

# TEST REPORT

ACCORDING TO: FCC 47CFR part 27

FOR:

**Airspan Networks Inc.**  
**LTE Base Station**  
**Model: AirSpeed1200, 2.6 GHz (B41LH)**  
**FCC ID:PIDAS1200**

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## 1 Applicant information

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**Telephone:** +1 561 893 8670  
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**E-mail:** zlevi@airspan.com  
**Contact name:** Mr. Zion Levi

## 2 Equipment under test attributes

**Product name:** LTE Base Station  
**Product type:** Transceiver  
**Model(s):** AirSpeed1200 2.6 GHz (B41LH)  
**Serial number:** DA4B13417C14  
**Hardware version:** A0  
**Software release:** 6\_4\_1\_119  
**Receipt date** 15-Aug-17

## 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:** 29984  
**Location:** Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel  
**Test started:** 15-Aug-17  
**Test completed:** 03-Sep-17  
**Test specification(s):** FCC 47CFR part 27

## 5 Tests summary

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

	Name and Title	Date	Signature
<b>Tested by:</b>	Mr. S. Samokha, test engineer Mr. A. Morozov, test engineer	September 3, 2017	 
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	September 11, 2017	
<b>Approved by:</b>	Mr. M. Nikishin, EMC and Radio group manager	September 28, 2017	

## 6 EUT description

### 6.1 General information

The EUT, digital station, model AirSpeed1200 2.6GHz (B41LH), 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 10.5 dBi external antenna. Advanced Antenna Techniques 2x8 MIMO are supported. The maximum total RF output power (not including antenna gain) is 28.33 dBm for 10.5 dBi and it can be reduced by software.

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.

### 6.2 Ports and lines

Port Type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	AC power	EUT	AC mains	1	Unshielded	3
Signal	GPS	EUT	GPS external antenna	1	Coax	3
Signal	Eth. POE	EUT	Laptop	1	FTP	3
Signal	Serial*	Not connected	Not connected	1	NA	NA

\*for maintenance only

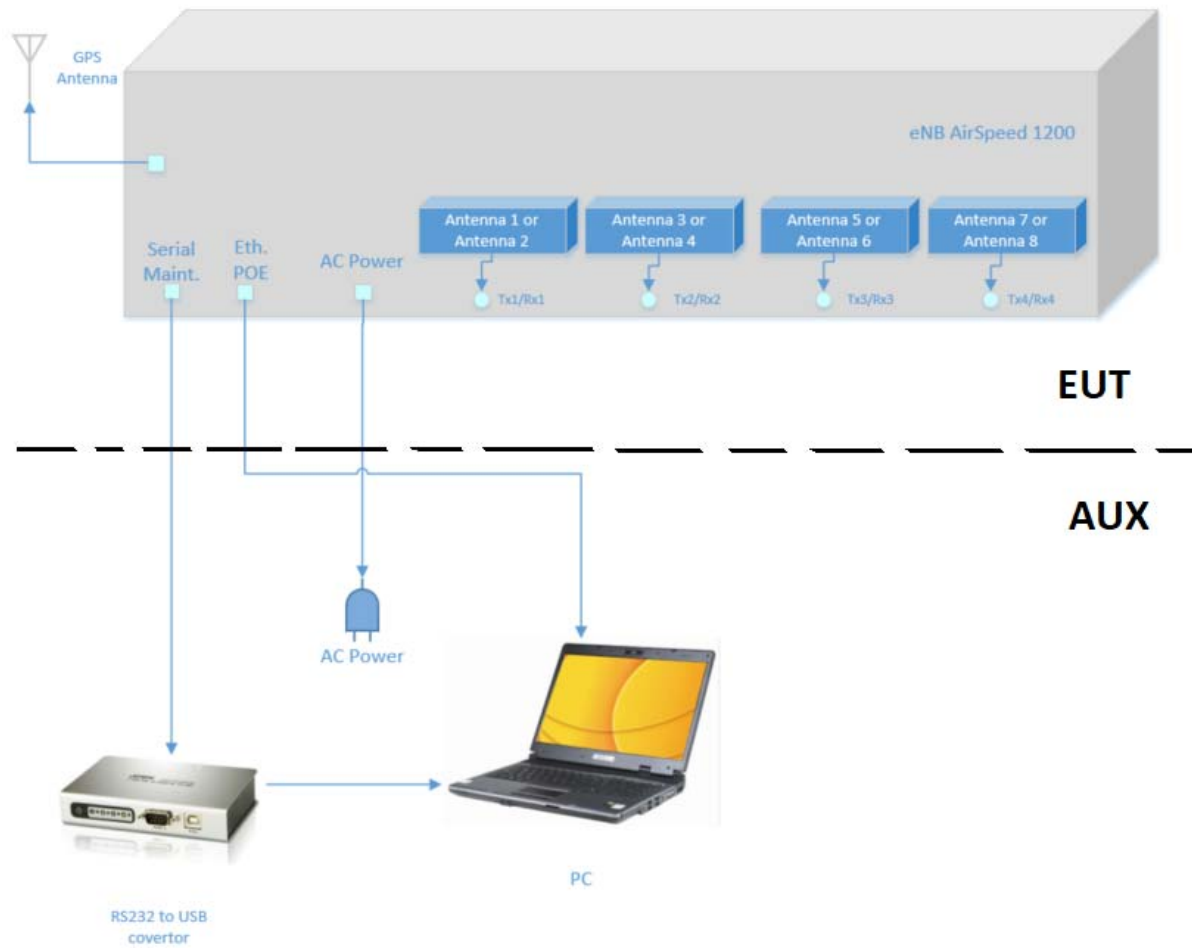
### 6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Laptop	Dell	E7450	8TYRP32

### 6.4 Changes made in the EUT

No changes were implemented in the EUT during testing.

## 6.5 Test configuration



## 6.6 Transmitter characteristics

<b>Type of equipment</b>			
<input checked="" type="checkbox"/>	Stand-alone (Equipment with or without its own control provisions)		
<input type="checkbox"/>	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)		
<input type="checkbox"/>	Plug-in card (Equipment intended for a variety of host systems)		
<b>Intended use</b>		<b>Condition of use</b>	
<input checked="" type="checkbox"/>	fixed	Always at a distance more than 2 m from all people	
<input type="checkbox"/>	mobile	Always at a distance more than 20 cm from all people	
<input type="checkbox"/>	portable	May operate at a distance closer than 20 cm to human body	
<b>Assigned frequency range</b>		2496.0 – 2690.0 MHz	
<b>Operating frequency (full bands)</b>		2506.0 – 2680.0 MHz	
<b>RF channel spacing</b>		20 MHz	
<b>Maximum rated output power</b>		At transmitter 50 $\Omega$ RF output connector (aggregate power of both RF chains)	
		28.33 dBm	
<b>Is transmitter output power variable?</b>		<input type="checkbox"/> No	
		<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> continuous variable
			<input checked="" type="checkbox"/> stepped variable with step size
			0.25 dB
		minimum RF power	
		-30 dBm	
		maximum RF power at antenna connector	
		28.33 dBm	
<b>Antenna connection</b>			
<input type="checkbox"/> unique coupling	<input checked="" type="checkbox"/> standard connector	<input type="checkbox"/> Integral	<input checked="" type="checkbox"/> with temporary RF connector
		<input type="checkbox"/> without temporary RF connector	
<b>Antenna/s technical characteristics</b>			
Type	Manufacturer	Model number	Gain
External	ALPHA Wireless Ltd	AW3627	10.5 dBi
<b>Transmitter aggregate data rate/s, MBps</b>			
Transmitter 26dBc power bandwidth		Type of modulation	
		QPSK	16QAM
20 MHz		23.4	45.4
		64QAM	
		95.0	
<b>Type of multiplexing</b>		TDD	
<b>Modulating test signal (baseband)</b>		PRBS	
<b>Maximum transmitter duty cycle in normal use</b>		55%	
<b>Transmitter power source</b>			
	Nominal rated voltage	Battery type	
<input type="checkbox"/>	DC	Nominal rated voltage	
<input checked="" type="checkbox"/>	AC mains	Nominal rated voltage	120 VAC
		Frequency	
<b>Common power source for transmitter and receiver</b>		<input checked="" type="checkbox"/> yes	<input type="checkbox"/> no

<b>Test specification:</b> <b>Section 2.1049, Occupied bandwidth</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1049			
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.2 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

## 7 Transmitter tests according to 47CFR part 27

### 7.1 Occupied bandwidth test

#### 7.1.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, %	Maximum allowed bandwidth, kHz
2496.0 – 2690.0 MHz	99%	NA

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

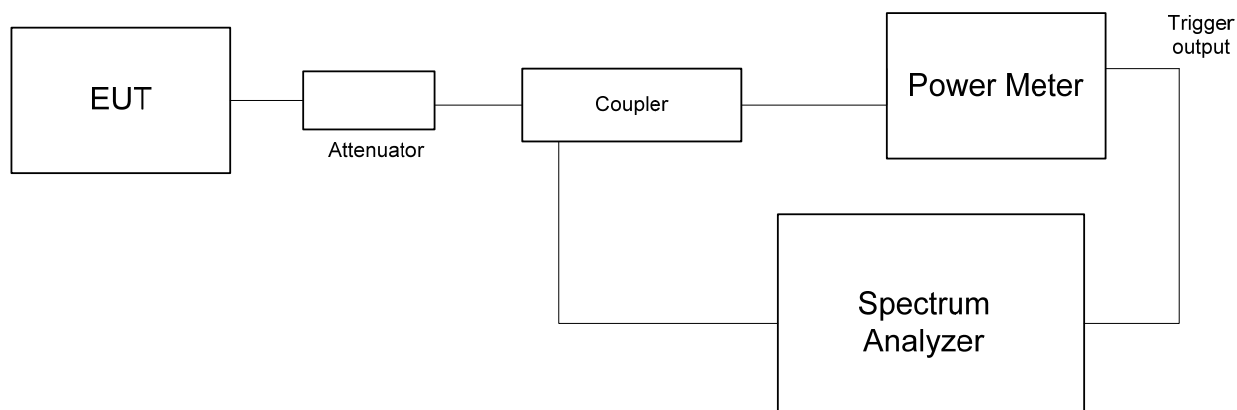
#### 7.1.2 Test procedure

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 set to transmit the normal modulated signal and actual channel width was measured at the 26 dBc modulation envelope reference points.

7.1.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.1.2 and the associated plots.

Figure 7.1.1 Occupied bandwidth test setup







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<b>Test specification:</b> <b>Section 2.1049, Occupied bandwidth</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1049			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.2 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Table 7.1.2 Occupied bandwidth test results

DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 390 kHz  
 MODULATION ENVELOPE REFERENCE POINTS: 26 dBc; 99%  
 EBW: 20 MHz

Carrier frequency, MHz	OBW 26 dBc, MHz	OBW 99%, MHz	Limit, kHz	Verdict
<b>QPSK</b>				
2506.0	19.020	17.9699	NA	Pass
2624.0	19.125	17.9729	NA	Pass
2680.0	19.154	17.9548	NA	Pass
<b>64QAM</b>				
2506.0	19.270	17.9778	NA	Pass
2624.0	18.996	17.8498	NA	Pass
2680.0	19.270	17.9580	NA	Pass

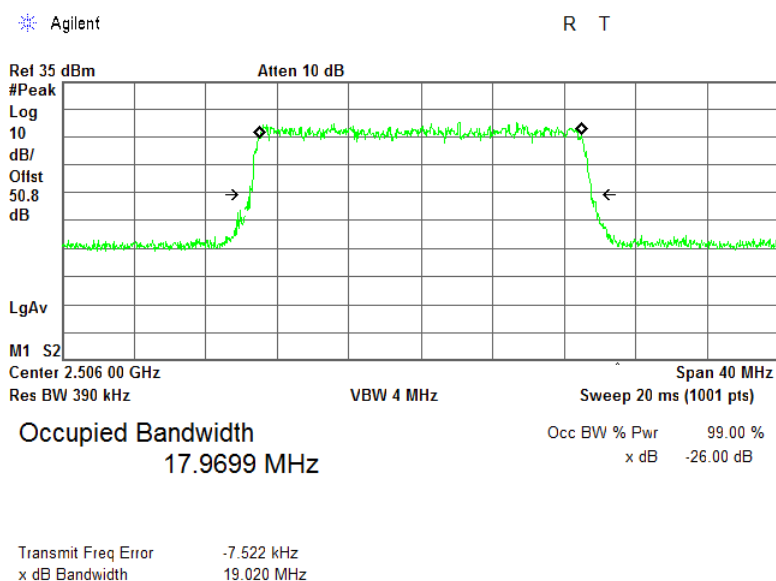
**Reference numbers of test equipment used**

HL 3301	HL 3302	HL 3667	HL 3901	HL 5112			
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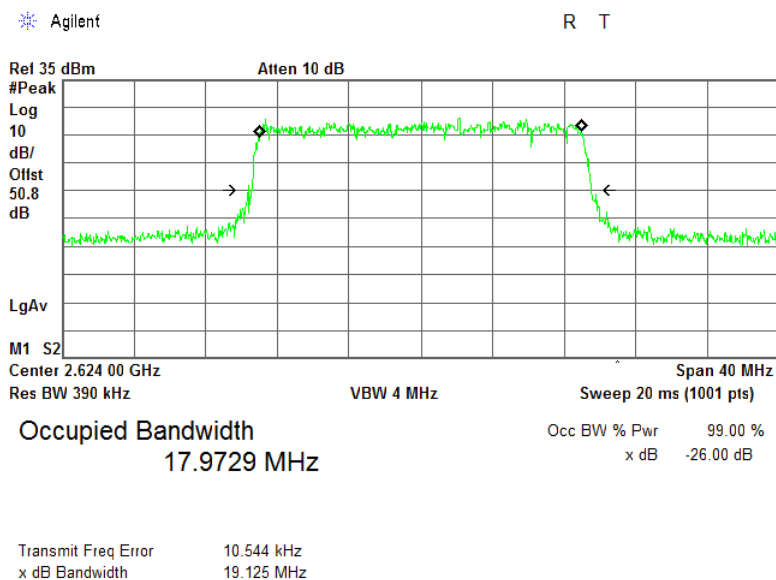
Full description is given in Appendix A.

<b>Test specification:</b> <b>Section 2.1049, Occupied bandwidth</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1049			
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.2 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.1.1 Occupied bandwidth test results at low frequency, 20 MHz EBW, QPSK

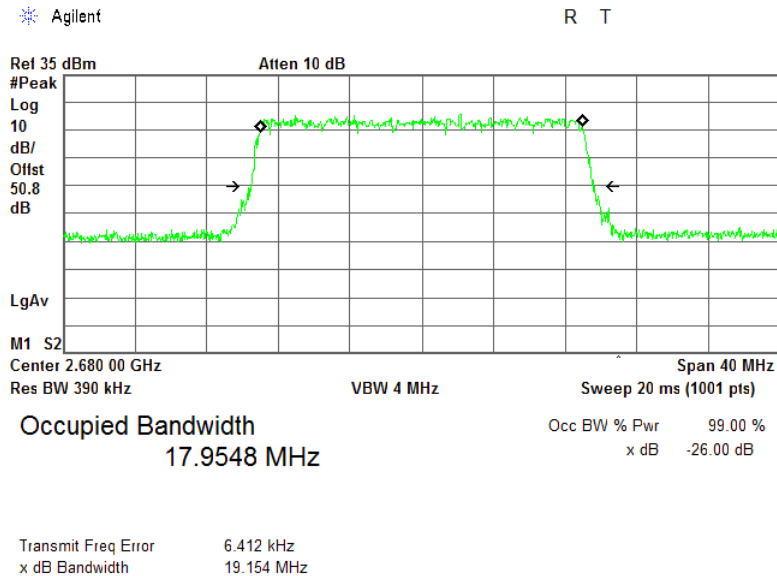


Plot 7.1.2 Occupied bandwidth test results at mid frequency, 20 MHz EBW, QPSK

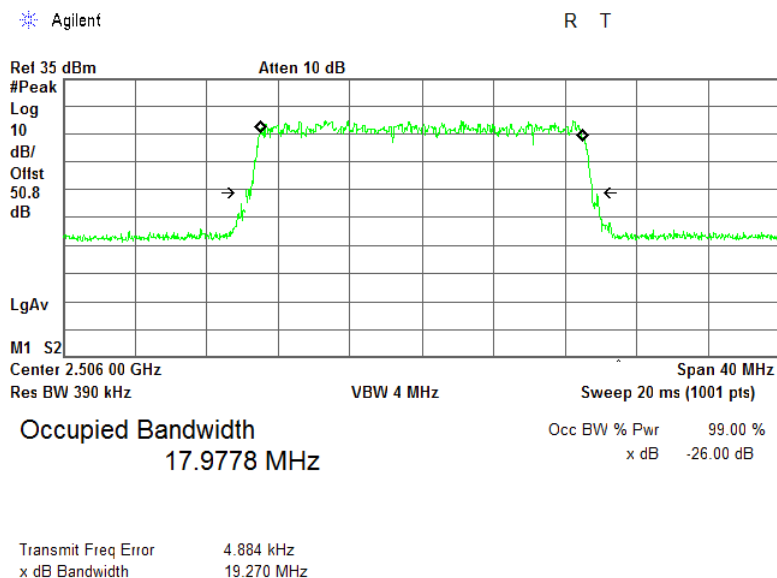


Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-17			
Temperature: 24.2 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 120 VAC
Remarks:			

Plot 7.1.3 Occupied bandwidth test results at high frequency, 20 MHz EBW, QPSK



Plot 7.1.4 Occupied bandwidth test results at low frequency, 20 MHz EBW, 64QAM

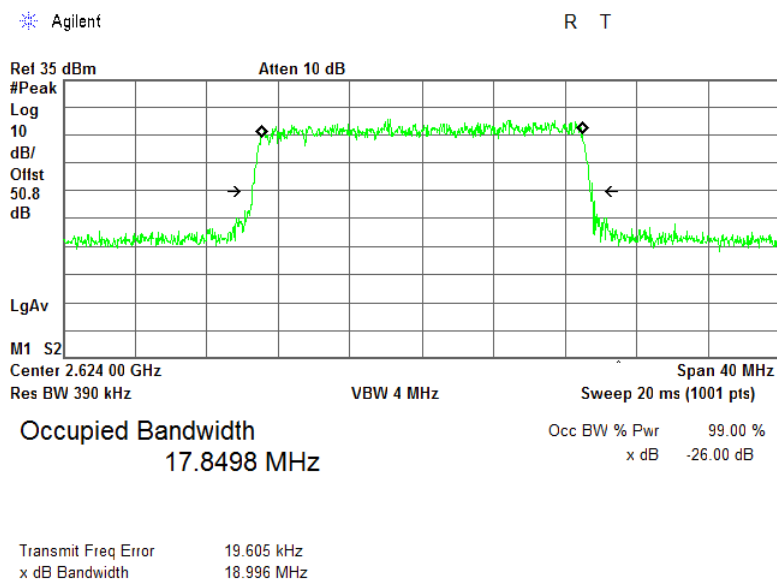




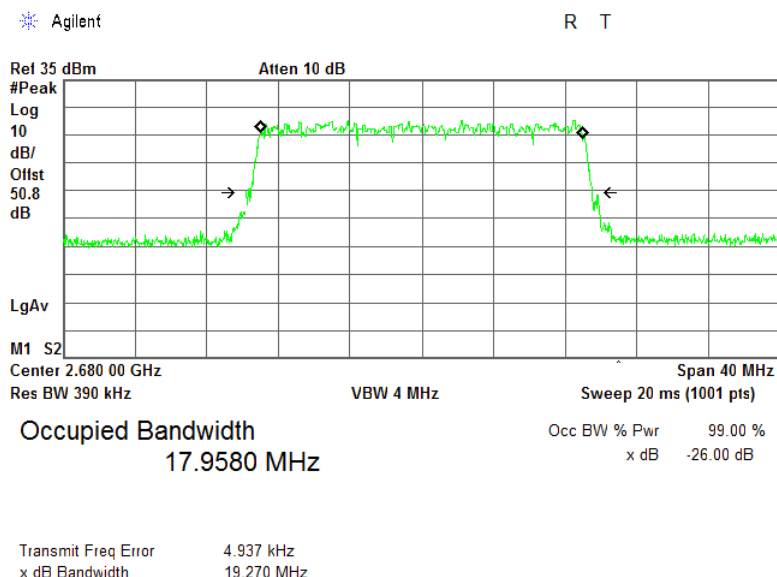
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Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-17			
Temperature: 24.2 °C	Relative Humidity: 43 %	Air Pressure: 1008 hPa	Power: 120 VAC
Remarks:			

Plot 7.1.5 Occupied bandwidth test results at mid frequency, 20 MHz EBW, 64QAM



Plot 7.1.6 Occupied bandwidth test results at high frequency, 20 MHz EBW, 64QAM





<b>Test specification: Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

## 7.2 Peak output power test

### 7.2.1 General

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

Table 7.2.1 Peak output power limits

Transmitter type	Assigned frequency range, MHz	Maximum peak output power, dBm
Main, booster and base stations	2496.0 – 2690.0	$63 + 10\log(X/Y) + 10\log(360/\text{beamwidth})$
		<b>Maximum peak power density, dBm/100 kHz</b>
		$\text{EIRP} + 10\log(0.1/Y)$

\*- X is the actual channel width in MHz (occupied bandwidth), Y is either

- 1) 6 MHz if prior to transition or the station is in the MBS following transition or
- 2) 5.5 MHz if the station is in the LBS and UBS following transition, and
- 3) beamwidth is the total horizontal plane beam width of the individual transmitting antenna for the station or any sector measured at the half-power points.

### 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.

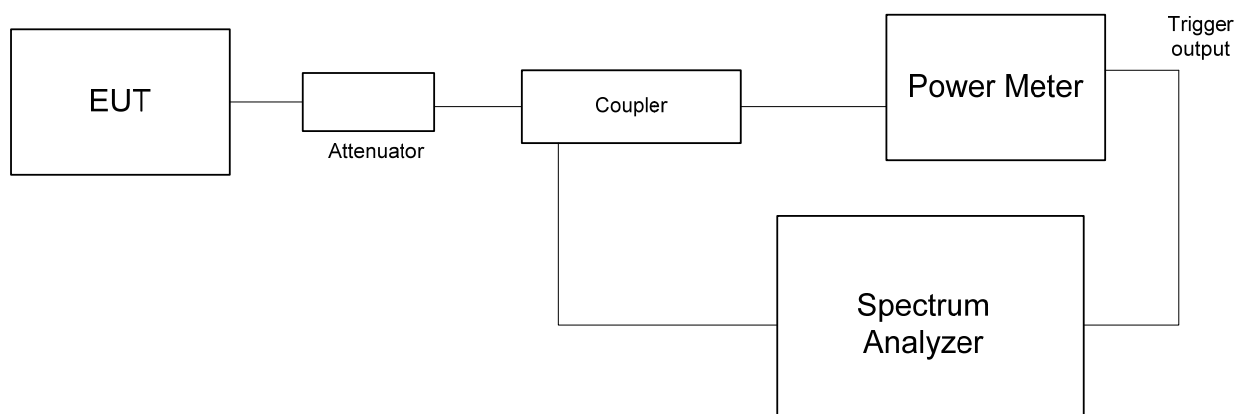
**7.2.2.3** The average output power was measured with power meter as provided in Table 7.2.2.

**7.2.2.4** The power spectral density was measured with spectrum analyzer as provided in Table 7.2.3 and the associated plots.

**7.2.2.5** The test results are provided in the tables below and associated plots.

<b>Test specification:</b>		<b>Section 27.50, Peak output power</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>			
15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Figure 7.2.1 Peak output power test setup





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<b>Test specification:</b>		<b>Section 27.50, Peak output power</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date(s):</b>	15-Aug-17		
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Table 7.2.2 Peak output power test results

DETECTOR USED:

Average within Tx burst

DUTY CYCLE:

55%

EBW:

20 MHz

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power**, dBm	Antenna gain, dBi	Total EIRP*, dBm	Limit***, dBm	Margin, dB	Verdict
<b>Antenna Chain RF #1 / #3</b>								
<b>QPSK</b>								
2506.0	24.70	25.06	27.88	10.5	38.38	69.01	-30.63	Pass
2624.0	25.12	25.35	28.24	10.5	38.75	69.31	-30.56	Pass
2680.0	25.17	25.14	28.16	10.5	38.66	69.11	-30.45	Pass
<b>64QAM</b>								
2506.0	25.19	25.26	28.23	10.5	38.74	69.02	-30.27	Pass
2624.0	25.17	25.24	28.21	10.5	38.71	69.28	-30.58	Pass
2680.0	25.21	25.24	28.23	10.5	38.74	69.11	-30.37	Pass
<b>Antenna Chain RF #2 / #4</b>								
<b>QPSK</b>								
2506.0	24.92	25.34	28.14	10.5	38.64	69.01	-30.38	Pass
2624.0	25.19	25.14	28.17	10.5	38.68	69.31	-30.63	Pass
2680.0	25.09	25.20	28.15	10.5	38.65	69.11	-30.46	Pass
<b>64QAM</b>								
2506.0	24.59	25.06	27.83	10.5	38.35	69.02	-30.67	Pass
2624.0	25.29	25.23	28.26	10.5	38.76	69.28	-30.52	Pass
2680.0	25.22	25.34	28.28	10.5	38.80	69.11	-30.31	Pass
<b>Antenna Chain RF #5 / #7</b>								
<b>QPSK</b>								
2506.0	24.33	25.23	27.80	10.5	38.30	69.01	-30.71	Pass
2624.0	25.15	25.36	28.26	10.5	38.77	69.31	-30.54	Pass
2680.0	25.23	25.37	28.30	10.5	38.80	69.11	-30.31	Pass
<b>64QAM</b>								
2506.0	24.92	25.20	28.06	10.5	38.58	69.02	-30.44	Pass
2624.0	25.39	25.26	28.33	10.5	38.83	69.28	-30.46	Pass
2680.0	25.28	25.21	28.25	10.5	38.76	69.11	-30.35	Pass
<b>Antenna Chain RF #6 / #8</b>								
<b>QPSK</b>								
2506.0	24.63	25.22	27.94	10.5	38.44	69.01	-30.58	Pass
2624.0	25.23	25.16	28.20	10.5	38.71	69.31	-30.60	Pass
2680.0	25.25	25.22	28.24	10.5	38.74	69.11	-30.37	Pass
<b>64QAM</b>								
2506.0	24.21	24.98	27.61	10.5	38.13	69.02	-30.89	Pass
2624.0	25.43	25.21	28.32	10.5	38.82	69.28	-30.46	Pass
2680.0	25.37	25.27	28.32	10.5	38.84	69.11	-30.27	Pass

\* - EIRP total, dBm = Total RF power\*\*, dBm + Antenna Gain, dBi

\*\* - Total RF power, dBm =  $10 \cdot \log[10^{(\text{Power RF\#1}/10)} + 10^{(\text{Power RF\#2}/10)}]$ 

\*\*\* - See Table 7.2.5

## Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302					
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Full description is given in Appendix A.



