

TEST REPORT

ACCORDING TO: FCC 47CFR part 27

FOR:

Airspan Networks Inc.

LTE Base Station

Model: AirHarmony 1000D 2.49-2.69 GHz (B38, B41)

FCC ID:PIDH1KD25F

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1 Applicant information

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Contact name: Mr. Zion Levi

2 Equipment under test attributes

Product name: LTE Base Station
Product type: Transceiver
Model(s): AirHarmony 1000D 2.49-2.69 GHz (B38, B41)
Serial number: 0CEFFACCB208
Hardware version: C0
Software release: 14.14.50.071
Receipt date 16-Nov-15

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: 27592
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 16-Nov-15
Test completed: 08-Dec-15
Test specification(s): FCC 47CFR part 27

5 Tests summary

Test	Status
Transmitter characteristics	
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
Section 2.1049, Occupied bandwidth	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
Tested by:	Mrs. E. Pitt, test engineer	December 8, 2015	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	December 24, 2015	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	January 26, 2016	

6 EUT description

6.1 General information

The EUT, Base station radio, AirHarmony 1000D 2.49-2.69 GHz (B38, B41), is part of a LTE broadband fixed cellular wireless access system. The system provides a radio link between an end-user (a subscriber) and a network to give high-speed data access. The AirHarmony's transceiver/receiver (Up to 64 QAM modulation, data rate up to 95) uses OFDM and operating in TDD mode, equipped with a 18 dBi external antenna. The maximum total RF output power (not including antenna gain) is 40.31 dBm for 18 dBi antenna and it can be reduced by software.

The AirHarmony is installed outdoors and typically is mounted on a pole. 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	AC mains	Power Box	1	Unshielded	3
Power	DC power	Power Box	EUT	1	Unshielded	3
Signal	GPS	EUT	GPS external antenna	1	Coax	3
Signal	Ethernet	EUT	Power Box	1	FTP	3
Signal	Ethernet	Power Box	Laptop	1	NA	NA
RF	RF Link (Tx/Rx)	EUT	Antenna	2	Coax	0.5
Signal*	Serial*	Not connected	Not connected	1	NA	NA

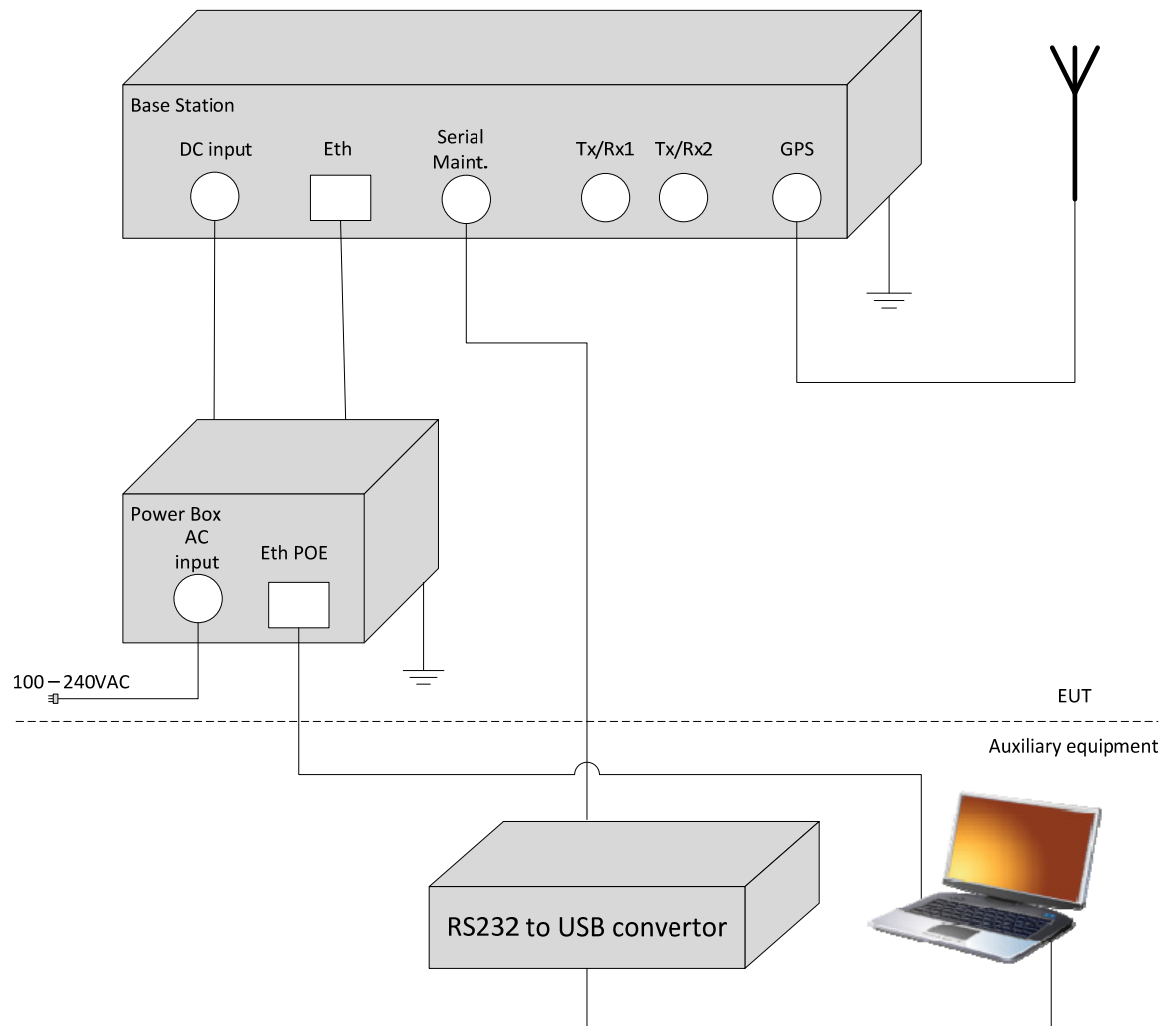
* For maintenance only

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.



6.6 Transmitter characteristics

Type of equipment			
☒	Stand-alone (Equipment with or without its own control provisions)		
☐	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)		
☐	Plug-in card (Equipment intended for a variety of host systems)		
Intended use		Condition of use	
☒	fixed	Always at a distance more than 2 m from all people	
☐	mobile	Always at a distance more than 20 cm from all people	
☐	portable	May operate at a distance closer than 20 cm to human body	
Assigned frequency range		2496.0 – 2690.0 MHz	
Operating frequency		2498.5 – 2687.5 MHz for 5 MHz OBW 2501.0 – 2685.0 MHz for 10 MHz OBW 2506.0 – 2680.0 MHz for 20 MHz OBW	
RF channel spacing		5 MHz; 10 MHz, 20 MHz	
Maximum rated output power		At transmitter 50 Ω RF output connector (aggregate power of both RF chains) 40.31 dBm	
Is transmitter output power variable?		☐ No	
		☒ Yes	☐ continuous variable
			☒ stepped variable with step size 0.25 dB
			minimum RF power -30 dBm
		maximum RF power at antenna connector 37.00 dBm	
Antenna connection			
☐ unique coupling	☒ standard connector	☐ Integral	☒ with temporary RF connector without temporary RF connector
Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
External	ALPHA Wireless Ltd	AW3007	18 dBi
External	ALPHA Wireless Ltd	AW3008	17 dBi
External sector	Cobham Antenna Systems	SA12-2.5-DS/1915	11 dBi
Transmitter aggregate data rate/s, MBps			
Transmitter 26dBc power bandwidth	Type of modulation		
	QPSK	16QAM	64QAM
	5 MHz	5.3	10.7
	10 MHz	10.7	22.7
	20 MHz	23.4	45.4
Type of multiplexing		TDD	
Modulating test signal (baseband)		PRBS	
Maximum transmitter duty cycle in normal use		75%	
Transmitter power source			
☐	☐ DC	Nominal rated voltage	Battery type
☒	☒ AC mains	Nominal rated voltage 120VAC	Frequency
Common power source for transmitter and receiver		☒ yes	☐ no

Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 24-Nov-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

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*, dBc	Maximum allowed bandwidth, kHz
2496.0 – 2690.0 MHz	26	NA

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

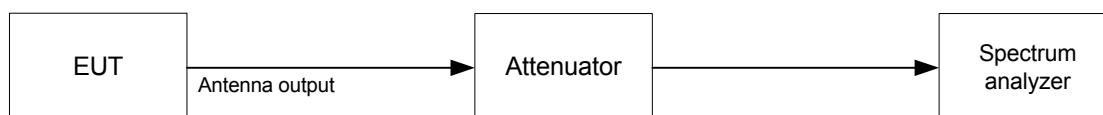
7.1.2 Test procedure

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





Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 24-Nov-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.1.2 Occupied bandwidth test results

DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 100 kHz
 MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
 EBW: 5 MHz

Carrier frequency, MHz	OBW 26 dBc, MHz	OBW 99%. MHz	Limit, kHz	Verdict
QPSK				
2498.5	4.760	4.396	NA	Pass
2593.0	4.744	4.417	NA	Pass
2687.5	4.743	4.418	NA	Pass
64QAM				
2498.5	4.747	4.415	NA	Pass
2593.0	4.754	4.408	NA	Pass
2687.5	4.740	4.404	NA	Pass

DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 100 kHz
 MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
 EBW: 10 MHz

Carrier frequency, MHz	OBW 26 dBc, MHz	OBW 99%. MHz	Limit, kHz	Verdict
QPSK				
2501	9.473	8.918	NA	Pass
2595	9.460	8.912	NA	Pass
2685	9.474	8.929	NA	Pass
64QAM				
2501	9.483	8.941	NA	Pass
2595	9.480	8.912	NA	Pass
2685	9.449	8.939	NA	Pass

DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 200 kHz
 MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
 EBW: 20 MHz

Carrier frequency, MHz	OBW 26 dBc, MHz	OBW 99%. MHz	Limit, kHz	Verdict
QPSK				
2506	18.585	17.550	NA	Pass
2595	18.683	17.564	NA	Pass
2680	18.670	17.558	NA	Pass
64QAM				
2506	18.588	17.548	NA	Pass
2595	18.552	17.542	NA	Pass
2680	18.591	17.527	NA	Pass

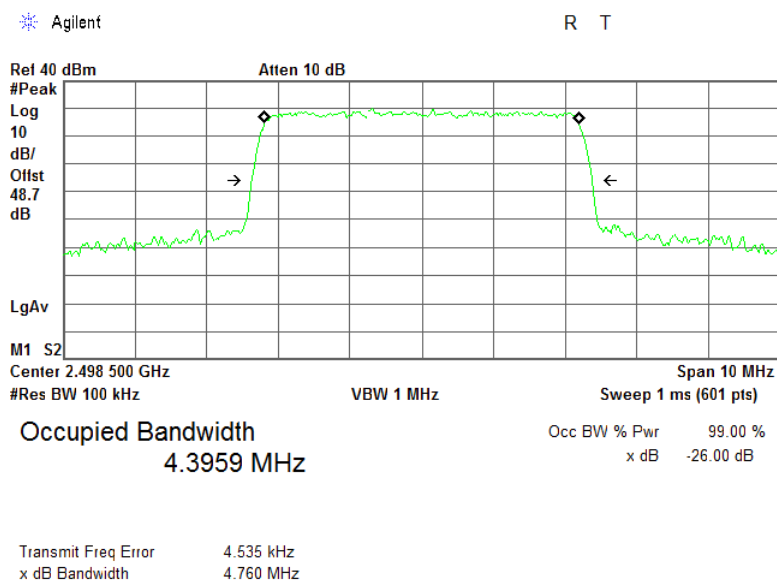
Reference numbers of test equipment used

HL 3818							
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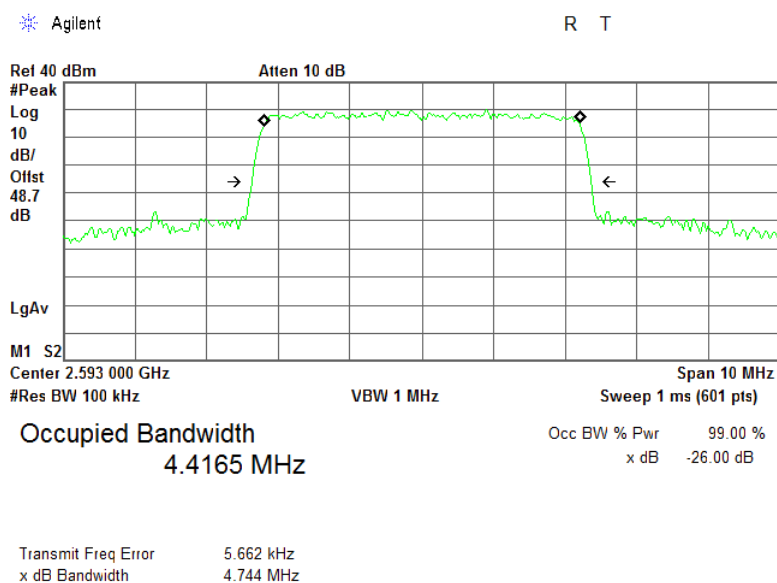
Full description is given in Appendix A.

Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 24-Nov-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.1 Occupied bandwidth test results at low frequency, 5 MHz EBW, QPSK, RF#2

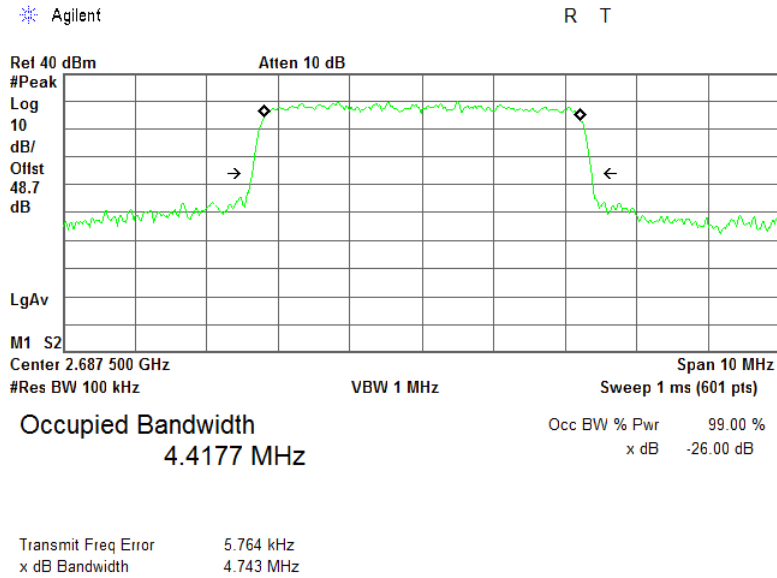


Plot 7.1.2 Occupied bandwidth test results at mid frequency, 5 MHz EBW, QPSK, RF#2

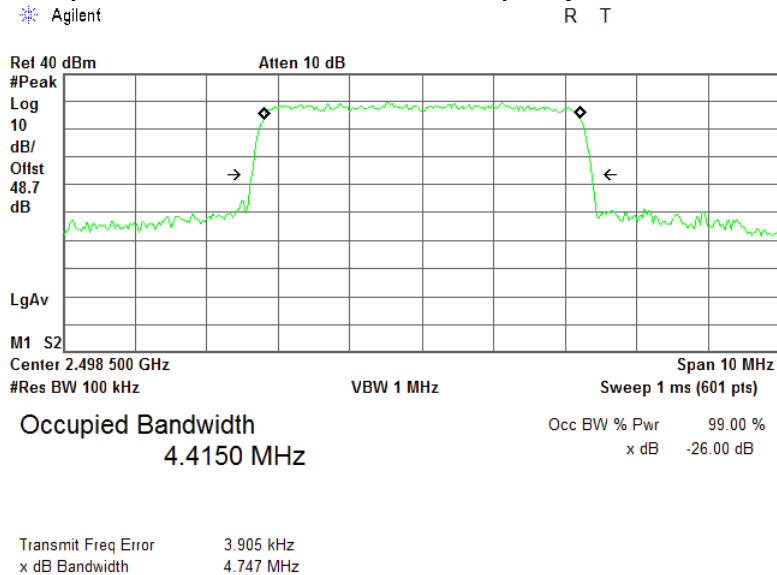


Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 24-Nov-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.3 Occupied bandwidth test results at high frequency, 5 MHz EBW, QPSK, RF#2

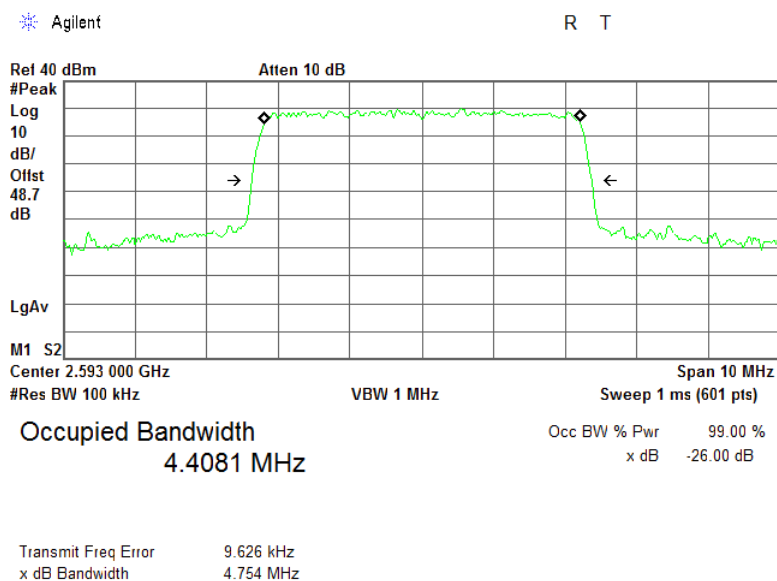


Plot 7.1.4 Occupied bandwidth test results at low frequency, 5 MHz EBW, 64QAM, RF#2

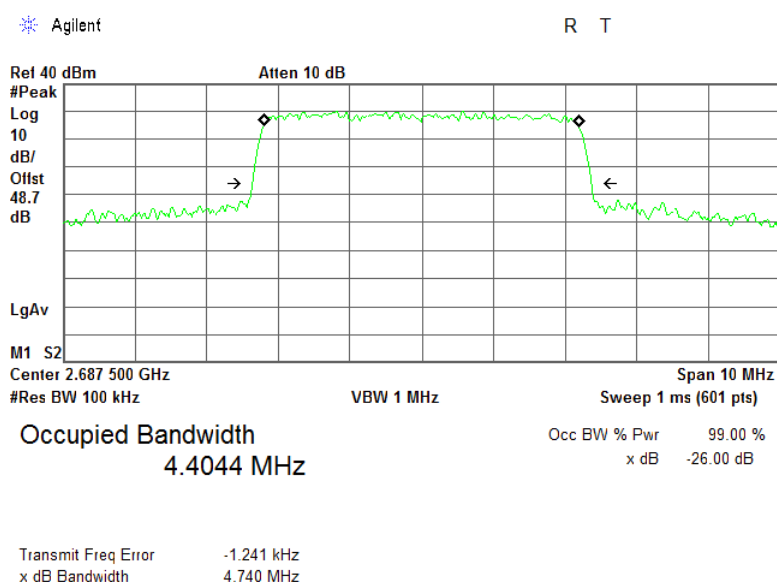


Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 24-Nov-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.5 Occupied bandwidth test results at mid frequency, 5 MHz EBW, 64QAM, RF#2

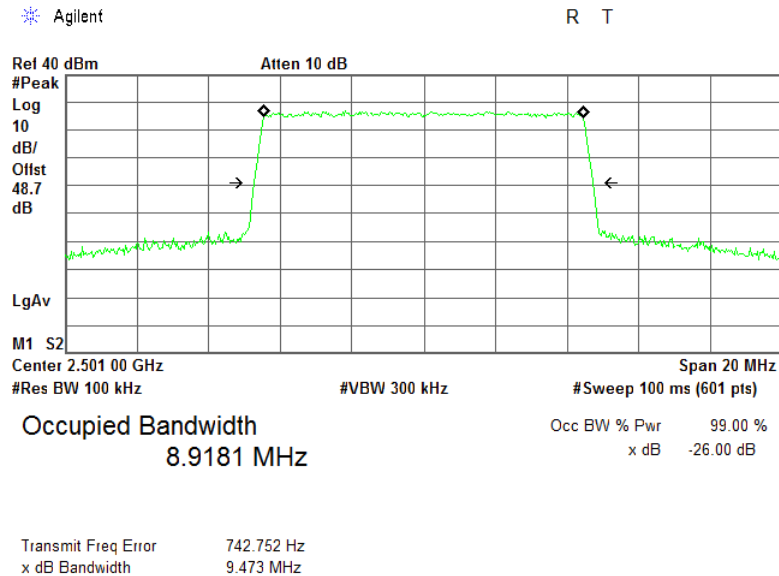


Plot 7.1.6 Occupied bandwidth test results at high frequency, 5 MHz EBW, 64QAM, RF#2

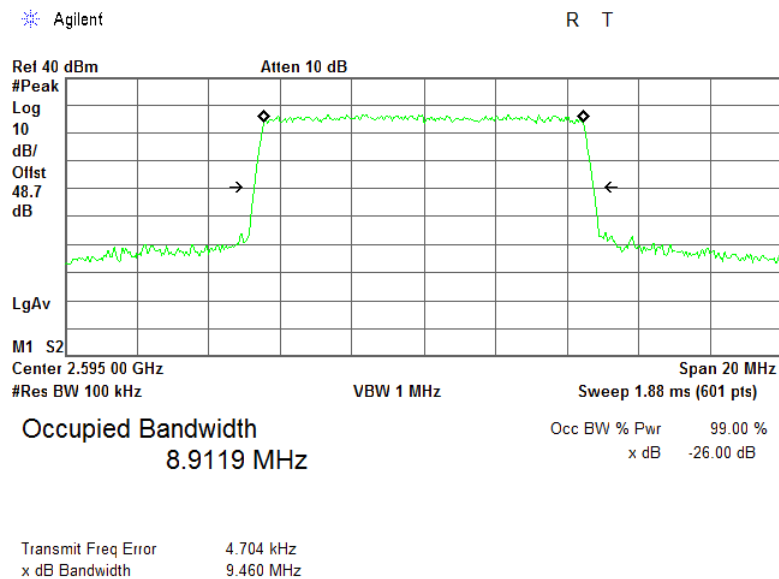


Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 24-Nov-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.7 Occupied bandwidth test results at low frequency, 10 MHz EBW, QPSK, RF#2



Plot 7.1.8 Occupied bandwidth test results at mid frequency, 10 MHz EBW, QPSK, RF#2

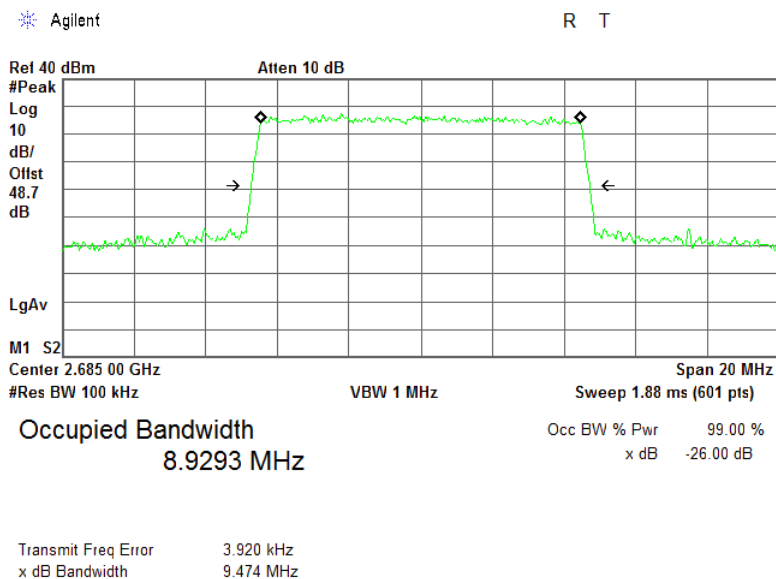




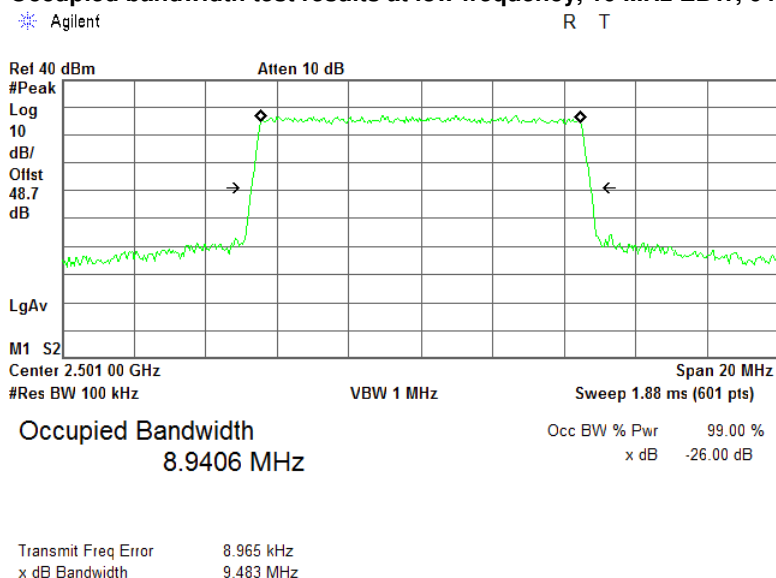
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Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance			Verdict: PASS
Date(s): 17-Nov-15 - 24-Nov-15			
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.9 Occupied bandwidth test results at high frequency, 10 MHz EBW, QPSK, RF#2

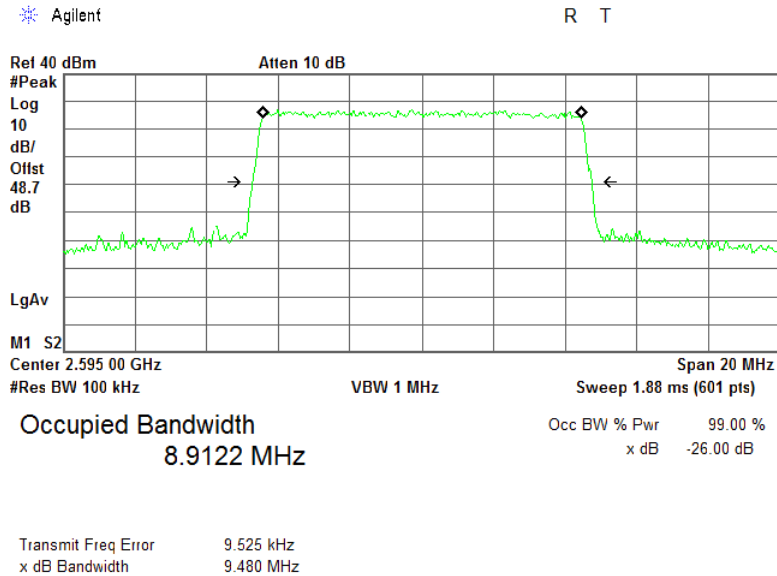


Plot 7.1.10 Occupied bandwidth test results at low frequency, 10 MHz EBW, 64QAM, RF#2

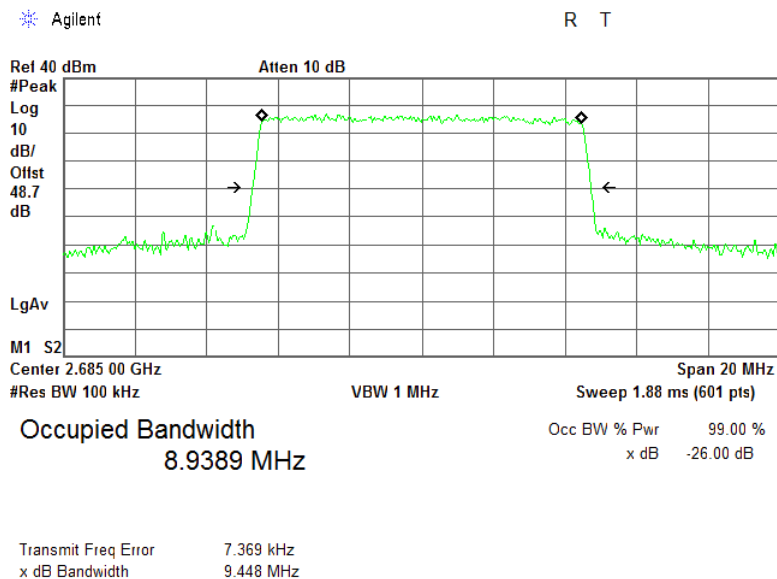


Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 24-Nov-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.11 Occupied bandwidth test results at mid frequency, 10 MHz EBW, 64QAM, RF#2

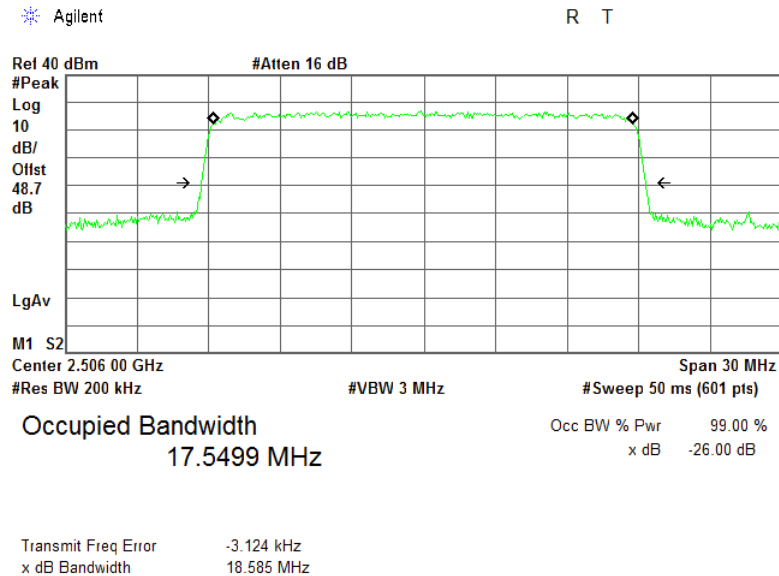


Plot 7.1.12 Occupied bandwidth test results at high frequency, 10 MHz EBW, 64QAM, RF#2

