HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

Hermon Laboratories Ltd.
Harakevet Industrial Zone, Binyamina 30500,
Israel
Tel. +972-4-6288001
Fax. +972-4-6288277
E-mail: mail@hermonlabs.com

TEST REPORT

ACCORDING TO: FCC 47 CFR part 15 section 15.255

FOR:

Siklu Communication Ltd.

Point-to-point wireless Ethernet link operating in 57-64 GHz

Model: EtherHaul EH-600T

FCC ID:2ACYESK-60GTDD-A1

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1 Applicant information

Client name:	Siklu Communication Ltd.
Address:	43 Hasivim street, Petach-Tikva 49517, Israel
Telephone:	+972 3921 4015
Fax:	+972 3921 4162
E-mail:	baruch@siklu.com
Contact name:	Mr. Baruch Schwarz

2 Equipment under test attributes

Product name:	Point-to-point wireless Ethernet link operating at 57-64 GHz
Product type:	Transceiver
Model(s):	EtherHaul EH-600T
Serial number:	S344000254
Hardware version:	A0
Software release:	V5.2.1
Receipt date	6/12/2014

3 Manufacturer information

Manufacturer name:	Siklu Communication Ltd.
Address:	43 Hasivim street, Petach-Tikva 49517, Israel
Telephone:	+972 3921 4015
Fax:	+972 3921 4162
E-Mail:	baruch@siklu.com
Contact name:	Mr. Baruch Schwarz

4 Test details

Project ID:	25826
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	6/12/2014
Test completed:	8/07/2014
Test specification(s):	FCC 47 CFR part 15 section 15.255

5 Tests summary

Test	Status
Section 15.255(b)(e), Transmitter power and power spectral density	Pass
Section 15.215(c), 2.1049, Occupied bandwidth	Pass
Section 15.255(c), Conducted spurious emissions	Pass
Section 15.255(c)(b), Radiated spurious emissions below 40 GHz	Pass
Section 15. 255(c)(3), Radiated emissions outside assigned band and above 40 GHz up to 220 GHz	Pass
Section 15.255(f), Frequency tolerance	Tested without limit
Section 15.255(g), RF exposure	Pass, exhibit included in Application for certification

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

This test report supersedes the previously issued test report identified by Doc ID:SIKRAD_FCC.25826_rev1.

	Name and Title	Date	Signature
Tested by:	Mr. S. Samokha, test engineer	August 7, 2014	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	August 27, 2014	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	September 3, 2014	

6 EUT description

6.1 General information

The EUT, EtherHaul EH-600T Outdoor unit of point-to-point high BW system, is the first TDD member of Siklu's EtherHaul family of wireless products, featuring carrier grade, high capacity Ethernet with flexible support of the 57-64 GHz regulated E-Band. The EtherHaul EH-600T radio supports up to 1 Gbps.
Siklu's EtherHaul EH-600T wireless backhaul radio link operates in the new E-band spectrum, which has clear technological and economical advantages over the existing lower frequency bands.
The EtherHaul EH-600T system comprises:
• the EtherHaul EH-600T outdoor unit (radio link unit and antenna);
• the EtherHaul system host software and command line interface for complete and flexible system configuration, administration and management.
The EUT system is powered from 48 VDC.

6.2 Ports and lines

Port type	Port description	Conected from	Connected to	Qty.	Cable type	Cable length, m
Telecom	Ethernet	EUT	EUT (Loop)	2	F.O.	2
Signal	USB	For debugging only	Not connected	1	NA	NA
Power	AC	AC mains	DC power supply	1	Unshielded	10
Power	48 VDCDC	DC power supply	EUT	1	Unshielded	1.5

6.3 Support and test equipment

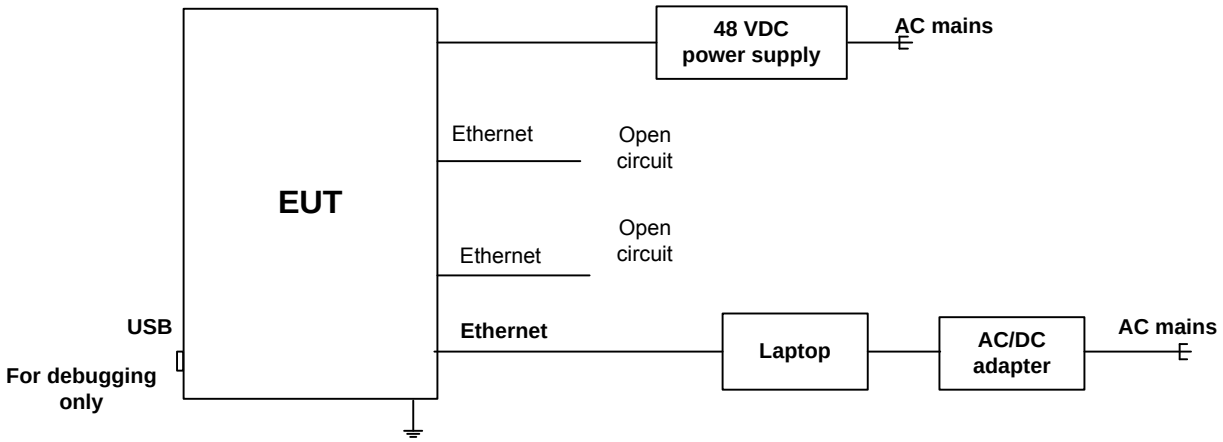
Description	Manufacturer	Model number	Serial number
Laptop	Lenovo	ThinkPad T61	L3-E0080
AC/DC adapter	PHIHONG	PDA041B-48VB	NA
Power supply	MEAN WELL	MRD- 40-48	RB11015370

6.4 Changes made in the EUT

No changes were performed in the EUT during testing.

6.5 Test configuration

6.5.1 EUT test configuration



6.6 Transmitter characteristics

Type of equipment	
V	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**
V	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	57.0 GHz – 64.0 GHz
Operating frequencies (tested)	57375, 60375, 63375 MHz for all BW
Maximum rated output power	At transmitter 50 Ω RF output connector: 8.32 dBm

Is transmitter output power variable?				
	V	No		
		Yes		continuous variable
				stepped variable with stepsize: dB
			minimum RF power: dBm	
			maximum RF power:	

Antenna connection			
unique coupling	**V** standard connector	Integral	with temporary RF connector
			without temporary RF connector

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Integrated (cassegrain reflector)	Siklu Ltd.	VSAN003	35 dBi

Transmitter 99% power bandwidth, MHz	**Transmitter aggregate data rate/s, Mbps**	**Type of modulation**
62.5	20	QPSK
125	40	QPSK
250	80	QPSK
500	160	QPSK
500	852	16QAM
500	1280	64QAM

Type of multiplexing	TDD

Transmitter power source					
		Nominal rated voltage		Battery type	
V	DC	**Nominal rated voltage**	48 V		
		Voltage range	36-57 V		
	AC mains	**Nominal rated voltage**		Frequency	

Common power source for transmitter and receiver	**V** yes	no

Test specification:	Section 15.255(b)(e), Transmitter power and power spectral density		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	Air Pressure: 1007 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

7 Transmitter tests

7.1 Transmitter power and maximum power spectral density test

7.1.1 General

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

Table 7.1.1 Power density limits

Assigned frequency range, MHz	Maximum power density, μW/cm^2			
	Detector Peak		Detector Average	
	μW/cm^2	dBuV/m	μW/cm^2	dBuV/m
57000 – 64000	18.0	138.0	9.0	135.0

Table 7.1.2 Conducted output power limits

Assigned frequency range, MHz	Maximum output power			
	Detector Peak		Detector Average	
	mW	dBm	mW	dBm
57000 – 64000	500	27.0	500	27.0

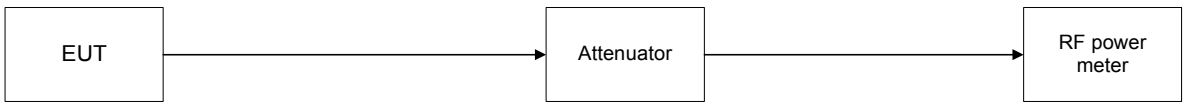
7.1.2 Test procedure

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

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

7.1.2.3 The peak output power was measured with spectrum analyzer as provided in Table 7.1.3, Table 7.1.4 and associated plots.

Figure 7.1.1 Peak output power test setup



Test specification:	**Section 15.255(b)(e), Transmitter power and power spectral density**		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	**Verdict:**	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	**Air Pressure:** 1007 hPa	**Relative Humidity:** 42%	**Power Supply:** 48 VDC
Remarks:			

Table 7.1.3 Peak output power test results

OPERATING FREQUENCY RANGE: 57.0 – 64.0 GHz
DETECTOR USED: Power Peak
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 50 MHz
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Modulation	Bit rate, Mbps	SA reading, dBm	Duty Cycle, %	Maximum output power, dBm	Limit, dBm	Margin, dB**	Verdict
Emission Bandwidth 62.5 MHz								
57375	QPSK	20	7.65	100	7.65	25.0*	-17.35	Pass
60375	QPSK	20	8.32	100	8.32	25.0*	-16.68	Pass
63375	QPSK	20	7.77	100	7.77	25.0*	-17.23	Pass
Emission Bandwidth 125 MHz								
57375	QPSK	40	7.55	100	7.55	27.0	-19.45	Pass
60375	QPSK	40	7.75	100	7.75	27.0	-19.25	Pass
63375	QPSK	40	7.77	100	7.77	27.0	-19.23	Pass
Emission Bandwidth 250 MHz								
57375	QPSK	80	7.53	100	7.53	27.0	-19.47	Pass
60375	QPSK	80	7.79	100	7.79	27.0	-19.21	Pass
63375	QPSK	80	7.79	100	7.79	27.0	-19.21	Pass
Emission Bandwidth 500 MHz								
57375	QPSK	160	7.27	100	7.27	27.0	-19.73	Pass
	16QAM	852	7.33	100	7.33	27.0	-19.67	Pass
	64QAM	1280	7.24	100	7.24	27.0	-19.76	Pass
60375	QPSK	160	7.56	100	7.56	27.0	-19.44	Pass
	16QAM	852	7.71	100	7.71	27.0	-19.29	Pass
	64QAM	1280	7.72	100	7.72	27.0	-19.28	Pass
63375	QPSK	160	7.28	100	7.28	27.0	-19.72	Pass
	16QAM	852	7.79	100	7.79	27.0	-19.21	Pass
	64QAM	1280	7.83	100	7.83	27.0	-19.17	Pass

*****- Limit reduced for emission bandwidth less than 100 MHz
******- Margin = RF power – Limit

Test specification:	**Section 15.255(b)(e), Transmitter power and power spectral density**		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	**Verdict:**	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	**Air Pressure:** 1007 hPa	**Relative Humidity:** 42%	**Power Supply:** 48 VDC
Remarks:			

Table 7.1.4 Peak output power test results

OPERATING FREQUENCY RANGE: 57.0 – 64.0 GHz
DETECTOR USED: Average
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 50 MHz
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Modulation	Bit rate, Mbps	SA reading, dBm	Duty Cycle, %	Maximum output power, dBm	Limit, dBm	Margin, dB**	Verdict
Emission Bandwidth 62.5 MHz								
57375	QPSK	20	4.99	100	4.99	25.0*	-20.01	Pass
60375	QPSK	20	5.39	100	5.39	25.0*	-19.61	Pass
63375	QPSK	20	5.23	100	5.23	25.0*	-19.77	Pass
Emission Bandwidth 125 MHz								
57375	QPSK	40	5.13	100	5.13	27.0	-21.87	Pass
60375	QPSK	40	5.19	100	5.19	27.0	-21.81	Pass
63375	QPSK	40	5.11	100	5.11	27.0	-21.89	Pass
Emission Bandwidth 250 MHz								
57375	QPSK	80	4.88	100	4.88	27.0	-22.12	Pass
60375	QPSK	80	5.15	100	5.15	27.0	-21.85	Pass
63375	QPSK	80	5.17	100	5.17	27.0	-21.83	Pass
Emission Bandwidth 500 MHz								
57375	QPSK	160	4.53	100	4.53	27.0	-22.47	Pass
	16QAM	852	4.16	100	4.16	27.0	-22.84	Pass
	64QAM	1280	4.62	100	4.62	27.0	-22.38	Pass
60375	QPSK	160	5.18	100	5.18	27.0	-21.82	Pass
	16QAM	852	5.19	100	5.19	27.0	-21.81	Pass
	64QAM	1280	5.19	100	5.19	27.0	-21.81	Pass
63375	QPSK	160	4.90	100	4.90	27.0	-22.10	Pass
	16QAM	852	5.25	100	5.25	27.0	-21.75	Pass
	64QAM	1280	5.31	100	5.31	27.0	-21.69	Pass

*****- Limit reduced for emission bandwidth less than 100 MHz
******- Margin = RF power – Limit

Test specification:	**Section 15.255(b)(e), Transmitter power and power spectral density**		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	**Verdict:**	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	**Air Pressure:** 1007 hPa	**Relative Humidity:** 42%	**Power Supply:** 48 VDC
Remarks:			

Table 7.1.5 Peak power density test results

OPERATING FREQUENCY RANGE: 57.0 – 64.0 GHz
DETECTOR USED: Power Peak
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 50 MHz
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Modulation	Bit rate, Mbps	SA reading, dBm/MHz	Duty Cycle, %	Field strength, dBuV/m **	Limit, dBuV/m	Margin, dB*	Verdict
Emission Bandwidth 62.5 MHz								
57375	QPSK	20	-5.73	100	124.50	138.0	-13.50	Pass
60375	QPSK	20	-5.32	100	124.91	138.0	-13.09	Pass
63375	QPSK	20	-5.77	100	124.46	138.0	-13.54	Pass
Emission Bandwidth 125 MHz								
57375	QPSK	40	-8.76	100	121.47	138.0	-16.53	Pass
60375	QPSK	40	-8.79	100	121.44	138.0	-16.56	Pass
63375	QPSK	40	-8.78	100	121.45	138.0	-16.55	Pass
Emission Bandwidth 250 MHz								
57375	QPSK	80	-11.34	100	118.89	138.0	-19.11	Pass
60375	QPSK	80	-11.02	100	119.21	138.0	-18.79	Pass
63375	QPSK	80	-10.65	100	119.58	138.0	-18.42	Pass
Emission Bandwidth 500 MHz								
57375	QPSK	160	-13.77	100	116.46	138.0	-21.54	Pass
	16QAM	852	-13.14	100	117.09	138.0	-20.91	Pass
	64QAM	1280	-13.34	100	116.89	138.0	-21.11	Pass
60375	QPSK	160	-12.89	100	117.34	138.0	-20.66	Pass
	16QAM	852	-11.13	100	119.10	138.0	-18.90	Pass
	64QAM	1280	-12.15	100	118.08	138.0	-19.92	Pass
63375	QPSK	160	-13.92	100	116.31	138.0	-21.69	Pass
	16QAM	852	-11.95	100	118.28	138.0	-19.72	Pass
	64QAM	1280	-11.64	100	118.59	138.0	-19.41	Pass

***** - Margin = Power density – Limit

** - Field strength, dBuV/m = SA reading + Antenna Gain + 95.2 dB
where - SA Reading is the peak power density in dBm (with1 MHz RBW), Antenna Gain = 35.0 dBi and 95.2 dB is a correction factor for 3 m test distance.

Test specification:	**Section 15.255(b)(e), Transmitter power and power spectral density**		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	**Verdict:**	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	**Air Pressure:** 1007 hPa	**Relative Humidity:** 42%	**Power Supply:** 48 VDC
Remarks:			

Table 7.1.6 Average power density test results

OPERATING FREQUENCY RANGE: 57.0 – 64.0 GHz
DETECTOR USED: Average
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 50 MHz
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Modulation	Bit rate, Mbps	SA reading, dBm/MHz	Duty Cycle, %	Field strength, dBuV/m **	Limit, dBuV/m	Margin, dB*	Verdict
Emission Bandwidth 62.5 MHz								
57375	QPSK	20	-7.72	100	122.51	135.0	-12.49	Pass
60375	QPSK	20	-7.73	100	122.50	135.0	-12.50	Pass
63375	QPSK	20	-7.78	100	122.45	135.0	-12.55	Pass
Emission Bandwidth 125 MHz								
57375	QPSK	40	-9.52	100	120.71	135.0	-14.29	Pass
60375	QPSK	40	-9.96	100	120.27	135.0	-14.73	Pass
63375	QPSK	40	-9.66	100	120.57	135.0	-14.43	Pass
Emission Bandwidth 250 MHz								
57375	QPSK	80	-12.32	100	117.91	135.0	-17.09	Pass
60375	QPSK	80	-12.63	100	117.60	135.0	-17.40	Pass
63375	QPSK	80	-12.21	100	118.02	135.0	-16.98	Pass
Emission Bandwidth 500 MHz								
57375	QPSK	160	-15.18	100	115.05	135.0	-19.95	Pass
	16QAM	852	-15.47	100	114.76	135.0	-20.24	Pass
	64QAM	1280	-15.13	100	115.10	135.0	-19.90	Pass
60375	QPSK	160	-14.82	100	115.41	135.0	-19.59	Pass
	16QAM	852	-13.38	100	116.85	135.0	-18.15	Pass
	64QAM	1280	-13.83	100	116.40	135.0	-18.60	Pass
63375	QPSK	160	-15.33	100	114.90	135.0	-20.10	Pass
	16QAM	852	-13.88	100	116.35	135.0	-18.65	Pass
	64QAM	1280	-14.12	100	116.11	135.0	-18.89	Pass

***** - Margin = Power density – Limit

** - Field strength, dBuV/m = SA reading + Antenna Gain + 95.2 dB
where - SA Reading is the peak power density in dBm (with1 MHz RBW), Antenna Gain = 35.0 dBi and 95.2 dB is a correction factor for 3 m test distance.

Reference numbers of test equipment used

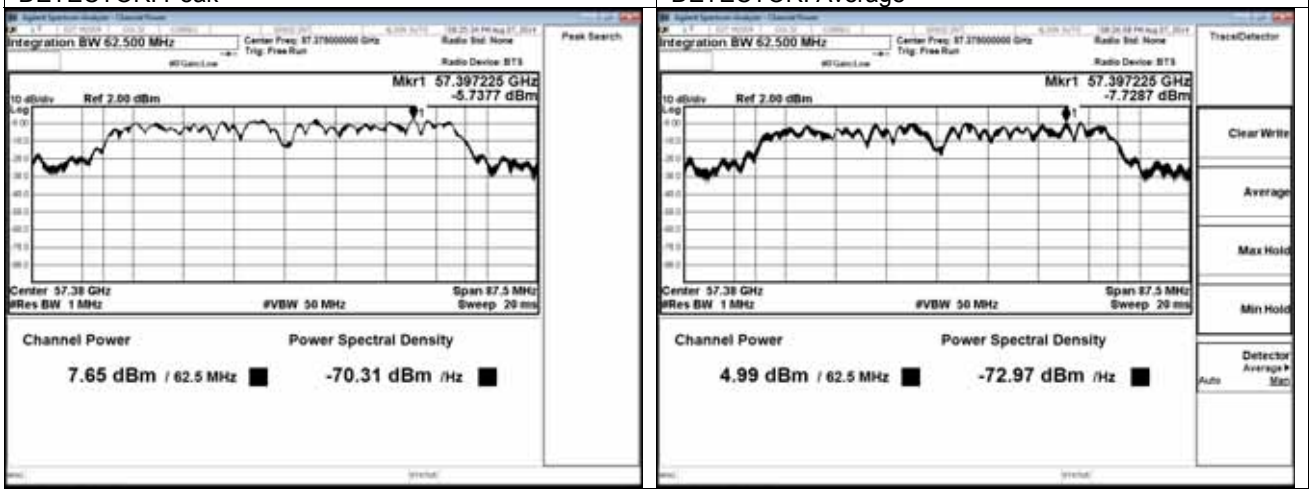
HL 1303	HL 2358	HL 2909	HL 3291	HL 3295	HL 3305	HL 3433	HL 3434

Full description is given in Appendix A.

Test specification:	Section 15.255(b)(e), Transmitter power and power spectral density		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	Air Pressure: 1007 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

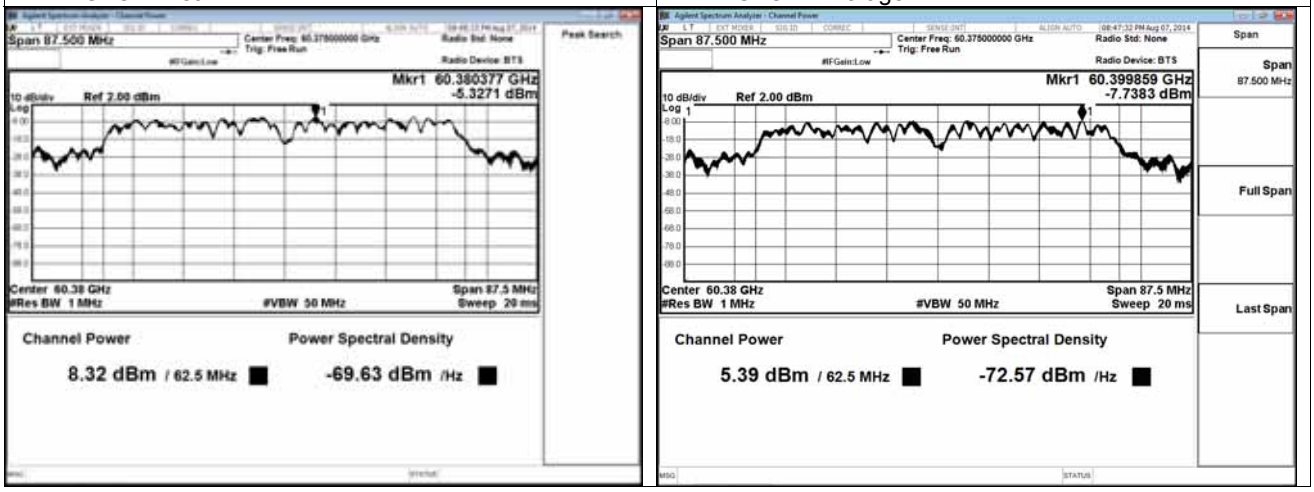
Plot 7.1.1 Output power test result at the low frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	62.5 MHz
DETECTOR: Peak	DETECTOR: Average



Plot 7.1.2 Output power test result at the mid frequency

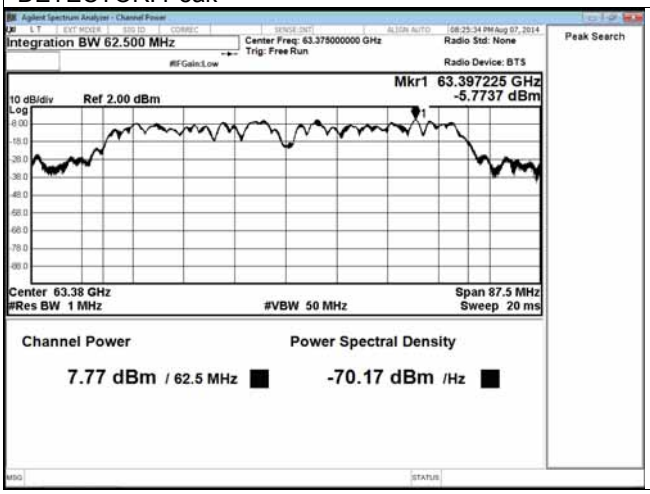
MODULATION:	QPSK
EMISSION BANDWIDTH:	62.5 MHz
DETECTOR: Peak	DETECTOR: Average

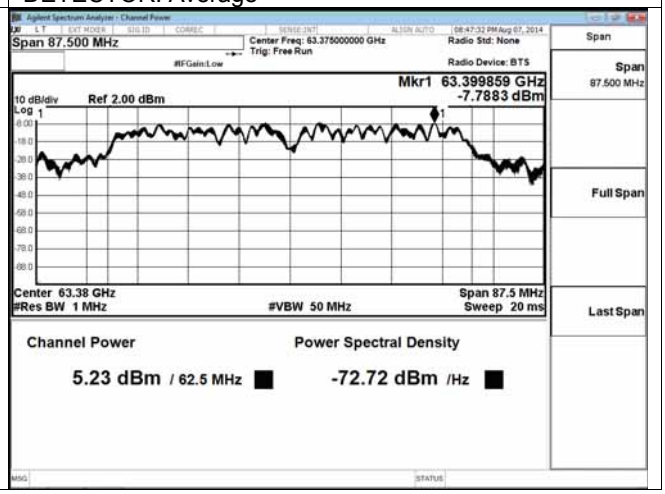


Test specification:	Section 15.255(b)(e), Transmitter power and power spectral density		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	Air Pressure: 1007 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

Plot 7.1.3 Output power test result at the high frequency

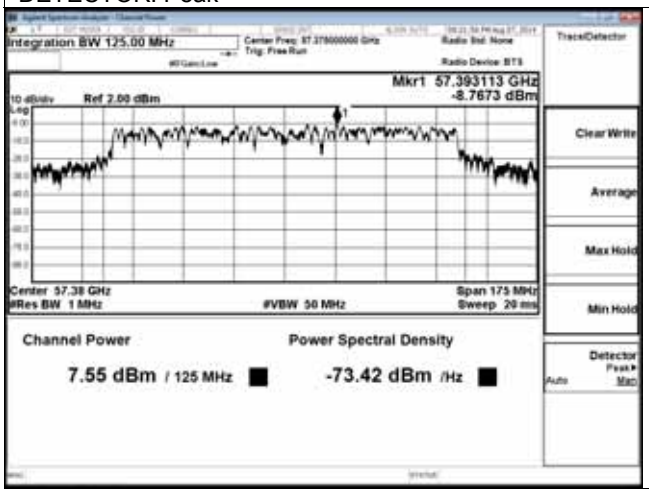
MODULATION:	QPSK
EMISSION BANDWIDTH:	62.5 MHz
DETECTOR: Peak	DETECTOR: Average

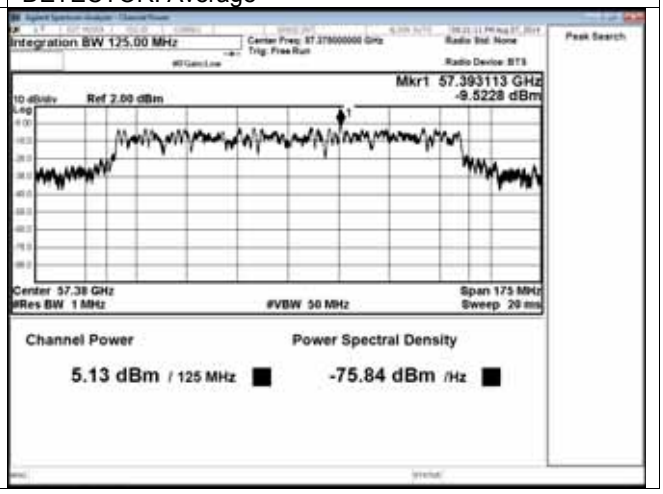




Plot 7.1.4 Output power test result at the low frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	125 MHz
DETECTOR: Peak	DETECTOR: Average

