

TEST REPORT

ACCORDING TO: FCC 47CFR part 27

FOR:

Airspan Networks Inc.

LTE Base Station

Model: AirHarmony 4000 DC 700 MHz (B12/B17)

FCC ID:PIDH4K700

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested.
This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.

Table of contents

1	Applicant information	3
2	Equipment under test attributes	3
3	Manufacturer information	3
4	Test details	3
5	Tests summary	4
6	EUT description	5
6.1	General information	5
6.2	Ports and lines	5
6.3	Support and test equipment	5
6.4	Changes made in the EUT	5
6.5	Test configuration	6
6.6	Transmitter characteristics	7
7	Transmitter tests according to 47CFR part 27	8
7.1	Occupied bandwidth test	8
7.2	Output power test	13
7.3	Band edge emission (emission mask) test	30
7.4	Spurious emissions at RF antenna connector test	44
7.5	Radiated spurious emission measurements	58
7.6	Frequency stability test	67
8	APPENDIX A Test equipment and ancillaries used for tests	70
9	APPENDIX B Measurement uncertainties	72
10	APPENDIX C Test facility description	73
11	APPENDIX D Specification references	73
12	APPENDIX E Test equipment correction factors	74
13	APPENDIX F Abbreviations and acronyms	82

1 Applicant information

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

2 Equipment under test attributes

Product name: LTE Base Station
Product type: Transceiver
Model(s): AirHarmony 4000 DC 700 GHz (B12/B17)
Serial number: A99853126NPI
Hardware version: A1
Software release: 14.15.00.095
Receipt date: 07-Aug-16

3 Manufacturer information

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

4 Test details

Project ID: 28708
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 07-Aug-16
Test completed: 16-Aug-16
Test specification(s): FCC 47CFR part 27

5 Tests summary

Test	Status
Transmitter characteristics	
Section 27.50(c)(3), Peak output power at RF antenna connector	Pass
Section 27.50(c), Spectral power density	Pass
Section 2.1091, 27.52, RF safety	Pass, exhibit provided in Application for certification
Section 27.53(g), Band edge emissions	Pass
Section 27.53(g), Spurious emissions at RF antenna connector	Pass
Section 27.53(g), 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:	Mr. K. Zushchuk, test engineer	August 16, 2016	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	August 28, 2016	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	September 8, 2016	

6 EUT description

6.1 General information

The EUT, Base station radio, AirHarmony 4000 DC 700 MHz (B12/B17), 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 75 Mbps) uses OFDM and operating in FDD mode, equipped with a 12.5 dBi and 13.5 dBi external antenna. Advanced Antenna Techniques 2x2 MIMO are supported (the detailed description provided in the Operational description exhibit in Application for certification). The maximum total RF output power (not including antenna gain) is 46.06 dBm for 12.5 dBi and 13.5 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.

The EUT comes in range of frequency band variant that can be installed with different external Cavity filters. Frequency bands are 728 – 746 MHz. The external Cavity filters are designed specifically for AirHarmony 4000 deployments. The installation and replacement of the external filters can be performed by licensed installer only according installation procedure.

6.2 Ports and lines

Port Type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	AC power	EUT	AC mains	1	Unshielded	3
Signal	GPS	EUT	GPS external antenna	1	Coax	3
Signal	Eth. POE	EUT	Laptop	1	FTP	3
Signal	Eth. POE	EUT	Open circuit	1	FTP	3
Signal	Eth.	EUT	Open circuit	2	FTP	3
RF	RF Link (Tx/Rx)	EUT	Antenna (via filter)	2	Coax	0.5
Signal*	Serial*	Not connected	Not connected	1	NA	NA

*for maintenance only

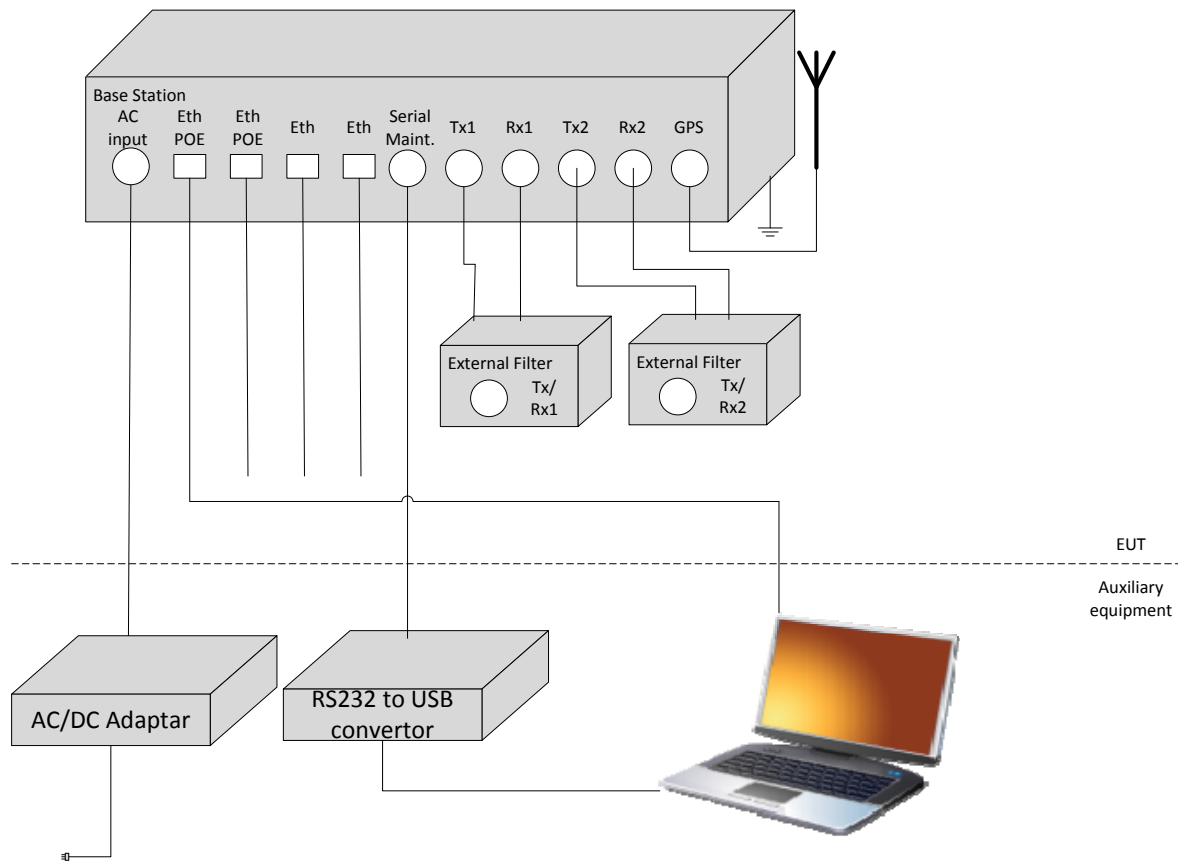
6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
DC power supply	Mean Well	PSP-600-48	RB29063683
GPS antenna	Tallysman Wireless	32-3030-0	20110606
Laptop	DELL	E7440	R41000418
4 Port USB to RS-232 hub	ATEN INTERNATIONAL	UC2324	Z3E2216AB0098

6.4 Changes made in the EUT

No changes were implemented in the EUT during testing.

6.5 Test configuration



6.6 Transmitter characteristics

Type of equipment					
☒	Stand-alone (Equipment with or without its own control provisions)				
☐	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
☐	Plug-in card (Equipment intended for a variety of host systems)				
Intended use		Condition of use			
☒	fixed	Always at a distance more than 2 m from all people			
☐	mobile	Always at a distance more than 20 cm from all people			
☐	portable	May operate at a distance closer than 20 cm to human body			
Assigned frequency range		728.0 – 746.0 MHz			
Operating frequency (full bands)		730.5 – 743.5 MHz for 5 MHz OBW 733.0 – 741.0 MHz for 10 MHz OBW			
RF channel spacing		5 MHz; 10 MHz			
Maximum rated output power		At transmitter 50 Ω RF output connector (aggregate power of both RF chains)		46.06 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	46.00 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.	AW3052	13.5 dBi		
External	ALPHA Wireless Ltd.	AW3054	12.5 dBi		
Transmitter aggregate data rate/s, MBps					
Transmitter 26dBc power bandwidth		Type of modulation			
		QPSK	16QAM	64QAM	
		5 MHz	7 Mbps	15 Mbps	37 Mbps
		10 MHz	15.5 Mbps	30.5 Mbps	75 Mbps
Type of multiplexing		FDD			
Modulating test signal (baseband)		PRBS			
Maximum transmitter duty cycle in normal use		100%			
Transmitter power source					
		Nominal rated voltage	Battery type		
	DC	Nominal rated voltage	48 VDC via adapter form mains		
☒	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): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
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
728-746	26	NA

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

7.1.2 Test procedure

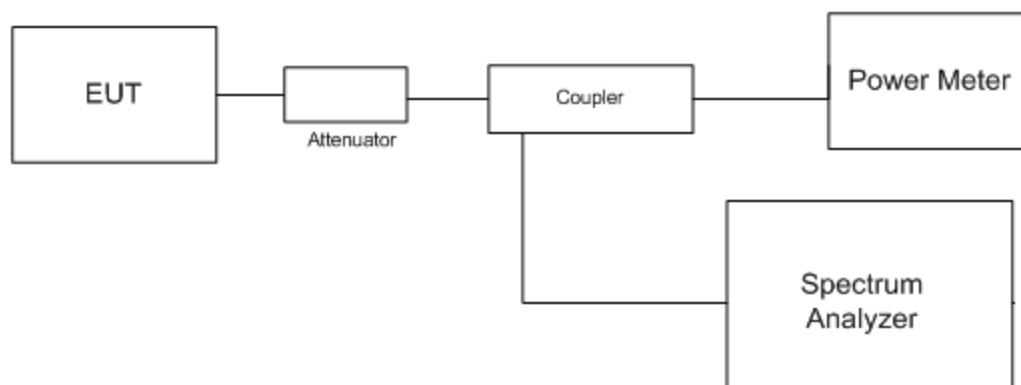
7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

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

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

7.1.2.4 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.1.2 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): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Table 7.1.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
 RESOLUTION BANDWIDTH: 100 kHz
 VIDEO BANDWIDTH: 300 kHz
 MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
 MODULATING SIGNAL: PRBS
 TESTED RF OUTPUT: 1
 OCCUPIED BANDWIDTH: 5 MHz

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
QPSK				
730.5	4725.00	NA	NA	Pass
737.0	4728.00	NA	NA	Pass
743.5	4730.00	NA	NA	Pass
64QAM				
730.5	4731.00	NA	NA	Pass
737.0	4727.00	NA	NA	Pass
743.5	4731.00	NA	NA	Pass

OCCUPIED BANDWIDTH: 10 MHz

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
QPSK				
733.0	9470.00	NA	NA	Pass
737.0	9468.00	NA	NA	Pass
741.0	9483.00	NA	NA	Pass
64QAM				
733.0	9476.00	NA	NA	Pass
738.0	9467.00	NA	NA	Pass
741.0	9464.00	NA	NA	Pass

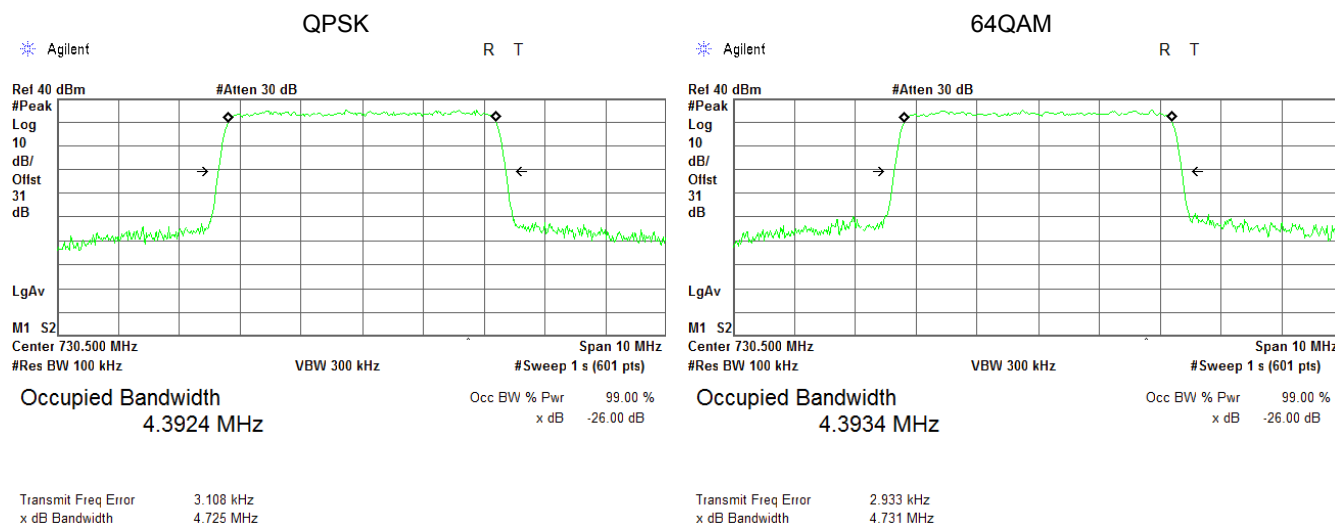
Reference numbers of test equipment used

HL 3818	HL 3903	HL 4756				
---------	---------	---------	--	--	--	--

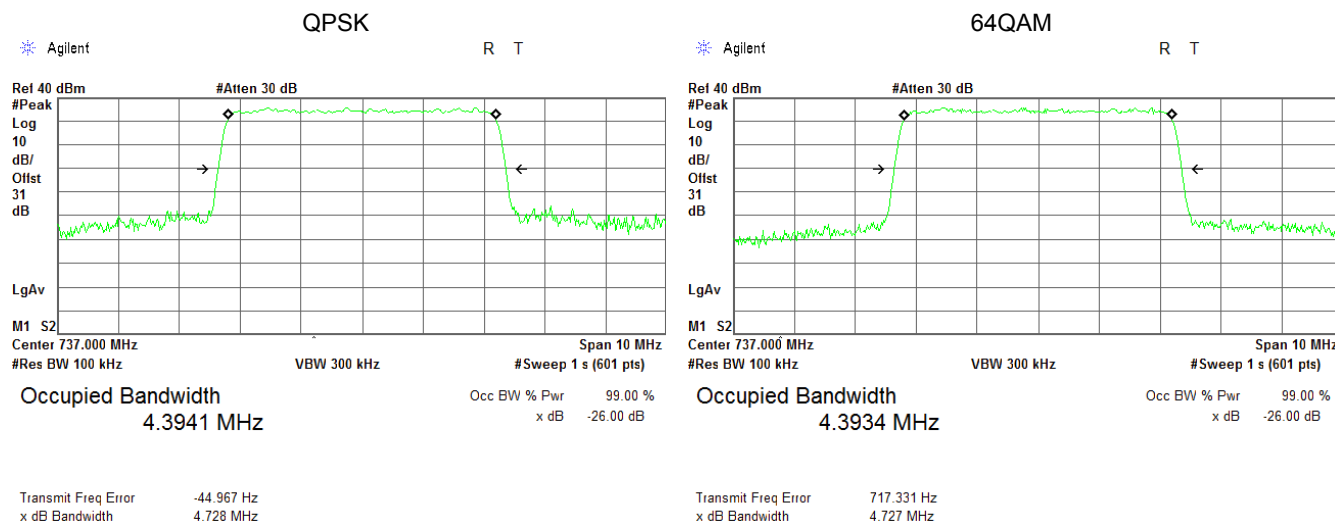
Full description is given in Appendix A.

Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.1 Occupied bandwidth test result at low frequency, RF# 1, 5 MHz EBW

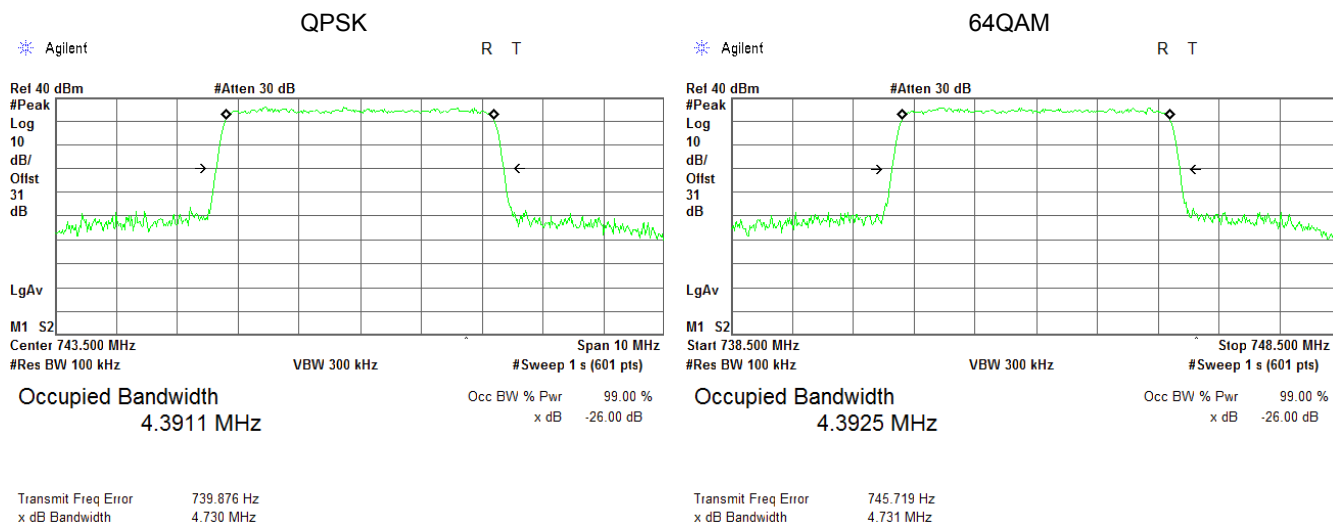


Plot 7.1.2 Occupied bandwidth test result at mid frequency, RF# 1, 5 MHz EBW

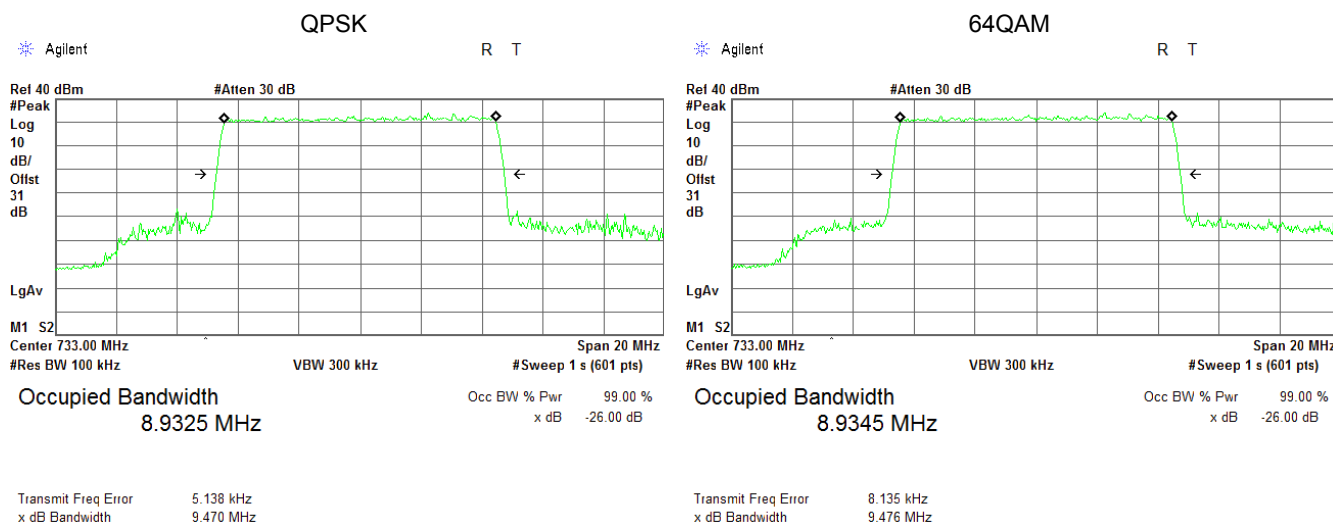


Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.3 Occupied bandwidth test result at high frequency, RF# 1, 5 MHz EBW