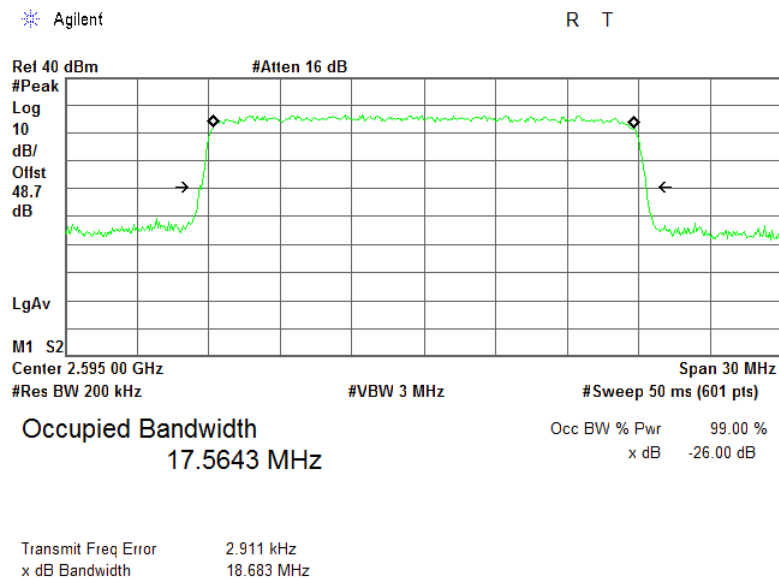


Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 24-Nov-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.13 Occupied bandwidth test results at low frequency, 20 MHz EBW, QPSK, RF#2

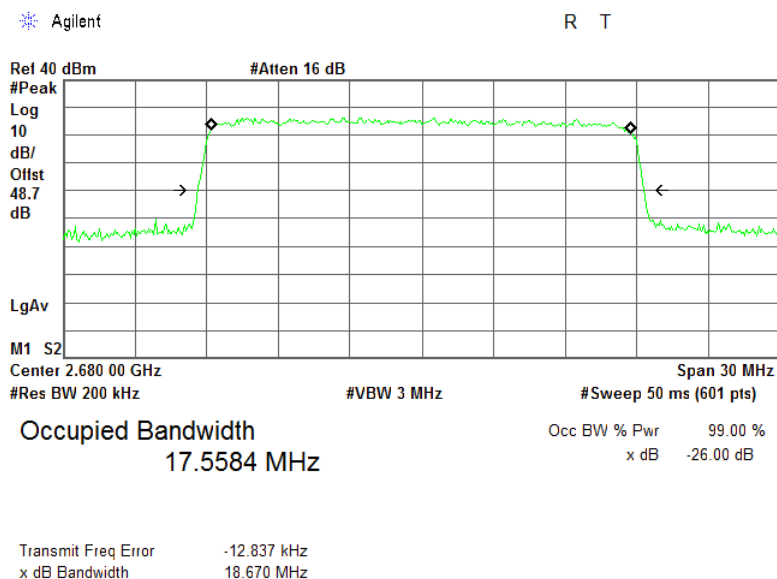


Plot 7.1.14 Occupied bandwidth test results at mid frequency, 20 MHz EBW, QPSK, RF#2

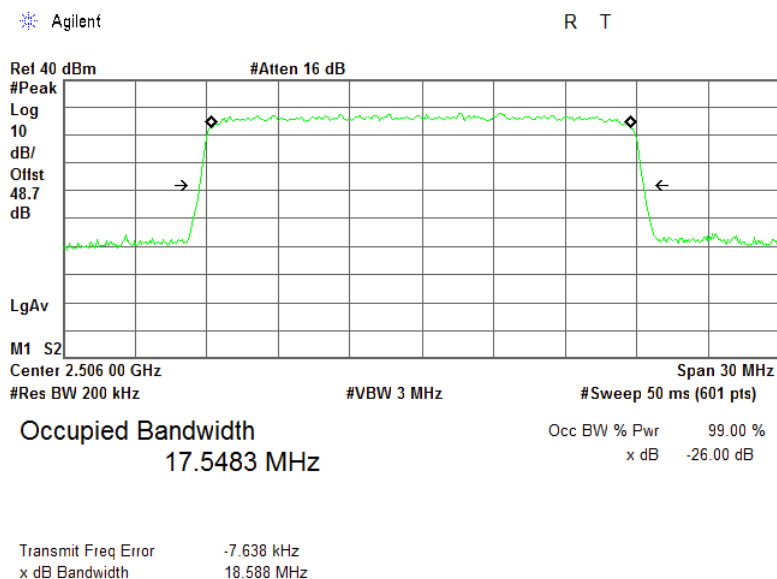


Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 24-Nov-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.15 Occupied bandwidth test results at high frequency, 20 MHz EBW, QPSK, RF#2

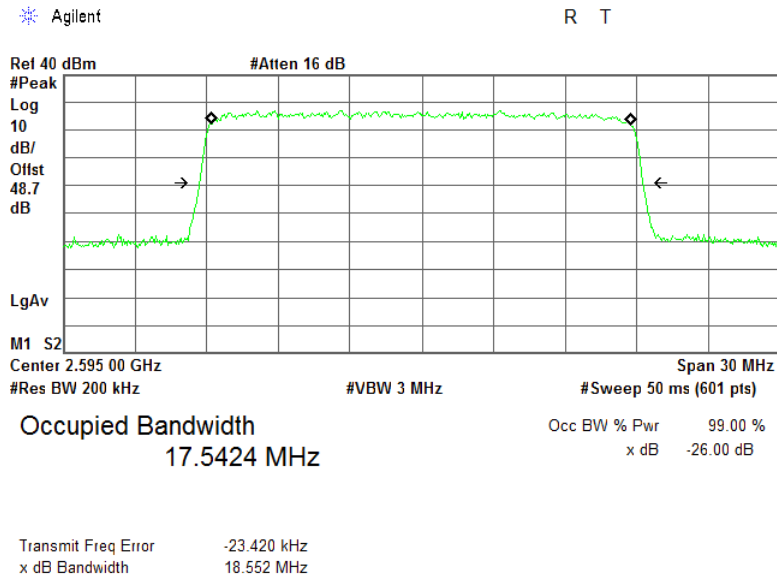


Plot 7.1.16 Occupied bandwidth test results at low frequency, 20 MHz EBW, 64QAM, RF#2

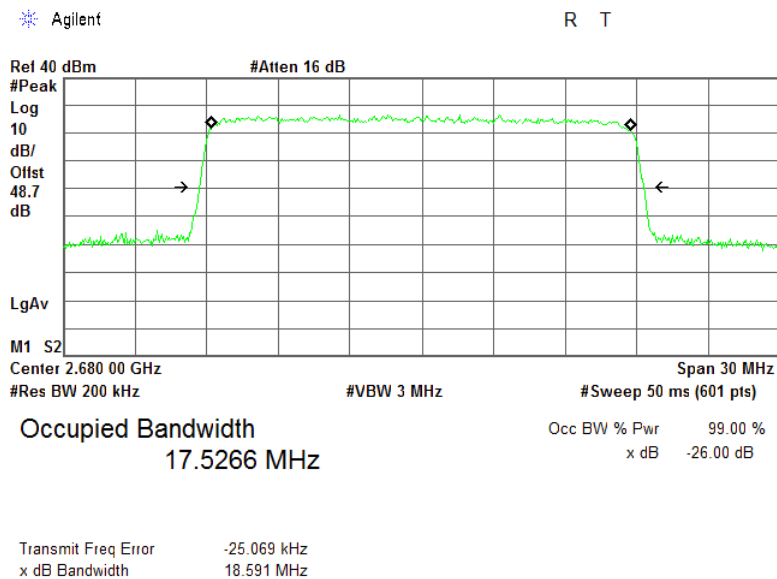


Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 24-Nov-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.17 Occupied bandwidth test results at mid frequency, 20 MHz EBW, 64QAM, RF#2



Plot 7.1.18 Occupied bandwidth test results at high frequency, 20 MHz EBW, 64QAM, RF#2



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):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

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 – 2690	$63 + 10\log(X/Y) + 10\log(360/\text{beamwidth})$
		Maximum peak power density dBm/100 kHz
		$\text{EIRP} + 10\log(0.1/Y)$

X is the actual channel width in MHz (occupied bandwidth)

Y is either Frequency assignment for the BRS/EBS band

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.

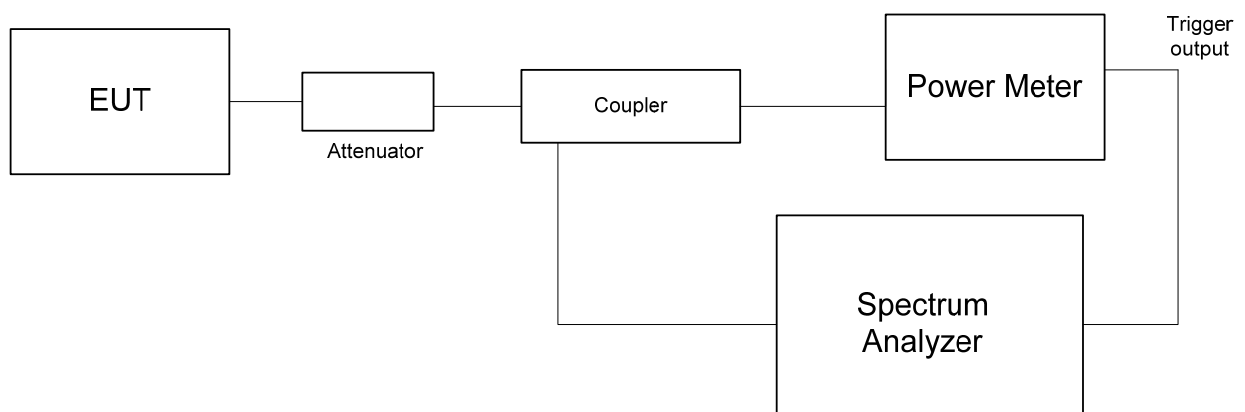
7.2.2.2 The EUT was adjusted to produce maximum available to the end user RF output power.

7.2.2.3 The average output power was measured with power meter as provided in Table 7.2.2 to Table 7.2.4.

7.2.2.4 The power spectral density was measured with spectrum analyzer as provided in Table 7.2.5 to Table 7.2.7 and the associated plots.

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

Figure 7.2.1 Peak output power test setup





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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):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.2 Peak output power test results

DETECTOR USED:

Average within Tx burst

DUTY CYCLE:

75%

EBW:

5 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
QPSK								
2498.5	37.1	37.5	40.31	18.0	58.31	67.18	-8.87	Pass
2593.0	36.8	37.1	39.96	18.0	57.96	69.38	-11.42	Pass
2687.5	36.8	36.9	39.86	18.0	57.86	67.16	-9.30	Pass
64QAM								
2498.5	37.1	37.3	40.21	18.0	58.21	67.16	-8.95	Pass
2593.0	37.0	37.3	40.16	18.0	58.16	69.39	-11.23	Pass
2687.5	36.7	36.9	39.81	18.0	57.81	67.16	-9.35	Pass
QPSK								
2498.5	37.1	37.5	40.31	17.0	57.31	65.78	-8.47	Pass
2593.0	36.8	37.1	39.96	17.0	56.96	67.98	-11.02	Pass
2687.5	36.8	36.9	39.86	17.0	56.86	65.76	-8.90	Pass
64QAM								
2498.5	37.1	37.3	40.21	17.0	57.21	65.76	-8.55	Pass
2593.0	37.0	37.3	40.16	17.0	57.16	67.99	-10.83	Pass
2687.5	36.7	36.9	39.81	17.0	56.81	65.76	-8.95	Pass

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

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

*** - See Table 7.2.9



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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):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.3 Peak output power test results

DETECTOR USED:

Average within Tx burst

DUTY CYCLE:

75%

EBW:

10 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
QPSK								
2501	36.9	37.1	40.01	18.0	58.01	70.16	-12.15	Pass
2595	36.9	37.2	40.06	18.0	58.06	69.37	-11.31	Pass
2685	37.2	37.3	40.26	18.0	58.26	70.17	-11.91	Pass
64QAM								
2501	36.9	37.2	40.06	18.0	58.06	70.17	-12.11	Pass
2595	37.1	37.2	40.16	18.0	58.16	69.38	-11.22	Pass
2685	37.1	37.2	40.16	18.0	58.16	70.15	-11.99	Pass
QPSK								
2501	36.9	37.1	40.01	17.0	57.01	68.76	-11.75	Pass
2595	36.9	37.2	40.06	17.0	57.06	67.97	-10.91	Pass
2685	37.2	37.3	40.26	17.0	57.26	68.77	-11.51	Pass
64QAM								
2501	36.9	37.2	40.06	17.0	57.06	68.77	-11.71	Pass
2595	37.1	37.2	40.16	17.0	57.16	67.98	-10.82	Pass
2685	37.1	37.2	40.16	17.0	57.16	68.75	-11.59	Pass

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

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

*** - See Table 7.2.9



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):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.4 Peak output power test results

DETECTOR USED: Average within Tx burst
DUTY CYCLE: 75%
EBW: 20 MHz

EDW:				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
QPSK								
2506	37.1	37.3	40.21	18	58.21	69.67	-11.46	Pass
2595	36.8	37.1	39.96		57.96	69.31	-11.35	Pass
2680	37.0	37.1	40.06		58.06	69.69	-11.63	Pass
64QAM								
2506	37.1	37.2	40.16	18	58.16	69.67	-11.51	Pass
2595	36.7	37.4	40.07		58.07	69.28	-11.21	Pass
2680	36.8	36.9	39.86		57.86	69.67	-11.81	Pass
QPSK								
2506	37.1	37.3	40.21	17	57.21	68.27	-11.06	Pass
2595	36.8	37.1	39.96		56.96	67.91	-10.95	Pass
2680	37.0	37.1	40.06		57.06	68.29	-11.23	Pass
64QAM								
2506	37.1	37.2	40.16	17	57.16	68.27	-11.11	Pass
2595	36.7	37.4	40.07		57.07	67.88	-10.81	Pass
2680	36.8	36.9	39.86		56.86	68.27	-11.41	Pass

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

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

*** - See Table 7.2.9

Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302	HL 3818	HL 3903			
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Full description is given in Appendix A.



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):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.5 Power spectral density test results

DETECTOR USED: Average (gated)
 RESOLUTION BANDWIDTH: 100 kHz
 VIDEO BANDWIDTH: 300 kHz
 CHANNEL BANDWIDTH: 5 MHz
 DUTY CYCLE: 75%

Carrier frequency, MHz	SA reading, RF #1 dBm/100kHz	SA reading, RF #2 dBm/100kHz	Antenna gain, dBi	Total PSD*, dBm/100kHz	Limit**, dBm	Margin, dB	Verdict
QPSK							
2498.5	20.47	20.58	18.0	41.54	47.18	-5.64	Pass
2593.0	20.68	21.28	18.0	42.00	51.60	-9.60	Pass
2687.5	20.92	20.82	18.0	41.88	47.16	-5.28	Pass
64 QAM							
2498.5	20.37	20.37	18.0	41.38	47.16	-5.78	Pass
2593.0	20.49	20.72	18.0	41.62	51.99	-10.37	Pass
2687.5	21.52	21.09	18.0	42.32	47.16	-4.84	Pass
QPSK							
2498.5	20.47	20.58	17.0	40.54	45.78	-5.24	Pass
2593.0	20.68	21.28	17.0	41.00	50.20	-9.20	Pass
2687.5	20.92	20.82	17.0	40.88	45.76	-4.88	Pass
64 QAM							
2498.5	20.37	20.37	17.0	40.38	45.76	-5.38	Pass
2593.0	20.49	20.72	17.0	40.62	50.21	-9.59	Pass
2687.5	21.52	21.09	17.0	41.32	45.76	-4.44	Pass

* Total PSD, dBm/100kHz = $10 \log\{10^{\text{PSD}(\text{dBm}/100\text{kHz}, \text{RF}\#1)/10} + 10^{\text{P}(\text{dBm}/100\text{kHz}, \text{RF}\#2)/10}\} + \text{Antenna Gain, dBi}$

** - See Table 7.2.10



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):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.6 Power spectral density test results

DETECTOR USED: Average (gated)
 RESOLUTION BANDWIDTH: 100 kHz
 VIDEO BANDWIDTH: 300 kHz
 CHANNEL BANDWIDTH: 10 MHz
 DUTY CYCLE: 75%

Carrier frequency, MHz	SA reading, RF #1 dBm/100kHz	SA reading, RF #2 dBm/100kHz	Antenna gain, dBi	Total PSD*, dBm/100kHz	Limit**, dBm	Margin, dB	Verdict
QPSK							
2501	18.62	18.81	18.0	39.73	50.16	-10.43	Pass
2595	18.03	18.19	18.0	39.12	48.57	-9.45	Pass
2685	18.09	18.74	18.0	39.44	50.17	-10.73	Pass
64QAM							
2501	18.41	19.21	18.0	39.84	50.17	-10.33	Pass
2595	18.18	18.65	18.0	39.43	48.58	-9.15	Pass
2685	18.30	18.52	18.0	39.42	50.15	-10.73	Pass
QPSK							
2501	18.62	18.81	17.0	38.73	48.76	-10.03	Pass
2595	18.03	18.19	17.0	38.12	47.17	-9.05	Pass
2685	18.09	18.74	17.0	38.44	48.77	-10.33	Pass
64QAM							
2501	18.41	19.21	17.0	38.84	48.77	-9.93	Pass
2595	18.18	18.65	17.0	38.43	47.18	-8.75	Pass
2685	18.30	18.52	17.0	38.42	48.75	-10.33	Pass

* Total PSD, dBm/100kHz = $10 \log\{10^{[PSD(dBm/100kHz, RF\#1)/10]} + 10^{[P(dBm/100kHz, RF\#2)/10]}\} + \text{Antenna Gain, dBi}$

** - See Table 7.2.10



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):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.7 Power spectral density test results

DETECTOR USED: Average (gated)
 RESOLUTION BANDWIDTH: 100 kHz
 VIDEO BANDWIDTH: 300 kHz
 CHANNEL BANDWIDTH: 20 MHz
 DUTY CYCLE: 75%

Carrier frequency, MHz	SA reading, RF #1 dBm/100kHz	SA reading, RF #2 dBm/100kHz	Antenna gain, dBi	Total PSD*, dBm/100kHz	Limit**, dBm	Margin, dB	Verdict
QPSK							
2506	14.80	15.68	18.0	36.27	46.27	-10.00	Pass
2595	13.99	15.19	18.0	35.64	45.51	-9.87	Pass
2680	14.17	14.51	18.0	35.35	46.29	-10.94	Pass
64QAM							
2506	14.95	15.48	18.0	36.23	46.27	-10.04	Pass
2595	14.86	15.27	18.0	36.08	45.48	-9.40	Pass
2680	14.26	14.38	18.0	35.33	46.27	-10.94	Pass
QPSK							
2506	14.80	15.68	17.0	35.27	44.87	-9.60	Pass
2595	13.99	15.19	17.0	34.64	44.11	-9.47	Pass
2680	14.17	14.51	17.0	34.35	44.89	-10.54	Pass
64QAM							
2506	14.95	15.48	17.0	35.23	44.87	-9.64	Pass
2595	14.86	15.27	17.0	35.08	44.08	-9.00	Pass
2680	14.26	14.38	17.0	34.33	44.87	-10.54	Pass

* Total PSD, dBm/100kHz = $10 \log\{10^{[PSD(dBm/100kHz, RF\#1)/10]} + 10^{[(P(dBm/100kHz, RF\#2)/10)]} + Antenna\ Gain, dBi\}$

** - See Table 7.2.10

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):	17-Nov-15 - 03-Dec-15		
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.8 Pre - transition frequency channels assignment

Channel	OBW, MHz	Peak power limit, dBm	Power density limit, dBm/100kHz
5 MHz Dual Channel QPSK 5.3 Mbps			
2498.5 MHz BRS Ch.1 + EBS Ch. A1	4.760	$63+10\log(\text{OBW}/10.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/10.0)$
2593.0 MHz EBS Ch.D4	4.744	$63+10\log(\text{OBW}/6.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/6.0)$
2687.5 MHz EBS Ch.I + EBS Ch.G4	4.743	$63+10\log(\text{OBW}/10.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/10.0)$
5 MHz Dual Channel 64QAM 23 Mbps			
2498.5 MHz BRS Ch.1 + EBS Ch. A1	4.747	$63+10\log(\text{OBW}/10.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/10.0)$
2593.0 MHz EBS Ch.D4	4.754	$63+10\log(\text{OBW}/6.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/6.0)$
2687.5 MHz EBS Ch.I + EBS Ch.G4	4.740	$63+10\log(\text{OBW}/10.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/10.0)$
10 MHz Dual Channel QPSK 10.7 Mbps			
2501.0 MHz BRS Ch.1+EBS Ch. A1	9.473	$63+10\log(\text{OBW}/10.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/10.0)$
2595.0 MHz EBS Ch.D4+BRS Ch. E1	9.460	$63+10\log(\text{OBW}/12.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/12.0)$
2685.0 MHz EBS Ch.I + EBS Ch.G4	9.474	$63+10\log(\text{OBW}/10.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/10.0)$
10 MHz Dual Channel 64QAM 47.3 Mbps			
2501.0 MHz BRS Ch.1 + EBS Ch. A1	9.483	$63+10\log(\text{OBW}/10.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/10.0)$
2595.0 MHz EBS Ch.D4+ BRS Ch. E1	9.480	$63+10\log(\text{OBW}/12.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/12.0)$
2685.0 MHz EBS Ch.I + EBS Ch.G4	9.449	$63+10\log(\text{OBW}/10.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/10.0)$
20 MHz 4 Channels QPSK 23.4 Mbps			
2506.0 MHz BRS Ch.1+EBS Ch. A1+A2+B1	18.5845	$63+10\log(\text{OBW}/22.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.0)$
2595.0 MHz EBS Ch.C4+D4+BRS Ch.E1+F1	18.683	$63+10\log(\text{OBW}/24.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/24.0)$
2680.0 MHz EBS CH.I+G3+G4 BRS Ch.H3	18.670	$63+10\log(\text{OBW}/22.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.0)$
20 MHz 4 Channels 64QAM 95 Mbps			
2506.0 MHz BRS Ch.1+ EBS Ch. A1+A2+B1	18.588	$63+10\log(\text{OBW}/22.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.0)$
2595.0 MHz EBS Ch.C4+D4+ BRS Ch.E1+F1	18.552	$63+10\log(\text{OBW}/24.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/24.0)$
2680.0 MHz EBS CH.I+G3+G4 BRS Ch.H3	18.591	$63+10\log(\text{OBW}/22.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.0)$



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):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.9 EIRP limits

Channel	Channel BW, MHz	Peak power limit, dBm	
		17 dBi, 90º beamwidth	11 dBi/18 dBi, 65ºbeamwidth
5 MHz Dual Channel QPSK			
2498.5 MHz BRS Ch.1 + EBS Ch. A1	10.0	65.78	67.18
2593.0 MHz EBS Ch.D4	6.0	67.98	69.38
2687.5 MHz EBS Ch.I + EBS Ch.G4	10.0	65.76	67.16
10 MHz Dual Channel QPSK			
2501.0 MHz BRS Ch.1 + EBS Ch. A1	10.0	68.76	70.16
2595.0 MHz EBS Ch.D4+BRS Ch. E1	12.0	67.97	69.37
2685.0 MHz EBS Ch.I + EBS Ch.G4	10.0	68.77	70.17
20 MHz Dual Channel QPSK			
2506.0 MHz BRS Ch.1+ EBS Ch.A1+A2+B1	22.0	68.27	69.67
2595.0 MHz EBS Ch.C4+D4+BRS Ch.E1+F1	24.0	67.91	69.31
2680.0 MHz EBS CH.I+G3+G4 BRS Ch.H3	22.0	68.29	69.69
5 MHz Dual Channel 64 QAM			
2498.5 MHz BRS Ch.1 + EBS Ch. A1	10.0	68.77	70.17
2593.0 MHz EBS Ch.D4	6.0	67.98	69.38
2687.5 MHz EBS Ch.I + EBS Ch.G4	10.0	68.75	70.15
10 MHz Dual Channel 64 QAM			
2501.0 MHz BRS Ch.1 + ERS Ch. A1	10.0	68.27	69.67
2595.0 MHz EBS Ch.D4+BRS Ch. E1	12.0	67.88	69.28
2685.0 MHz EBS Ch.I + EBS Ch.G4	10.0	68.27	69.67
20 MHz Dual Channel 64 QAM			
2506.0 MHz BRS Ch.1+ EBS Ch.A1+A2+B1	22.0	68.27	69.67
2595.0 MHz EBS Ch.C4+D4+BRS Ch.E1+F1	24.0	67.88	69.28
2680.0 MHz EBS CH.I+G3+G4 BRS Ch.H3	22.0	68.27	69.67



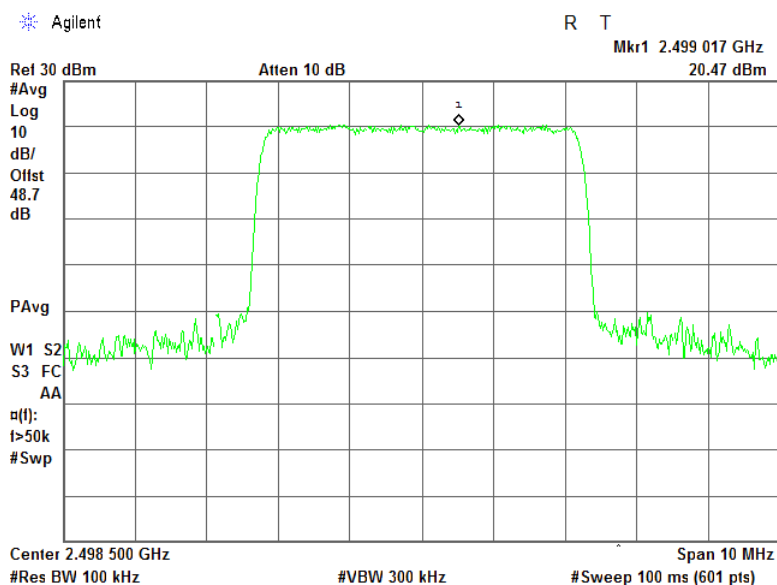
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.10 Peak power density limits

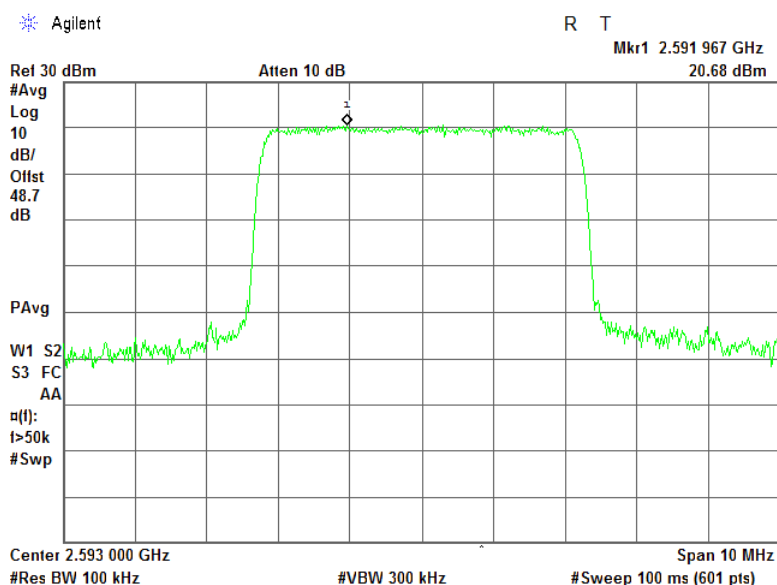
Channel	Channel BW, MHz	Peak power density, dBm/100kHz	
		17 dBi, 90° beamwidth	18 dBi, 65°beamwidth
5 MHz Dual Channel QPSK			
2498.5 MHz BRS Ch.1 + ERS Ch. A1	10.0	45.78	47.18
2593.0 MHz EBS Ch.D4	6.0	50.20	51.60
2687.5 MHz EBS Ch.I + EBS Ch.G4	10.0	45.76	47.16
10 MHz Dual Channel QPSK			
2501.0 MHz BRS Ch.1 + ERS Ch. A1	10.0	48.76	50.16
2595.0 MHz EBS Ch.D4+BRS Ch. E1	12.0	47.17	48.57
2685.0 MHz EBS Ch.I + EBS Ch.G4	10.0	48.77	50.17
20 MHz Dual Channel QPSK			
2506.0 MHz BRS Ch.1+ EBCh.A1+A2+B1	22.0	44.87	46.27
2595.0 MHz EBS Ch.C4+D4+BRS Ch.E1+F1	24.0	44.11	45.51
2680.0 MHz EBS CH.I+G3+G4 BRS Ch.H3	22.0	44.89	46.29
5 MHz Dual Channel 64 QAM			
2499.5 MHz BRS Ch.1 + ERS Ch. A1	10.0	45.76	47.16
2593.0 MHz EBS Ch.D4	6.0	50.21	51.99
2687.5 MHz EBS Ch.I + EBS Ch.G4	10.0	45.76	47.16
10 MHz Dual Channel 64 QAM			
2501.0 MHz BRS Ch.1 + ERS Ch. A1	10.0	48.77	50.17
2595.0 MHz EBS Ch.D4+BRS Ch. E1	12.0	47.18	48.58
2685.0 MHz EBS Ch.I + EBS Ch.G4	10.0	48.75	50.15
20 MHz Dual Channel 64 QAM			
2506.0 MHz BRS Ch.1+ EBCh.A1+A2+B1	22.0	44.87	46.27
2595.0 MHz EBS Ch.C4+D4+BRS Ch.E1+F1	24.0	44.08	45.48
2680.0 MHz EBS CH.I+G3+G4 BRS Ch.H3	22.0	44.87	46.27

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):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.1 Power spectral density test results at low frequency, QPSK, 5 MHz EBW, RF # 1