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<b>Test specification:</b> Section 27.50, Peak output power			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Table 7.2.3 Power spectral density test results

DETECTOR USED: Average gated  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 CHANNEL BANDWIDTH: 20 MHz  
 DUTY CYCLE: 55%

Carrier frequency, MHz	SA reading*, RF #1 dBm/100kHz	SA reading*, RF #2 dBm/100kHz	Total PSD dBm/100kHz	Antenna gain, dBi	Total EIRP**, dBm/100kHz	Limit***, dBm/100kHz	Margin, dB	Verdict
<b>Antenna Chain RF #1 / #3</b>								
<b>QPSK</b>								
2506.0	4.19	4.58	7.39	10.5	17.89	45.49	-27.60	Pass
2624.0	5.00	4.88	7.94	10.5	18.44	46.09	-27.65	Pass
2680.0	4.40	4.78	7.59	10.5	18.09	45.68	-27.59	Pass
<b>64QAM</b>								
2506.0	4.54	4.94	7.74	10.5	18.24	45.49	-27.25	Pass
2624.0	4.98	5.41	8.20	10.5	18.70	46.06	-27.36	Pass
2680.0	4.99	4.97	7.98	10.5	18.48	45.68	-27.20	Pass
<b>Antenna Chain RF #2 / #4</b>								
<b>QPSK</b>								
2506.0	4.70	4.48	7.59	10.5	18.09	45.49	-27.40	Pass
2624.0	5.33	5.41	8.37	10.5	18.87	46.09	-27.22	Pass
2680.0	4.71	4.64	7.68	10.5	18.18	45.68	-27.51	Pass
<b>64QAM</b>								
2506.0	4.41	4.93	7.68	10.5	18.18	45.49	-27.32	Pass
2624.0	5.51	5.44	8.48	10.5	18.98	46.06	-27.09	Pass
2680.0	4.79	4.84	7.82	10.5	18.32	45.68	-27.37	Pass
<b>Antenna Chain RF #5 / #7</b>								
<b>QPSK</b>								
2506.0	3.82	4.79	7.33	10.5	17.83	45.49	-27.66	Pass
2624.0	5.44	5.05	8.25	10.5	18.75	46.09	-27.34	Pass
2680.0	4.78	5.36	8.08	10.5	18.58	45.68	-27.10	Pass
<b>64QAM</b>								
2506.0	4.36	4.96	7.67	10.5	18.17	45.49	-27.32	Pass
2624.0	5.66	5.36	8.51	10.5	19.01	46.06	-27.05	Pass
2680.0	5.02	5.24	8.13	10.5	18.63	45.68	-27.05	Pass
<b>Antenna Chain RF #6 / #8</b>								
<b>QPSK</b>								
2506.0	4.11	4.75	7.44	10.5	17.94	45.49	-27.55	Pass
2624.0	5.49	5.04	8.27	10.5	18.79	46.09	-27.30	Pass
2680.0	4.94	5.03	7.99	10.5	18.49	45.68	-27.20	Pass
<b>64QAM</b>								
2506.0	3.66	4.43	7.06	10.5	17.58	45.49	-27.92	Pass
2624.0	5.76	5.18	8.48	10.5	18.98	46.06	-27.08	Pass
2680.0	4.88	5.39	8.14	10.5	18.66	45.68	-27.03	Pass

\* SA reading including attenuation, cable loss and **Duty Cycle correction factor**

\*\* - Total EIRP PSD, dBm =  $10 \cdot \log[10^{\wedge}(\text{SA reading Max (dBm/100kHz, RF\#1/10)} + 10^{\wedge}(\text{SA reading Max (dBm/100kHz, RF\#2/10)})] + \text{Antenna Gain, dBi}$

\*\*\* See Table 7.2.6

#### Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302	HL 3818	HL 3901			
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Full description is given in Appendix A.





Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-17			
Temperature: 24.3 °C	Relative Humidity: 43 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

Table 7.2.4 Post - transition frequency channels assignment

Channel	OBW, MHz	Peak power limit, dBm	Power density limit, dBm/100kHz
<b>20 MHz QPSK</b>			
2506.0 MHz BRS1+EBS A1+A2+A3	17.9699	$63+10\log(\text{OBW}/22.5)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.5)$
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	17.9729	$63+10\log(\text{OBW}/24.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/24.0)$
2680.0 MHz EBS H3+G1+G2+G3	17.9548	$63+10\log(\text{OBW}/22.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.0)$
<b>20 MHz 64QAM</b>			
2506.0 MHz BRS1+EBS A1+A2+A3	17.9778	$63+10\log(\text{OBW}/22.5)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.5)$
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	17.8498	$63+10\log(\text{OBW}/24.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/24.0)$
2680.0 MHz EBS H3+G1+G2+G3	17.958	$63+10\log(\text{OBW}/22.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.0)$

Table 7.2.5 EIRP limits

Channel	Channel BW, MHz	Peak power limit, dBm
		10.5 dBi, 72° beamwidth
20 MHz QPSK		
2506.0 MHz BRS1+EBS A1+A2+A3	22.5	69.01
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	21.0	69.31
2680.0 MHz EBS H3+G1+G2+G3	22.0	69.11
20 MHz 64 QAM		
2506.0 MHz BRS1+EBS A1+A2+A3	22.5	69.02
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	21.0	69.28
2680.0 MHz EBS H3+G1+G2+G3	22.0	69.11



<b>Test specification:</b> Section 27.50, Peak output power			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Table 7.2.6 Peak power density limits

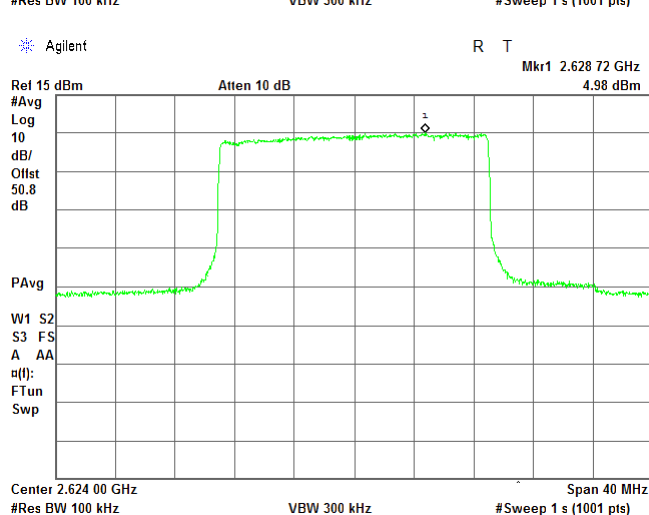
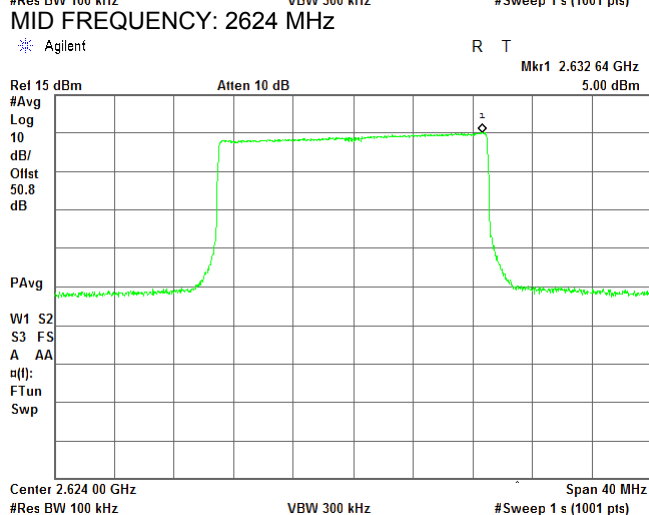
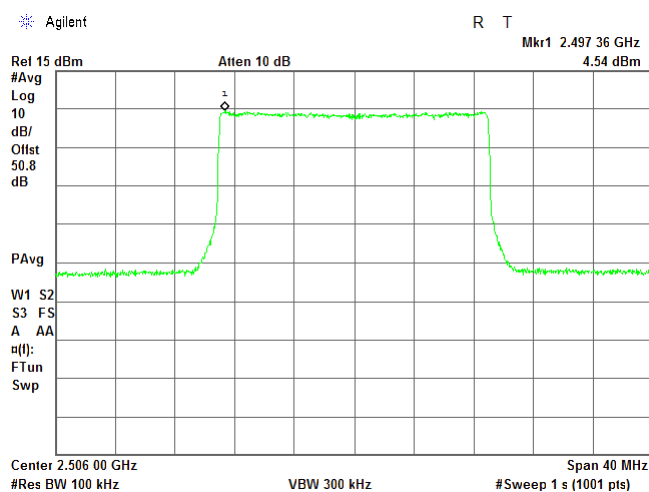
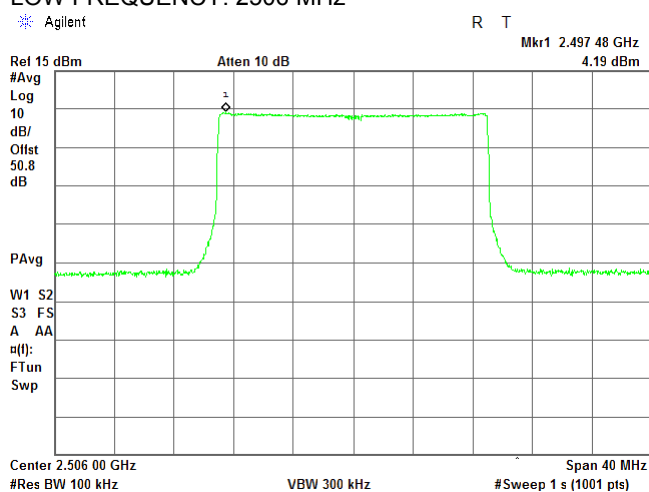
Channel	Channel BW, MHz	Peak power density, dBm/100kHz
		10.5 dBi, 72° beamwidth
20 MHz QPSK		
2506.0 MHz BRS1+EBS A1+A2+A3	22.5	45.49
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	21.0	46.09
2680.0 MHz EBS H3+G1+G2+G3	22.0	45.68
20 MHz 64 QAM		
2506.0 MHz BRS1+EBS A1+A2+A3	22.5	45.49
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	21.0	46.06
2680.0 MHz EBS H3+G1+G2+G3	22.0	45.68

<b>Test specification: Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

### Plot 7.2.1 Peak output power test results at antenna chain RF # 1

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK  
LOW FREQUENCY: 2506 MHz

20 MHz  
1  
Modulation: 64 QAM



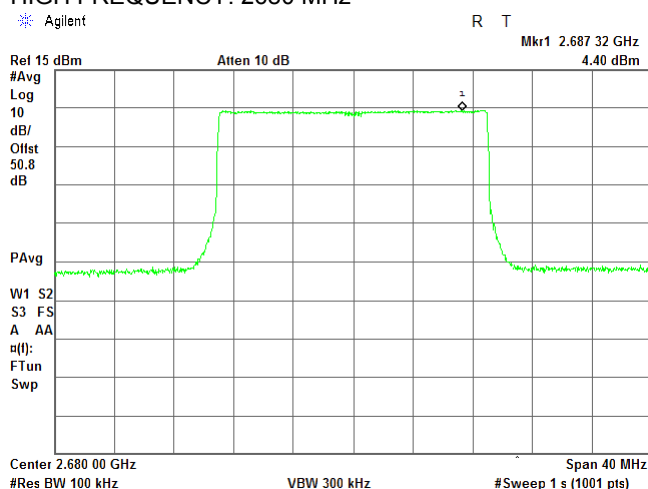
<b>Test specification: Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.2.2 Peak output power test results at antenna chain RF # 1

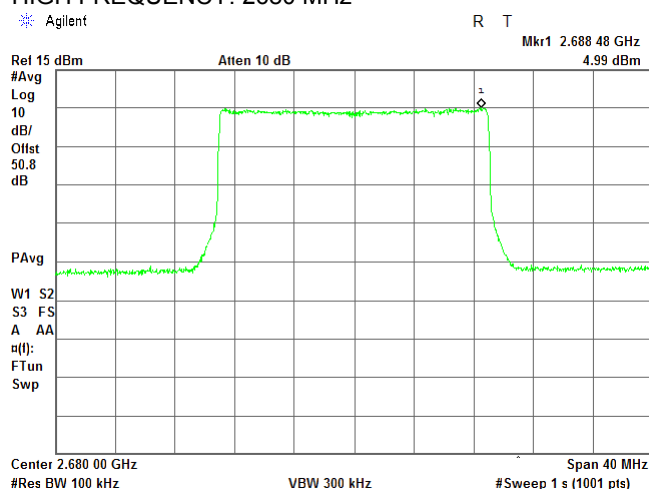
CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK

20 MHz  
1  
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz



HIGH FREQUENCY: 2680 MHz

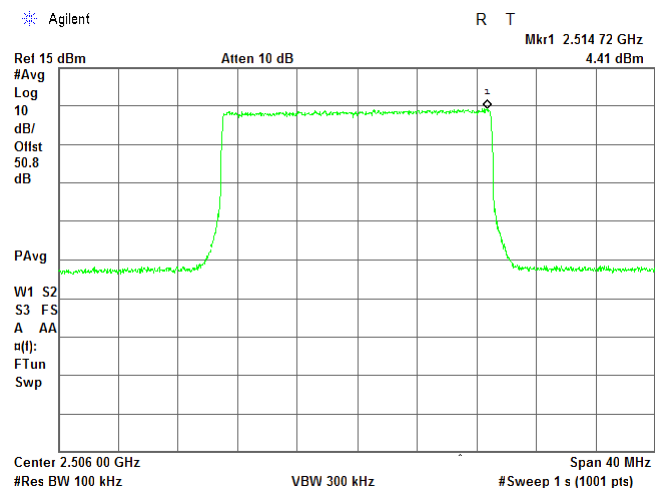
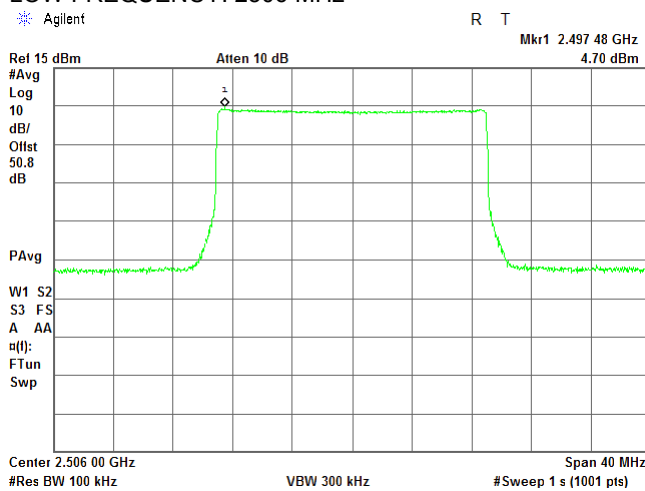


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-17			
Temperature: 24.3 °C	Relative Humidity: 43 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

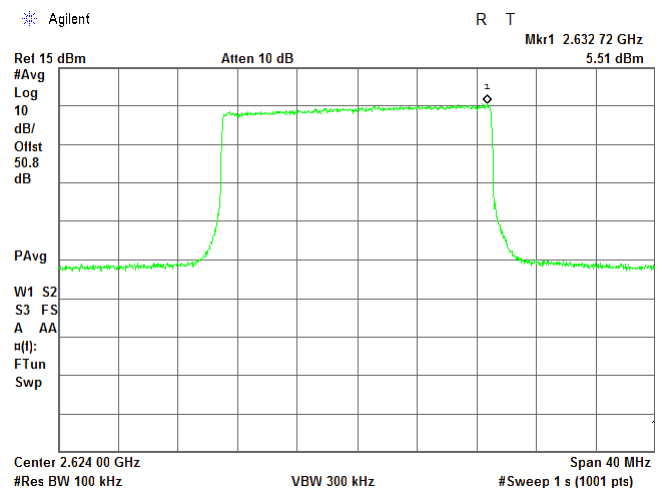
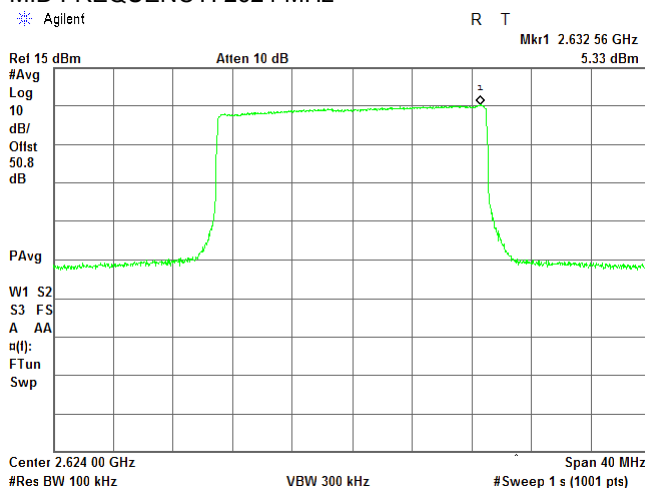
### Plot 7.2.3 Peak output power test results at antenna chain RF # 2

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK  
LOW FREQUENCY: 2506 MHz

20 MHz  
2  
Modulation: 64 QAM



MID FREQUENCY: 2624 MHz



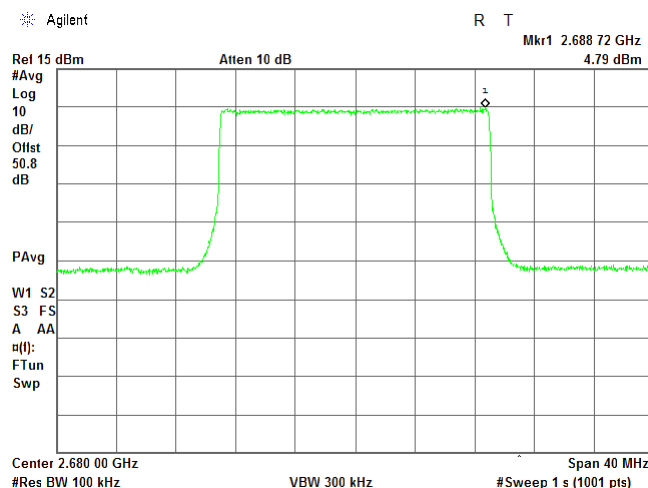
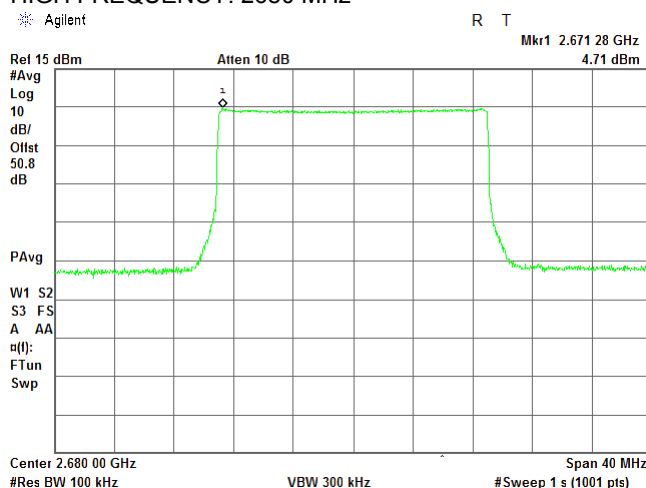
<b>Test specification:</b>		<b>Section 27.50, Peak output power</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b>		15-Aug-17	
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

#### Plot 7.2.4 Peak output power test results at antenna chain RF # 2

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK

20 MHz  
2  
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz

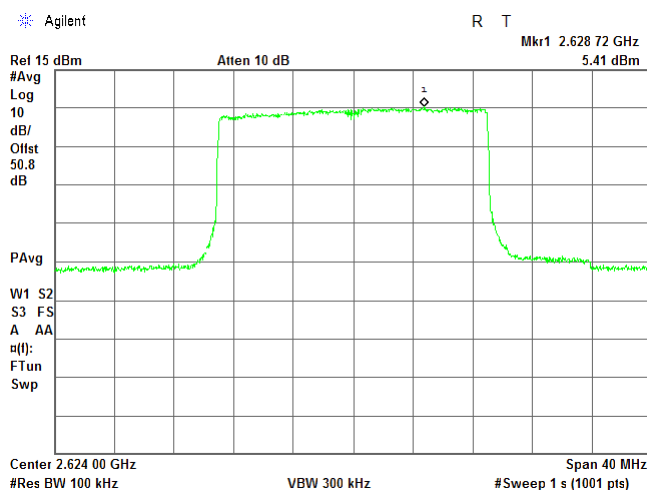
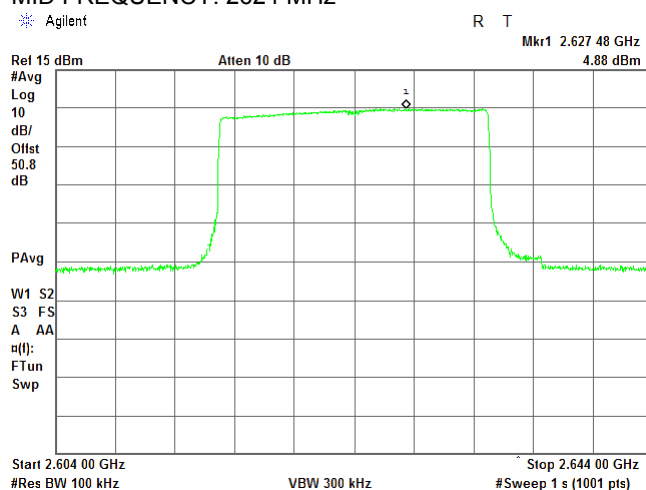
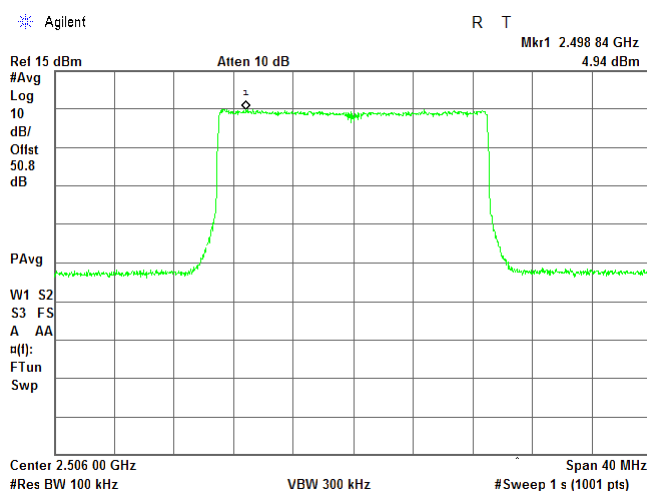
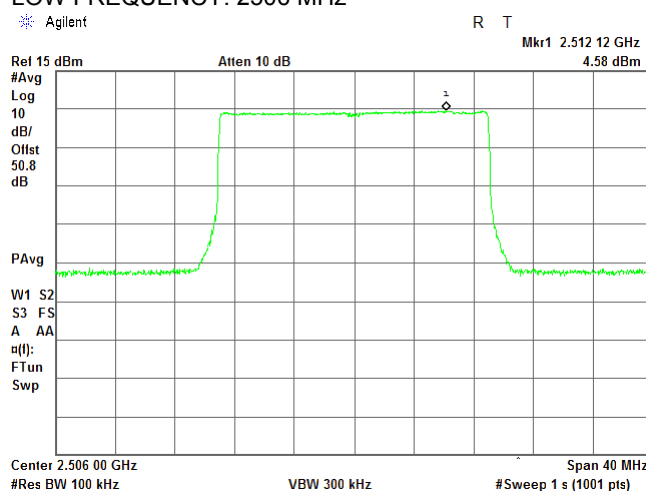


