614.445	NA	NA	NA	NA	NA	2614.580	2614.445
		Upper	2633.570	NA	NA	NA	NA	NA	2633.630	2633.630
20	15%	Lower	2614.475	NA	NA	NA	NA	NA	2614.475	2614.475
		Upper	2633.525	NA	NA	NA	NA	NA	2633.555	2633.555
20	nominal	Lower	2614.490	NA	NA	NA	NA	NA	2614.475	2614.475
		Upper	2633.555	NA	NA	NA	NA	NA	2633.525	2633.555
20	-15%	Lower	2614.445	NA	NA	NA	NA	NA	2614.475	2614.445
		Upper	2633.555	NA	NA	NA	NA	NA	2633.555	2633.555
30	nominal	Lower	2614.475	2614.460	2614.490	2614.520	2614.475	2614.480	2614.460	2614.460
		Upper	2633.585	2633.595	2633.555	2633.540	2633.540	2633.555	2633.595	2633.595
40	nominal	Lower	2614.505	NA	NA	NA	NA	NA	2614.445	2614.445
		Upper	2633.565	NA	NA	NA	NA	NA	2633.525	2633.565
50	nominal	Lower	2614.505	NA	NA	NA	NA	NA	2614.505	2614.505
		Upper	2633.570	NA	NA	NA	NA	NA	2633.575	2633.575

Test specification: Section 27.54, Frequency stability			
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 09-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

Table 7.6.2 Frequency stability test results (continued)

OPERATING FREQUENCY: 2496.0 – 2690.0 MHz
 NOMINAL POWER VOLTAGE: 12V
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: On
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 200 kHz
 VIDEO BANDWIDTH: 1000 kHz
 MODULATION: 64QAM

T, °C	Voltage, V	Bandedge side	Frequency, MHz							Max bandedge drift, MHz
			Start up	1 st min	2 nd min	3 rd min	4 th min	5 th min	10 th min	
High carrier frequency, 2680 MHz										
-30	nominal	Lower	2670.460	2670.490	2670.490	2670.445	2670.440	2670.460	2670.430	2670.430
		Upper	2689.585	2689.480	2689.555	2689.585	2689.590	2689.515	2689.525	2689.590
-20	nominal	Lower	2670.505	NA	NA	NA	NA	NA	2670.445	2670.445
		Upper	2689.600	NA	NA	NA	NA	NA	2689.585	2689.600
-10	nominal	Lower	2670.440	NA	NA	NA	NA	NA	2670.445	2670.440
		Upper	2689.465	NA	NA	NA	NA	NA	2689.480	2689.480
0	nominal	Lower	2670.475	2670.565	2670.535	2670.475	2670.475	2670.445	2670.415	2670.415
		Upper	2689.510	2689.450	2689.525	2689.510	2689.525	2689.540	2689.525	2689.540
10	nominal	Lower	2670.505	NA	NA	NA	NA	NA	2670.475	2670.475
		Upper	2689.570	NA	NA	NA	NA	NA	2689.600	2689.600
20	15%	Lower	2670.460	NA	NA	NA	NA	NA	2670.490	2670.460
		Upper	2689.510	NA	NA	NA	NA	NA	2689.525	2689.525
20	nominal	Lower	2670.460	NA	NA	NA	NA	NA	2670.520	2670.460
		Upper	2689.510	NA	NA	NA	NA	NA	2689.525	2689.525
20	-15%	Lower	2670.445	NA	NA	NA	NA	NA	2670.535	2670.445
		Upper	2689.510	NA	NA	NA	NA	NA	2689.525	2689.525
30	nominal	Lower	2670.505	2670.430	2670.415	2670.475	2670.480	2670.505	2670.475	2670.415
		Upper	2689.510	2689.600	2689.540	2689.495	2689.510	2689.510	2689.495	2689.600
40	nominal	Lower	2670.475	NA	NA	NA	NA	NA	2670.445	2670.445
		Upper	2689.480	NA	NA	NA	NA	NA	2689.525	2689.525
50	nominal	Lower	2670.475	NA	NA	NA	NA	NA	2670.445	2670.445
		Upper	2689.520	NA	NA	NA	NA	NA	2689.600	2689.600

* - Reference frequency



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Test specification: Section 27.54, Frequency stability			
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 09-Jun-16			
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power Supply: 12 VDC
Remarks:			

Table 7.6.3 Transmission occupied bandwidth with frequency drift test results

Lower measured* band edge, MHz	Upper measured* band edge, MHz	Lower specified band edge, MHz	Upper specified band edge, MHz	Lower margin**, MHz	Upper margin**, MHz	Verdict
2496.325	2515.855	2496.000	2516.000	-0.325	-0.145	Pass
2614.400	2633.690	2614.000	2634.000	-0.400	-0.310	Pass
2670.415	2689.600	2670.000	2690.000	-0.415	-0.400	Pass