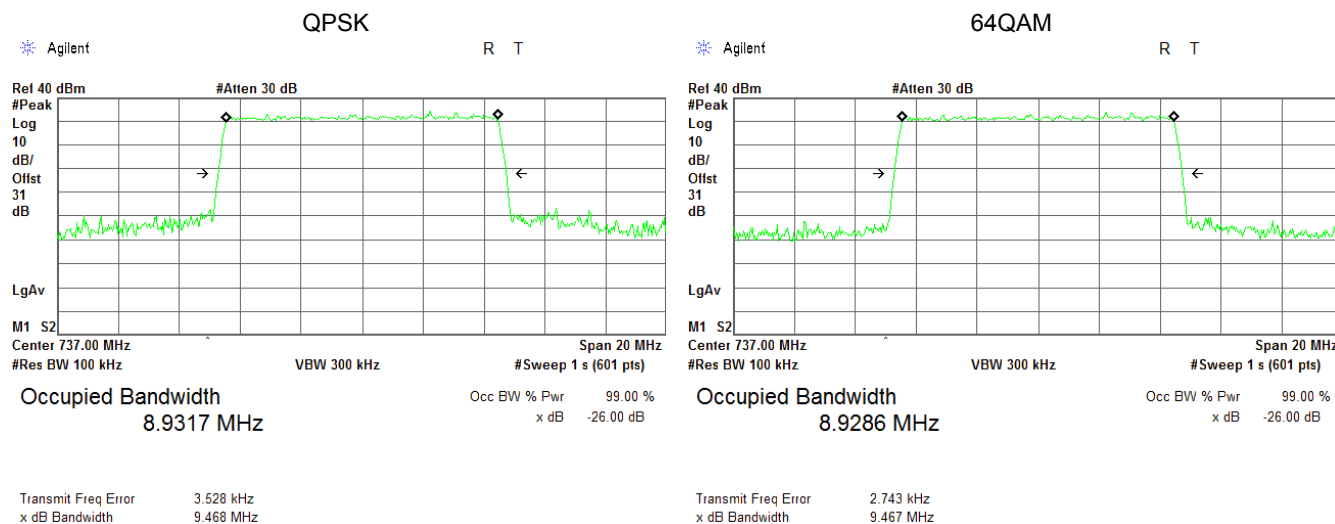


Plot 7.1.4 Occupied bandwidth test result at low frequency, RF# 1, 10 MHz EBW

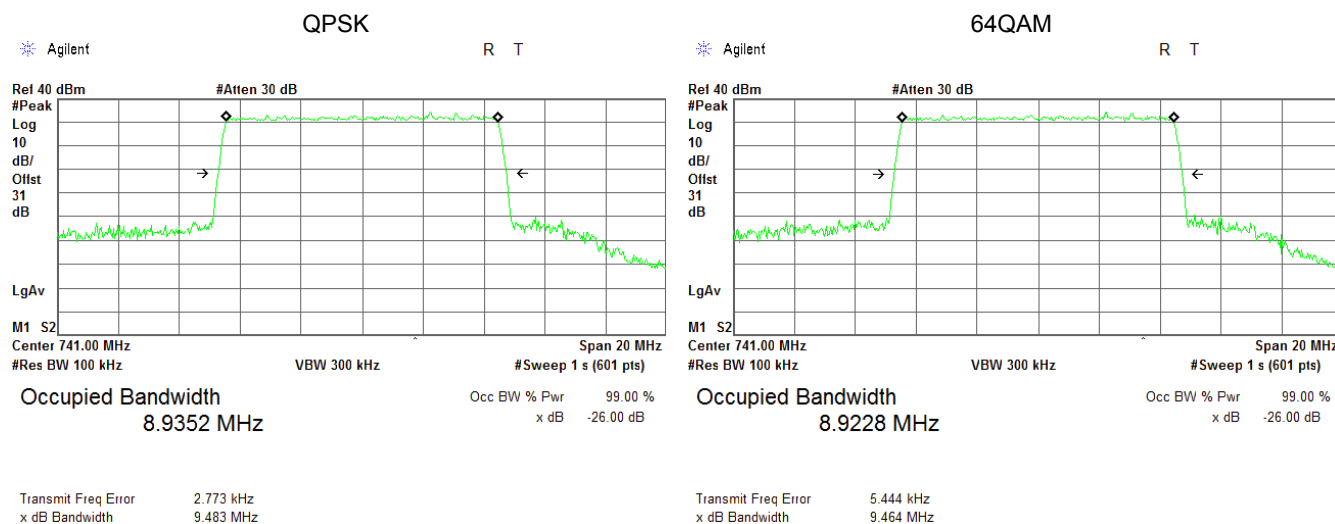


Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.5 Occupied bandwidth test result at mid frequency, RF# 1, 10 MHz EBW



Plot 7.1.6 Occupied bandwidth test result at high frequency, RF# 1, 10 MHz EBW



Test specification: Section 27.50(c)(3), Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

7.2 Output power test

7.2.1 General

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

Table 7.2.1 Maximum output power limits

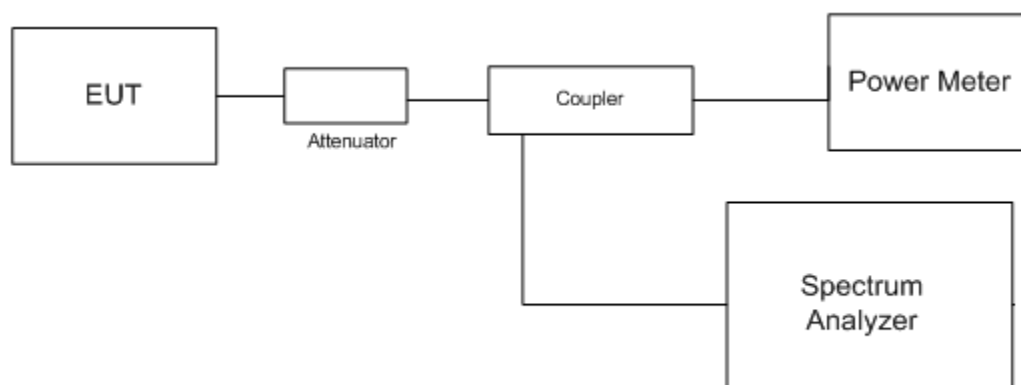
Transmitter type	Assigned frequency range, MHz	Maximum Output power, ERP	
		W	dBm
Fixed and base stations	728 – 746	1000/1 MHz	60.0/1 MHz

* The maximum output power limit shall be calculated by subtracting of antenna gain in dBd from maximum allowed ERP.

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 maximum output power was measured with power meter as provided in Table 7.2.2 to Table 7.2.5.
- 7.2.2.4 The resolution bandwidth of spectrum analyzer was set to 1 MHz and the average power was integrated over EBW as provided in Table 7.2.2 to Table 7.2.5 and the associated plots.
- 7.2.2.5 The test results are provided in the tables below and associated plots.

Figure 7.2.1 Maximum output power test setup





Test specification: Section 27.50(c)(3), Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
Test mode: Compliance	Verdict: PASS		
Date(s): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Table 7.2.2 Output power test results

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
 DETECTOR USED: Average
 RESOLUTION BANDWIDTH: 1000 kHz
 VIDEO BANDWIDTH: 3000 kHz
 MODULATING SIGNAL: PRBS
 MAXIMUM ANTENNA GAIN: 13.5 dBi (11.35 dBd)
 POWER SETTINGS: Maximum
 CHANNEL BANDWIDTH: 5 MHz

Carrier frequency, MHz	SA reading, dBm/MHz RF#1,	SA reading, dBm/MHz RF#2,	Total RF power**, dBm/MHz	Antenna gain, dBd	Total ERP*, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
QPSK 7.0 Mbps								
730.50	35.22	35.62	38.43	11.35	49.78	60.00	-10.22	Pass
737.00	35.44	36.08	38.78	11.35	50.13	60.00	-9.87	Pass
743.50	34.95	35.41	38.20	11.35	49.55	60.00	-10.45	Pass
64QAM 37.0 Mbps								
730.50	35.50	36.14	38.84	11.35	50.19	60.00	-9.81	Pass
737.00	35.22	35.69	38.47	11.35	49.82	60.00	-10.18	Pass
743.50	35.47	36.34	38.94	11.35	50.29	60.00	-9.71	Pass

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power**, dBm	Antenna gain, dBd	Total ERP*, dBm	Limit, dBm	Margin, dB	Verdict
QPSK 7.0 Mbps								
730.50	42.69	42.99	45.85	11.35	57.20	NA	NA	Pass
737.00	42.06	42.80	45.46	11.35	56.81	NA	NA	Pass
743.50	42.26	42.67	45.48	11.35	56.83	NA	NA	Pass
64QAM 37.0 Mbps								
730.50	42.69	43.00	45.86	11.35	57.21	NA	NA	Pass
737.00	42.47	42.80	45.65	11.35	57.00	NA	NA	Pass
743.50	42.60	43.35	46.00	11.35	57.35	NA	NA	Pass

* - ERP total, dBm/MHz = Total RF power**, dBm/MHz + Antenna Gain, dBd

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



Test specification:		Section 27.50(c)(3), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Table 7.2.3 Output power test results

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
 DETECTOR USED: Average
 RESOLUTION BANDWIDTH: 1000 kHz
 VIDEO BANDWIDTH: 3000 kHz
 MODULATING SIGNAL: PRBS
 MAXIMUM ANTENNA GAIN: 13.5 dBi (11.35 dBd)
 POWER SETTINGS: Maximum
 CHANNEL BANDWIDTH: 10 MHz

Carrier frequency, MHz	SA reading, dBm/MHz RF#1,	SA reading, dBm/MHz RF#2,	Total RF power**, dBm/MHz	Antenna gain, dBd	Total ERP*, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
QPSK 15.5 Mbps								
733.00	32.47	32.75	35.62	11.35	46.97	60.00	-13.03	Pass
737.00	33.31	33.28	36.31	11.35	47.66	60.00	-12.34	Pass
741.00	32.64	33.29	35.99	11.35	47.34	60.00	-12.66	Pass
64QAM 75.0 Mbps								
733.00	32.94	33.13	36.05	11.35	47.40	60.00	-12.60	Pass
737.00	32.20	33.14	35.71	11.35	47.06	60.00	-12.94	Pass
741.00	32.77	33.22	36.01	11.35	47.36	60.00	-12.64	Pass

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power**, dBm	Antenna gain, dBd	Total ERP*, dBm	Limit, dBm	Margin, dB	Verdict
QPSK 15.5 Mbps								
733.00	42.15	42.89	45.55	11.35	56.90	NA	NA	Pass
737.00	42.96	43.04	46.01	11.35	57.36	NA	NA	Pass
741.00	42.53	43.10	45.83	11.35	57.18	NA	NA	Pass
64QAM 75.0 Mbps								
733.00	42.84	43.25	46.06	11.35	57.41	NA	NA	Pass
737.00	42.28	43.05	45.69	11.35	57.04	NA	NA	Pass
741.00	42.47	43.09	45.80	11.35	57.15	NA	NA	Pass

* - ERP total, dBm = Total RF power**, dBm + Antenna Gain, dBd

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



Test specification: Section 27.50(c)(3), Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
Test mode: Compliance	Verdict: PASS		
Date(s): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Table 7.2.4 Output power test results

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
 DETECTOR USED: Average
 RESOLUTION BANDWIDTH: 1000 kHz
 VIDEO BANDWIDTH: 3000 kHz
 MODULATING SIGNAL: PRBS
 MAXIMUM ANTENNA GAIN: 12.5 dBi (10.35 dBd)
 POWER SETTINGS: Maximum
 CHANNEL BANDWIDTH: 5 MHz

Carrier frequency, MHz	SA reading, dBm/MHz RF#1,	SA reading, dBm/MHz RF#2,	Total RF power**, dBm/MHz	Antenna gain, dBd	Total ERP*, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
QPSK 7.0 Mbps								
730.50	35.22	35.62	38.43	10.35	48.78	60.00	-11.22	Pass
737.00	35.44	36.08	38.78	10.35	49.13	60.00	-10.87	Pass
743.50	34.95	35.41	38.20	10.35	48.55	60.00	-11.45	Pass
64QAM 37.0 Mbps								
730.50	35.50	36.14	38.84	10.35	49.19	60.00	-10.81	Pass
737.00	35.22	35.69	38.47	10.35	48.82	60.00	-11.18	Pass
743.50	35.47	36.34	38.94	10.35	49.29	60.00	-10.71	Pass

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power**, dBm	Antenna gain, dBd	Total ERP*, dBm	Limit, dBm	Margin, dB	Verdict
QPSK 7.0 Mbps								
730.50	42.69	42.99	45.85	10.35	56.20	NA	NA	Pass
737.00	42.06	42.80	45.46	10.35	55.81	NA	NA	Pass
743.50	42.26	42.67	45.48	10.35	55.83	NA	NA	Pass
64QAM 37.0 Mbps								
730.50	42.69	43.00	45.86	10.35	56.21	NA	NA	Pass
737.00	42.47	42.80	45.65	10.35	56.00	NA	NA	Pass
743.50	42.60	43.35	46.00	10.35	56.35	NA	NA	Pass

* - ERP total, dBm/MHz = Total RF power**, dBm/MHz + Antenna Gain, dBd

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



Test specification: Section 27.50(c)(3), Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
Test mode: Compliance	Verdict: PASS		
Date(s): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Table 7.2.5 Output power test results

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
 DETECTOR USED: Average
 RESOLUTION BANDWIDTH: 1000 kHz
 VIDEO BANDWIDTH: 3000 kHz
 MODULATING SIGNAL: PRBS
 MAXIMUM ANTENNA GAIN: 12.5 dBi (10.35 dBd)
 POWER SETTINGS: Maximum
 CHANNEL BANDWIDTH: 10 MHz

Carrier frequency, MHz	SA reading, dBm/MHz RF#1,	SA reading, dBm/MHz RF#2,	Total RF power**, dBm/MHz	Antenna gain, dBd	Total ERP*, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
QPSK 15.5 Mbps								
733.00	32.47	32.75	35.62	10.35	45.97	60.00	-14.03	Pass
737.00	33.31	33.28	36.31	10.35	46.66	60.00	-13.34	Pass
741.00	32.64	33.29	35.99	10.35	46.34	60.00	-13.66	Pass
64QAM 75.0 Mbps								
733.00	32.94	33.13	36.05	10.35	46.40	60.00	-13.60	Pass
737.00	32.20	33.14	35.71	10.35	46.06	60.00	-13.94	Pass
741.00	32.77	33.22	36.01	10.35	46.36	60.00	-13.64	Pass

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power**, dBm	Antenna gain, dBd	Total ERP*, dBm	Limit, dBm	Margin, dB	Verdict
QPSK 15.5 Mbps								
733.00	42.15	42.89	45.55	10.35	55.90	NA	NA	Pass
737.00	42.96	43.04	46.01	10.35	56.36	NA	NA	Pass
741.00	42.53	43.10	45.83	10.35	56.18	NA	NA	Pass
64QAM 75.0 Mbps								
733.00	42.84	43.25	46.06	10.35	56.41	NA	NA	Pass
737.00	42.28	43.05	45.69	10.35	56.04	NA	NA	Pass
741.00	42.47	43.09	45.80	10.35	56.15	NA	NA	Pass

* - ERP total, dBm = Total RF power**, dBm + Antenna Gain, dBd

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

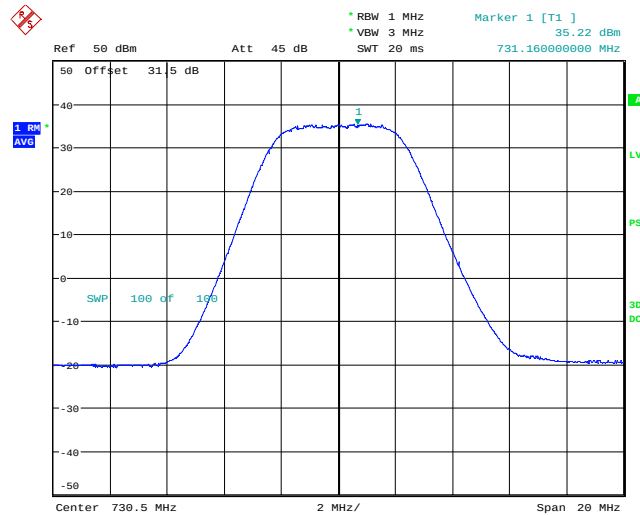
Reference numbers of test equipment used

HL 2011	HL 3301	HL 3302	HL 3903	HL 4360	HL 4756		
---------	---------	---------	---------	---------	---------	--	--

Full description is given in Appendix A.

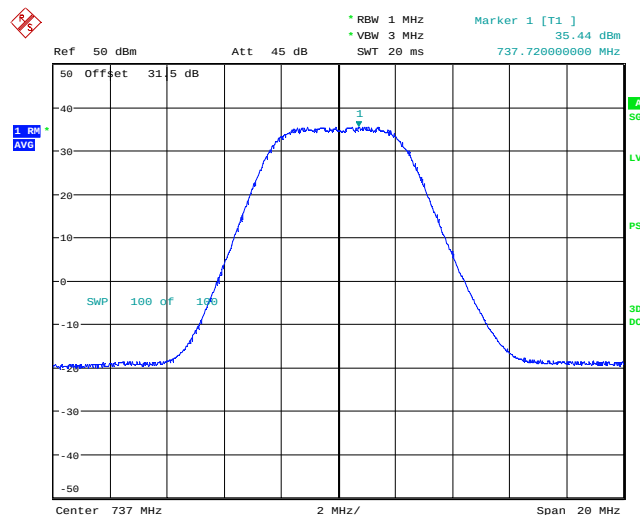
Test specification:		Section 27.50(c)(3), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:	Compliance	Verdict: PASS	
Date(s):	15-Aug-16		
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.1 Maximum output power test results at low frequency, QPSK modulation, RF Output #1, 5 MHz



Date: 15.AUG.2016 11:31:17

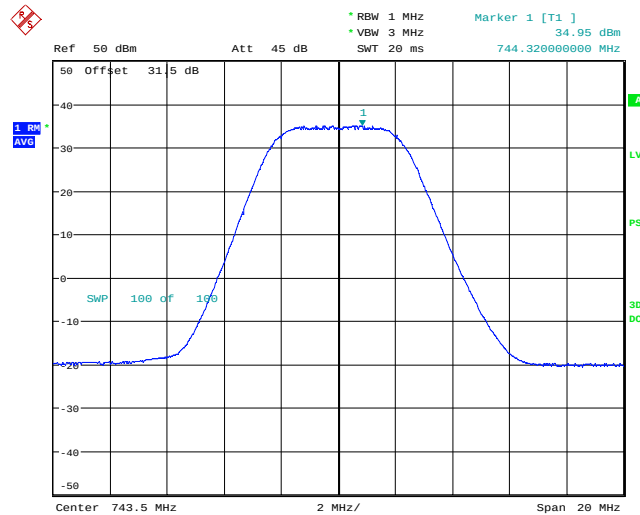
Plot 7.2.2 Maximum output power test results at medium frequency, QPSK modulation RF Output #1, 5 MHz



Date: 15.AUG.2016 12:16:56

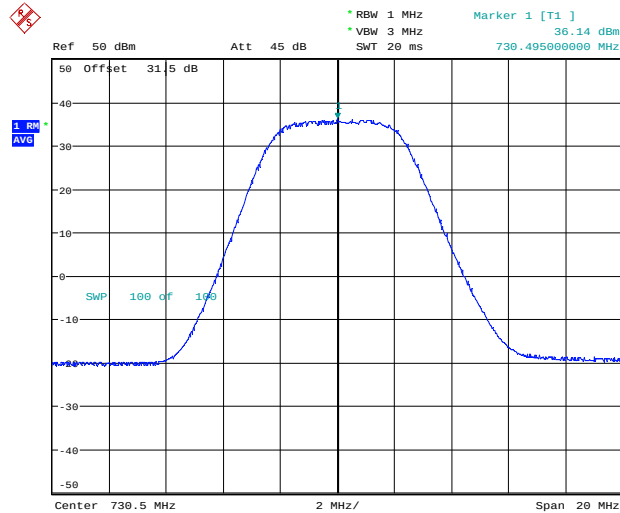
Test specification:		Section 27.50(c)(3), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.3 Maximum output power test results at high frequency, QPSK modulation RF Output #1, 5 MHz