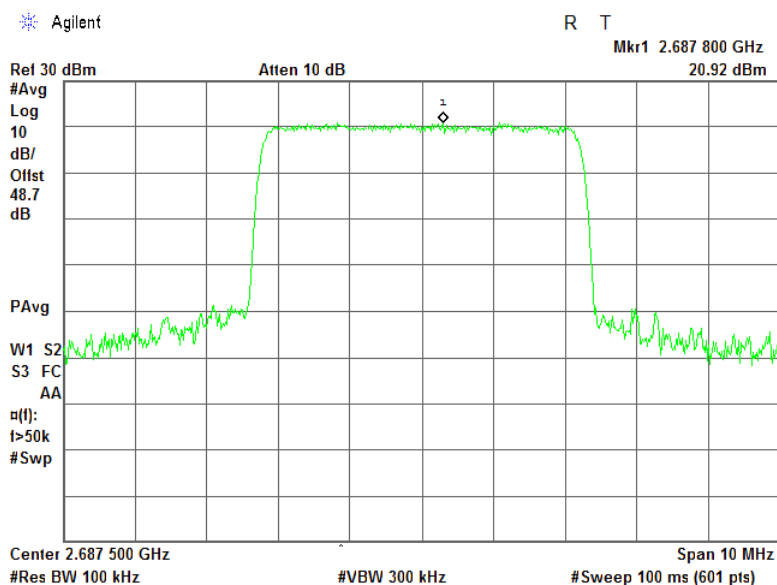


Plot 7.2.2 Power spectral density test results at mid frequency, QPSK, 5 MHz EBW, RF # 1

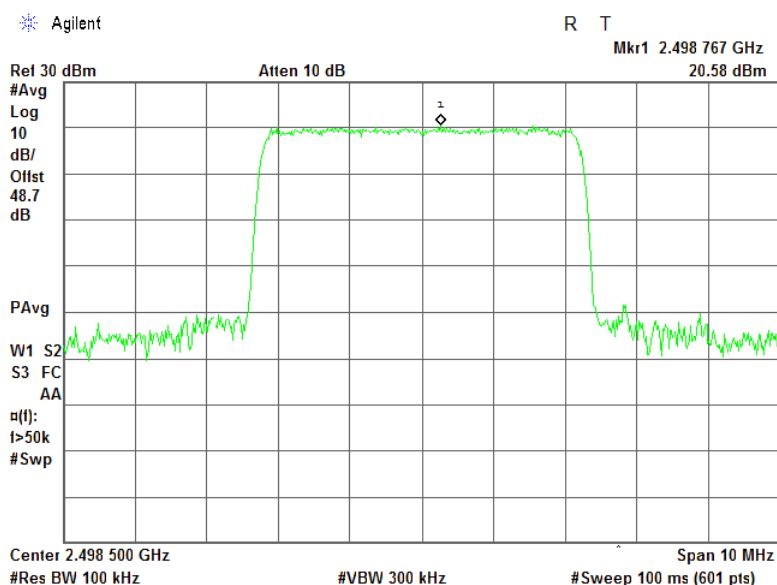


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.3 Power spectral density test results at high frequency, QPSK, 5 MHz EBW, RF # 1



Plot 7.2.4 Power spectral density test results at low frequency, QPSK, 5 MHz EBW, RF # 2

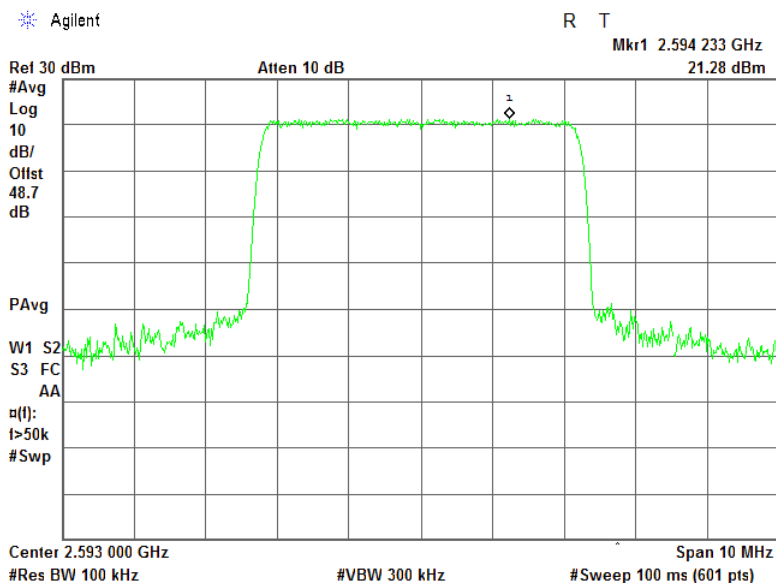




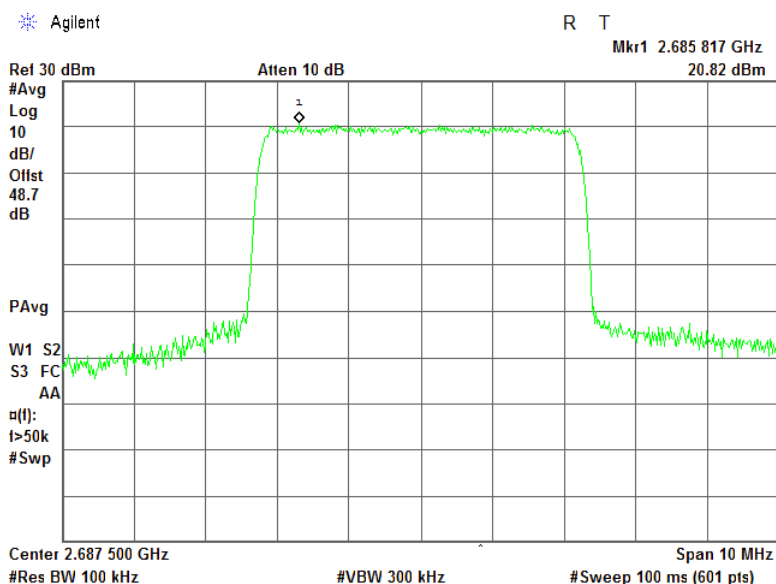
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Test specification: Section 27.50, Peak output power	
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode: Compliance	Verdict: PASS
Date(s): 17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa
	Relative Humidity: 54 %
	Power Supply: 120 VAC
Remarks:	

Plot 7.2.5 Power spectral density test results at mid frequency, QPSK, 5 MHz EBW, RF # 2

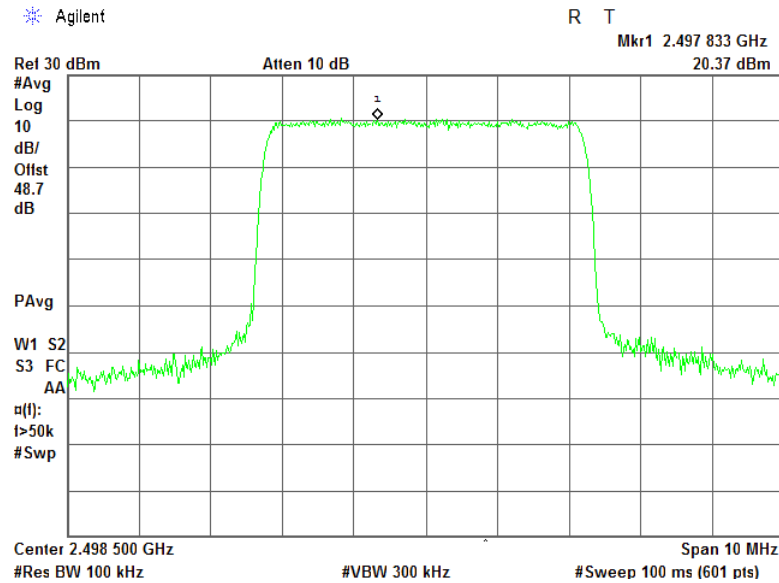


Plot 7.2.6 Power spectral density test results at high frequency, QPSK, 5 MHz EBW, RF # 2

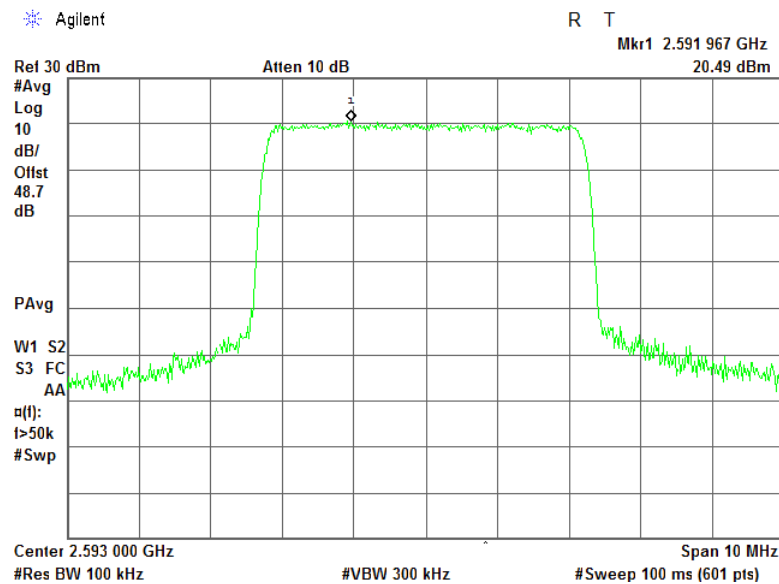


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.7 Power spectral density test results at low frequency, 64QAM, 5 MHz EBW, RF # 1

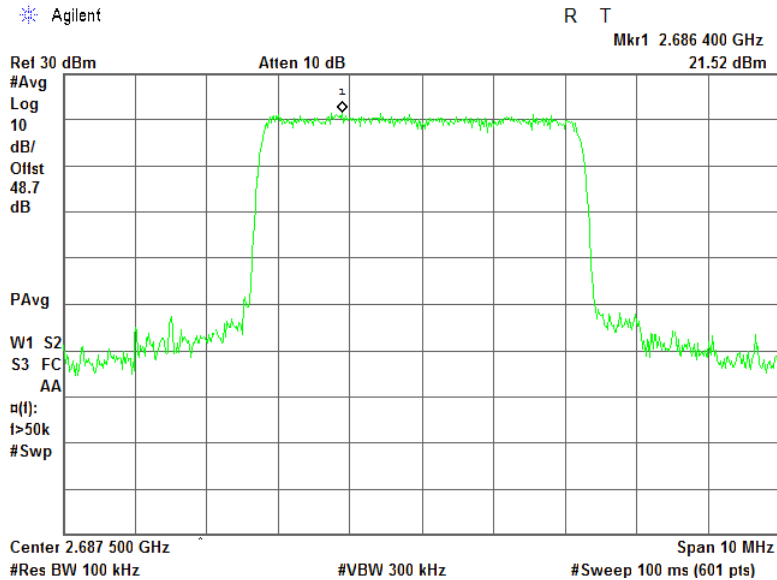


Plot 7.2.8 Power spectral density test results at mid frequency, 64QAM, 5 MHz EBW, RF # 1

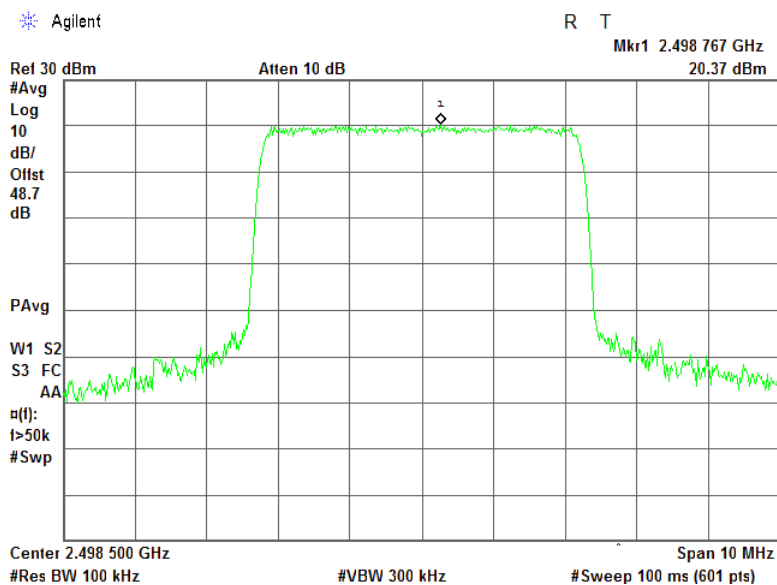


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.9 Power spectral density test results at high frequency, 64QAM, 5 MHz EBW, RF # 1

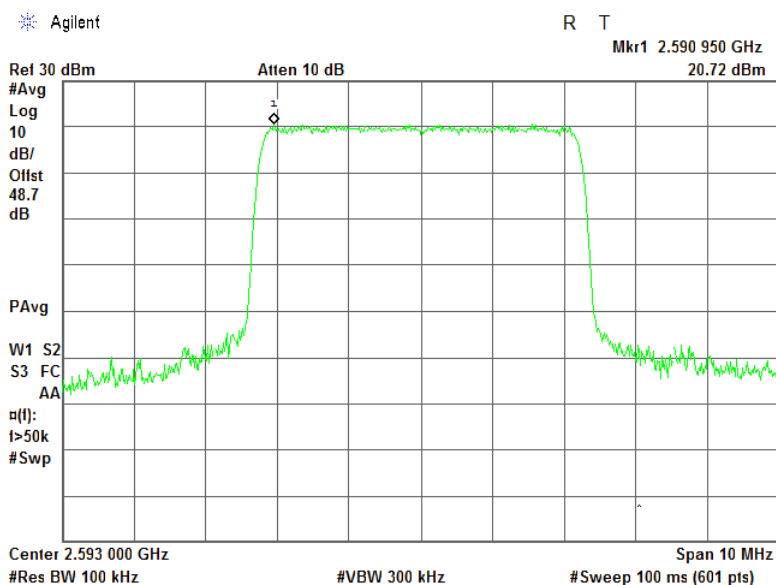


Plot 7.2.10 Power spectral density test results at low frequency, 64QAM, 5 MHz EBW, RF # 2

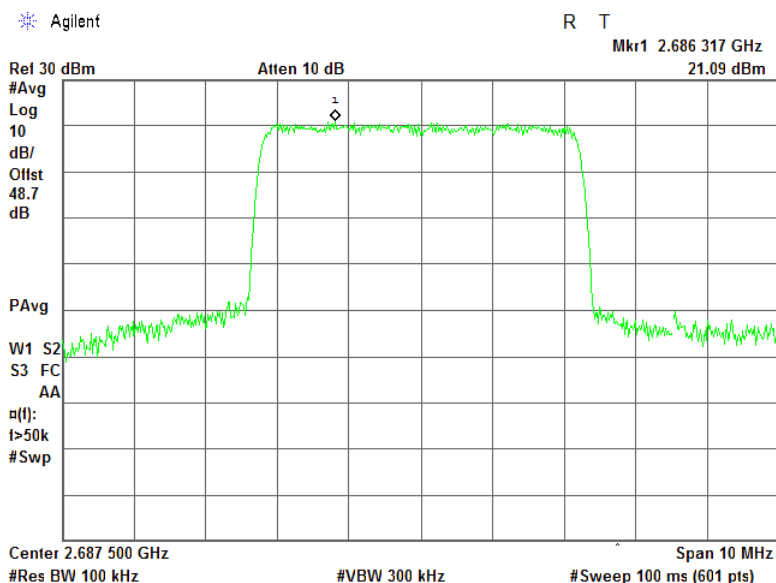


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.11 Power spectral density test results at mid frequency, 64QAM, 5 MHz EBW, RF # 2

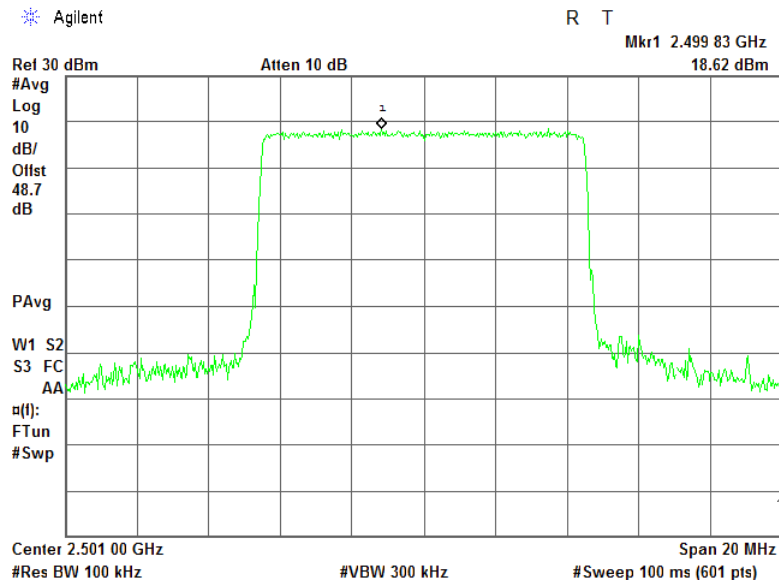


Plot 7.2.12 Power spectral density test results at high frequency, 64QAM, 5 MHz EBW, RF # 2

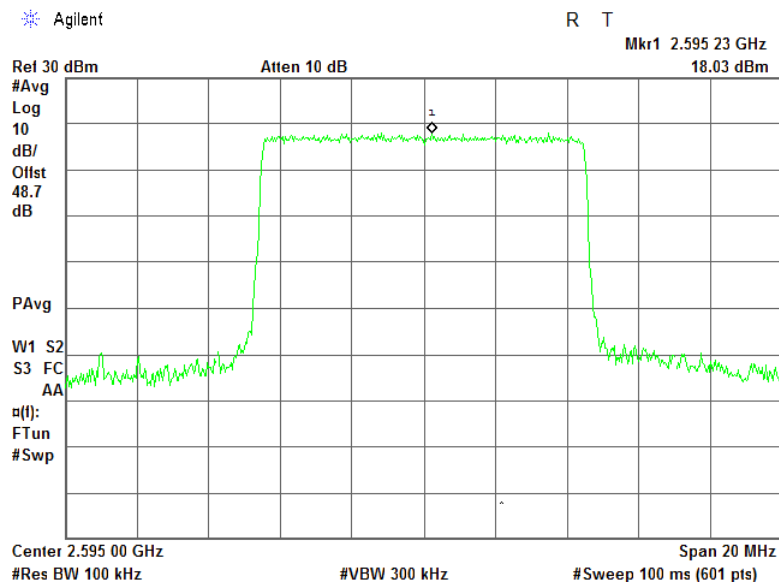


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.13 Power spectral density test results at low frequency, QPSK, 10 MHz EBW, RF # 1

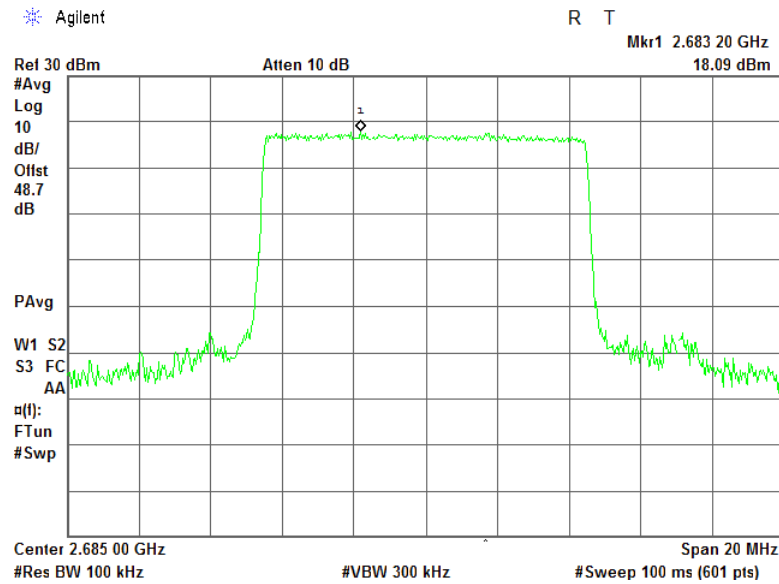


Plot 7.2.14 Power spectral density test results at mid frequency, QPSK, 10 MHz EBW RF, # 1

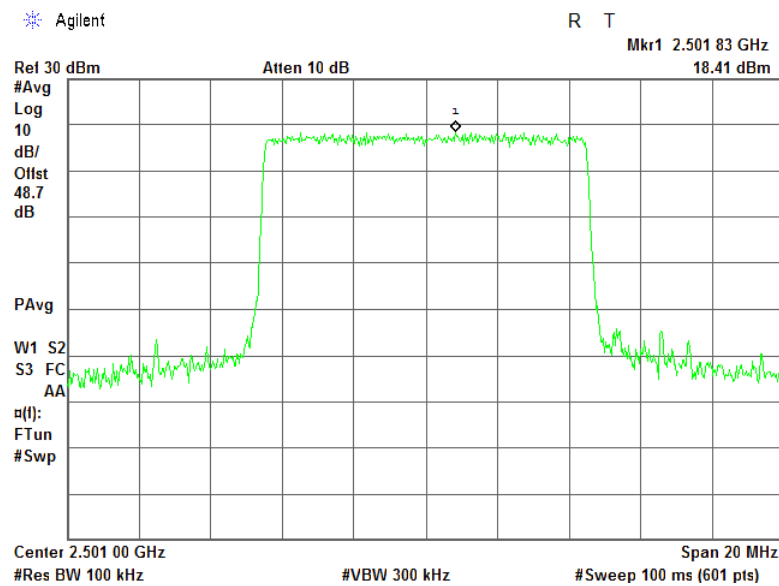


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.15 Power spectral density test results at high frequency, QPSK, 10 MHz EBW, RF # 1

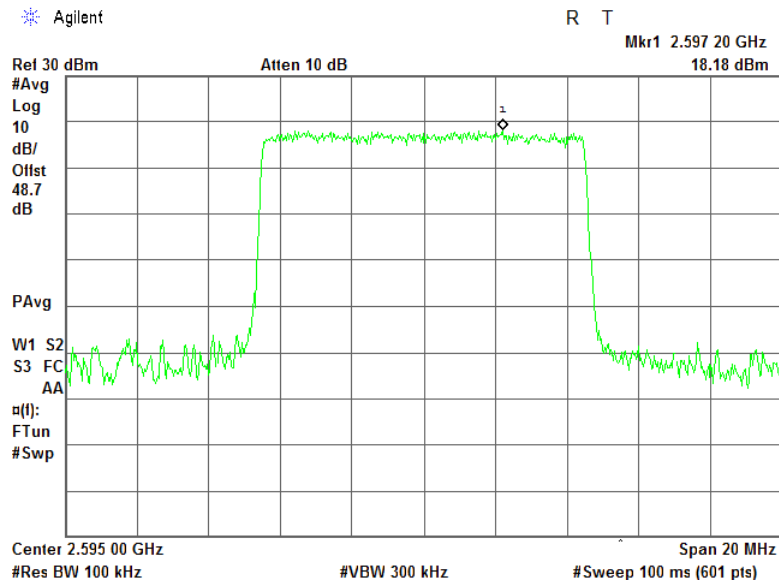


Plot 7.2.16 Power spectral density test results at low frequency, 64QAM, 10 MHz EBW, RF # 1

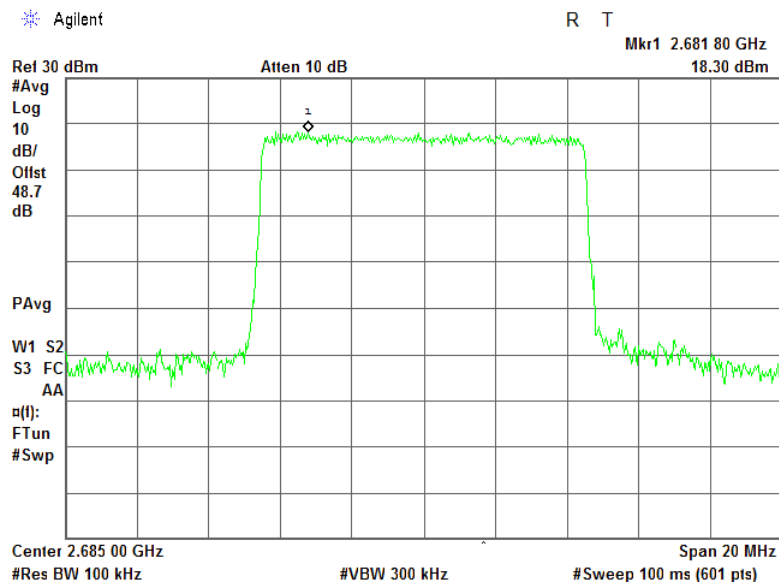


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.17 Power spectral density test results at mid frequency, 64QAM, 10 MHz EBW, RF # 1

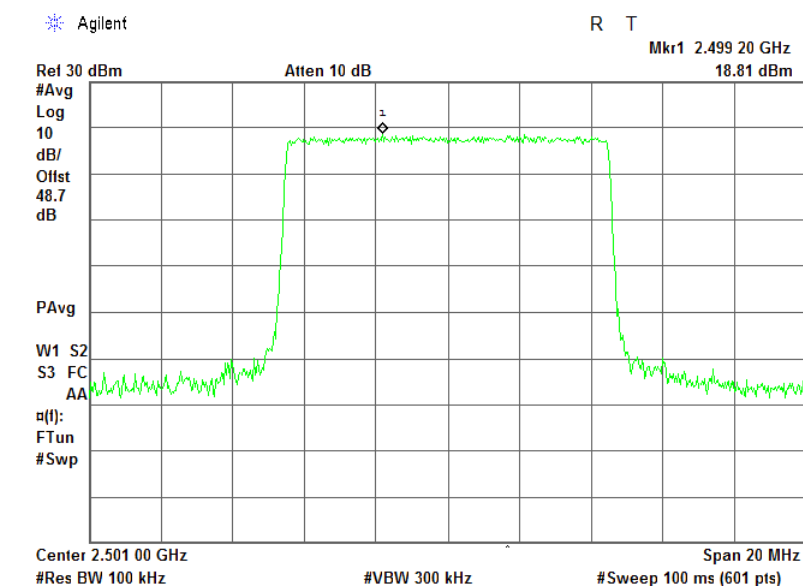


Plot 7.2.18 Power spectral density test results at high frequency, 64QAM, 10 MHz EBW, RF # 1

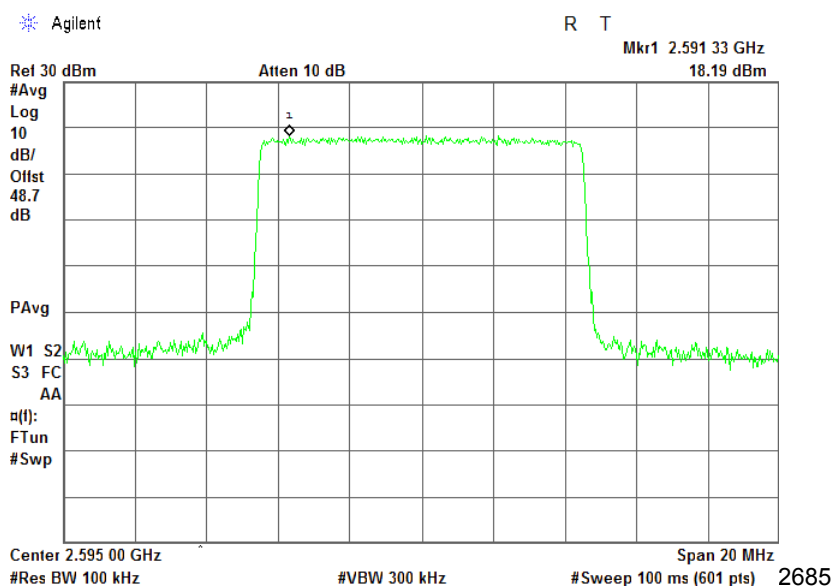


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.19 Power spectral density test results at low frequency, QPSK, 10 MHz EBW, RF # 2

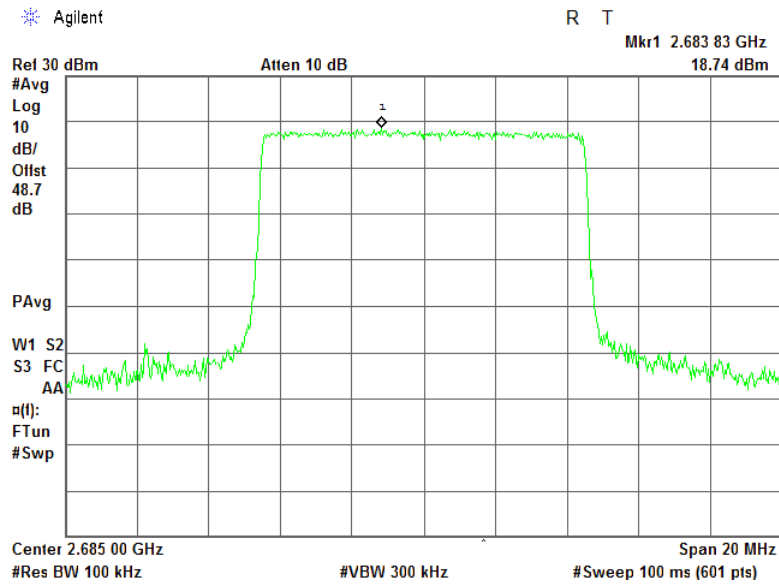


Plot 7.2.20 Power spectral density test results at mid frequency, QPSK, 10 MHz EBW, RF # 2

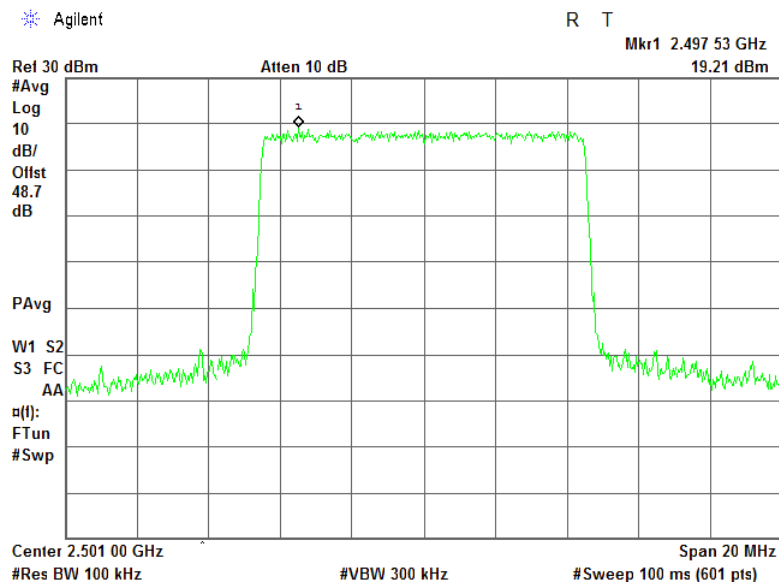


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.21 Power spectral density test results at high frequency, QPSK, 10 MHz EBW, RF # 2