* - Measured under normal test conditions at 26 dBc points

** - Margin = Measured band edge – specified band edge

Reference numbers of test equipment used

HL 3210	HL 3286	HL 3818	HL 4068	HL 4224	HL 4275	HL 4756	
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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
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	18-Jan-16	18-Jan-17
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Oct-15	27-Oct-16
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	10-May-16	10-May-17
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY451024 62	08-Sep-15	08-Sep-16
3210	Temperature Chamber, (-50...+100) °C	Associated Environmental Systems	NA	NA	09-Sep-15	09-Sep-16
3286	Temperature Chamber, (-50 to +170) °C	Thermotron	EL-8-CH-1-1-CO2	21-9048	01-Oct-15	01-Oct-16
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	26-Apr-16	26-Jul-17
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	30-Jan-16	30-Apr-17
3433	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25679	20-Mar-16	20-Mar-17
3787	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	01-Dec-15	01-Dec-16
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	03-May-16	03-May-17
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	15-Feb-16	15-Feb-17
4068	Attenuator, SMA, 30 dB, DC to 12.4 GHz	Midwest Microwave	ATT-0527-30-SMA-07	NA	13-Jul-15	13-Jul-16
4224	Precision Fixed Attenuator, 50 Ohm, 5W, 10dB, DC to 18000 MHz	Mini-Circuits	BW-N10W5+	NA	09-Mar-16	09-Mar-17
4275	Test Cable , DC-18 GHz, 1.8 m, SMA/M - N/M	Mini-Circuits	CBL-6FT-SMNM+	70050	22-Nov-15	22-Nov-16
4278	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0755A	22-Nov-15	22-Nov-16
4338	Reject Band Filter, 50 Ohm, 0 to 2170 and 3000 to 18000 MHz, SMA-FM / SMA-M	Micro-Tronics	BRM 50702-02	023	08-May-16	08-May-17
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101 003	15-Mar-16	15-Mar-17
4366	Directional coupler, 1 GHz to 18 GHz, 10 dB, SMA Female	Tiger Micro-Electronics Institute	TGD-A1101-10	01e-JSDE805-007	26-May-16	26-May-18
4916	High Pass Filter, 50 Ohm, 3150 to 6500 MHz, SMA-FM / SMA-M	Mini-Circuits	VHF-2700+	NA	01-Oct-15	01-Oct-17



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Report ID: AIRRAD_FCC.28457.docx
Date of Issue: 18-Jul-16

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	04-Sep-15	04-Sep-16
4956	Active horn antenna, 18 to 40 GHz	Com-Power Corporation	AHA-840	105004	09-Nov-15	09-Nov-16
4756	Digital Hygrometer / Thermometer, (0 to +50) deg., (20 to 99) %RH	WESTERN Humidor Corporation	Caliber 4	NA	02-Nov-15	02-Nov-16

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 %

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

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.

Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file number IC 2186A-1 for OATS), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01). The FCC Designation Number is IL1001.

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Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

47CFR part 27: 2015	Private land mobile radio services
47CFR part 1: 2015	Practice and procedure
47CFR part 2: 2015	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: 2009	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.
ANSI/TIA/EIA-603-D:2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

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
Biconilog antenna EMCO Model 3141
Ser.No.1011, HL 0604

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
26	7.8	580	20.6	1320	27.8
28	7.8	600	21.3	1340	28.3
30	7.8	620	21.5	1360	28.2
40	7.2	640	21.2	1380	27.9
60	7.1	660	21.4	1400	27.9
70	8.5	680	21.9	1420	27.9
80	9.4	700	22.2	1440	27.8
90	9.8	720	22.2	1460	27.8
100	9.7	740	22.1	1480	28.0
110	9.3	760	22.3	1500	28.5
120	8.8	780	22.6	1520	28.9
130	8.7	800	22.7	1540	29.6
140	9.2	820	22.9	1560	29.8
150	9.8	840	23.1	1580	29.6
160	10.2	860	23.4	1600	29.5
170	10.4	880	23.8	1620	29.3
180	10.4	900	24.1	1640	29.2
190	10.3	920	24.1	1660	29.4
200	10.6	940	24.0	1680	29.6
220	11.6	960	24.1	1700	29.8
240	12.4	980	24.5	1720	30.3
260	12.8	1000	24.9	1740	30.8
280	13.7	1020	25.0	1760	31.1
300	14.7	1040	25.2	1780	31.0
320	15.2	1060	25.4	1800	30.9
340	15.4	1080	25.6	1820	30.7
360	16.1	1100	25.7	1840	30.6
380	16.4	1120	26.0	1860	30.6
400	16.6	1140	26.4	1880	30.6
420	16.7	1160	27.0	1900	30.6
440	17.0	1180	27.0	1920	30.7
460	17.7	1200	26.7	1940	30.9
480	18.1	1220	26.5	1960	31.2
500	18.5	1240	26.5	1980	31.6
520	19.1	1260	26.5	2000	32.0
540	19.5	1280	26.6		
560	19.8	1300	27.0		

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).