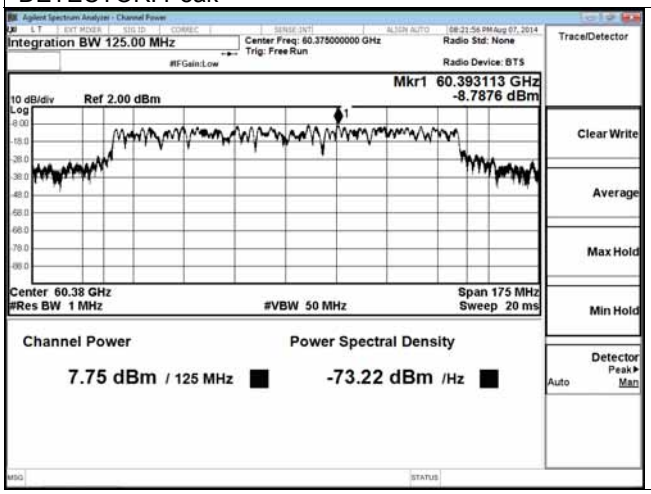


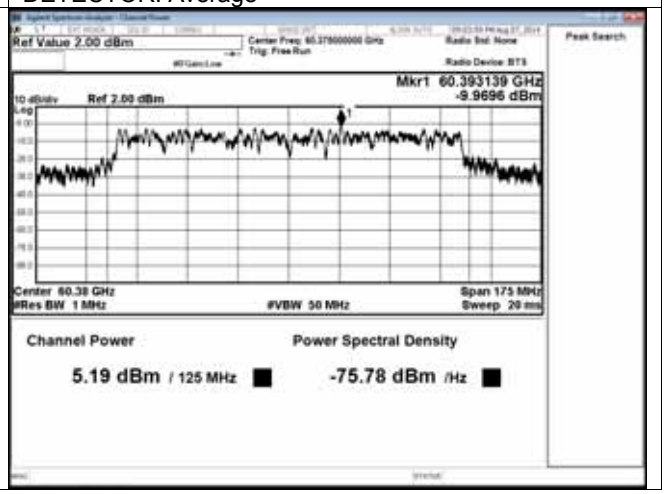


Test specification:	Section 15.255(b)(e), Transmitter power and power spectral density		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	Air Pressure: 1007 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

Plot 7.1.5 Output power test result at the mid frequency

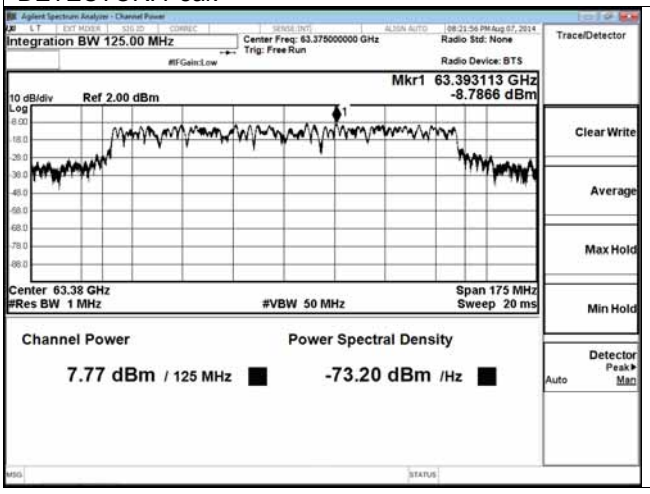
MODULATION:	QPSK
EMISSION BANDWIDTH:	125 MHz
DETECTOR: Peak	DETECTOR: Average

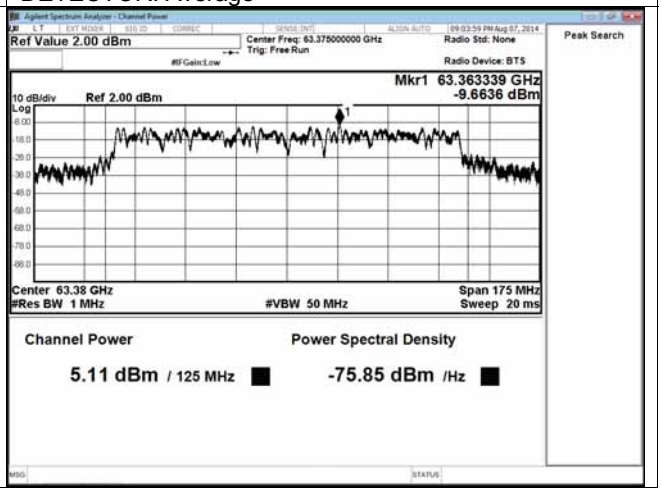




Plot 7.1.6 Output power test result at the high frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	125 MHz
DETECTOR: Peak	DETECTOR: Average

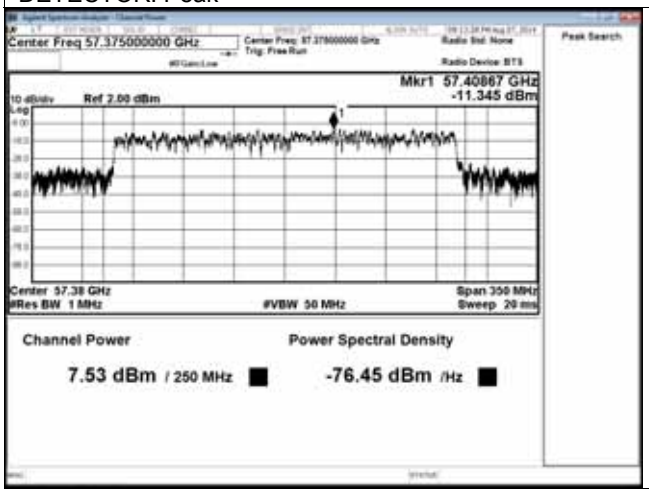


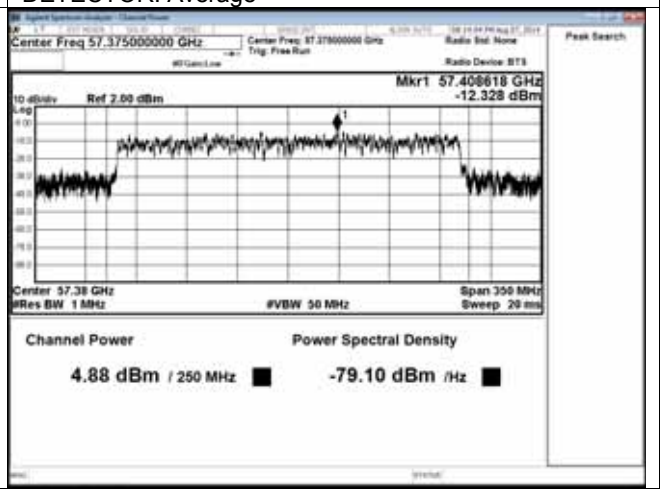


Test specification:	Section 15.255(b)(e), Transmitter power and power spectral density		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	Air Pressure: 1007 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

Plot 7.1.7 Output power test result at the low frequency

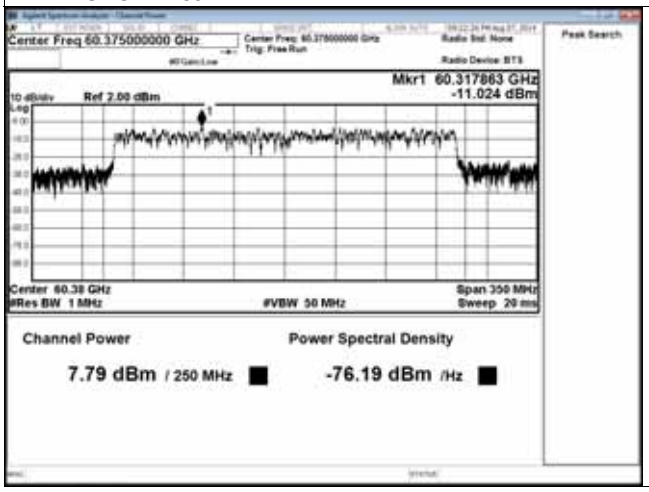
MODULATION:	QPSK
EMISSION BANDWIDTH:	250 MHz
DETECTOR: Peak	DETECTOR: Average

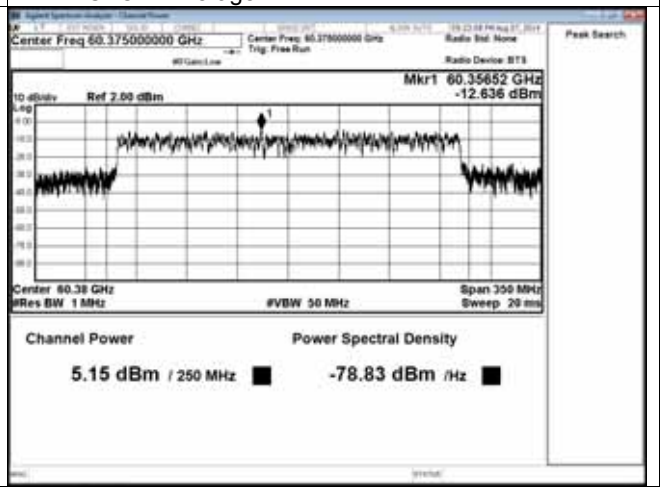




Plot 7.1.8 Output power test result at the mid frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	250 MHz
DETECTOR: Peak	DETECTOR: Average

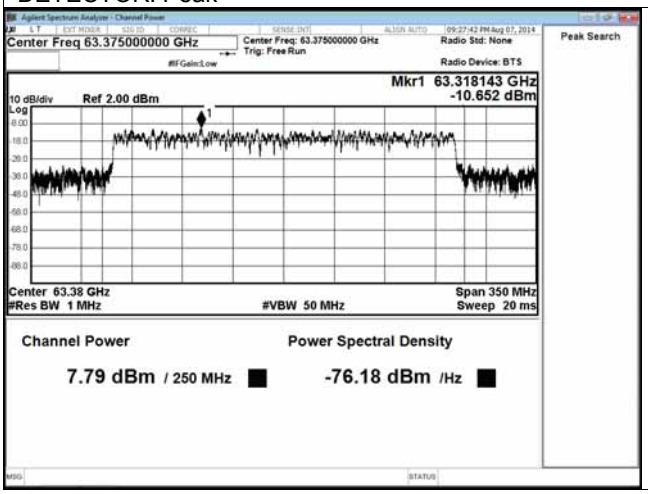


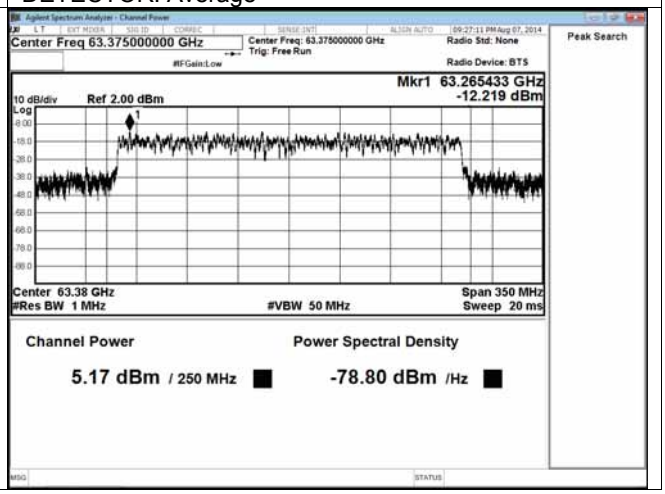


Test specification:	**Section 15.255(b)(e), Transmitter power and power spectral density**		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	**Verdict:**	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	**Air Pressure:** 1007 hPa	**Relative Humidity:** 42%	**Power Supply:** 48 VDC
Remarks:			

Plot 7.1.9 Output power test result at the high frequency

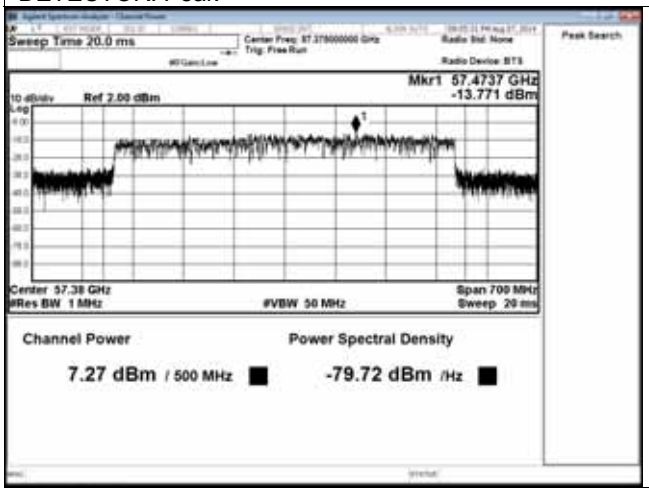
MODULATION:	QPSK
EMISSION BANDWIDTH:	250 MHz
DETECTOR: Peak	DETECTOR: Average

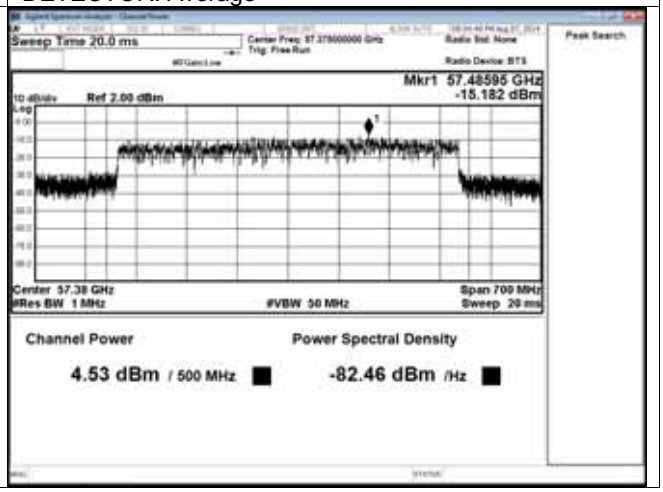




Plot 7.1.10 Average output power at the low frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	500 MHz
DETECTOR: Peak	DETECTOR: Average

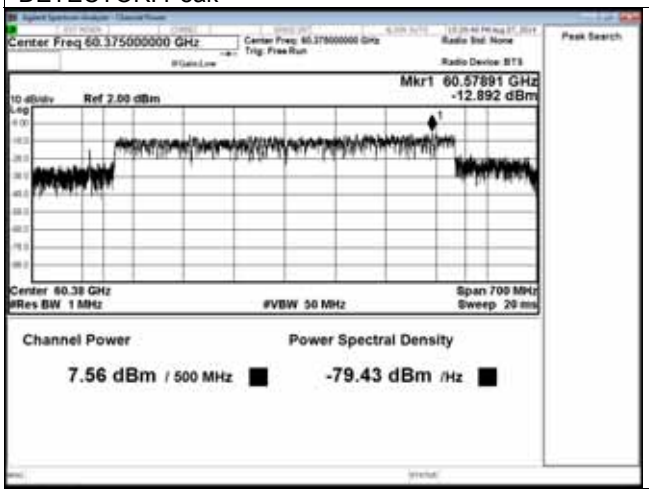


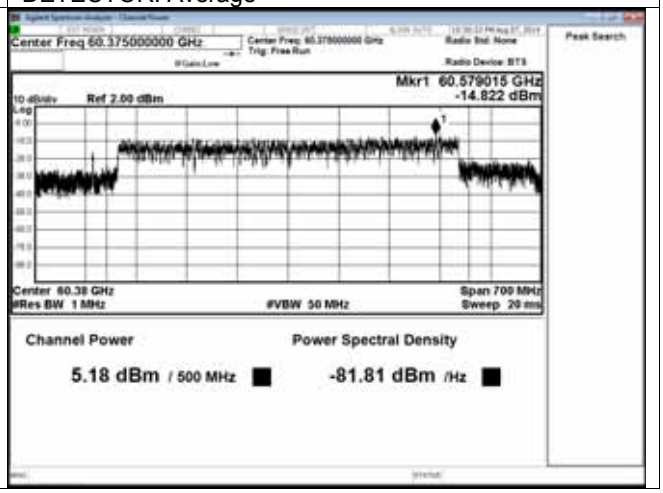


Test specification:	Section 15.255(b)(e), Transmitter power and power spectral density		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	Air Pressure: 1007 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

Plot 7.1.11 Average output power at the mid frequency

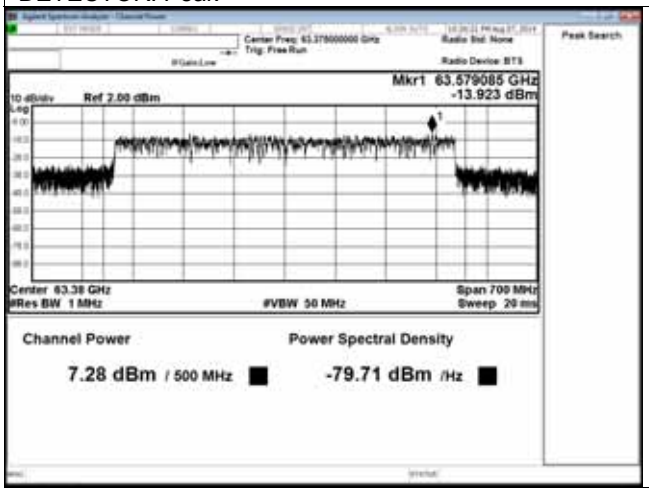
MODULATION:	QPSK
EMISSION BANDWIDTH:	500 MHz
DETECTOR: Peak	DETECTOR: Average

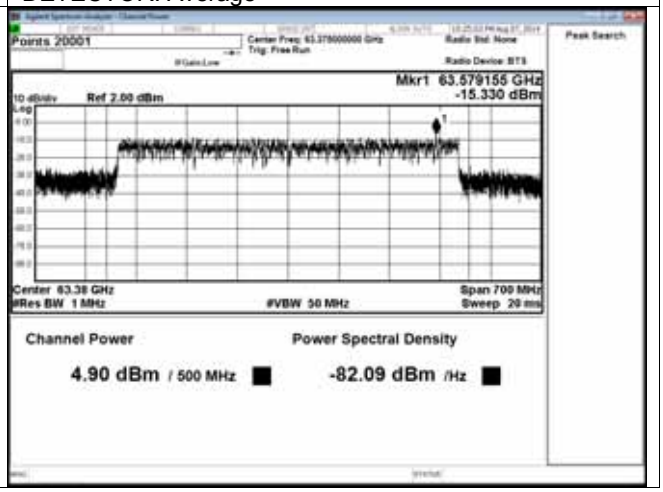




Plot 7.1.12 Output power test result at the high frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	500 MHz
DETECTOR: Peak	DETECTOR: Average

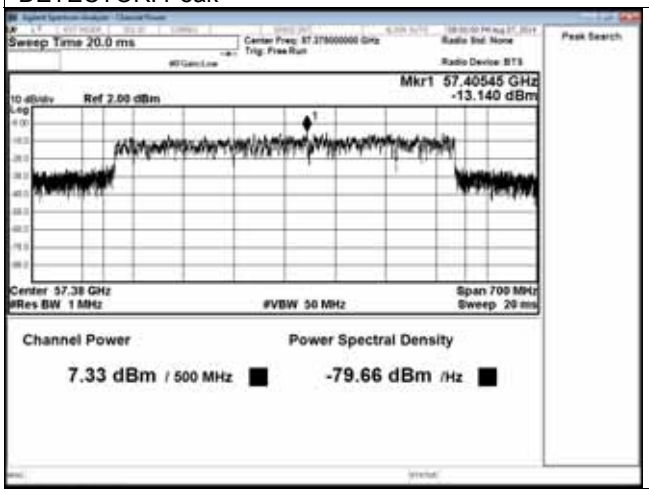


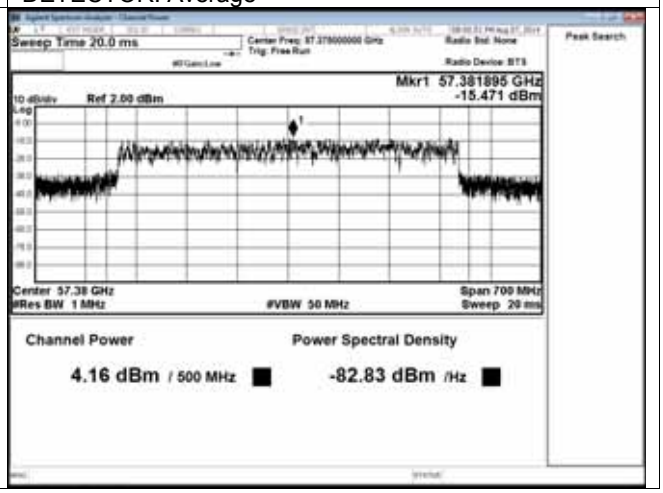


Test specification:	Section 15.255(b)(e), Transmitter power and power spectral density		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	Air Pressure: 1007 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

Plot 7.1.13 Output power test result at the low frequency

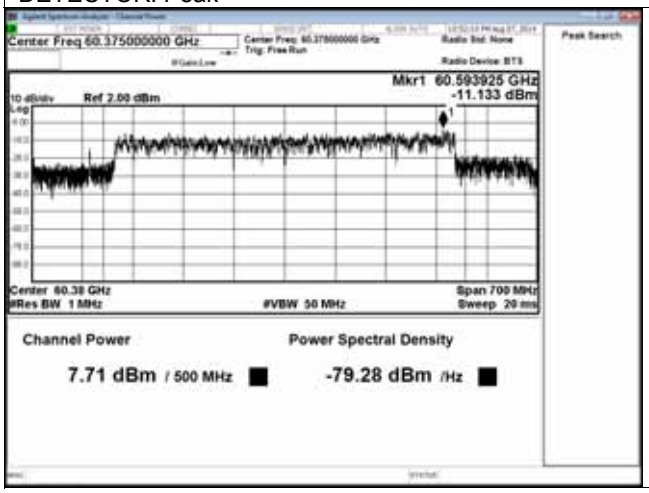
MODULATION:	16QAM
EMISSION BANDWIDTH:	500 MHz
DETECTOR: Peak	DETECTOR: Average

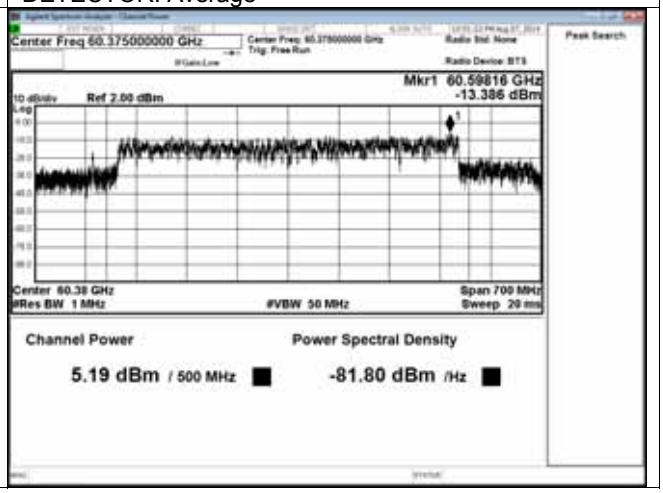




Plot 7.1.14 Output power test result at the mid frequency

MODULATION:	16QAM
EMISSION BANDWIDTH:	500 MHz
DETECTOR: Peak	DETECTOR: Average

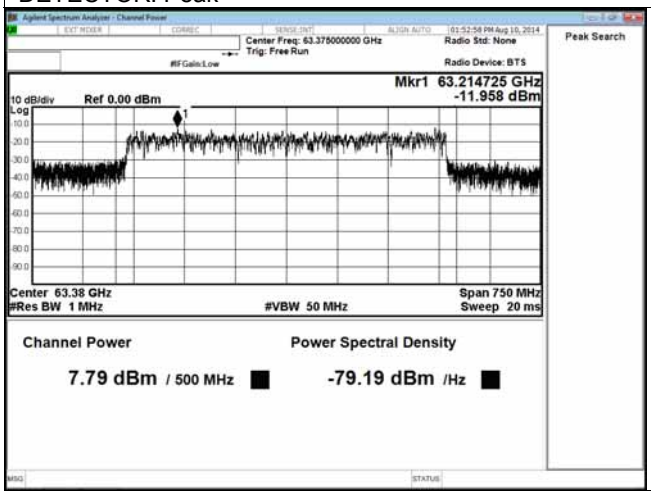


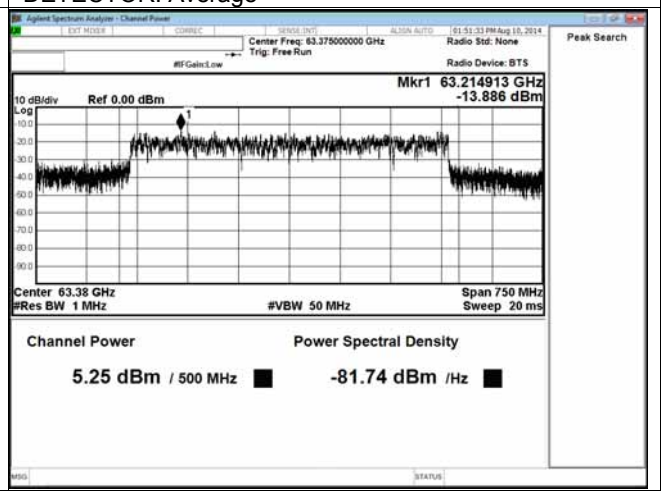


Test specification:	Section 15.255(b)(e), Transmitter power and power spectral density		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	Air Pressure: 1007 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

Plot 7.1.15 Output power test result at the high frequency

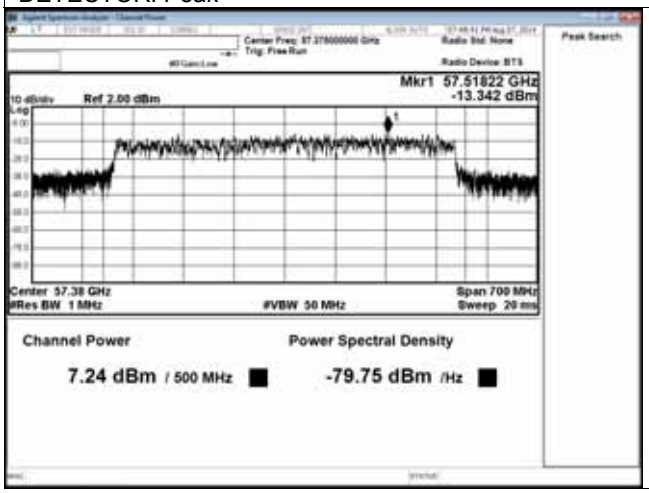
MODULATION:	16QAM
EMISSION BANDWIDTH:	500 MHz
DETECTOR: Peak	DETECTOR: Average