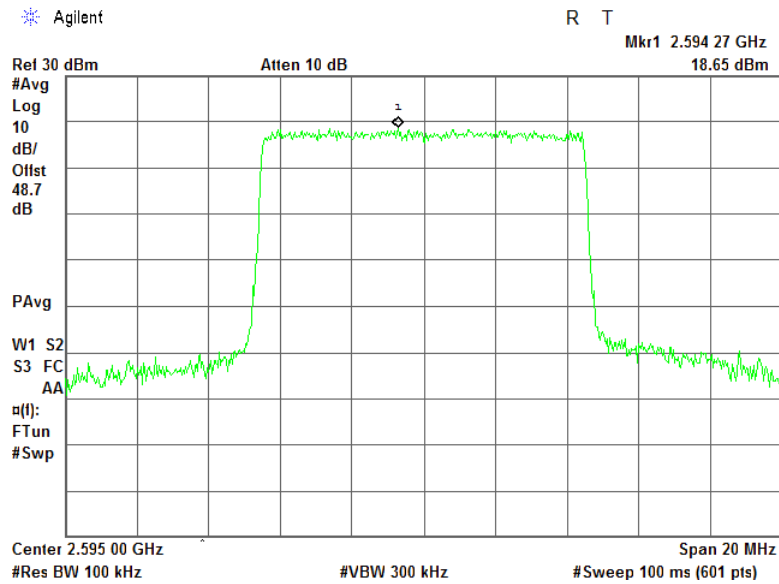


Plot 7.2.22 Power spectral density test results at low frequency, 64QAM, 10 MHz EBW, RF # 2

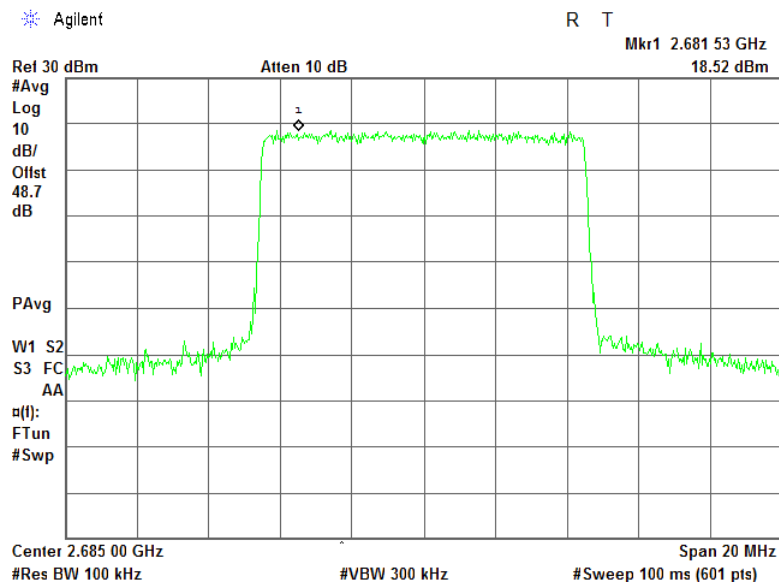


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.23 Power spectral density test results at mid frequency, 64QAM, 10 MHz EBW, RF # 2

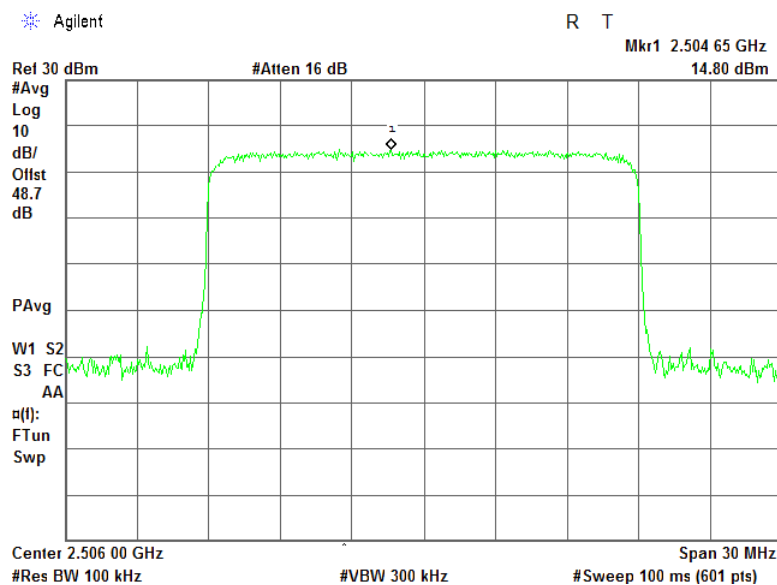


Plot 7.2.24 Power spectral density test results at high frequency, 64QAM, 10 MHz EBW, RF # 2

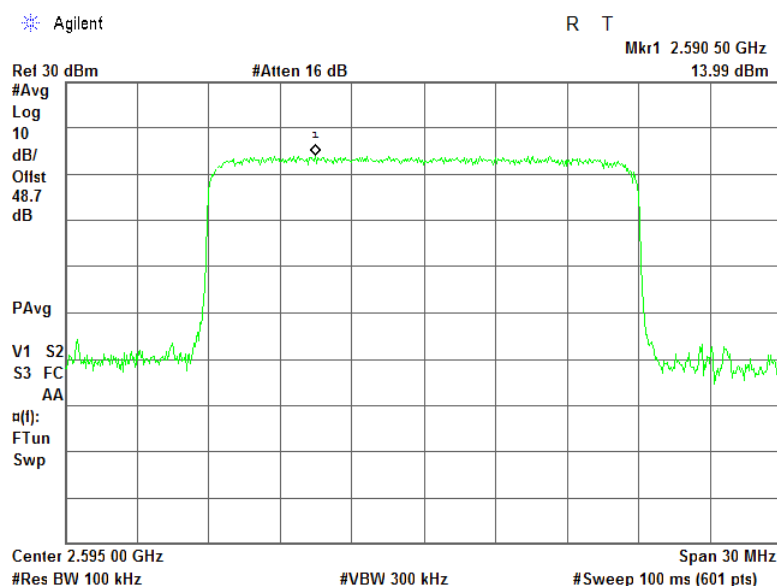


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.25 Power spectral density test results at low frequency, QPSK, 20 MHz EBW, RF # 1

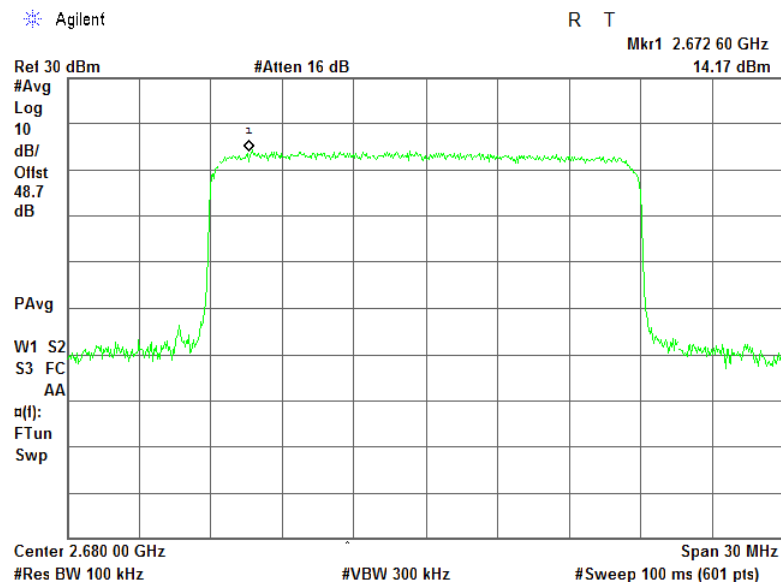


Plot 7.2.26 Power spectral density test results at mid frequency, QPSK, 20 MHz EBW, RF # 1

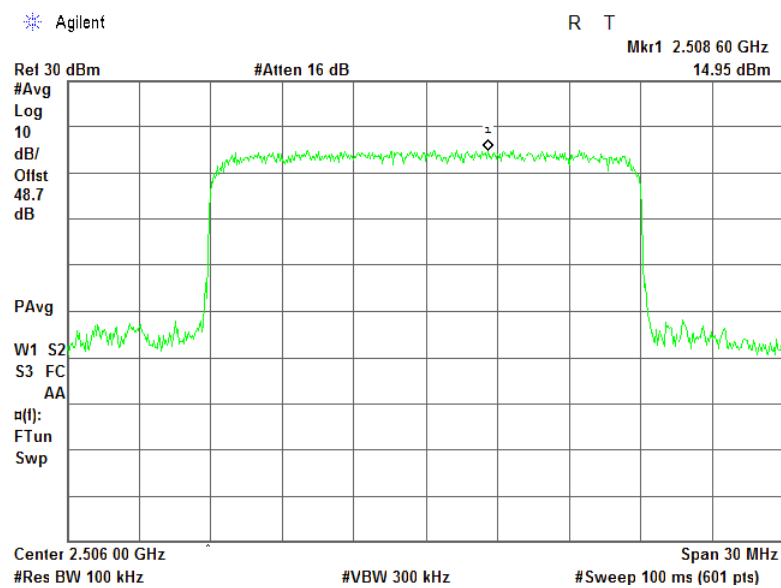


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.27 Power spectral density test results at high frequency, QPSK, 20 MHz EBW, RF # 1

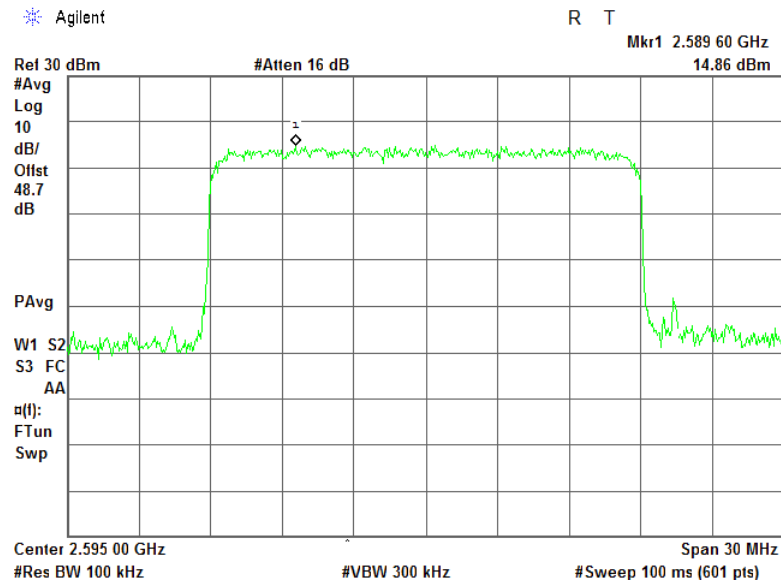


Plot 7.2.28 Power spectral density test results at low frequency, 64QAM, 20 MHz EBW, RF # 1

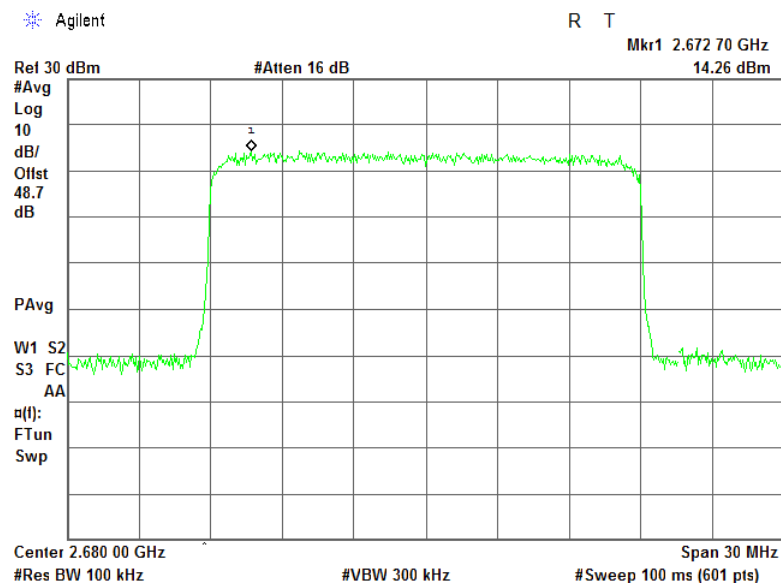


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.29 Power spectral density test results at mid frequency, 64QAM, 20 MHz EBW, RF # 1

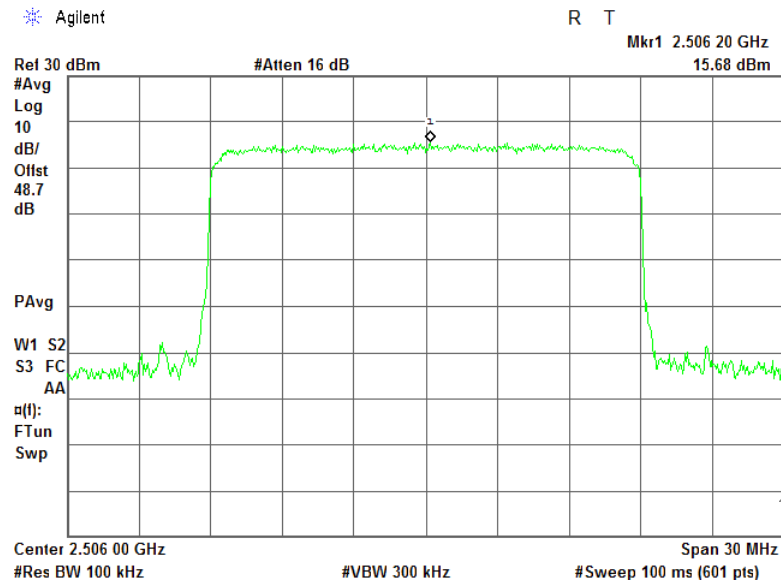


Plot 7.2.30 Power spectral density test results at high frequency, 64QAM, 20 MHz EBW, RF # 1

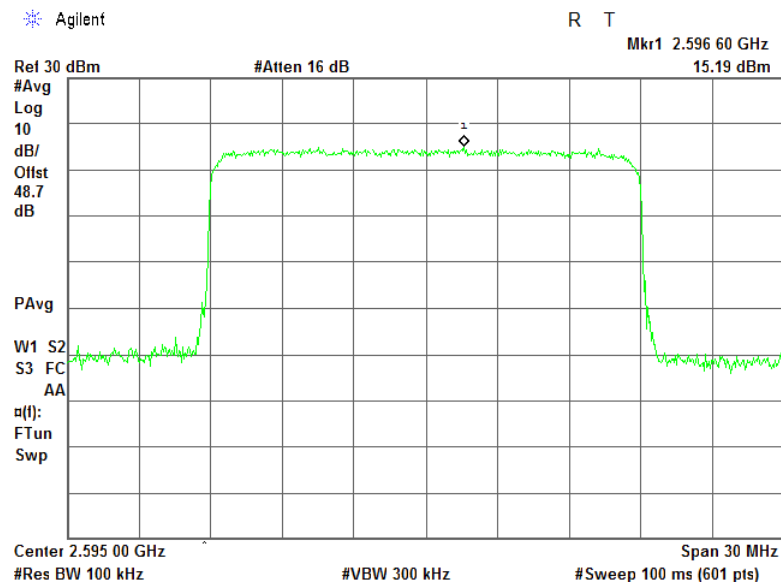


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.31 Power spectral density test results at low frequency, QPSK, 20 MHz EBW, RF # 2

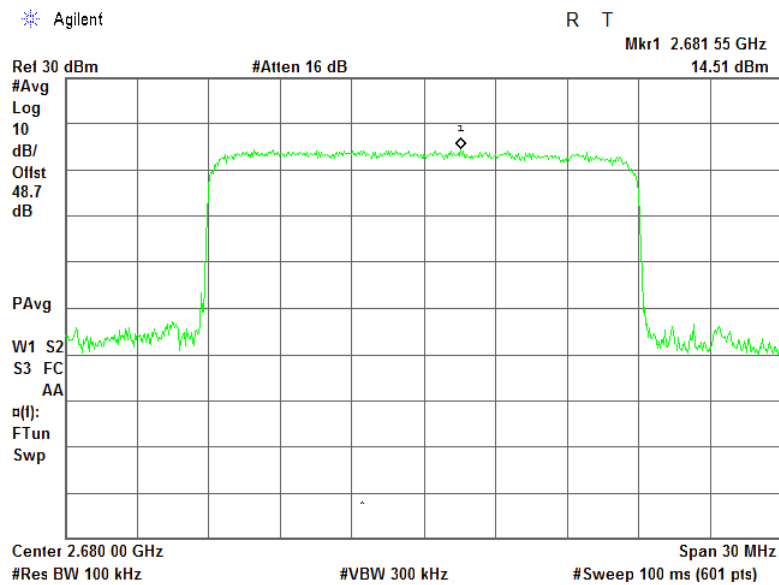


Plot 7.2.32 Power spectral density test results at mid frequency, QPSK, 20 MHz EBW, RF # 2

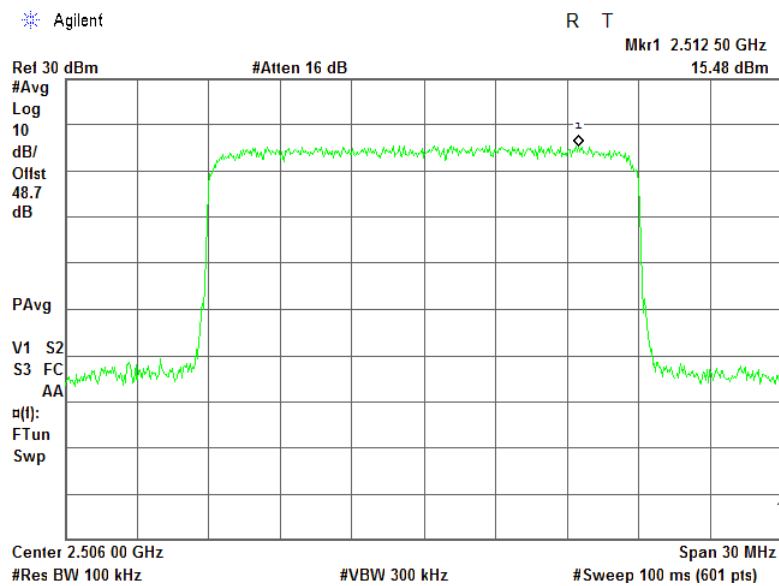


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.33 Power spectral density test results at high frequency, QPSK, 20 MHz EBW, RF # 2

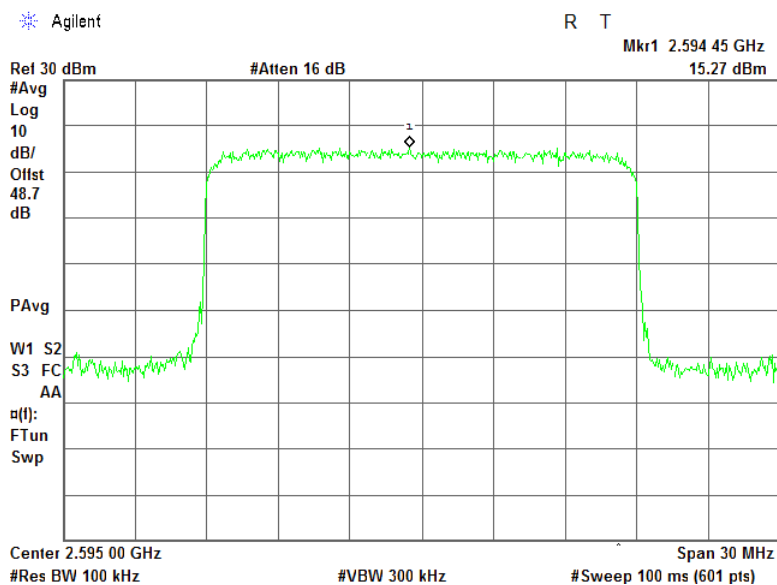


Plot 7.2.34 Power spectral density test results at low frequency, 64QAM, 20 MHz EBW, RF # 2

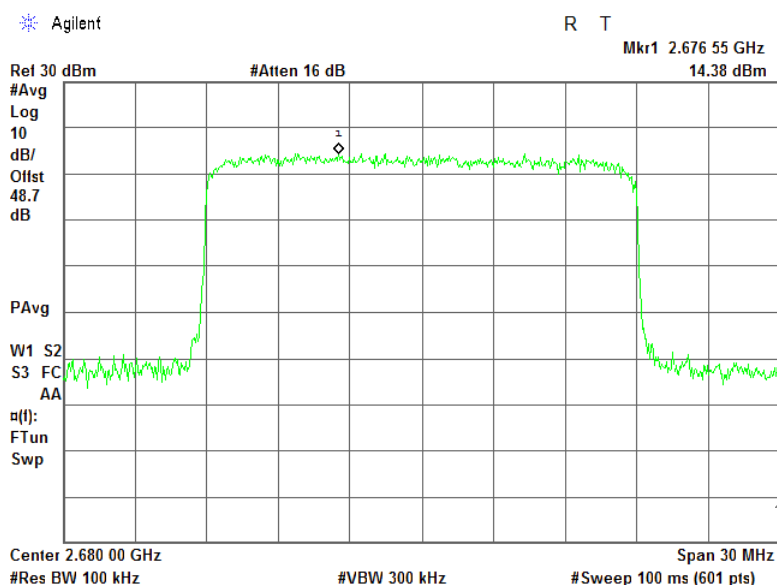


Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 03-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.35 Power spectral density test results at mid frequency, 64QAM, 20 MHz EBW, RF # 2



Plot 7.2.36 Power spectral density test results at high frequency, 64QAM, 20 MHz EBW, RF # 2





Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

7.3 Band edge emissions at RF connector test

7.3.1 General

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

Table 7.3.1 Spurious emission limits at band edges

Channel	Frequency range	Attenuation below carrier, dBc	Limit, dBm
Channel bandwidth 5 MHz			
2498.5	2496.0 - 2500.0 2500.0 - 2506.0	43+ 10*Log (P*)	-13.0
2593.0	2590.0 - 2596.0	43+ 10*Log (P*)	-13.0
2687.5	2680.0 - 2686.0 2686.0 - 2690.0	43+ 10*Log (P*)	-13.0
Channel bandwidth 10 MHz			
2501	2496.0 - 2506.0	43+ 10*Log (P*)	-13.0
2595	2590.0 - 2596.0 2596.0 - 2602.0	43+ 10*Log (P*)	-13.0
2685	2680.0 - 2686.0 2686.0 - 2690.0	43+ 10*Log (P*)	-13.0
Channel bandwidth 20 MHz			
2506	2496.0 - 2500.0 2500.0 - 2506.0 2506.0 - 2512.0 2512.0 - 2518.0	43+ 10*Log (P*)	-13.0
2595	2584.0 - 2590.0 2590.0 - 2596.0 2596.0 - 2602.0 2602.0 - 2608.0	43+ 10*Log (P*)	-13.0
2680	2668.0 - 2674.0 2674.0 - 2680.0 2680.0 - 2686.0 2686.0 - 2690.0	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 to Table 7.3.7 and the associated plots.

Figure 7.3.1 Spurious emission test setup for single output





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Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.2 Spurious emission at the low band edge test results

ASSIGNED FREQUENCY RANGE: 2496.0 – 2690.0 MHz
DETECTOR USED: Average (gated)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
EBW: 5 MHz

Frequency, MHz	Frequency offset, ± MHz	Low band edge dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK						
2498.5	3.0	-13.74	51	1000	-13.0	Pass
	4.0	-17.52	51	1000	-13.0	
2593.0	3.0	-14.86	51	1000	-13.0	Pass
	4.0	-18.36	51	1000	-13.0	
2587.5	3.0	-14.08	51	1000	-13.0	Pass
	4.0	-18.40	51	1000	-13.0	
64QAM						
2498.5	3.0	-15.18	51	1000	-13.0	Pass
	4.0	-19.85	51	1000	-13.0	
2593.0	3.0	-13.97	51	1000	-13.0	Pass
	4.0	-18.09	51	1000	-13.0	
2587.5	3.0	-15.35	51	1000	-13.0	Pass
	4.0	-18.66	51	1000	-13.0	

Table 7.3.3 Spurious emission at the high band edge test results

DETECTOR USED: Average (gated)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
EBW: 5 MHz

Frequency, MHz		Frequency offset, ± MHz	Low band edge dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK							
2498.5	3.0	-13.57	51	1000	-13.0	Pass	
	4.0	-15.94	51	1000	-13.0		
2593.0	3.0	-14.96	51	1000	-13.0	Pass	
	4.0	-17.84	51	1000	-13.0		
2587.5	3.0	-13.57	51	1000	-13.0	Pass	
	4.0	-16.54	51	1000	-13.0		
64QAM							
2498.5	3.0	-14.75	51	1000	-13.0	Pass	
	4.0	-19.16	51	1000	-13.0		
2593.0	3.0	-14.61	51	1000	-13.0	Pass	
	4.0	-18.29	51	1000	-13.0		
2587.5	3.0	-13.30	51	1000	-13.0	Pass	
	4.0	-15.76	51	1000	-13.0		



HERMON LABORATORIES

Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.4 Spurious emission at the low band edge test results

ASSIGNED FREQUENCY RANGE:

2496.0 – 2690.0 MHz

DETECTOR USED:

Average (gated)

VIDEO BANDWIDTH:

≥ Resolution bandwidth

EBW:

10 MHz

Frequency, MHz	Frequency offset, ± MHz	Low band edge dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK						
2501	5.5	-15.33	100	1000	-13.0	Pass
	6.5	-17.33	100	1000	-13.0	
2595	5.5	-17.75	100	1000	-13.0	Pass
	6.5	-21.30	100	1000	-13.0	
2685	5.5	-15.24	100	1000	-13.0	Pass
	6.5	-16.31	100	1000	-13.0	
64QAM						
2501	5.5	-16.61	100	1000	-13.0	Pass
	6.5	-17.05	100	1000	-13.0	
2595	5.5	-19.67	100	1000	-13.0	Pass
	6.5	-21.67	100	1000	-13.0	
2685	5.5	-18.47	100	1000	-13.0	Pass
	6.5	-21.10	100	1000	-13.0	

Table 7.3.5 Spurious emission at the high band edge test results

DETECTOR USED:

Average (gated)

VIDEO BANDWIDTH:

≥ Resolution bandwidth

EBW:

10MHz

Frequency, MHz	Frequency offset, ± MHz	Low band edge dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK						
2501	5.5	-15.91	100	1000	-13.0	Pass
	6.5	-17.01	100	1000	-13.0	
2595	5.5	-18.38	100	1000	-13.0	Pass
	6.5	-19.24	100	1000	-13.0	
2685	5.5	-15.90	100	1000	-13.0	Pass
	6.5	-17.09	100	1000	-13.0	
64QAM						
2501	5.5	-15.78	100	1000	-13.0	Pass
	6.5	-17.01	100	1000	-13.0	
2595	5.5	-17.78	100	1000	-13.0	Pass
	6.5	-19.58	100	1000	-13.0	
2685	5.5	-16.31	100	1000	-13.0	Pass
	6.5	-18.07	100	1000	-13.0	



HERMON LABORATORIES

Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.6 Spurious emission at the low band edge test results

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

EDW:

Frequency, MHz	Frequency offset, ± MHz	Low band edge dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK						
2506	10.5	-20.69	200	1000	-13.0	Pass
	11.5	-22.04	200	1000	-13.0	
2595	10.5	-20.13	200	1000	-13.0	Pass
	11.5	-19.45	200	1000	-13.0	
2680	10.5	-16.87	200	1000	-13.0	Pass
	11.5	-16.65	200	1000	-13.0	
64QAM						
2506	10.5	-22.44	200	1000	-13.0	Pass
	11.5	-22.60	200	1000	-13.0	
2595	10.5	-16.68	200	1000	-13.0	Pass
	11.5	-16.80	200	1000	-13.0	
2680	10.5	-18.31	200	1000	-13.0	Pass
	11.5	-19.65	200	1000	-13.0	

Table 7.3.7 Spurious emission at the high band edge test results

DETECTOR USED: Average (gated)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
EBW: 20MHz

Frequency, MHz	Frequency offset, ± MHz	Low band edge dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK						
2506	10.5	-19.15	200	1000	-13.0	Pass
	11.5	-20.76	200	1000	-13.0	
2595	10.5	-19.20	200	1000	-13.0	Pass
	11.5	-20.06	200	1000	-13.0	
2680	10.5	-17.72	200	1000	-13.0	Pass
	11.5	-16.07	200	1000	-13.0	
64QAM						
2506	10.5	-21.37	200	1000	-13.0	Pass
	11.5	-20.61	200	1000	-13.0	
2595	10.5	-17.11	200	1000	-13.0	Pass
	11.5	-17.39	200	1000	-13.0	
2680	10.5	-20.90	200	1000	-13.0	Pass
	11.5	-21.04	200	1000	-13.0	

Reference numbers of test equipment used

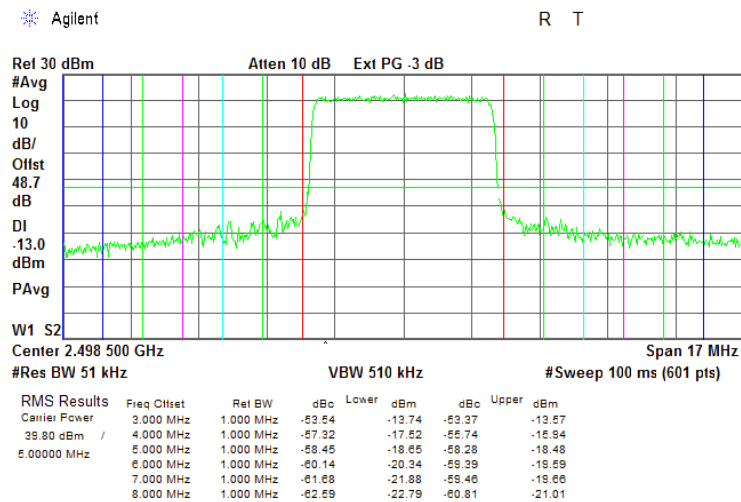
HL 3301	HL 3302	HL 3818	HL 4229	HL 4234	HL 4293	HL 4366	
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Full description is given in Appendix A.

Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

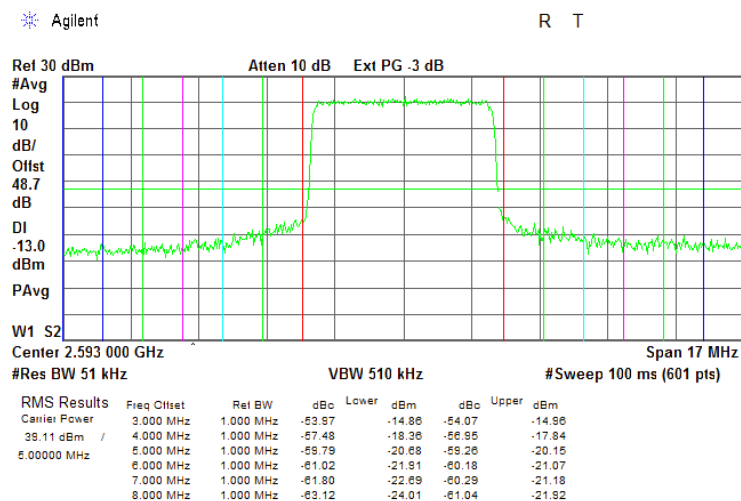
Plot 7.3.1 Spurious emission at band edges test results at low carrier frequency, 5 MHz EBW

DETECTOR USED: Average (gated)
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 5.3 Mbps



Plot 7.3.2 Spurious emission at band edges test results at mid carrier frequency, 5 MHz EBW

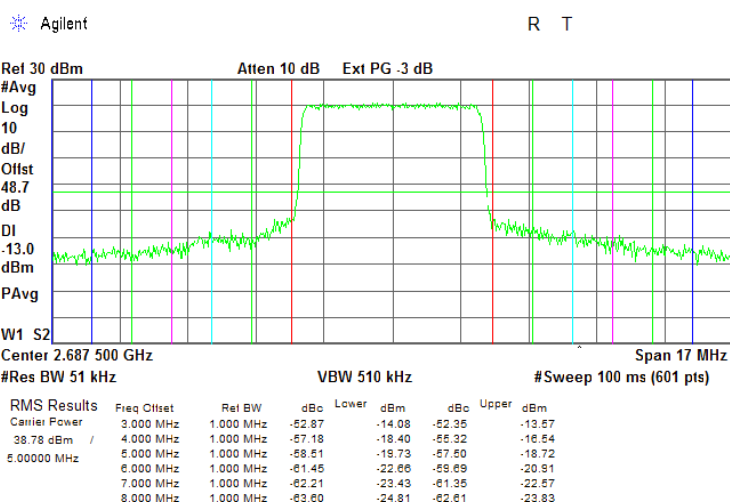
ASSIGNED FREQUENCY RANGE: 2590.0 – 2696.0 MHz
DETECTOR USED: Average (gated)
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 5.3 Mbps



Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Nov-15 - 08-Dec-15		
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

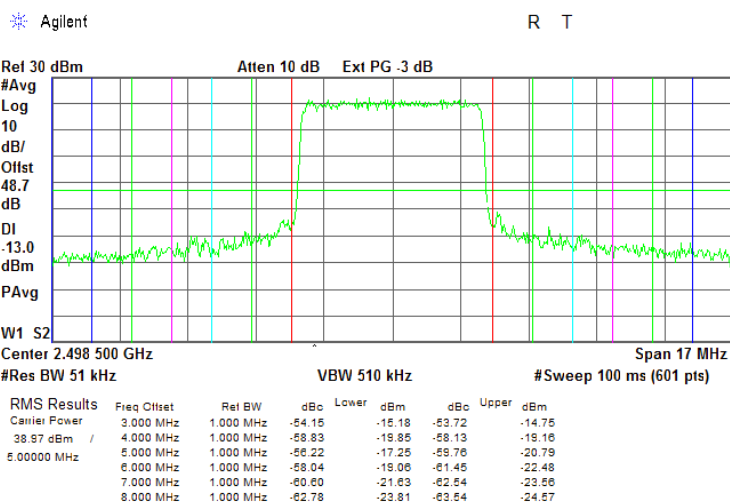
Plot 7.3.3 Spurious emission at band edges test results at high carrier frequency, 5 MHz EBW

ASSIGNED FREQUENCY RANGE: 2680.0 – 2690.0 MHz
DETECTOR USED: Average (gated)
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 5.3 Mbps



Plot 7.3.4 Spurious emission at band edges test results at low carrier frequency, 5 MHz EBW

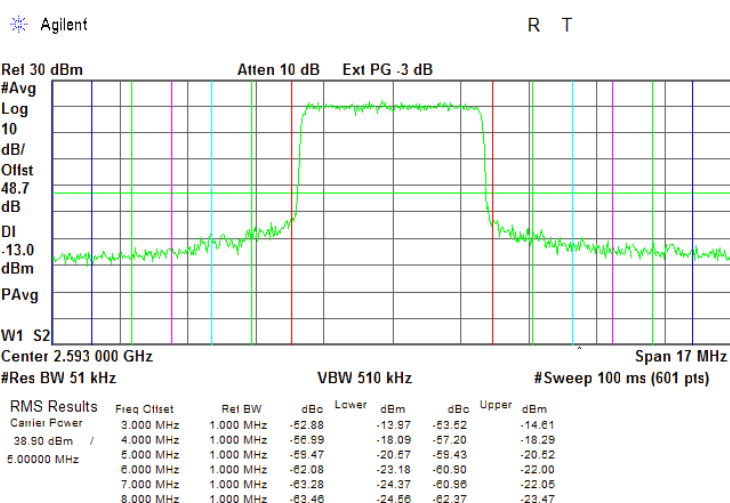
ASSIGNED FREQUENCY RANGE: 2496.0 – 2506.0 MHz
DETECTOR USED: Average (gated)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 23 Mbps



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

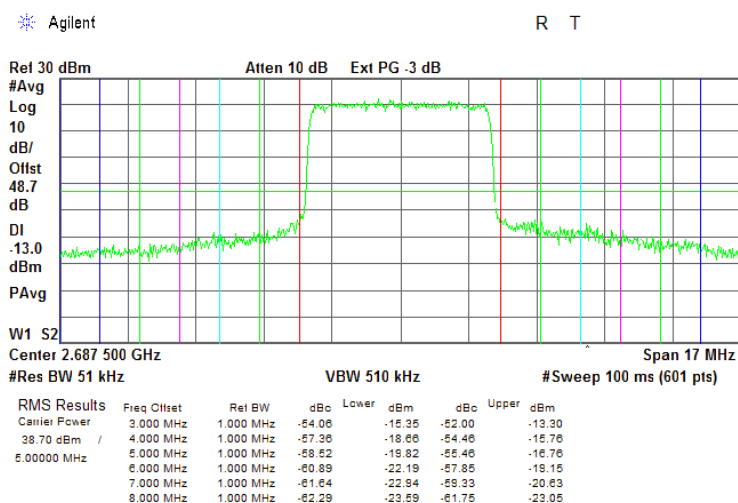
Plot 7.3.5 Spurious emission at band edges test results at mid carrier frequency, 5 MHz EBW

ASSIGNED FREQUENCY RANGE: 2590.0 – 2696.0 MHz
DETECTOR USED: Average (gated)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 23 Mbps



Plot 7.3.6 Spurious emission at band edges test results at high carrier frequency, 5 MHz EBW

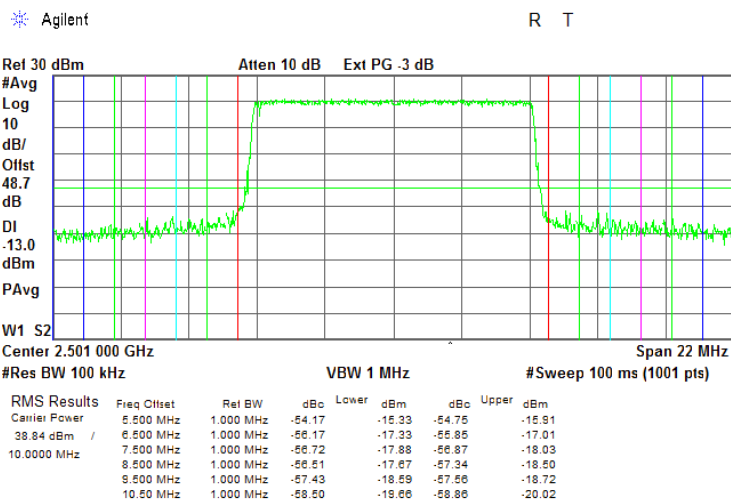
ASSIGNED FREQUENCY RANGE: 2680.0 – 2690.0 MHz
DETECTOR USED: Average (gated)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 23 Mbps



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

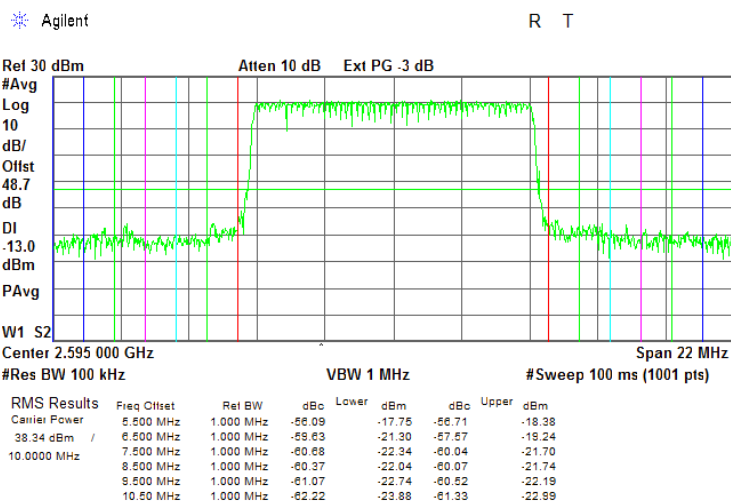
Plot 7.3.7 Spurious emission at band edges test results at low carrier frequency, 10 MHz EBW

ASSIGNED FREQUENCY RANGE: 2490.0 – 2512.0 MHz
DETECTOR USED: Average (gated)
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 10.7 Mbps



Plot 7.3.8 Spurious emission at band edges test results at mid carrier frequency, 10 MHz EBW

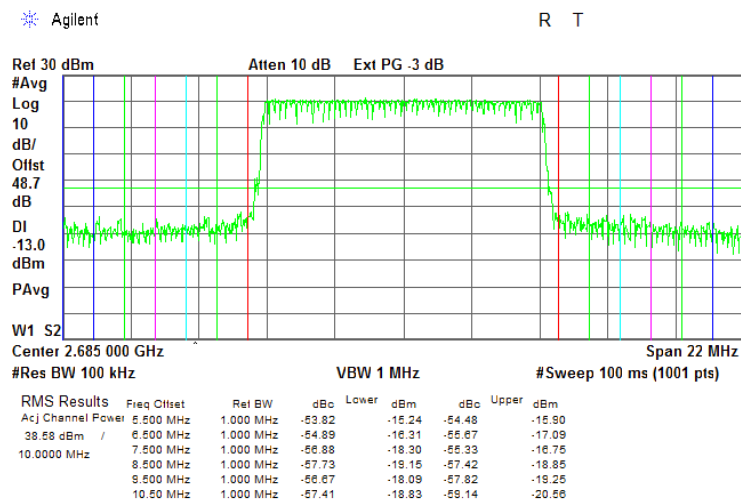
ASSIGNED FREQUENCY RANGE: 2584.0 – 2608.0 MHz
DETECTOR USED: Average (gated)
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 10.7 Mbps



Test specification:	Section 27.53, Band edge emissions		
Test procedure:	47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13		
Test mode:	Compliance	Verdict: PASS	
Date(s):	16-Nov-15 - 08-Dec-15		
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

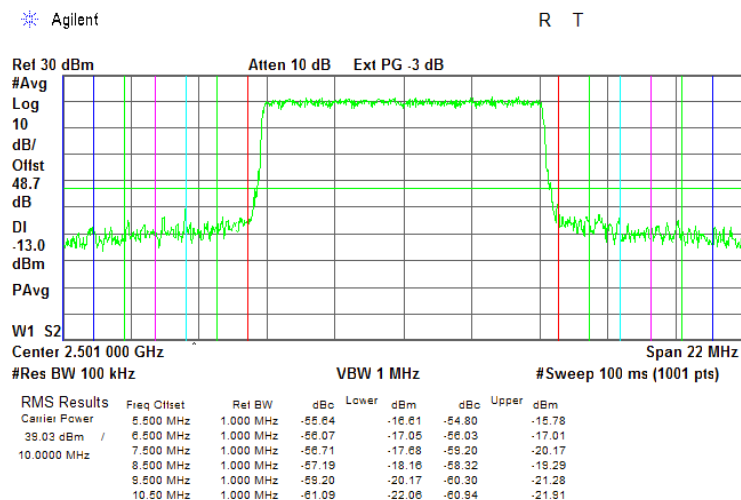
Plot 7.3.9 Spurious emission at band edges test results at high carrier frequency, 10 MHz EBW

ASSIGNED FREQUENCY RANGE: 2674.0 – 2696.0 MHz
DETECTOR USED: Average (gated)
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 10.7 Mbps



Plot 7.3.10 Spurious emission at band edges test results at low carrier frequency, 10 MHz EBW

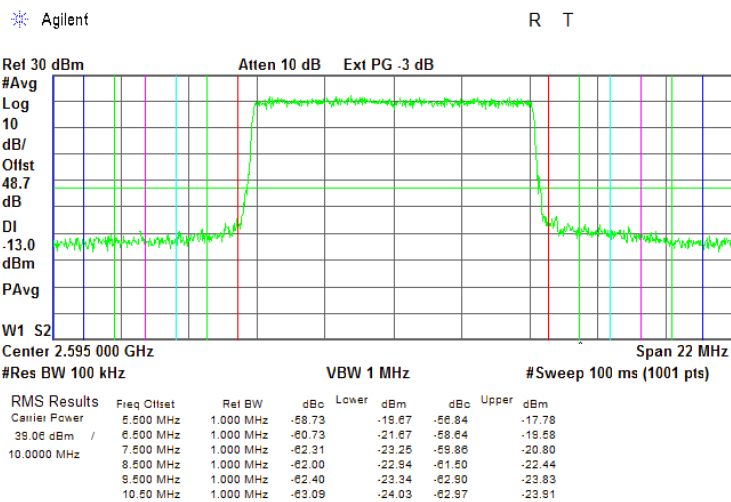
ASSIGNED FREQUENCY RANGE: 2490.0 – 2512.0 MHz
DETECTOR USED: Average (gated)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 47.3 Mbps



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

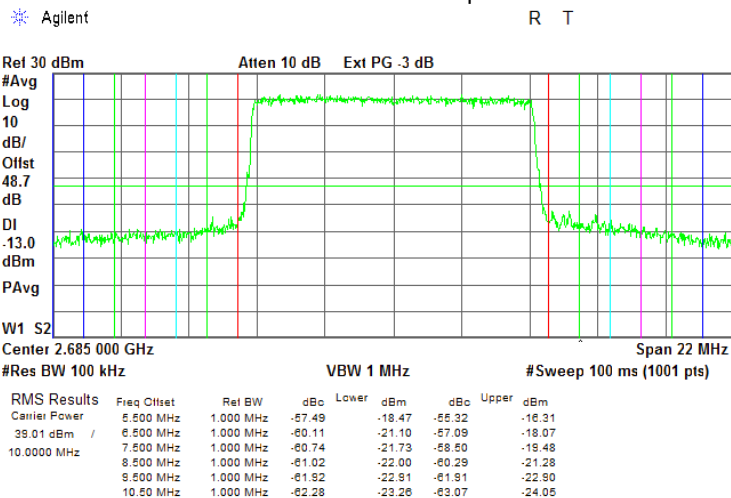
Plot 7.3.11 Spurious emission at band edges test results at mid carrier frequency, 10 MHz EBW

ASSIGNED FREQUENCY RANGE: 2584.0 – 2608.0 MHz
DETECTOR USED: Average (gated)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 47.3 Mbps



Plot 7.3.12 Spurious emission at band edges test results at high carrier frequency, 10 MHz EBW

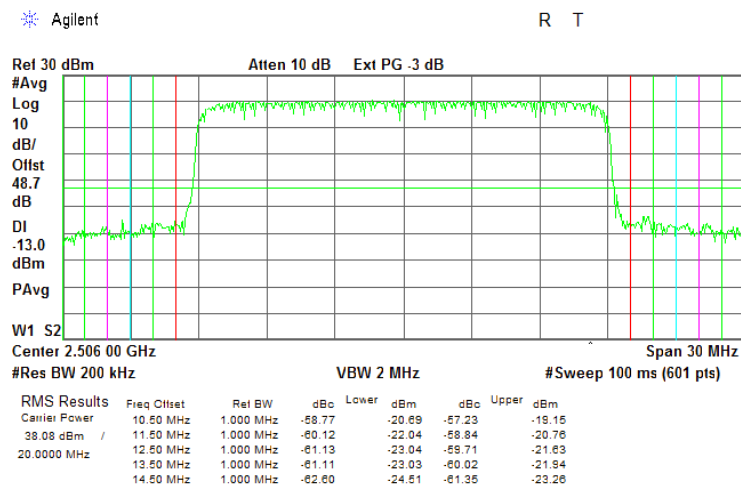
ASSIGNED FREQUENCY RANGE: 2674.0 – 2696.0 MHz
DETECTOR USED: Average (gated)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 47.3 Mbps



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

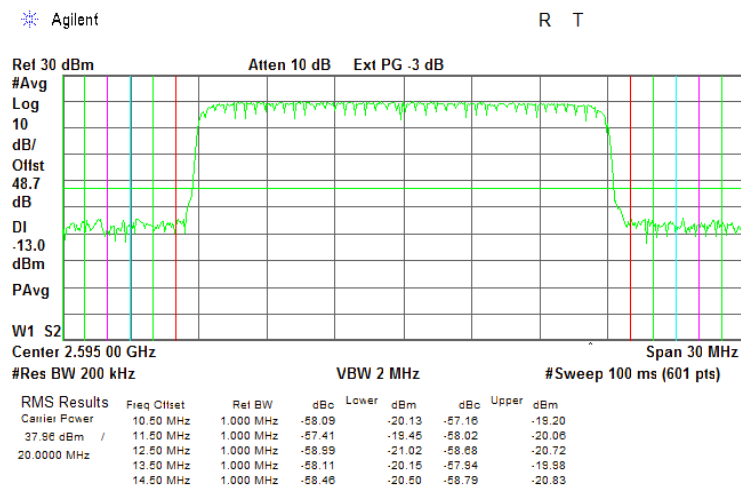
Plot 7.3.13 Spurious emission at band edges test results at low carrier frequency, 20 MHz EBW

ASSIGNED FREQUENCY RANGE: 2490.0 – 2524.0 MHz
DETECTOR USED: Average (gated)
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 23.4 Mbps



Plot 7.3.14 Spurious emission at band edges test results at mid carrier frequency, 20 MHz EBW

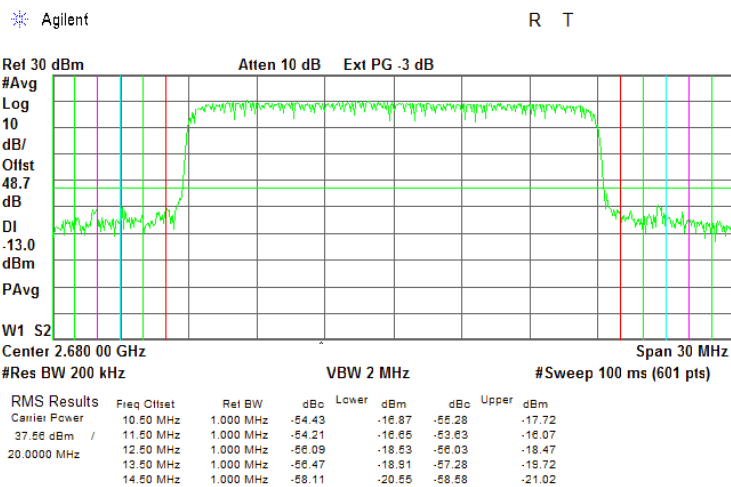
ASSIGNED FREQUENCY RANGE: 2578.0 – 2614.0 MHz
DETECTOR USED: Average (gated)
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 23.4 Mbps



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

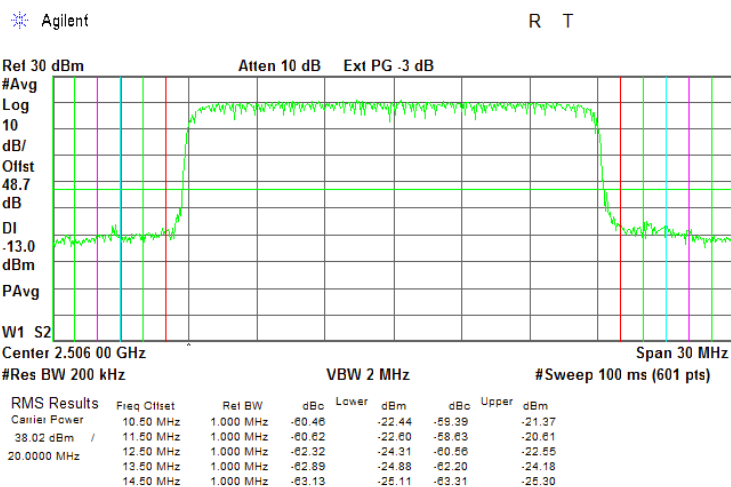
Plot 7.3.15 Spurious emission at band edges test results at high carrier frequency, 20 MHz EBW

ASSIGNED FREQUENCY RANGE: 2662.0 – 2696.0 MHz
DETECTOR USED: Average (gated)
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 23.4 Mbps



Plot 7.3.16 Spurious emission at band edges test results at low carrier frequency, 20 MHz EBW

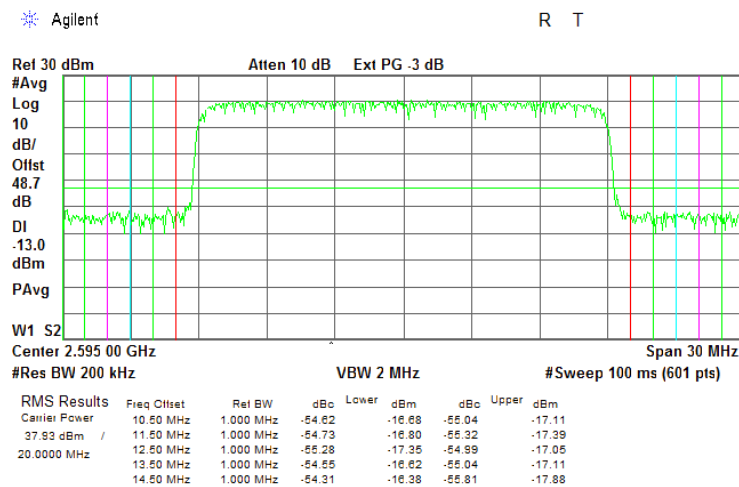
ASSIGNED FREQUENCY RANGE: 2490.0 – 2524.0 MHz
DETECTOR USED: Average (gated)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 95 Mbps



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-D, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Nov-15 - 08-Dec-15	
Temperature: 24 °C	Air Pressure: 1017 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

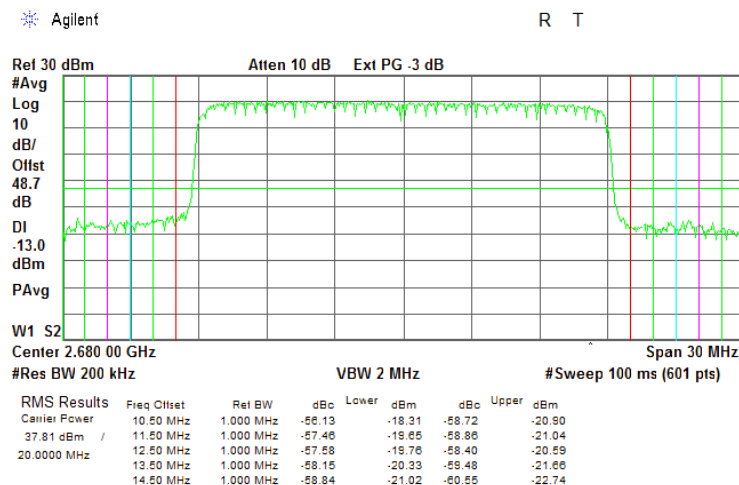
Plot 7.3.17 Spurious emission at band edges test results at mid carrier frequency, 20 MHz EBW

ASSIGNED FREQUENCY RANGE: 2578.0 – 2614.0 MHz
DETECTOR USED: Average (gated)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 95 Mbps



Plot 7.3.18 Spurious emission at band edges test results at high carrier frequency, 20 MHz EBW

ASSIGNED FREQUENCY RANGE: 2662.0 – 2696.0 MHz
DETECTOR USED: Average (gated)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 95 Mbps



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):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

7.4 Spurious emissions at RF antenna connector test

7.4.1 General

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

Table 7.4.1 Spurious emission limits

Frequency, MHz	Attenuation below carrier, dBc	Spurious emissions, dBm
Base and fixed user stations		
0.009 – 10th harmonic	43+10logP(W)**	-13.0

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

** - P is transmitter output power in watts

7.4.2 Test procedure

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

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

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

Figure 7.4.1 Spurious emission test setup, single output





Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.4.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 2496 - 2690 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 –27000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATION: 64 QAM
 EMISSION BANDWIDTH: 5 MHz

Frequency, MHz	SA reading, dBm	Attenuation, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency 2498.5 MHz								
2491.78	-30.40	including	including	1000	-30.40	-13	-17.40	Pass
2506.00	-26.59	including	including	1000	-26.59	-13	-26.59	Pass
Mid carrier frequency 2593 MHz								
2585.75	-26.16	including	including	1000	-26.16	-13	-13.16	Pass
2600.00	-24.36	including	including	1000	-24.36	-13	-11.36	Pass
High carrier frequency 2687.5 MHz								
2680.0	-24.60	including	including	1000	-24.60	-13	-11.60	Pass
2695.11	-22.02	including	including	1000	-22.02	-13	-9.02	Pass

*- Margin = Spurious emission – specification limit.

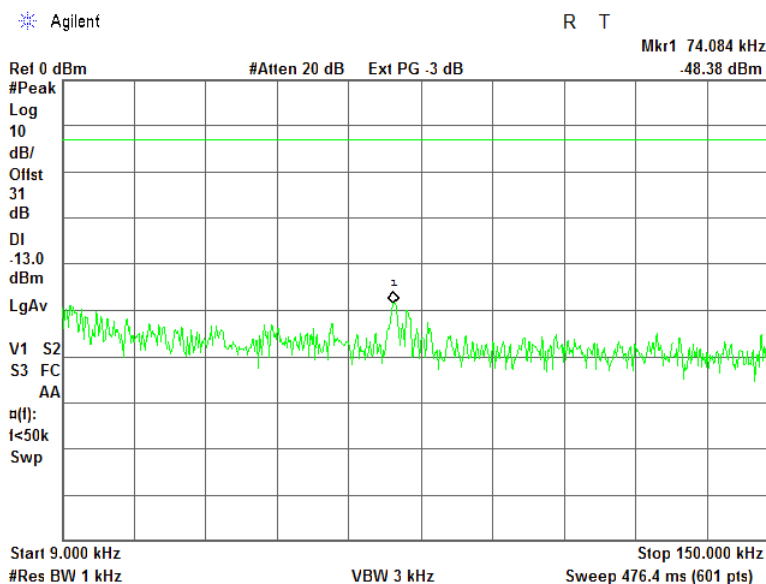
Reference numbers of test equipment used

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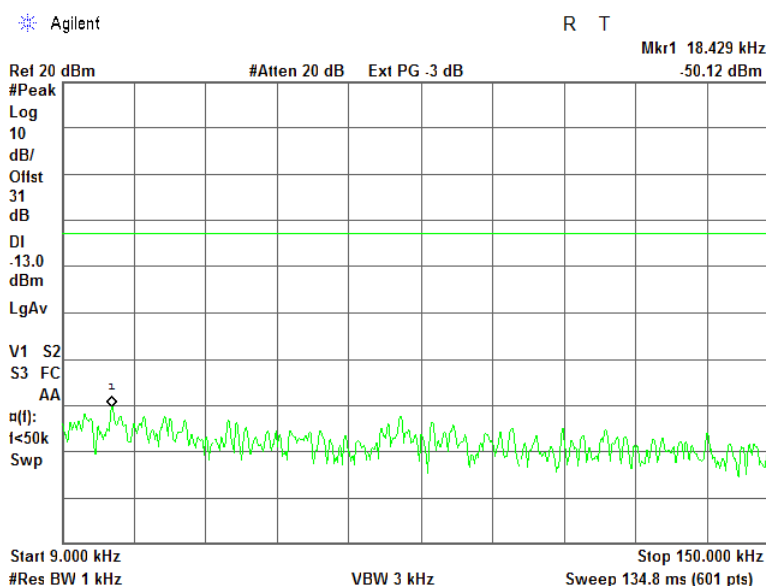
Full description is given in Appendix A.

Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

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

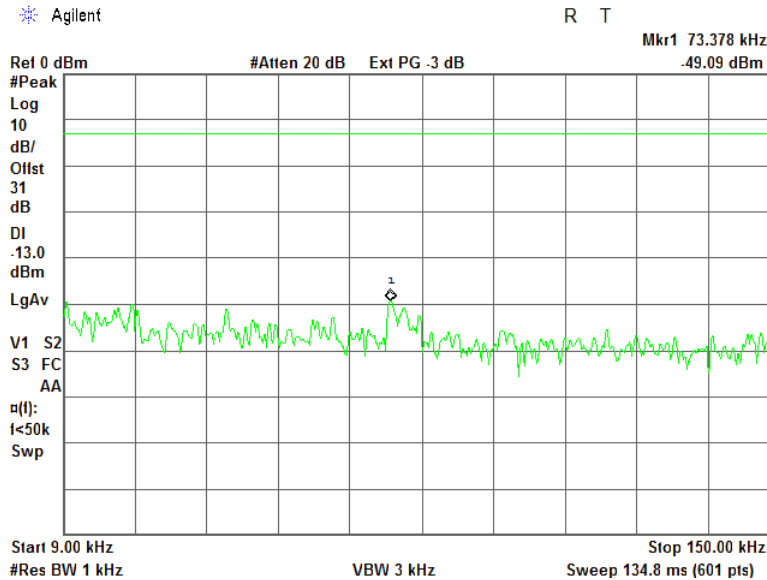


Plot 7.4.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency

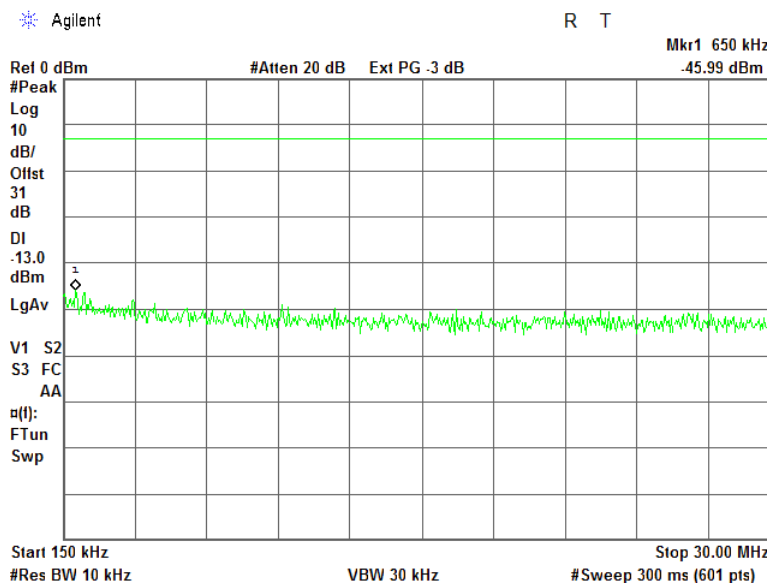


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

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

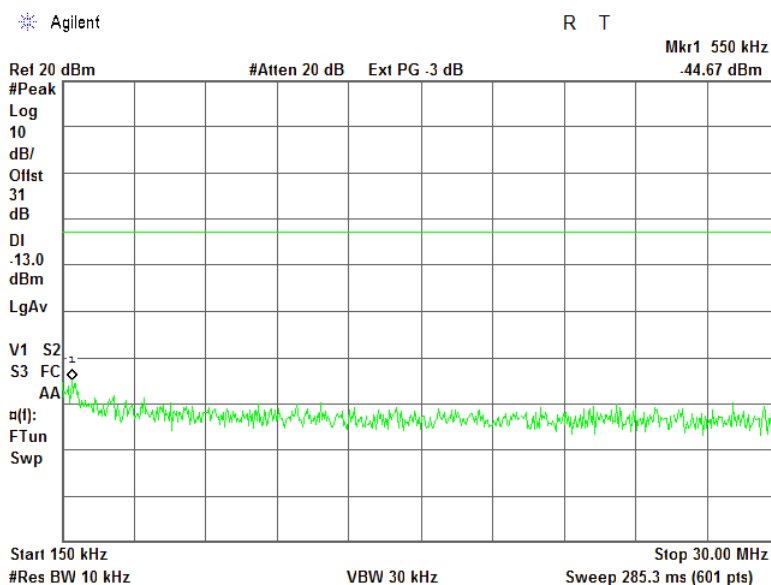


Plot 7.4.4 Spurious emission measurements in 0.15 - 30.0 MHz range at low carrier frequency

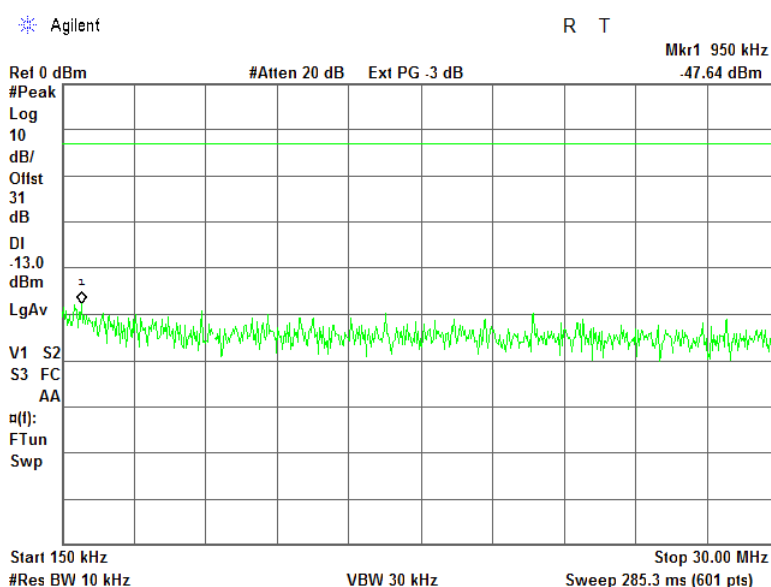


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

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

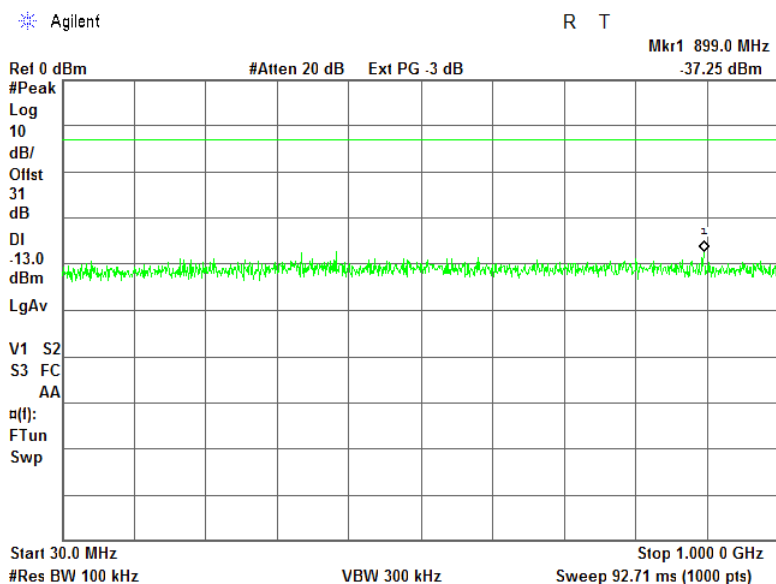


Plot 7.4.6 Spurious emission measurements in 0.15 - 30.0 MHz range at high carrier frequency

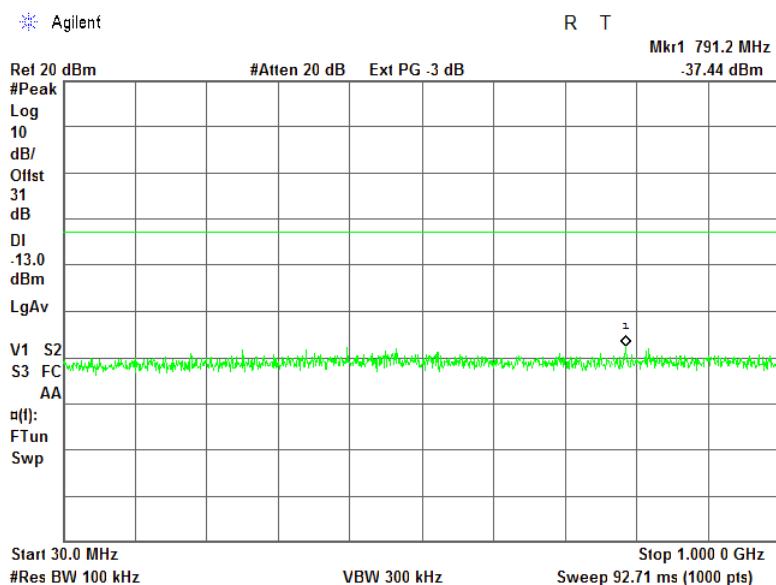


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

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



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

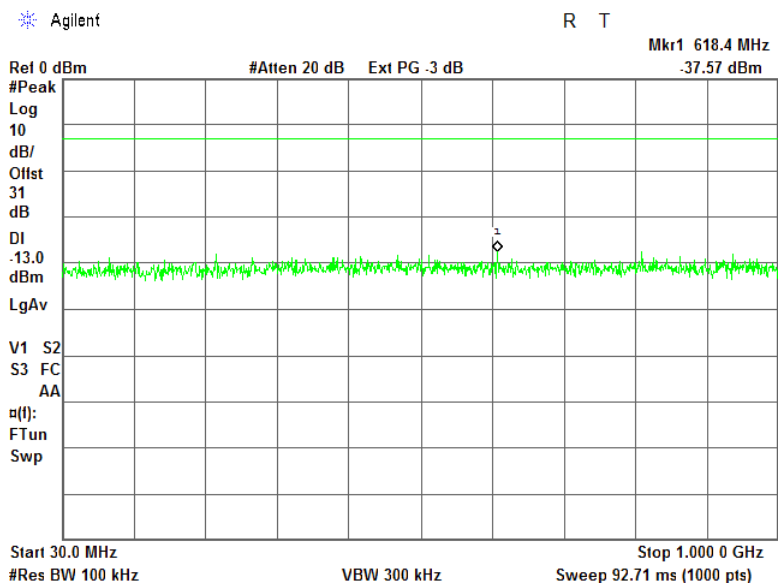




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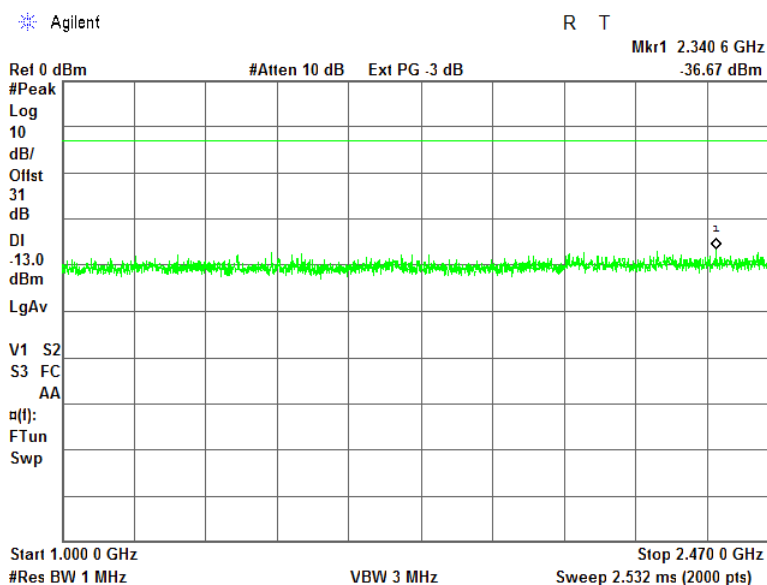
Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

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

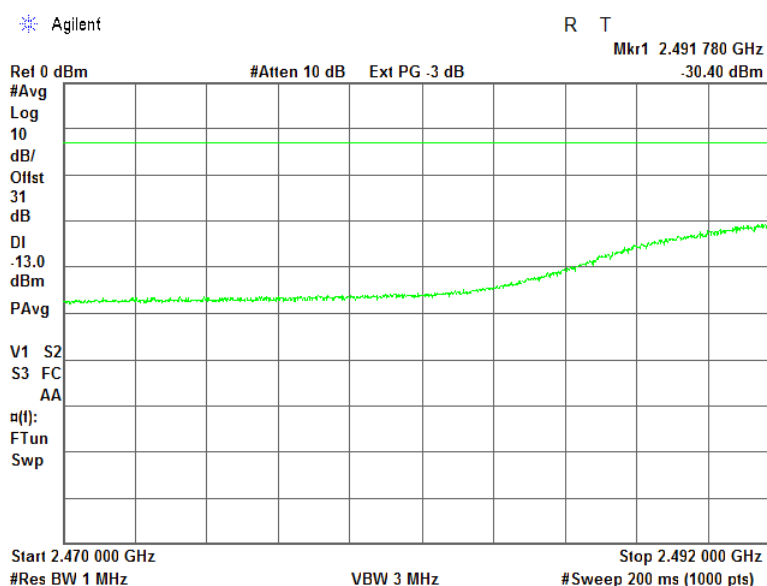


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.10 Spurious emission measurements in 1000 - 2470 MHz range at low carrier frequency



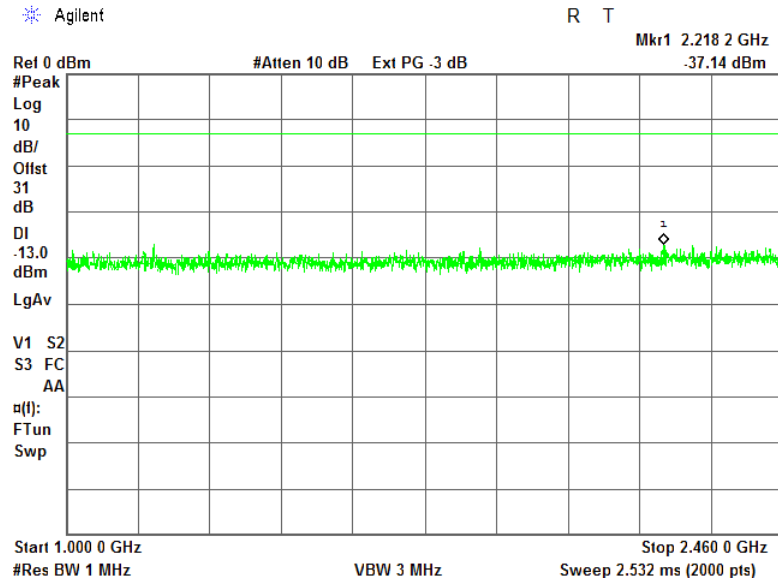
Plot 7.4.11 Spurious emission measurements in 2470 – 2492 MHz range at low carrier frequency



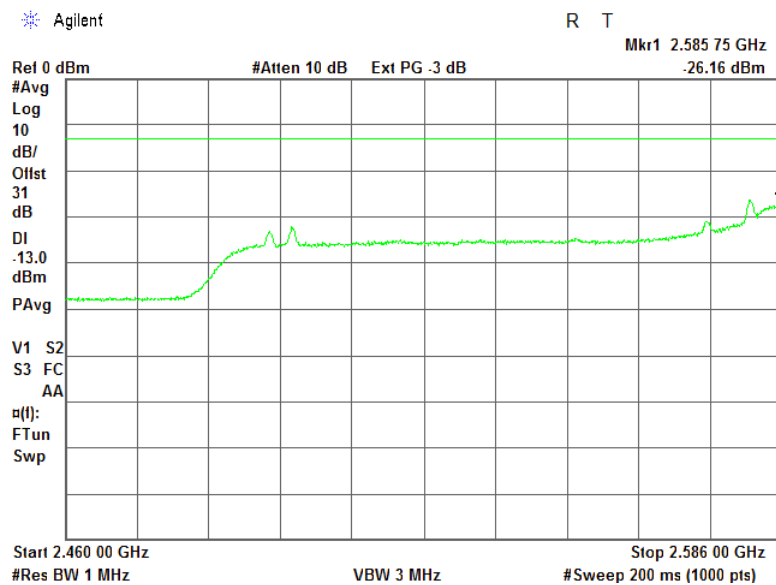
NOTE: Average Detector and Max Hold were used

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):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.12 Spurious emission measurements in 1000 - 2460 MHz at mid carrier frequency



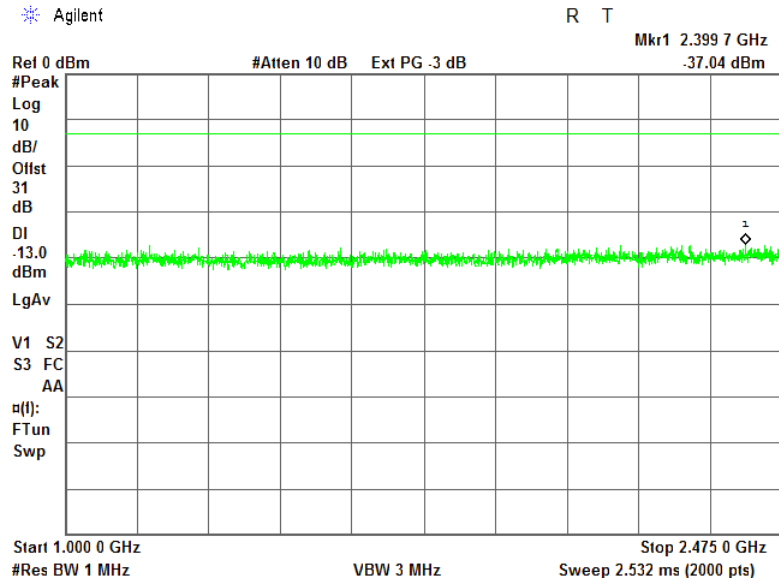
Plot 7.4.13 Spurious emission measurements in 2550 - 2586 MHz at mid carrier frequency



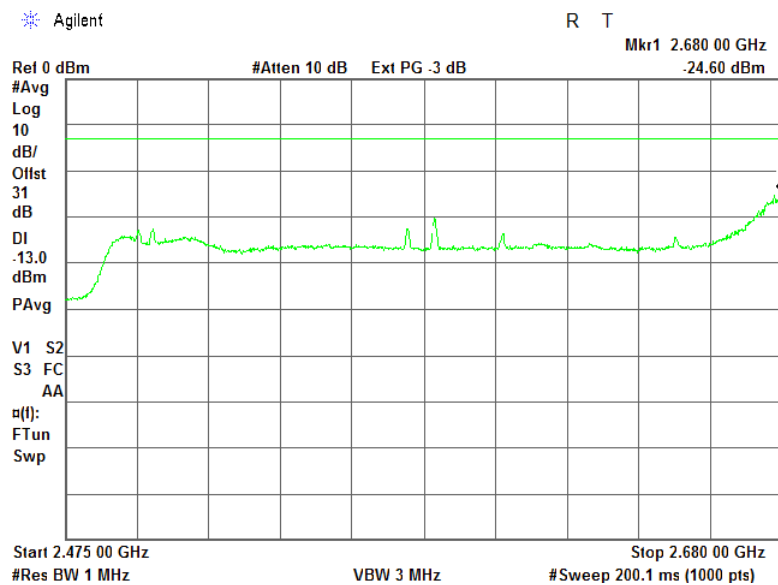
NOTE: Average Detector and Max Hold were used

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):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.14 Spurious emission measurements in 1000 - 2475 MHz at high carrier frequency



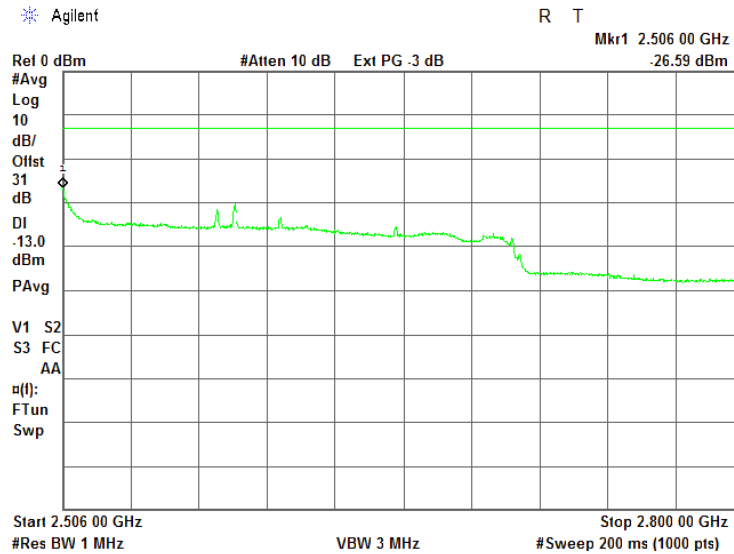
Plot 7.4.15 Spurious emission measurements in 2475 -2680 MHz at high carrier



NOTE: Average Detector and Max Hold were used

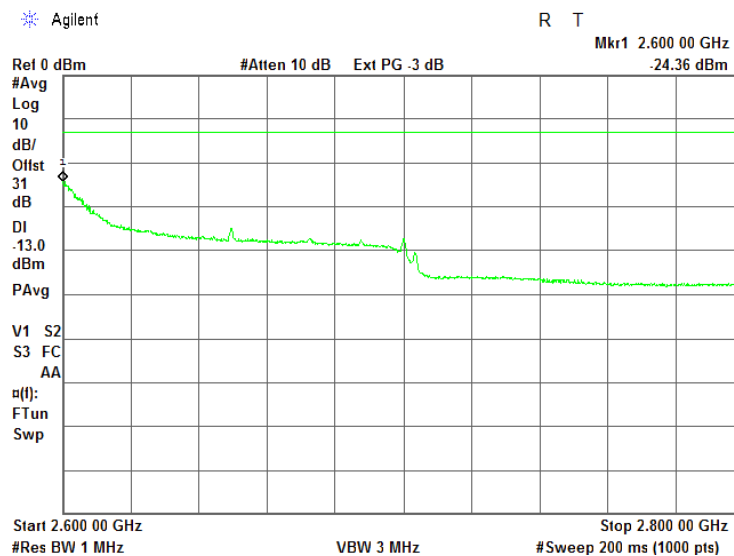
Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.16 Spurious emission measurements in 2506 - 2800 MHz range at low carrier frequency



NOTE: Average Detector and Max Hold were used

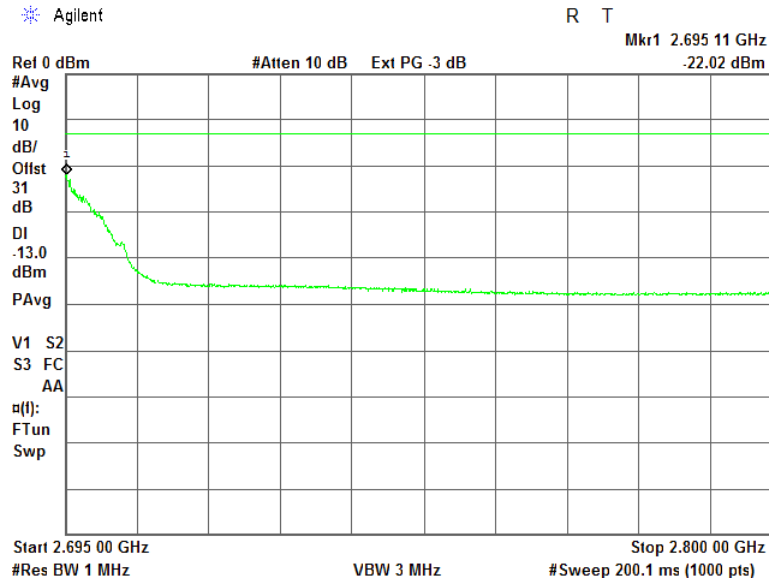
Plot 7.4.17 Spurious emission measurements in 2600 - 2800 MHz at mid carrier frequency



NOTE: Average Detector and Max Hold were used

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):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

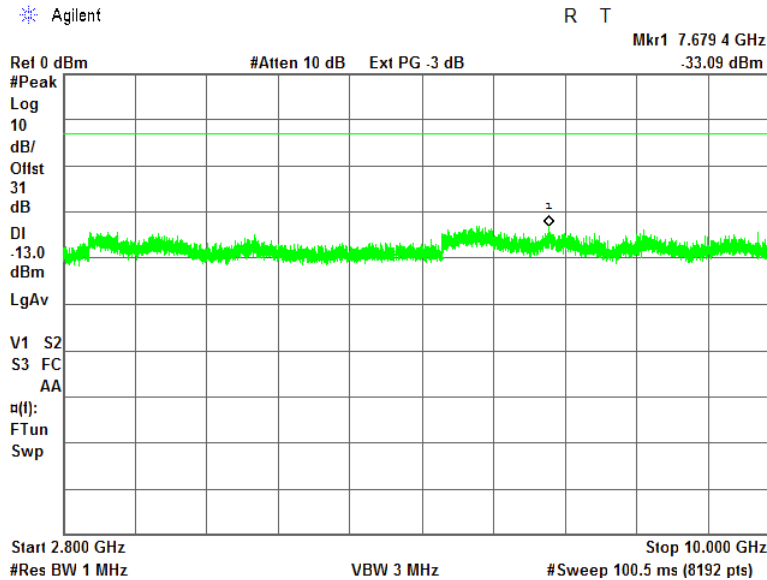
Plot 7.4.18 Spurious emission measurements in 2695 - 2800 MHz at high carrier frequency



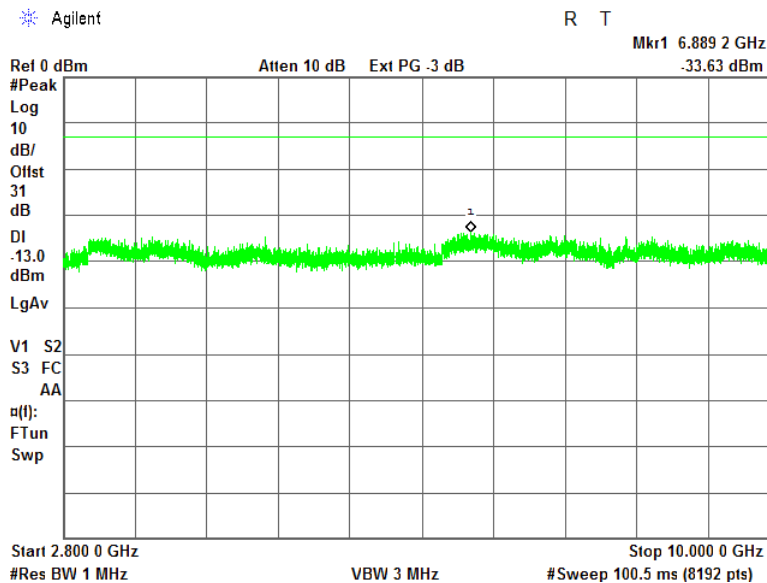
NOTE: Average Detector and Max Hold were used

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):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.19 Spurious emission measurements in 2800-10000 MHz range at low carrier frequency

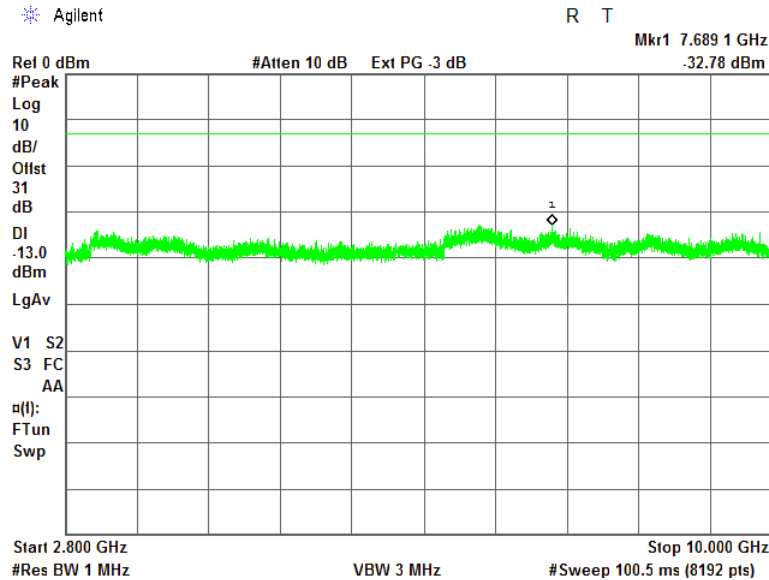


Plot 7.4.20 Spurious emission measurements in 2800 - 10000 MHz at mid carrier frequency

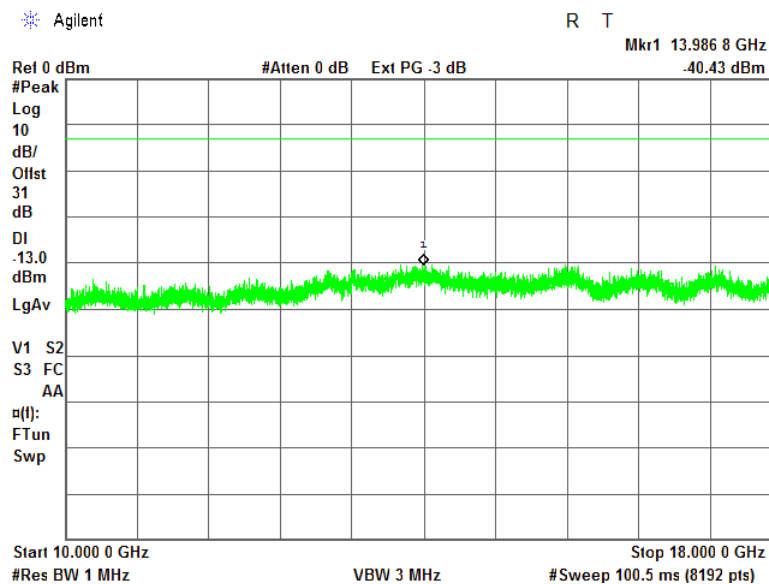


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.21 Spurious emission measurements in 2800 - 10000 MHz at high carrier frequency

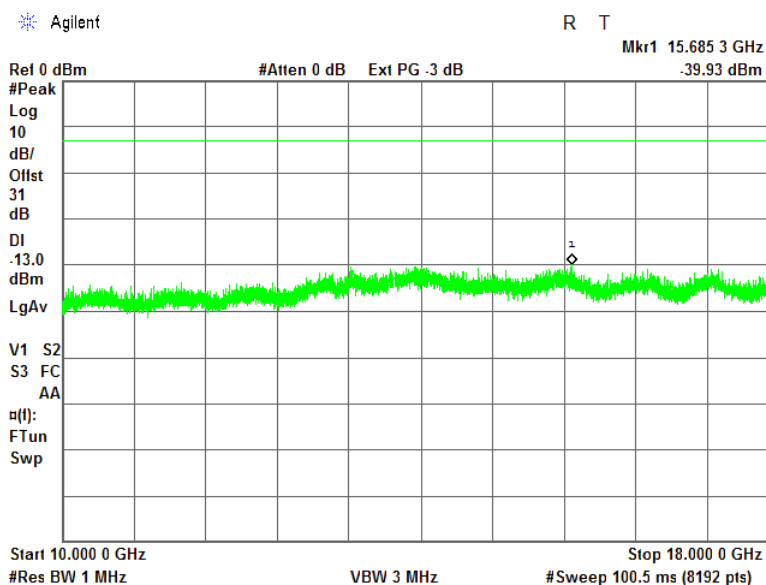


Plot 7.4.22 Spurious emission measurements in 10000-18000 MHz range at low carrier frequency