<b>Test specification: Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

### Plot 7.2.5 Peak output power test results at antenna chain RF # 3

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK  
LOW FREQUENCY: 2506 MHz

20 MHz  
3  
Modulation: 64 QAM





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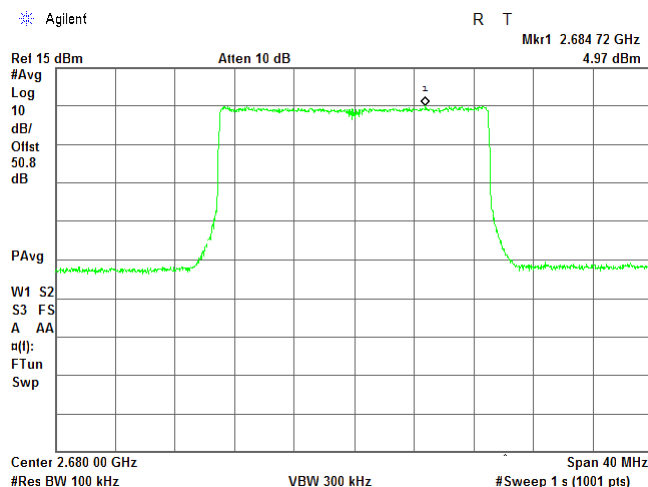
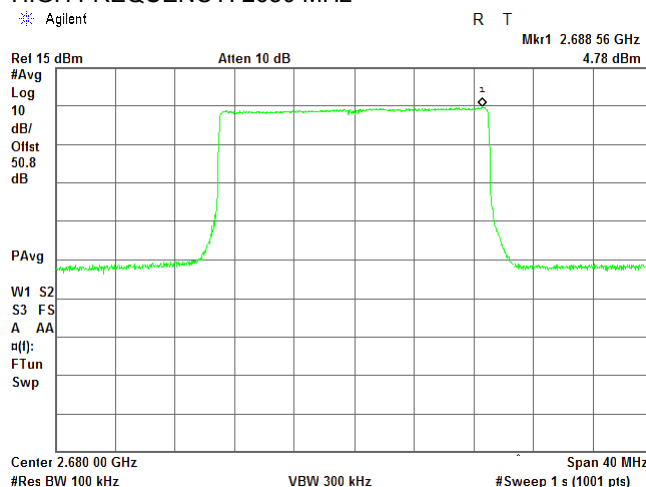
<b>Test specification:</b> <b>Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.2.6 Peak output power test results at antenna chain RF # 3

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK

20 MHz  
3  
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz



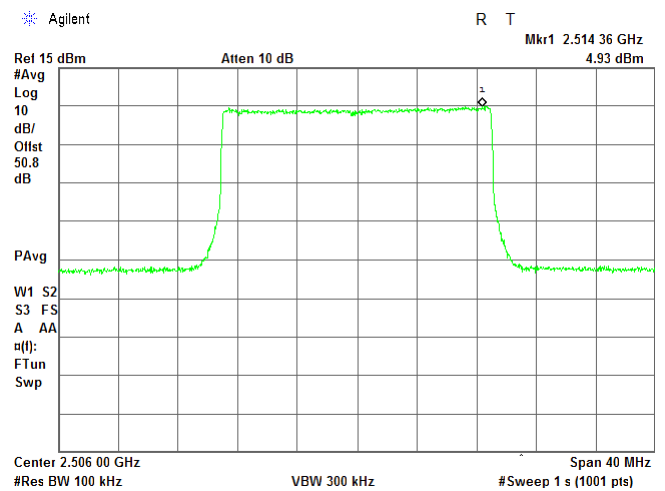
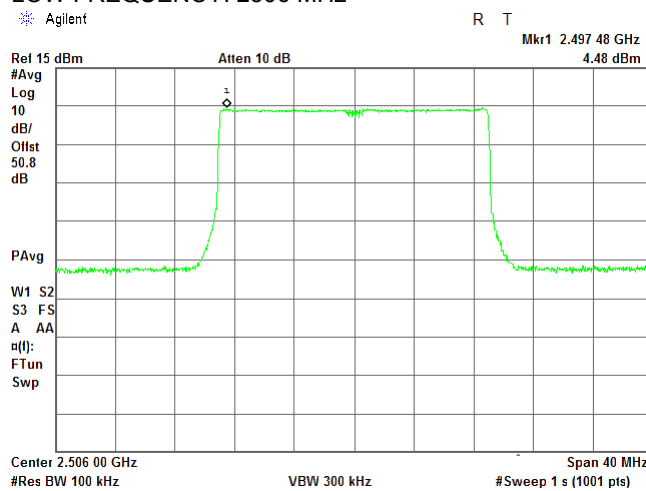


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-17			
Temperature: 24.3 °C	Relative Humidity: 43 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

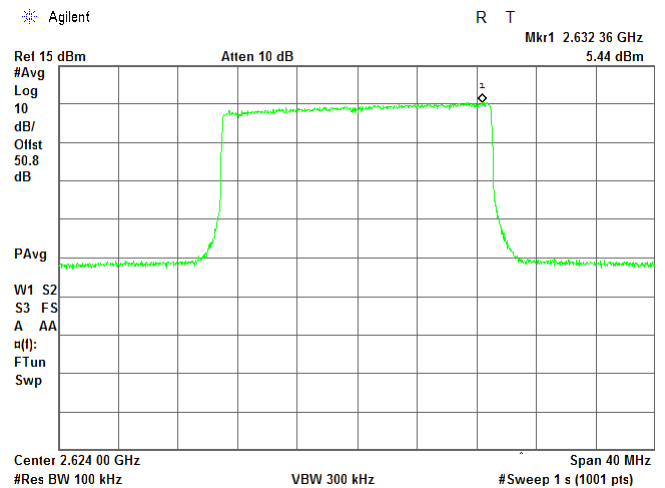
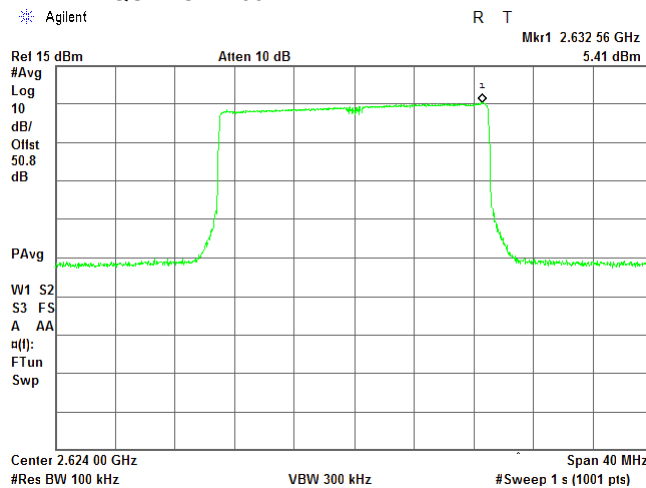
### Plot 7.2.7 Peak output power test results at antenna chain, RF # 4

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK  
LOW FREQUENCY: 2506 MHz

20 MHz  
4  
Modulation: 64 QAM



MID FREQUENCY: 2594 MHz



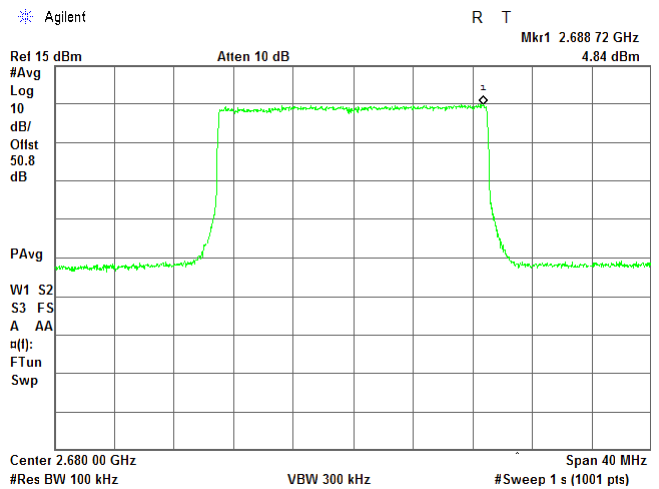
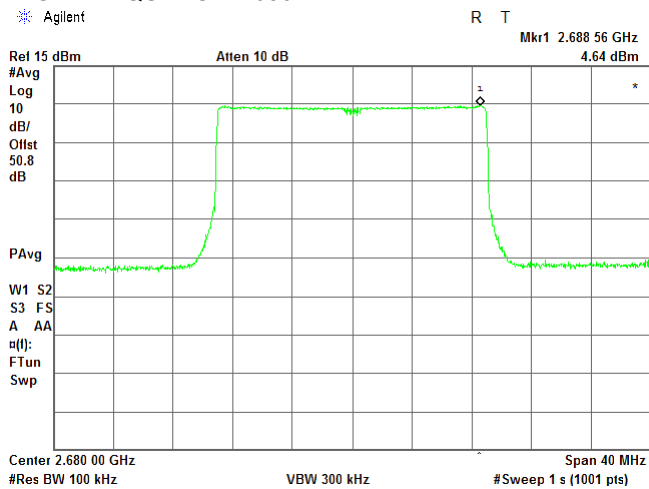
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-17			
Temperature: 24.3 °C	Relative Humidity: 43 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

**Plot 7.2.8 Peak output power test results at antenna chain, RF # 4**

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK

20 MHz  
4  
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz



<b>Test specification: Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

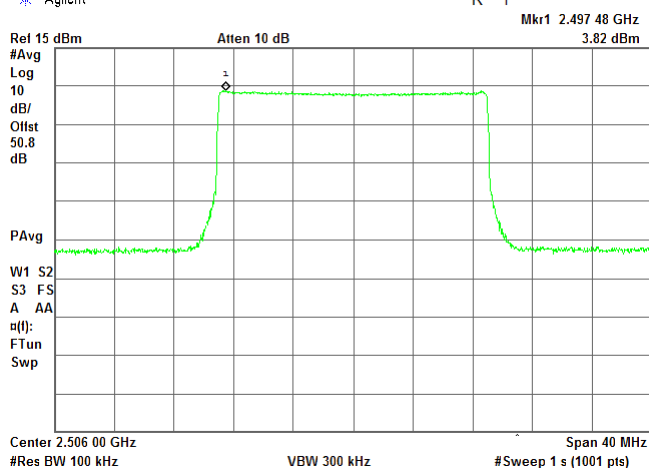
### Plot 7.2.9 Peak output power test results at antenna chain RF # 5

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK  
LOW FREQUENCY: 2506 MHz

20 MHz  
5  
Modulation: 64 QAM

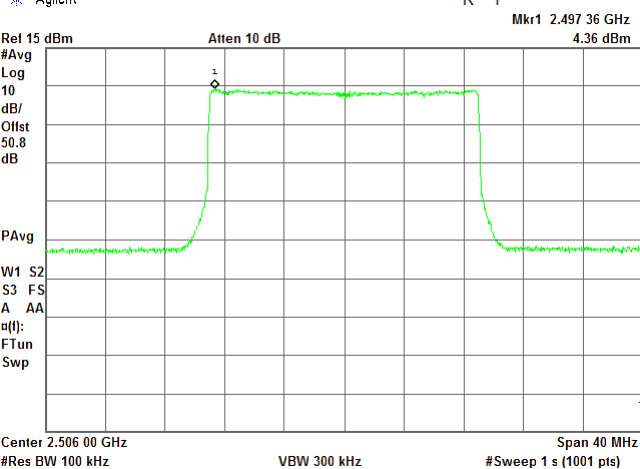
Agilent

R T



Agilent

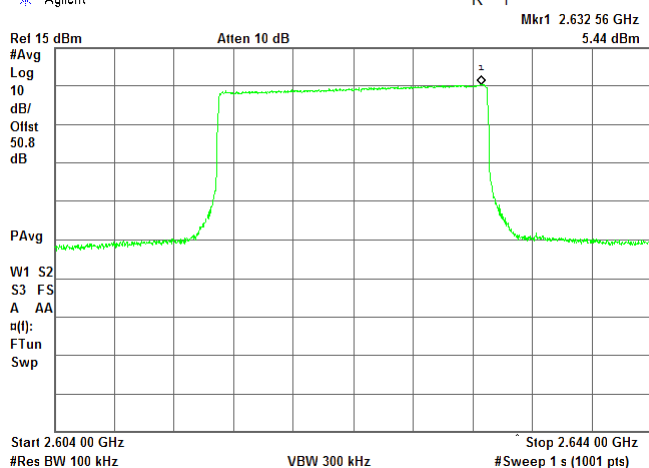
R T



MID FREQUENCY: 2624 MHz

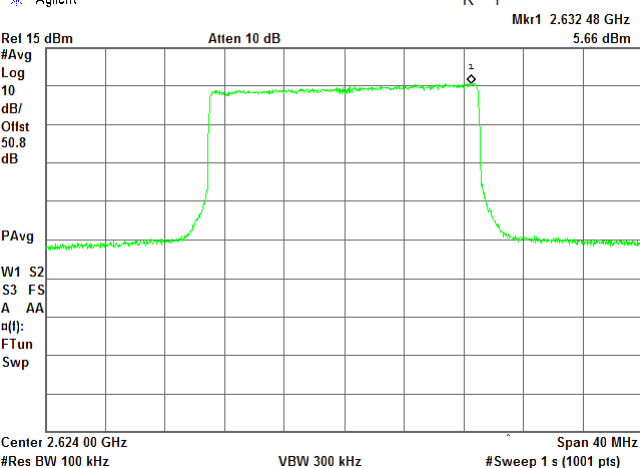
Agilent

R T



Agilent

R T





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<b>Test specification:</b> <b>Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

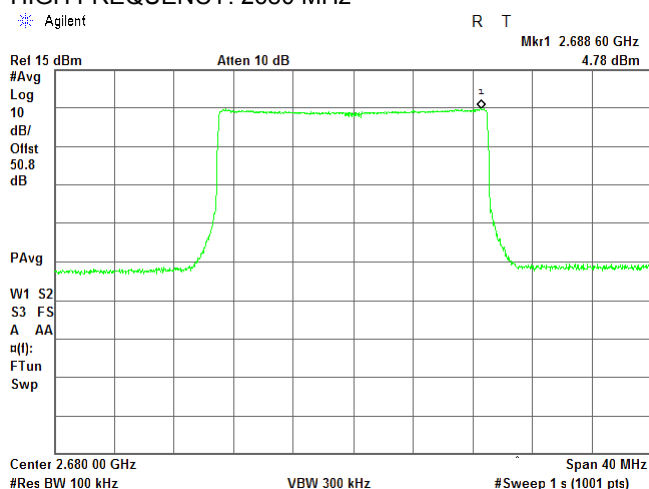
Plot 7.2.10 Peak output power test results at antenna chain RF # 5

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK

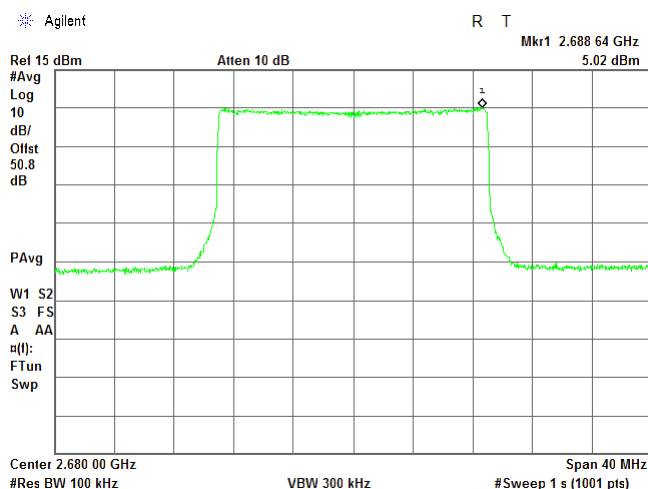
20 MHz  
5  
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz

Agilent



Agilent

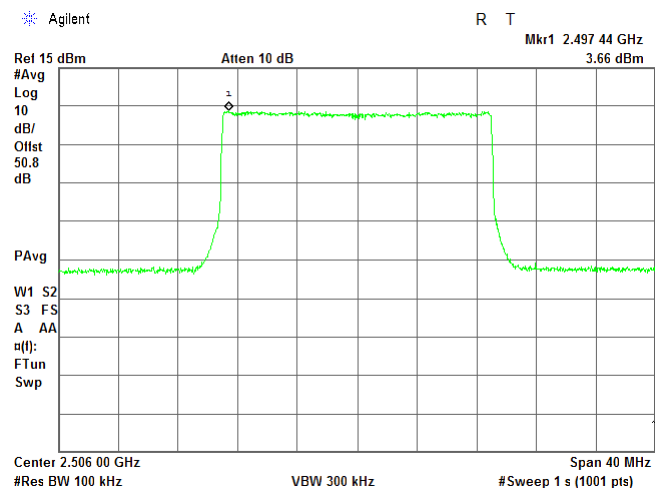
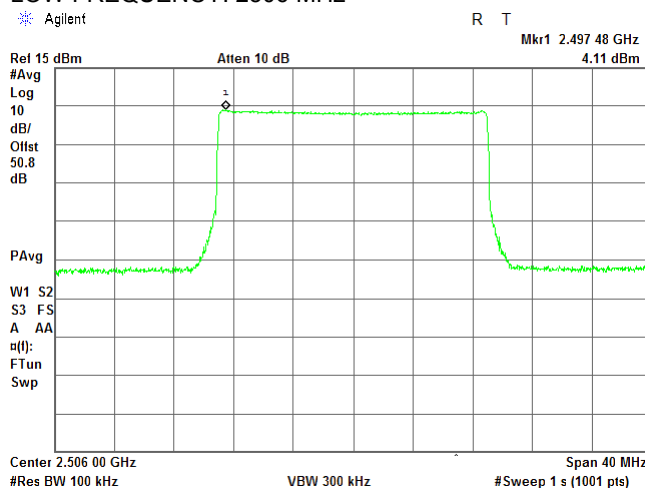


<b>Test specification:</b>		<b>Section 27.50, Peak output power</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b>		15-Aug-17	
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.2.11 Peak output power test results at antenna chain RF # 6

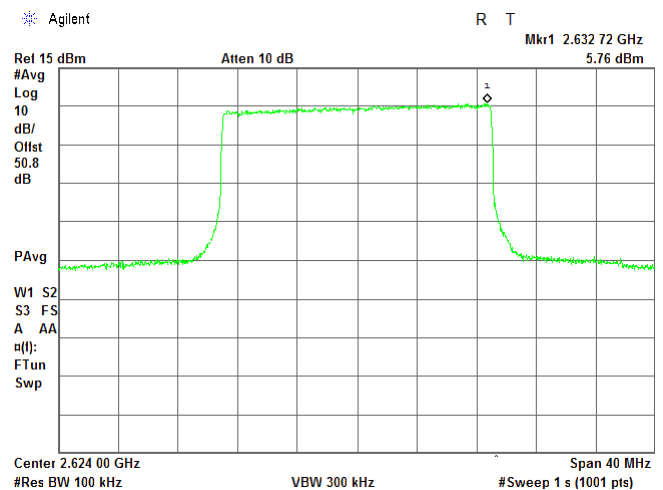
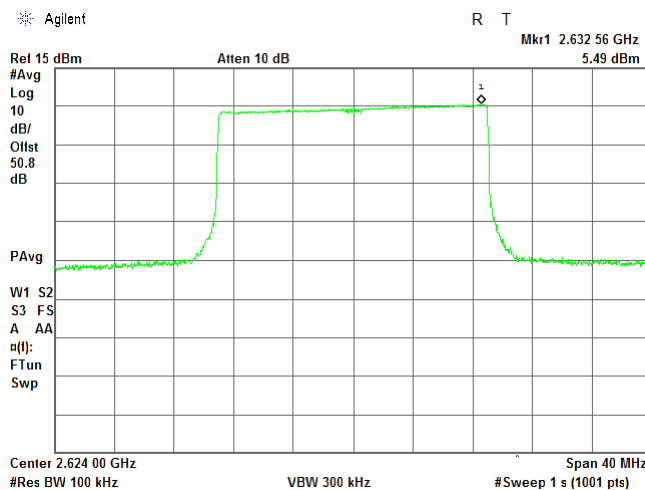
CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK  
LOW FREQUENCY: 2506 MHz

20 MHz  
6  
Modulation: 64 QAM



MID FREQUENCY: 2 MHz

2





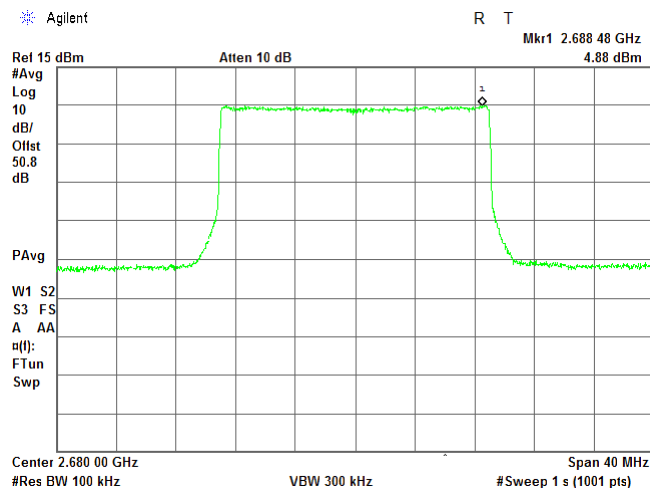
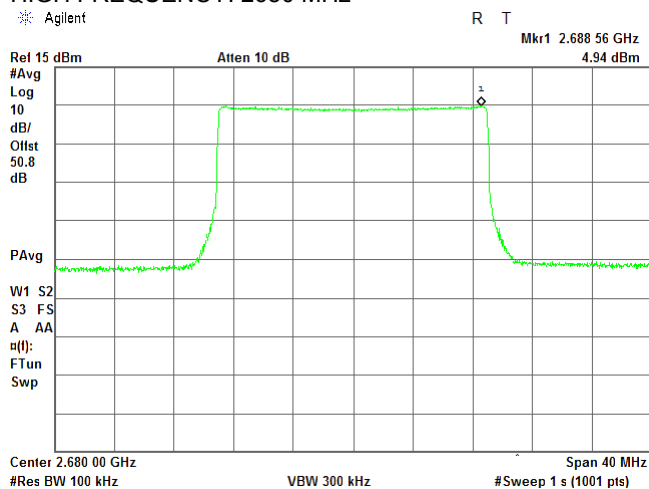
HERMON LABORATORIES

Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-17			
Temperature: 24.3 °C	Relative Humidity: 43 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

Plot 7.2.12 Peak output power test results at antenna chain RF # 6

CHANNEL BANDWIDTH: 20 MHz  
NUMBER OF ANTENNA: 6

HIGH FREQUENCY: 2680 MHz

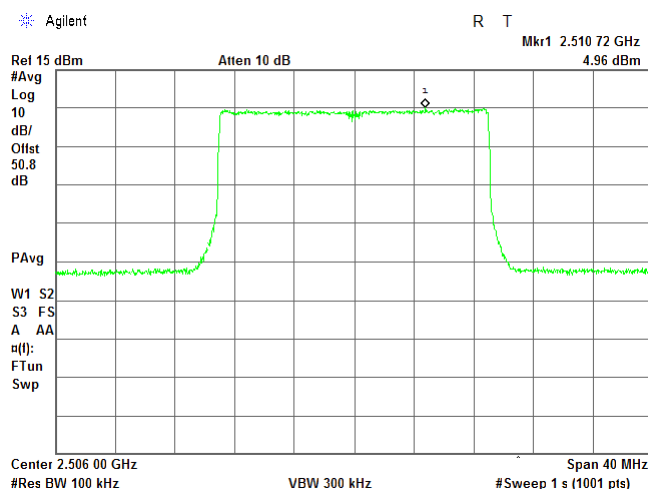
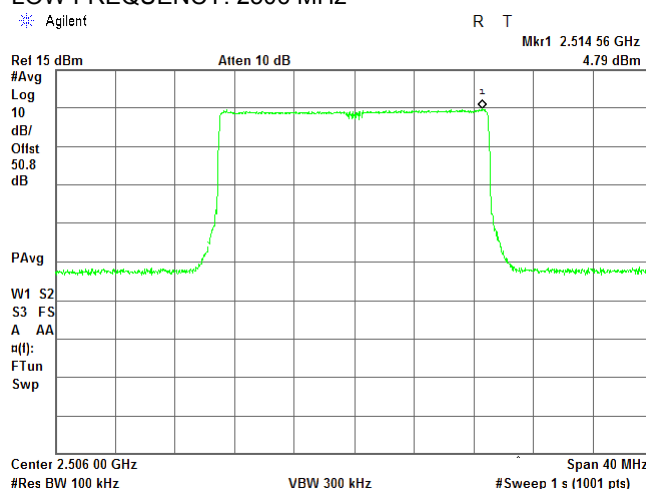


<b>Test specification:</b> <b>Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

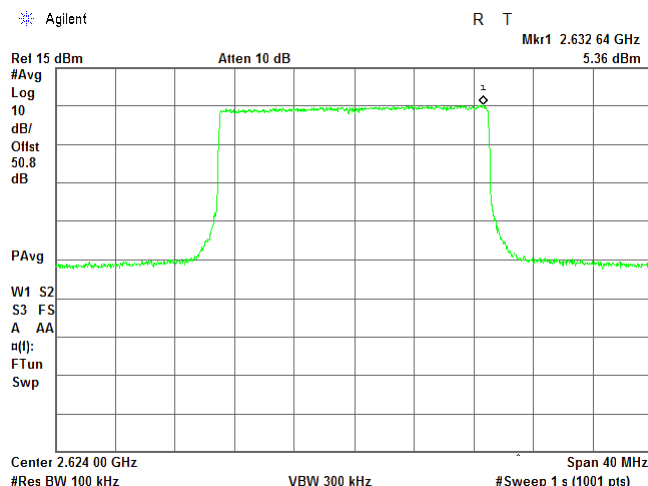
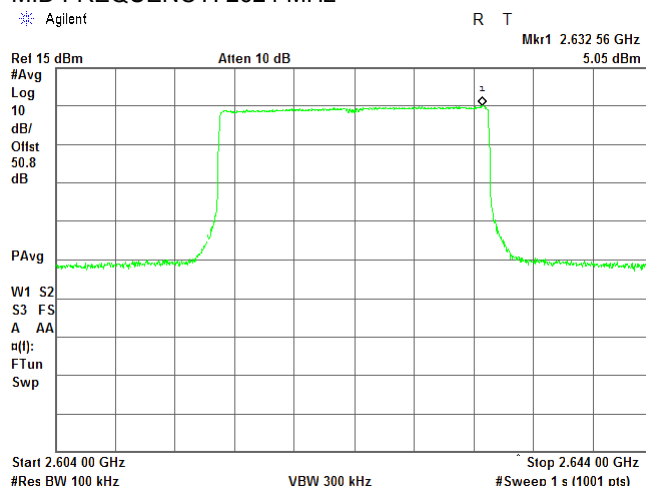
Plot 7.2.13 Peak output power test results at antenna chain RF # 7