Date: 15.AUG.2016 11:38:48

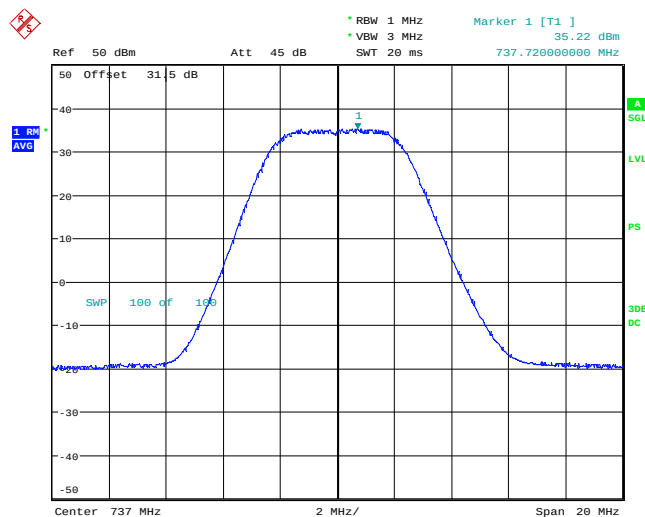
Plot 7.2.4 Maximum output power test results at low frequency, 64QAM modulation RF Output #1, 5 MHz



Date: 15.AUG.2016 11:51:23

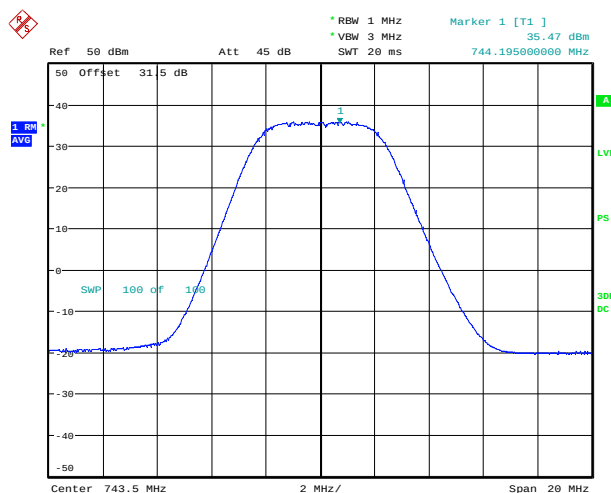
Test specification: Section 27.50(c)(3), Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.5 Maximum output power test results at medium frequency, 64QAM modulation RF Output #1, 5 MHz



Date: 15.AUG.2016 11:57:24

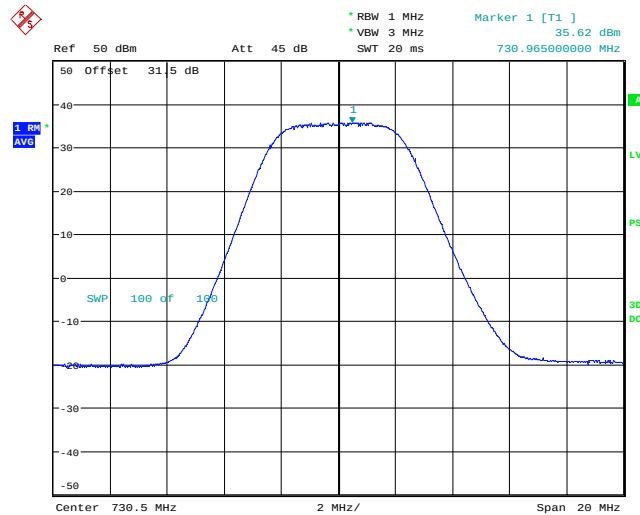
Plot 7.2.6 Maximum output power test results at high frequency, 64QAM modulation RF Output #1, 5 MHz



Date: 15.AUG.2016 11:43:08

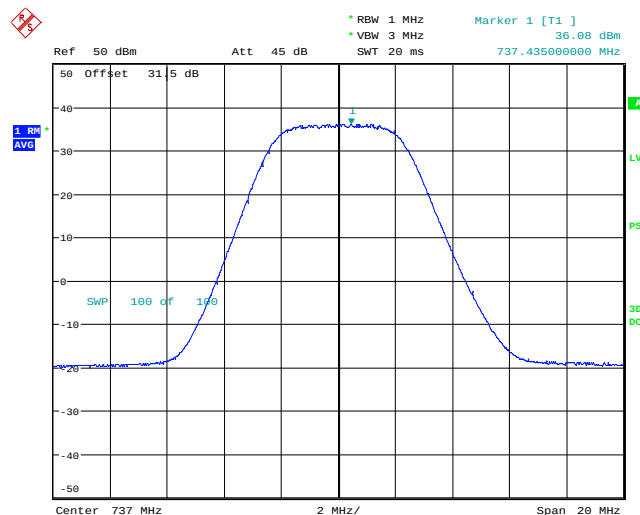
Test specification:		Section 27.50(c)(3), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.7 Maximum output power test results at low frequency, QPSK modulation, RF Output #2, 5 MHz



Date: 15.AUG.2016 11:33:15

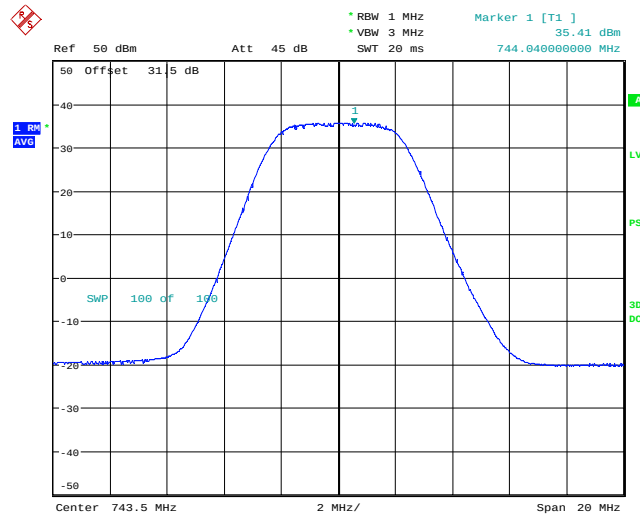
Plot 7.2.8 Maximum output power test results at medium frequency, QPSK modulation RF Output #2, 5 MHz



Date: 15.AUG.2016 11:04:33

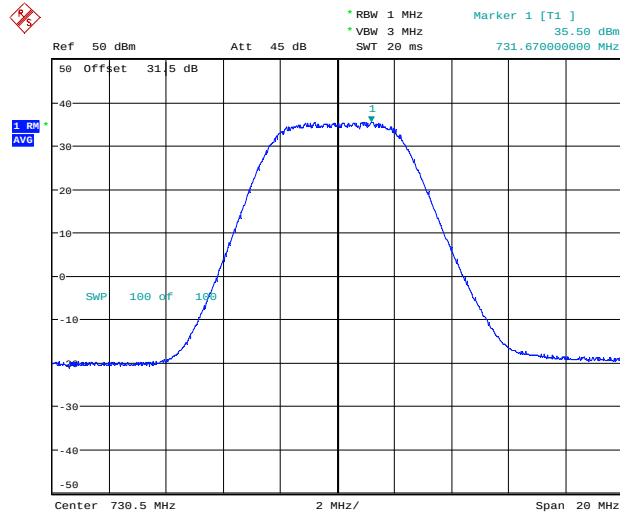
Test specification:		Section 27.50(c)(3), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.9 Maximum output power test results at high frequency, QPSK modulation RF Output #2, 5 MHz



Date: 15.AUG.2016 11:37:11

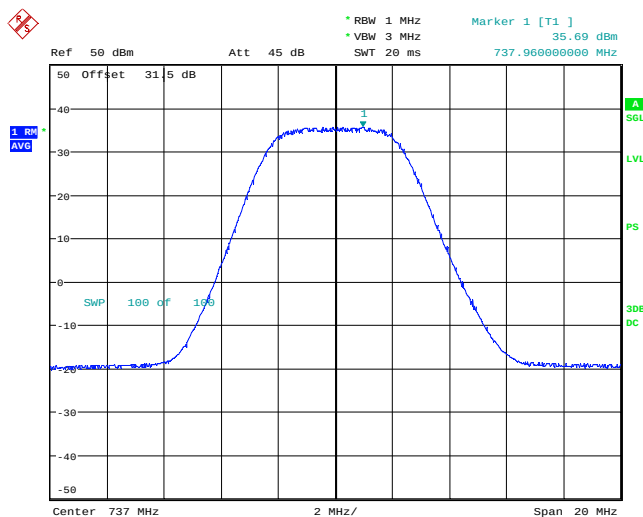
Plot 7.2.10 Maximum output power test results at low frequency, 64QAM modulation RF Output #2, 5 MHz



Date: 15.AUG.2016 11:49:33

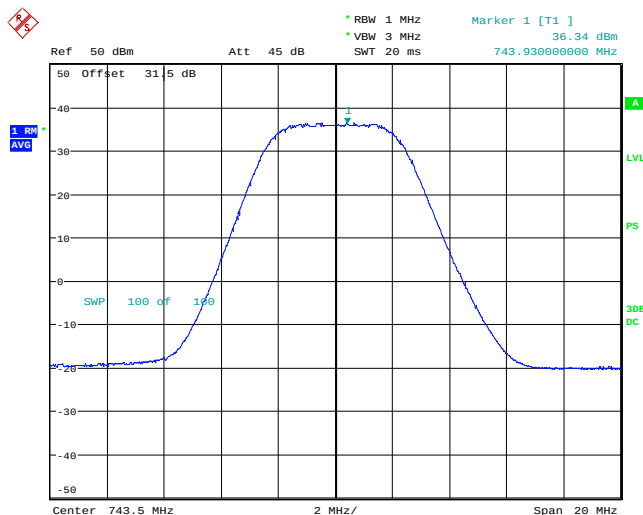
Test specification: Section 27.50(c)(3), Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.11 Maximum output power test results at medium frequency, 64QAM modulation RF Output #2, 5 MHz



Date: 15.AUG.2016 11:54:42

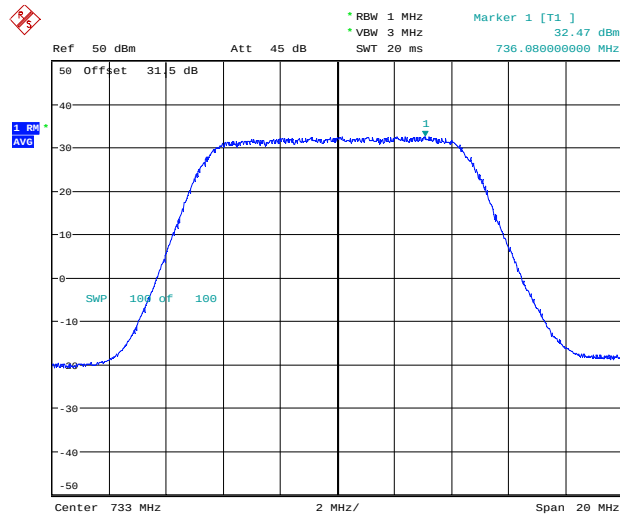
Plot 7.2.12 Maximum output power test results at high frequency, 64QAM modulation RF Output #2, 5 MHz



Date: 15.AUG.2016 11:45:17

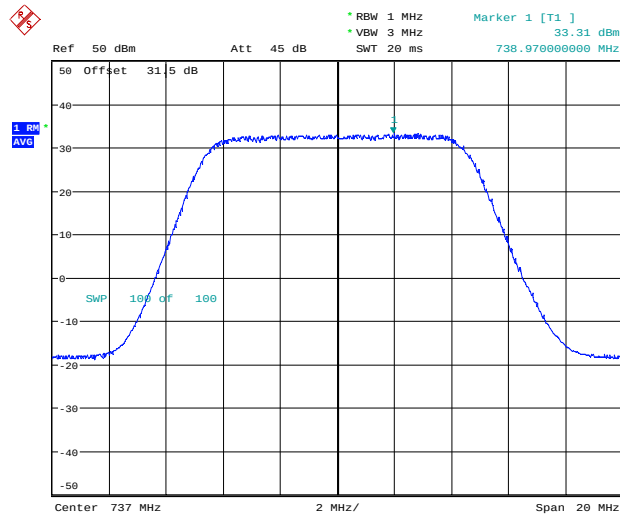
Test specification:		Section 27.50(c)(3), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.13 Maximum output power test results at low frequency, QPSK modulation, RF Output #1, 10 MHz



Date: 15.AUG.2016 12:36:17

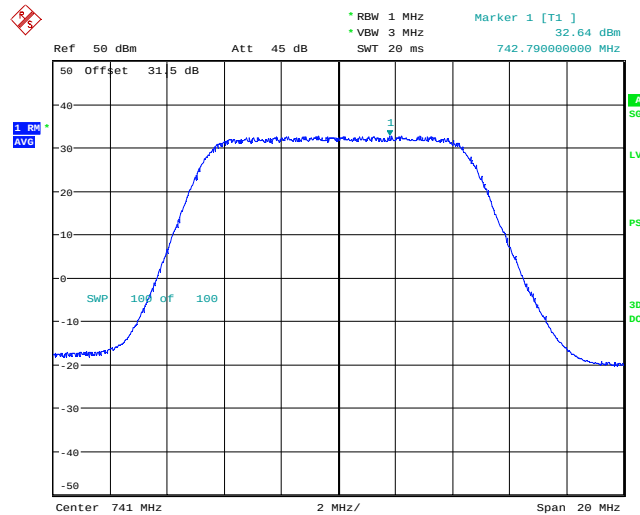
Plot 7.2.14 Maximum output power test results at medium frequency, QPSK modulation RF Output #1, 10 MHz



Date: 15.AUG.2016 12:28:57

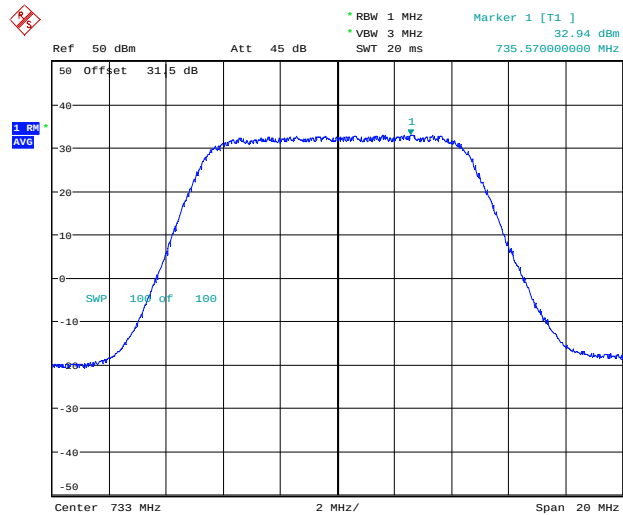
Test specification:		Section 27.50(c)(3), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.15 Maximum output power test results at high frequency, QPSK modulation RF Output #1, 10 MHz



Date: 15.AUG.2016 12:37:39

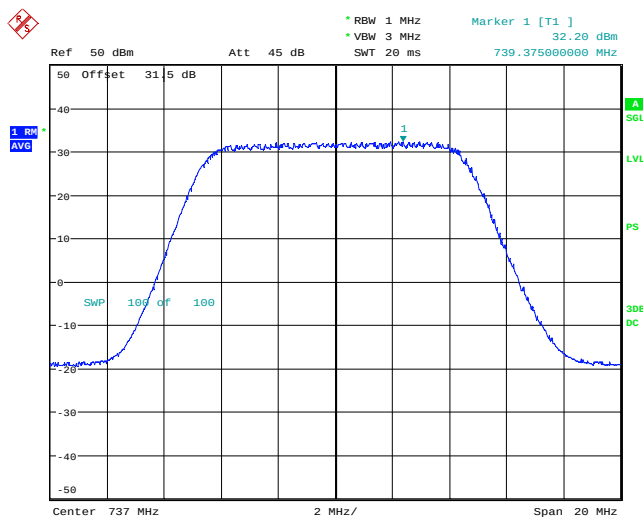
Plot 7.2.16 Maximum output power test results at low frequency, 64QAM modulation RF Output #1, 10 MHz



Date: 15.AUG.2016 14:09:15

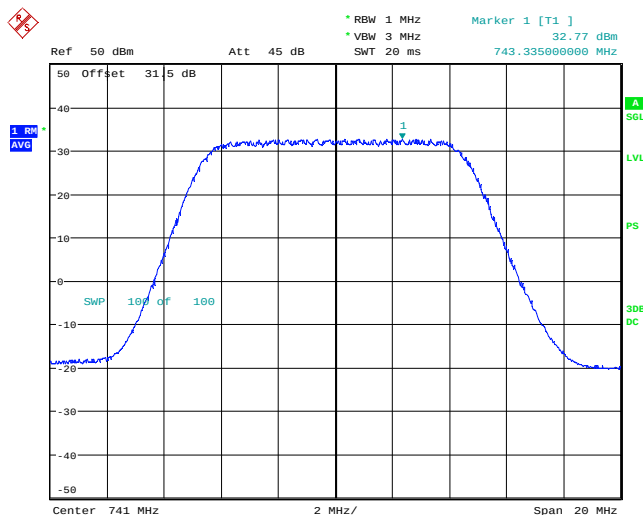
Test specification: Section 27.50(c)(3), Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.17 Maximum output power test results at medium frequency, 64QAM modulation RF Output #1, 10 MHz



Date: 15.AUG.2016 12:52:04

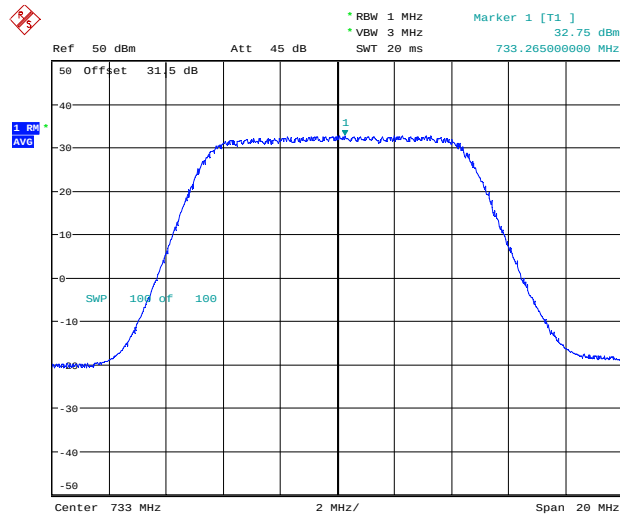
Plot 7.2.18 Maximum output power test results at high frequency, 64QAM modulation RF Output #1, 10 MHz



Date: 15.AUG.2016 12:46:27

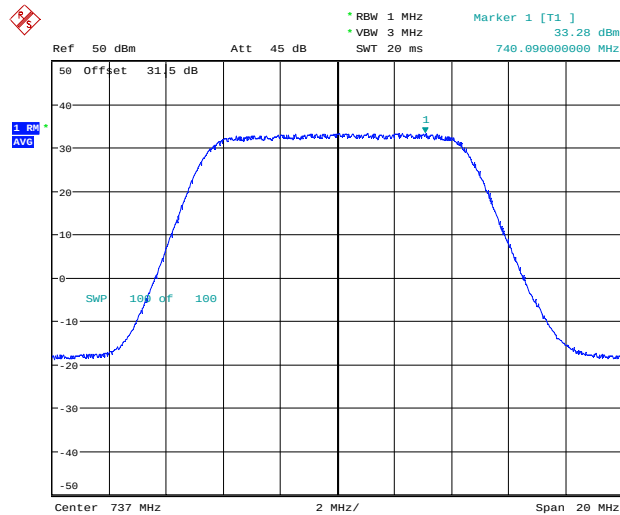
Test specification:		Section 27.50(c)(3), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.19 Maximum output power test results at low frequency, QPSK modulation, RF Output #2, 10 MHz



Date: 15.AUG.2016 12:34:57

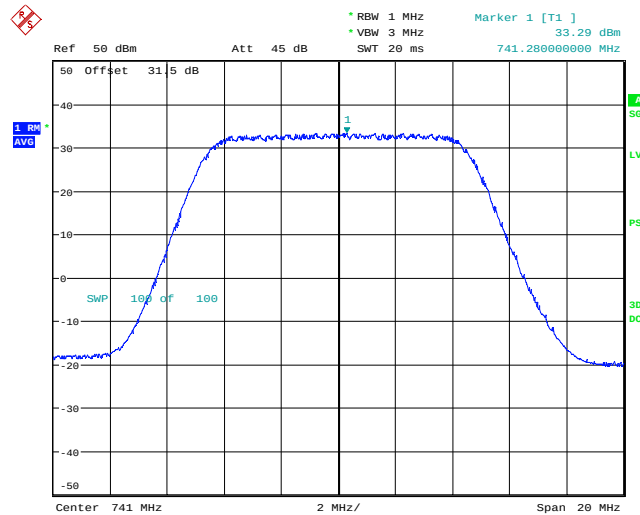
Plot 7.2.20 Maximum output power test results at medium frequency, QPSK modulation RF Output #2, 10 MHz