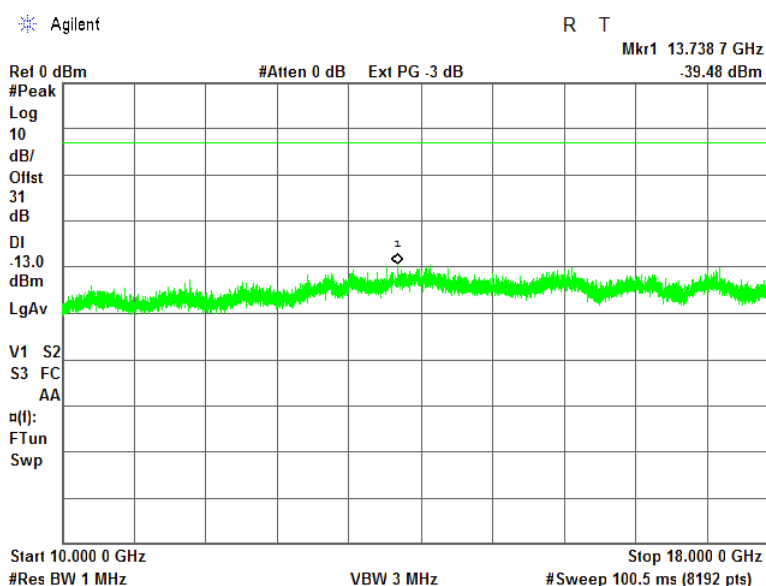


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.23 Spurious emission measurements in 10000 - 18000 MHz at mid carrier frequency

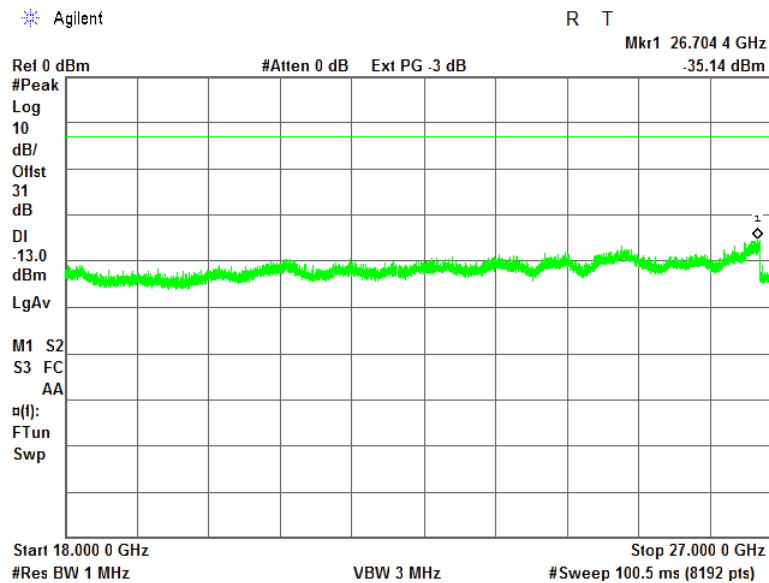


Plot 7.4.24 Spurious emission measurements in 10000 - 18000 MHz at high carrier frequency

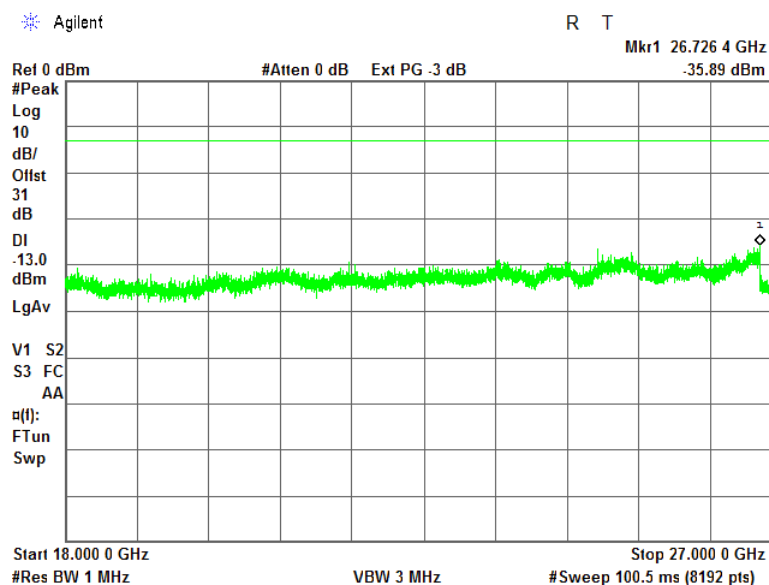


Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.25 Spurious emission measurements in 18000-27000 MHz range at low carrier frequency

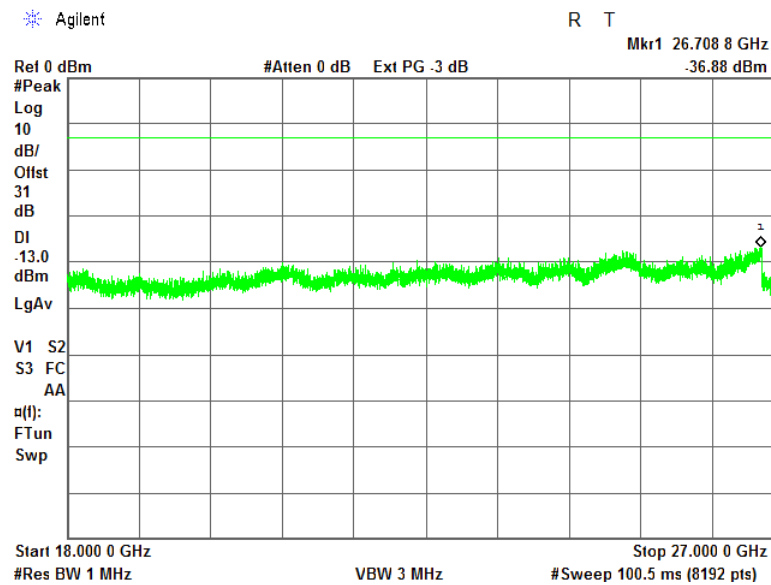


Plot 7.4.26 Spurious emission measurements in 18000 - 27000 MHz at mid carrier frequency



Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53	
Test mode:		Compliance	Verdict: PASS
Date(s):		26-Nov-15	
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.27 Spurious emission measurements in 18000 - 27000 MHz at high carrier frequency





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:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

7.5 Radiated spurious emission measurements

7.5.1 General

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

Table 7.5.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10 th harmonic*	43+10logP** fixed	-13	84.4

* - Excluding the band emission

** - P is transmitter output power in Watts

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

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

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

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

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

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

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

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

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

Test specification:		Section 27.53, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

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

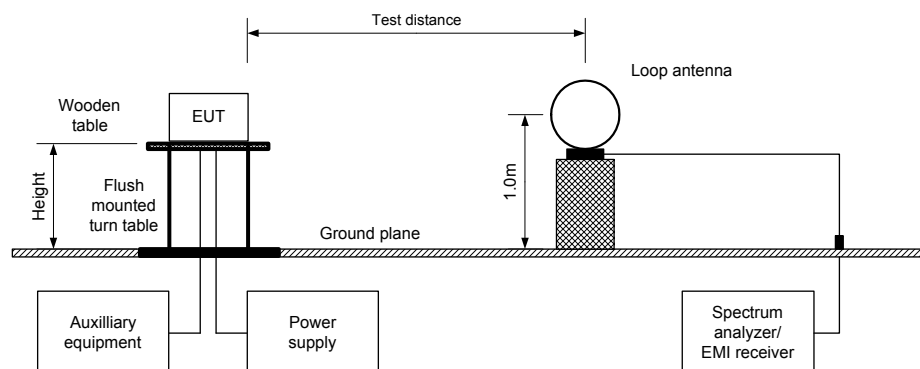
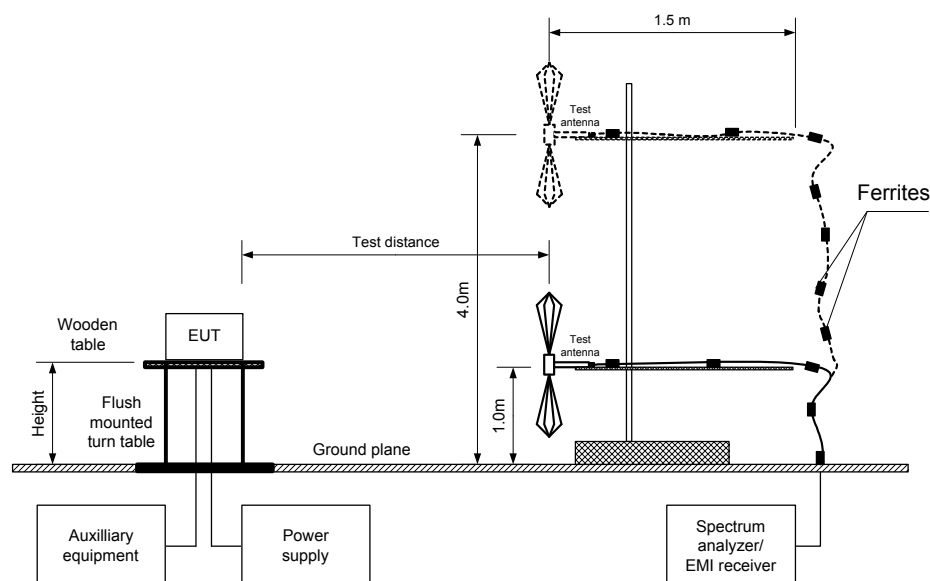


Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz





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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:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Table 7.5.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 2496-2690 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Semi anechoic chamber
 EUT HEIGHT: 0.8 m
 INVESTIGATED FREQUENCY RANGE: 0.009 – 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: 64QAM***
 MODULATING SIGNAL: PRBS
 BANDWIDTH: 5 MHz***

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Low carrier frequency							
No emissions were found							
Mid carrier frequency							
No emissions were found							
High carrier frequency							
No emissions were found							

Verdict: Pass

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

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

***- Maximum Power Density

Reference numbers of test equipment used

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

Full description is given in Appendix A.

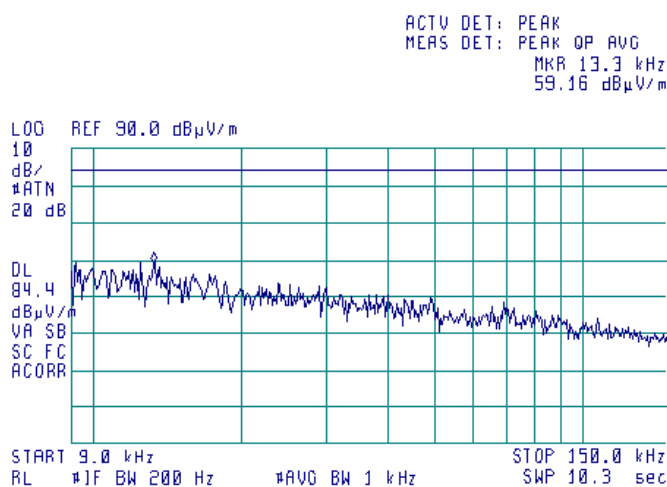


HERMON LABORATORIES

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:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

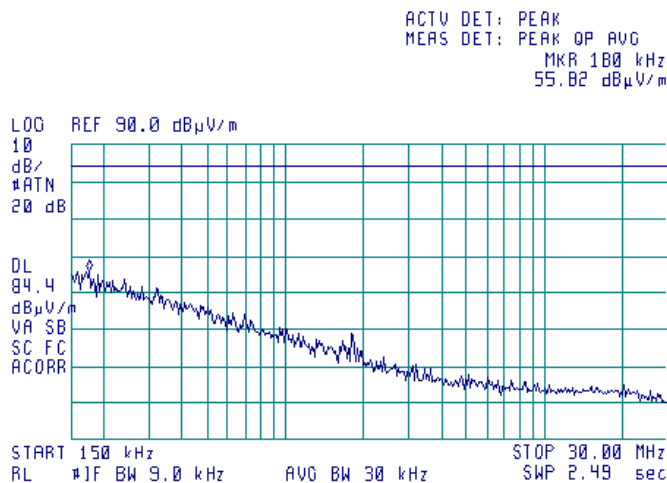
Plot 7.5.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.5.2 Radiated emission measurements in 0.15 - 30 MHz range

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





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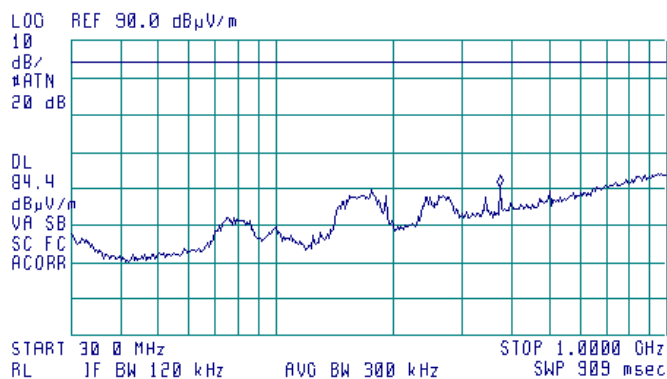
Test specification:		Section 27.53, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.3 Radiated emission measurements in 30 - 1000 MHz range

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



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 374.2 MHz
50.66 dBµV/m

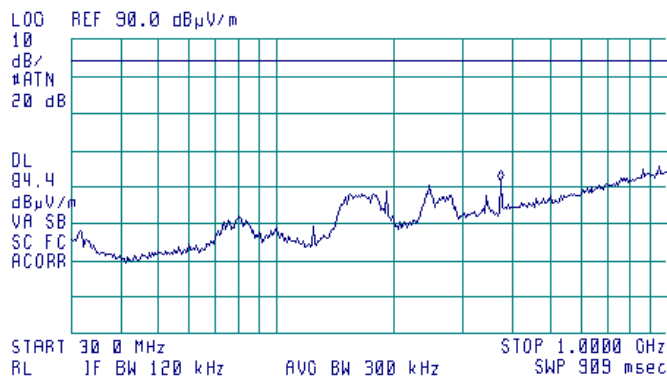


Plot 7.5.4 Radiated emission measurements in 30 - 1000 MHz range

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



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 374.2 MHz
51.73 dBµV/m



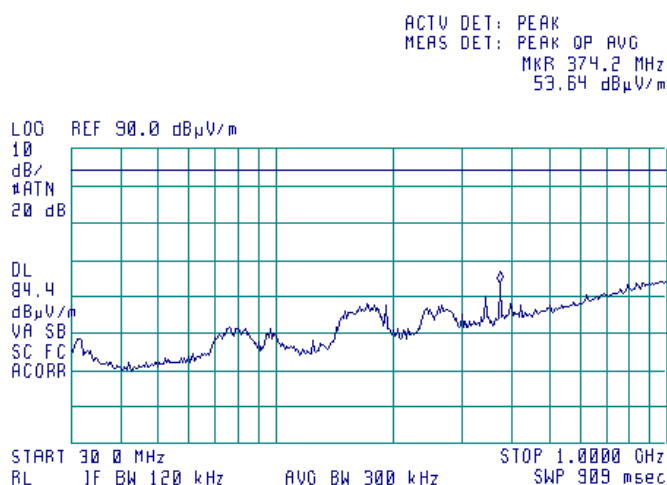


HERMON LABORATORIES

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:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

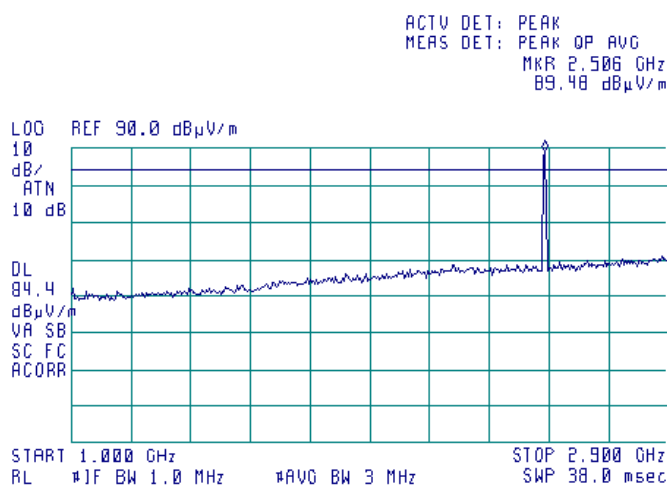
Plot 7.5.5 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.5.6 Radiated emission measurements in 1000 – 2900 MHz range

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

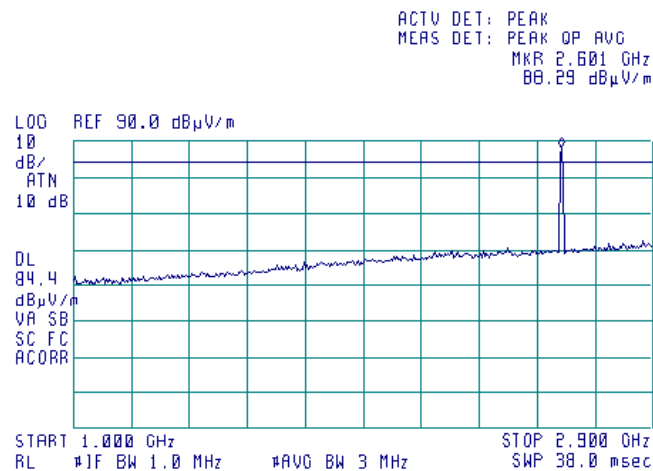


NOTE: 2498.5 MHz - carrier frequency

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:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.7 Radiated emission measurements in 1000 – 2900 MHz range

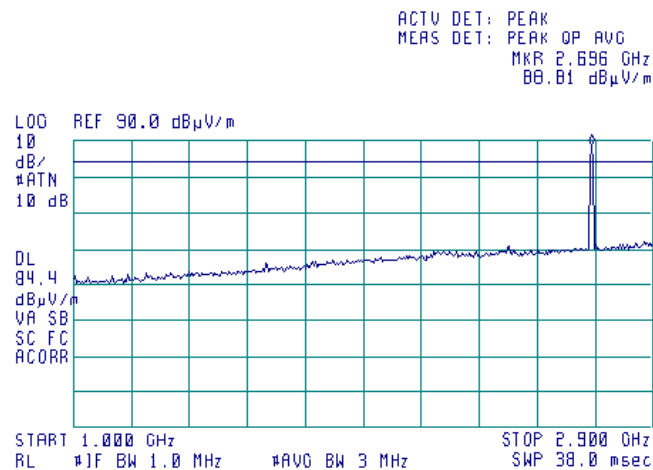
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



NOTE: 2593 MHz - carrier frequency

Plot 7.5.8 Radiated emission measurements in 1000 –2900 MHz range

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



NOTE: 2687.5 MHz - carrier frequency

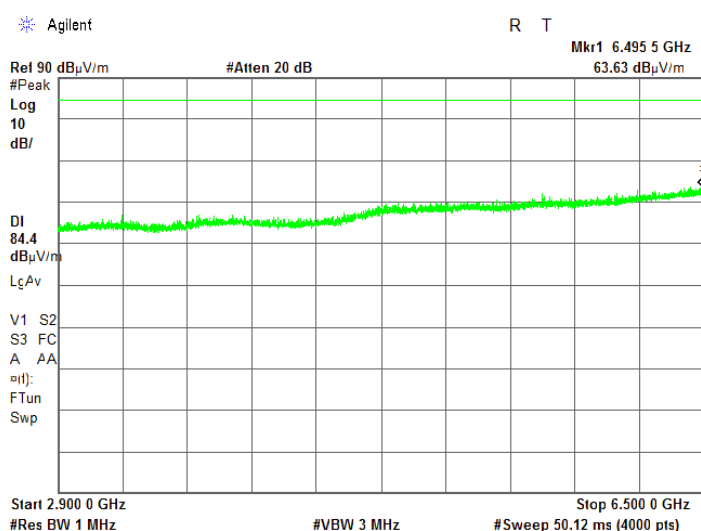


HERMON LABORATORIES

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):			
29-Nov-15 - 30-Nov-15			
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

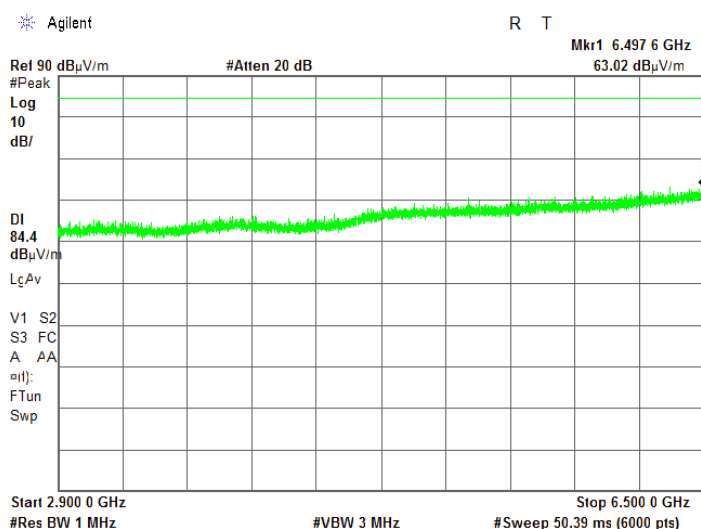
Plot 7.5.9 Radiated emission measurements in 2900 - 6500 MHz range

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



Plot 7.5.10 Radiated emission measurements in 2900 - 6500 MHz range

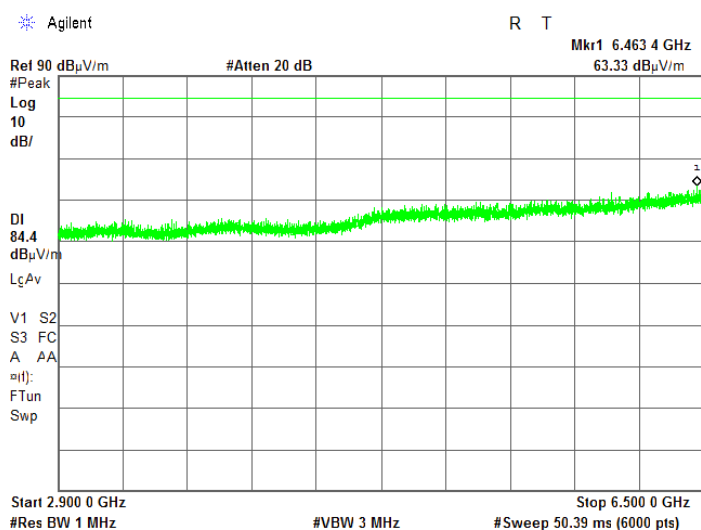
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



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:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

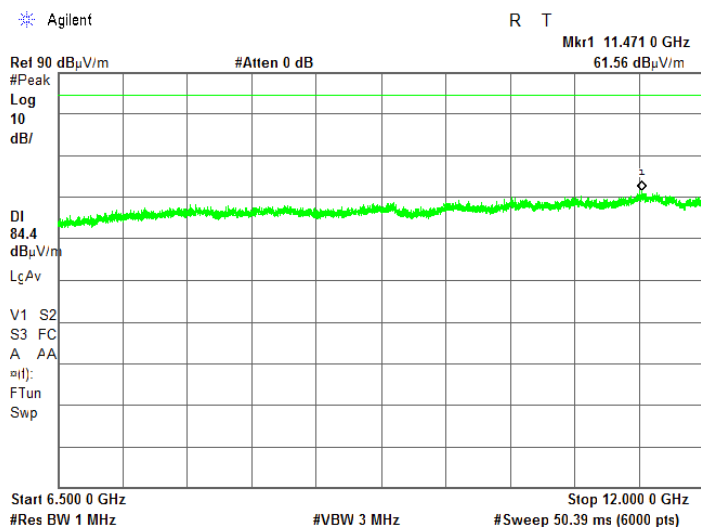
Plot 7.5.11 Radiated emission measurements in 2900 - 6500 MHz range

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



Plot 7.5.12 Radiated emission measurements in 6500 – 12000 MHz range

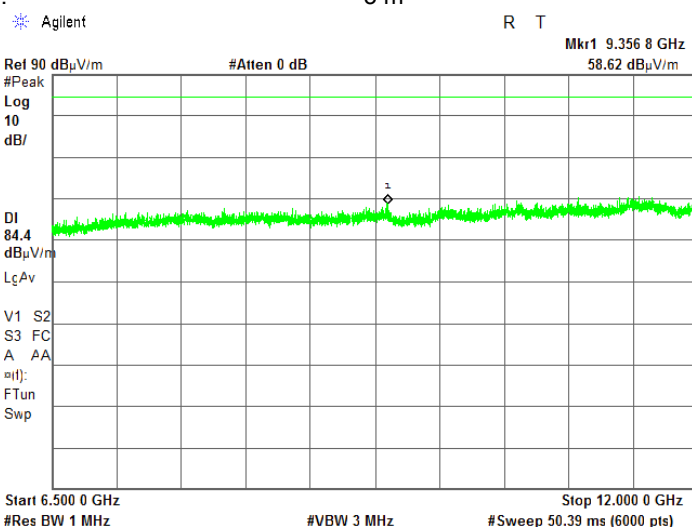
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



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:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

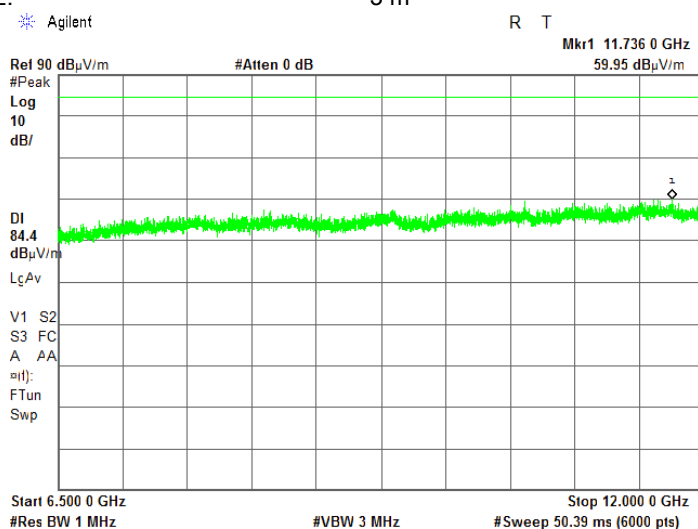
Plot 7.5.13 Radiated emission measurements in 6500 – 12000 MHz range

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



Plot 7.5.14 Radiated emission measurements in 6500 – 12000 MHz range

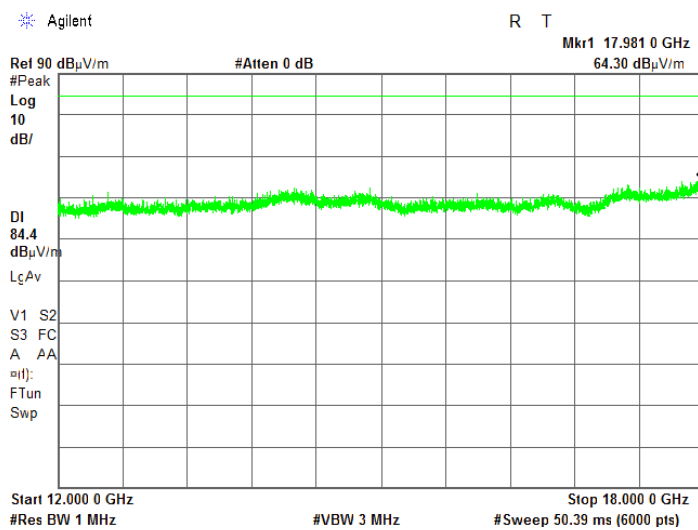
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



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:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

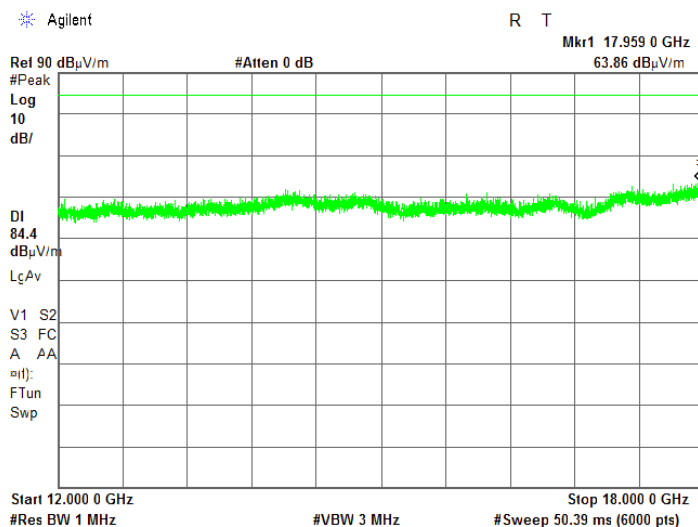
Plot 7.5.15 Radiated emission measurements in 12000 – 18000 MHz range

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



Plot 7.5.16 Radiated emission measurements in 12000 – 18000 MHz range

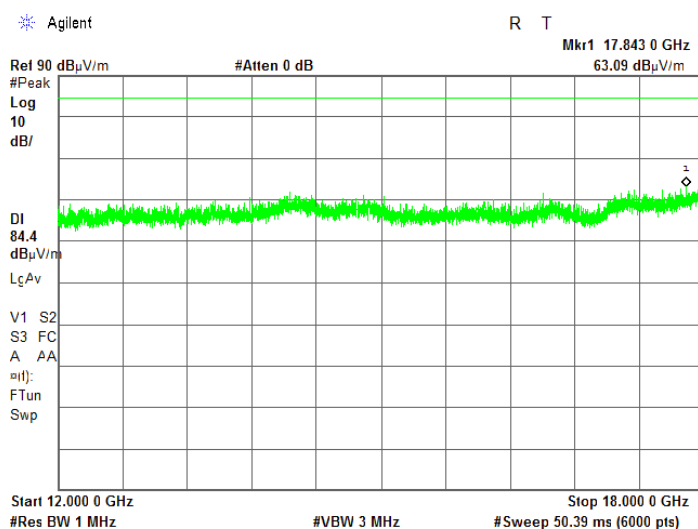
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:		Section 27.53, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

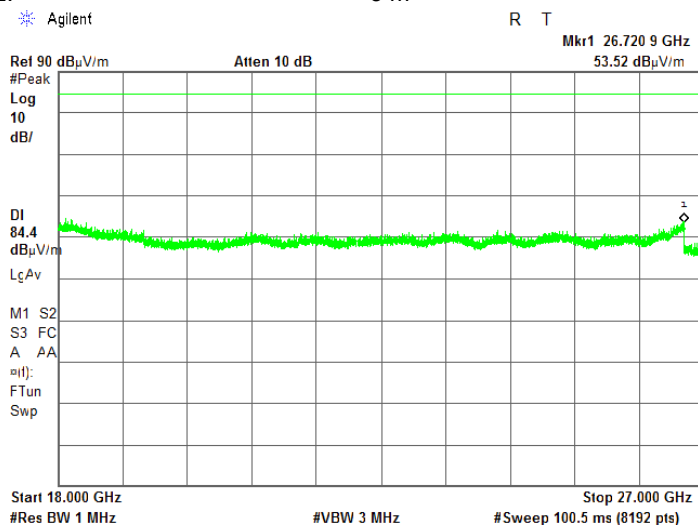
Plot 7.5.17 Radiated emission measurements in 12000 – 18000 MHz range