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK  
LOW FREQUENCY: 2506 MHz

20 MHz  
7  
Modulation: 64 QAM



MID FREQUENCY: 2624 MHz



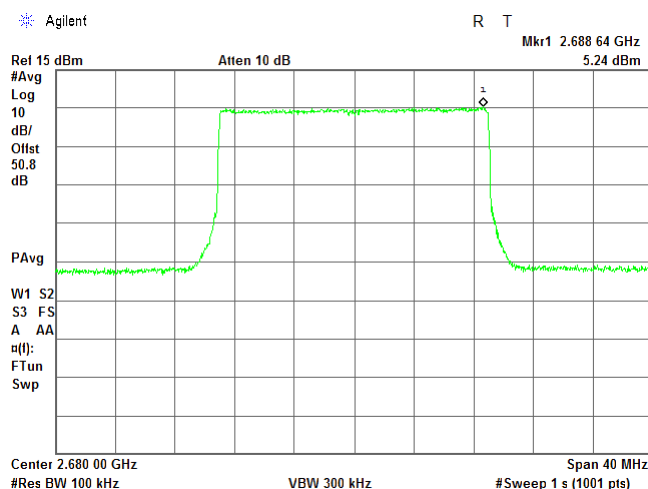
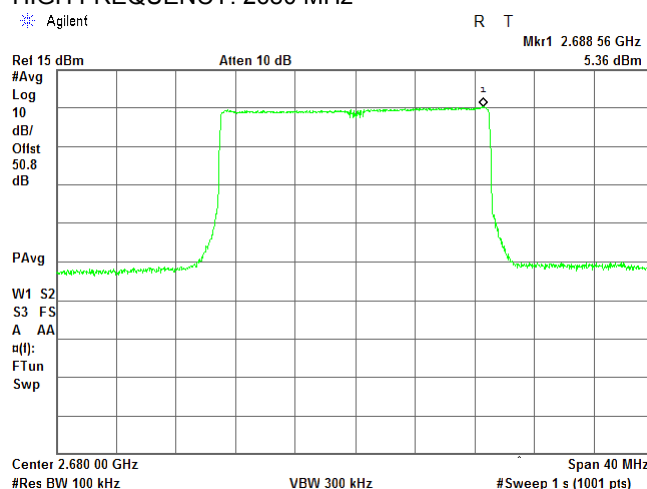
<b>Test specification: Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.2.14 Peak output power test results at antenna chain RF # 7

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK

20 MHz  
7  
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz



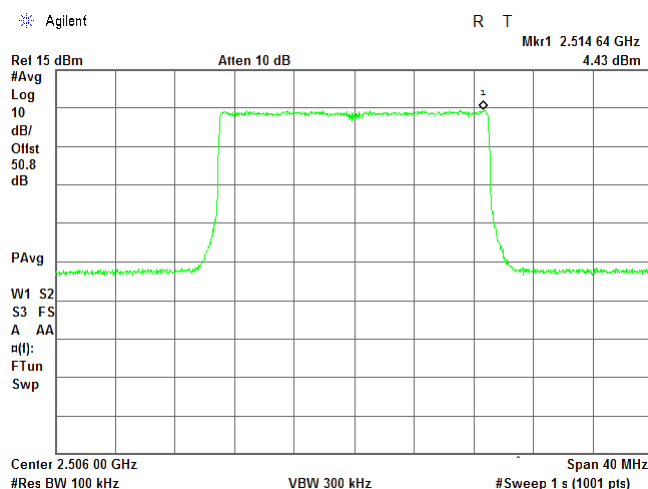
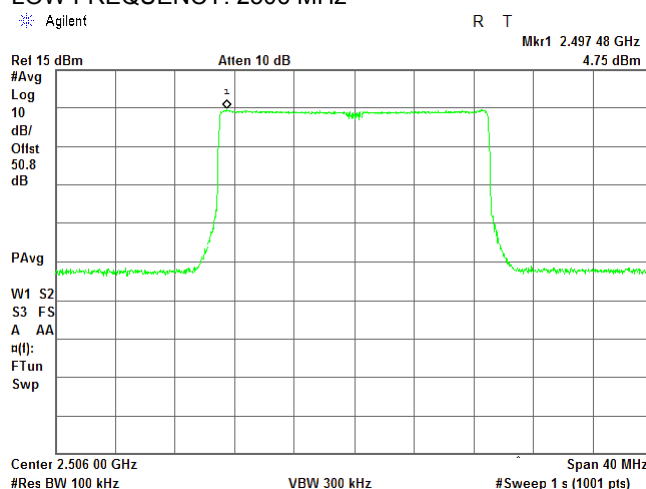


<b>Test specification: Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

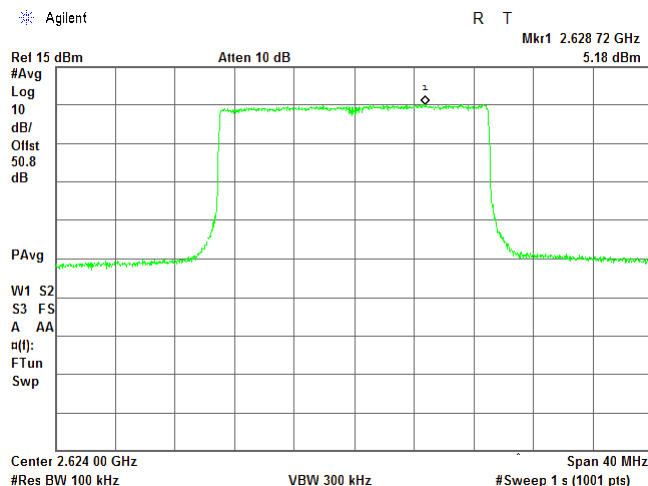
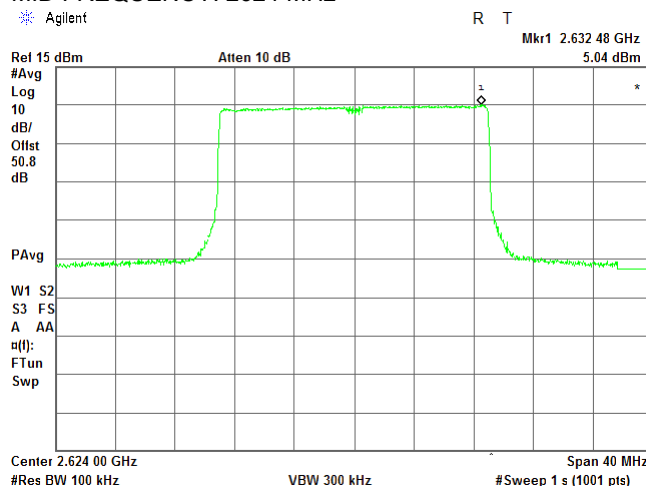
Plot 7.2.15 Peak output power test results at antenna chain RF # 8

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK  
LOW FREQUENCY: 2506 MHz

20 MHz  
8  
Modulation: 64 QAM



MID FREQUENCY: 2624 MHz



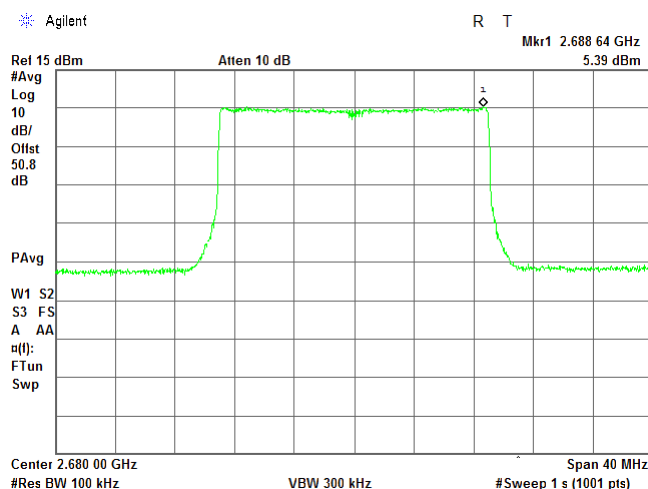
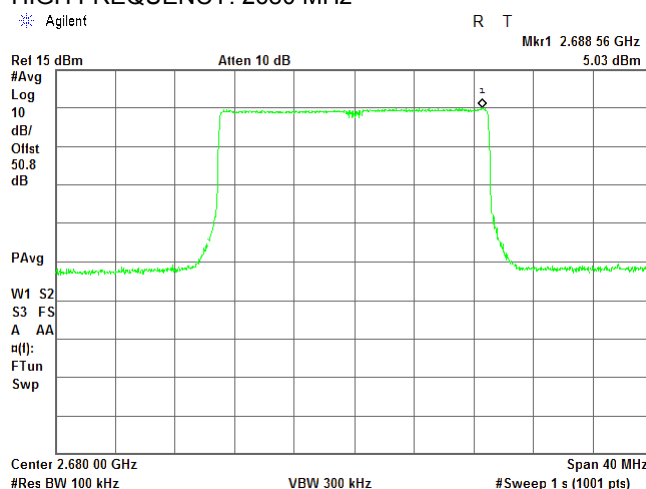
<b>Test specification: Section 27.50, Peak output power</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 15-Aug-17			
<b>Temperature:</b> 24.3 °C	<b>Relative Humidity:</b> 43 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.2.16 Peak output power test results at antenna chain RF # 8

CHANNEL BANDWIDTH:  
NUMBER OF ANTENNA:  
Modulation: QPSK

20 MHz  
8  
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz



<b>Test specification:</b> <b>Section 27.53, Band edge emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13			
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 16-Aug-17			
<b>Temperature:</b> 24.4 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

## 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	RBW, kHz	Attenuation below carrier, dBc	Limit, dBm
2496.0 – 2518.5	2495.0-2496.0	300	43+ 10*Log (P*)	-13.0
	Below 2495 MHz	1000	43+ 10*Log (P*)	-13.0
	Above 2518.5 MHz	1000	43+ 10*Log (P*)	-13.0
2614.0 – 2635.0	2613.0 – 2614.0	300	43+ 10*Log (P*)	-13.0
	Below 2495 MHz	1000	43+ 10*Log (P*)	-13.0
	Above 2518.5 MHz	1000	43+ 10*Log (P*)	-13.0
2668.0 – 2690.0	Below 2668.0 MHz	1000	43+ 10*Log (P*)	-13.0
	2690.0 – 2691.0	300	43+ 10*Log (P*)	-13.0
	Above 2691.0	1000	43+ 10*Log (P*)	-13.0

\* - 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**



<b>Test specification:</b> <b>Section 27.53, Band edge emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13			
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 16-Aug-17			
<b>Temperature:</b> 24.4 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

**Table 7.3.2 Spurious emission at the 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  
NUMBER OF CHAINS: 2  
ANTENNA PORT: #5

Frequency MHz	Band edge	SA reading over 1chain, dBm	Total band edge*, dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK							
Low frequency 2506.0 MHz							
2496.64	Low	-27.33	-24.33	300	NA	-13.0	Pass
2495.00	Low	-26.83	-23.83	100	1000	-13.0	
2515.36	High	-27.84	-24.84	300	NA	-13.0	
2517.00	High	-26.56	-23.56	100	1000	-13.0	
Mid frequency 2624.0 MHz							
2614.00	Low	-25.96	-22.96	300	NA	-13.0	Pass
2613.00	Low	-24.23	-21.23	100	1000	-13.0	
2634.00	High	-23.52	-20.52	300	NA	-13.0	
2635.00	High	-23.76	-20.76	100	1000	-13.0	
High frequency 2680.0 MHz							
2670.00	Low	-25.98	-22.98	300	NA	-13.0	Pass
2669.00	Low	-25.70	-22.70	100	1000	-13.0	
2690.00	High	-26.00	-23.00	300	NA	-13.0	
2691.00	High	-25.07	-22.07	100	1000	-13.0	
64QAM							
Low frequency 2506.0 MHz							
2496.00	Low	-28.11	-25.11	300	NA	-13.0	Pass
2495.00	Low	-26.34	-23.34	100	1000	-13.0	
2515.00	High	-27.28	-24.28	300	NA	-13.0	
2517.00	High	-26.32	-23.32	100	1000	-13.0	
Mid frequency 2624.0 MHz							
2614.00	Low	-24.12	-21.12	300	NA	-13.0	Pass
2613.00	Low	-24.46	-21.46	100	1000	-13.0	
2634.00	High	-24.12	-21.12	300	NA	-13.0	
2635.00	High	-23.56	-20.56	100	1000	-13.0	
High frequency 2680.0 MHz							
2670.00	Low	-27.30	-24.30	300	NA	-13.0	Pass
2669.00	Low	-25.66	-22.66	100	1000	-13.0	
2690.00	High	-25.58	-22.58	300	NA	-13.0	
2691.00	High	-24.77	-21.77	100	1000	-13.0	

\*- Total band edge, dBm = SA Reading band edge, dBm + 10\*log(N) = SA Reading band edge, dBm + 3 dB

**Reference numbers of test equipment used**

HL 2214	HL 3301	HL 3302	HL 3433	HL 3434	HL 3818		
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Full description is given in Appendix A.

<b>Test specification: Section 27.53, Band edge emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 16-Aug-17			
<b>Temperature:</b> 24.4 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

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

ASSIGNED FREQUENCY RANGE:

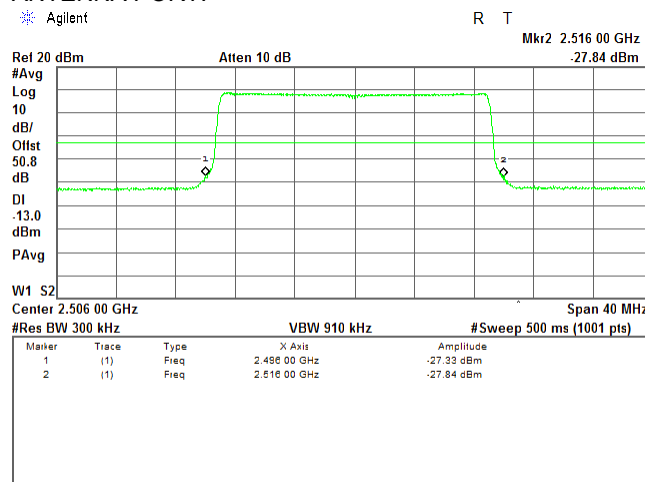
DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

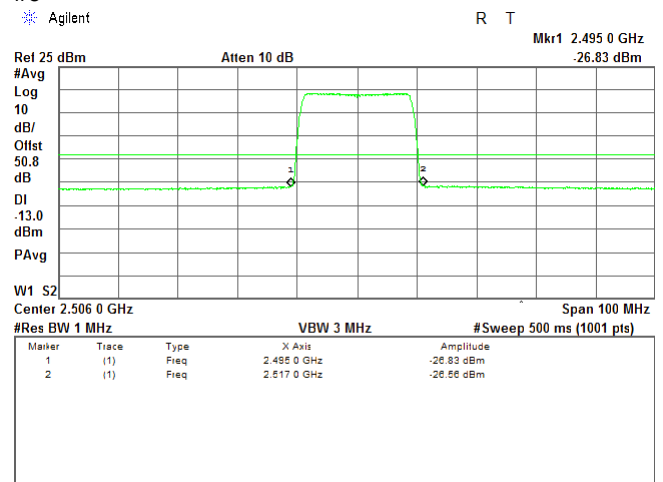
Average

QPSK

PRBS

Maximum

#5



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

ASSIGNED FREQUENCY RANGE:

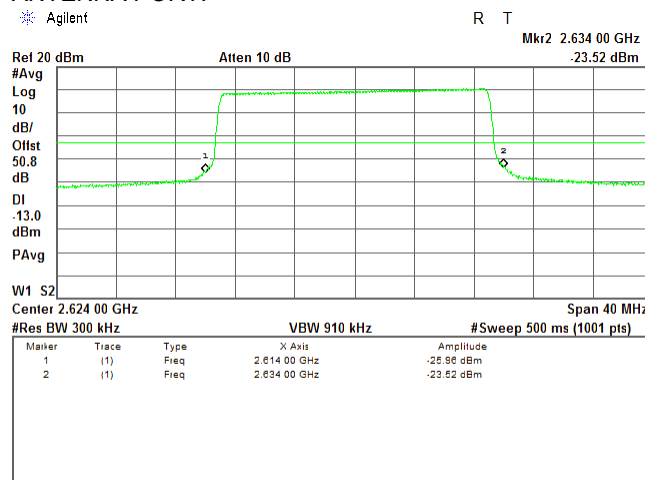
DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

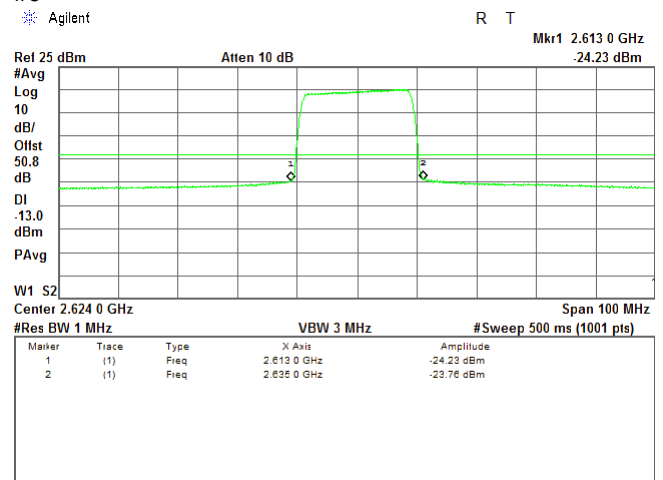
Average

QPSK

PRBS

Maximum

#5



<b>Test specification:</b>		<b>Section 27.53, Band edge emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b>		16-Aug-17	
<b>Temperature:</b> 24.4 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

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

ASSIGNED FREQUENCY RANGE:

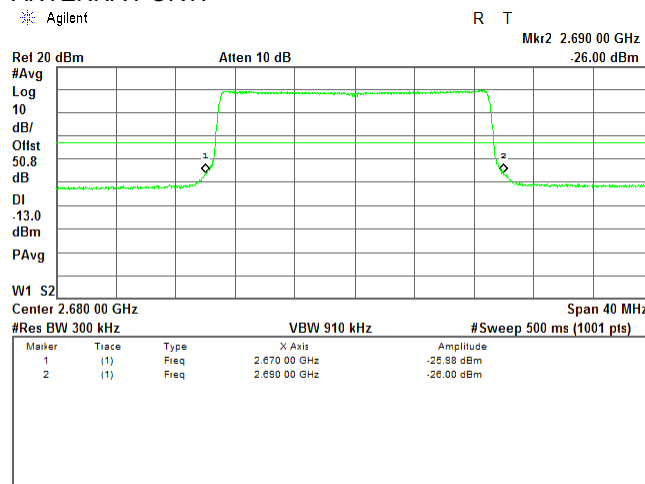
DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

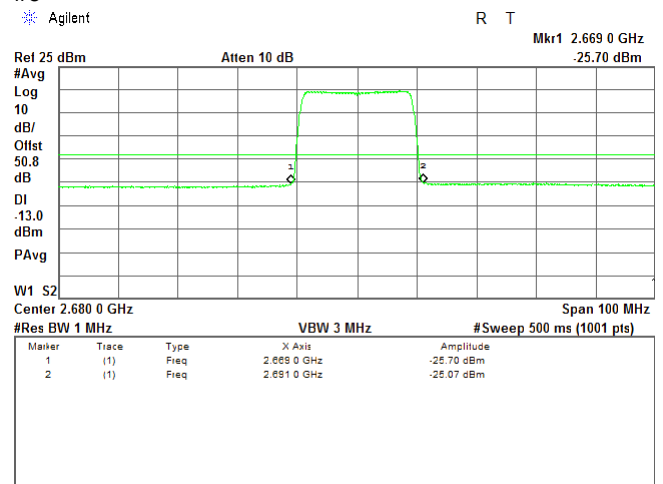
Average

QPSK

PRBS

Maximum

#5



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

ASSIGNED FREQUENCY RANGE:

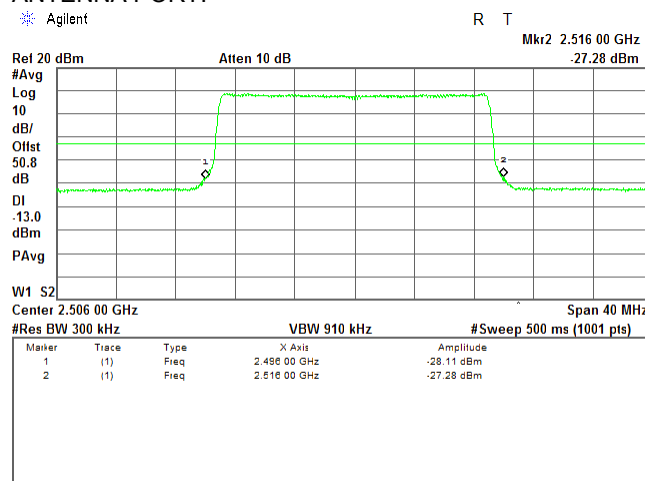
DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

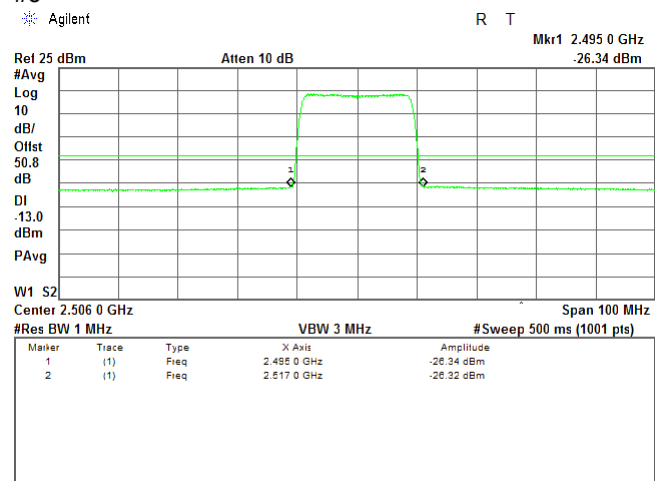
Average

64QAM

PRBS

Maximum

#5



<b>Test specification:</b> Section 27.53, Band edge emissions	
<b>Test procedure:</b> 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b> 16-Aug-17	
<b>Temperature:</b> 24.4 °C	<b>Relative Humidity:</b> 44 %
<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>	

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

ASSIGNED FREQUENCY RANGE:

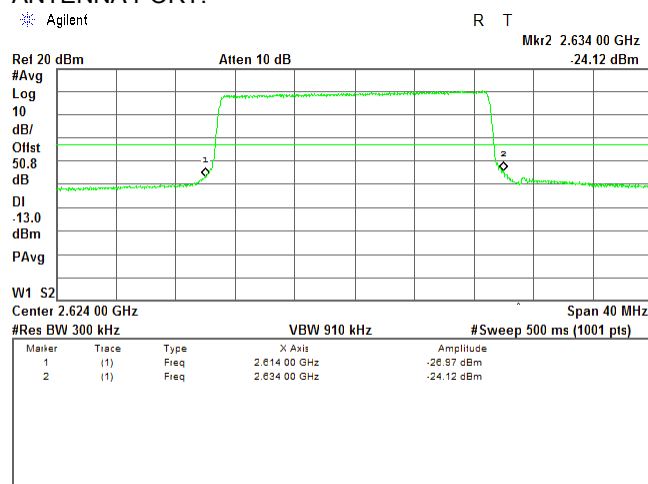
DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

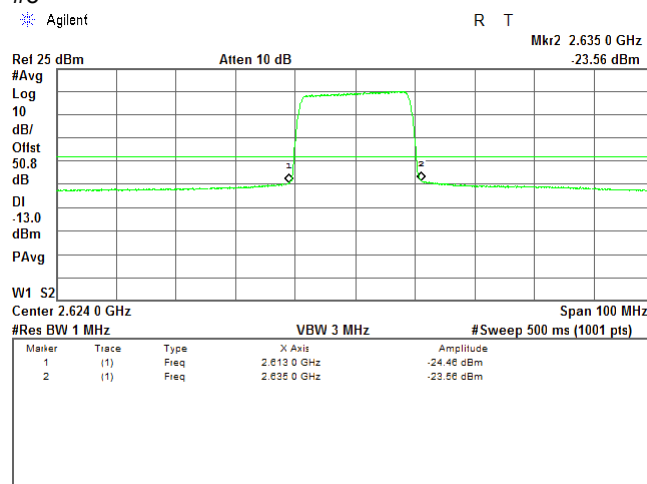
Average

64QAM

PRBS

Maximum

#5



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

ASSIGNED FREQUENCY RANGE:

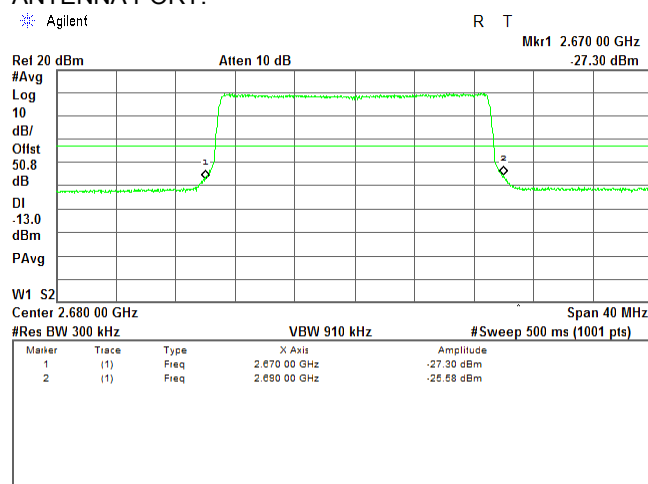
DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

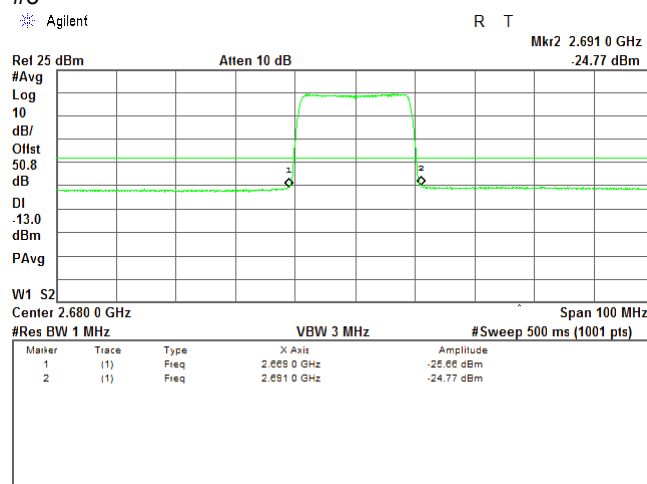
Average

64QAM

PRBS

Maximum

#5





<b>Test specification:</b> Section 27.53, Spurious emissions at RF antenna connector			
<b>Test procedure:</b> 47 CFR, Sections 2.1051, 27.53			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 16-Aug-17			
<b>Temperature:</b> 24.4 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

## 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
Base and fixed user stations		
0.009 – 10th harmonic	43+10logP(W)**	-13.0
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 the associated plots.