Date: 15.AUG.2016 12:31:58

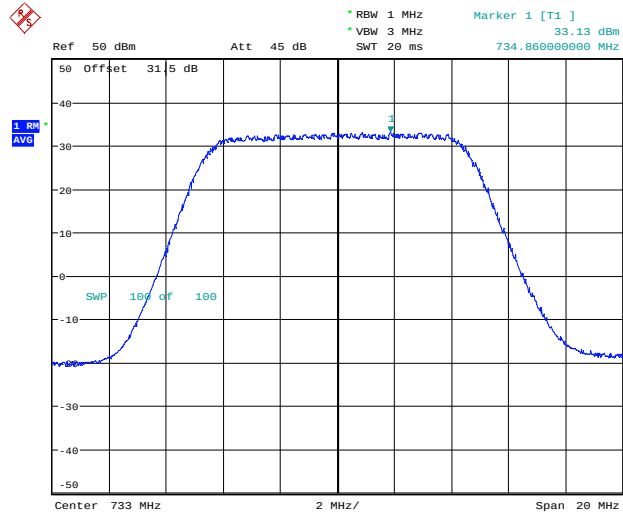
Test specification:		Section 27.50(c)(3), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.21 Maximum output power test results at high frequency, QPSK modulation RF Output #2, 10 MHz



Date: 15.AUG.2016 12:39:15

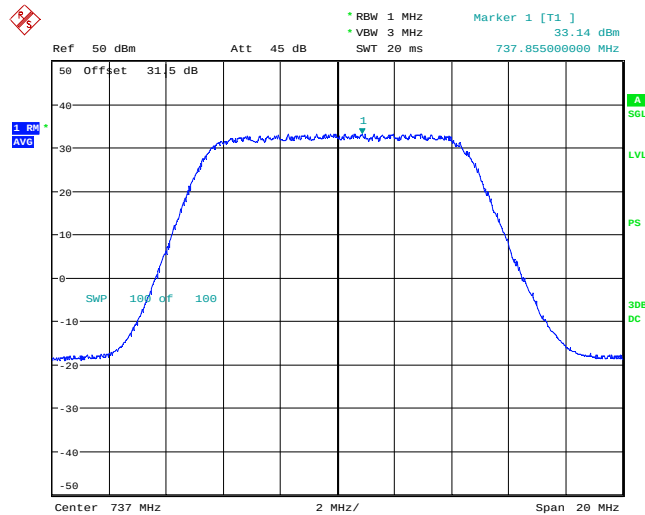
Plot 7.2.22 Maximum output power test results at low frequency, 64QAM modulation RF Output #2, 10 MHz



Date: 15.AUG.2016 14:13:27

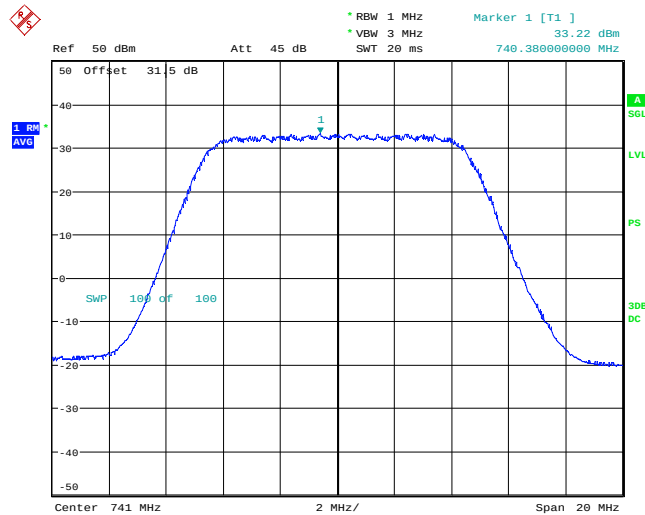
Test specification:		Section 27.50(c)(3), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
15-Aug-16			
Temperature: 25 °C	Relative Humidity: 51 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.23 Maximum output power test results at medium frequency, 64QAM modulation RF Output #2, 10 MHz



Date: 15.AUG.2016 12:58:01

Plot 7.2.24 Maximum output power test results at high frequency, 64QAM modulation RF Output #2, 10 MHz



Date: 15.AUG.2016 12:42:30

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

7.3 Band edge emission (emission mask) test

7.3.1 General

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

Table 7.3.1 Band edge emission limits

Investigated band, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	RBW, kHz
0.009 - 7500	43+10logP(W)	-13.0	100
100 kHz bands immediately outside and adjacent to a licensee's frequency block	43+10logP(W)	-13.0	30

Frequency range (MHz)	Investigated Band Edge	Attenuation below carrier, dBc
728.0 - 740.0 MHz Channel (Block A high + Block B high)		
10	727.9 – 728.0 MHz	43+10logP(W) (RBW = 30 kHz)
	740.0 – 740.1 MHz	
734.0 - 746.0 MHz Channel (Block B high + Block C high)		
10	733.9 – 734.0 MHz	43+10logP(W) (RBW = 30 kHz)
	746.0 – 746.1 MHz	

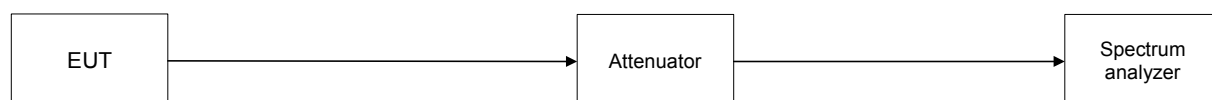
* - P is a transmitter output power in watts.

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, Table 7.3.3 and the associated plots.

Figure 7.3.1 Emission mask test setup for single output





Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Table 7.3.2 Emission mask test results

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
 RBW: 100 kHz
 DETECTOR USED: Average
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER: Maximum
 EBW: 5 MHz
 NUMBER OF RF OUTPUTS: N = 2

TESTED RF OUTPUT: 2 (single chain)

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm**	Limit, dBm	Margin, dB*	Verdict
QPSK, Low carrier frequency								
728.000	-21.16	Included	Included	100	-21.16	-13.0	-8.16	Pass
734.064	-24.95	Included	Included	100	-24.95	-13.0	-11.95	Pass
QPSK, Mid carrier frequency								
733.967	-25.49	Included	Included	100	-25.49	-13.0	-12.49	Pass
740.032	-24.98	Included	Included	100	-24.98	-13.0	-11.98	Pass
QPSK, High carrier frequency								
740.000	-27.00	Included	Included	100	-27.00	-13.0	-14.00	Pass
746.100	-24.39	Included	Included	100	-24.39	-13.0	-11.39	Pass
64QAM, Low carrier frequency								
728.000	-22.45	Included	Included	100	-22.45	-13.0	-9.45	Pass
734.000	-24.69	Included	Included	100	-24.69	-13.0	-11.69	Pass
64QAM, Mid carrier frequency								
733.967	-25.59	Included	Included	100	-25.59	-13.0	-12.59	Pass
740.032	-24.79	Included	Included	100	-24.79	-13.0	-11.79	Pass
64QAM, High carrier frequency								
740.000	-26.29	Included	Included	100	-26.29	-13.0	-13.29	Pass
746.132	-22.45	Included	Included	100	-22.45	-13.0	-9.45	Pass

Note: Measurements were done at both RF output connectors, the worst test results obtained at RF output #2 submitted.

* - Margin = Spurious emission – specification limit

** - Spurious Emission, dBm = SA Reading



Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Table 7.3.2 Emission mask test results (continued)

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
 RBW: 100 kHz
 DETECTOR USED: Average
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER: Maximum
 EBW: 5 MHz
 NUMBER OF RF OUTPUTS: N = 2

TESTED RF OUTPUT: 2 (dual chains)

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm**	Limit, dBm	Margin, dB*	Verdict
QPSK, Low carrier frequency								
728.000	-21.16	Included	Included	100	-18.16	-13.0	-5.16	Pass
734.064	-24.95	Included	Included	100	-21.95	-13.0	-8.95	Pass
QPSK, Mid carrier frequency								
733.967	-25.49	Included	Included	100	-22.49	-13.0	-9.49	Pass
740.032	-24.98	Included	Included	100	-21.98	-13.0	-8.98	Pass
QPSK, High carrier frequency								
740.000	-27.00	Included	Included	100	-24.00	-13.0	-11.00	Pass
746.100	-24.39	Included	Included	100	-21.39	-13.0	-8.39	Pass
64QAM, Low carrier frequency								
728.000	-22.45	Included	Included	100	-19.45	-13.0	-6.45	Pass
734.000	-24.69	Included	Included	100	-21.69	-13.0	-8.69	Pass
64QAM, Mid carrier frequency								
733.967	-25.59	Included	Included	100	-22.59	-13.0	-9.59	Pass
740.032	-24.79	Included	Included	100	-21.79	-13.0	-8.79	Pass
64QAM, High carrier frequency								
740.000	-26.29	Included	Included	100	-23.29	-13.0	-10.29	Pass
746.132	-22.45	Included	Included	100	-19.45	-13.0	-6.45	Pass

* - Margin = Spurious emission – specification limit

** - Spurious Emission, dBm = SA Reading + 10log(N)

Reference numbers of test equipment used

HL 1908	HL 2780	HL 3301	HL 3302	HL 3435	HL 3442	HL 4229	HL 4274
---------	---------	---------	---------	---------	---------	---------	---------

Full description is given in Appendix A.



Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Table 7.3.3 Emission mask test results

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
 RBW: 100 kHz
 DETECTOR USED: Average
 VIDEO BANDWIDTH: $\geq$ Resolution bandwidth
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 EBW: 10 MHz
 RF OUTPUTS: N=2

TESTED RF OUTPUT: 2 (single chain)

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm**	Limit, dBm	Margin, dB*	Verdict
QPSK, Low								
728.000	-23.52	Included	Included	100	-23.52	-13.0	-10.52	Pass
740.048	-24.13	Included	Included	100	-24.13	-13.0	-11.13	Pass
QPSK, High								
735.858	-23.61	Included	Included	100	-23.61	-13.0	-10.61	Pass
746.000	-22.94	Included	Included	100	-22.94	-13.0	-9.94	Pass
64QAM, Low								
728.000	-22.15	Included	Included	100	-22.15	-13.0	-9.15	Pass
740.112	-23.34	Included	Included	100	-23.34	-13.0	-10.34	Pass
64QAM, High								
735.666	-23.22	Included	Included	100	-23.22	-13.0	-10.22	Pass
746.000	-23.30	Included	Included	100	-23.30	-13.0	-10.30	Pass

* - Margin = Spurious emission – specification limit

** - Spurious Emission, dBm = SA Reading

RF OUTPUTS: N=2
 TESTED RF OUTPUT: 2 (dual chains)

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm**	Limit, dBm	Margin, dB*	Verdict
QPSK, Low								
728.000	-23.52	Included	Included	100	-20.52	-13.0	-7.52	Pass
740.048	-24.13	Included	Included	100	-21.13	-13.0	-8.13	Pass
QPSK, High								
735.858	-23.61	Included	Included	100	-20.61	-13.0	-7.61	Pass
746.000	-22.94	Included	Included	100	-19.94	-13.0	-6.94	Pass
64QAM, Low								
728.000	-22.15	Included	Included	100	-19.15	-13.0	-6.15	Pass
740.112	-23.34	Included	Included	100	-20.34	-13.0	-7.34	Pass
64QAM, High								
735.666	-23.22	Included	Included	100	-20.22	-13.0	-7.22	Pass
746.000	-23.30	Included	Included	100	-20.30	-13.0	-7.30	Pass

* - Margin = Spurious emission – specification limit

** - Spurious Emission, dBm = SA Reading + 10log(N)

Reference numbers of test equipment used

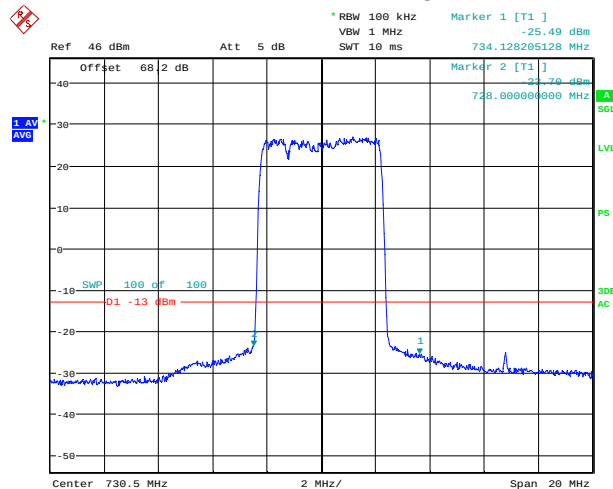
HL 1908	HL 2780	HL 3301	HL 3302	HL 3435	HL 3442	HL 4229	HL 4274
---------	---------	---------	---------	---------	---------	---------	---------

Full description is given in Appendix A.

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.1 Emission mask test results at low carrier frequency, RF#1, 5 MHz EBW

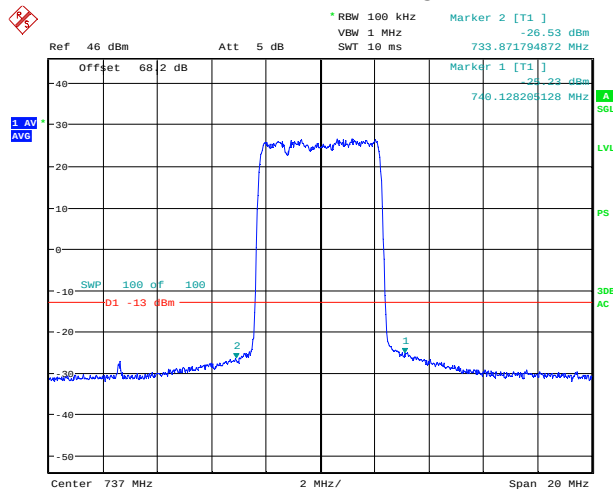
ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 15:59:27

Plot 7.3.2 Emission mask test results at mid carrier frequency, RF#1, 5 MHz EBW

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS

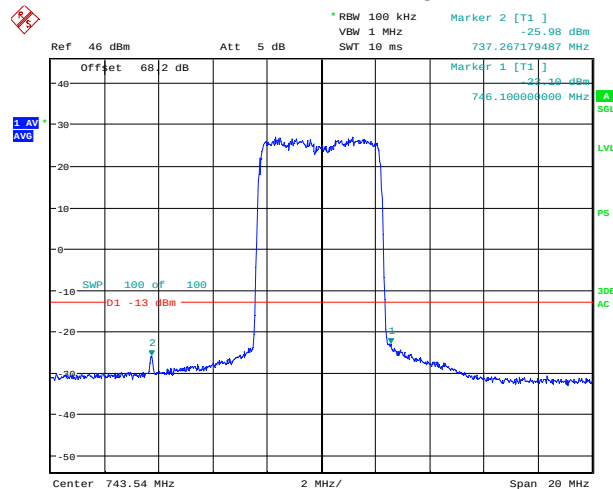


Date: 7.AUG.2016 15:43:51

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.3 Emission mask test results at high carrier frequency, RF#1, 5 MHz EBW

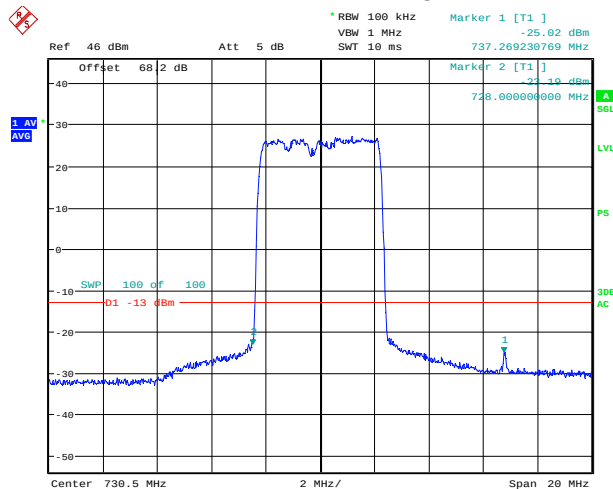
ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 14:42:23

Plot 7.3.4 Emission mask test results at low carrier frequency, RF#1, 5 MHz EBW

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS

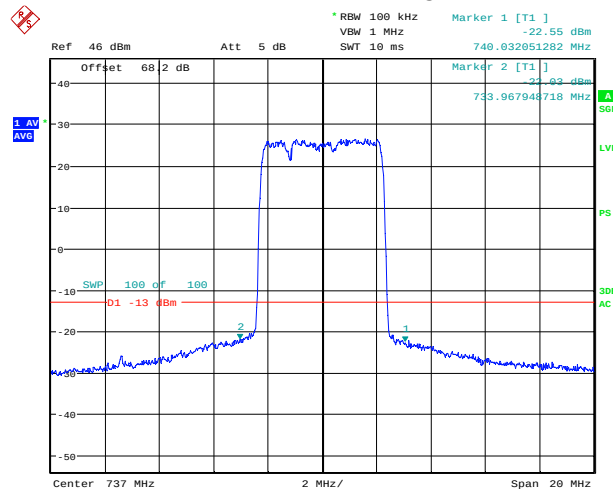


Date: 7.AUG.2016 16:03:20

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.5 Emission mask test results at mid carrier frequency, RF#1, 5 MHz EBW

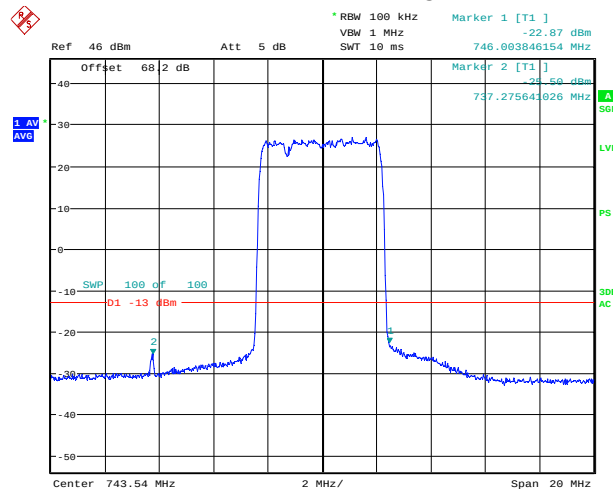
ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 15:30:19

Plot 7.3.6 Emission mask test results at high carrier frequency, RF#1, 5 MHz EBW

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS

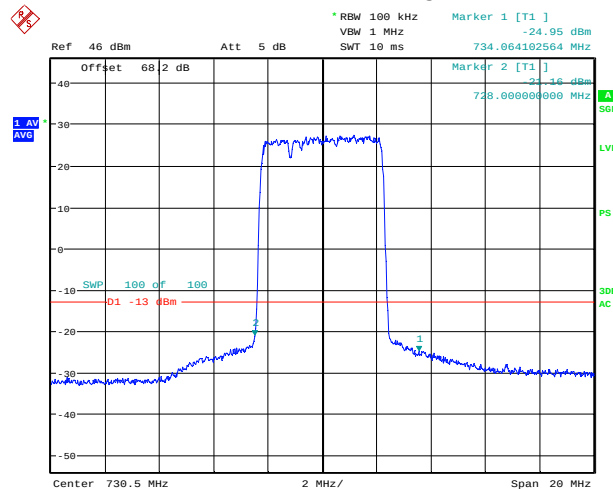


Date: 7.AUG.2016 15:26:05

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.7 Emission mask test results at low carrier frequency, RF#2, 5 MHz EBW

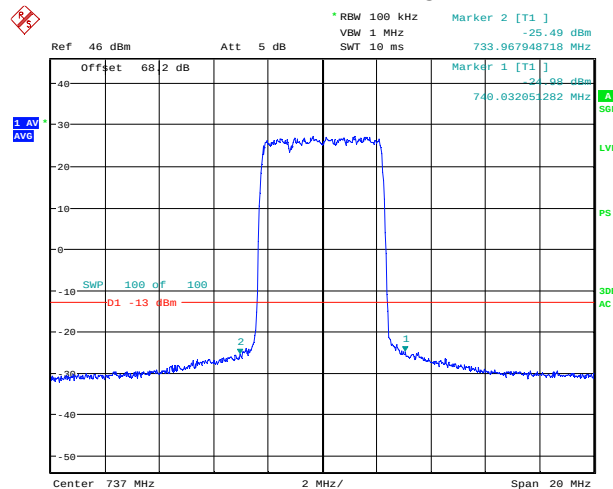
ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 15:56:34