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



Plot 7.5.18 Radiated emission measurements in 18000 – 27000 MHz range

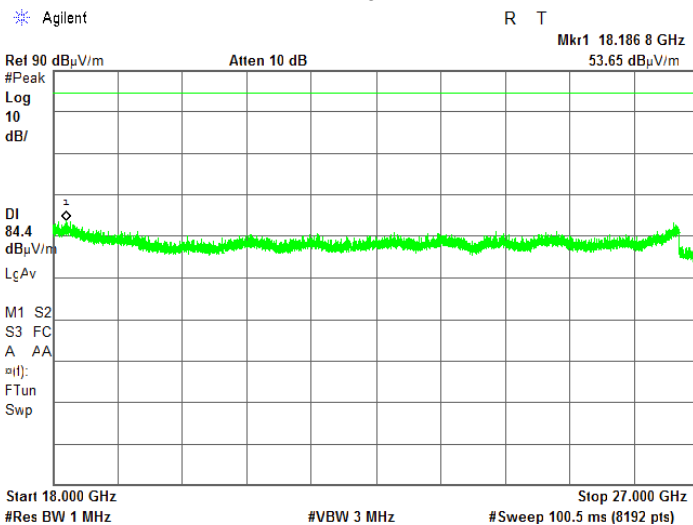
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



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:		Compliance	Verdict: PASS
Date(s):		29-Nov-15 - 30-Nov-15	
Temperature: 24 °C	Air Pressure: 1013 hPa	Relative Humidity: 54 %	Power Supply: 120 VAC
Remarks:			

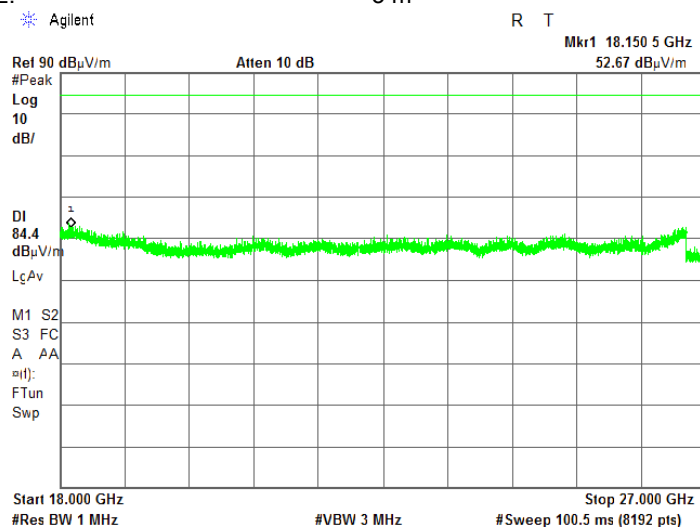
Plot 7.5.19 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.5.20 Radiated emission measurements in 18000 – 27000 MHz range

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



Test specification:		Section 27.54, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-D, Section 2.2.2	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 18-Nov-15	
Temperature: 23 °C	Air Pressure: hPa	Relative Humidity: 50 %	Power Supply: 120 VAC
Remarks:			

7.6 Frequency stability test

7.6.1 General

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

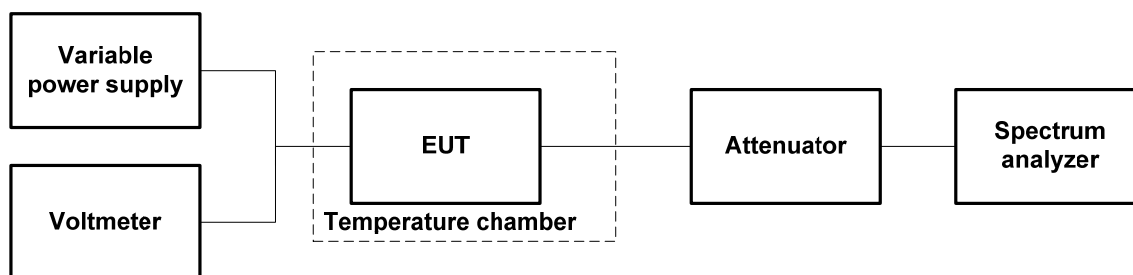
Table 7.6.1 Frequency stability limits

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

7.6.2 Test procedure

- 7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.
- 7.6.2.2 The EUT power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.6.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.6.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.6.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.
- 7.6.2.6 Frequency displacement was calculated and provided in Table 7.6.2.
- 7.6.2.7 The test results provided in Table 7.6.3, Table 7.6.4 and the associated plots.

Figure 7.6.1 Frequency stability test setup



Test specification:		Section 27.54, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-D, Section 2.2.2	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 18-Nov-15	
Temperature: 23 °C	Air Pressure: hPa	Relative Humidity: 50 %	Power Supply: 120 VAC
Remarks:			

Table 7.6.2 Frequency stability test results

OPERATING FREQUENCY: 2496.0 – 2690.0 MHz
 NOMINAL POWER VOLTAGE: 120VAC
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Max Hold
 RESOLUTION BANDWIDTH: 1 kHz
 VIDEO BANDWIDTH: 3 kHz
 MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz	
		Start up	1 st min	2 nd min	3 rd min	4 th min	5 th min	10 th min	Positive	Negative
Low carrier frequency 2498.5 MHz										
-30	120	2498.501130	2498.501120	2498.501170	2498.501230	2498.501130	2498.501130	2498.501170	50	50
-20	120	2498.501230	NA	NA	NA	NA	NA	2498.501200	50	0
-10	120	2498.501170	NA	NA	NA	NA	NA	2498.501200	20	10
0	120	2498.501130	2498.501230	2498.501200	2498.501170	2498.501200	2498.501230	2498.501130	50	50
10	120	2498.501200	NA	NA	NA	NA	NA	2498.501170	20	10
20	138	2498.501170	NA	NA	NA	NA	NA	2498.501230	50	10
20	120	2498.501200	NA	NA	NA	NA	NA	2498.501270*	20	0
20	102	2498.501200	NA	NA	NA	NA	NA	2498.501230	50	0
30	120	2498.501130	2498.501200	2498.501170	2498.501170	2498.501200	2498.501123	2498.501270	50	50
40	120	2498.501270	NA	NA	NA	NA	NA	2498.501170	90	10
50	120	2498.501400	NA	NA	NA	NA	NA	2498.501320	150	0
Mid carrier frequency 2593.0 MHz										
-30	120	2593.001180	2593.001180	2593.001200	2593.001180	2593.001150	2593.001180	2593.001180	0	150
-20	120	2593.001230	NA	NA	NA	NA	NA	2593.001230	0	50
-10	120	2593.001230	NA	NA	NA	NA	NA	2593.001270	0	0
0	120	2593.001270	2593.001270	2593.001170	2593.001230	2593.001200	2593.001230	2593.001270	0	10
10	120	2593.001330	NA	NA	NA	NA	NA	2593.001300	50	0
20	138	2593.001230	NA	NA	NA	NA	NA	2593.001200	0	80
20	120	2593.001230	NA	NA	NA	NA	NA	2593.001270*	0	50
20	102	2593.001230	NA	NA	NA	NA	NA	2593.001300	20	50
30	120	2593.001230	2593.001300	2593.001370	2593.001230	2593.001270	2593.001230	2593.001300	90	50
40	120	2593.001330	NA	NA	NA	NA	NA	2593.001200	50	80
50	120	2593.001500	NA	NA	NA	NA	NA	2593.001420	120	0
High carrier frequency 2687.5 MHz										
-30	120	2687.501330	2687.501330	2687.501230	2687.501330	2687.501370	2687.501300	2687.501270	20	120
-20	120	2687.501300	NA	NA	NA	NA	NA	2687.501300	0	50
-10	120	2687.501270	NA	NA	NA	NA	NA	2687.501300	0	80
0	120	2687.501270	2687.501300	2687.501270	2687.501330	2687.501270	2687.501300	2687.501400	0	80
10	120	2687.501230	NA	NA	NA	NA	NA	2687.501270	0	150
20	138	2687.501230	NA	NA	NA	NA	NA	2687.501330	0	120
20	120	2687.501200	NA	NA	NA	NA	NA	2687.501270*	0	70
20	102	2687.501370	NA	NA	NA	NA	NA	2687.501330	20	20
30	120	2687.501300	2687.501270	2687.501370	2687.501400	2687.501300	2687.501270	2687.501400	20	80
40	120	2687.501420	NA	NA	NA	NA	NA	2687.501300	20	50
50	120	2687.501500	NA	NA	NA	NA	NA	2687.501420	40	0

* - Reference frequency



HERMON LABORATORIES

Test specification:		Section 27.54, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-D, Section 2.2.2	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 18-Nov-15	
Temperature: 23 °C	Air Pressure: hPa	Relative Humidity: 50 %	Power Supply: 120 VAC
Remarks:			

Table 7.6.3 Maximum frequency displacement

Channel	Maximum frequency displacement			
	ppm		Hz	
	Negative	Positive	Negative	Positive
Low (2498.5 MHz)	0.12	0.37	50.00	150.00
Mid (2593.0 MHz)	0.39	0.31	150.00	120.00
High (2687.5 MHz)	0.40	0.11	150.00	40.00

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
5 MHz BW								
2496.139	2500.861	2496.14	2500.86	2496.00	2506.00	-0.14	-5.14	Pass
2590.633	2595.361	2590.63	2595.36	2590.00	2596.00	-0.63	-0.64	Pass
2685.133	2689.855	2685.13	2689.86	2680.00	2690.00	-5.13	-0.14	Pass
10 MHz BW								
2496.228	2505.784	2496.23	2505.78	2496.00	2506.00	-0.23	-0.22	Pass
2590.228	2599.772	2590.23	2599.77	2590.00	2602.00	-0.23	-2.23	Pass
2680.228	2689.759	2680.23	2689.76	2680.00	2690.00	-0.23	-0.24	Pass
20 MHz BW								
2496.657	2515.343	2496.66	2515.34	2496.00	2518.00	-0.66	-2.66	Pass
2585.657	2604.318	2585.66	2604.32	2584.00	2608.00	-1.66	-3.68	Pass
2670.632	2689.293	2670.63	2689.29	2668.00	2690.00	-2.63	-0.71	Pass

* - Measured under normal test conditions

** - Measured band edge with proper drift addition

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

Reference numbers of test equipment used

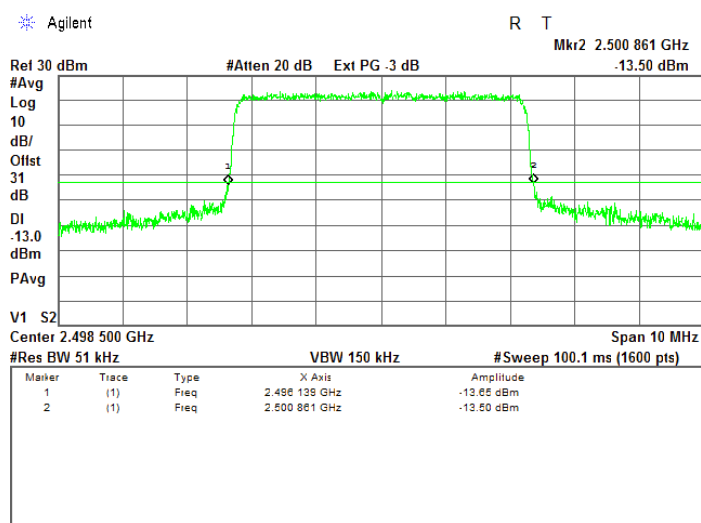
HL 3818	HL 3903						
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Full description is given in Appendix A.

Test specification:		Section 27.54, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-D, Section 2.2.2	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 18-Nov-15	
Temperature: 23 °C	Air Pressure: hPa	Relative Humidity: 50 %	Power Supply: 120 VAC
Remarks:			

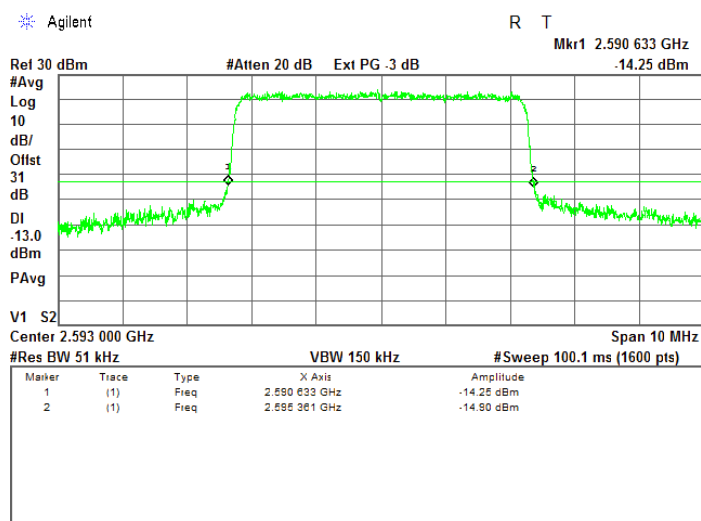
Plot 7.6.1 Emission mask test results at low carrier frequency, 5 MHz EBW

ASSIGNMENT FREQUENCY BANDS: 2496.0 – 2506.0 MHz
DETECTOR USED: Average
MODULATION: 64 QAM



Plot 7.6.2 Emission mask test results at mid carrier frequency, 5 MHz EBW

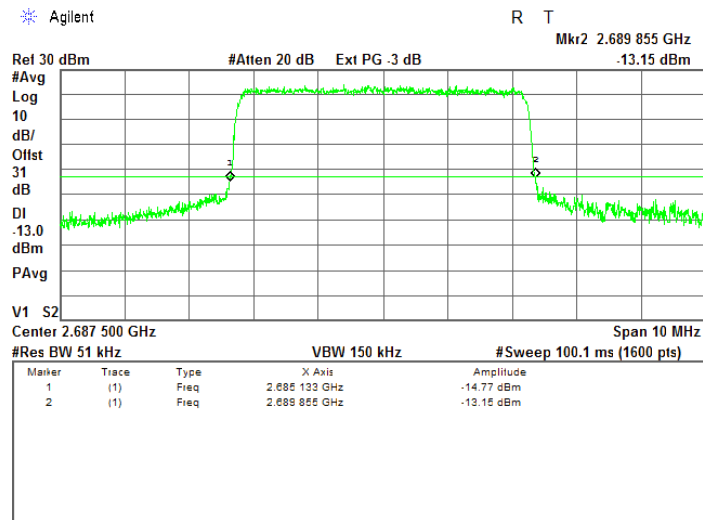
ASSIGNMENT FREQUENCY BANDS: 2590.0 – 2696.0 MHz
DETECTOR USED: Average
MODULATION: 64 QAM



Test specification:		Section 27.54, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-D, Section 2.2.2	
Test mode:	Compliance	Verdict: PASS	
Date(s):	17-Nov-15 - 18-Nov-15		
Temperature: 23 °C	Air Pressure: hPa	Relative Humidity: 50 %	Power Supply: 120 VAC
Remarks:			

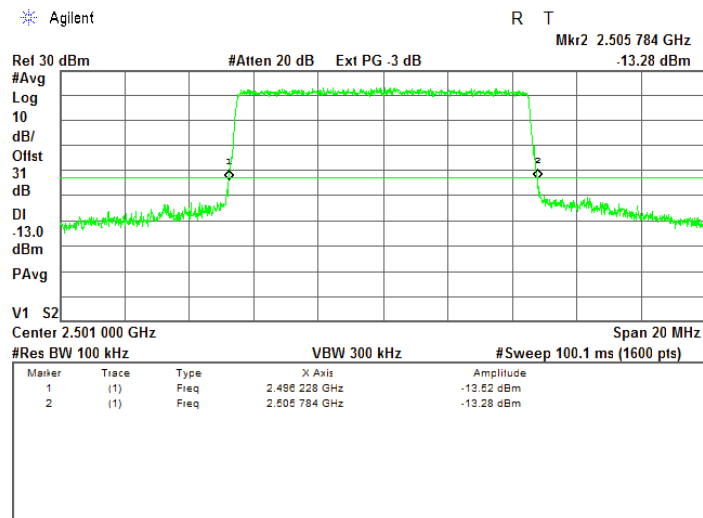
Plot 7.6.3 Emission mask test results at high carrier frequency, 5 MHz EBW

ASSIGNMENT FREQUENCY BANDS: 2680.0 – 2690.0 MHz
DETECTOR USED: Average
MODULATION: 64 QAM



Plot 7.6.4 Emission mask test results at low carrier frequency, 10 MHz EBW

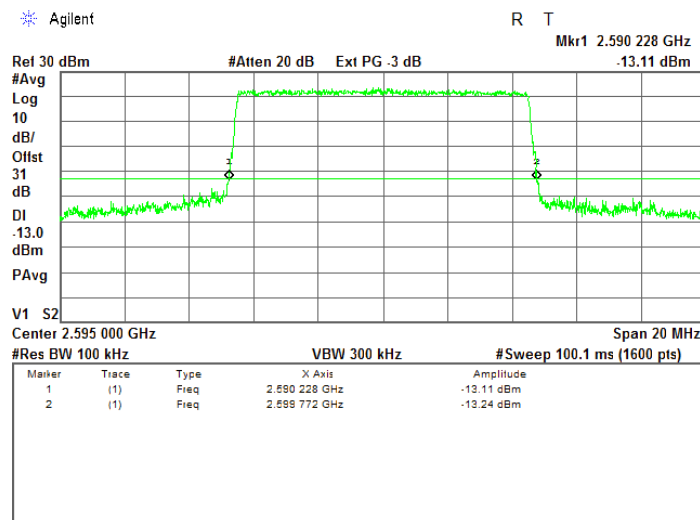
ASSIGNMENT FREQUENCY BANDS: 2496.0 – 2506.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM



Test specification:		Section 27.54, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-D, Section 2.2.2	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 18-Nov-15	
Temperature: 23 °C	Air Pressure: hPa	Relative Humidity: 50 %	Power Supply: 120 VAC
Remarks:			

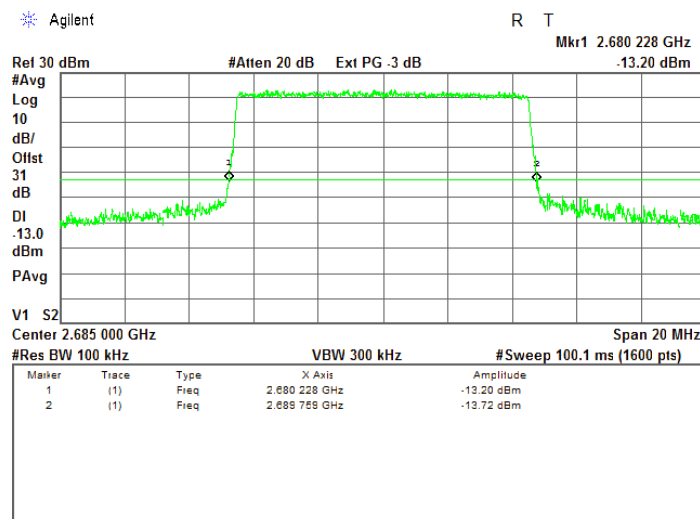
Plot 7.6.5 Emission mask test results at mid carrier frequency, 10 MHz EBW

ASSIGNMENT FREQUENCY BANDS: 2590 – 2602 MHz
DETECTOR USED: Average
MODULATION: 64QAM



Plot 7.6.6 Emission mask test results at high carrier frequency, 10 MHz EBW

ASSIGNMENT FREQUENCY BANDS: 2680.0 – 2690.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM





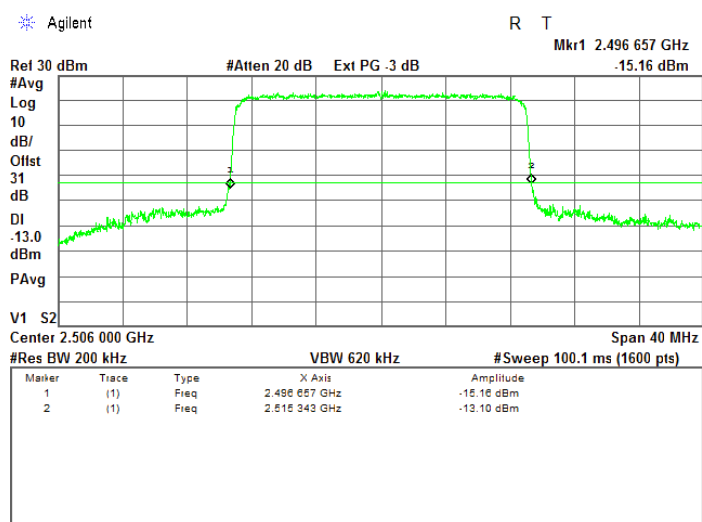
HERMON LABORATORIES

Test specification: Section 27.54, Frequency stability			
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-D, Section 2.2.2			
Test mode: Compliance			Verdict: PASS
Date(s): 17-Nov-15 - 18-Nov-15			
Temperature: 23 °C	Air Pressure: hPa	Relative Humidity: 50 %	Power Supply: 120 VAC
Remarks:			

Plot 7.6.7 Emission mask test results at low carrier frequency, 20 MHz EBW

ASSIGNMENT FREQUENCY BANDS:
DETECTOR USED:
MODULATION:

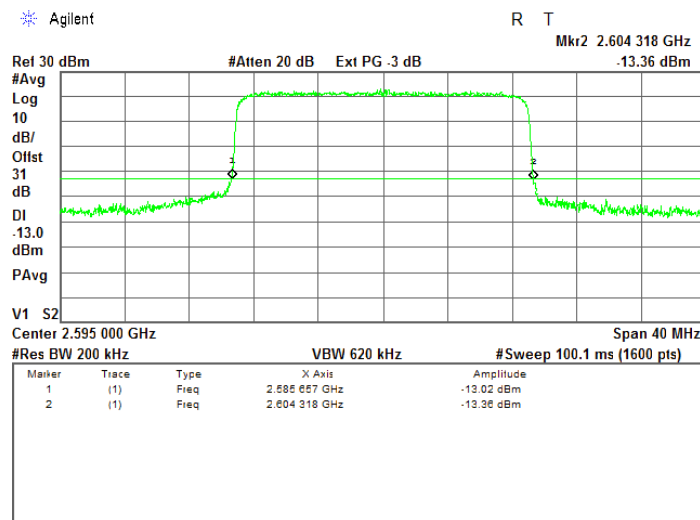
2496 – 2518 MHz
Average
64QAM



Test specification:		Section 27.54, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-D, Section 2.2.2	
Test mode:		Compliance	Verdict: PASS
Date(s):		17-Nov-15 - 18-Nov-15	
Temperature: 23 °C	Air Pressure: hPa	Relative Humidity: 50 %	Power Supply: 120 VAC
Remarks:			

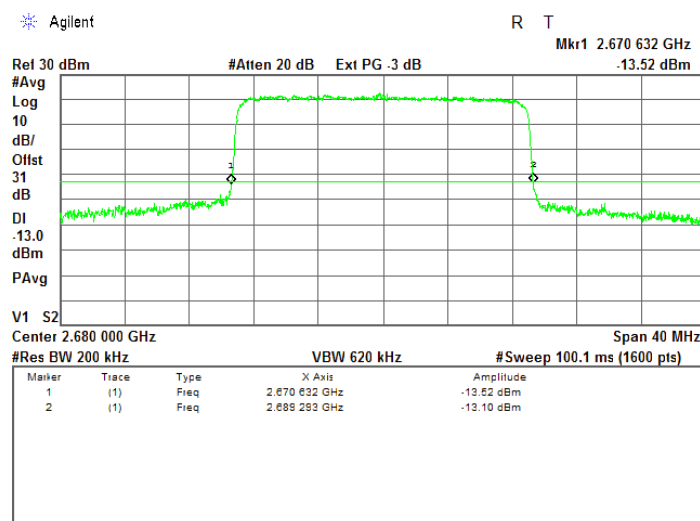
Plot 7.6.8 Emission mask test results at mid carrier frequency, 20 MHz EBW

ASSIGNMENT FREQUENCY BANDS: 2584.0 – 2608.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM



Plot 7.6.9 Emission mask test results at high carrier frequency, 20 MHz EBW

ASSIGNMENT FREQUENCY BANDS: 2668.0 – 2690.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM



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	13-Jan-15	13-Jan-16
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Oct-15	27-Oct-16
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	15-May-15	15-May-16
2214	Directional Coupler 1.7-26.5 GHz	Krytar	2616	31354	16-Sep-15	16-Sep-17
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	30-Jan-15	30-Jan-16
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	30-Jan-15	30-Jan-16
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	29-Apr-15	29-Apr-16
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1225/2A	10-Feb-15	10-Feb-16
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1226/2A	10-Feb-15	10-Feb-16
4229	Precision Fixed Attenuator, 50 Ohm, 5W, 10dB, DC to 18000 MHz	Mini-Circuits	BW- N10W5+	NA	09-Mar-15	09-Mar-16
4234	Precision Fixed Attenuator, 50 Ohm, 5W, 20dB, DC to 18000 MHz	Mini-Circuits	BW- N20W5+	NA	10-Mar-15	10-Mar-16
4278	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC- 15FT- NMNM+	0755A	22-Nov-15	22-Nov-16
4293	Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA	Huber-Suhner	Sucoflex P103	NA	02-Dec-15	02-Dec-16
4338	Reject Band Filter, 50 Ohm, 0 to 2170 and 3000 to 18000 MHz, SMA-FM / SMA-M	Micro-Tronics	BRM 50702-02	023	05-May-15	05-May-16
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-15	15-Mar-16
4366	Directional coupler, 1 GHz to 18 GHz, 10 dB, SMA Female	Tiger Micro-Electronics Institute	TGD- A1101-10	01e- JSDE805- 007	18-May-14	18-May-16
4916	High Pass Filter, 50 Ohm, 3150 to 6500 MHz, SMA-FM / SMA-M	Mini-Circuits	VHF- 2700+	NA	01-Oct-15	01-Oct-17
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	04-Sep-15	04-Sep-16
4956	Active horn antenna, 18 to 40 GHz	Com-Power Corporation	AHA-840	105004	09-Nov-15	09-Nov-16

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	$\pm 8\%$
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency error	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)
Transient frequency behaviour	187 Hz $\pm 13.9\%$
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

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

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

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website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

47CFR part 27: 2014	Private land mobile radio services
47CFR part 1: 2014	Practice and procedure
47CFR part 2: 2014	Frequency allocations and radio treaty matters; general rules and regulations
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI/TIA/EIA-603-D:2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

12 APPENDIX E Test equipment correction factors

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

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

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

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

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

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



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Antenna factor, HL 4933

**Active Horn Antenna Factor Calibration**

1 GHz to 18 GHz

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



HERMON LABORATORIES

Antenna factor, HL 4956

**Active Horn Antenna Factor Calibration**

18 GHz to 40 GHz

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

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

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

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

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

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

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

Cable loss
Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA, Huber-Suhner,
Sucoflex P103, HL 4293

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.20	4900	2.01	9800	2.94	14700	3.85
100	0.28	5000	2.03	9900	2.95	14800	3.87
200	0.39	5100	2.06	10000	2.98	14900	3.89
300	0.48	5200	2.08	10100	3.01	15000	3.94
400	0.55	5300	2.07	10200	3.04	15100	3.94
500	0.61	5400	2.12	10300	3.04	15200	3.91
600	0.68	5500	2.12	10400	3.04	15300	3.93
700	0.73	5600	2.16	10500	3.07	15400	3.94
800	0.78	5700	2.16	10600	3.10	15500	3.96
900	0.83	5800	2.22	10700	3.11	15600	3.96
1000	0.88	5900	2.24	10800	3.12	15700	3.97
1100	0.92	6000	2.28	10900	3.15	15800	4.00
1200	0.96	6100	2.31	11000	3.22	15900	4.01
1300	1.00	6200	2.32	11100	3.20	16000	4.03
1400	1.04	6300	2.34	11200	3.19	16100	4.02
1500	1.07	6400	2.37	11300	3.21	16200	4.05
1600	1.11	6500	2.38	11400	3.26	16300	4.06
1700	1.15	6600	2.38	11500	3.27	16400	4.08
1800	1.19	6700	2.40	11600	3.27	16500	4.07
1900	1.22	6800	2.42	11700	3.28	16600	4.10
2000	1.25	6900	2.43	11800	3.32	16700	4.14
2100	1.28	7000	2.44	11900	3.34	16800	4.12
2200	1.34	7100	2.48	12000	3.34	16900	4.13
2300	1.35	7200	2.46	12100	3.35	17000	4.13
2400	1.39	7300	2.51	12200	3.39	17100	4.19
2500	1.40	7400	2.53	12300	3.44	17200	4.22
2600	1.44	7500	2.50	12400	3.44	17300	4.20
2700	1.47	7600	2.53	12500	3.43	17400	4.21
2800	1.50	7700	2.63	12600	3.45	17500	4.19
2900	1.54	7800	2.62	12700	3.47	17600	4.22
3000	1.56	7900	2.58	12800	3.51	17700	4.24
3100	1.59	8000	2.64	12900	3.51	17800	4.23
3200	1.62	8100	2.66	13000	3.52	17900	4.26
3300	1.64	8200	2.67	13100	3.56	18000	4.27
3400	1.67	8300	2.63	13200	3.57		
3500	1.69	8400	2.64	13300	3.58		
3600	1.72	8500	2.65	13400	3.60		
3700	1.74	8600	2.68	13500	3.61		
3800	1.78	8700	2.72	13600	3.66		
3900	1.80	8800	2.73	13700	3.68		
4000	1.83	8900	2.74	13800	3.67		
4100	1.84	9000	2.77	13900	3.68		
4200	1.86	9100	2.79	14000	3.73		
4300	1.89	9200	2.82	14100	3.74		
4400	1.92	9300	2.81	14200	3.74		
4500	1.94	9400	2.85	14300	3.76		
4600	1.97	9500	2.89	14400	3.78		
4700	1.97	9600	2.90	14500	3.81		
4800	2.01	9700	2.92	14600	3.83		

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

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

13 APPENDIX F Abbreviations and acronyms

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

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