HERMON LABORATORIES

Antenna factor, HL 4933

**Active Horn Antenna Factor Calibration**

1 GHz to 18 GHz

Equipment:			ACTIVE HORN ANTENNA		
Model:			AHA-118		
Serial Number:			701046		
Calibration Distance:			3 Meter		
Polarization:			Horizontal		
Calibration Date:			11/12/2014		
Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)	Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)
1	40.96	-16.47	10	40.94	-1.97
1.5	41.21	-14.53	10.5	40.63	-1.06
2	41.44	-13.30	11	40.74	-1.50
2.5	41.71	-12.87	11.5	40.65	-0.52
3	41.96	-12.26	12	40.76	-0.15
3.5	42.14	-11.77	12.5	41.03	-0.85
4	42.13	-10.91	13	41.37	-0.81
4.5	41.79	-9.41	13.5	41.18	0.05
5	41.44	-7.54	14	40.98	0.36
5.5	40.91	-6.47	14.5	40.81	1.26
6	40.69	-5.48	15	40.65	0.25
6.5	40.64	-5.53	15.5	40.93	-1.05
7	40.76	-4.12	16	41.31	-1.44
7.5	40.94	-3.12	16.5	40.96	-0.80
8	40.68	-1.69	17	40.64	-0.02
8.5	40.08	-1.71	17.5	40.57	1.81
9	40.41	-1.86	18	40.08	3.63
9.5	41.21	-2.73			
Calibration according to ARP 958					
Antenna Factor to be added to receiver reading:					
Meter Reading (dBuV) + Antenna Factor (dB/m) = Corrected Reading (dBuV/m)					



HERMON LABORATORIES

Antenna factor, HL 4956

**Active Horn Antenna Factor Calibration**

18 GHz to 40 GHz

Equipment:			ACTIVE HORN ANTENNA		
Model:			AHA-840		
Serial Number:			105004		
Calibration Distance:			3 meter		
Polarization:			Horizontal		
Calibration Date:			1/26/2015		
Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)	Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)
18	38.83	-1.06	29.5	42.47	-5.33
18.5	39.34	-2.65	30	41.91	-4.86
19	39.71	-3.88	30.5	41.60	-4.64
19.5	39.87	-4.35	31	41.52	-4.60
20	39.98	-3.97	31.5	41.56	-4.79
20.5	40.42	-3.68	32	41.80	-5.21
21	41.12	-4.06	32.5	42.29	-5.54
21.5	41.74	-5.46	33	42.79	-5.63
22	42.14	-6.22	33.5	42.88	-5.38
22.5	42.35	-6.42	34	42.62	-4.76
23	42.50	-6.59	34.5	42.63	-4.84
23.5	42.65	-6.82	35	43.15	-5.13
24	42.81	-7.01	35.5	43.91	-5.83
24.5	42.86	-7.37	36	44.59	-6.39
25	42.73	-7.53	36.5	45.04	-6.64
25.5	42.77	-7.45	37	45.08	-6.40
26	42.85	-7.21	37.5	44.82	-5.75
26.5	42.98	-7.17	38	44.16	-4.58
27	43.14	-7.22	38.5	42.90	-2.66
27.5	43.18	-7.32	39	42.39	-1.71
28	43.04	-7.10	39.5	43.76	-2.49
28.5	43.01	-6.73	40	45.98	-5.21
Calibration per ANSI C63.5: 2006 Standard Site Method, Equations 1-6 (3-antenna) Corrected Reading (dBμV/m) = Meter Reading (dBμV) + AFE(dB/m)					

Cable loss
Test Cable, Mini-Circuits, CBL-5FT-SMSM+, SMA-SMA, 18 GHz, 1.5 m, S/N 25679
Mini-Circuits, HL 3433