Plot 7.3.8 Emission mask test results at mid carrier frequency, RF#2, 5 MHz EBW

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS

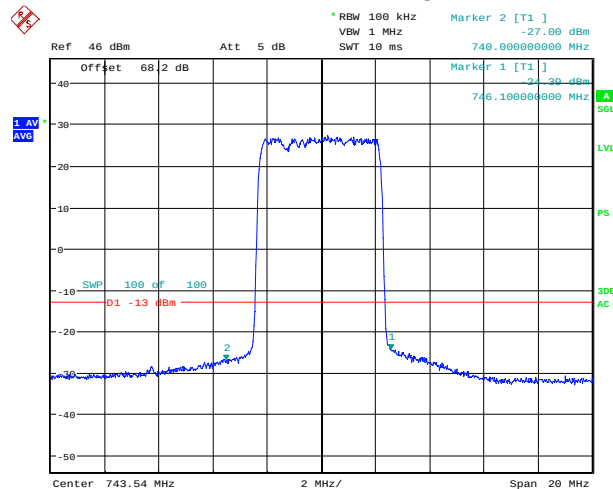


Date: 7.AUG.2016 15:41:45

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.9 Emission mask test results at high carrier frequency, RF#2, 5 MHz EBW

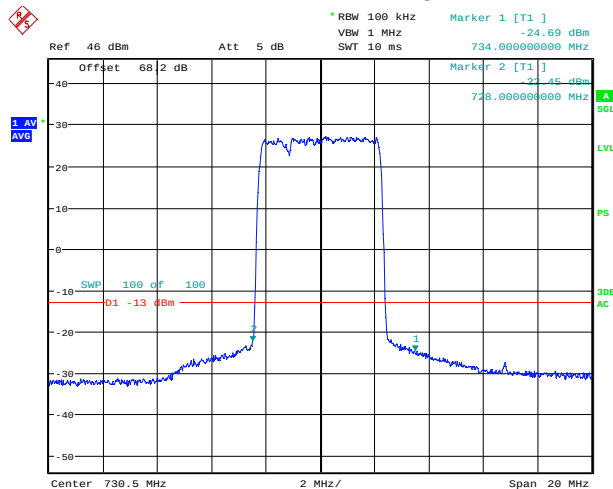
ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 14:47:35

Plot 7.3.10 Emission mask test results at low carrier frequency, RF#2, 5 MHz EBW

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS

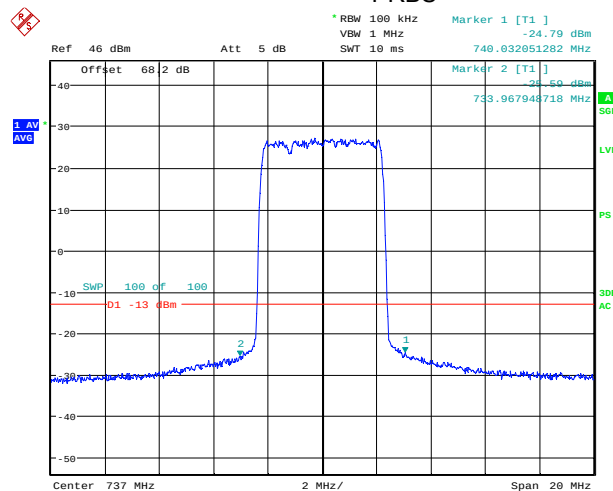


Date: 7.AUG.2016 16:09:30

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.11 Emission mask test results at mid carrier frequency, RF#2, 5 MHz EBW

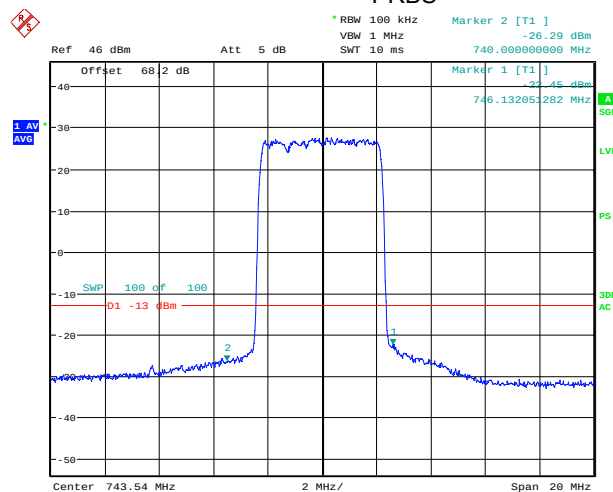
ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 15:34:47

Plot 7.3.12 Emission mask test results at high carrier frequency, RF#2, 5 MHz EBW

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS

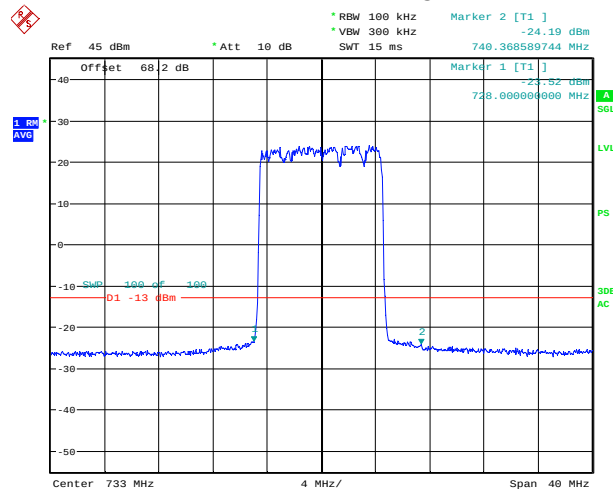


Date: 7.AUG.2016 15:22:21

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.13 Emission mask test results at low carrier frequency, RF#1, 10 MHz EBW

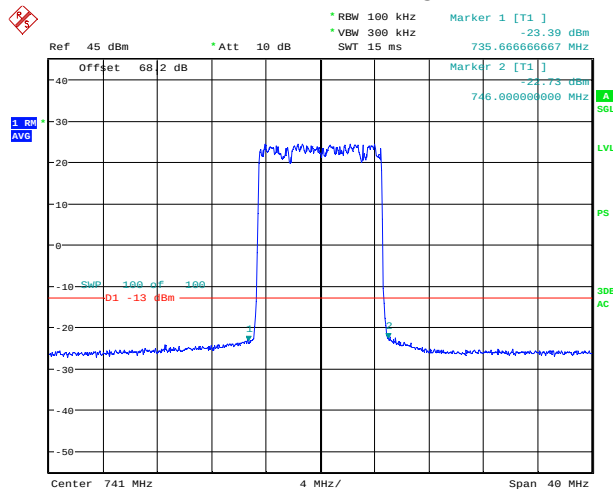
ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 16:42:35

Plot 7.3.14 Emission mask test results at high carrier frequency, RF#1, 10 MHz EBW

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS

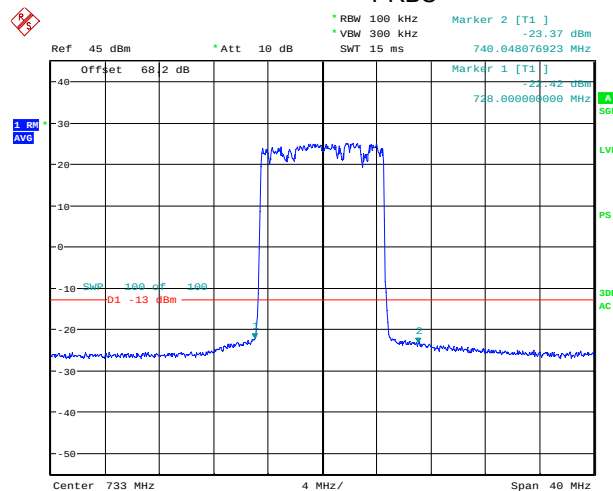


Date: 7.AUG.2016 18:02:44

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.15 Emission mask test results at low carrier frequency, RF#1, 10 MHz EBW

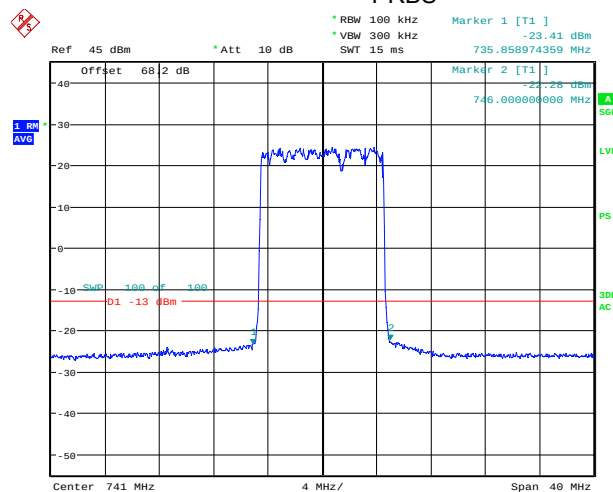
ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 17:09:32

Plot 7.3.16 Emission mask test results at high carrier frequency, RF#1, 10 MHz EBW

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS

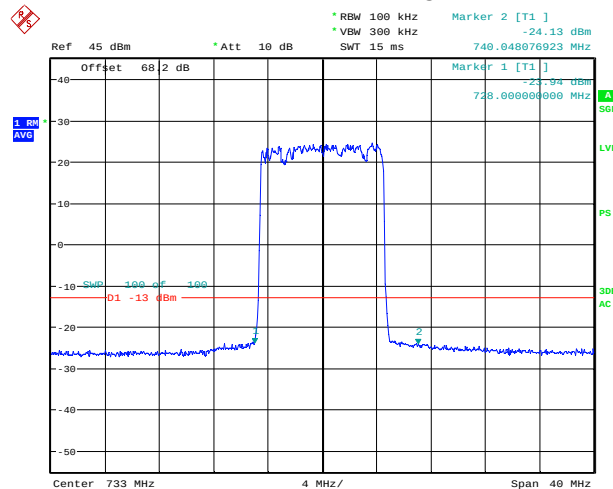


Date: 7.AUG.2016 18:04:59

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.17 Emission mask test results at low carrier frequency, RF#2, 10 MHz EBW

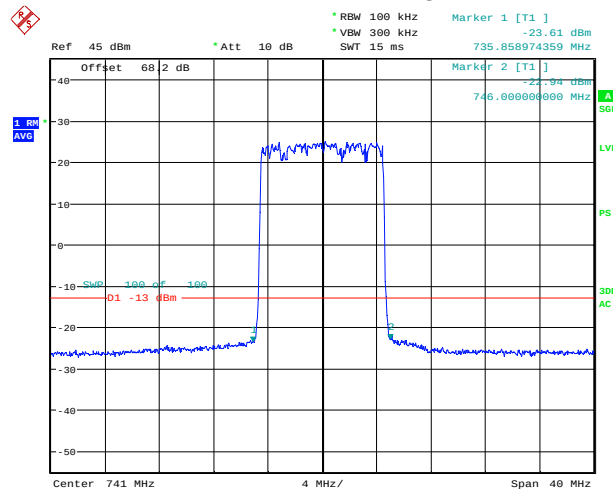
ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 16:40:44

Plot 7.3.18 Emission mask test results at high carrier frequency, RF#2, 10 MHz EBW

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS

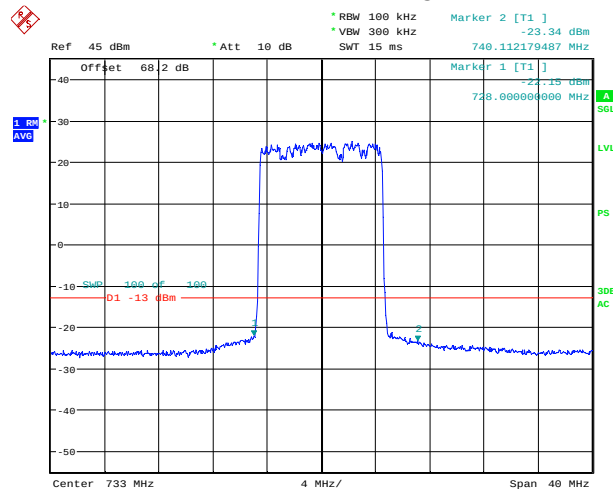


Date: 7.AUG.2016 18:06:04

Test specification: Section 27.53(g), Band edge emission			
Test procedure: 47 CFR, Sections 2.1051 and 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 07-Aug-16			
Temperature: 22.5 °C	Relative Humidity: 56 %	Air Pressure: 1006 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.19 Emission mask test results at low carrier frequency, RF#2, 10 MHz EBW

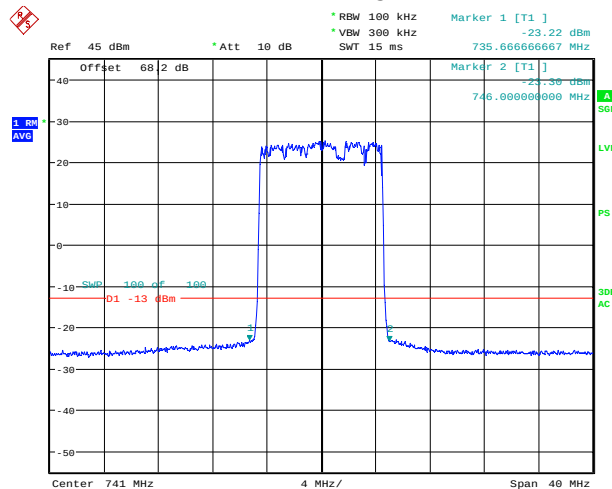
ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 17:12:24

Plot 7.3.20 Emission mask test results at high carrier frequency, RF#2, 10 MHz EBW

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS



Date: 7.AUG.2016 18:01:20

Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

7.4 Spurious emissions at RF antenna connector test

7.4.1 General

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

Table 7.4.1 Spurious emission limits

Investigated band, MHz	Attenuation below carrier, dBc	Spurious emissions, dBm	RBW, kHz
0.009 - 10th harmonic*	$43+10\log P(W)^{**}$	-13.0	100
100 kHz bands immediately outside and adjacent to a licensee's frequency block	$43+10\log P(W)^{**}$	-13.0	30

* - spurious emission limits do not apply to the in band emission investigated in course of emission mask 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(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Table 7.4.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 728.0 – 746.0 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 7500 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATION: 64QAM
 MODULATING SIGNAL: PRBS
 BIT RATE: 75 Mbps
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 NUMBER OF RF OUTPUTS: N = 2

TESTED RF OUTPUT: 1

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

*- Margin = Spurious emission – specification limit.

TESTED RF OUTPUT: 2

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

*- Margin = Spurious emission – specification limit.

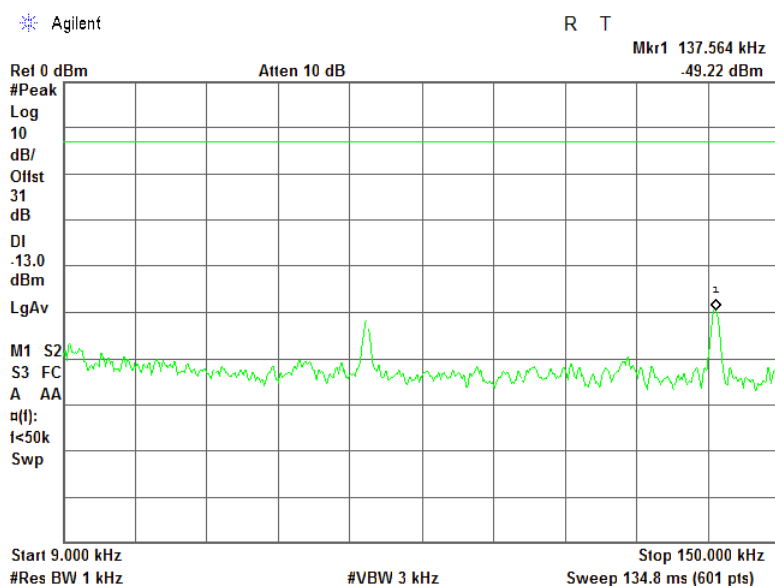
Reference numbers of test equipment used

HL 3818	HL 3903	HL 4756					
---------	---------	---------	--	--	--	--	--

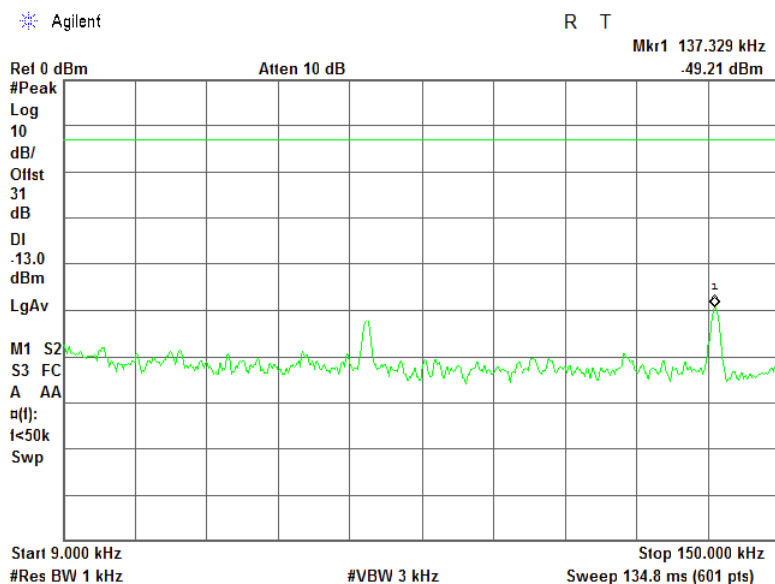
Full description is given in Appendix A.

Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.1 Spurious emission measurements in 9 - 150 kHz range at low carrier frequency, RF# 1

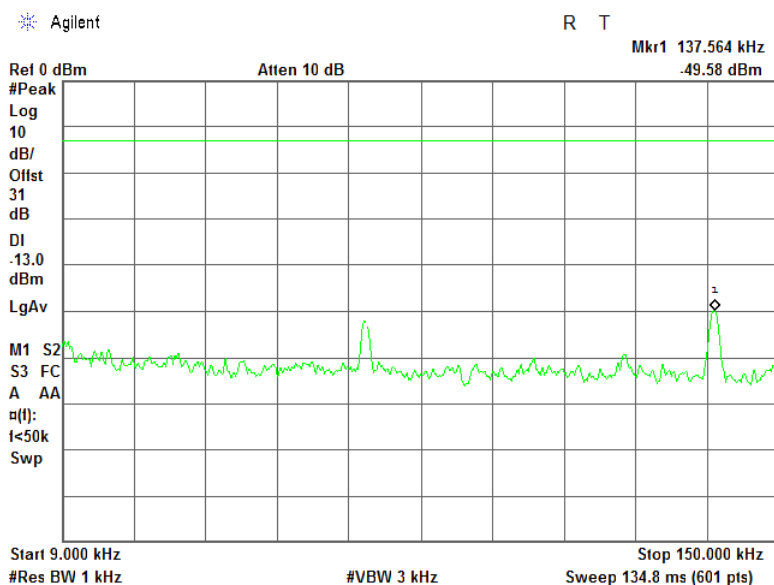


Plot 7.4.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency, RF# 1

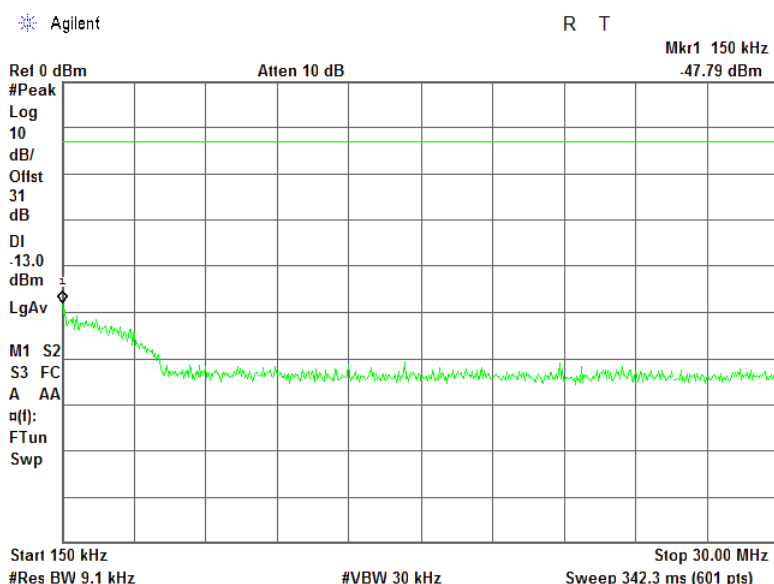


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.3 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency, RF# 1