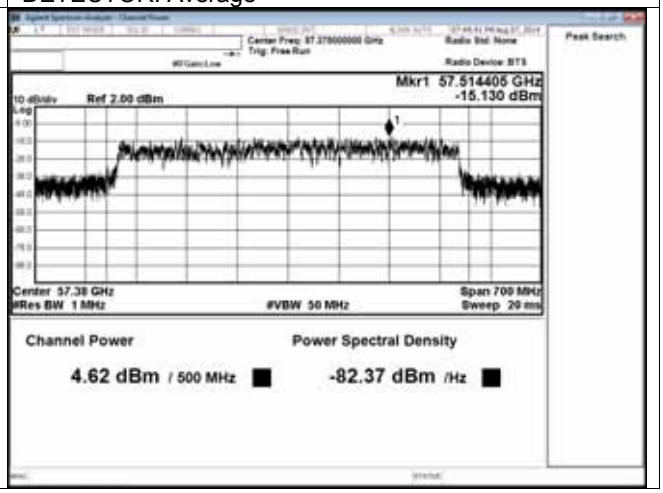




Plot 7.1.16 Output power test result at the low frequency

MODULATION:	64QAM
EMISSION BANDWIDTH:	500 MHz
DETECTOR: Peak	DETECTOR: Average

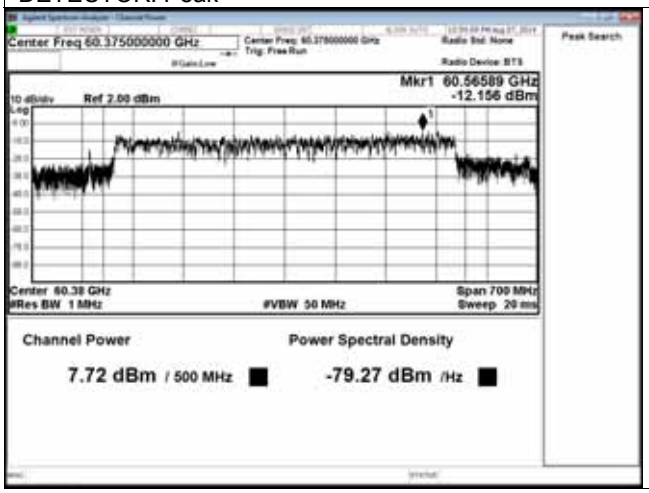


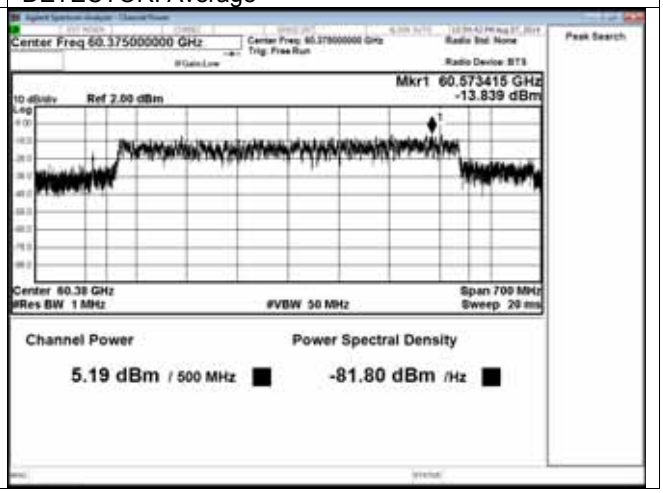


Test specification:	Section 15.255(b)(e), Transmitter power and power spectral density		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	8/07/2014		
Temperature: 24.3 ºC	Air Pressure: 1007 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

Plot 7.1.17 Output power test result at the mid frequency

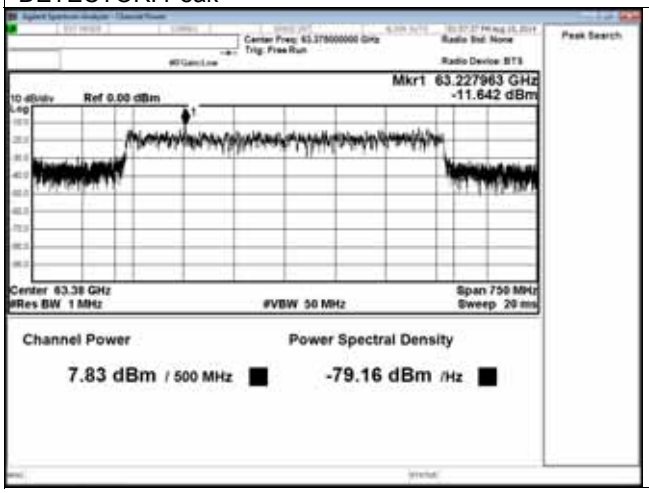
MODULATION:	64QAM
EMISSION BANDWIDTH:	500 MHz
DETECTOR: Peak	DETECTOR: Average

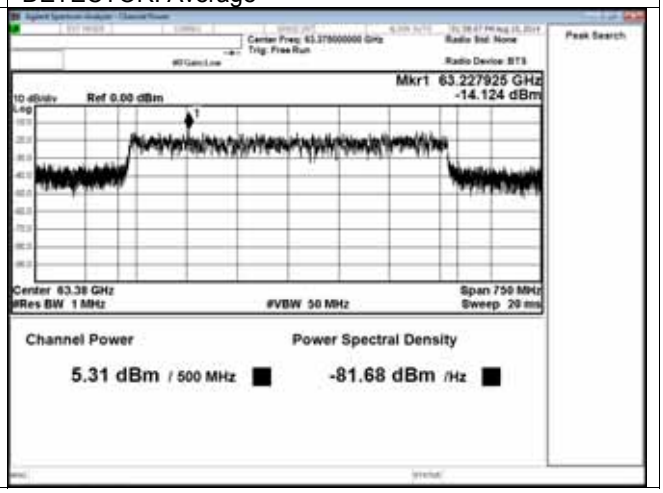




Plot 7.1.18 Output power test result at the high frequency

MODULATION:	64QAM
EMISSION BANDWIDTH:	500 MHz
DETECTOR: Peak	DETECTOR: Average





Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	8/05/2014		
Temperature: 23 ºC	Air Pressure: 1008 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

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

Table 7.2.1 Occupied bandwidth limits

Assigned frequency range, MHz	Modulation envelope reference points	Max bandwidth, MHz
57000 - 64000	99%	500

NOTE: Modulation envelope reference points provided in terms of attenuation below unmodulated carrier.

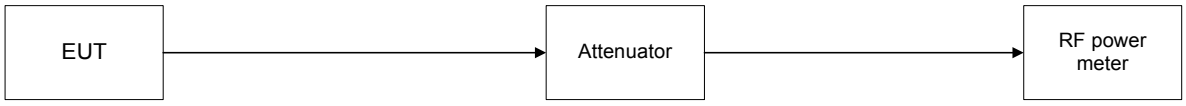
7.2.2 Test procedure

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

7.2.2.2 The EUT was set to transmit modulated carrier as provided in Table 7.2.2.

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

Figure 7.2.1 Occupied bandwidth test setup



Test specification:	**Section 15.215(c), Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date:	8/05/2014		
Temperature: 23 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 42%	**Power Supply:** 48 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

OPERATING FREQUENCY RANGE: 57000 –64000 MHz
DETECTOR USED: Average
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 3 MHz
MODULATING SIGNAL: PRBS

Frequency, MHz	Modulation	Occupied bandwidth 99%, MHz	Limit, MHz	Verdict
EBW = 62.5 MHz				
57375	QPSK	62.0567	500.0	Pass
60375	QPSK	62.0277	500.0	Pass
63375	QPSK	61.2781	500.0	Pass
EBW = 125 MHz				
57375	QPSK	120.8914	500.0	Pass
60375	QPSK	121.8666	500.0	Pass
63375	QPSK	119.0236	500.0	Pass
EBW = 250 MHz				
57375	QPSK	234.2718	500.0	Pass
60375	QPSK	236.7817	500.0	Pass
63375	QPSK	235.0995	500.0	Pass
EBW = 500 MHz				
57375	QPSK	464.7823	500.0	Pass
60375	QPSK	467.2801	500.0	Pass
63375	QPSK	467.4077	500.0	Pass
57375	16QAM	464.6026	500.0	Pass
60375	16QAM	467.0638	500.0	Pass
63375	16QAM	467.3511	500.0	Pass
57375	64QAM	465.7540	500.0	Pass
60375	64QAM	468.6450	500.0	Pass
63375	64QAM	468.7090	500.0	Pass

Reference numbers of test equipment used

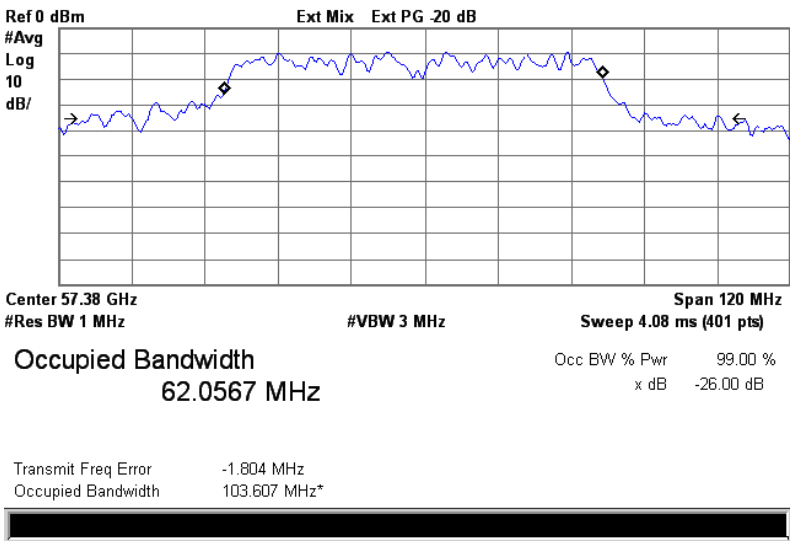
HL 1303	HL 2358	HL 2909	HL 3291	HL 3295	HL 3305	HL 3433	HL 3434

Full description is given in Appendix A.

Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	8/05/2014		
Temperature: 23 ºC	Air Pressure: 1008 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

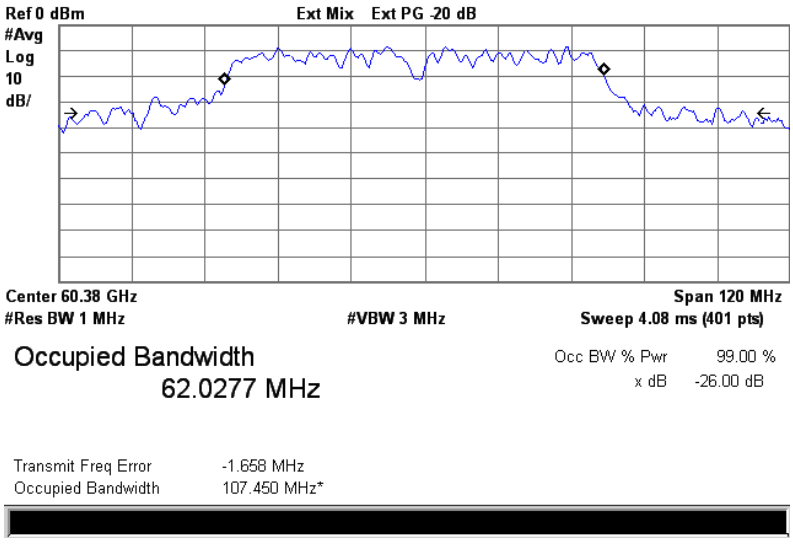
Plot 7.2.1 Occupied bandwidth at low frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	62.5 MHz



Plot 7.2.2 Occupied bandwidth at the mid frequency

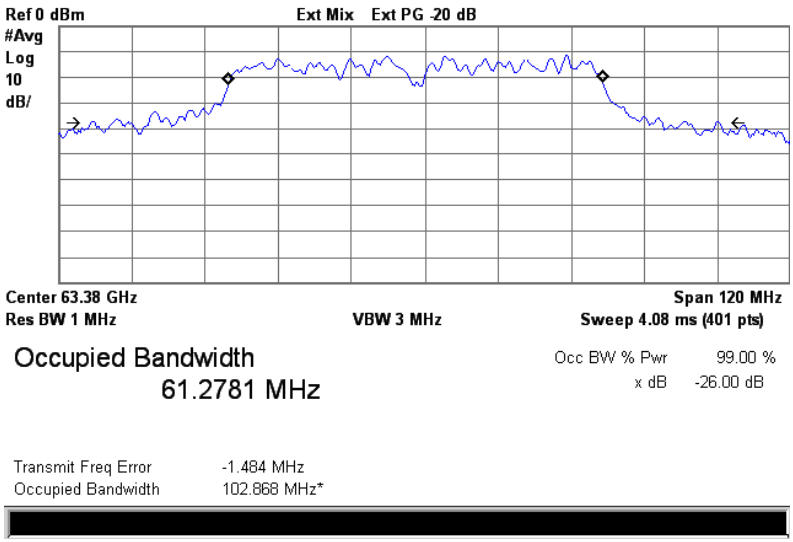
MODULATION:	QPSK
EMISSION BANDWIDTH:	62.5 MHz



Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	8/05/2014		
Temperature: 23 ºC	Air Pressure: 1008 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

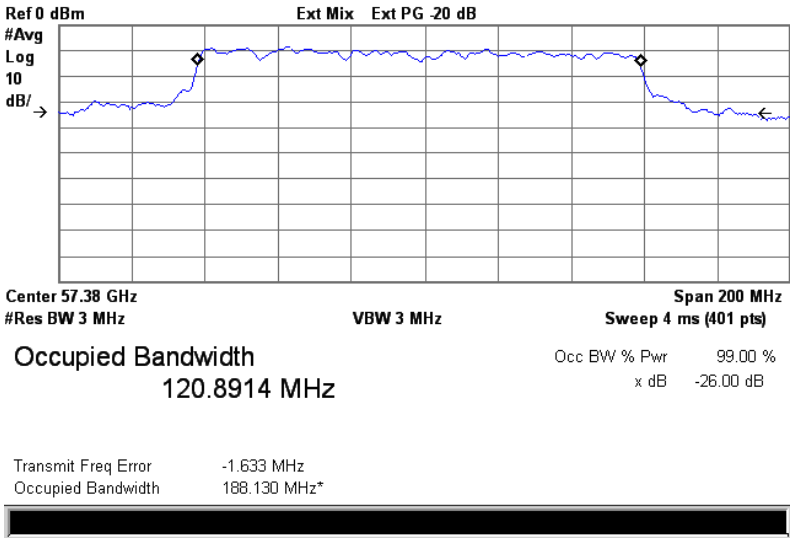
Plot 7.2.3 Occupied bandwidth at the high frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	62.5 MHz



Plot 7.2.4 Occupied bandwidth at low frequency

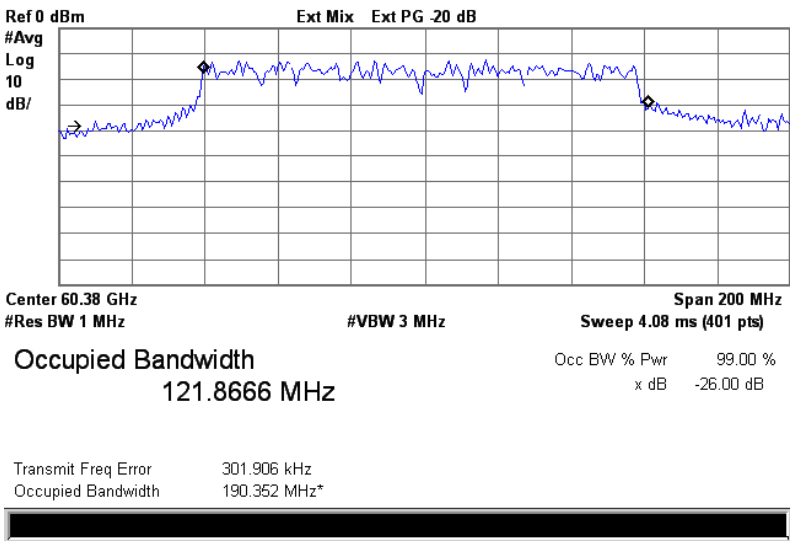
MODULATION:	QPSK
EMISSION BANDWIDTH:	125 MHz



Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	8/05/2014		
Temperature: 23 ºC	Air Pressure: 1008 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

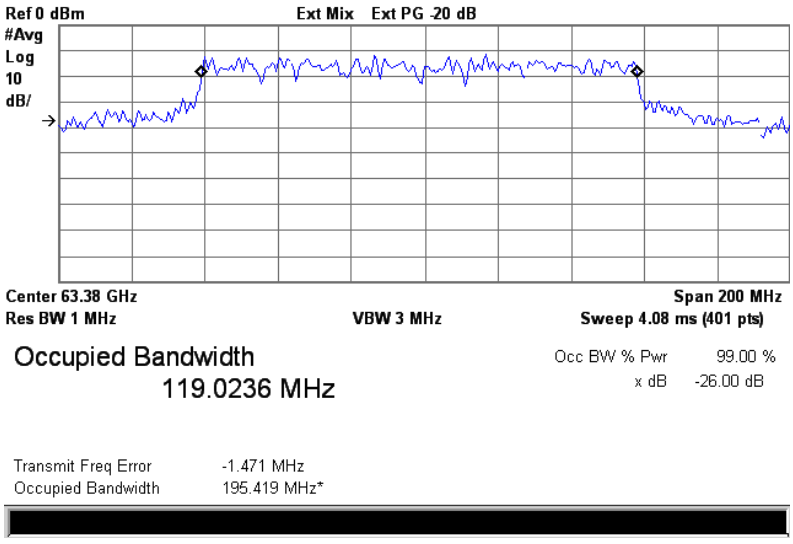
Plot 7.2.5 Occupied bandwidth at the mid frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	125 MHz



Plot 7.2.6 Occupied bandwidth at the high frequency

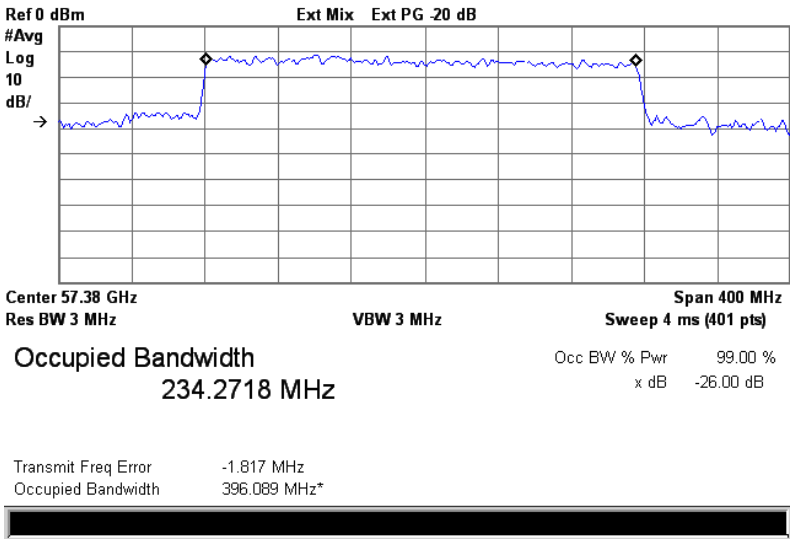
MODULATION:	QPSK
EMISSION BANDWIDTH:	125 MHz



Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	8/05/2014		
Temperature: 23 ºC	Air Pressure: 1008 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

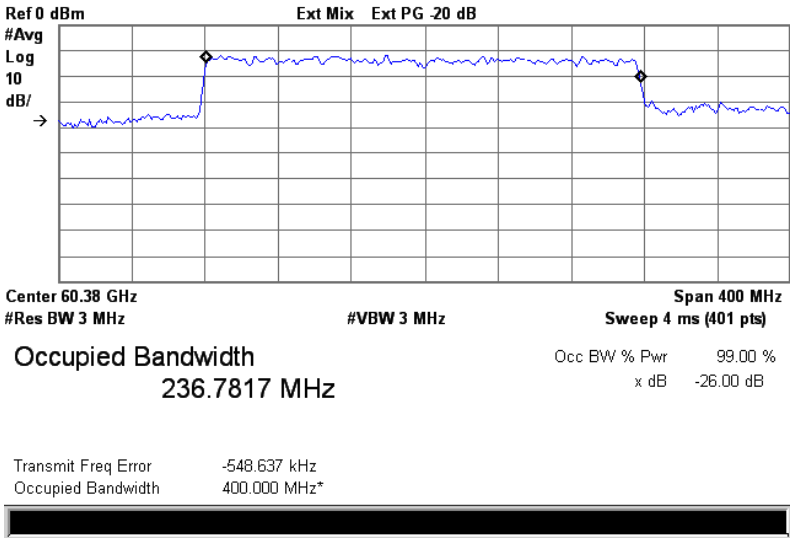
Plot 7.2.7 Occupied bandwidth at the low frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	250 MHz



Plot 7.2.8 Occupied bandwidth at the mid frequency

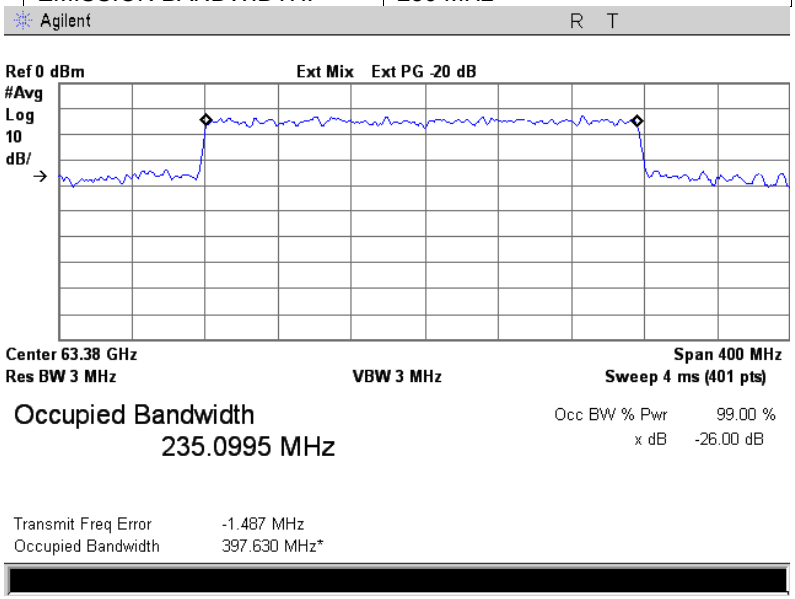
MODULATION:	QPSK
EMISSION BANDWIDTH:	250 MHz



Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	8/05/2014		
Temperature: 23 ºC	Air Pressure: 1008 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

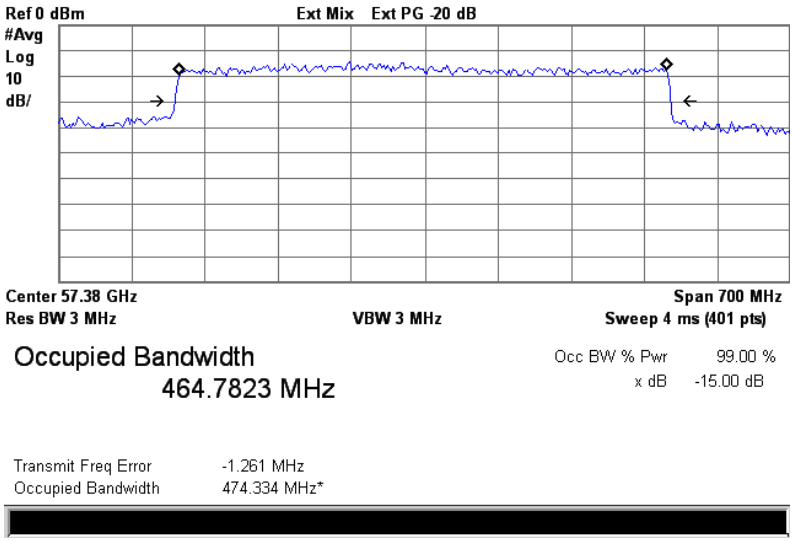
Plot 7.2.9 Occupied bandwidth at the high frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	250 MHz



Plot 7.2.10 Occupied bandwidth at the low frequency

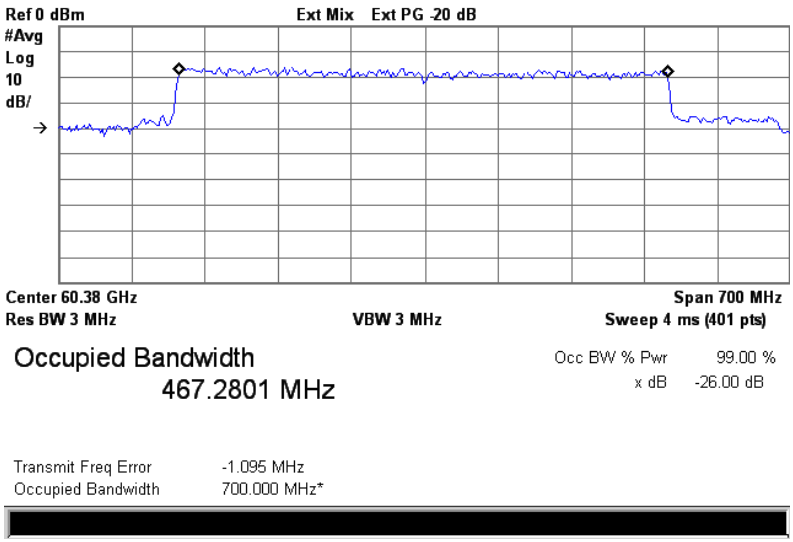
MODULATION:	QPSK
EMISSION BANDWIDTH:	500 MHz



Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	8/05/2014		
Temperature: 23 ºC	Air Pressure: 1008 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

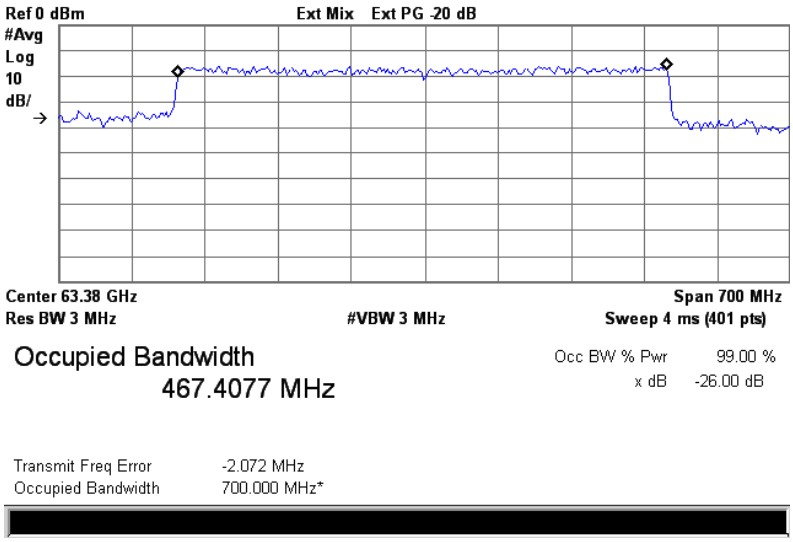
Plot 7.2.11 Occupied bandwidth at the mid frequency

MODULATION:	QPSK
EMISSION BANDWIDTH:	500 MHz



Plot 7.2.12 Occupied bandwidth at the high frequency

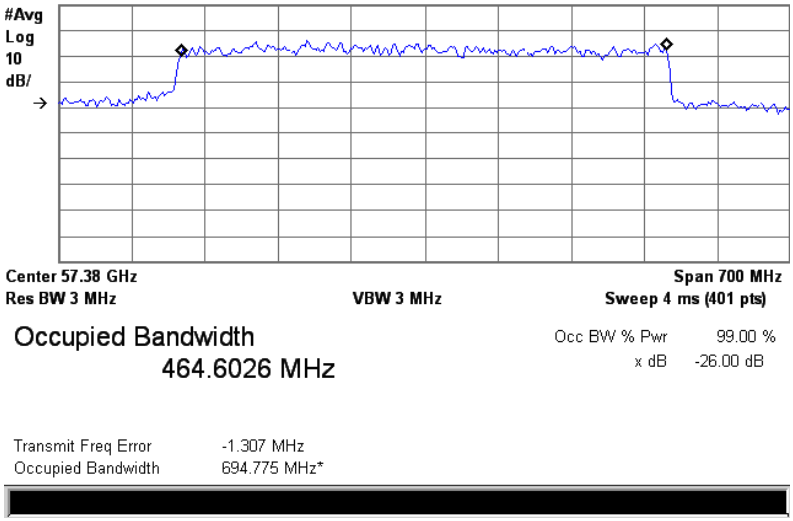
MODULATION:	QPSK
EMISSION BANDWIDTH:	500 MHz



Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	8/05/2014		
Temperature: 23 ºC	Air Pressure: 1008 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