Figure 7.4.1 Spurious emission test setup, single output







<b>Test specification:</b> Section 27.53, Spurious emissions at RF antenna connector			
<b>Test procedure:</b> 47 CFR, Sections 2.1051, 27.53			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 16-Aug-17			
<b>Temperature:</b> 24.4 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Table 7.4.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 2496-2690 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 26900 MHz  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: ≥ Resolution bandwidth  
 MODULATION: 64QAM  
 MODULATING SIGNAL: PRBS  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 ANTENNA PORT: #1

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

ANTENNA PORT: #2

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

\*- Margin = Spurious emission – specification limit.

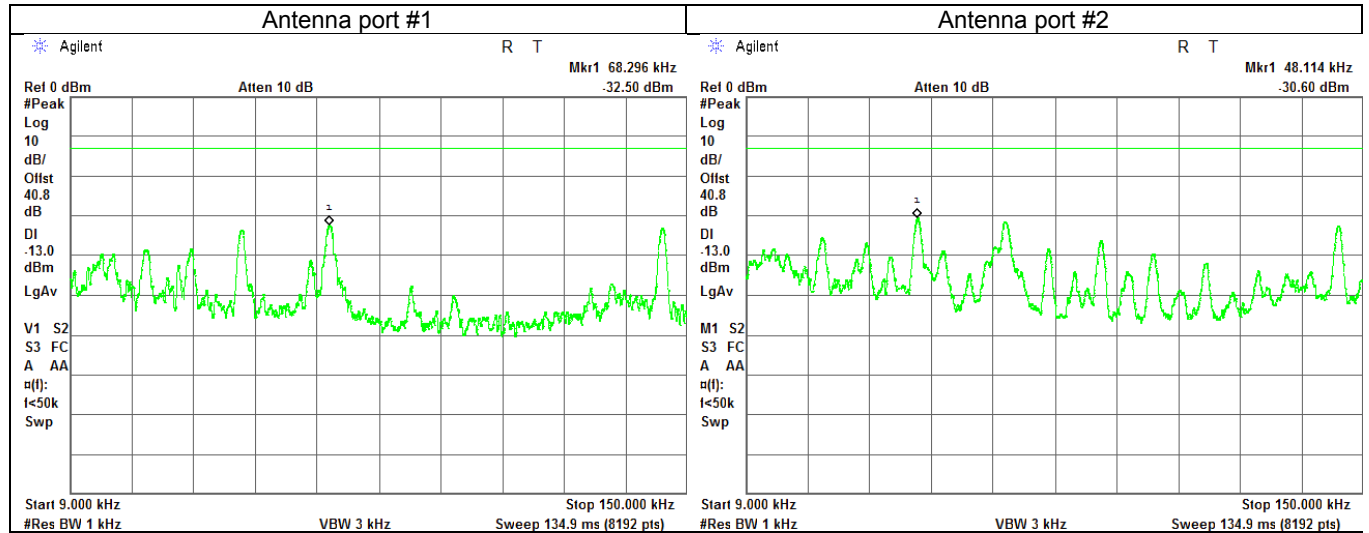
## Reference numbers of test equipment used

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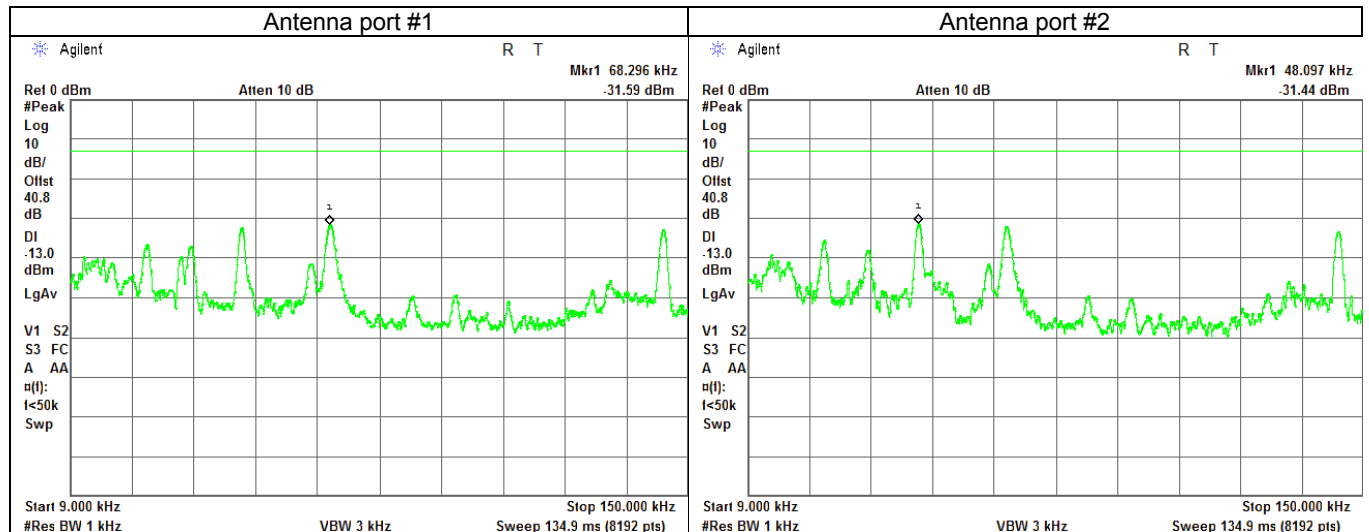
Full description is given in Appendix A.

Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Verdict: PASS	
Date(s):			
16-Aug-17			
Temperature: 24.4 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

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

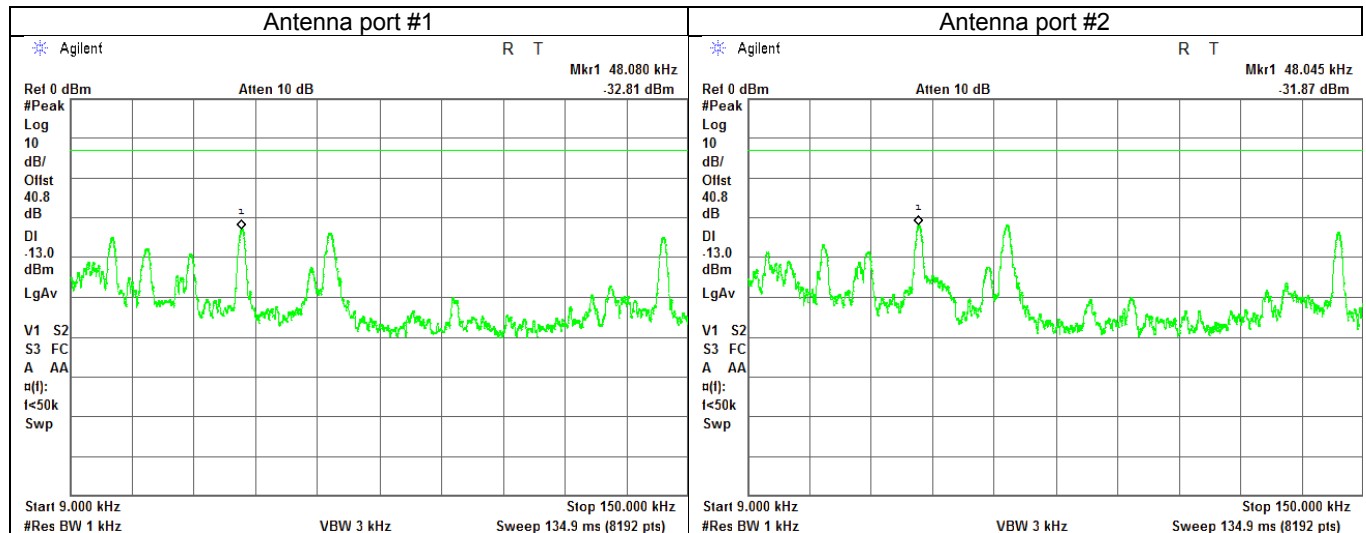


Plot 7.4.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency

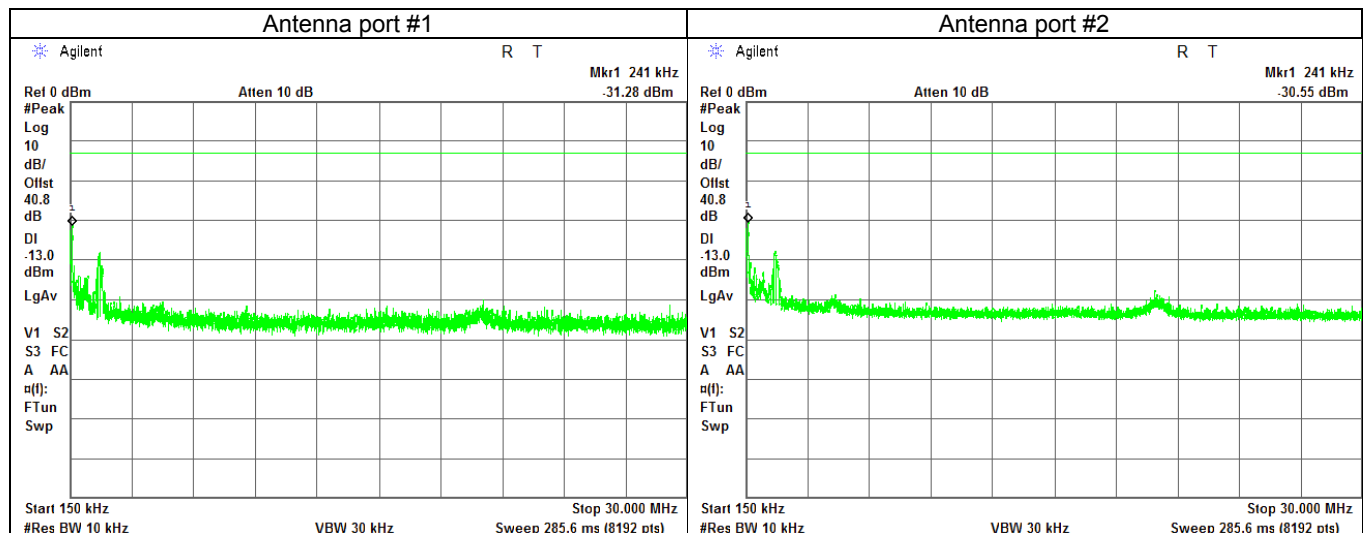


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Verdict: PASS	
Date(s):			
16-Aug-17			
Temperature: 24.4 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

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

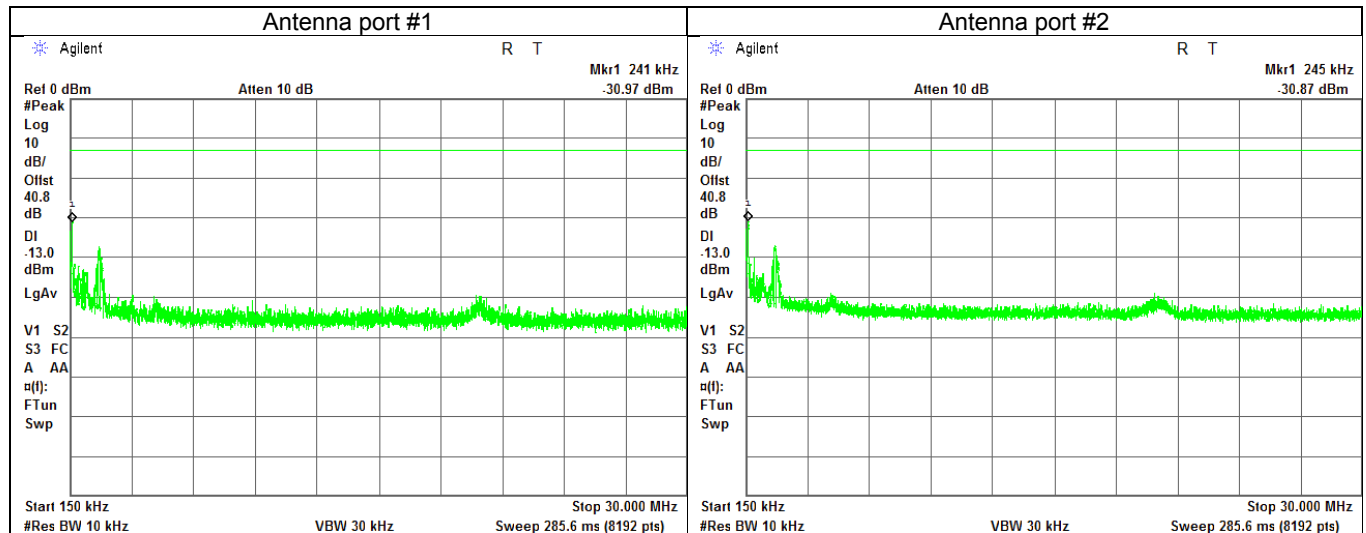


Plot 7.4.4 Spurious emission measurements in 0.15 - 30.0 MHz range at low carrier frequency

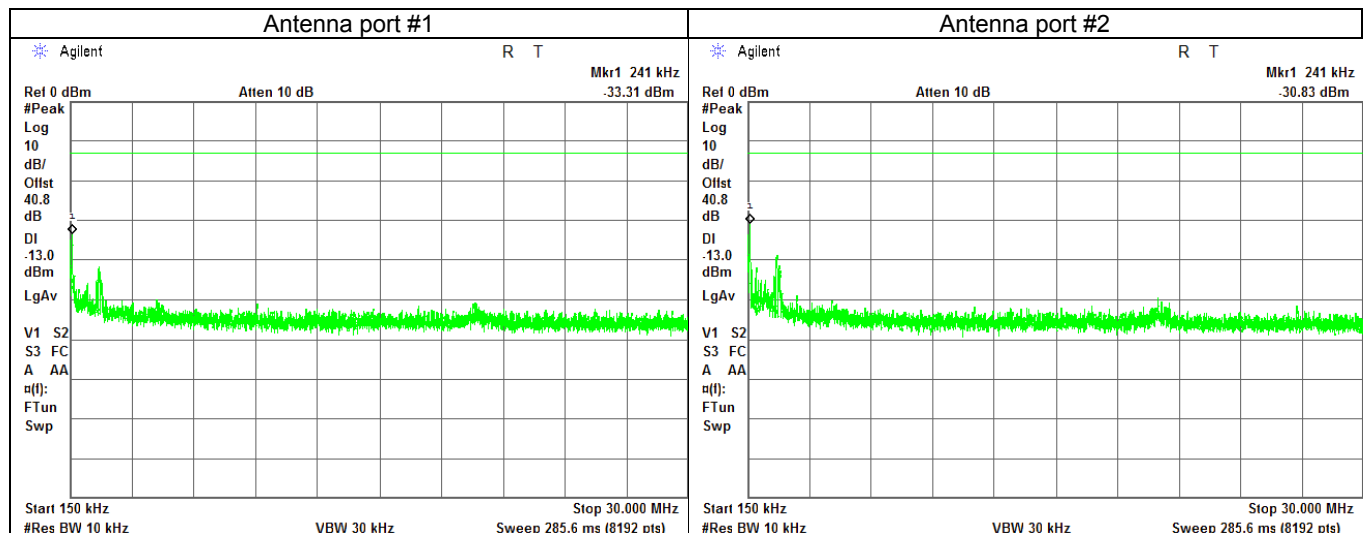


<b>Test specification:</b>		<b>Section 27.53, Spurious emissions at RF antenna connector</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051, 27.53	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b>		16-Aug-17	
<b>Temperature:</b> 24.4 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

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

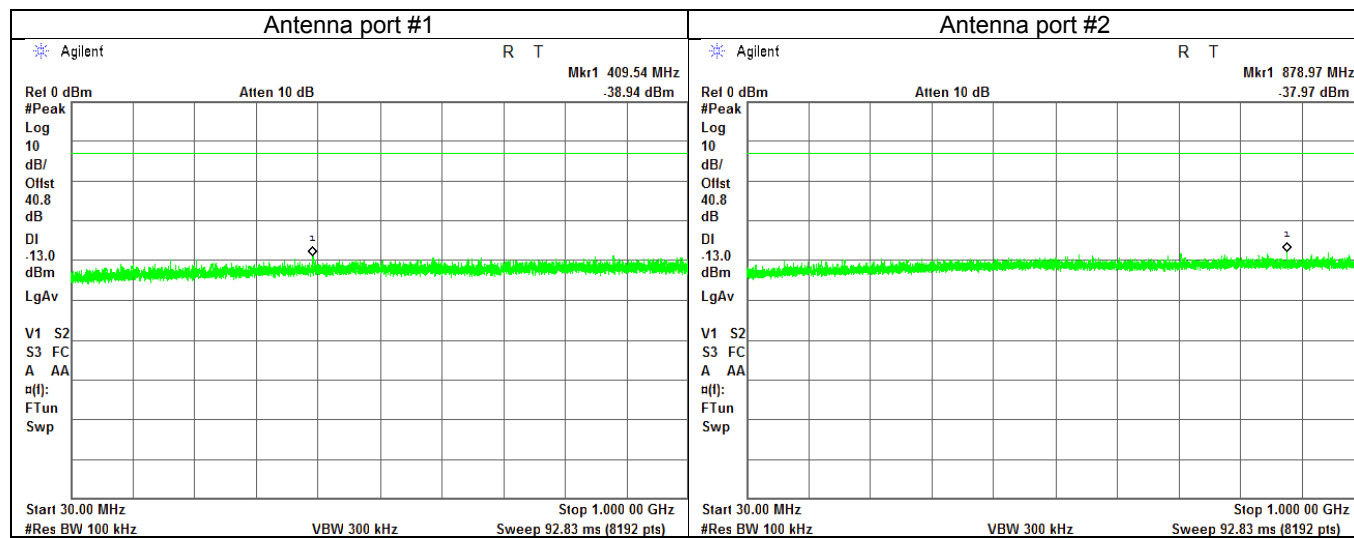


Plot 7.4.6 Spurious emission measurements in 0.15 - 30.0 MHz range at high carrier frequency

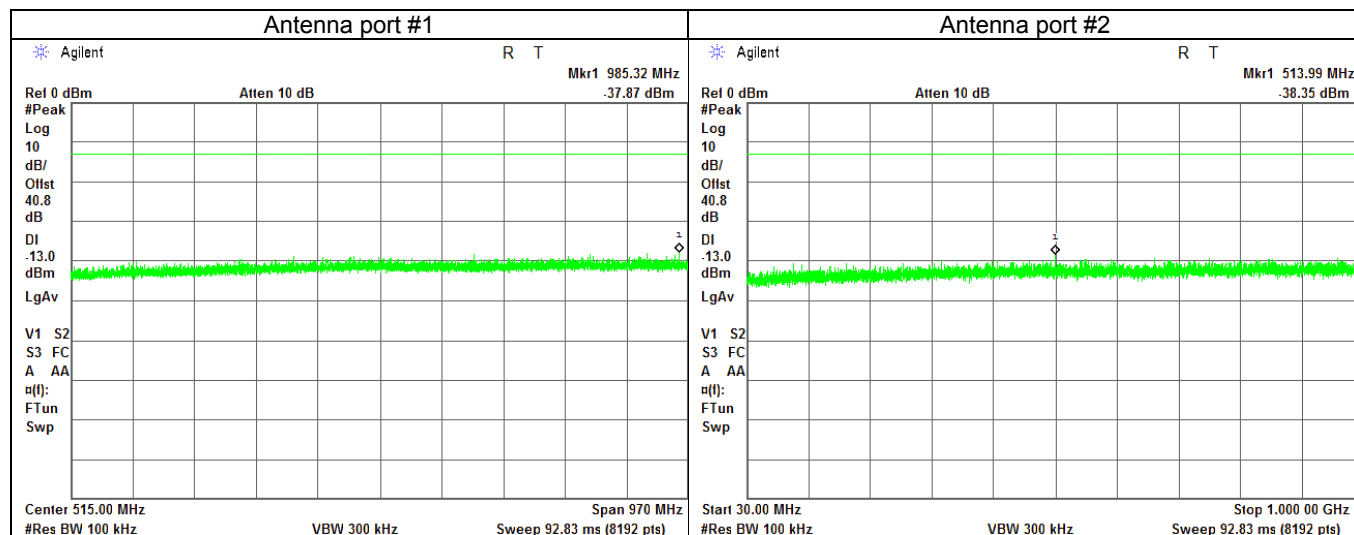


<b>Test specification:</b>		<b>Section 27.53, Spurious emissions at RF antenna connector</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051, 27.53	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>			
16-Aug-17			
<b>Temperature:</b> 24.4 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

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



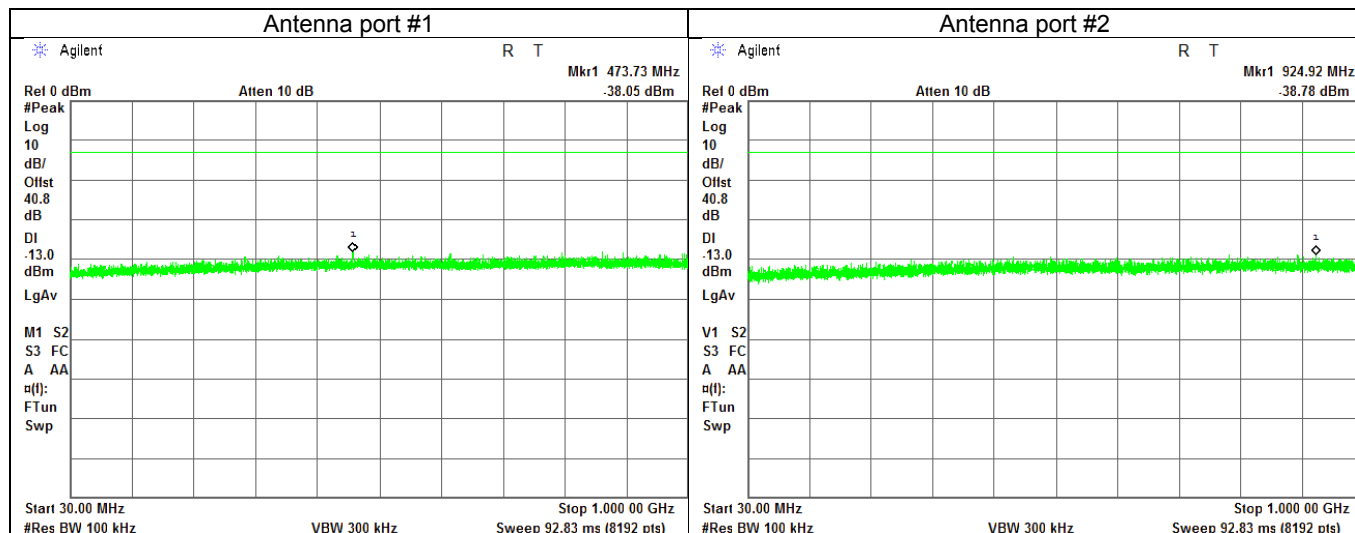


HERMON LABORATORIES

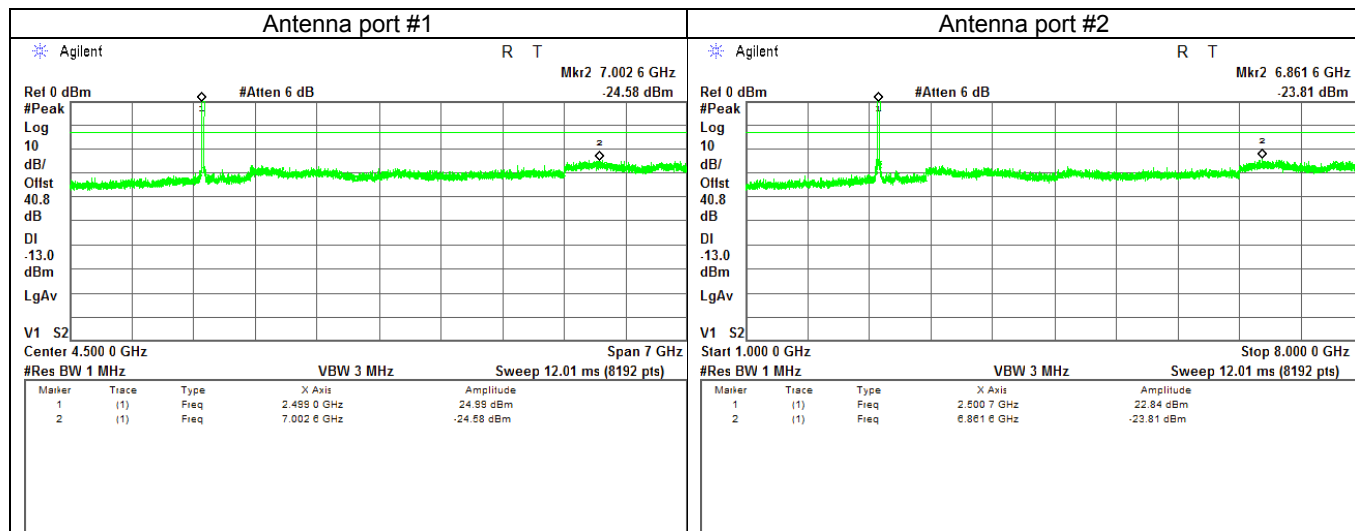
Report ID: AIRRAD\_FCC.29984.docx  
Date of Issue: 28-Sep-17