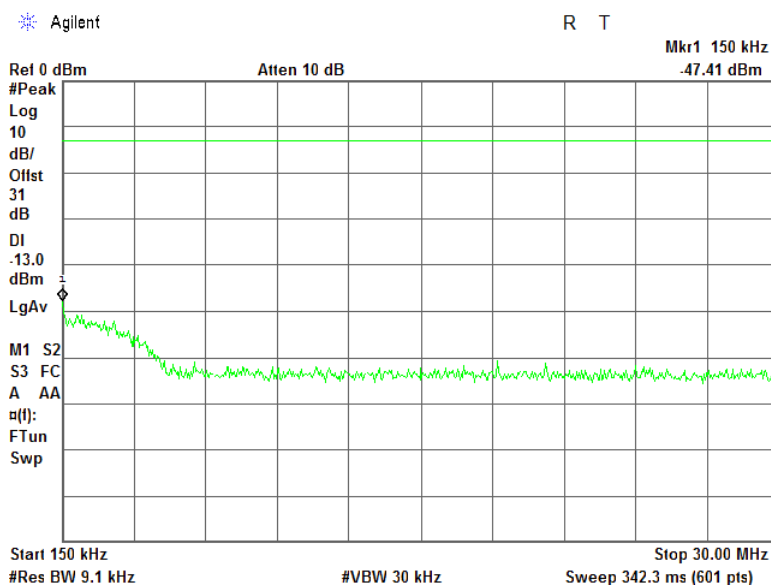


Plot 7.4.4 Spurious emission measurements in 0.15 - 30.0 MHz range at low carrier frequency, RF# 1

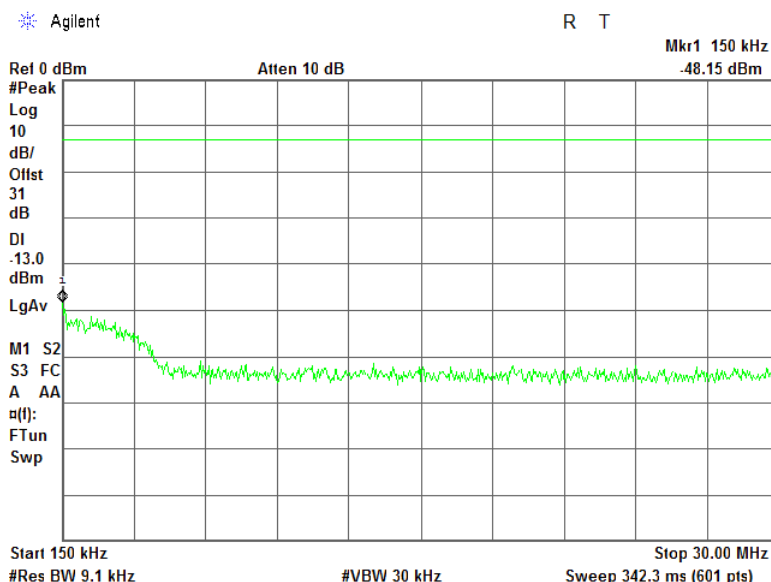


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.5 Spurious emission measurements in 0.15 - 30.0 MHz range at mid carrier frequency, RF# 1

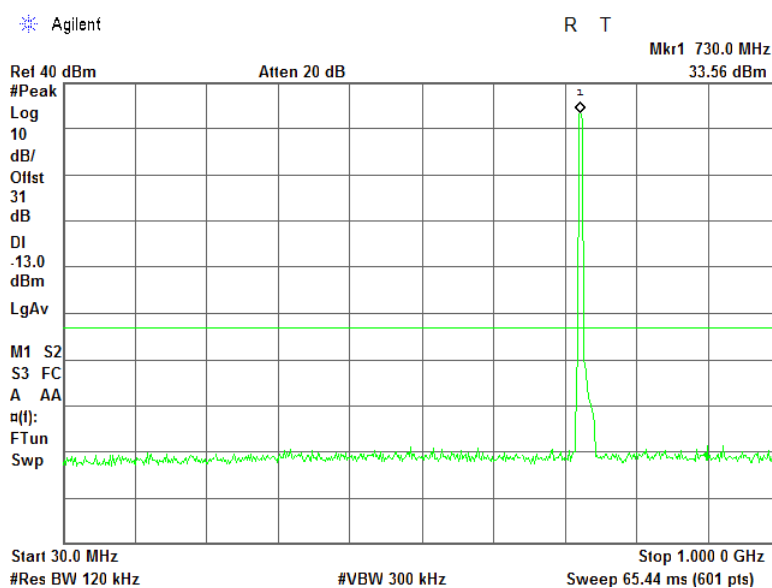


Plot 7.4.6 Spurious emission measurements in 0.15 - 30.0 MHz range at high carrier frequency, RF# 1

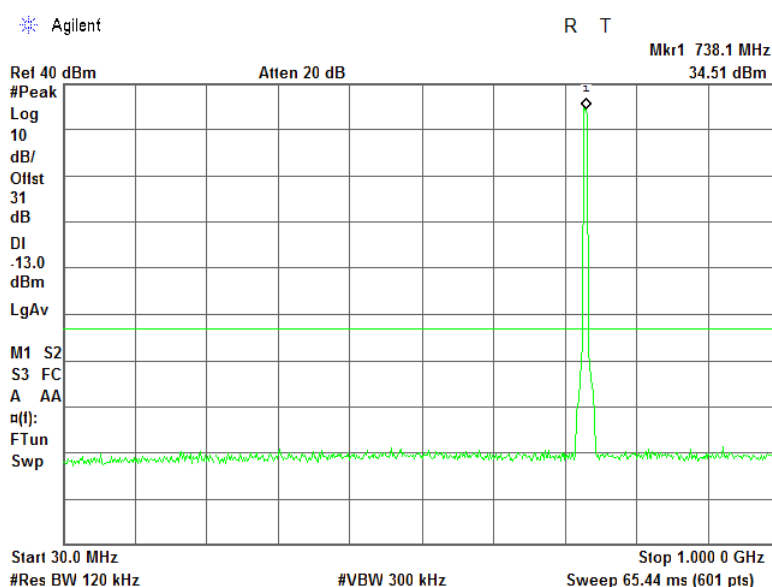


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.7 Spurious emission measurements in 30 - 1000 MHz range at low carrier frequency, RF# 1

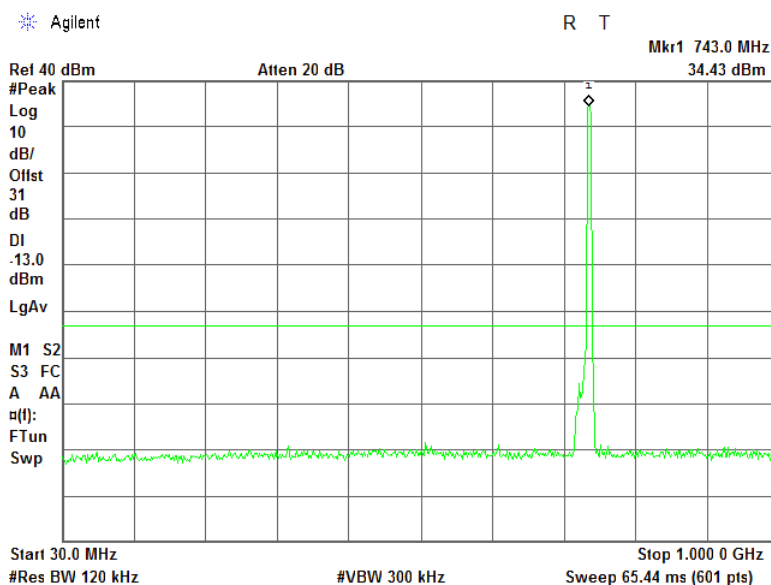


Plot 7.4.8 Spurious emission measurements in 30 - 1000 MHz range at mid carrier frequency, RF# 1

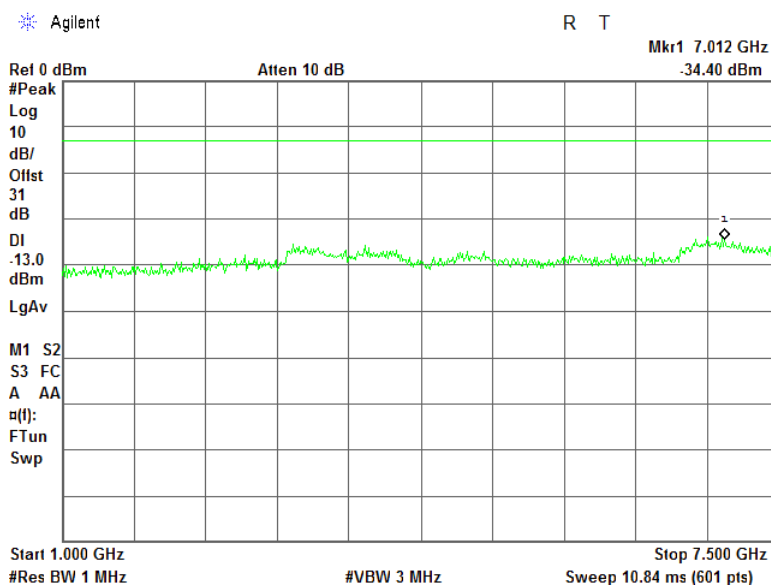


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.9 Spurious emission measurements in 30 - 1000 MHz range at high carrier frequency, RF# 1

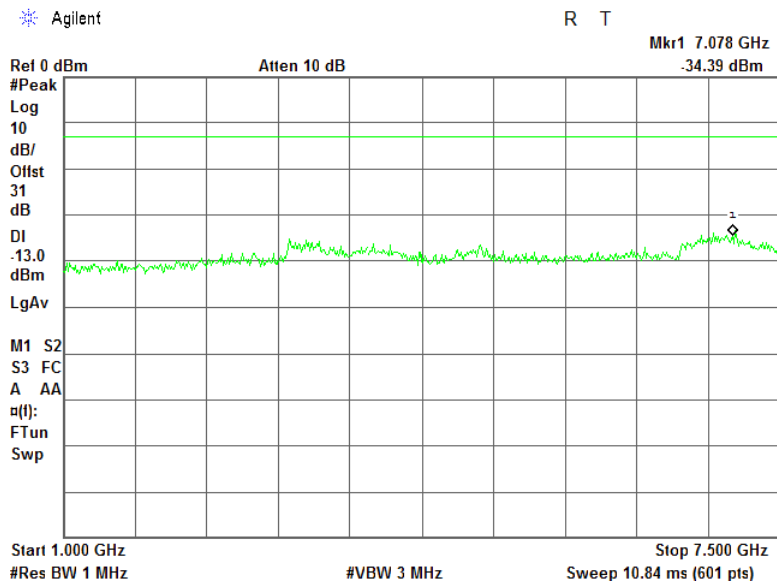


Plot 7.4.10 Spurious emission measurements in 1000 - 7500MHz range at low carrier frequency, RF# 1

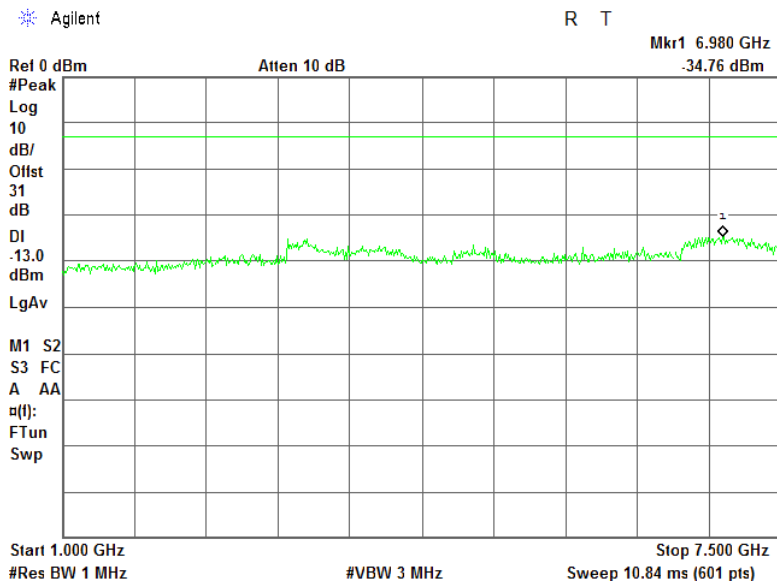


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.11 Spurious emission measurements in 1000 - 7500 MHz at mid carrier frequency, RF# 1

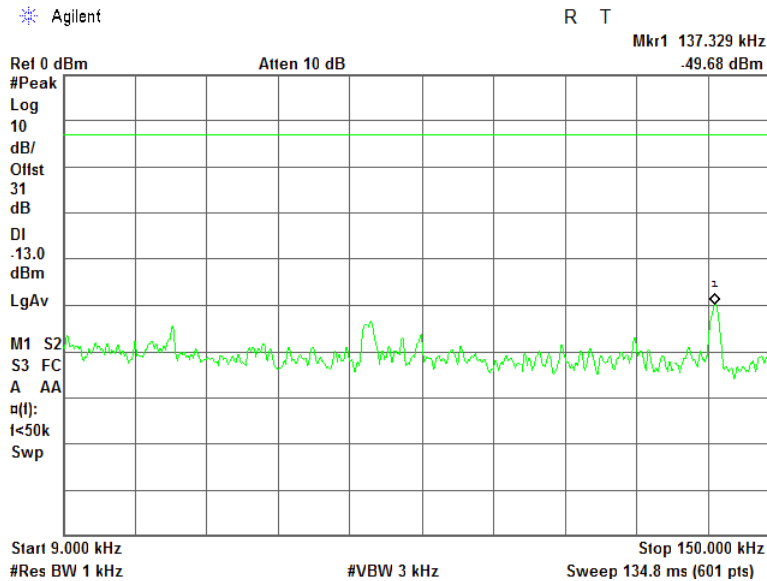


Plot 7.4.12 Spurious emission measurements in 1000 - 7500 MHz at high carrier frequency, RF# 1

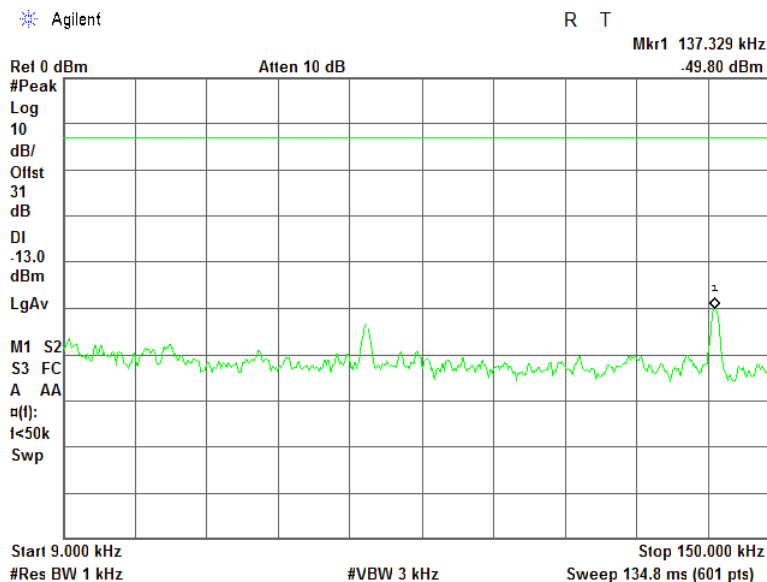


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.13 Spurious emission measurements in 9 - 150 kHz range at low carrier frequency, RF# 2

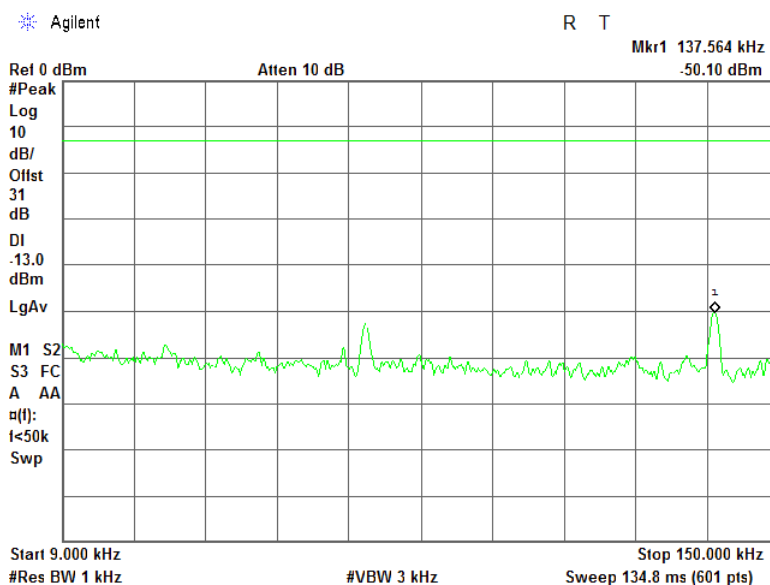


Plot 7.4.14 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency, RF# 2

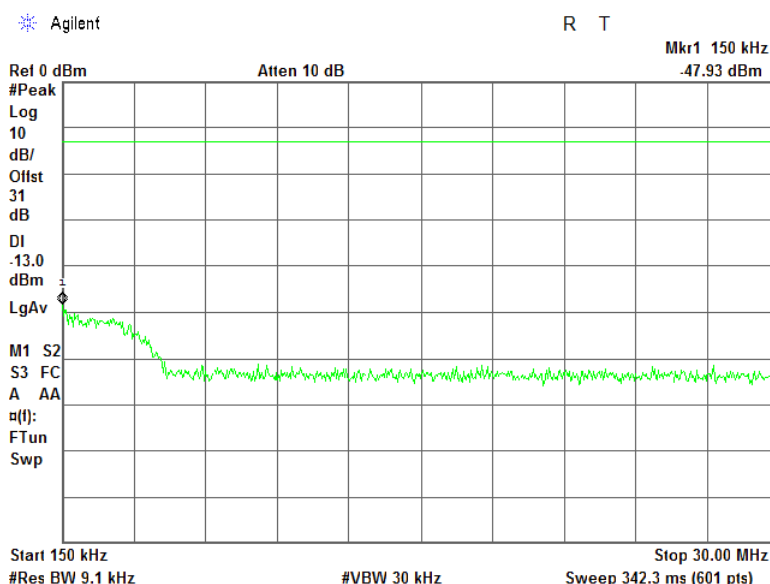


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.15 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency, RF# 2

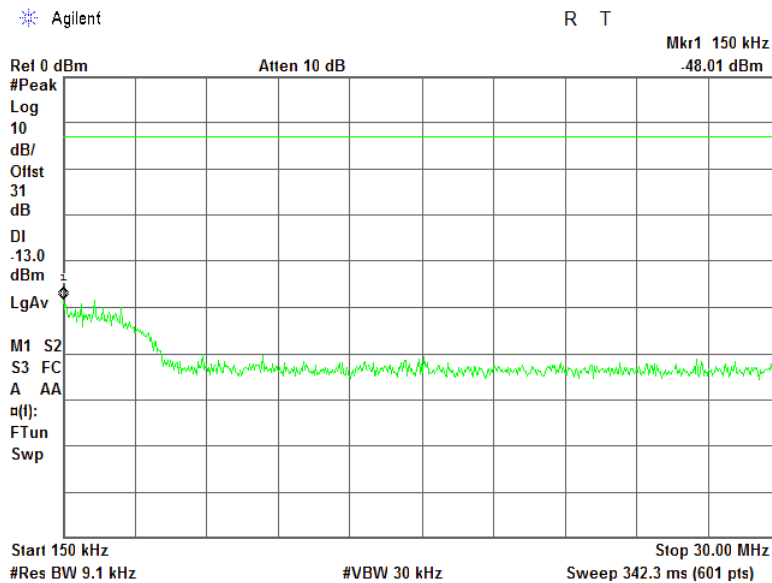


Plot 7.4.16 Spurious emission measurements in 0.15 - 30.0 MHz range at low carrier frequency, RF# 2

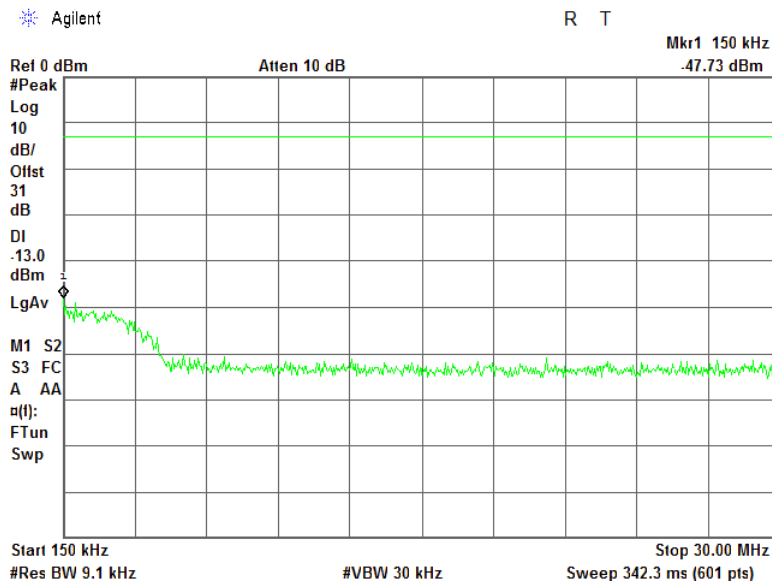


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.17 Spurious emission measurements in 0.15 - 30.0 MHz range at mid carrier frequency, RF# 2