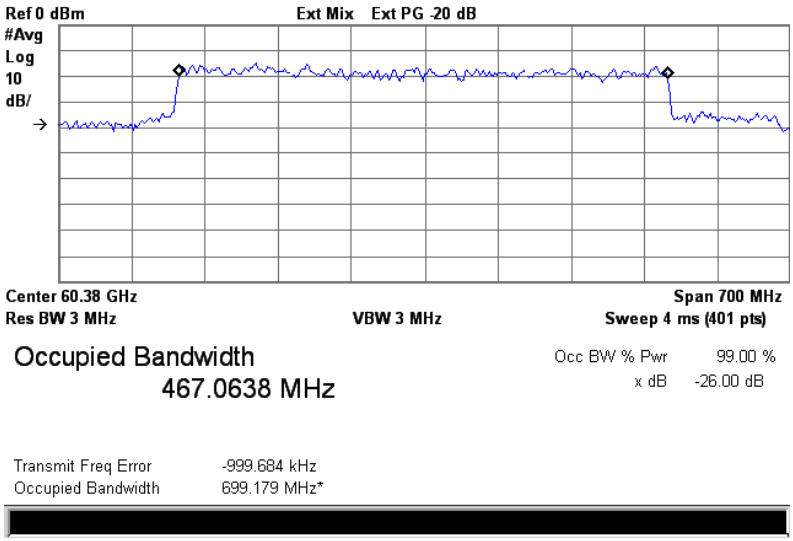
Plot 7.2.13 Occupied bandwidth at the low frequency

MODULATION:	16QAM
EMISSION BANDWIDTH:	500 MHz



Plot 7.2.14 Occupied bandwidth at the mid frequency

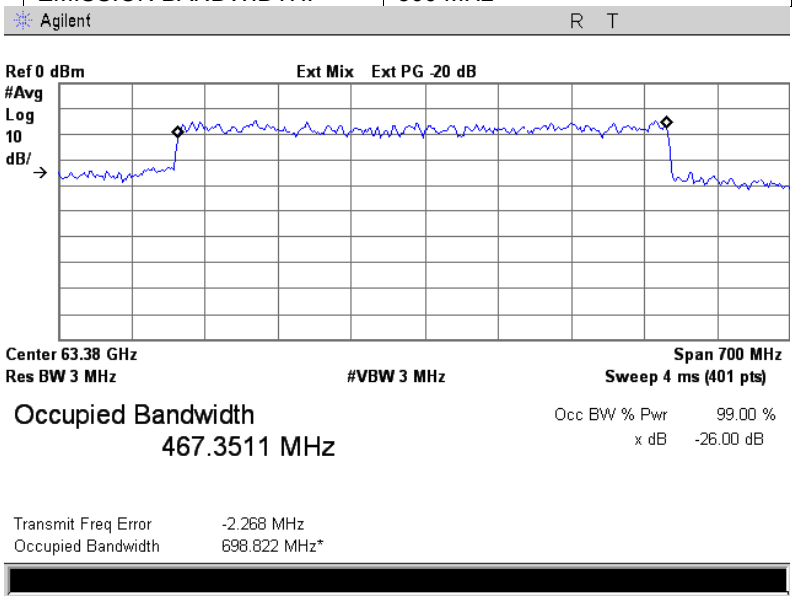
MODULATION:	16QAM
EMISSION BANDWIDTH:	500 MHz



Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	8/05/2014		
Temperature: 23 ºC	Air Pressure: 1008 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

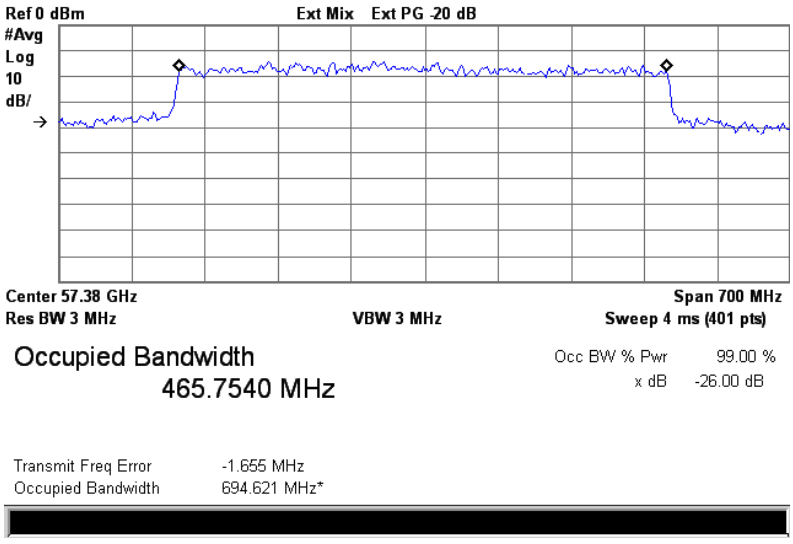
Plot 7.2.15 Occupied bandwidth at the high frequency

MODULATION:	16QAM
EMISSION BANDWIDTH:	500 MHz



Plot 7.2.16 Occupied bandwidth at the low frequency

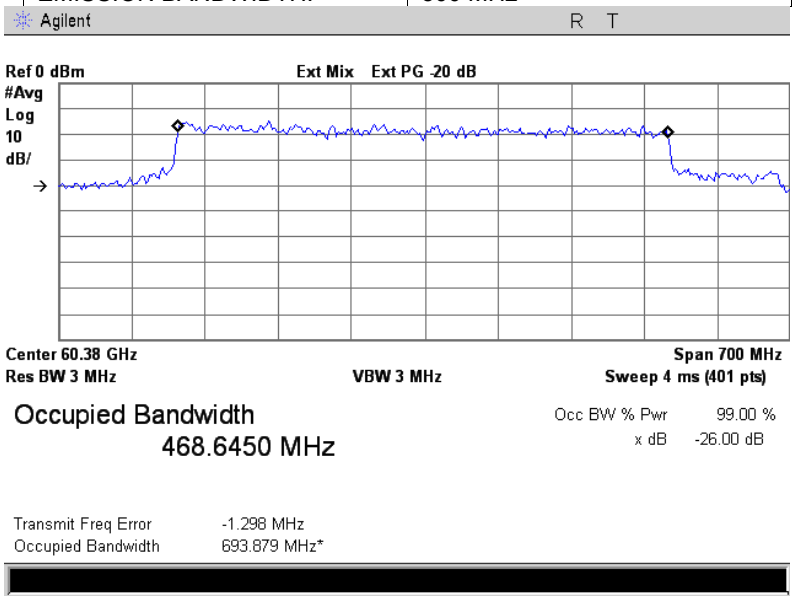
MODULATION:	64QAM
EMISSION BANDWIDTH:	500 MHz



Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	8/05/2014		
Temperature: 23 ºC	Air Pressure: 1008 hPa	Relative Humidity: 42%	Power Supply: 48 VDC
Remarks:			

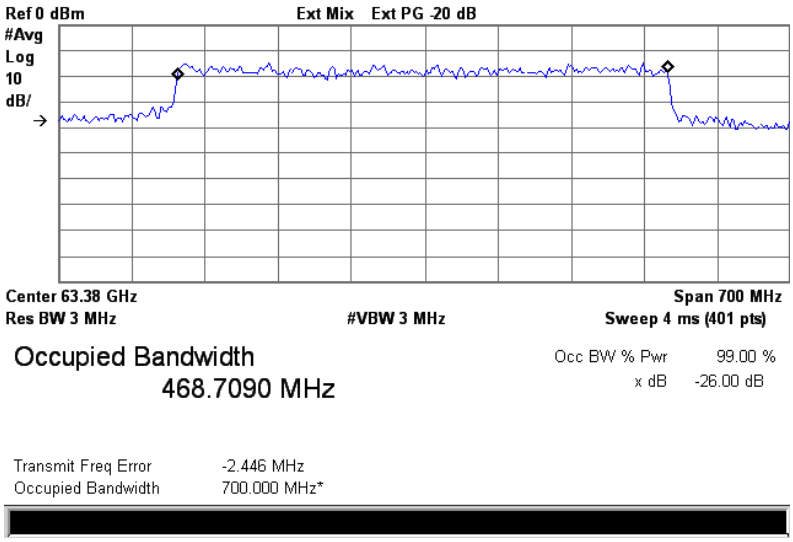
Plot 7.2.17 Occupied bandwidth at the mid frequency

MODULATION:	64QAM
EMISSION BANDWIDTH:	500 MHz



Plot 7.2.18 Occupied bandwidth at the high frequency

MODULATION:	64QAM
EMISSION BANDWIDTH:	500 MHz



Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

7.3 Spurious emissions at RF antenna connector test

7.3.1 General

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

Table 7.3.1 Spurious emission limits

Frequency, MHz	Spurious emission level	
	pW/cm²	Power of spurious, dBm
9 kHz – 10th harmonic	90	-9.92

NOTE 1: Spurious emission limits do not apply to in band emission within ± 250 % of the authorized bandwidth from the carrier.

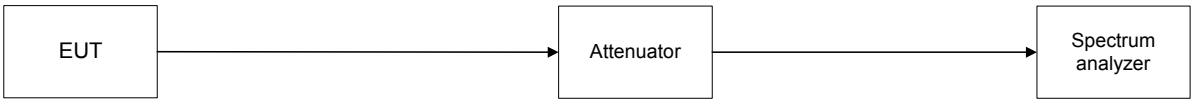
7.3.2 Test procedure

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

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

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

Figure 7.3.1 Spurious emission test setup



Test specification:	**Section 15.255(c), Conducted spurious emissions**		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	**Verdict:**	PASS
Date:	8/03/2014		
Temperature: 24ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 46%	**Power Supply:** 48 VDC
Remarks:			

Table 7.3.2 Spurious emission test results

OPERATING FREQUENCY RANGE:	57000 – 64000 MHz
INVESTIGATED FREQUENCY RANGE:	30000* - 200000 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1 MHz
VIDEO BANDWIDTH:	3 MHz
MODULATION:	QPSK
EMISSION BANDWIDTH:	125 MHz
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum

Carrier frequency, MHz	Spurious frequency, MHz	Spurious emission, dBm	Spurious attenuation, dBc	Spurious emission limit, dBm	Spurious attenuation limit, dBc	Margin, dB	Verdict
Low frequency 57375 MHz							
No emissions were found							Pass
Mid frequency 60375 MHz							
No emissions were found							Pass
High frequency 63375 MHz							
No emissions were found							Pass

* - The EUT uses a waveguide antenna connector of WR15 type.

Reference numbers of test equipment used

HL 0747	HL 0748	HL 1295	HL 1299	HL 1300	HL 1303	HL 1304
HL 1306	HL 1312	HL 1424	HL 2909	HL 3235	HL 3290	HL 3291
HL 3294	HL 3297	HL 3305	HL 3433	HL 3434	HL 3455	HL 3901
HL 4023						

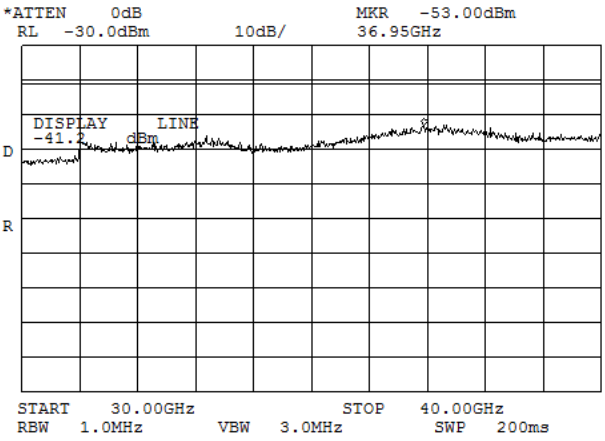
Full description is given in Appendix A.

Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

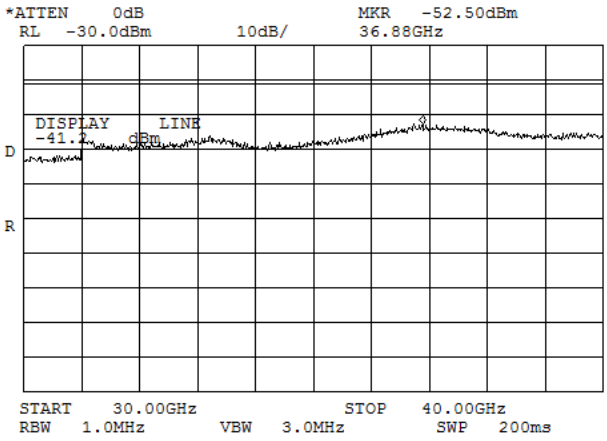
Plot 7.3.1 Spurious emission test results frequency from 30 to 40 GHz

DETECTOR: Peak
LIMIT: Average

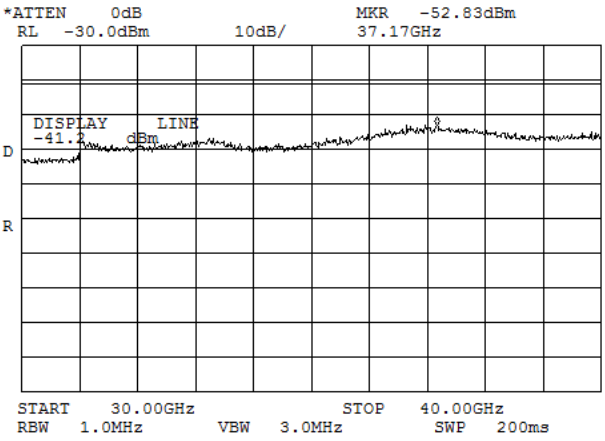
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

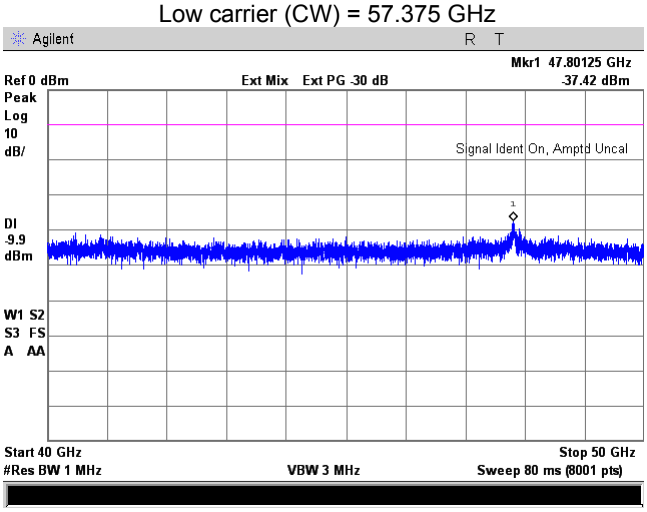


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

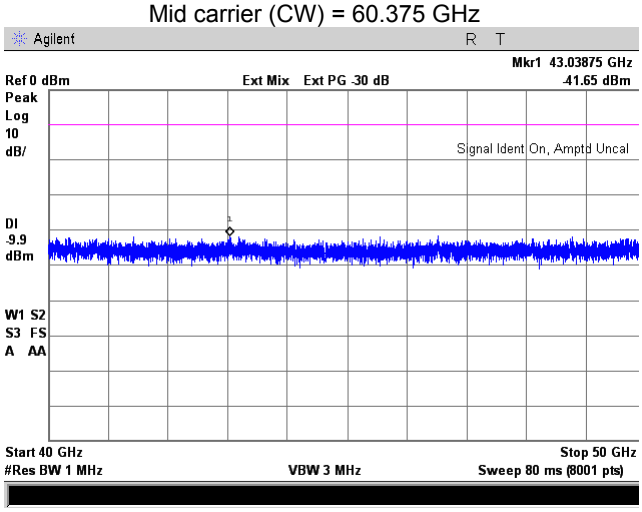
Plot 7.3.2 Spurious emission measurements in 40 – 50 GHz range

DETECTOR: Peak

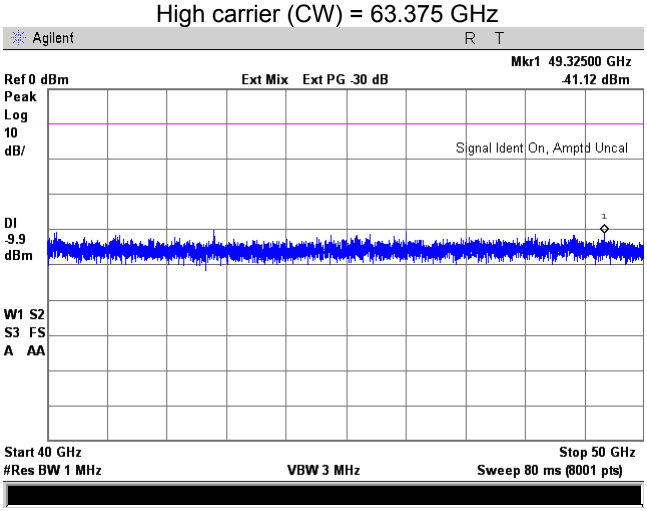
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

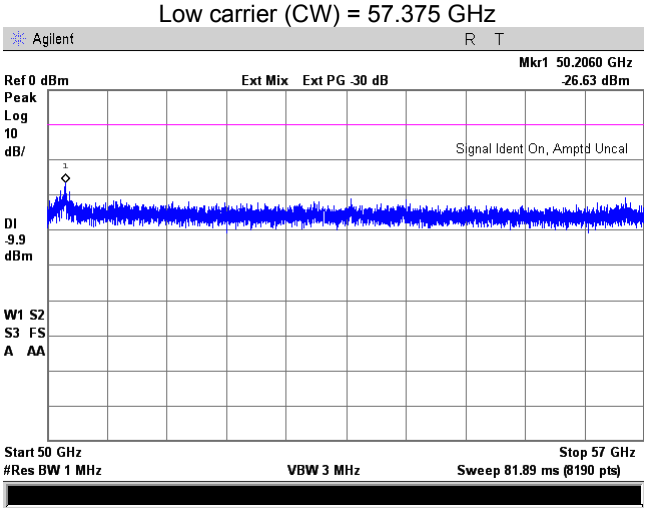


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

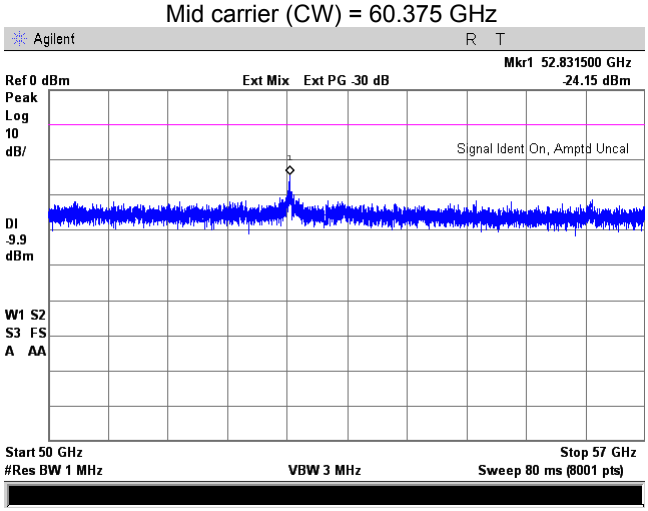
Plot 7.3.3 Spurious emission measurements in 50 – 57 GHz range

DETECTOR: Peak

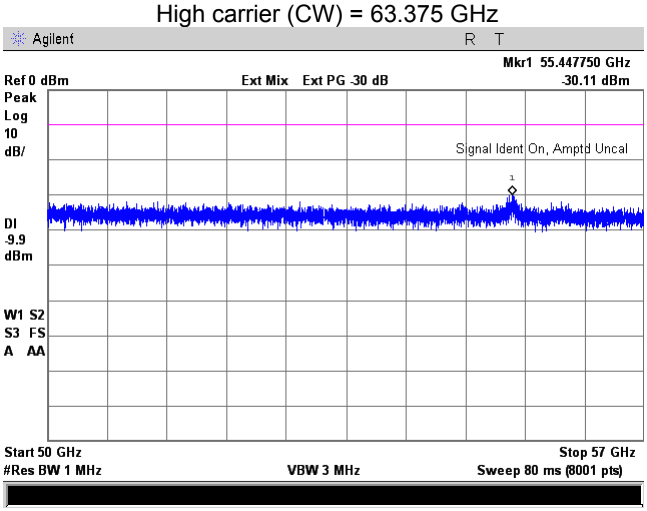
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

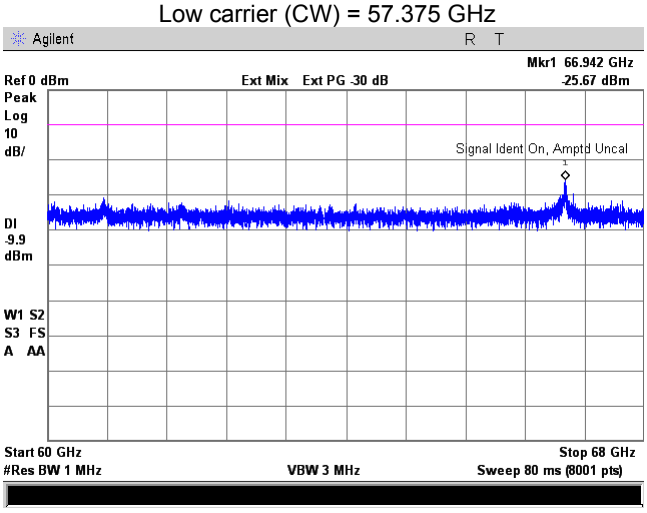


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

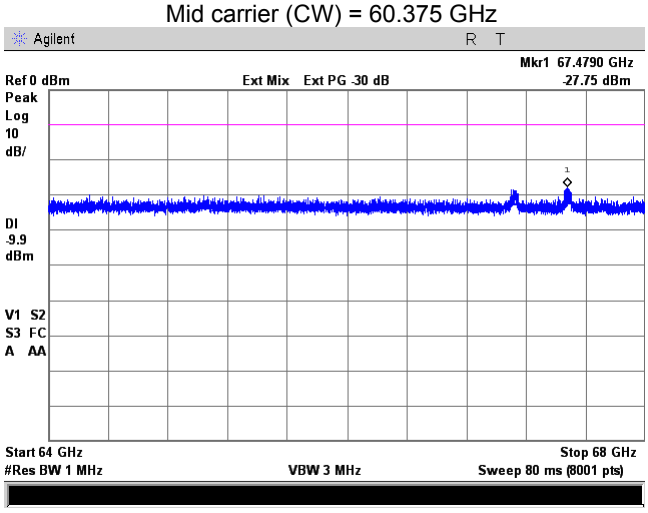
Plot 7.3.4 Spurious emission measurements in 60 – 68 GHz range

DETECTOR: Peak

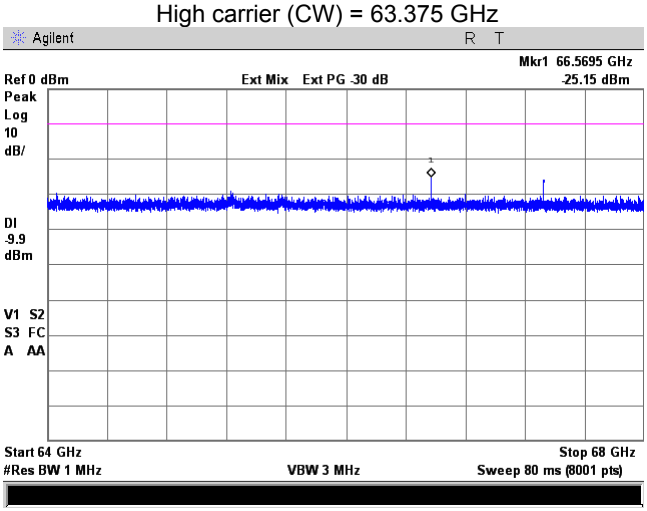
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

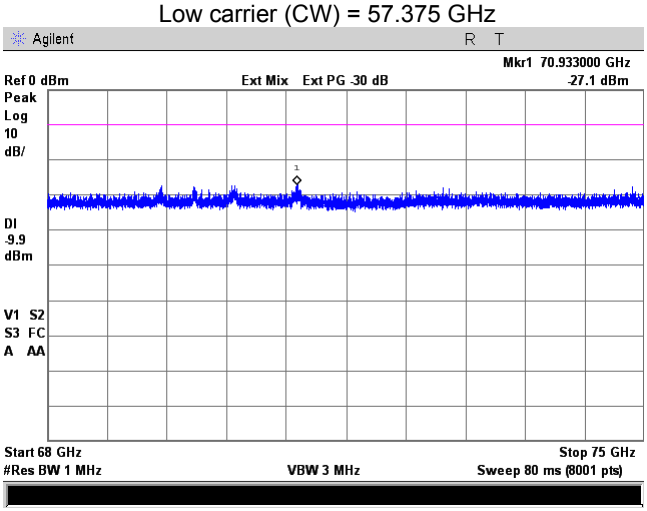


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

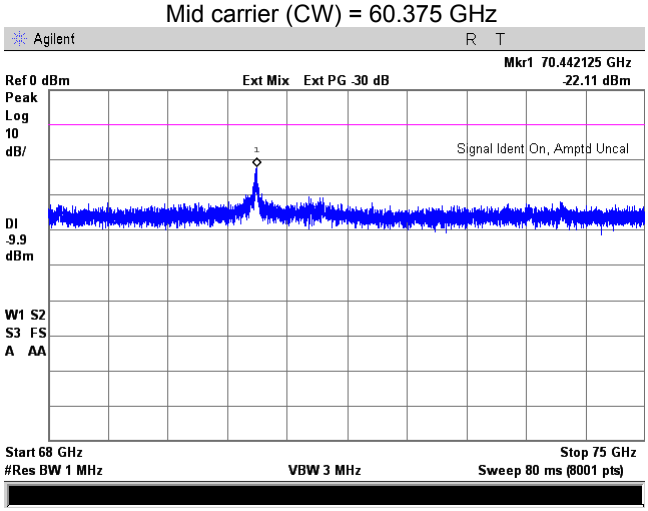
Plot 7.3.5 Spurious emission measurements in 68 – 75 GHz range

DETECTOR: Peak

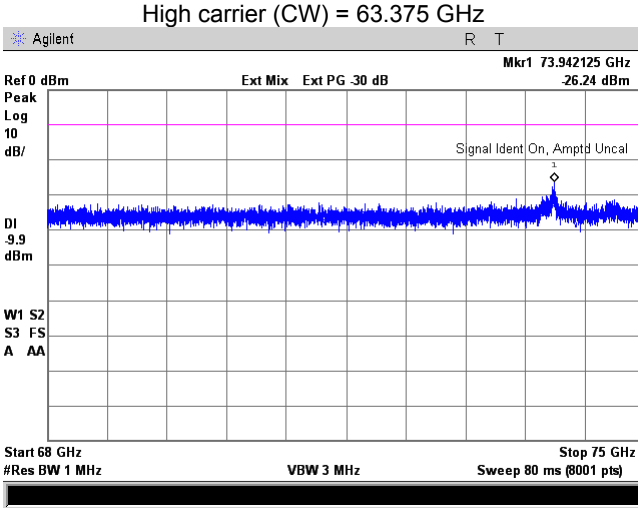
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