Test specification: Section 27.53, Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53			
Test mode: Compliance		Verdict: PASS	
Date(s): 16-Aug-17			
Temperature: 24.4 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

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

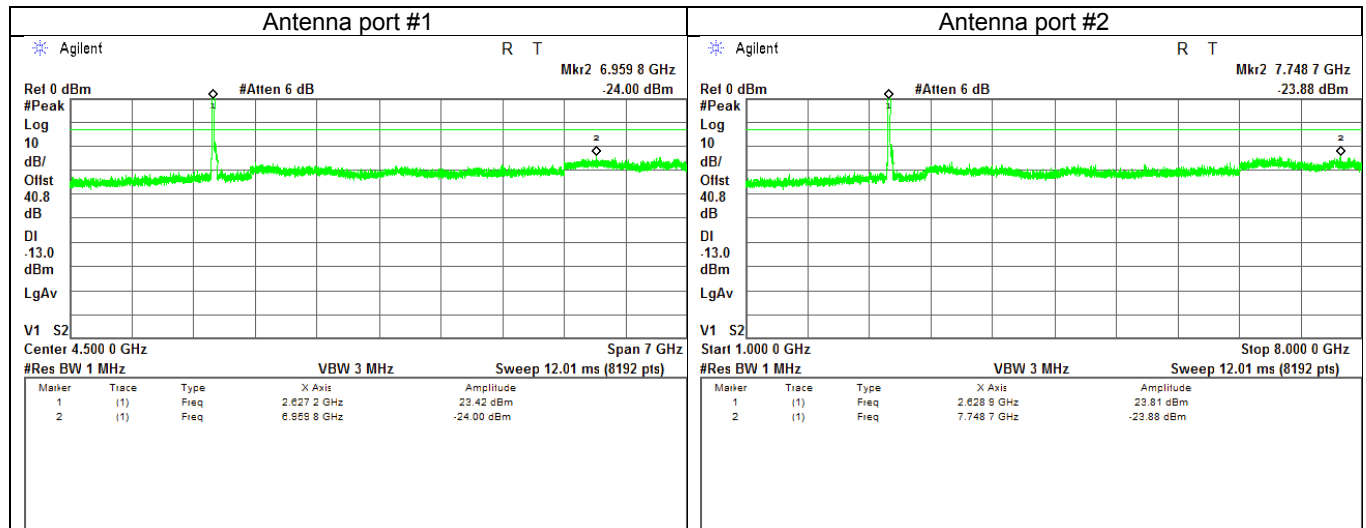


Plot 7.4.10 Spurious emission measurements in 1000 - 8000 MHz range at low carrier frequency

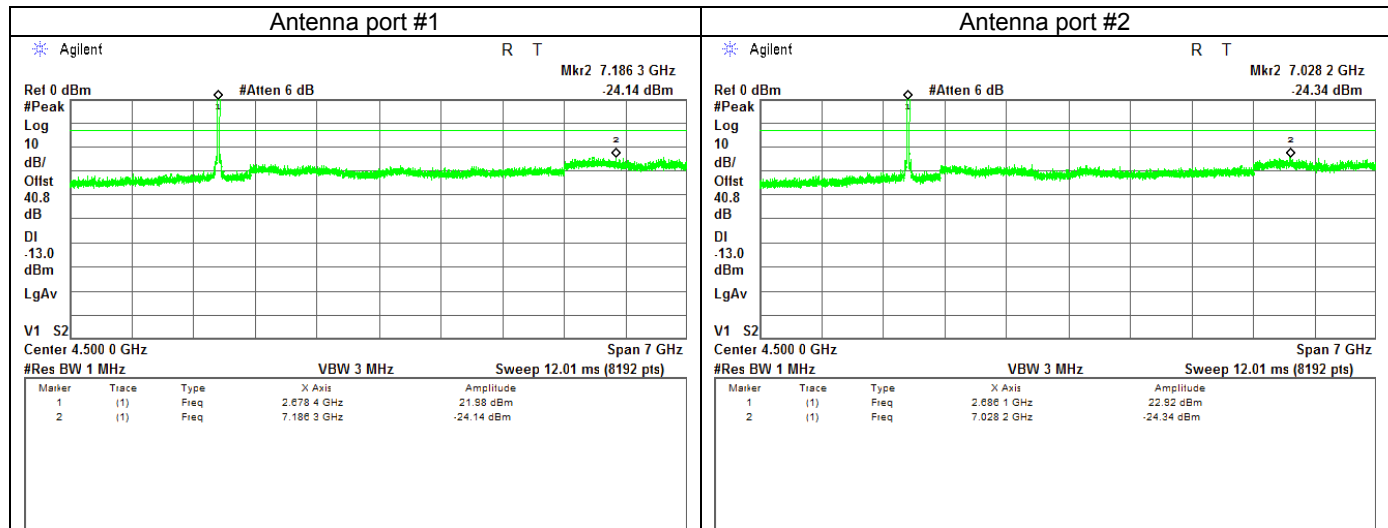


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Verdict: PASS	
Date(s):			
16-Aug-17			
Temperature: 24.4 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

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

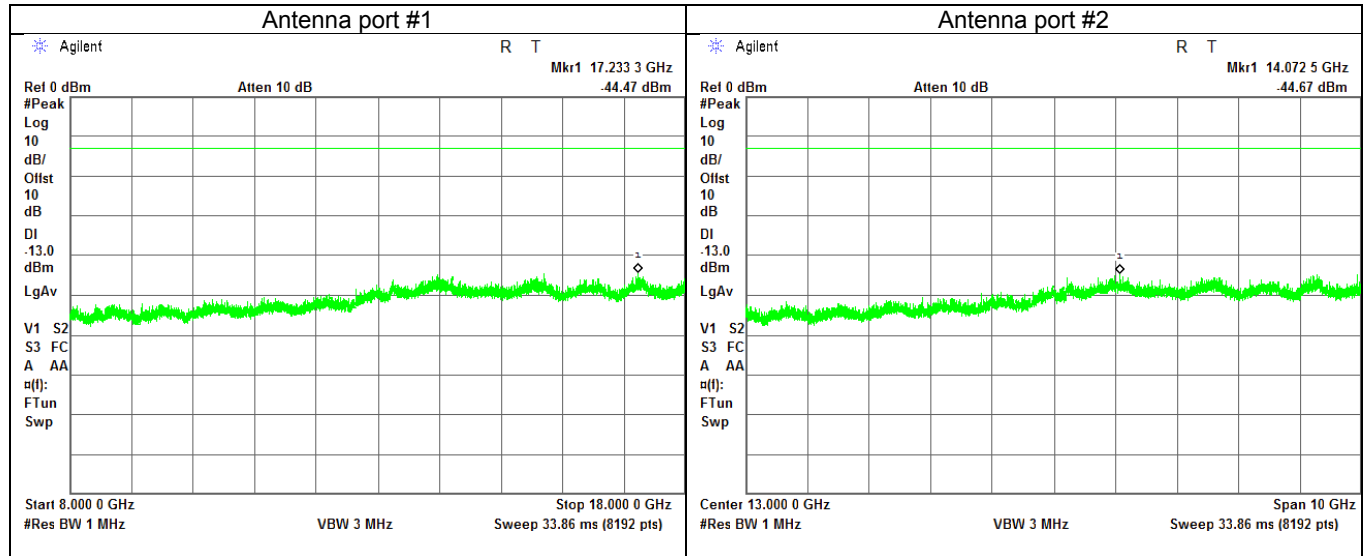


Plot 7.4.12 Spurious emission measurements in 1000 - 8000 MHz range at high carrier frequency

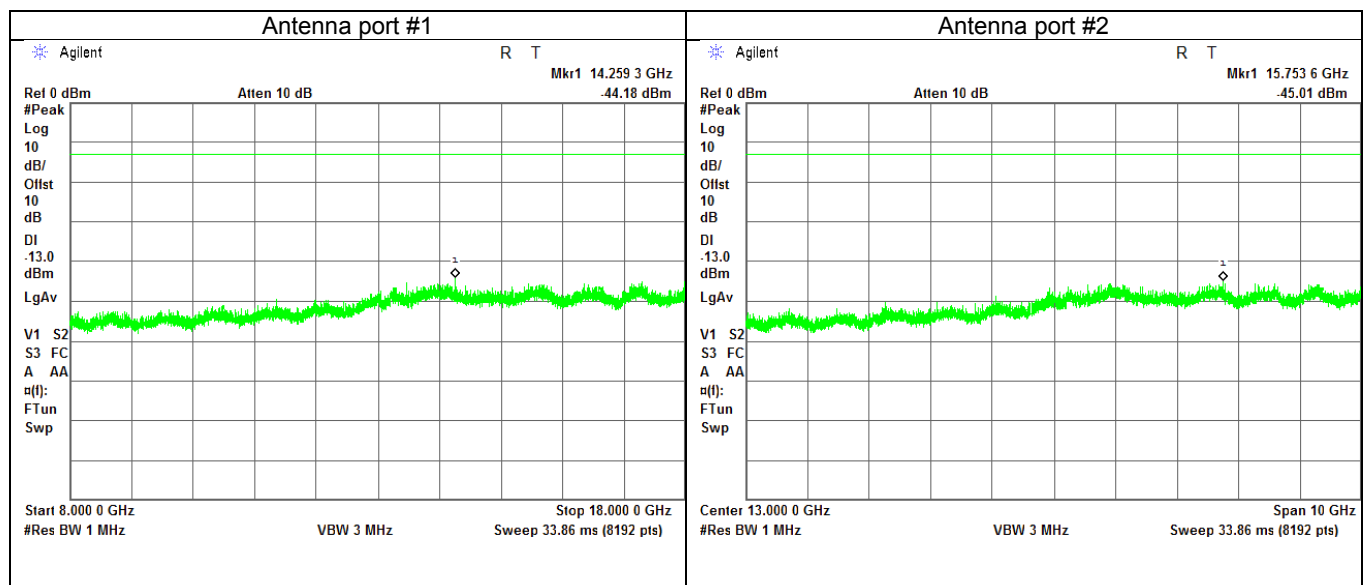


<b>Test specification:</b>		<b>Section 27.53, Spurious emissions at RF antenna connector</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051, 27.53	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b>		16-Aug-17	
<b>Temperature:</b> 24.4 °C	<b>Relative Humidity:</b> 44 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

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



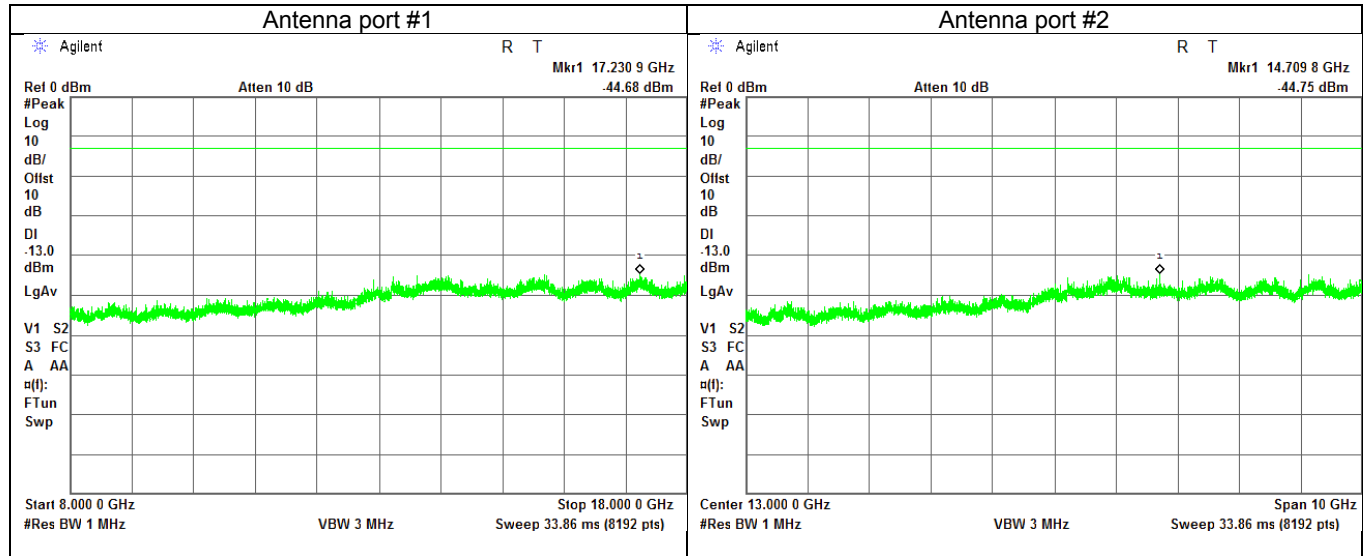
Plot 7.4.14 Spurious emission measurements in 8000 - 18000 MHz at mid carrier frequency



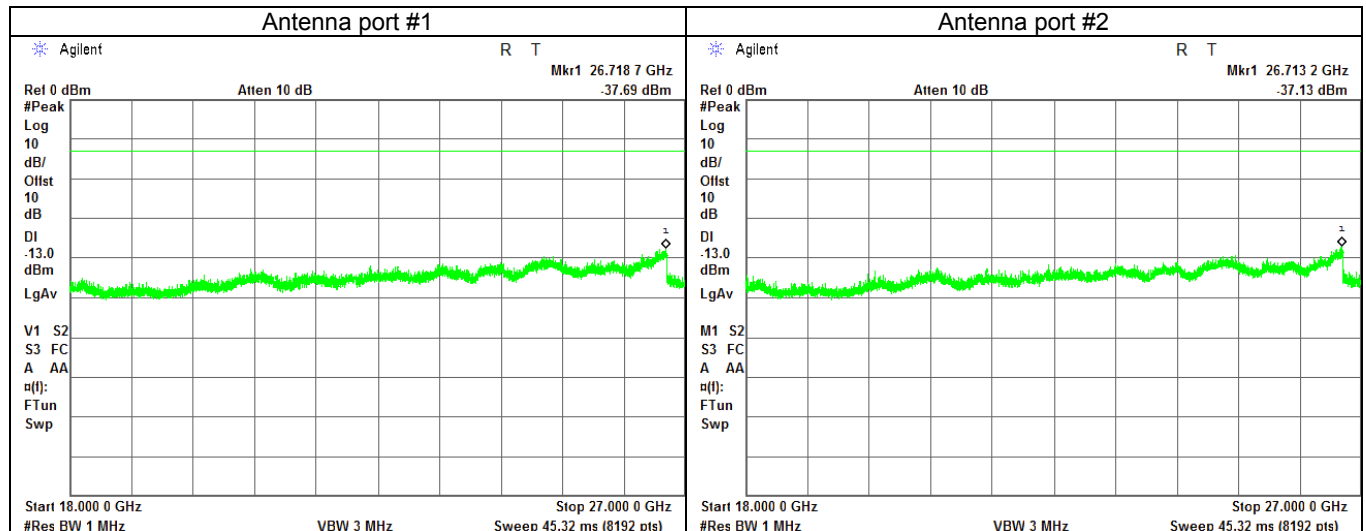


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Verdict: PASS	
Date(s):			
16-Aug-17			
Temperature: 24.4 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

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

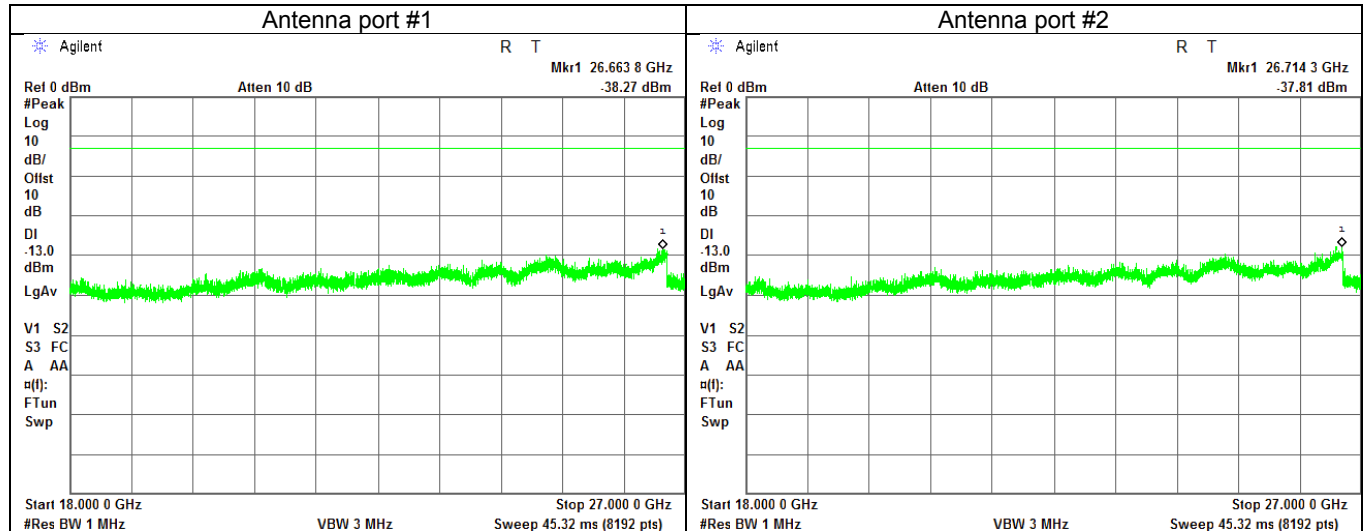


Plot 7.4.16 Spurious emission measurements in 18000 - 27000 MHz range at low carrier frequency

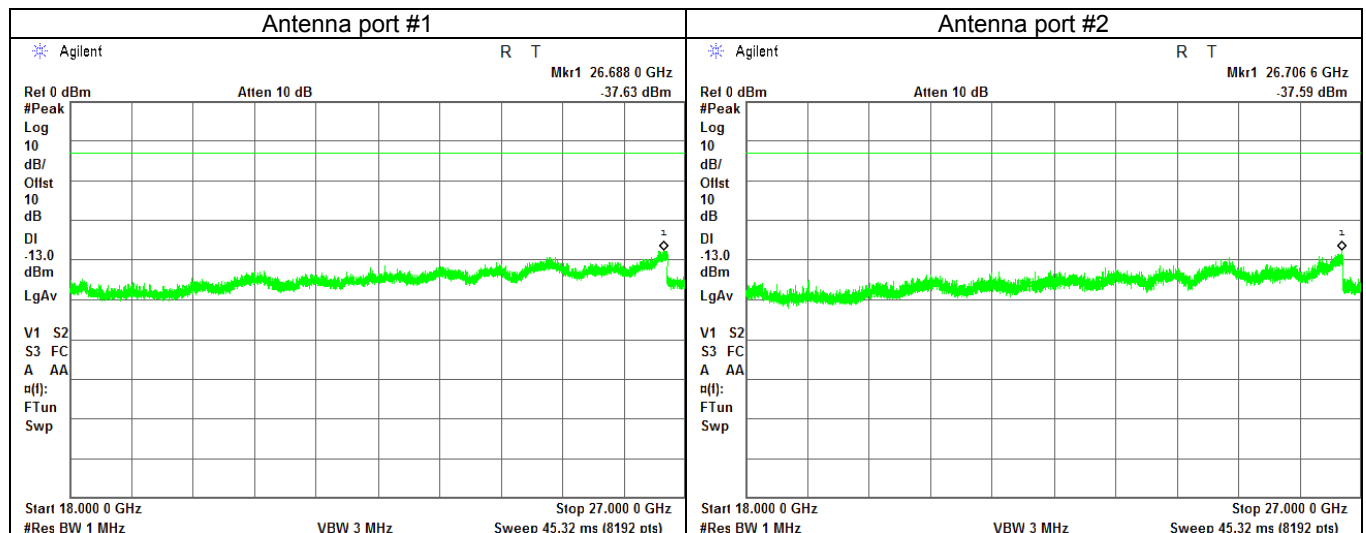


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Verdict: PASS	
Date(s):			
16-Aug-17			
Temperature: 24.4 °C	Relative Humidity: 44 %	Air Pressure: 1009 hPa	Power: 120 VAC
Remarks:			

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





<b>Test specification:</b> Section 27.53, Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

## 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 – 10 <sup>th</sup> harmonic*	43+10logP** fixed	-13	84.4
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.

### 7.5.4 Test procedure for substitution ERP 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 ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd 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.

<b>Test specification:</b> Section 27.53, Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

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

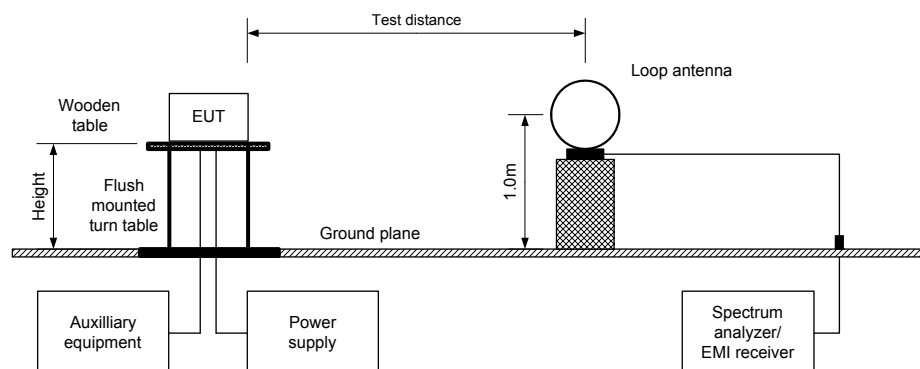
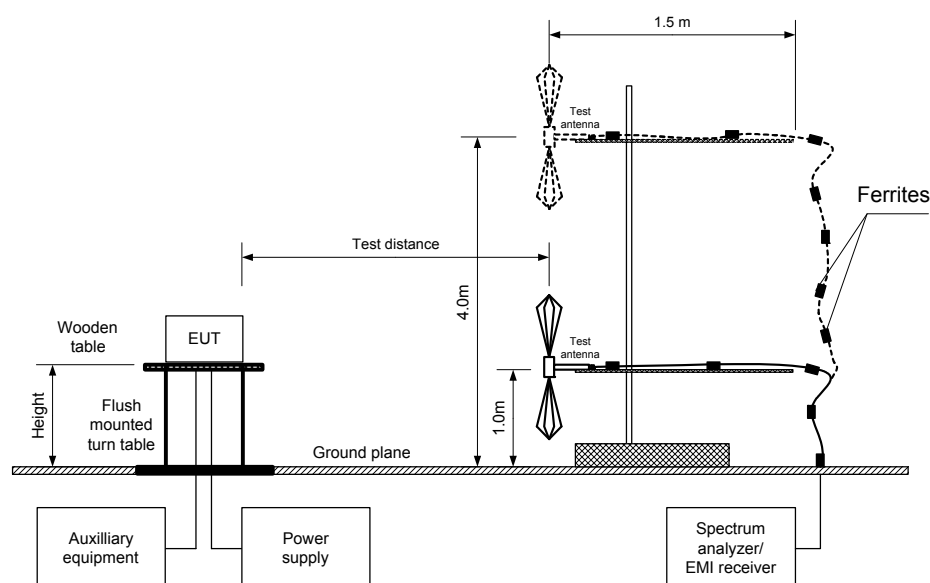
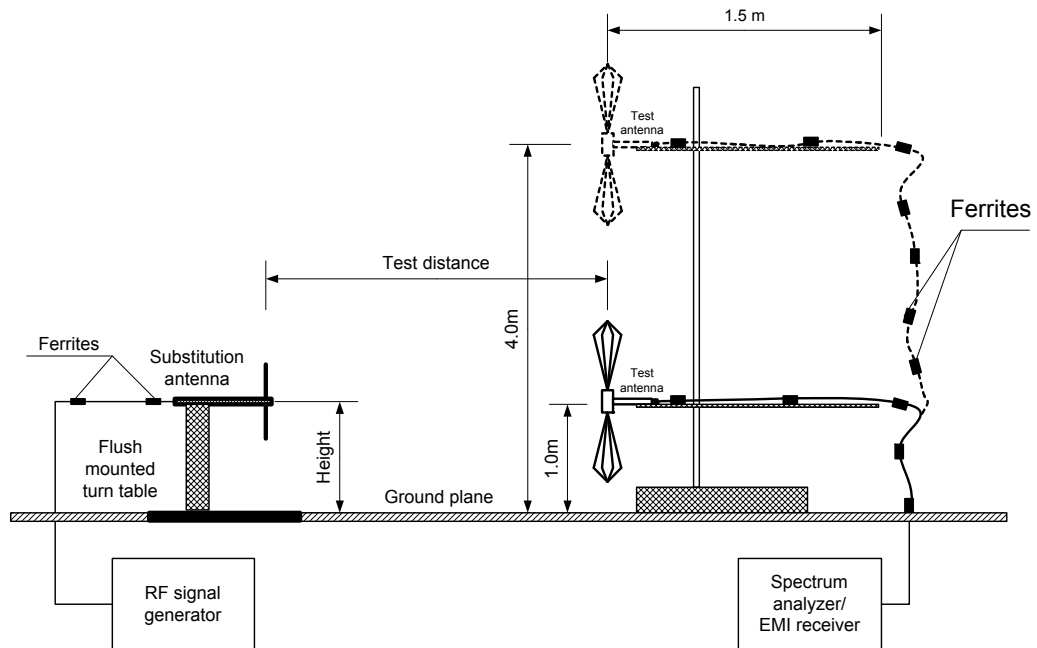


Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:		Section 27.53, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12	
Test mode:		Verdict: PASS	
Date(s):			
20-Aug-17 - 21-Aug-17			
Temperature: 24.6 °C	Relative Humidity: 38 %	Air Pressure: 1011 hPa	Power: 120 VAC
Remarks:			

Figure 7.5.3 Setup for substitution ERP measurements of spurious





<b>Test specification:</b> Section 27.53, Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

**Table 7.5.2 Spurious emission field strength test results**

ASSIGNED FREQUENCY RANGE: 2496.0 – 2690.0 MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: OATS  
 EUT HEIGHT: 0.8 m  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 27000 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
<b>Low carrier frequency MHz</b>							
15035.79	58.25	84.4	-26.15	1000	Hor	1.0	75
<b>Mid carrier frequency MHz</b>							
15743.86	58.05	84.4	-26.35	1000	Vert	1.15	114
<b>High carrier frequency MHz</b>							
16079.82	59.29	84.4	-25.11	1000	Vert	1.1	121

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

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



<b>Test specification:</b> Section 27.53, Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Table 7.5.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 2496.0 – 2690.0 MHz  
 TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 SUBSTITUTION ANTENNA HEIGHT: 0.8 m  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: > Resolution bandwidth  
 SUBSTITUTION ANTENNA TYPE: Tunable dipole (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Limit, dBm	Margin, dB*	Verdict
<b>Low carrier frequency</b>										
15035.79	58.25	1000	Hor	-44.63	11.02	8.49	-42.10	-13.00	-29.10	Pass
<b>Mid carrier frequency</b>										
15743.86	58.05	1000	Vert	-45.08	11.45	8.70	-42.33	-13.00	-29.33	Pass
<b>High carrier frequency</b>										
16079.82	59.29	1000	Vert	-44.15	11.07	8.79	-41.88	-13.00	-28.88	Pass

\*- Margin = Spurious emission – specification limit.