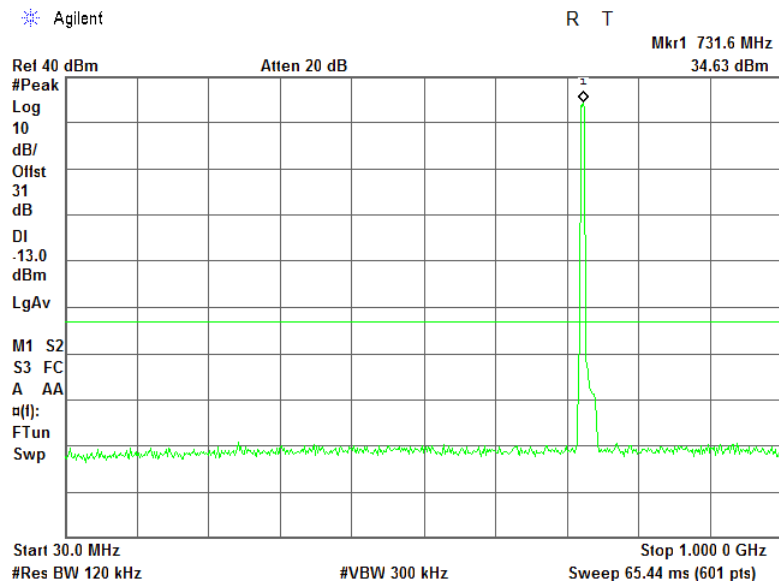


Plot 7.4.18 Spurious emission measurements in 0.15 - 30.0 MHz range at high carrier frequency, RF# 2

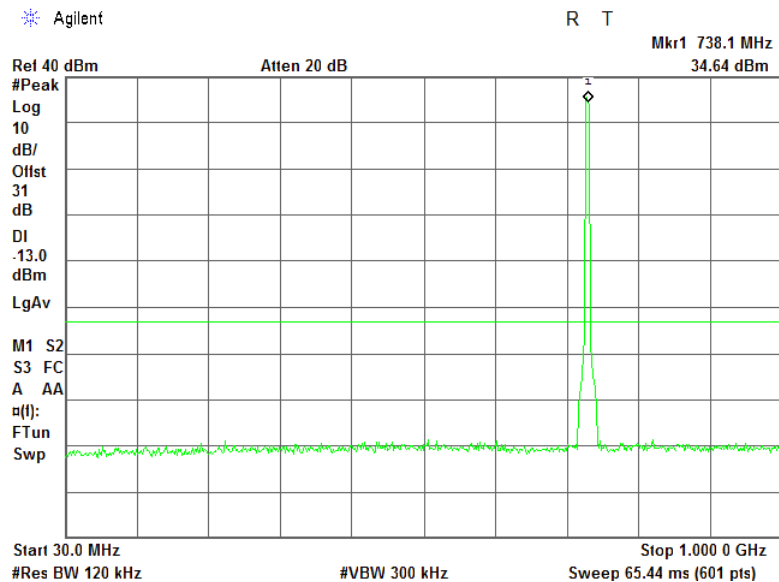


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.19 Spurious emission measurements in 30 - 1000 MHz range at low carrier frequency, RF# 2

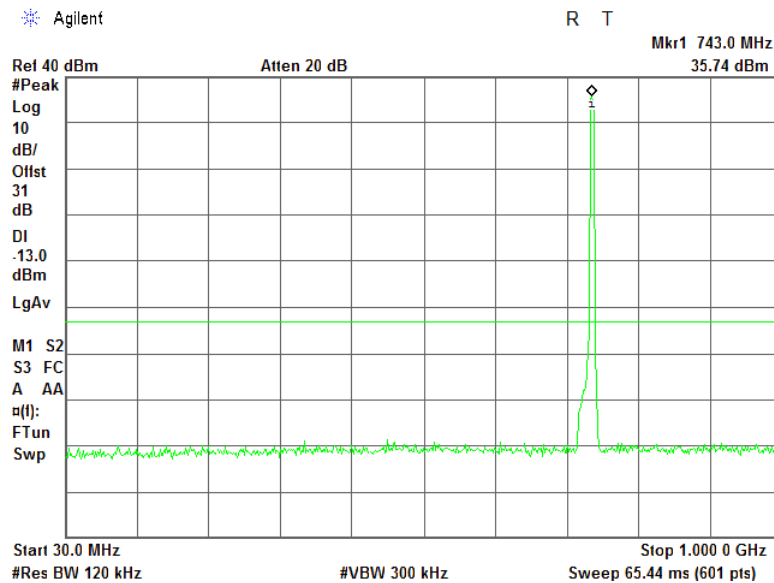


Plot 7.4.20 Spurious emission measurements in 30 - 1000 MHz range at mid carrier frequency, RF# 2

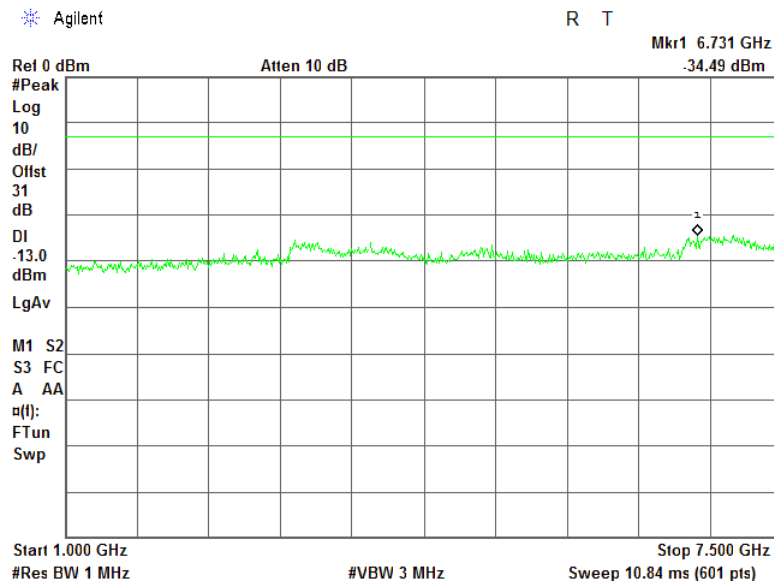


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.21 Spurious emission measurements in 30 - 1000 MHz range at high carrier frequency, RF# 2

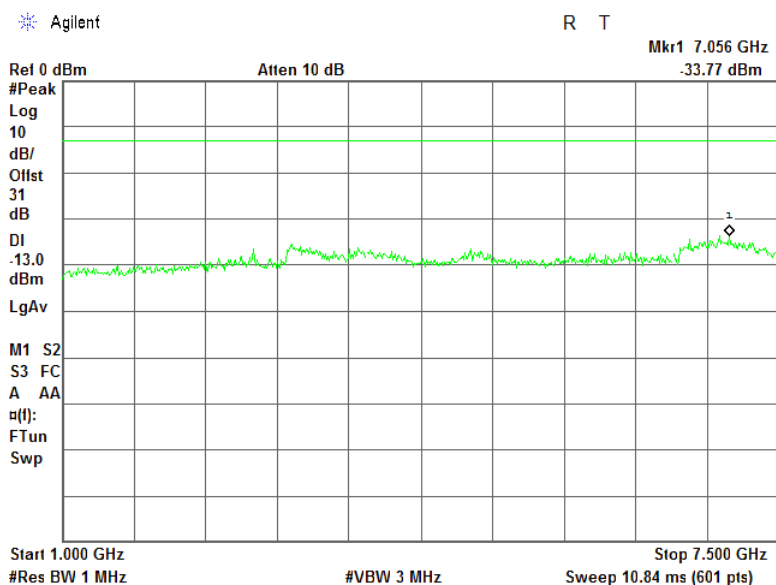


Plot 7.4.22 Spurious emission measurements in 1000 – 7500 MHz range at low carrier frequency, RF# 2

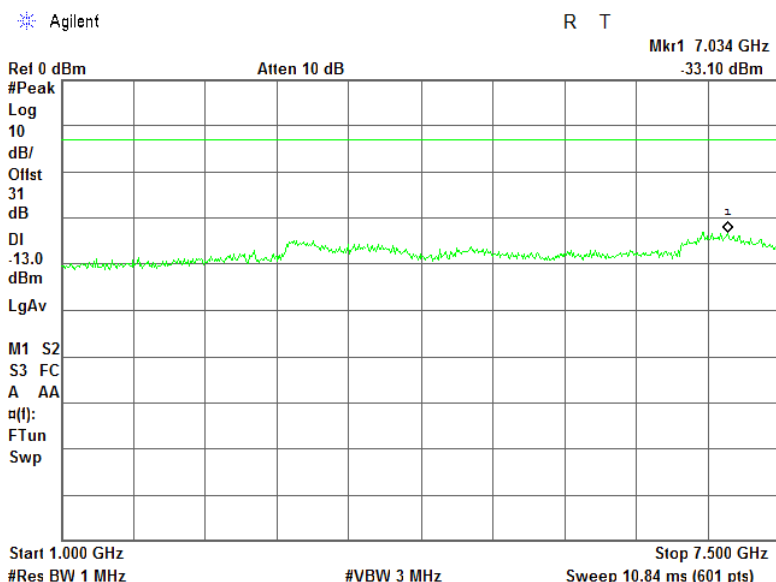


Test specification: Section 27.53(g), Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53(g)			
Test mode: Compliance		Verdict: PASS	
Date(s): 15-Aug-16			
Temperature: 24 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.23 Spurious emission measurements in 1000 - 7500 MHz at mid carrier frequency, RF# 2



Plot 7.4.24 Spurious emission measurements in 1000 - 7500 MHz at high carrier frequency, RF# 2



Test specification: Section 27.53(g), 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): 14-Aug-16			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

7.5 Radiated spurious emission measurements

7.5.1 General

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

Table 7.5.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10 th harmonic*	43+10logP**	-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(g), 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): 14-Aug-16			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

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

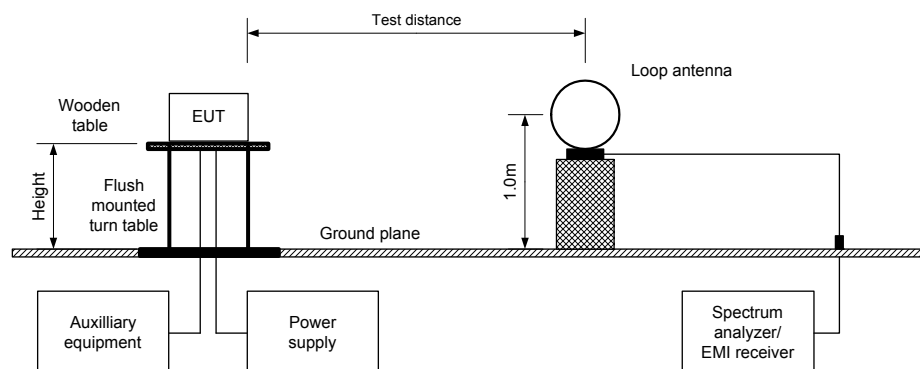
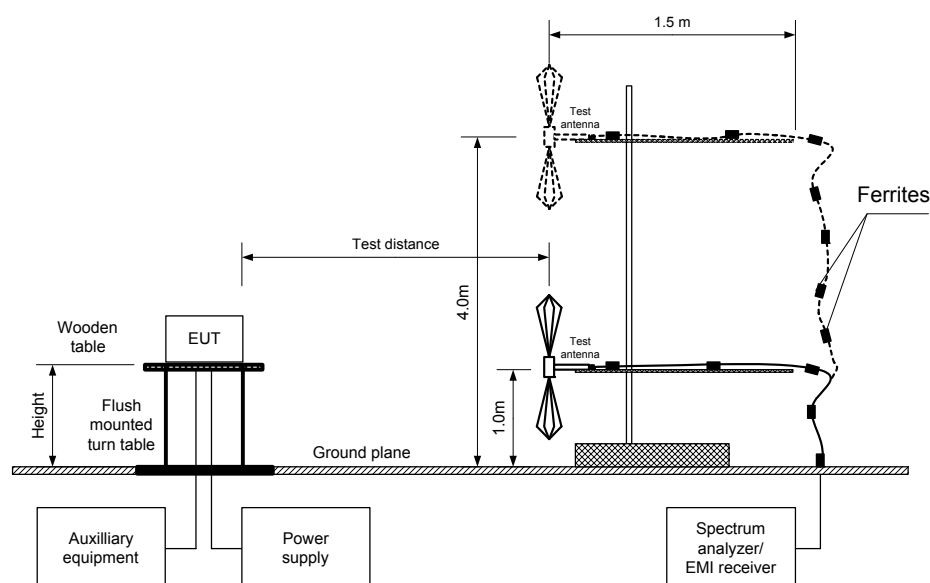


Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz





Test specification: Section 27.53(g), 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): 14-Aug-16			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Table 7.5.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 728 – 746 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Semi anechoic chamber
 EUT HEIGHT: 0.8 m
 INVESTIGATED FREQUENCY RANGE: 0.009 –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
 BIT RATE: 75 Mbps
 TRANSMITTER OUTPUT POWER: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Low carrier frequency MHz							
All spurious were found at least 20 dB below the specified limit							
Mid carrier frequency MHz							
All spurious were found at least 20 dB below the specified limit							
High carrier frequency MHz							
All spurious were found at least 20 dB below the specified limit							

Verdict: Pass

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

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

Reference numbers of test equipment used

HL 0446	HL 0521	HL 0604	HL 1984	HL 2780	HL 4011	HL 4278	HL 4353
---------	---------	---------	---------	---------	---------	---------	---------

Full description is given in Appendix A.

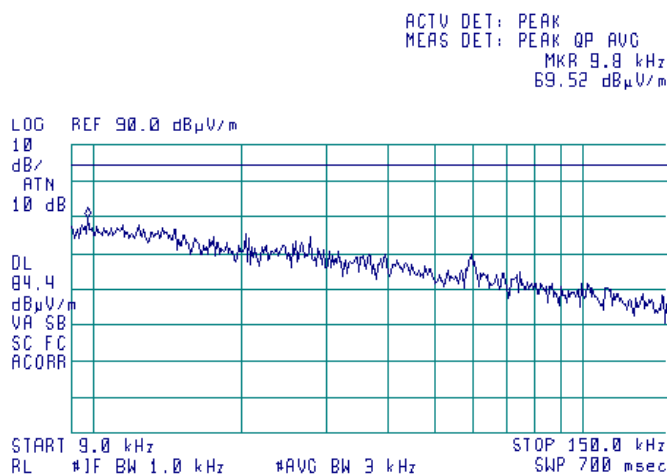


HERMON LABORATORIES

Test specification: Section 27.53(g), 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): 14-Aug-16			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

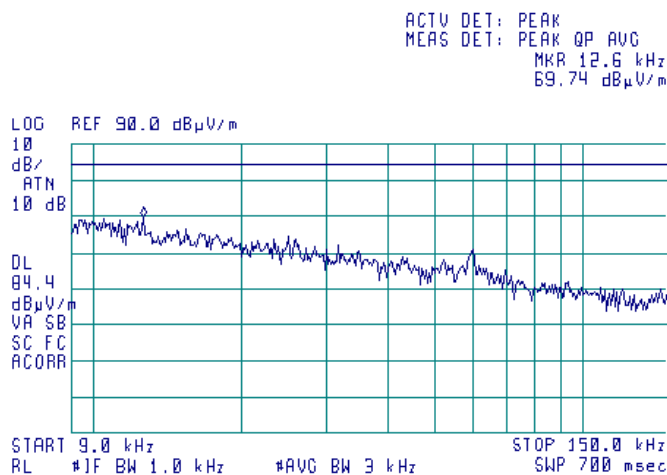
Plot 7.5.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.5.2 Radiated emission measurements in 9 - 150 kHz range

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



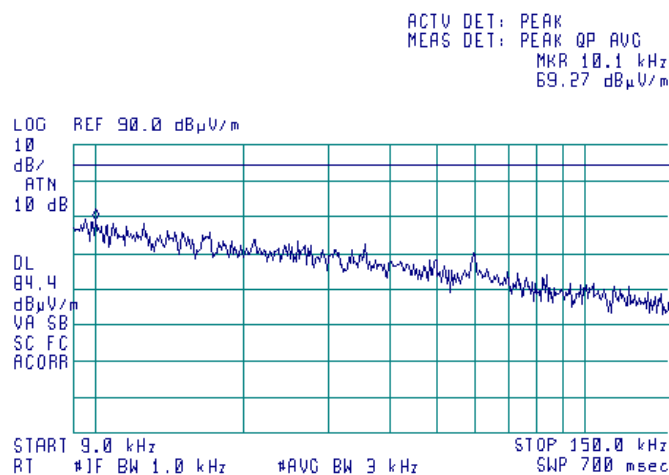


HERMON LABORATORIES

Test specification: Section 27.53(g), 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): 14-Aug-16			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

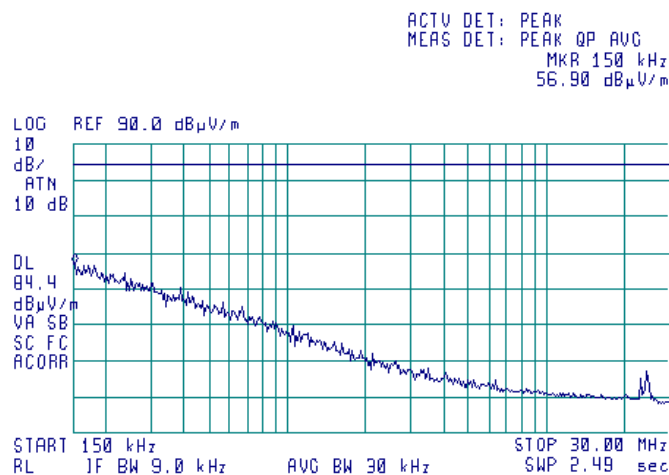
Plot 7.5.3 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.5.4 Radiated emission measurements in 0.15 - 30 MHz range

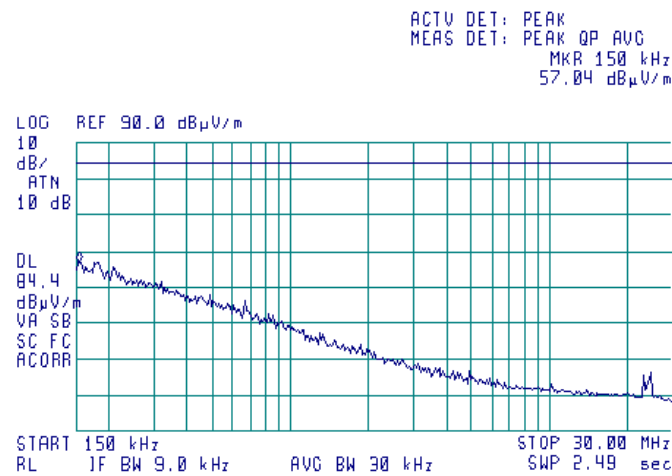
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification: Section 27.53(g), 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): 14-Aug-16			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

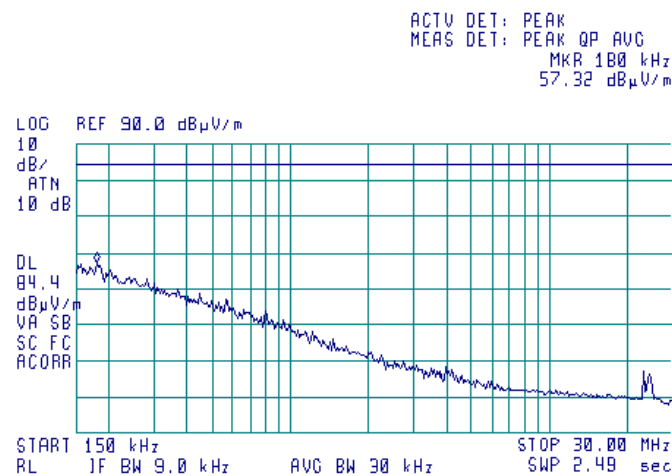
Plot 7.5.5 Radiated emission measurements in 0.15 - 30 MHz range