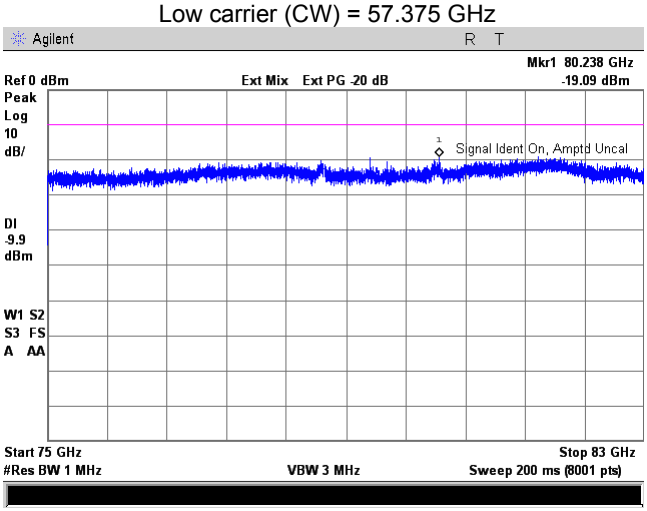


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

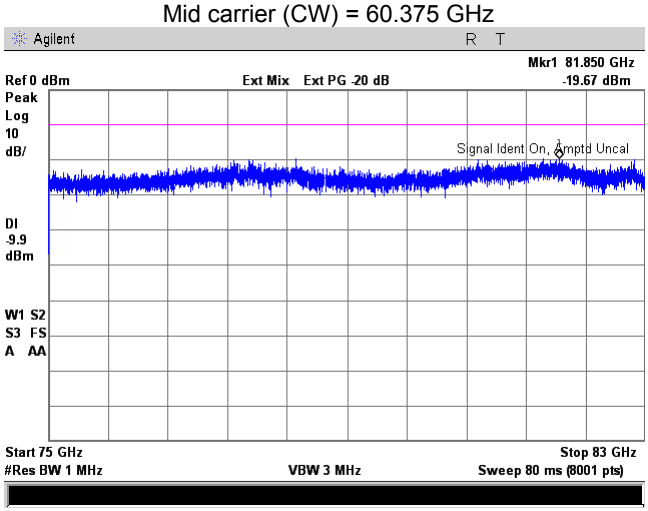
Plot 7.3.6 Spurious emission test results at low carrier frequency from 75 to 83 GHz

DETECTOR: Peak

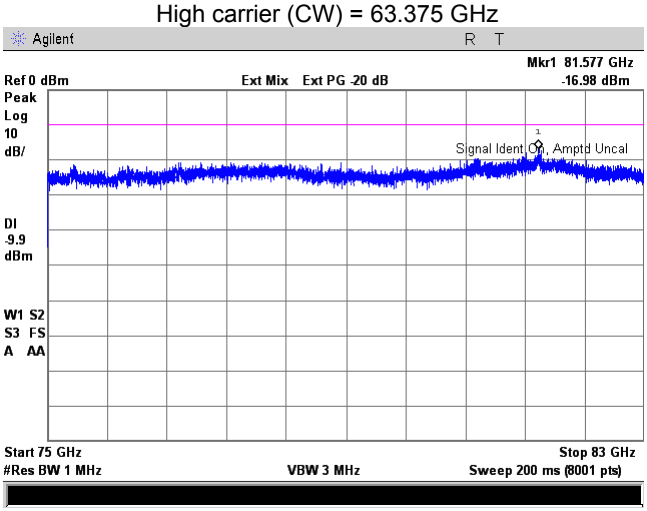
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

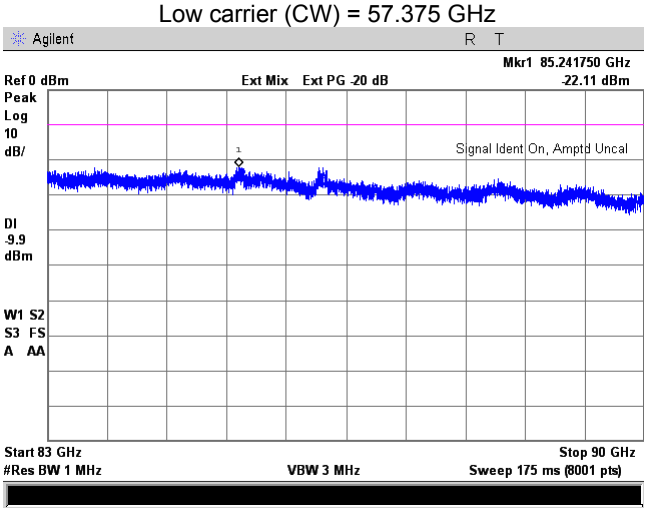


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

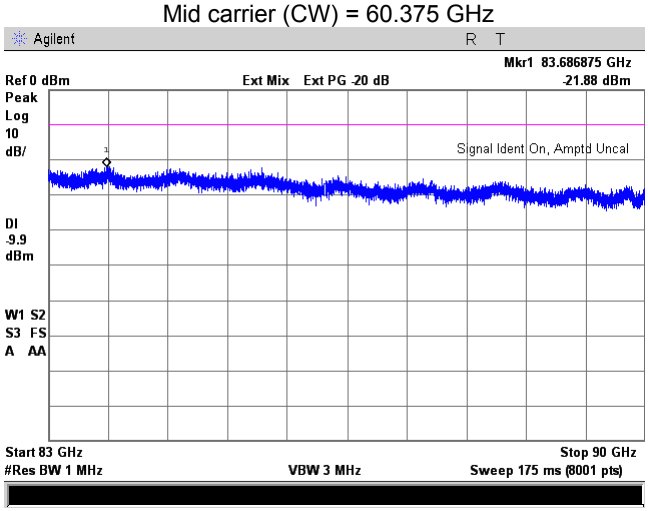
Plot 7.3.7 Spurious emission test results at low carrier frequency from 83 to 90 GHz

DETECTOR: Peak

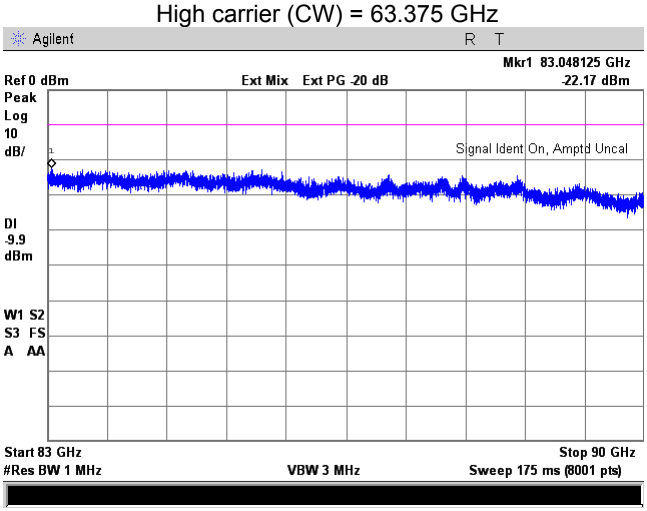
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

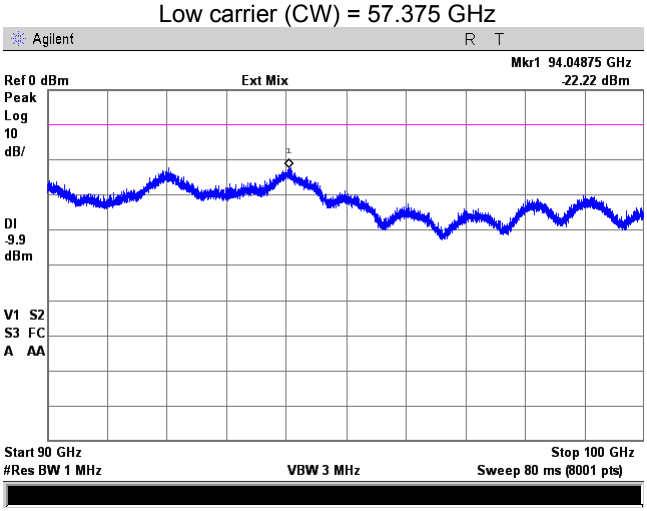


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

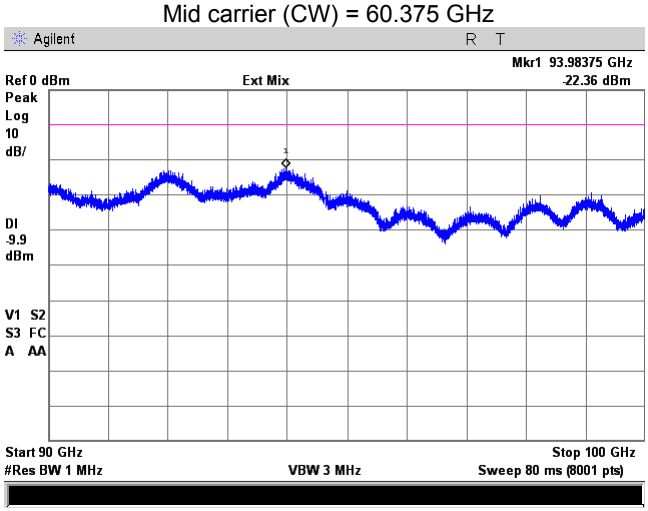
Plot 7.3.8 Spurious emission test results at low carrier frequency from 90 to 100 GHz

DETECTOR: Peak

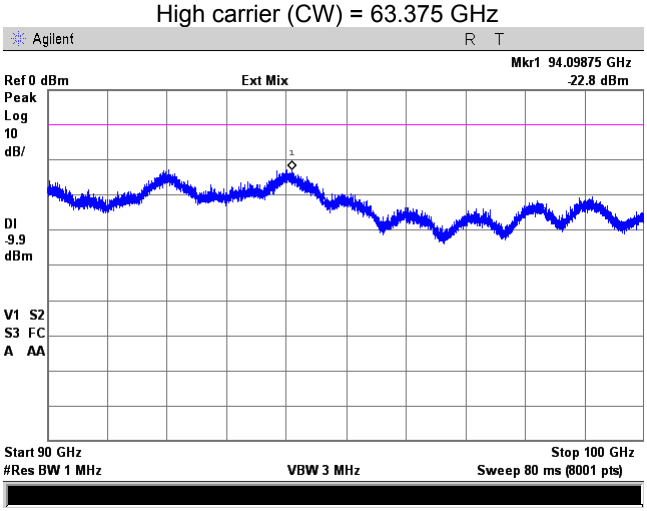
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

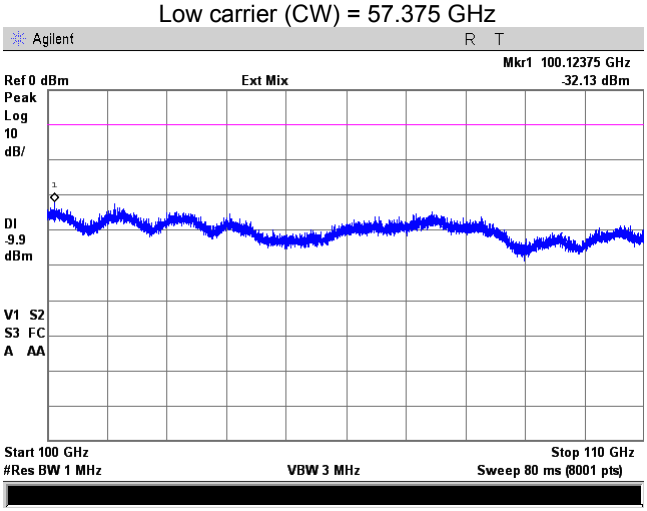


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

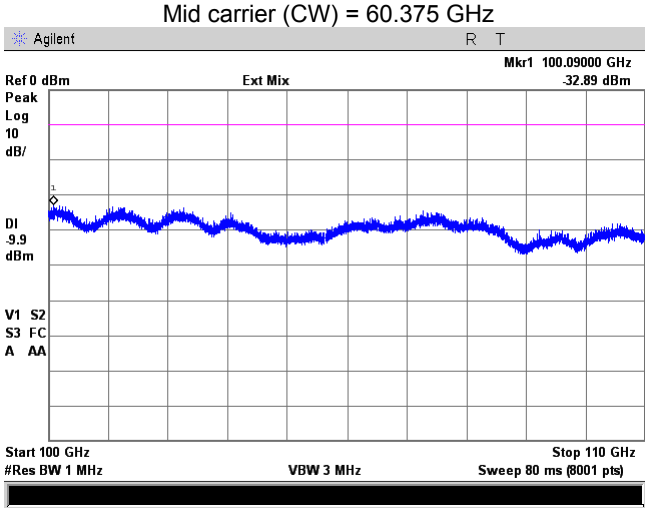
Plot 7.3.9 Spurious emission test results at low carrier frequency from 100 to 110 GHz

DETECTOR: Peak

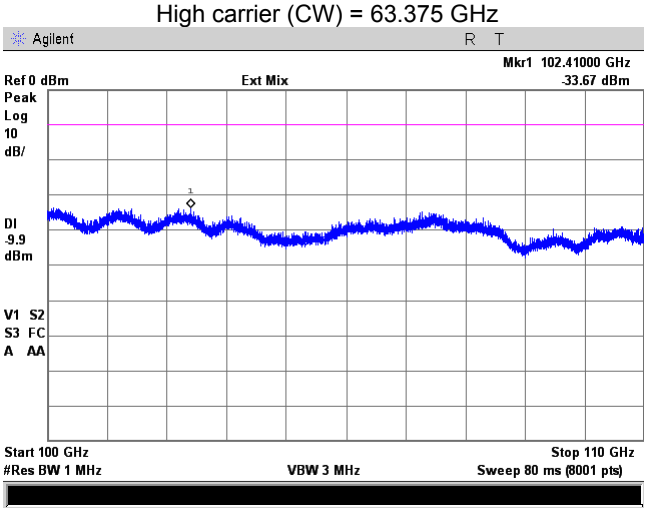
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

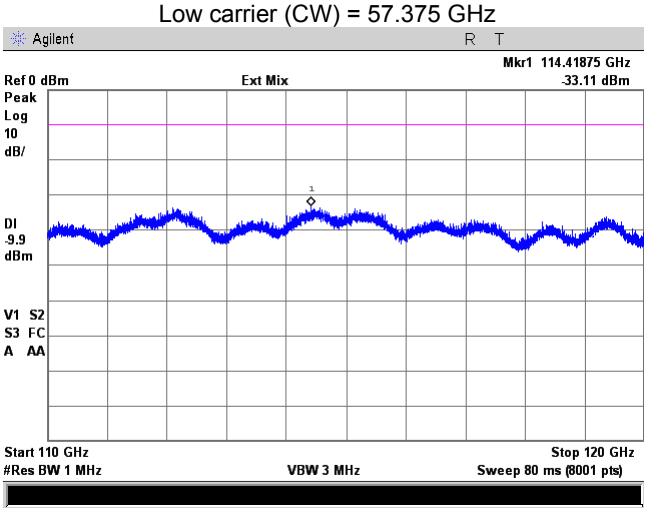


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

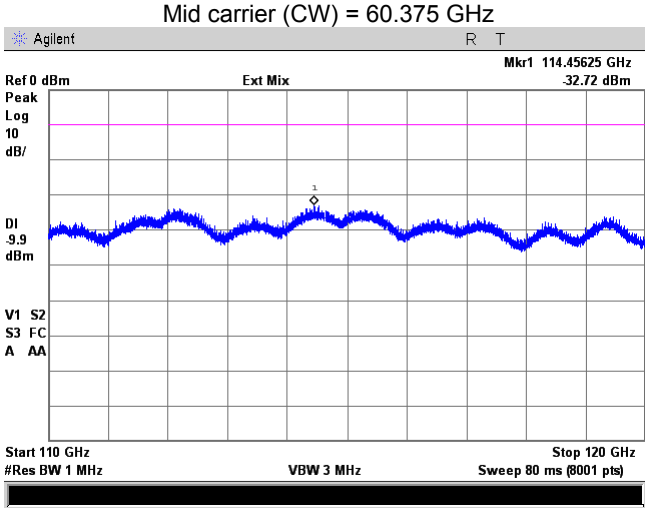
Plot 7.3.10 Spurious emission test results at low carrier frequency from 110 to 120 GHz

DETECTOR: Peak

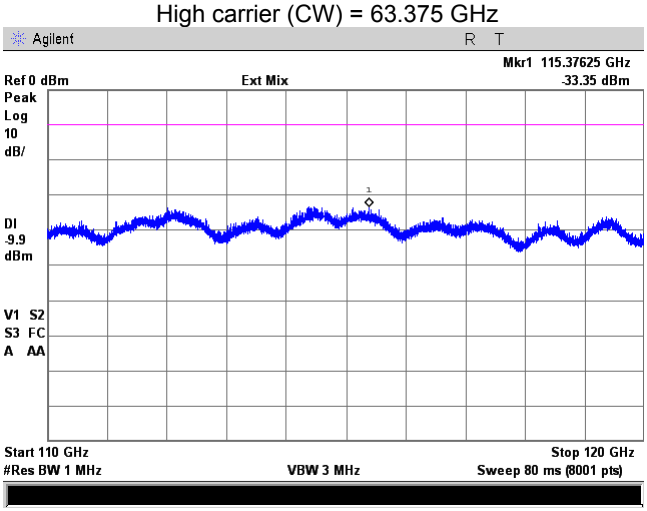
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

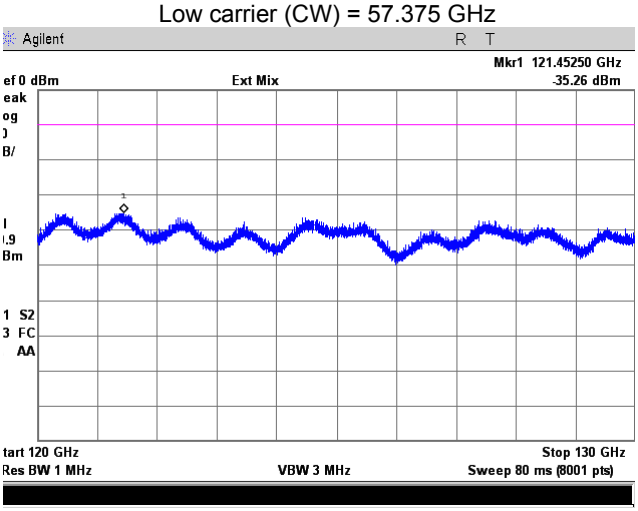


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

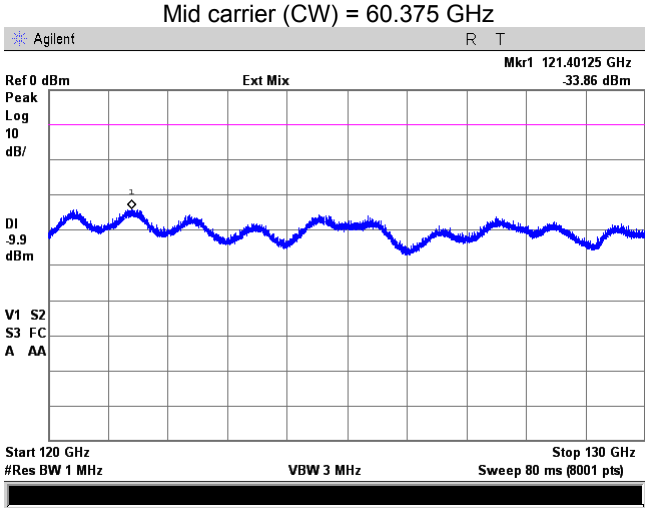
Plot 7.3.11 Spurious emission test results at low carrier frequency from 120 to 130 GHz

DETECTOR: Peak

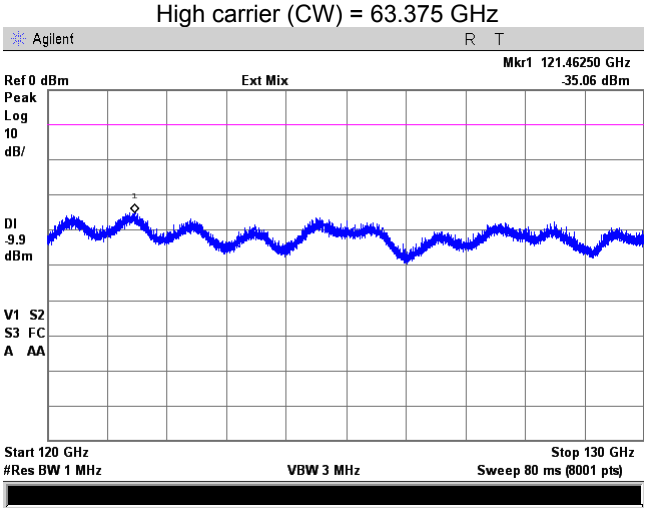
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

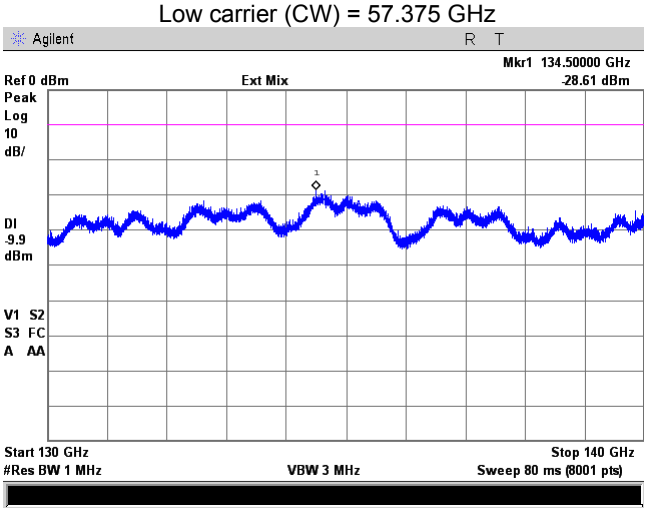


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

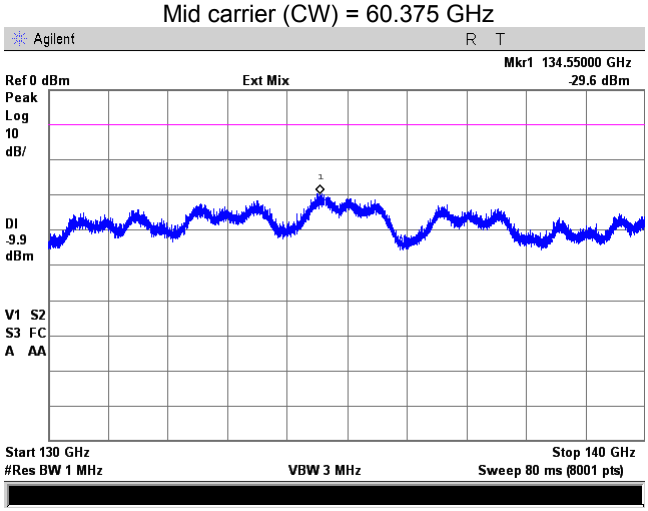
Plot 7.3.12 Spurious emission test results at low carrier frequency from 130 to 140 GHz

DETECTOR: Peak

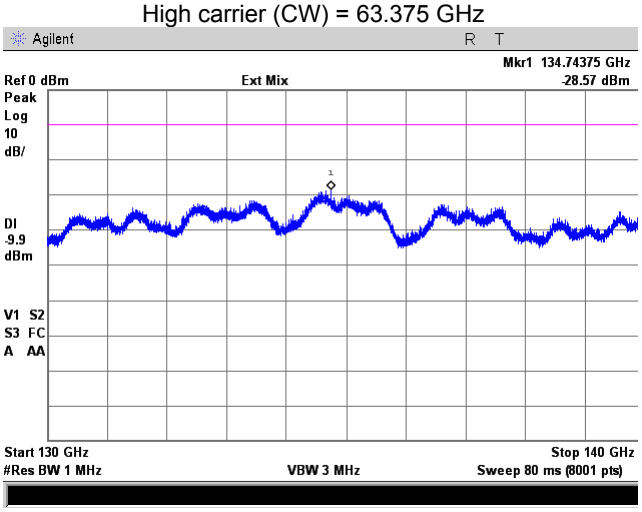
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

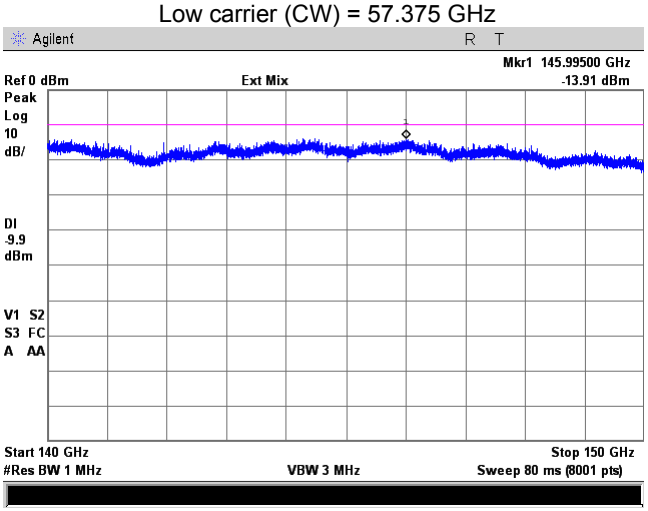


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

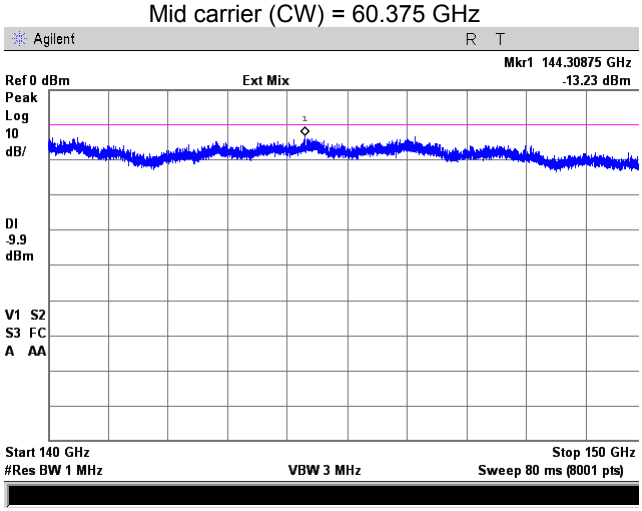
Plot 7.3.13 Spurious emission test results at low carrier frequency from 140 to 150 GHz

DETECTOR: Peak

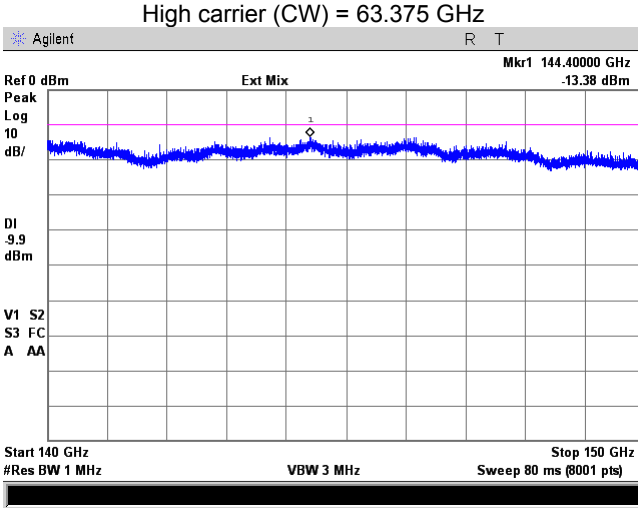
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

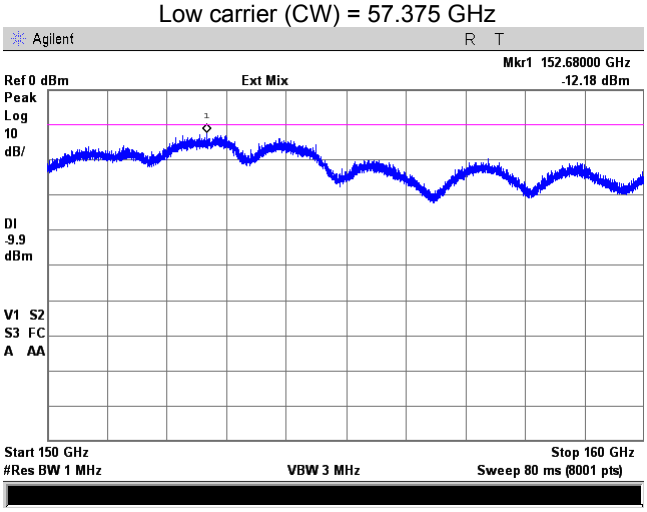


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

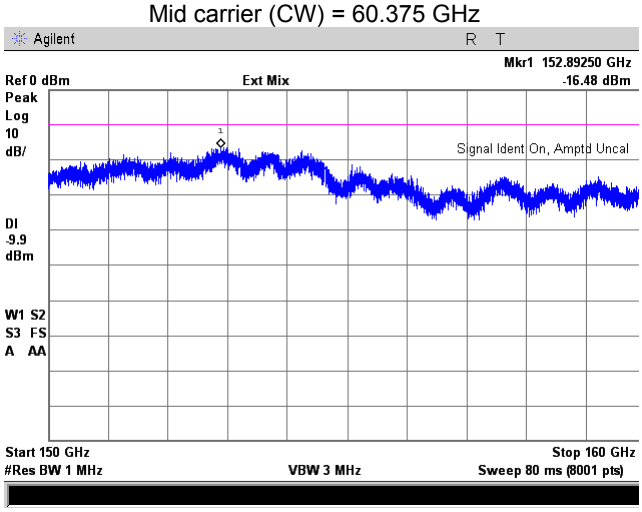
Plot 7.3.14 Spurious emission test results at low carrier frequency from 150 to 160 GHz