## Reference numbers of test equipment used

HL 0446	HL 0604	HL 0661	HL 2909	HL 3818	HL 4114	HL 4353	HL 4933
HL 4956	HL 5110	HL 5111	HL 5112				

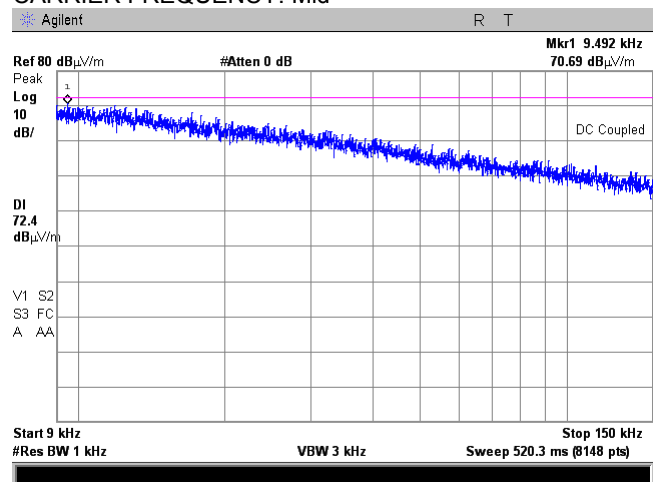
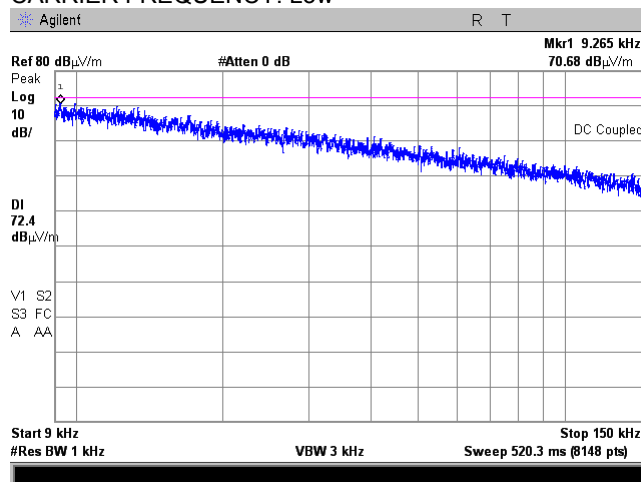
Full description is given in Appendix A.

<b>Test specification: Section 27.53, Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

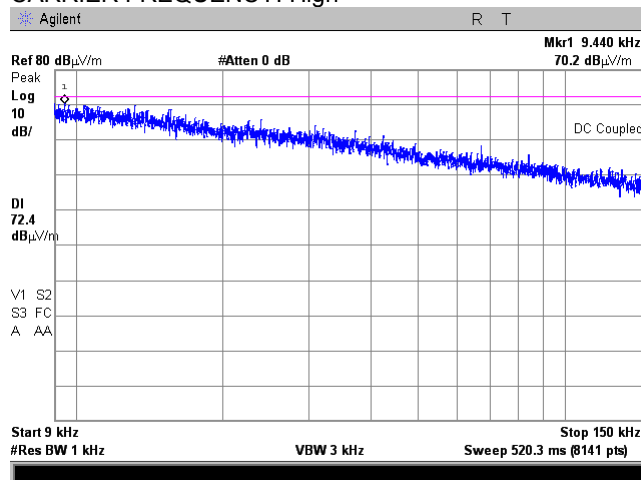
Plot 7.5.1 Radiated emission measurements in 9 - 150 kHz range

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
CARRIER FREQUENCY: Low

Semi anechoic chamber  
3 m  
Vertical  
Typical (Vertical)  
CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



NOTE: limit 84.4 dBuV/m was applied

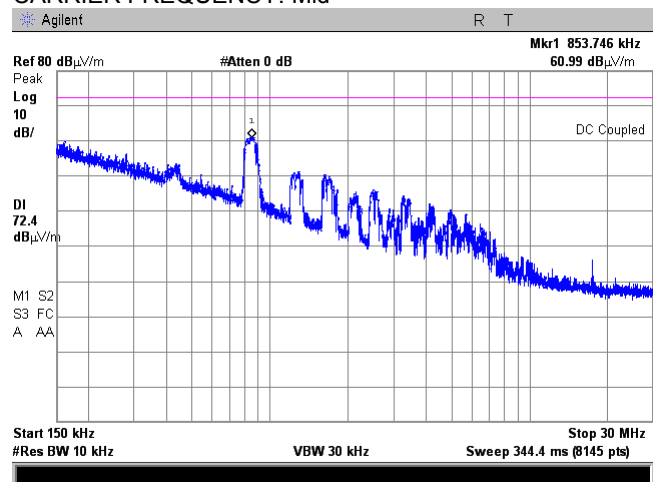
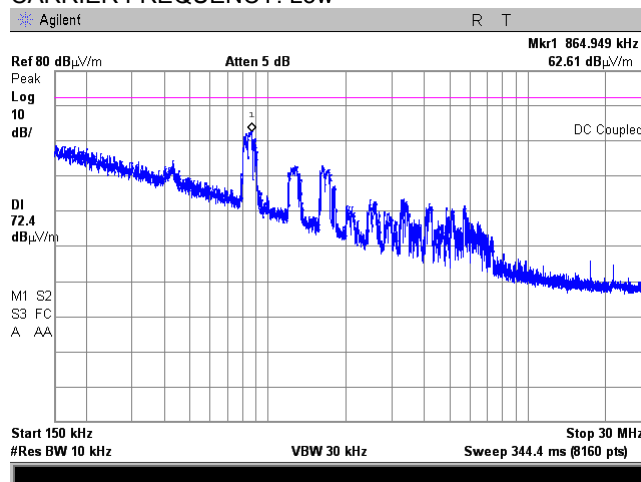


<b>Test specification: Section 27.53, Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

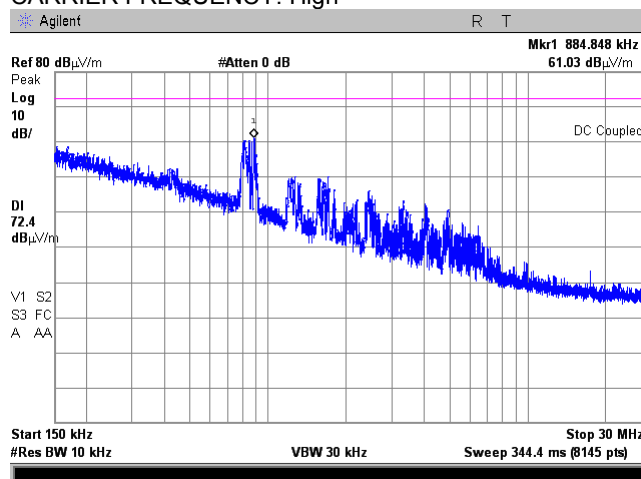
### Plot 7.5.2 Radiated emission measurements in 0.15 - 30 MHz range

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
CARRIER FREQUENCY: Low

Semi anechoic chamber  
3 m  
Vertical  
Typical (Vertical)  
CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



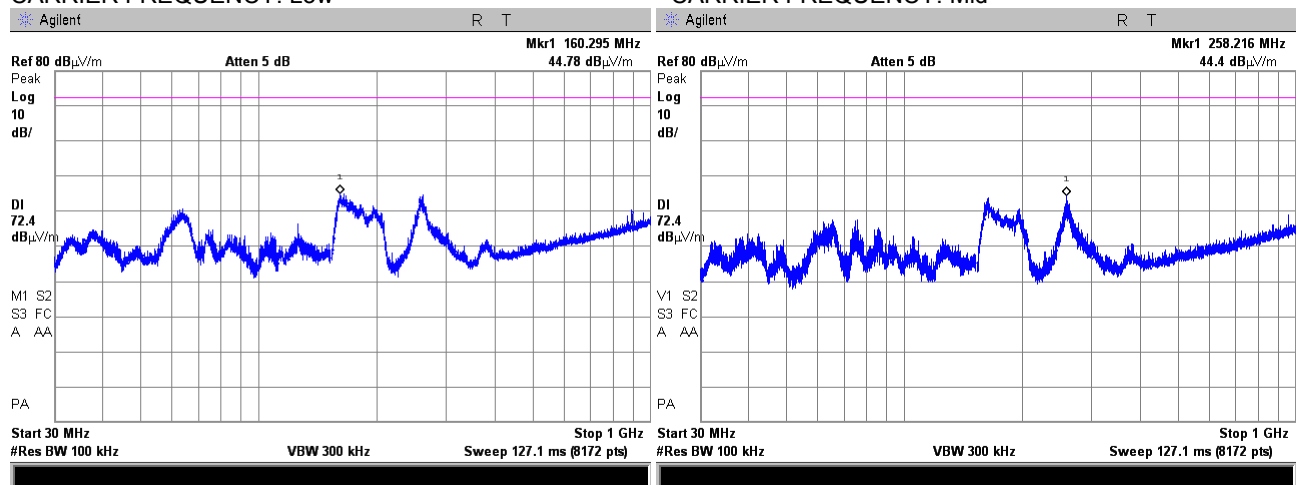
NOTE: limit 84.4 dB $\mu$ V/m was applied

<b>Test specification: Section 27.53, Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

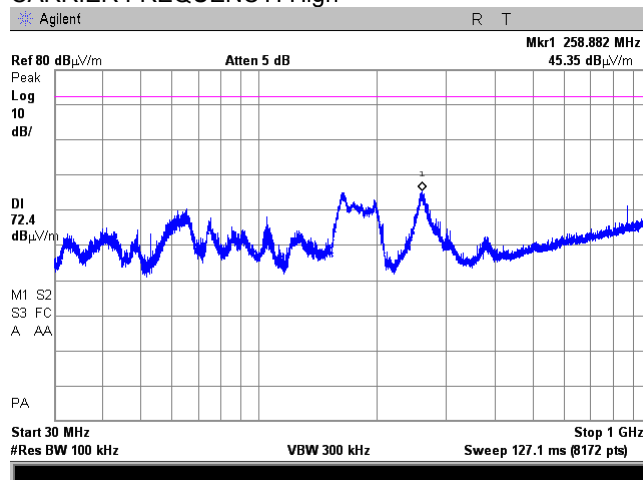
### Plot 7.5.3 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
CARRIER FREQUENCY: Low

Semi anechoic chamber  
3 m  
Vertical and Horizontal  
Typical (Vertical)  
CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



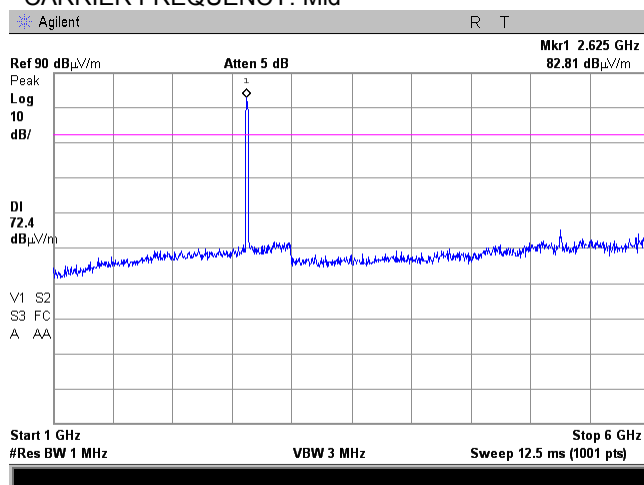
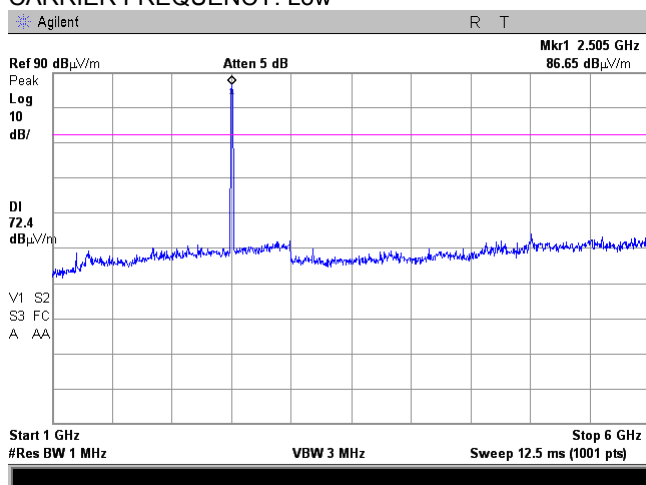
NOTE: limit 84.4 dBuV/m was applied

<b>Test specification:</b> Section 27.53, Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

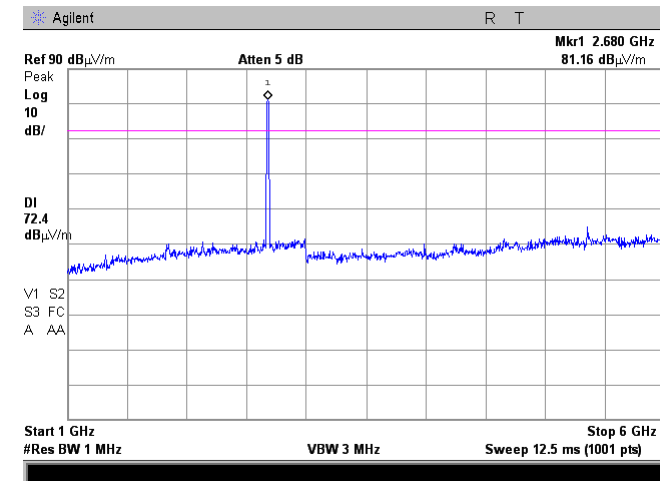
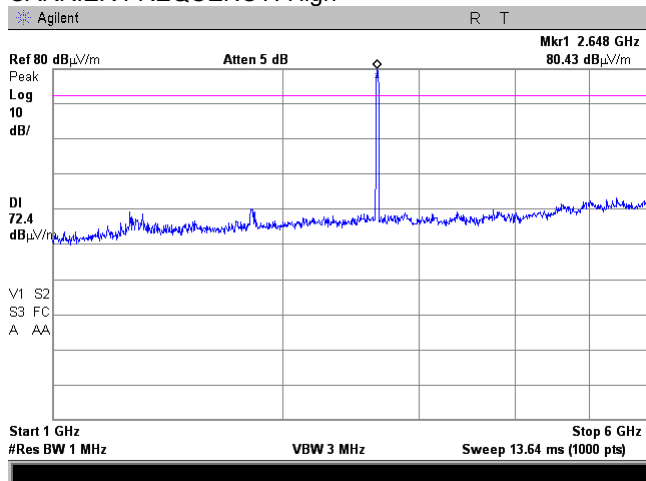
### Plot 7.5.4 Radiated emission measurements in 1000 – 6000 MHz range

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
CARRIER FREQUENCY: Low

Semi anechoic chamber  
3 m  
Vertical and Horizontal  
Typical (Vertical)  
CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



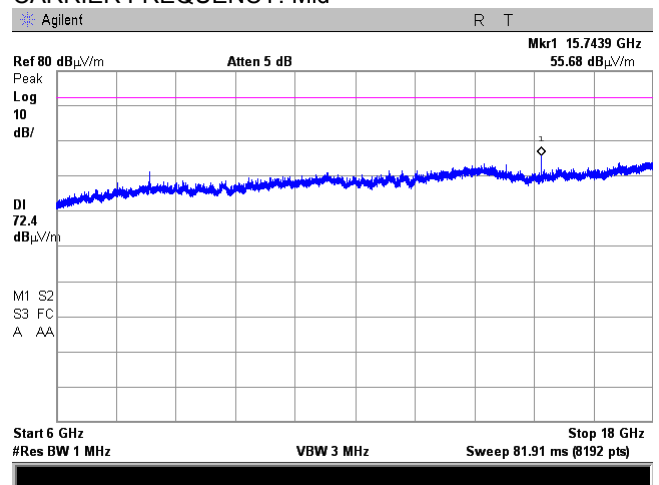
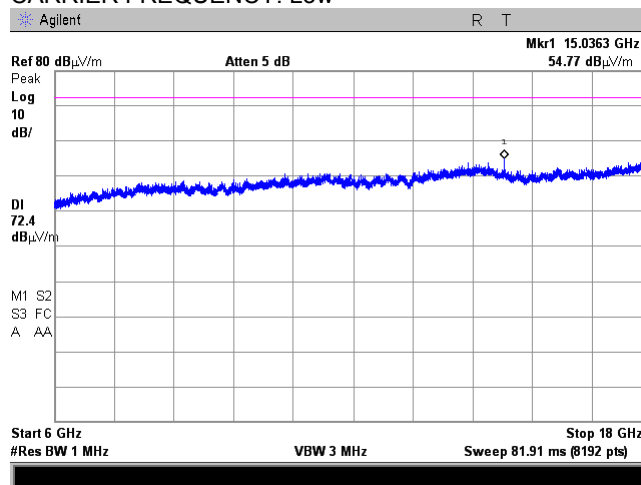
NOTE: limit 84.4 dB $\mu$ V/m was applied

<b>Test specification: Section 27.53, Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

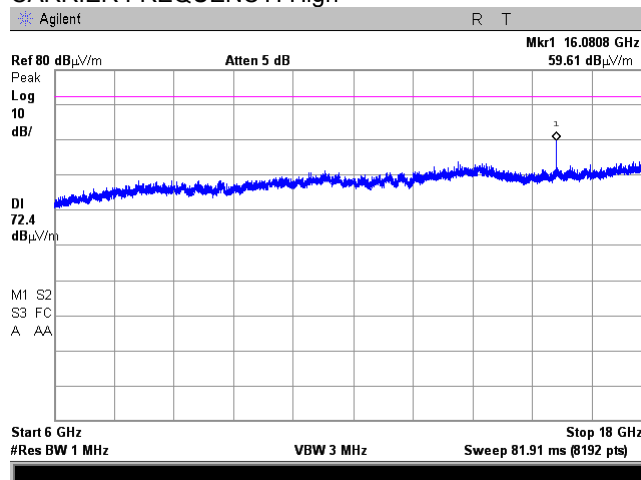
### Plot 7.5.5 Radiated emission measurements in 6000 – 18000 MHz range

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
CARRIER FREQUENCY: Low

Semi anechoic chamber  
3 m  
Vertical and Horizontal  
Typical (Vertical)  
CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



NOTE: limit 84.4 dB $\mu$ V/m was applied



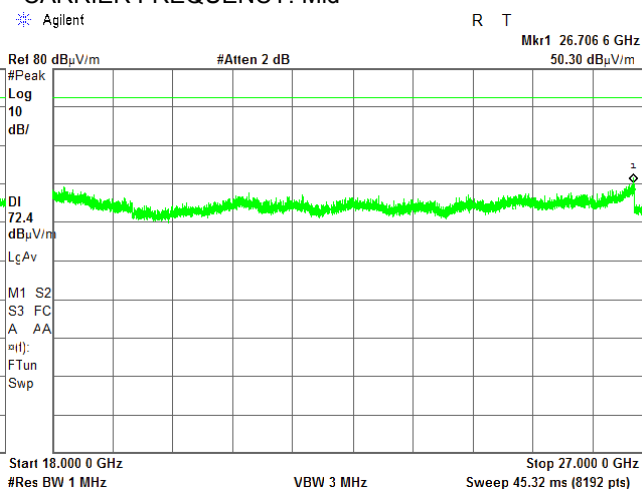
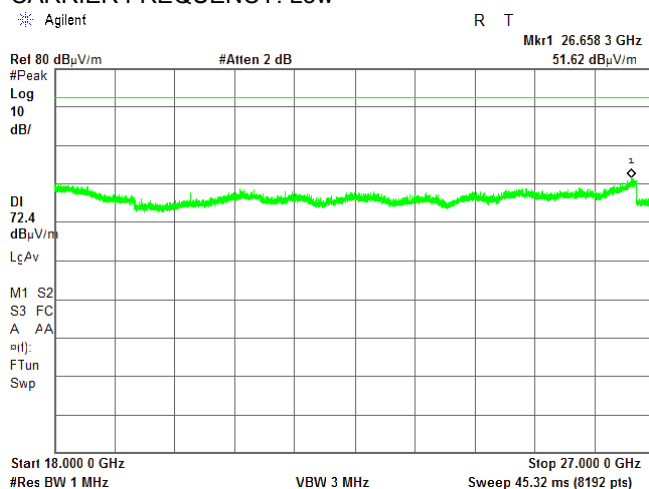
HERMON LABORATORIES

<b>Test specification: Section 27.53, Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

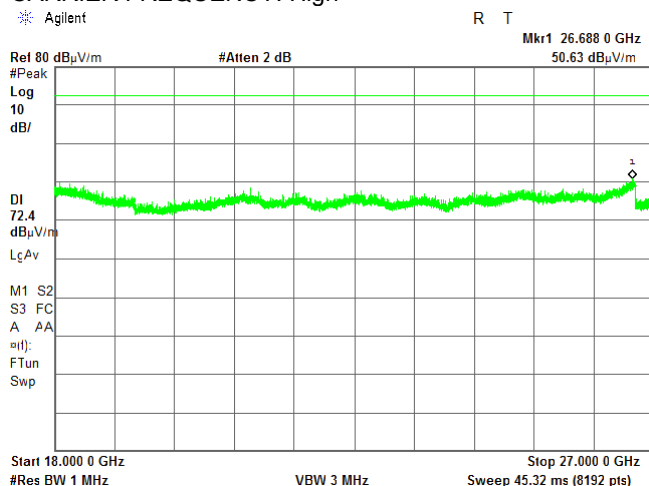
Plot 7.5.6 Radiated emission measurements in 18000 – 27000 MHz range

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
CARRIER FREQUENCY: Low

Semi anechoic chamber  
3 m  
Vertical and Horizontal  
Typical (Vertical)  
CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



NOTE: limit 84.4 dB $\mu$ V/m was applied

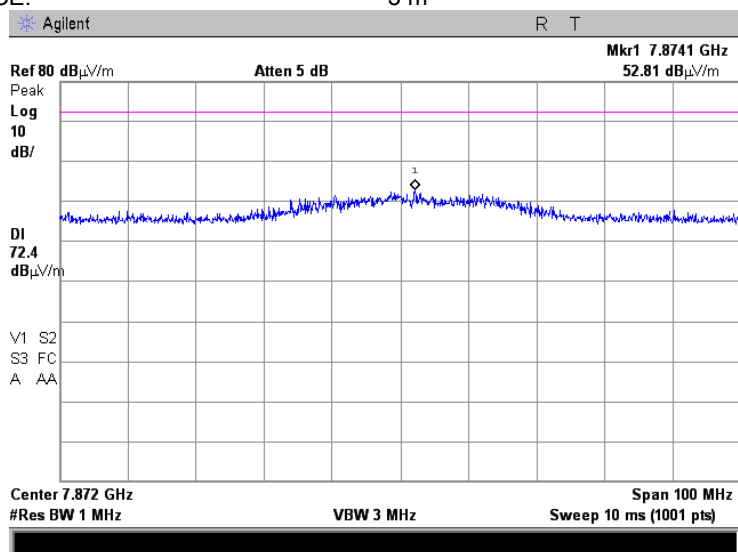


HERMON LABORATORIES

<b>Test specification:</b>		<b>Section 27.53, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b>		20-Aug-17 - 21-Aug-17	
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