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



Plot 7.5.6 Radiated emission measurements in 0.15 - 30 MHz range

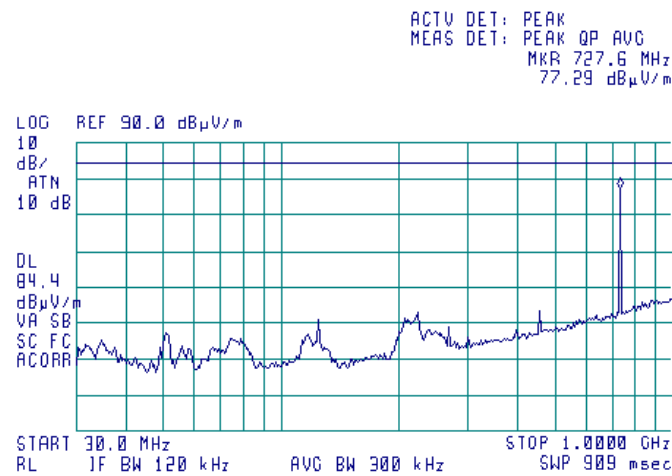
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification: Section 27.53(g), 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): 14-Aug-16			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

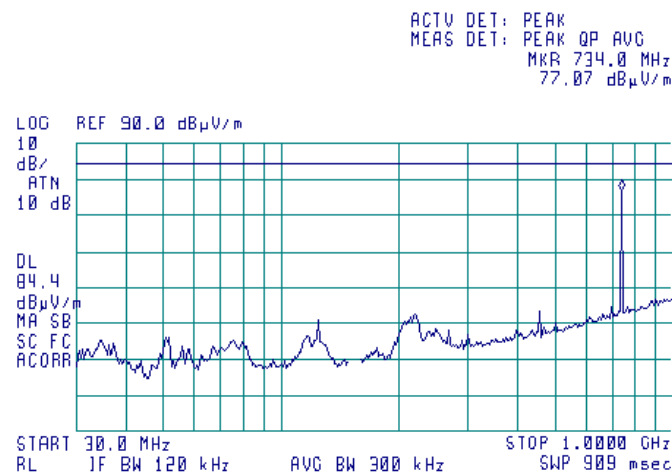
Plot 7.5.7 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.5.8 Radiated emission measurements in 30 - 1000 MHz range

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



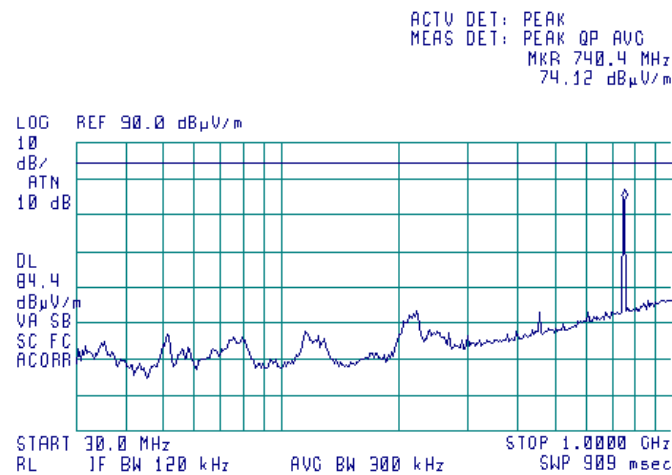


HERMON LABORATORIES

Test specification:		Section 27.53(g), Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053; TIA/EIA-603-D, Section 2.2.12	
Test mode:		Verdict: PASS	
Date(s):			
14-Aug-16			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

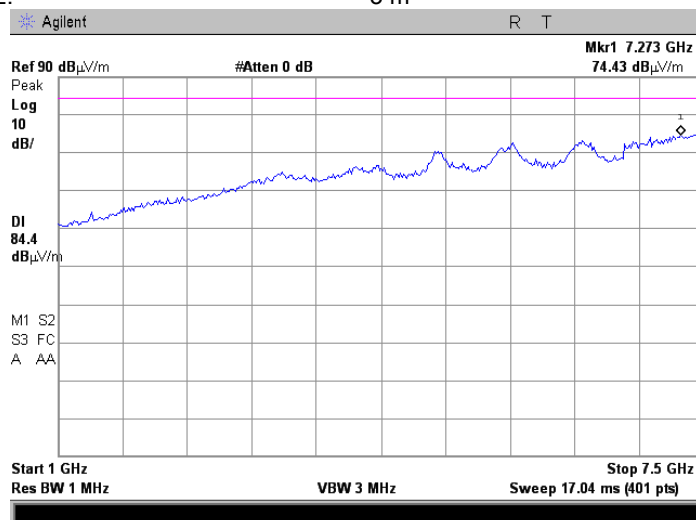
Plot 7.5.9 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.5.10 Radiated emission measurements in 1000 – 7500 MHz range

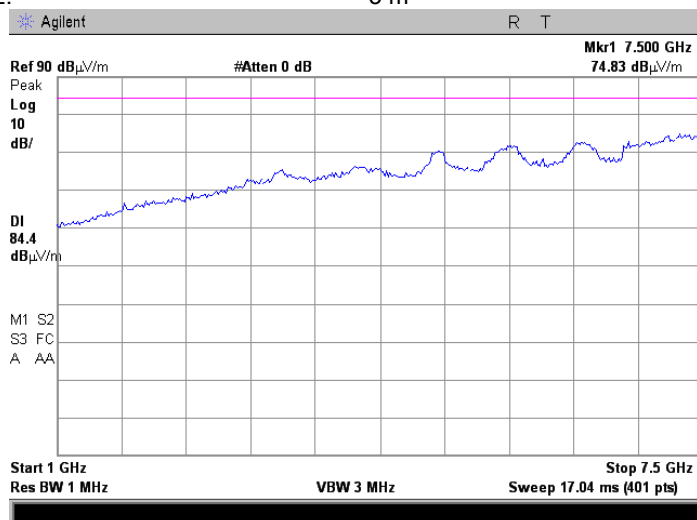
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification: Section 27.53(g), 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): 14-Aug-16			
Temperature: 23 °C	Relative Humidity: 45 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

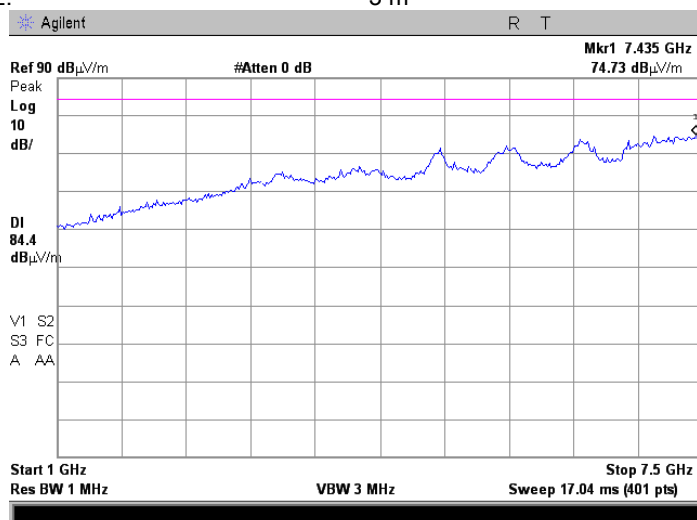
Plot 7.5.11 Radiated emission measurements in 1000 – 7500 MHz range

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



Plot 7.5.12 Radiated emission measurements in 1000 – 7500 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): 16-Aug-16			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

7.6 Frequency stability test

7.6.1 General

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

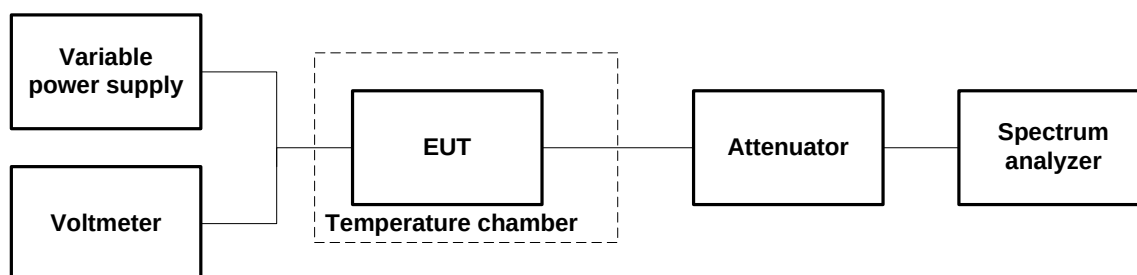
Table 7.6.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement
728.0 – 746.0	The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation

7.6.2 Test procedure

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

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): 16-Aug-16			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Table 7.6.2 Frequency stability test results

OPERATING FREQUENCY: 728.0 – 746.0 MHz
 NOMINAL POWER VOLTAGE: 48 VDC
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 1 kHz
 VIDEO BANDWIDTH: 3 kHz
 MODULATION: Unmodulated

T, °C	Voltage, VDC	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										
-30	nominal	730.500150	730.500050	730.500150	730.500125	730.500150	730.500075	730.500125	0	100
-20	nominal	730.500125	NA	NA	NA	NA	NA	730.500150	0	25
-10	nominal	730.500125	NA	NA	NA	NA	NA	730.500150	0	25
0	nominal	730.500100	730.500050	730.500150	730.500150	730.500125	730.500150	730.500175	25	50
10	nominal	730.500200	NA	NA	NA	NA	NA	730.500175	50	0
20	115%	730.500100	NA	NA	NA	NA	NA	730.500125	0	50
20	Nominal	730.500150	NA	NA	NA	NA	NA	730.500325	175	0
20	85%	730.500150	NA	NA	NA	NA	NA	730.500175	25	0
30	nominal	730.500125	730.500250	730.500075	730.500075	730.500150	730.500150	730.500100	100	75
40	nominal	730.500100	NA	NA	NA	NA	NA	730.500125	0	50
50	nominal	730.500175	NA	NA	NA	NA	NA	730.500200	50	0
Mid carrier frequency										
-30	nominal	737.000150	737.000175	737.000150	737.000150	737.000175	737.000250	737.000150	130	0
-20	nominal	737.000125	NA	NA	NA	NA	NA	737.000125	5	0
-10	nominal	737.000150	NA	NA	NA	NA	NA	737.000075	30	45
0	nominal	737.000175	737.000075	737.000150	737.000200	737.000150	737.000100	737.000125	80	45
10	nominal	737.000125	NA	NA	NA	NA	NA	737.000175	55	0
20	115%	737.000175	NA	NA	NA	NA	NA	737.000050	55	70
20	Nominal	737.000120	NA	NA	NA	NA	NA	737.000150	30	0
20	85%	737.000150	NA	NA	NA	NA	NA	737.000025	30	95
30	nominal	737.000100	737.000150	737.000125	737.000200	737.000150	737.000075	737.000100	80	45
40	nominal	737.000150	NA	NA	NA	NA	NA	737.000275	155	0
50	nominal	737.000125	NA	NA	NA	NA	NA	737.000200	80	0
High carrier frequency										
-30	nominal	743.500025	743.500150	743.500125	743.500150	743.500150	743.500150	743.500175	25	125
-20	nominal	743.500150	NA	NA	NA	NA	NA	743.500275	125	0
-10	nominal	743.500175	NA	NA	NA	NA	NA	743.500150	25	0
0	nominal	743.500300	743.500150	743.500175	743.500125	743.500125	743.500175	743.500150	150	25
10	nominal	743.500150	NA	NA	NA	NA	NA	743.500125	0	25
20	115%	743.500100	NA	NA	NA	NA	NA	743.500200	50	50
20	Nominal	743.500150	NA	NA	NA	NA	NA	743.500150	0	0
20	85%	743.500175	NA	NA	NA	NA	NA	743.500125	25	25
30	nominal	743.500150	743.500175	743.500250	743.500125	743.500050	743.500100	743.500100	100	100
40	nominal	743.500150	NA	NA	NA	NA	NA	743.500250	100	0
50	nominal	743.500150	NA	NA	NA	NA	NA	743.500125	0	25

* - Reference frequency



HERMON LABORATORIES

Report ID: AIRRAD_FCC.28708.docx

Date of Issue: 8-Sep-16

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): 16-Aug-16			
Temperature: 24 °C	Relative Humidity: 42 %	Air Pressure: 1008 hPa	Power: 48 VDC
Remarks:			

Table 7.6.3 Maximum frequency displacement

Channel	Maximum frequency displacement			
	Hz		ppm	
	Positive	Negative	Positive	Negative
Low	175	100	0.24	0.14
Mid	155	95	0.21	0.13
High	150	125	0.20	0.17

Reference numbers of test equipment used

HL 2358	HL 2780	HL 3286	HL 3637	HL 4756			
---------	---------	---------	---------	---------	--	--	--

Full description is given in Appendix A.

8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	18-Jan-16	18-Jan-17
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Oct-15	27-Oct-16
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	10-May-16	10-May-17
1908	Power Splitter / Combiner 0.5-1 GHz	Mini-Circuits	ZAPD-1	1908	14-Jul-15	14-Jul-17
1984	Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz, 300 W	EMC Test Systems	3115	9911-5964	28-Mar-16	28-Mar-17
2011	Power Divider, 0.5-18.0 GHz, 80 W	Omni Spectra	2090-6204-00	NA	01-Dec-14	01-Dec-16
2358	Power Supply, 2 X 0-36VDC / 5A, 5VDC / 5A	Horizon Electronics	DHR3655 D	767469	02-Jun-16	02-Jun-17
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY451024 62	08-Sep-15	08-Sep-16
3286	Temperature Chamber, (-50 to +170) °C	Thermotron	EL-8-CH-1-1-CO2	21-9048	01-Oct-15	01-Oct-16
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	26-Apr-16	26-Jul-17
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	30-Jan-16	30-Apr-17
3435	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	09-Mar-16	09-Mar-17
3442	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	09-Mar-16	09-Mar-17
3637	Cable RF, 3.5 m, N type-N type, DC-6.5 GHz	Alpha Wire	RG 214/U	NA	27-Aug-16	27-Aug-17
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	03-May-16	03-May-17
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1226/2A	15-Feb-16	15-Feb-17
4011	Temp. & Humidity Meter, (-50 - +70) deg, (20 - 99)% RH	Mad Electronics	HTC-1	NA	07-Sep-15	07-Sep-16
4229	Precision Fixed Attenuator, 50 Ohm, 5W, 10dB, DC to 18000 MHz	Mini-Circuits	BW-N10W5+	NA	09-Mar-16	09-Mar-17
4274	Test Cable , DC-18 GHz, 1.8 m, SMA/M - N/M	Mini-Circuits	CBL-6FT-SMNM+	70047	30-May-16	30-May-17
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
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101 003	15-Mar-16	15-Mar-17
4360	EMI Test Receiver, 20 Hz to 40 GHz	Rohde & Schwarz	ESU40	100322	04-Sep-14	04-Sep-16

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
4756	Digital Hygrometer / Thermometer, (0 to +50) deg., (20 to 99) %RH	WESTERN Humidor Corporation	Caliber 4	NA	02-Nov-15	02-Nov-16

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	$\pm 8\%$
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

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

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

Address: P.O. Box 23, Binyamina 30500, Israel.
Telephone: +972 4628 8001
Fax: +972 4628 8277
e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

47CFR part 27: 2015	Private land mobile radio services
47CFR part 1: 2015	Practice and procedure
47CFR part 2: 2015	Frequency allocations and radio treaty matters; general rules and regulations
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI/TIA/EIA-603-D:2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

12 APPENDIX E Test equipment correction factors

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

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

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

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

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

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

Antenna factor
Double-ridged wave guide horn antenna
Model 3115, S/N 9911-5964, HL1984

Frequency, MHz	Antenna factor, dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.6
2500.0	28.9
3000.0	31.2
3500.0	32.0
4000.0	32.5
4500.0	32.7
5000.0	33.6
5500.0	35.1
6000.0	35.4
6500.0	34.9
7000.0	36.1
7500.0	37.8
8000.0	38.0
8500.0	38.1
9000.0	39.1
9500.0	38.3
10000.0	38.6
10500.0	38.2
11000.0	38.7
11500.0	39.5
12000.0	40.0
12500.0	40.4
13000.0	40.5
13500.0	41.1
14000.0	41.6
14500.0	41.7
15000.0	38.7
15500.0	38.2
16000.0	38.8
16500.0	40.5
17000.0	42.5
17500.0	45.9
18000.0	49.4

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).

Cable loss
Cable coaxial, RG-214/U, N type-N type, 3.5 m
Alpha Wire, HL 3637

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.03	3300	2.02
50	0.16	3400	2.11
100	0.24	3500	2.12
200	0.36	3600	2.19
300	0.45	3700	2.24
400	0.54	3800	2.27
500	0.60	3900	2.35
600	0.67	4000	2.35
700	0.74	4100	2.44
800	0.80	4200	2.45
900	0.86	4300	2.51
1000	0.91	4400	2.56
1100	0.97	4500	2.59
1200	1.02	4600	2.65
1300	1.07	4700	2.68
1400	1.13	4800	2.76
1500	1.17	4900	2.78
1600	1.23	5000	2.86
1700	1.30	5100	2.91
1800	1.33	5200	2.95
1900	1.37	5300	3.05
2000	1.43	5400	3.05
2100	1.48	5500	3.14
2200	1.52	5600	3.16
2300	1.57	5700	3.23
2400	1.61	5800	3.31
2500	1.66	5900	3.34
2600	1.70	6000	3.45
2700	1.75	6100	3.46
2800	1.80	6200	3.56
2900	1.84	6300	3.61
3000	1.89	6400	3.68
3100	1.94	6500	3.77
3200	1.99		

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 70047, 18 GHz, 1.8 m, SMA/M - N/M
CBL-6FT-SMNM+, HL 4274

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.07	4800	1.69	9800	2.62	14800	3.42
30	0.11	4900	1.70	9900	2.63	14900	3.39
50	0.14	5000	1.72	10000	2.64	15000	3.38
100	0.21	5100	1.75	10100	2.64	15100	3.40
200	0.26	5200	1.76	10200	2.66	15200	3.41
300	0.30	5300	1.77	10300	2.67	15300	3.40
400	0.37	5400	1.79	10400	2.68	15400	3.39
500	0.44	5500	1.82	10500	2.68	15500	3.41
600	0.49	5600	1.85	10600	2.70	15600	3.44
700	0.54	5700	1.86	10700	2.71	15700	3.46
800	0.58	5800	1.87	10800	2.73	15800	3.45
900	0.63	5900	1.91	10900	2.74	15900	3.47
1000	0.67	6000	1.94	11000	2.76	16000	3.51
1100	0.71	6100	1.97	11100	2.77	16100	3.56
1200	0.75	6200	1.98	11200	2.78	16200	3.55
1300	0.78	6300	1.99	11300	2.79	16300	3.54
1400	0.81	6400	2.02	11400	2.80	16400	3.57
1500	0.85	6500	2.05	11500	2.82	16500	3.62
1600	0.88	6600	2.06	11600	2.83	16600	3.61
1700	0.91	6700	2.06	11700	2.84	16700	3.60
1800	0.94	6800	2.08	11800	2.85	16800	3.62
1900	0.97	6900	2.10	11900	2.87	16900	3.68
2000	1.00	7000	2.12	12000	2.88	17000	3.70
2100	1.03	7100	2.12	12100	2.89	17100	3.68
2200	1.06	7200	2.13	12200	2.90	17200	3.70
2300	1.08	7300	2.16	12300	2.92	17300	3.80
2400	1.11	7400	2.19	12400	2.94	17400	3.84
2500	1.14	7500	2.22	12500	2.95	17500	3.83
2600	1.16	7600	2.23	12600	2.96	17600	3.83
2700	1.19	7700	2.26	12700	2.98	17700	3.86
2800	1.21	7800	2.30	12800	3.00	17800	3.86
2900	1.27	7900	2.33	12900	3.02	17900	3.80
3000	1.29	8000	2.35	13000	3.03	18000	3.79
3100	1.32	8100	2.37	13100	3.06		
3200	1.35	8200	2.41	13200	3.08		
3300	1.37	8300	2.44	13300	3.09		
3400	1.38	8400	2.47	13400	3.10		
3500	1.41	8500	2.48	13500	3.13		
3600	1.43	8600	2.51	13600	3.17		
3700	1.46	8700	2.53	13700	3.17		
3800	1.47	8800	2.55	13800	3.18		
3900	1.49	8900	2.56	13900	3.22		
4000	1.52	9000	2.57	14000	3.26		
4100	1.55	9100	2.58	14100	3.28		
4200	1.56	9200	2.59	14200	3.30		
4300	1.58	9300	2.59	14300	3.35		
4400	1.60	9400	2.60	14400	3.39		
4500	1.63	9500	2.60	14500	3.39		
4600	1.65	9600	2.61	14600	3.39		
4700	1.67	9700	2.61	14700	3.41		

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

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

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

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

13 APPENDIX F Abbreviations and acronyms

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

END OF DOCUMENT