DETECTOR: Peak

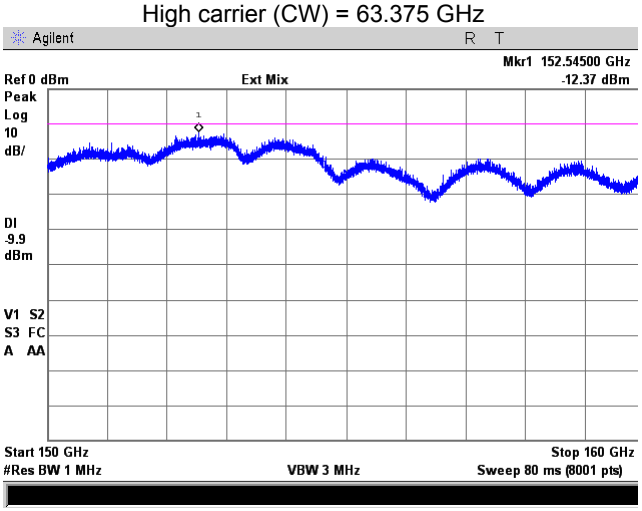
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

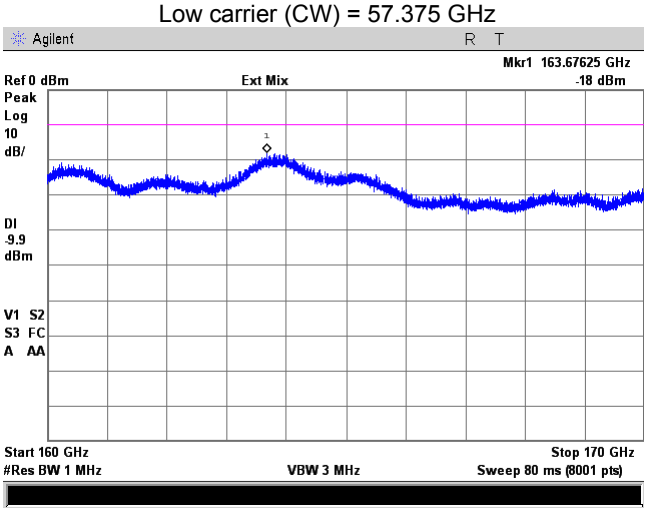


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

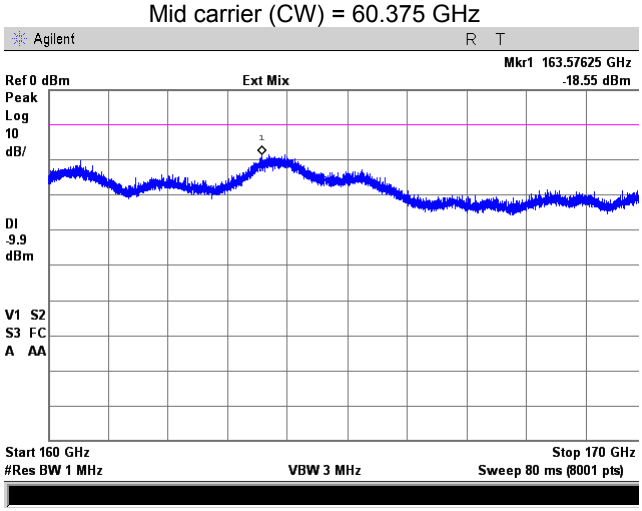
Plot 7.3.15 Spurious emission test results at low carrier frequency from 160 to 170 GHz

DETECTOR: Peak

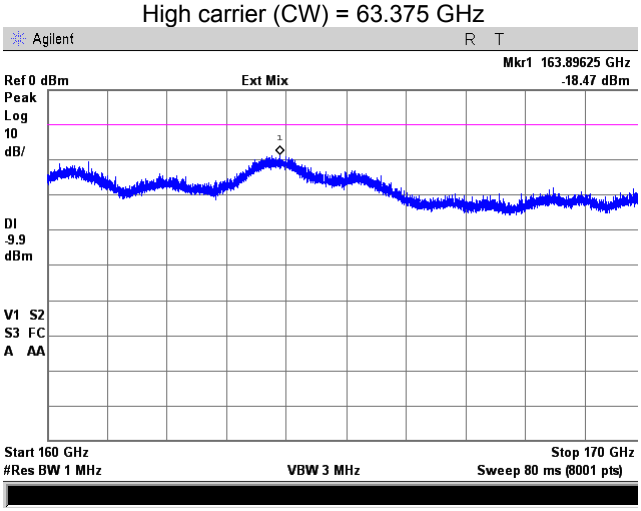
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

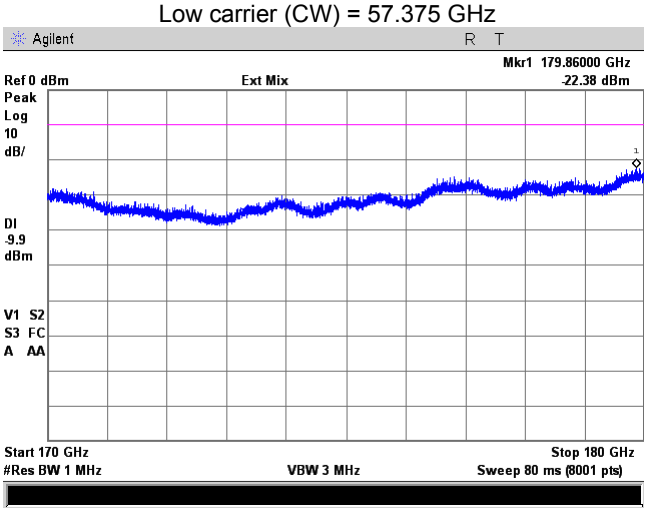


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

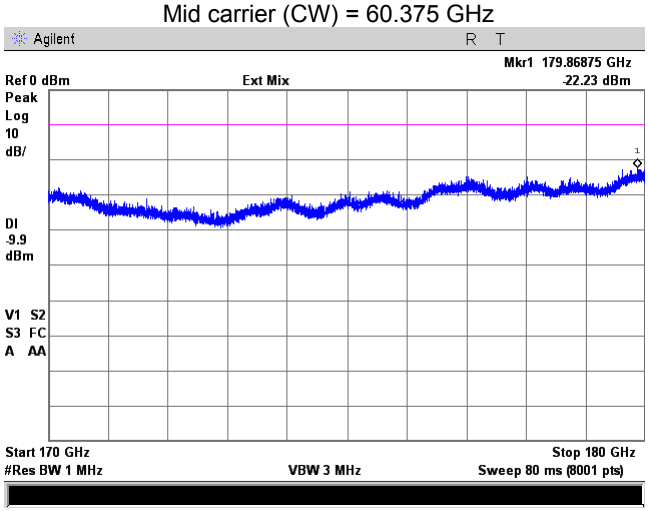
Plot 7.3.16 Spurious emission test results at low carrier frequency from 170 to 180 GHz GHz

DETECTOR: Peak

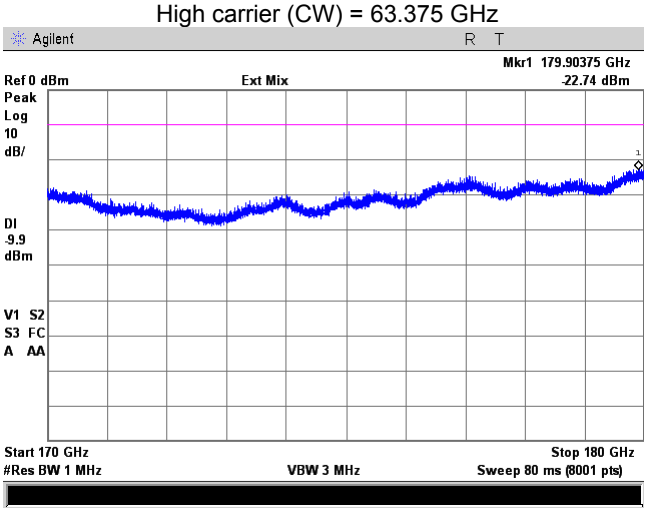
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

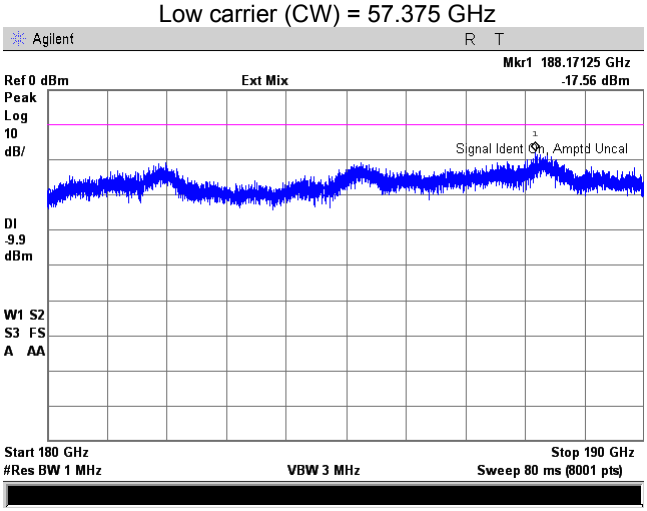


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

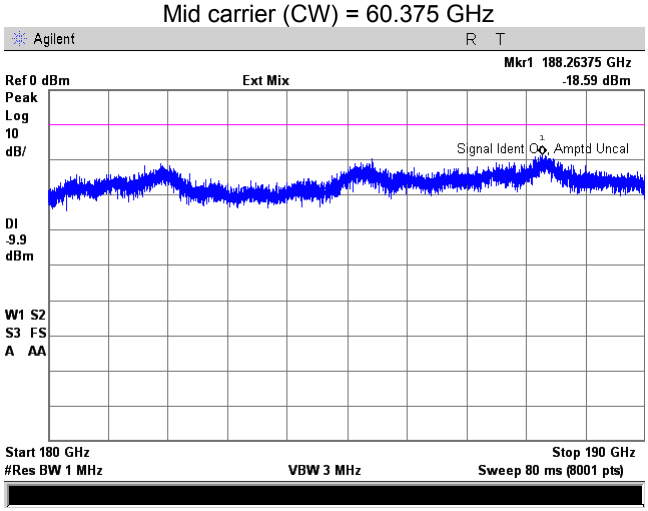
Plot 7.3.17 Spurious emission test results at low carrier frequency from 180 to 190 GHz GHz

DETECTOR: Peak

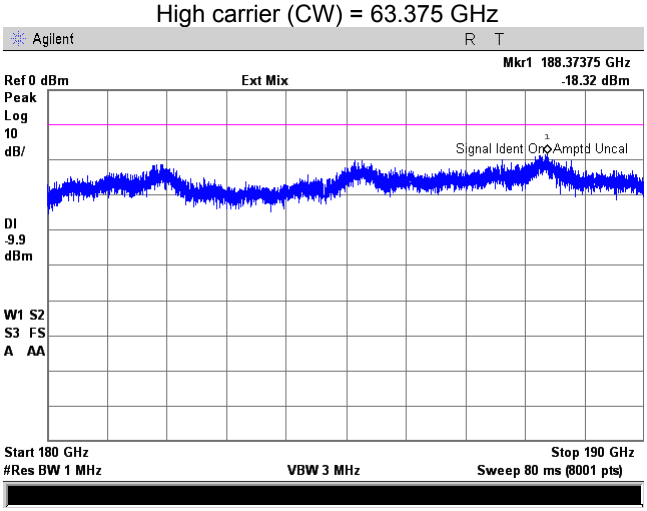
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz

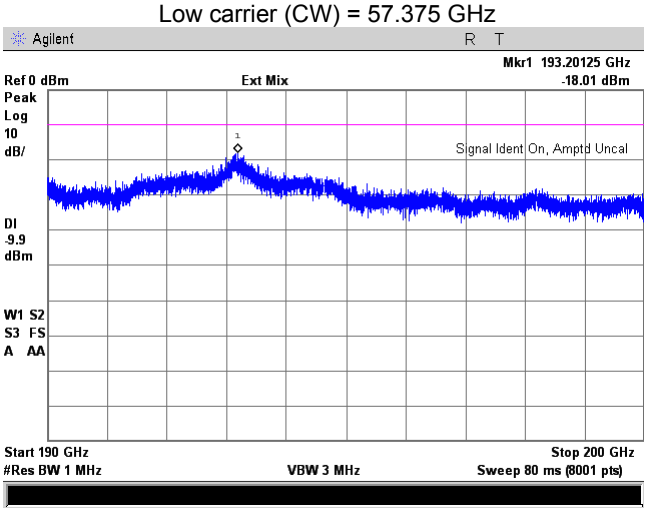


Test specification:	Section 15.255(c), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051; FCC Millimeter wave test procedures		
Test mode:	Compliance	Verdict:	PASS
Date:	8/03/2014		
Temperature: 24ºC	Air Pressure: 1008 hPa	Relative Humidity: 46%	Power Supply: 48 VDC
Remarks:			

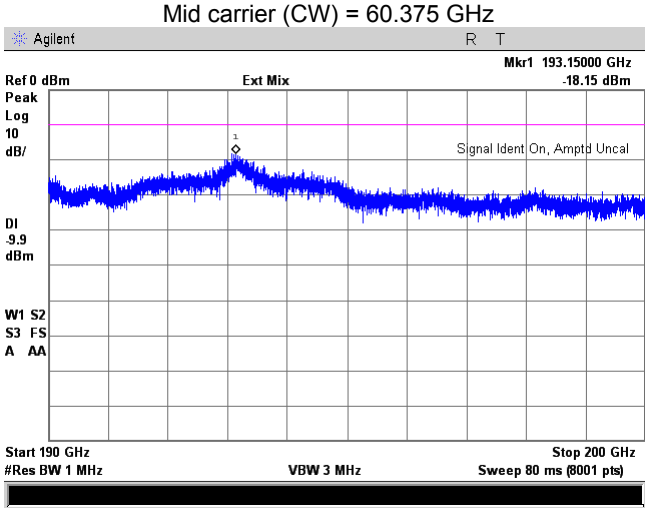
Plot 7.3.18 Spurious emission test results at low carrier frequency from 190 to 200 GHz GHz

DETECTOR: Peak

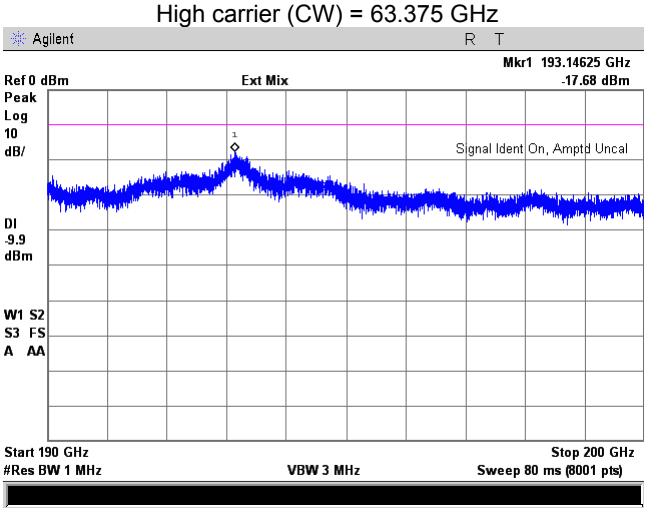
Low carrier (CW) = 57.375 GHz



Mid carrier (CW) = 60.375 GHz



High carrier (CW) = 63.375 GHz



Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

7.4 Out of band radiated emissions below 40 GHz

7.4.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Radiated emission limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m)***		
	Peak	Quasi Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**
0.090 – 0.110	NA	108.5 – 106.8**	NA
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**
0.490 – 1.705	NA	73.8 – 63.0**	NA
1.705 – 30.0*		69.5**	
30 – 88		40.0	
88 – 216		43.5	
216 – 960		46.0	
960 - 40000	74.0	NA	54.0

*- The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

**- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$Lim_{S2} = Lim_{S1} + 40 \log (S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

***- The limit decreases linearly with the logarithm of frequency.

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

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.

7.4.2.2 The specified frequency range was investigated with loop antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna was rotated around its vertical axis and the measuring antenna polarization was switched from vertical to horizontal.

7.4.2.3 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

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

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

7.4.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.4.3.3 The worst test results (the lowest margins) were recorded in Table 7.4.2, Table 7.5.3 and shown in the associated plots.

Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Figure 7.4.1 Radiated emissions below 30 MHz test set up

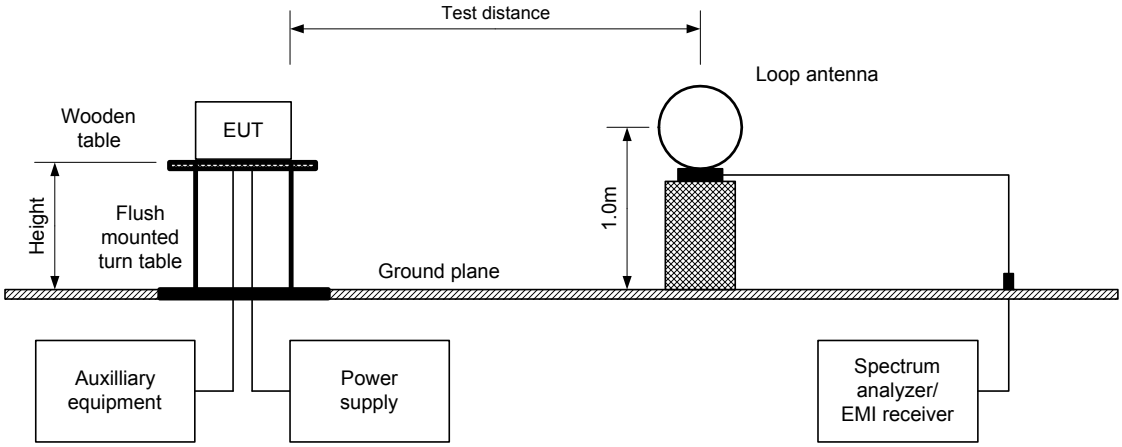
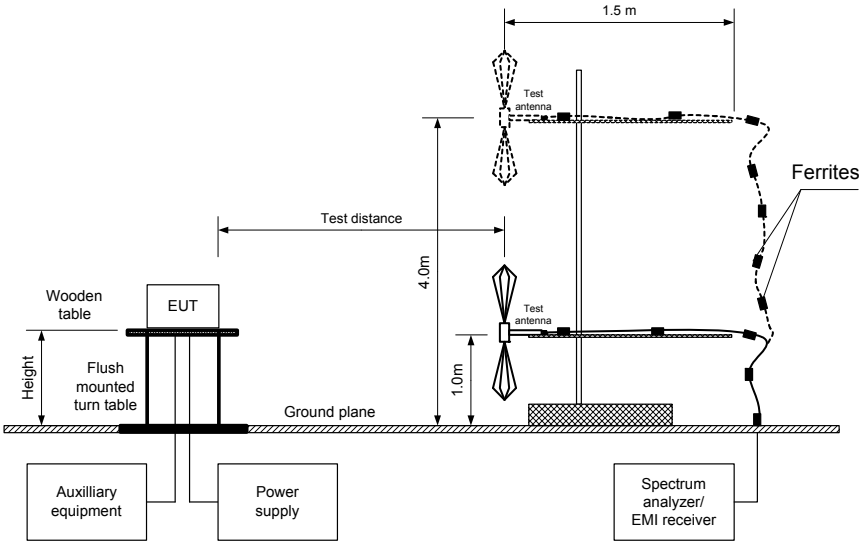


Figure 7.4.2 Radiated emissions above 30 MHz test set up



Test specification:	**Section 15.255(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 51%	**Power Supply:** 48 VDC
Remarks:			

Table 7.4.2 Radiated emissions test results below 1000 MHz

TEST SITE:	Semi Anechoic Chamber
TEST DISTANCE:	3 m
EUT POSITION:	Typical (Vertical)
MODULATION:	QPSK
EMISSION BANDWIDTH:	62.5 MHz
MODULATING SIGNAL:	PRBS
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 40000 MHz
RESOLUTION BANDWIDTH:	1.0 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz)

Frequency, MHz	**Peak emission, dB(μV/m)**	**Quasi-peak**			**Antenna polarization**	**Antenna height, m**	**Turn-table position**, degrees**	**Verdict**
		Measured emission, dB(μV/m)	**Limit, dB(μV/m)**	**Margin, dB***				
Low frequency 53375 MHz								
44.75	37.0	31.3	40.0	-8.7	Vertical	1.0	0	Pass
125.00	40.1	38.7	43.5	-4.8	Vertical	1.0	45	Pass
250.00	40.2	38.5	46.0	-7.5	Vertical	1.0	160	Pass
375.00	41.0	40.0	46.0	-6.0	Vertical	1.0	50	Pass
625.00	41.0	38.9	46.0	-7.1	Vertical	1.0	35	Pass
999.99	51.7	50.6	54.0	-3.4	Vertical	1.0	335	Pass
Mid frequency 60375 MHz								
44.67	37.9	29.9	40.0	-10.1	Vertical	1.0	0	Pass
125.00	39.5	38.3	43.5	-5.2	Vertical	1.0	45	Pass
250.00	39.8	38.1	46.0	-7.9	Vertical	1.0	160	Pass
375.00	41.2	40.0	46.0	-6.0	Vertical	1.0	50	Pass
625.00	38.6	37.0	46.0	-9.0	Vertical	1.0	35	Pass
999.99	50.3	48.9	54.0	-5.1	Vertical	1.0	335	Pass
High frequency 63375 MHz								
44.60	35.2	28.4	40.0	-11.6	Vertical	1.0	0	Pass
125.00	35.6	33.2	43.5	-10.3	Vertical	1.0	45	Pass
250.00	39.4	38.0	46.0	-8.0	Vertical	1.0	160	Pass
375.00	38.8	37.3	46.0	-8.7	Vertical	1.0	50	Pass
625.00	38.9	37.3	46.0	-8.7	Vertical	1.0	35	Pass
999.99	50.3	49.0	54.0	-5.0	Vertical	1.0	335	Pass

*****- Margin = Measured emission - specification limit.
******- EUT front panel refer to 0 degrees position of turntable.

Test specification:	**Section 15.255(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 51%	**Power Supply:** 48 VDC
Remarks:			

Table 7.4.3 Radiated emissions test results in 1000 – 40000 MHz range

TEST SITE:	OATS
TEST DISTANCE:	3 m
EUT POSITION:	Typical (Vertical)
MODULATION:	QPSK
EMISSION BANDWIDTH:	125 MHz
MODULATING SIGNAL:	PRBS
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	1000 – 40000 MHz
RESOLUTION BANDWIDTH:	1000 kHz
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Double-Ridged Waveguide Horn

Frequency, MHz	**Antenna**		**Azimuth, degrees***	**Peak field strength (VBW=3 MHz)**			**Average field strength (VBW=30 Hz)**			**Verdict**
	Polariz.	**Height, m**		**Measured, dB(μV/m)**	**Limit, dB(μV/m)**	**Margin, dB****	**Measured, dB(μV/m)**	**Limit, dB(μV/m)**	**Margin, dB*****	
Low frequency 57375 MHz										
1250.000	Vertical	1.1	110	41.90	74.0	-32.10	38.70	54.0	-15.30	Pass
35437.438	Vertical	1.0	26	53.52	74.0	-20.48	53.21	54.0	-0.79	
Mid frequency 60375 MHz										
1250.000	Vertical	12	110	41.70	74.0	-32.3	40.00	54.0	-14.00	Pass
36937.435	Vertical	1.0	26	60.13	74.0	-20.76	52.86	54.0	-1.14	
High frequency 63375 MHz										
1250.000	Vertical t	1.2	110	41.10	74.0	-32.9	37.90	54.0	-16.10	Pass
38437.445	Vertical	1.0	26	58.18	74.0	-20.83	52.65	54.0	-1.35	

*EUT front panel refer to 0 degrees position of turntable
**- Margin = Measured emission - specification limit.
***- Margin = Calculated emission - specification limit.

Reference numbers of test equipment used

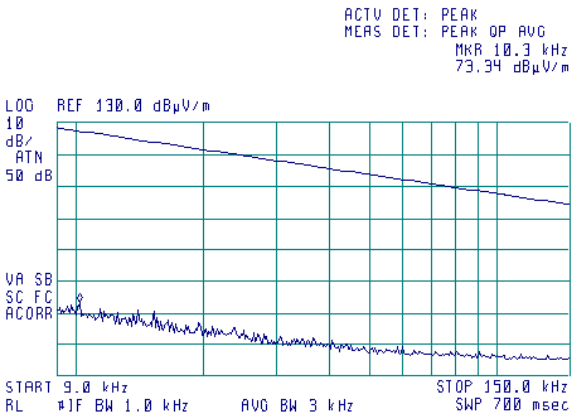
HL 0446	HL 0521	HL 0604	HL 0768	HL 0769	HL 2909	HL 3535	HL 3901
HL 4114	HL 4150	HL 4352	HL 4353				

Full description is given in Appendix A.