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10.0	0.06	9000	2.01
100	0.17	9500	2.06
500	0.41	10000	2.05
1000	0.58	10500	2.18
1500	0.72	11000	2.26
2000	0.86	11500	2.28
2500	0.96	12000	2.43
3000	1.04	12500	2.53
3500	1.13	13000	2.52
4000	1.23	13500	2.56
4500	1.31	14000	2.60
5000	1.41	14500	2.59
5500	1.49	15000	2.67
6000	1.55	15500	2.76
6500	1.63	16000	2.86
7000	1.71	16500	2.91
7500	1.78	17000	2.95
8000	1.86	17500	3.02
8500	1.92	18000	3.07

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
Test cable, Mini-Circuits, S/N 70050, 18 GHz, 1.8 m, SMA/M - N/M
CBL-6FT-SMNM+, HL 4275

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.08	5000	1.71	10200	2.64	15400	3.46
30	0.11	5100	1.73	10300	2.65	15500	3.47
50	0.14	5200	1.75	10400	2.66	15600	3.52
100	0.21	5300	1.76	10500	2.67	15700	3.55
200	0.30	5400	1.77	10600	2.70	15800	3.55
300	0.37	5500	1.82	10700	2.71	15900	3.55
400	0.43	5600	1.84	10800	2.72	16000	3.61
500	0.49	5700	1.86	10900	2.73	16100	3.62
600	0.54	5800	1.86	11000	2.75	16200	3.63
700	0.58	5900	1.89	11100	2.77	16300	3.62
800	0.62	6000	1.94	11200	2.78	16400	3.66
900	0.66	6100	1.95	11300	2.80	16500	3.71
1000	0.70	6200	1.96	11400	2.82	16600	3.71
1100	0.74	6300	1.97	11500	2.83	16700	3.67
1200	0.78	6400	2.01	11600	2.84	16800	3.69
1300	0.81	6500	2.03	11700	2.86	16900	3.74
1400	0.84	6600	2.02	11800	2.88	17000	3.73
1500	0.88	6700	2.02	11900	2.89	17100	3.71
1600	0.91	6800	2.05	12000	2.90	17200	3.73
1700	0.94	6900	2.06	12100	2.92	17300	3.77
1800	0.97	7000	2.07	12200	2.93	17400	3.77
1900	1.00	7100	2.07	12300	2.94	17500	3.76
2000	1.02	7200	2.08	12400	2.96	17600	3.76
2100	1.05	7300	2.11	12500	2.98	17700	3.78
2200	1.07	7400	2.13	12600	2.99	17800	3.80
2300	1.10	7500	2.15	12700	3.01	17900	3.79
2400	1.13	7600	2.16	12800	3.03	18000	3.78
2500	1.15	7700	2.18	12900	3.05		
2600	1.18	7800	2.21	13000	3.07		
2700	1.20	7900	2.24	13100	3.09		
2800	1.24	8000	2.25	13200	3.12		
2900	1.26	8100	2.26	13300	3.13		
3000	1.28	8200	2.29	13400	3.14		
3100	1.30	8300	2.31	13500	3.16		
3200	1.33	8400	2.33	13600	3.18		
3300	1.36	8500	2.33	13700	3.19		
3400	1.37	8600	2.34	13800	3.21		
3500	1.39	8700	2.36	13900	3.23		
3600	1.42	8800	2.38	14000	3.25		
3700	1.45	8900	2.39	14100	3.26		
3800	1.46	9000	2.40	14200	3.27		
3900	1.48	9100	2.42	14300	3.30		
4000	1.50	9200	2.45	14400	3.32		
4100	1.53	9300	2.46	14500	3.33		
4200	1.55	9400	2.48	14600	3.34		
4300	1.57	9500	2.50	14700	3.36		
4400	1.59	9600	2.52	14800	3.39		
4500	1.61	9700	2.54	14900	3.40		
4600	1.64	9800	2.56	15000	3.41		
4700	1.66	9900	2.58	15100	3.41		
4800	1.67	10000	2.60	15200	3.44		
4900	1.69	10100	2.61	15300	3.46		

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
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,
NC29-N1N1-244S/N 12025101 003,
HL 4353

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.20	9000	2.71
100	0.27	9500	2.81
300	0.47	10000	2.90
500	0.61	10500	2.97
1000	0.87	11000	3.06
1500	1.07	11500	3.13
2000	1.24	12000	3.20
2500	1.39	12500	3.26
3000	1.53	13000	3.34
3500	1.65	13500	3.39
4000	1.77	14000	3.47
4500	1.89	14500	3.54
5000	1.99	15000	3.62
5500	2.07	15500	3.69
6000	2.20	16000	3.76
6500	2.30	16500	3.83
7000	2.39	17000	3.86
7500	2.51	17500	3.94
8000	2.58	18000	4.02
8500	2.65		

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
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
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
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt

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