**Plot 7.5.7 Radiated emission measurements at the 3<sup>rd</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



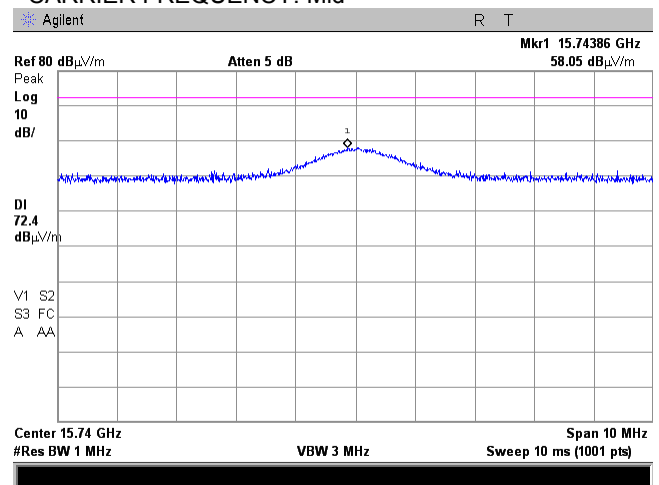
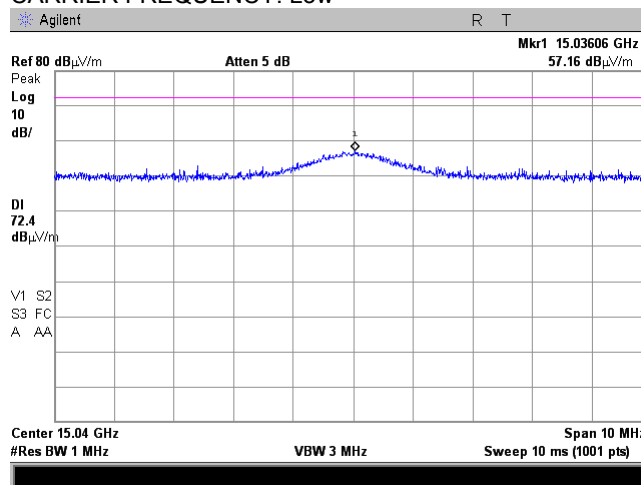
NOTE: limit 84.4 dBuV/m was applied

<b>Test specification: Section 27.53, Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 20-Aug-17 - 21-Aug-17			
<b>Temperature:</b> 24.6 °C	<b>Relative Humidity:</b> 38 %	<b>Air Pressure:</b> 1011 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

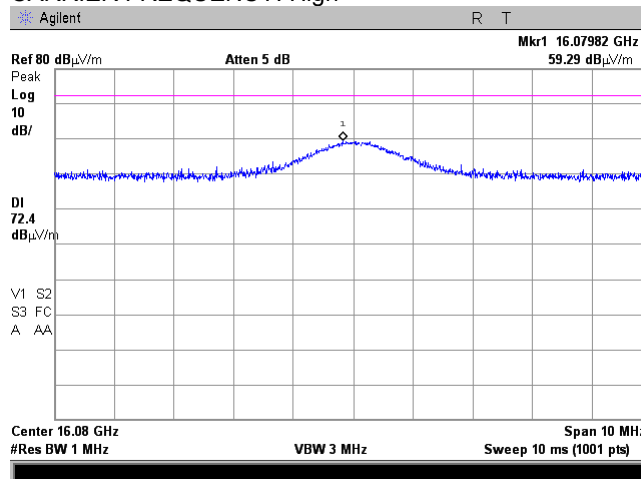
### Plot 7.5.8 Radiated emission measurements at the 7<sup>th</sup> harmonic

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
CARRIER FREQUENCY: Low

OATS  
3 m  
Vertical  
Typical (Vertical)  
CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



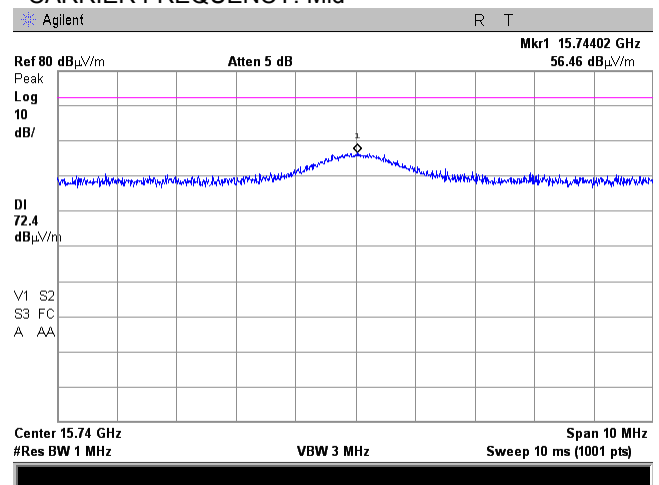
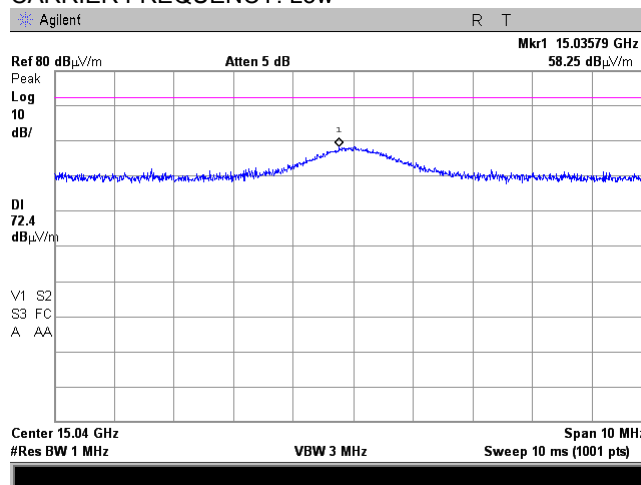
NOTE: limit 84.4 dB $\mu$ V/m was applied

Test specification:		Section 27.53, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12	
Test mode:		Verdict: PASS	
Date(s):			
20-Aug-17 - 21-Aug-17			
Temperature: 24.6 °C	Relative Humidity: 38 %	Air Pressure: 1011 hPa	Power: 120 VAC
Remarks:			

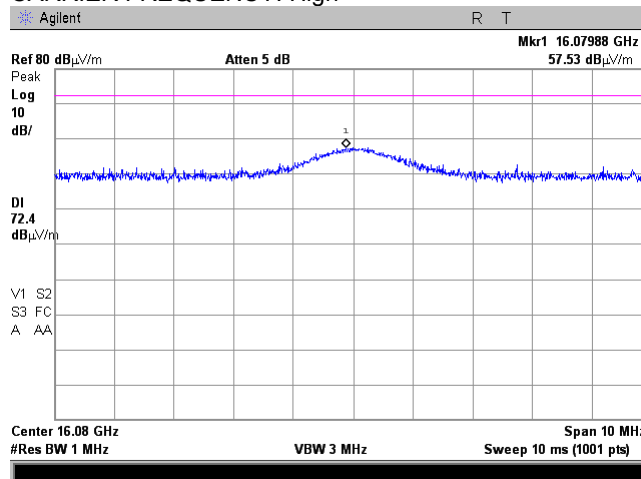
### Plot 7.5.9 Radiated emission measurements at the 7<sup>th</sup> harmonic

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
CARRIER FREQUENCY: Low

OATS  
3 m  
Horizontal  
Typical (Vertical)  
CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High



NOTE: limit 84.4 dB $\mu$ V/m was applied



<b>Test specification:</b> Section 27.54, Frequency stability			
<b>Test procedure:</b> 47 CFR, Section 2.1055; TIA/EIA-603-D Section 2.2.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 17-Aug-17			
<b>Temperature:</b> 24.5 °C	<b>Relative Humidity:</b> 39 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

## 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.

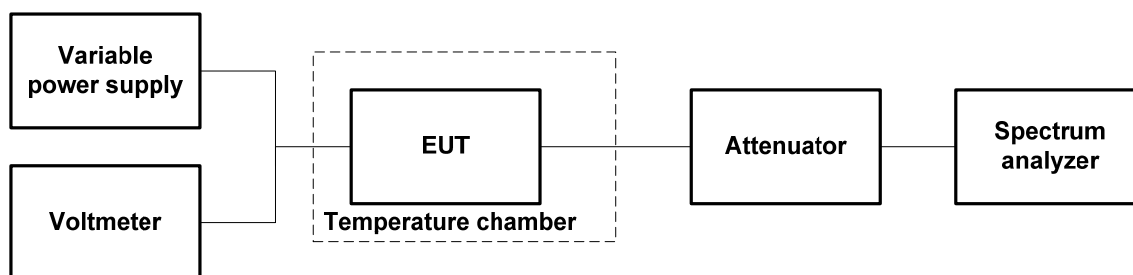
Table 7.6.1 Frequency stability limits

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, Table 7.6.3.
- 7.6.2.7 The test results provided in Table 7.6.4.

Figure 7.6.1 Frequency stability test setup





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<b>Test specification:</b>		<b>Section 27.54, Frequency stability</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1055; TIA/EIA-603-D Section 2.2.2	
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date(s):</b>	17-Aug-17		
<b>Temperature:</b> 24.5 °C	<b>Relative Humidity:</b> 39 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Table 7.6.2 Frequency stability test results

OPERATING FREQUENCY: 2496.0 – 2690.0 MHz  
 NOMINAL POWER VOLTAGE: 120 VAC  
 TEMPERATURE STABILIZATION PERIOD: 20 min  
 POWER DURING TEMPERATURE TRANSITION: Off  
 SPECTRUM ANALYZER MODE: Counter  
 RESOLUTION BANDWIDTH: 10 Hz  
 VIDEO BANDWIDTH: 30 Hz  
 MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz	
		Start up	1 <sup>st</sup> min	2 <sup>nd</sup> min	3 <sup>rd</sup> min	4 <sup>th</sup> min	5 <sup>th</sup> min	10 <sup>th</sup> min	Positive	Negative
Low carrier frequency										
-30	nominal	2506000.000	2506000.001	2506000.002	2506000.000	2506000.000	2506000.000	2506000.004	2	-2
-20	nominal	2505999.999	NA	NA	NA	NA	NA	2506000.009	7	-3
-10	nominal	2506000.004	NA	NA	NA	NA	NA	2506000.000	2	-3
0	nominal	2506000.004	2506000.003	2506000.005	2505999.996	2506000.003	2506000.003	2506000.001	3	-6
10	nominal	2505999.998	NA	NA	NA	NA	NA	2506000.004	2	-6
20	15%	2506000.009	NA	NA	NA	NA	NA	2506000.006	7	-4
20	nominal	2506000.009	NA	NA	NA	NA	NA	2506000.002	7	0
20	-15%	2506000.009	NA	NA	NA	NA	NA	2506000.003	7	0
30	nominal	2506000.000	2506000.005	2506000.006	2505999.998	2506000.002	2506000.001	2506000.003	4	-4
40	nominal	2505999.997	NA	NA	NA	NA	NA	2506000.002	0	-5
50	nominal	2505999.998	NA	NA	NA	NA	NA	2506000.005	3	-5
Mid carrier frequency										
-30	nominal	2624000.000	2623999.997	2624000.000	2623999.998	2623999.999	2623999.998	2623999.998	2	-1
-20	nominal	2624000.000	NA	NA	NA	NA	NA	2624000.001	3	2
-10	nominal	2624000.002	NA	NA	NA	NA	NA	2624000.000	4	2
0	nominal	2623999.994	2624000.002	2623999.998	2623999.998	2623999.998	2623999.998	2624000.001	4	-4
10	nominal	2624000.004	NA	NA	NA	NA	NA	2624000.003	6	5
20	15%	2624000.001	NA	NA	NA	NA	NA	2623999.999	3	1
20	nominal	2624000.001	NA	NA	NA	NA	NA	2623999.998	3	0
20	-15%	2624000.002	NA	NA	NA	NA	NA	2623999.997	4	-1
30	nominal	2623999.998	2623999.995	2623999.996	2623999.997	2623999.998	2623999.998	2624000.004	6	-3
40	nominal	2624000.002	NA	NA	NA	NA	NA	2624000.002	4	4
50	nominal	2624000.002	NA	NA	NA	NA	NA	2624000.008	10	4
High carrier frequency										
-30	nominal	2679999.999	2680000.001	2680000.004	2679999.996	2679999.997	2680000.001	2680000.004	4	-4
-20	nominal	2680000.002	NA	NA	NA	NA	NA	2680000.005	5	2
-10	nominal	2680000.000	NA	NA	NA	NA	NA	2680000.000	0	0
0	nominal	2680000.005	2680000.001	2680000.005	2680000.003	2680000.003	2680000.002	2680000.006	6	1
10	nominal	2679999.998	NA	NA	NA	NA	NA	2679999.997	-2	-3
20	15%	2680000.000	NA	NA	NA	NA	NA	2679999.999	0	-1
20	nominal	2680000.001	NA	NA	NA	NA	NA	2680000.000	1	0
20	-15%	2680000.002	NA	NA	NA	NA	NA	2680000.001	2	1
30	nominal	2680000.003	2680000.004	2680000.002	2680000.005	2680000.006	2680000.012	2680000.003	12	2
40	nominal	2680000.005	NA	NA	NA	NA	NA	2680000.005	5	5
50	nominal	2680000.006	NA	NA	NA	NA	NA	2679999.998	6	-2

\* - Reference frequency



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<b>Test specification:</b> <b>Section 27.54, Frequency stability</b>			
<b>Test procedure:</b> 47 CFR, Section 2.1055; TIA/EIA-603-D Section 2.2.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b> 17-Aug-17			
<b>Temperature:</b> 24.5 °C	<b>Relative Humidity:</b> 39 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 VAC
<b>Remarks:</b>			

Table 7.6.3 Maximum frequency displacement

Channel	Maximum frequency displacement			
	ppm		Hz	
	Negative	Positive	Negative	Positive
Low	0.24	0.28	-6	7
High	0.15	0.44	-4	12

Table 7.6.4 Transmission occupied bandwidth with frequency drift test results

Lower measured* band edge, MHz	Upper measured* band edge, MHz	Lower calculated** band edge, MHz	Upper calculated** band edge, MHz	Lower specified band edge, MHz	Upper specified band edge, MHz	Lower margin***, MHz	Upper margin***, MHz	Verdict
<b>Low frequency 2506 MHz</b>								
2496.64	2515.36	2496.639994	2515.360007	2496.000000	2516.000000	-0.639994	-0.639993	Pass
2496.64	2515.36	2496.639994	2515.360007	2496.000000	2516.000000	-0.639993	-0.639993	Pass
<b>Mid frequency 2624 MHz</b>								
2614.68	2633.36	2614.679990	2633.360004	2614.000000	2634.000000	-0.679990	-0.639996	Pass
2614.64	2633.36	2614.639990	2633.360004	2614.000000	2634.000000	-0.639996	-0.639996	Pass
<b>High frequency 2680 MHz</b>								
2670.64	2689.36	2670.639996	2689.360012	2670.000000	2690.000000	-0.639996	-0.639988	Pass
2670.64	2689.36	2670.639996	2689.360012	2670.000000	2690.000000	-0.639988	-0.639988	Pass

\* - Measured under normal test conditions at 26 dBc points

\*\* - Measured band edge with proper drift addition

\*\*\* - Margin = Calculated band edge – specified band edge

**Reference numbers of test equipment used**

HL 3818	HL 3901	HL 5174	HL 5175				
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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	19-Jan-17	19-Jan-18
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	12-May-17	12-May-18
0661	Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm	Hewlett Packard	83640B	3614A002 66	10-May-17	10-May-18
2214	Directional Coupler 1.7-26.5 GHz	Krytar	2616	31354	16-Sep-15	16-Sep-17
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	09-Mar-17	09-Mar-18
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	09-Apr-17	09-Apr-18
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	09-Apr-17	09-Apr-18
3433	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25679	27-Mar-17	27-Mar-18
3434	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25683	27-Mar-17	27-Mar-18
3667	Directional coupler, 2 GHz to 8 GHz, 10 dB	ELISRA	MW10162	1011	15-Jun-17	15-Jun-18
3787	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	07-Dec-16	07-Dec-17
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	07-May-17	07-May-18
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	20-Feb-17	20-Feb-18
4068	Attenuator, SMA, 30 dB, DC to 12.4 GHz	Midwest Microwave	ATT-0527-30-SMA-07	NA	16-Aug-17	16-Aug-18
4114	Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz	ETS Lindgren	3117	00123515	17-Jan-17	17-Jan-18
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-17	15-Mar-18
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
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	14-Oct-16	14-Oct-17
4956	Active horn antenna, 18 to 40 GHz	Com-Power Corporation	AHA-840	105004	17-Jan-17	17-Jan-18
5110	RF cable, 18 GHz, 3 m, N-type	Huber-Suhner	ST18A/N m/Nm/300 0	600818/18 A	27-Jul-17	27-Jul-18
5111	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/11SK/11SK/5500M M	502493/2E A	27-Jul-17	27-Jul-18



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HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
5112	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/ 11SK/11S K/5500M M	502494/2E A	27-Jul-17	27-Jul-18
5174	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 10 dB, 5 W	API Weinschel, Inc	75A-10-12	TD854	20-Feb-17	20-Feb-18
5175	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 20 dB, 5 W	API Weinschel, Inc	75A-20-12	TE289	20-Feb-17	20-Feb-18

## 9 APPENDIX B Measurement uncertainties

### Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
<b>Transmitter tests</b>	
Carrier power conducted at antenna connector	$\pm 1.7$ dB
Carrier power radiated (substitution method)	$\pm 4.5$ dB
Occupied bandwidth	$\pm 8\%$
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: $\pm 2.6$ dB 2.9 GHz to 6.46 GHz: $\pm 3.5$ dB 6.46 GHz to 13.2 GHz: $\pm 4.3$ dB 13.2 GHz to 22.0 GHz: $\pm 5.0$ dB 22.0 GHz to 26.8 GHz: $\pm 5.5$ dB 26.8 GHz to 40.0 GHz: $\pm 4.8$ dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	$\pm 4.5$ dB
Frequency error	30 – 300 MHz: $\pm 50.5$ Hz (1.68 ppm) 300 – 1000 MHz: $\pm 168$ Hz (0.56 ppm)
Transient frequency behaviour	187 Hz $\pm 13.9\%$
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0\%$

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

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-808 for OATS, R-1082 for anechoic chamber, G-869 for RE measurements above 1 GHz, C-845 for conducted emissions site and T-1606 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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Person for contact: Mr. Michael Nikishin, EMC&Radio group manager

## 11 APPENDIX D Specification references

47CFR part 27: 2016	Private land mobile radio services
47CFR part 1: 2016	Practice and procedure
47CFR part 2: 2016	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.
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( $\mu$ V) to convert it into field strength in dB( $\mu$ 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( $\mu$ V) to convert it into field strength in dB( $\mu$ V/m).

**Antenna factor**  
**Double-ridged waveguide horn antenna**  
**ETS Lindgren, Model 3117, serial number: 00123515, HL 4114**

Frequency, MHz	Antenna factor, dB/m		
	Measured	Manufacturer	Deviation
1000	28.0	28.4	-0.4
1500	28.0	27.4	0.6
2000	31.2	30.9	0.3
2500	32.5	33.4	-0.9
3000	32.9	32.6	0.3
3500	32.7	32.8	-0.1
4000	33.1	33.4	-0.3
4500	33.8	33.9	-0.1
5000	33.8	34.1	-0.3
5500	34.4	34.5	-0.1
6000	35.0	35.2	-0.2
6500	35.4	35.5	-0.1
7000	35.7	35.7	0.0
7500	35.9	35.7	0.2
8000	35.8	35.8	0.0
8500	35.9	35.8	0.1
9000	36.3	36.2	0.1
9500	36.6	36.6	0.0
10000	37.1	37.1	0.0
10500	37.6	37.5	0.1
11000	37.9	37.7	0.2
11500	38.5	38.1	0.4
12000	39.2	38.7	0.5
12500	39.0	38.9	0.1
13000	39.1	39.1	0.0
13500	38.9	38.8	0.1
14000	39.0	38.8	0.2
14500	39.6	39.9	-0.3
15000	39.9	39.7	0.2
15500	39.9	40.1	-0.2
16000	40.7	40.8	-0.1
16500	41.3	41.8	-0.5
17000	42.5	42.1	0.4
17500	41.3	41.2	0.1
18000	41.4	40.9	0.5

Antenna factor is to be added to receiver meter reading in dB( $\mu$ V) to convert to field strength in dB( $\mu$ V/meter)



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Antenna factor, HL 4933

**Active Horn Antenna Factor Calibration**

1 GHz to 18 GHz

<b>Equipment:</b>			<b>ACTIVE HORN ANTENNA</b>		
<b>Model:</b>			<b>AHA-118</b>		
<b>Serial Number:</b>			<b>701046</b>		
<b>Calibration Distance:</b>			<b>3 Meter</b>		
<b>Polarization:</b>			<b>Horizontal</b>		
<b>Calibration Date:</b>			<b>11/12/2014</b>		
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					
<b>Antenna Factor to be added to receiver reading:</b>					
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

<b>Equipment:</b>			<b>ACTIVE HORN ANTENNA</b>		
<b>Model:</b>			<b>AHA-840</b>		
<b>Serial Number:</b>			<b>105004</b>		
<b>Calibration Distance:</b>			<b>3 meter</b>		
<b>Polarization:</b>			<b>Horizontal</b>		
<b>Calibration Date:</b>			<b>1/26/2015</b>		
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
<p>Calibration per ANSI C63.5: 2006  <b>Standard Site Method, Equations 1-6 (3-antenna)</b></p> <p>Corrected Reading (dBμV/m) = Meter Reading (dBμV) + AFE(dB/m)</p>					

**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**  
**Test Cable, Mini-Circuits, CBL-5FT-SMSM+, SMA-SMA, 18 GHz, 1.5 m, S/N 25683**  
**Mini-Circuits, HL 3434**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10.0	0.06	9000	1.96
100	0.16	9500	2.01
500	0.40	10000	2.01
1000	0.57	10500	2.14
1500	0.72	11000	2.21
2000	0.85	11500	2.24
2500	0.95	12000	2.36
3000	1.03	12500	2.47
3500	1.11	13000	2.46
4000	1.21	13500	2.50
4500	1.29	14000	2.53
5000	1.39	14500	2.53
5500	1.46	15000	2.62
6000	1.52	15500	2.70
6500	1.60	16000	2.80
7000	1.68	16500	2.86
7500	1.75	17000	2.88
8000	1.83	17500	2.94
8500	1.88	18000	3.00

**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**  
**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		





**Cable loss**  
**RF Cable, Huber-Suhner, 18 GHz, 3 m, N- type,**  
**ST18A/Nm/Nm/3000, S/N 600818/18A**  
**HL 5110**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
0.1	0.01	5500	1.99
50	0.17	6000	2.10
100	0.24	6500	2.20
200	0.34	7000	2.29
300	0.42	7500	2.38
400	0.48	8000	2.47
500	0.54	8500	2.57
600	0.59	9000	2.65
700	0.64	9500	2.74
800	0.69	10000	2.83
900	0.73	10500	2.91
1000	0.77	11000	2.99
1100	0.82	11500	3.07
1200	0.86	12000	3.14
1300	0.89	12500	3.22
1400	0.93	13000	3.29
1500	0.96	13500	3.37
1600	1.00	14000	3.45
1700	1.03	14500	3.52
1800	1.06	15000	3.59
1900	1.10	15500	3.66
2000	1.13	16000	3.74
2500	1.28	16500	3.80
3000	1.41	17000	3.88
3500	1.54	17500	4.00
4000	1.66	18000	4.02
4500	1.78		
5000	1.89		

**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		

**Cable loss**  
**RF Cable, Huber-Suhner, 40 GHz, 5.5 m, K type,**  
**SF102EA/11SK/11SK/5500MM, S/N 502494/2EA**  
**HL 5112**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
100	0.69	20500	10.18
200	0.97	21000	10.32
300	1.18	21500	10.47
500	1.52	22000	10.60
1000	2.14	22500	10.75
1500	2.62	23000	10.87
2000	3.03	23500	11.00
2500	3.40	24000	11.12
3000	3.73	24500	11.23
3500	4.04	25000	11.35
4000	4.33	25500	11.52
4500	4.60	26000	11.64
5000	4.86	26500	11.73
5500	5.10	27000	11.84
6000	5.34	27500	11.93
6500	5.57	28000	12.05
7000	5.79	28500	12.19
7500	6.00	29000	12.33
8000	6.21	29500	12.44
8500	6.43	30000	12.53
9000	6.62	30500	12.58
9500	6.82	31000	12.71
10000	7.01	31500	12.86
10500	7.17	32000	13.00
11000	7.34	32500	13.11
11500	7.51	33000	13.24
12000	7.68	33500	13.33
12500	7.84	34000	13.44
13000	8.00	34500	13.58
13500	8.16	35000	13.69
14000	8.32	35500	13.81
14500	8.48	36000	13.93
15000	8.63	36500	14.05
15500	8.77	37000	14.24
16000	8.92	37500	14.28
16500	9.08	38000	14.38
17000	9.23	38500	14.50
17500	9.37	39000	14.61
18000	9.51	39500	14.70
18500	9.66	40000	14.83
19000	9.78		
19500	9.92		
20000	10.07		

## 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( $\mu$ V)	decibel referred to one microvolt
dB( $\mu$ V/m)	decibel referred to one microvolt per meter
dB( $\mu$ A)	decibel referred to one microampere
dB $\Omega$	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
$\mu$ s	microsecond
NA	not applicable
NB	narrow band
NT	not tested
OATS	open area test site
$\Omega$	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

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