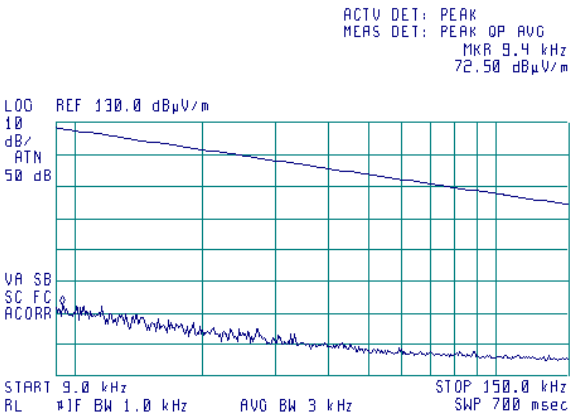
Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.4.1 Radiated emission measurements from 9 to 150 kHz

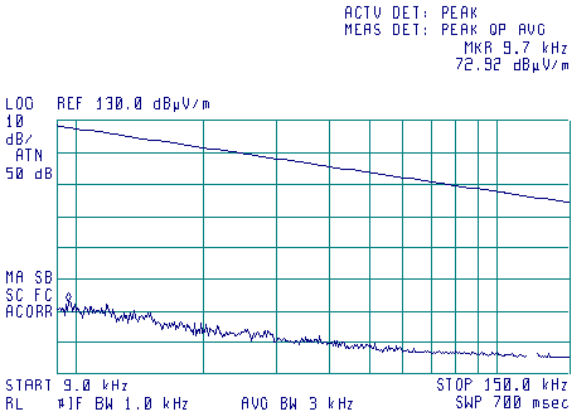
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
Low frequency: 57375 MHz



Mid frequency: 60375 MHz



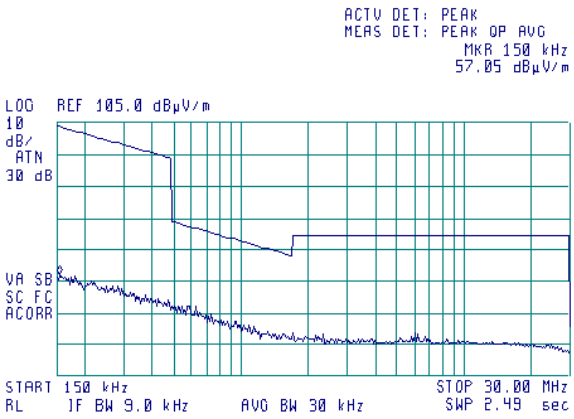
High frequency: 63375 MHz



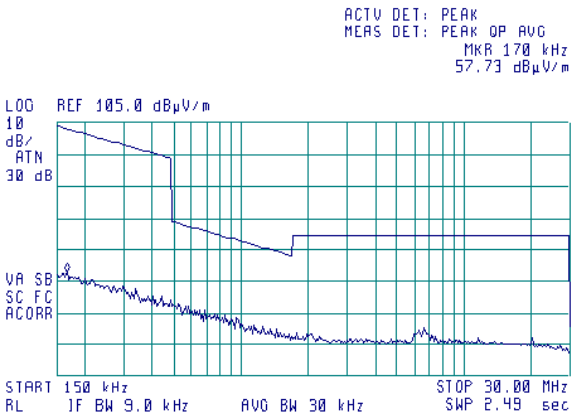
Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.4.2 Radiated emission measurements from 0.15 to 30 MHz

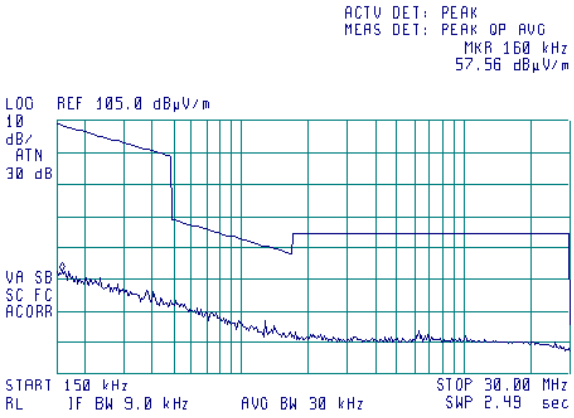
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
Low frequency 57375 MHz



Mid frequency 60375 MHz



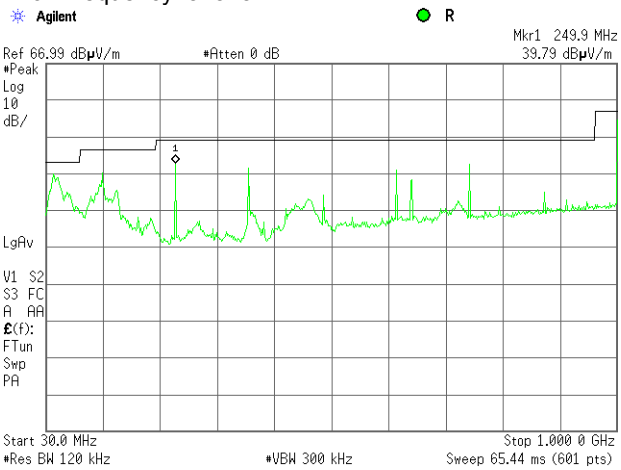
High frequency 63375 MHz



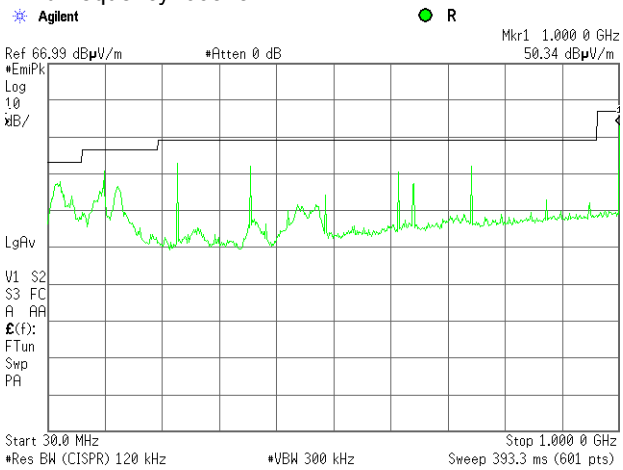
Test specification:	**Section 15.255(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 51%	**Power Supply:** 48 VDC
Remarks:			

Plot 7.4.3 Radiated emission measurements from 30 to 1000 MHz

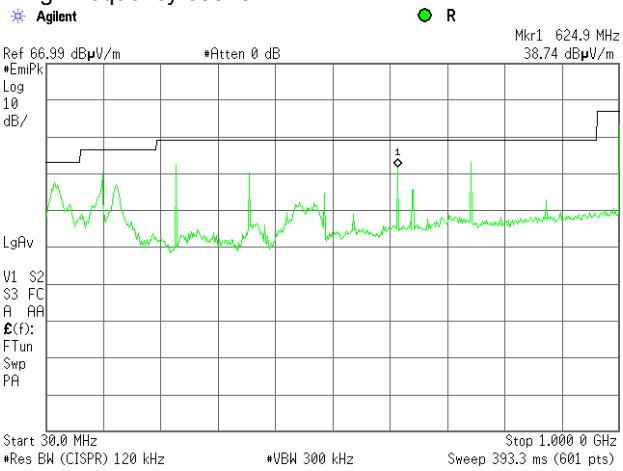
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
Low frequency: 57375 MHz



Mid frequency: 60375 MHz



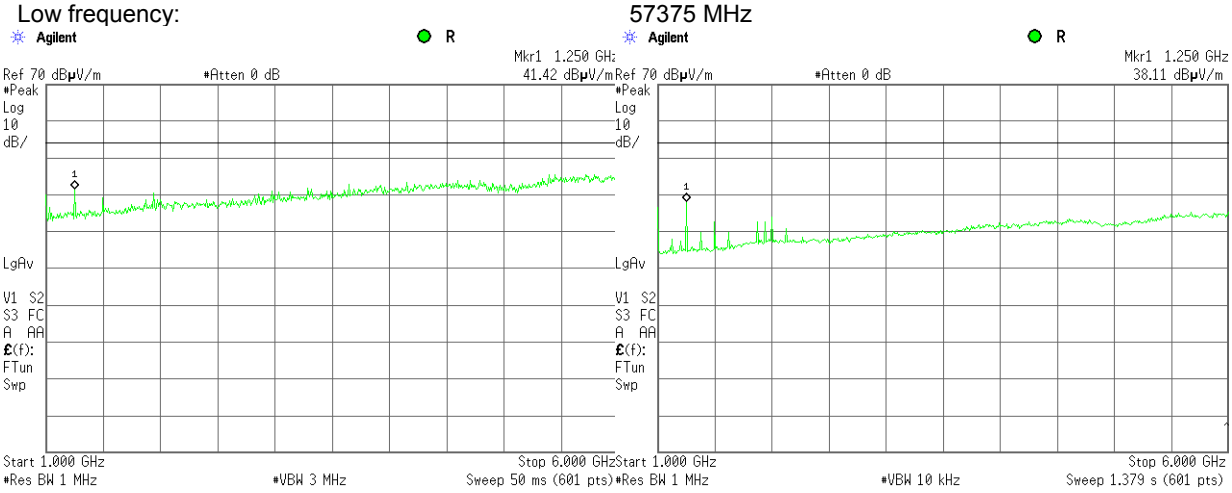
High frequency 63375 MHz



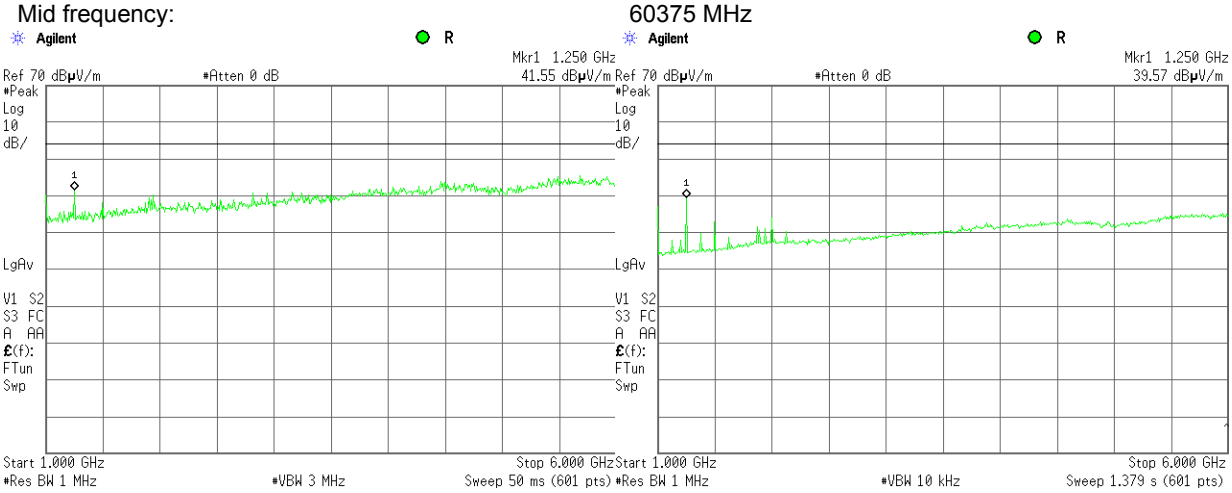
Test specification:	**Section 15.255(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 51%	**Power Supply:** 48 VDC
Remarks:			

Plot 7.4.4 Radiated emission measurements from 1000 to 6000 MHz

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average
Low frequency: 57375 MHz



Mid frequency: 60375 MHz

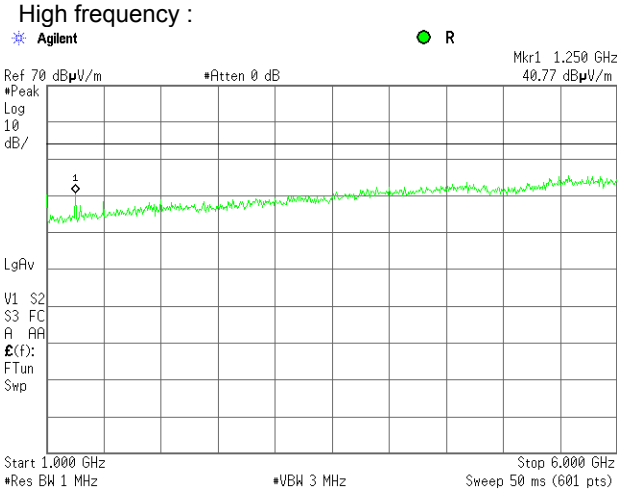


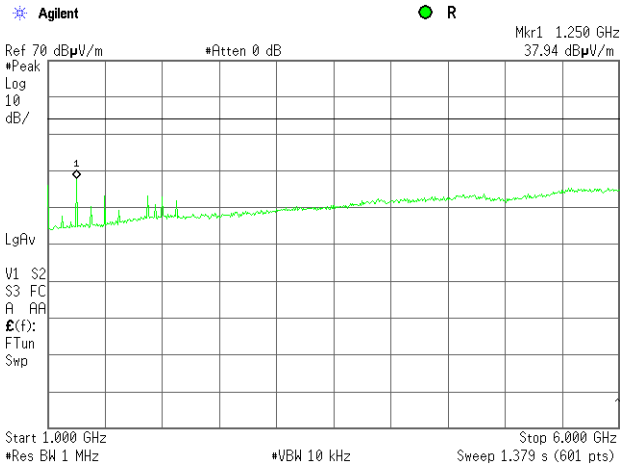
Test specification:	**Section 15.255(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 51%	**Power Supply:** 48 VDC
Remarks:			

Plot 7.4.5 Radiated emission measurements from 1000 to 6000 MHz

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

High frequency : 63375 MHz

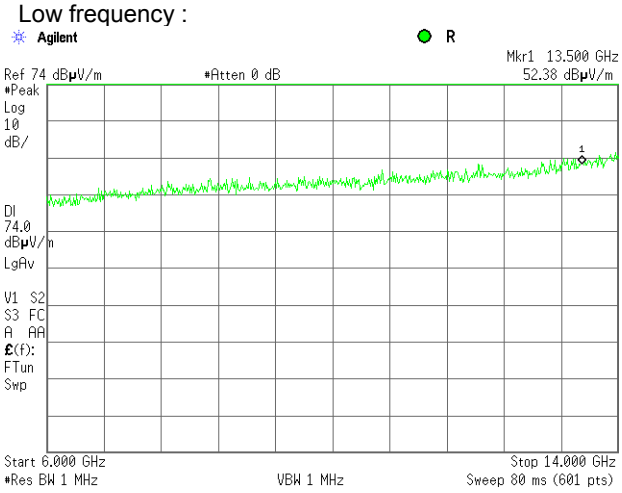


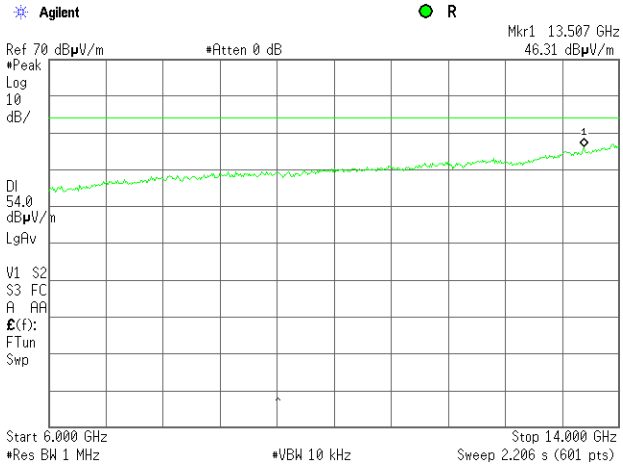


Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

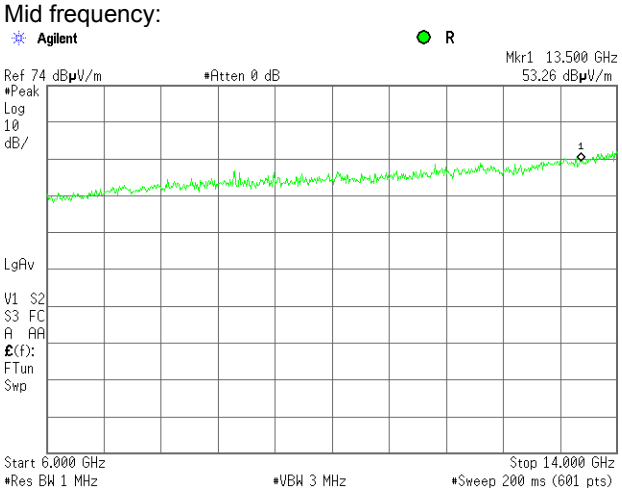
Plot 7.4.6 Radiated emission measurements from 6000 – 14000 MHz

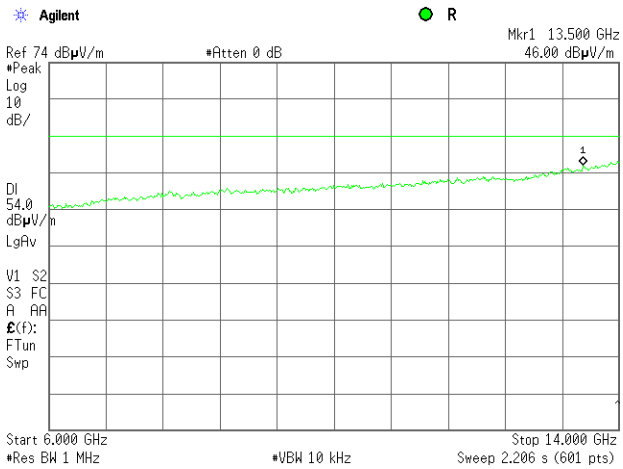
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak
Low frequency : 57375 MHz





Mid frequency: 60375 MHz



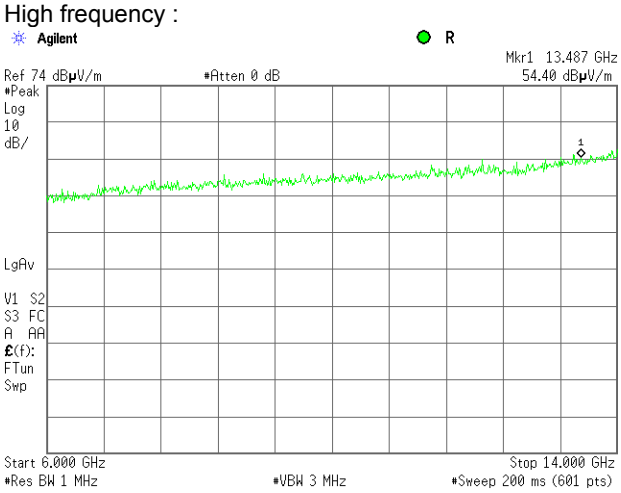


Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

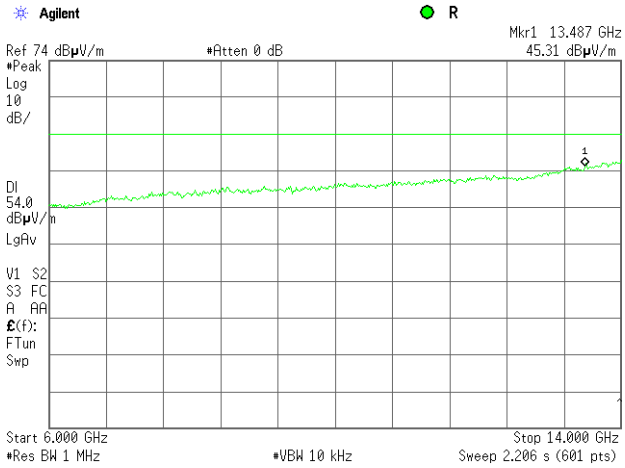
Plot 7.4.7 Radiated emission measurements from 6000 – 14000 MHz

TEST SITE:	Anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
DETECTOR:	Peak

High frequency :



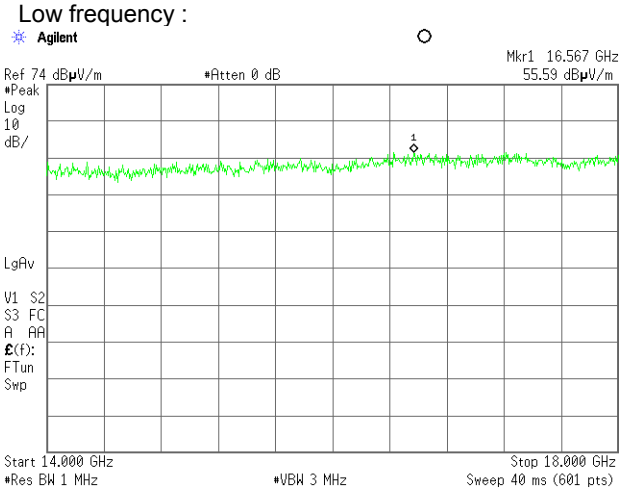
63375 MHz



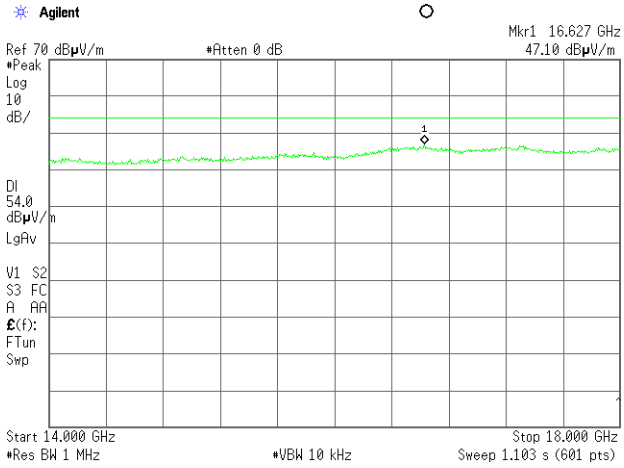
Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.4.8 Radiated emission measurements from 14000 – 18000 MHz

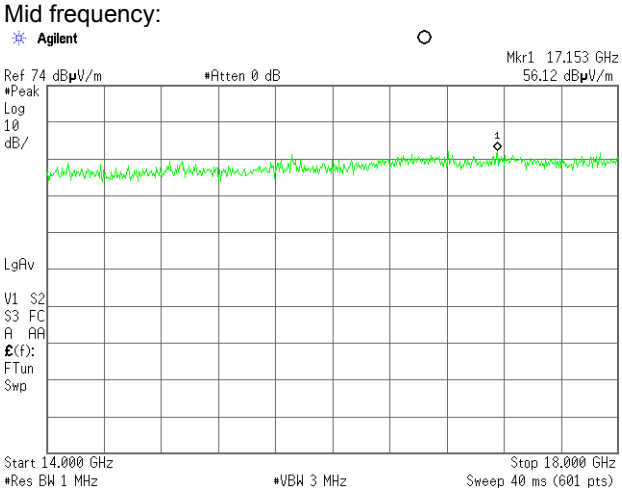
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak
Low frequency :



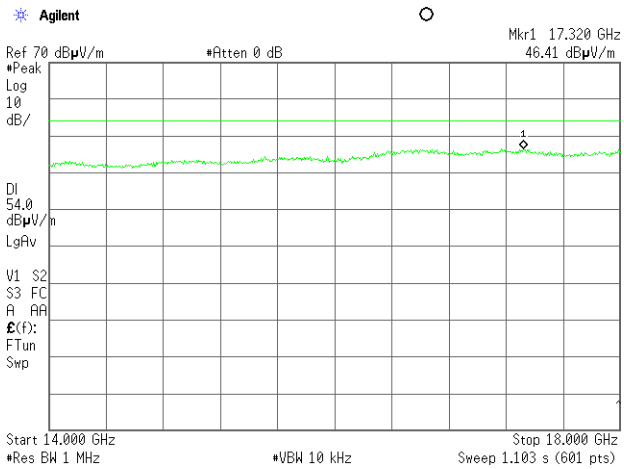
DETECTOR: Average
57375 MHz



Mid frequency:



60375 MHz

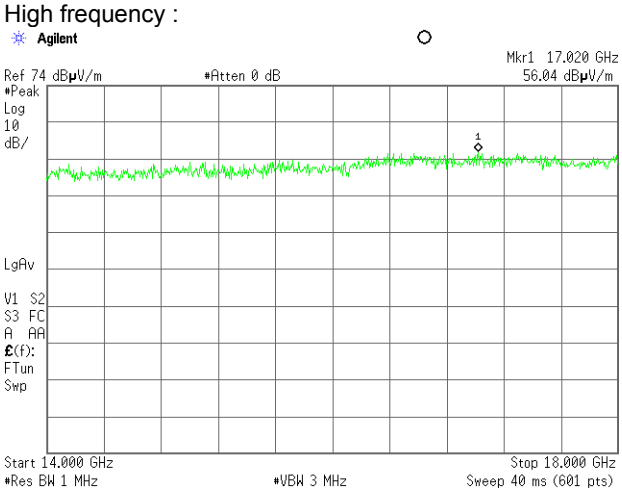


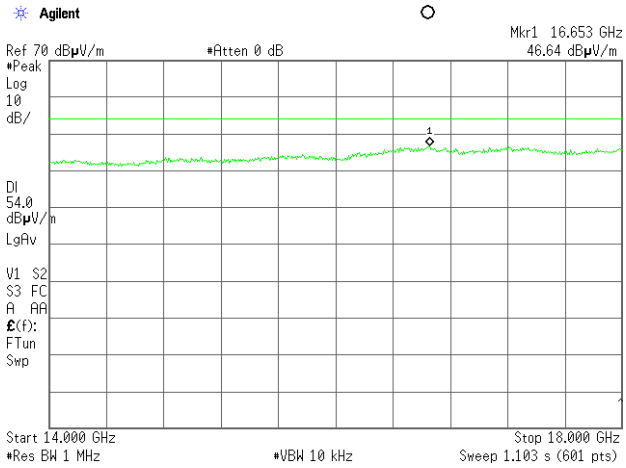
Test specification:	**Section 15.255(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 51%	**Power Supply:** 48 VDC
Remarks:			

Plot 7.4.9 Radiated emission measurements from 14000 – 18000 MHz

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

High frequency : 63375 MHz



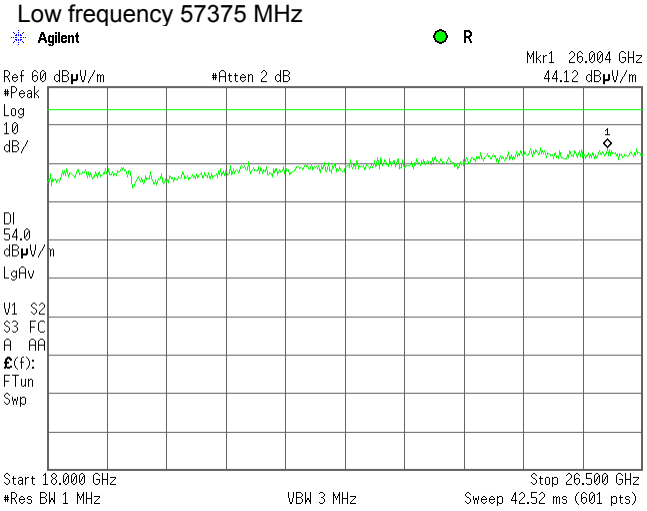


Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

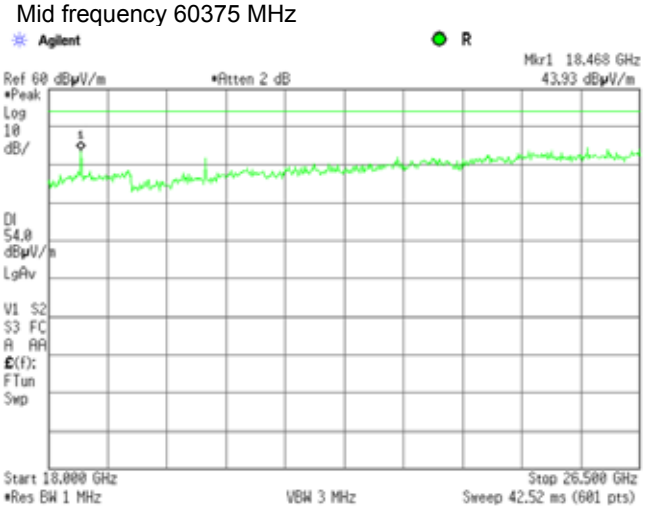
Plot 7.4.10 Radiated emission measurements from 18000 to 26500 MHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak

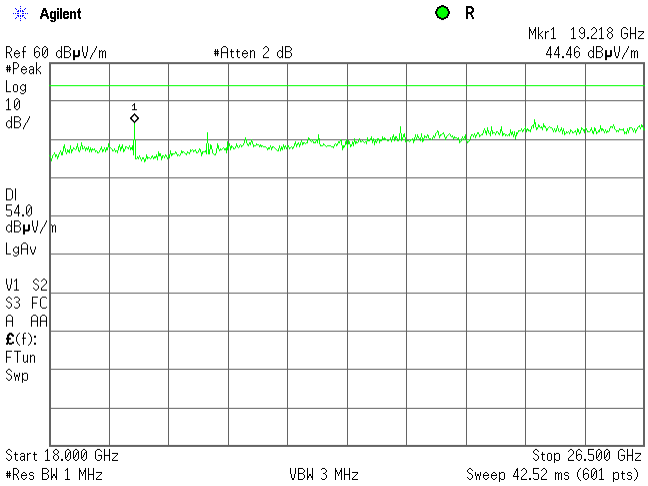
Low frequency 57375 MHz



Mid frequency 60375 MHz



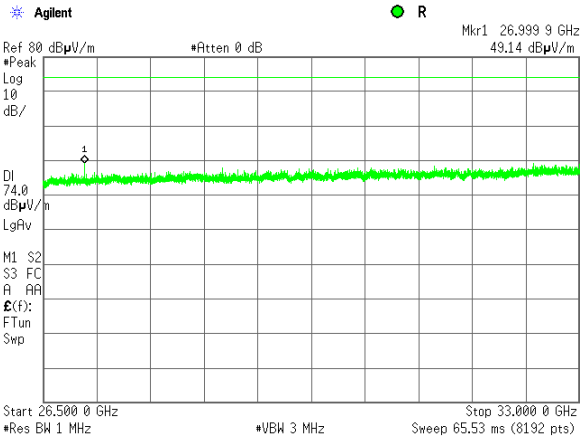
High frequency 63375 MHz

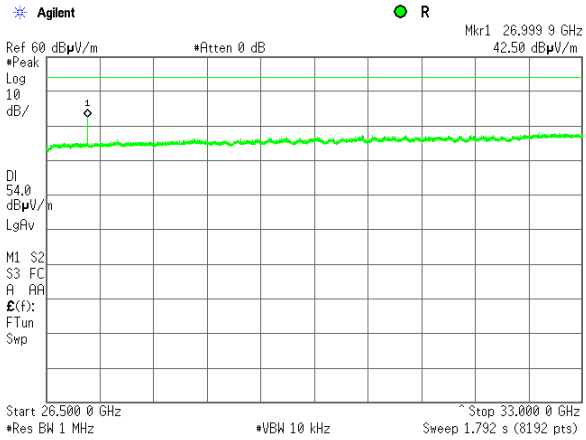


Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.4.11 Radiated emission measurements from 26500 to 33000 MHz

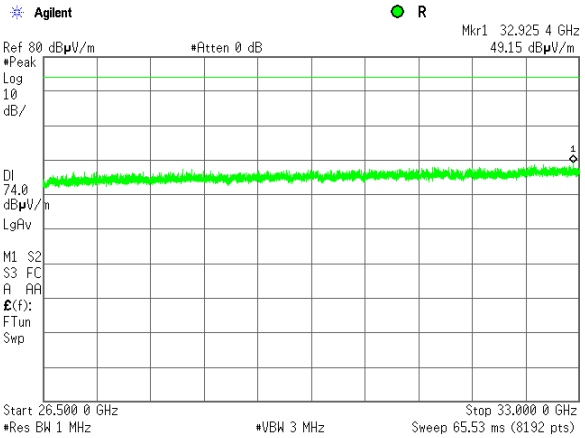
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak
LOW FREQUENCY: 57375 MHz

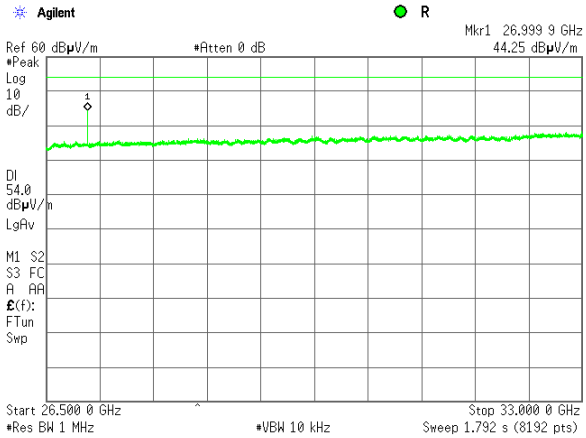




Plot 7.4.12 Radiated emission measurements from 26500 to 33000 MHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak
MID FREQUENCY: 60375 MHz

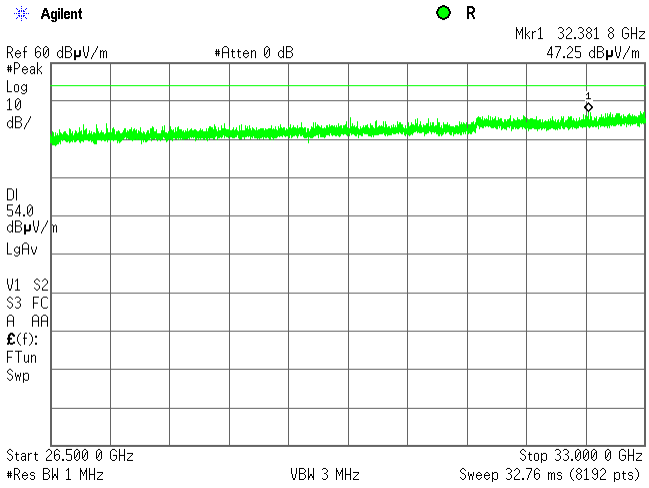




Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

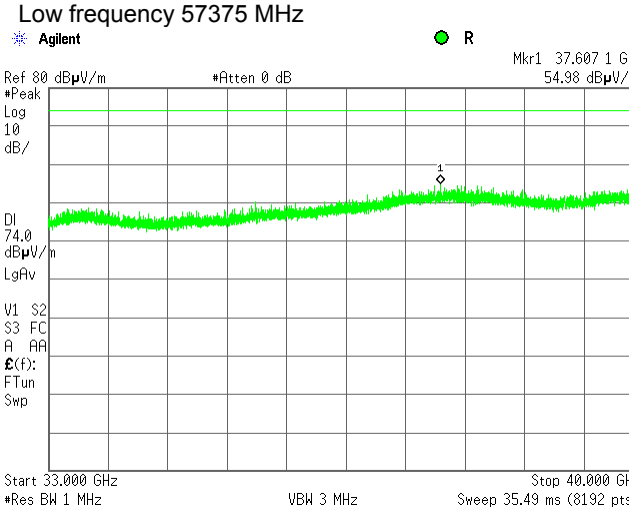
Plot 7.4.13 Radiated emission measurements from 26500 to 33000 MHz

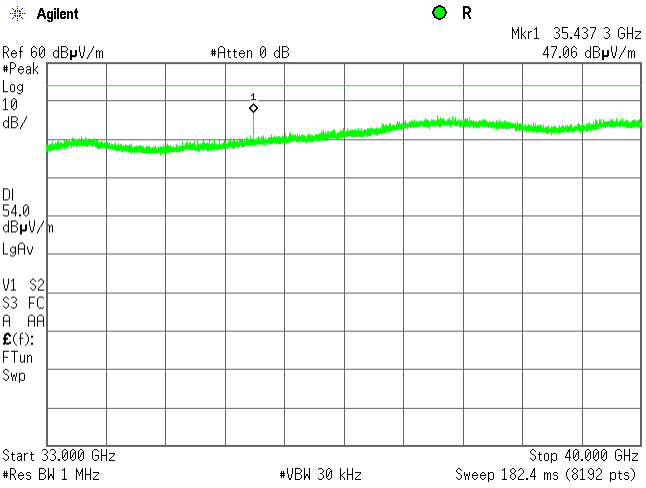
TEST SITE:	OATS
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
DETECTOR:	Peak
HIGH FREQUENCY:	63375 MHz



Plot 7.4.14 Radiated emission measurements from 33000 to 40000 MHz

TEST SITE:	OATS
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
DETECTOR:	Peak
Low frequency 57375 MHz	

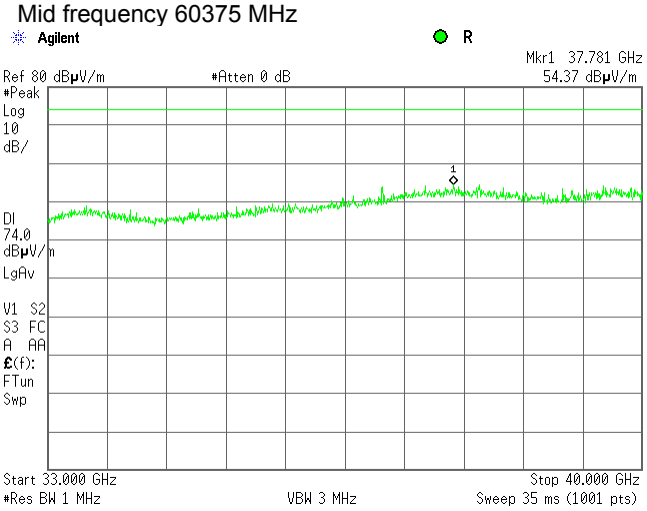


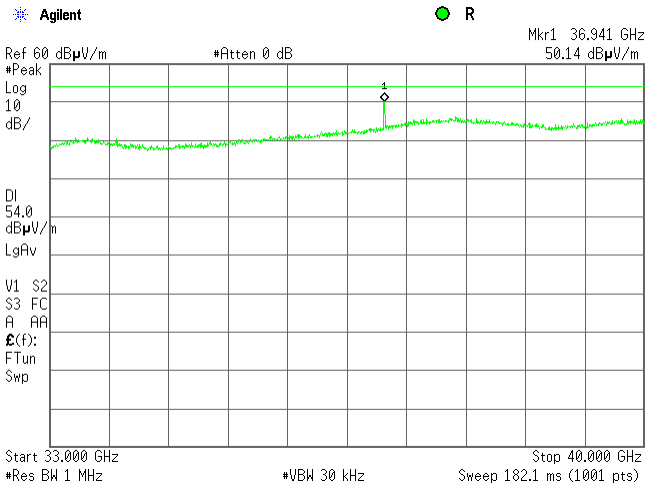


Test specification:	Section 15.255(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	47 CFR, Section 2.1053; ANSI C63.4, Sections 8.3.2, 13.2, 13.4		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014-7/16/2014		
Temperature: 24.8ºC	Air Pressure: 1012 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.4.15 Radiated emission measurements from 33000 to 40000 MHz

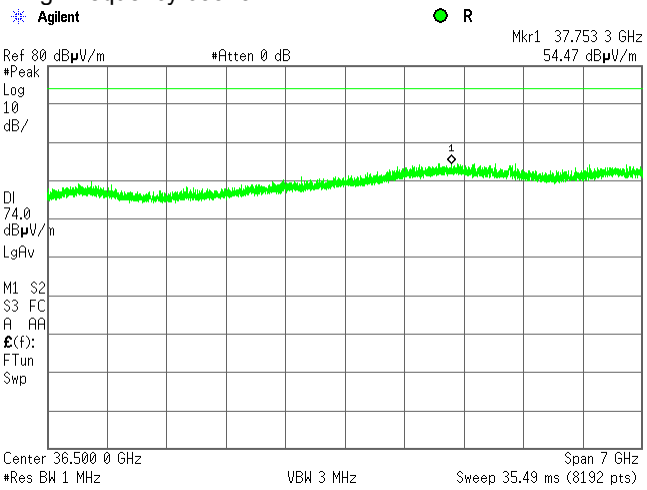
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak
Mid frequency 60375 MHz

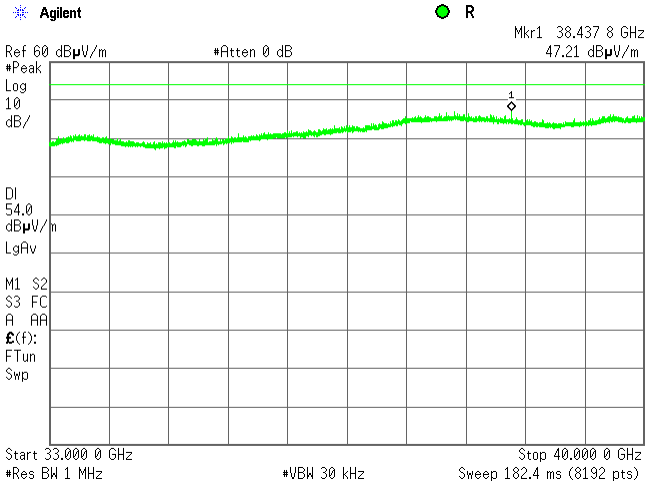




Plot 7.4.16 Radiated emission measurements from 33000 to 40000 MHz

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak
High frequency 63375 MHz





Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

7.5 Out of band radiated emissions above 40 GHz up to 220 GHz

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 7.5.2.

Table 7.5.1 Radiated spurious emission test limits

Frequency, MHz	Equivalent field strength limit @ 3m, dB(μV/m)***
40000 – 10th harmonic*	85.3

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier
** - P is transmitter output power in Watts
*** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: E=sqrt(30×P×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

Table 7.5.2 Radiated spurious emission test limits

Frequency, GHz	Power density at 3 m distance pW/cm^2	Distance, m	Field strength dB(μV/m)*, peak	Field strength dB(μV/m)*, average
40 – 220	90.0	3.0	105.3**	85.3**
75 - 90	90.0	0.7	118.1**	98.1**
90 - 110	90.0	0.15	136.3**	116.3**
110 - 140	90.0	0.15	128.1**	118.1**
140 - 170	90.0	0.05	152.1**	132.1**
170 - 200	90.0	0.05	153.8**	133.8**

*- The limit is provided in average values.
**- The limit for 1 m and other test distance was calculated using the inverse distance extrapolation factor as follows:

for far field: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
for near field: $Lim_{S3} = Lim_{S2} + 40 \log (S_2/S_3)$,

where S_1 – standard defined distance in meters;
S_2 – far field boundary distance in meters;
S_3 – near field test distance in meters.

7.5.2 Test procedure for spurious emission field strength measurements

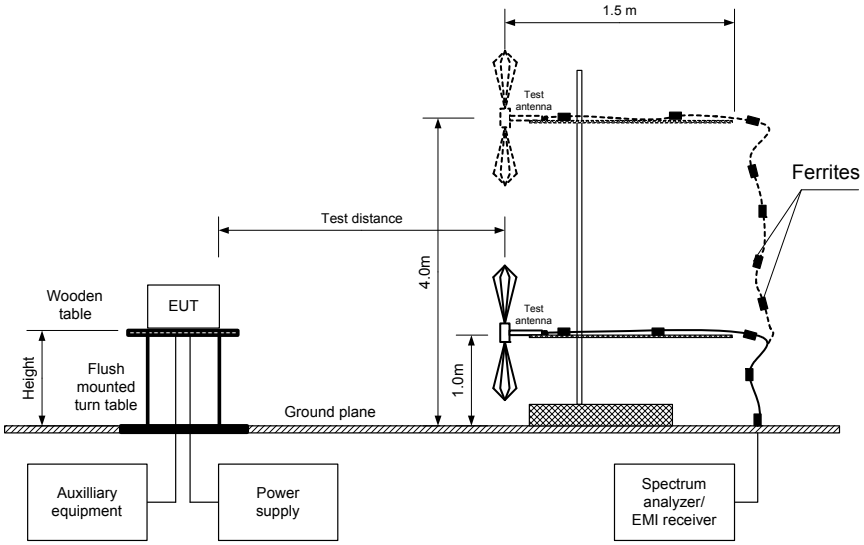
7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and the performance check was conducted.

7.5.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.5.2.3 The test results are shown in the associated plots.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Figure 7.5.1 Radiated emissions above 40 GHz test set up



Test specification:	**Section 15.255(c)(3), Out of band radiated emissions above 40 GHz**		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	**Verdict:**	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	**Air Pressure:** 1011 hPa	**Relative Humidity:** 51%	**Power Supply:** 48 VDC
Remarks:			

Table 7.5.3 Out of band radiated emissions test results

TEST DISTANCE:	0.05 - 3 m
EUT POSITION:	Typical (Vertical)
MODULATION:	QPSK
CHANNEL BANDWIDTH:	62.5 MHz
TRANSMITTER OUTPUT POWER:	Maximum
INVESTIGATED FREQUENCY RANGE:	40 – 220 GHz
RESOLUTION BANDWIDTH:	1000 kHz
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Standard Gain Horn 25dB (40-60 GHz) Standard Gain Horn 25dB (50-75 GHz) Standard Gain Horn 25dB (75-110 GHz) Standard Gain Horn 24dB (90-140 GHz) Standard Gain Horn 25dB (140-220 GHz)

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=1 kHz)			Verdict
	Polariz.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
Low carrier frequency 57375 MHz										
No emissions were found										Pass
Mid carrier frequency 60375 MHz										
No emissions were found										Pass
High carrier frequency 63375 MHz										
No emissions were found										Pass

*****- EUT front panel refer to 0 degrees position of turntable.
******- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

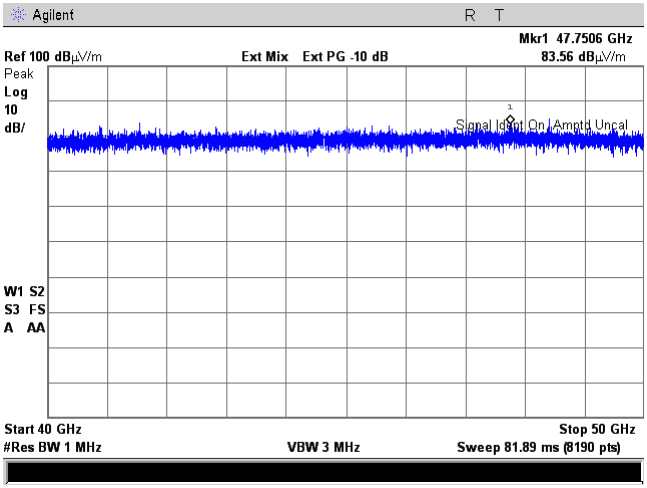
HL 0747	HL 0748	HL 0770	HL 0771	HL 0772	HL 1295	HL 1299	HL 1303
HL 1304	HL 1306	HL 1312	HL 2909	HL 3235	HL 3290	HL 3291	HL 3294
HL 3297	HL 3305	HL 3329	HL 3433	HL 3434	HL 3536	HL 3901	HL 4023

Full description is given in Appendix A.

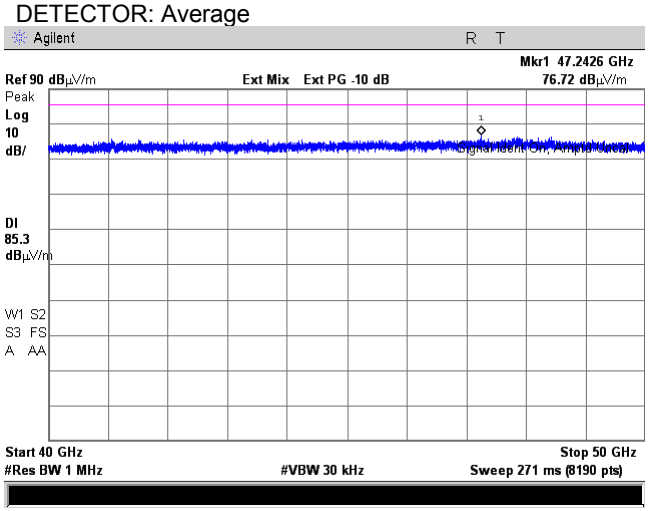
Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.1 Radiated emission measurements from 40 to 50 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



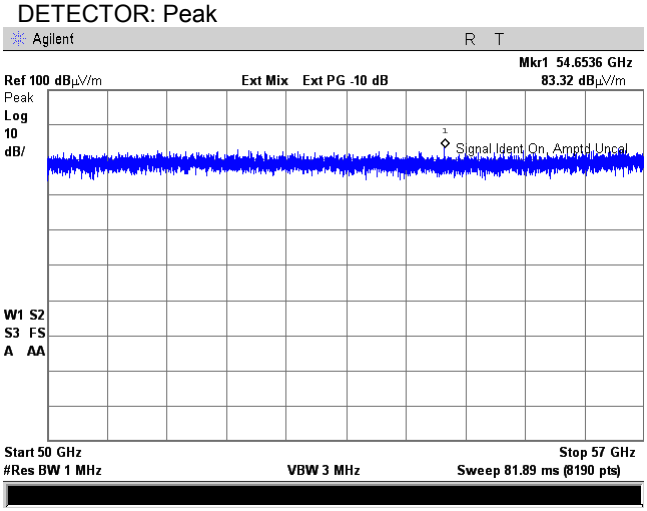
DETECTOR: Average



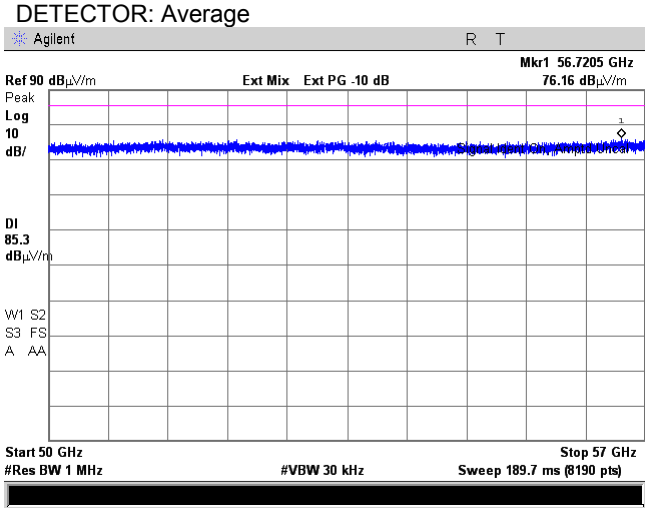
Peak limit 105.3 dBuV/m was applied.

Plot 7.5.2 Radiated emission measurements from 50 to 60 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



DETECTOR: Average

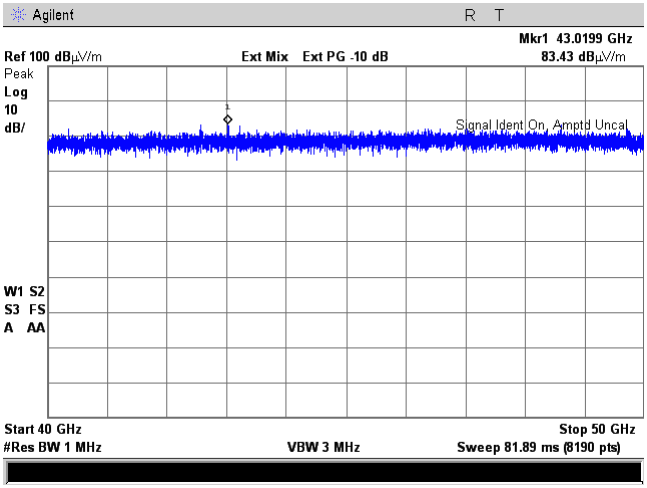


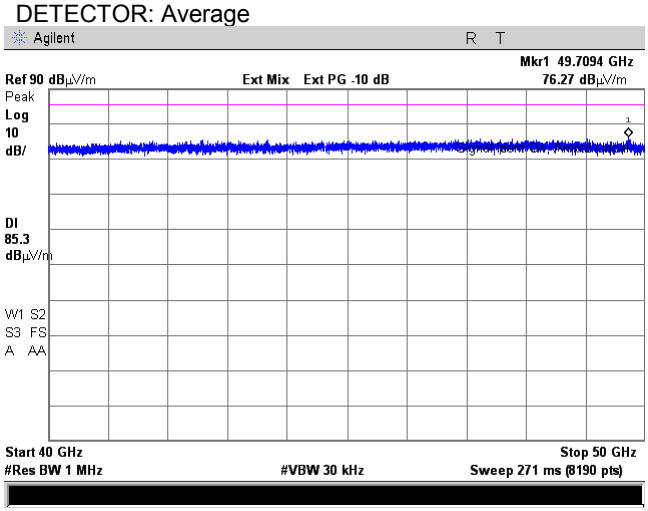
Peak limit 105.3 dBuV/m was applied.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.3 Radiated emission measurements from 40 to 50 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak / DETECTOR: Average

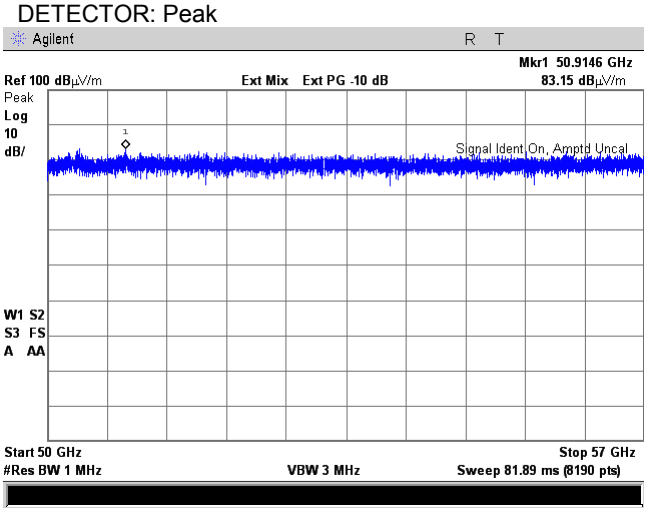


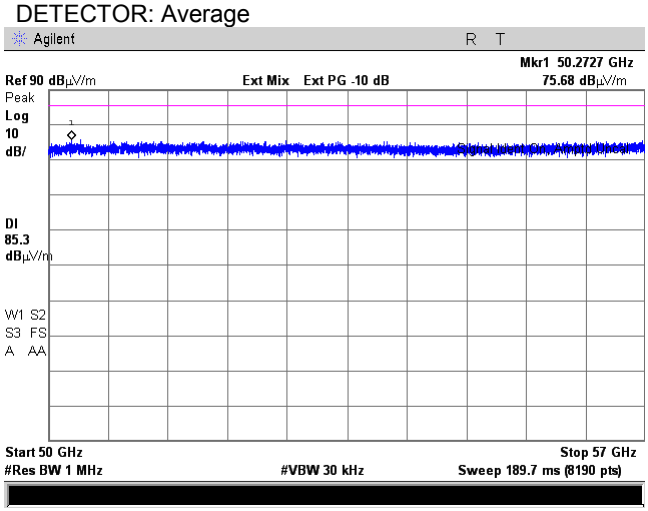


Peak limit 105.3 dBuV/m was applied.

Plot 7.5.4 Radiated emission measurements from 50 to 60 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak / DETECTOR: Average



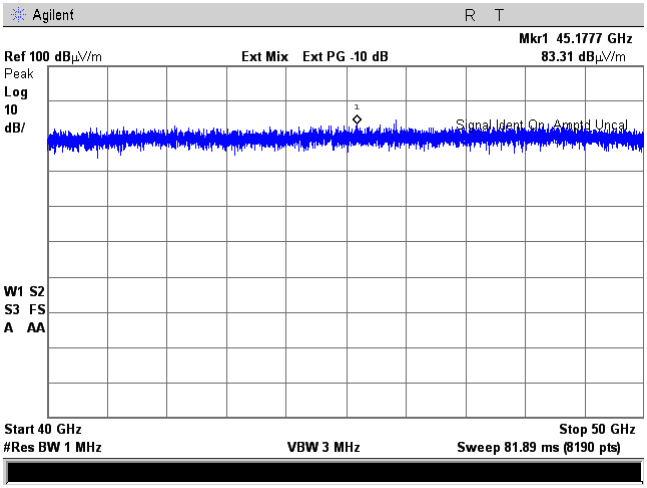


Peak limit 105.3 dBuV/m was applied.

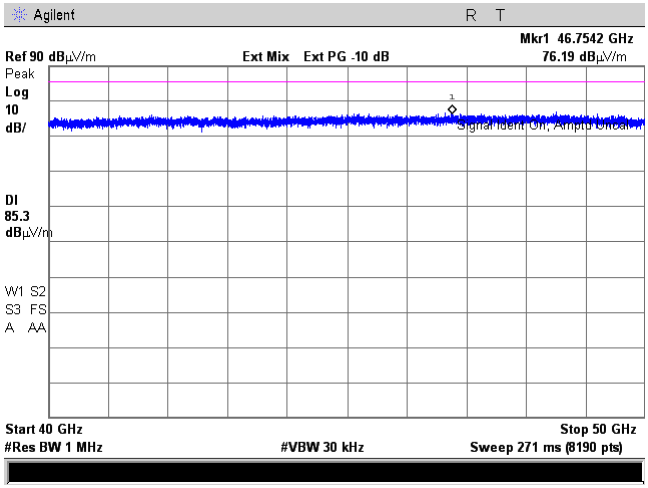
Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.5 Radiated emission measurements from 40 to 50 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
DETECTOR: Peak



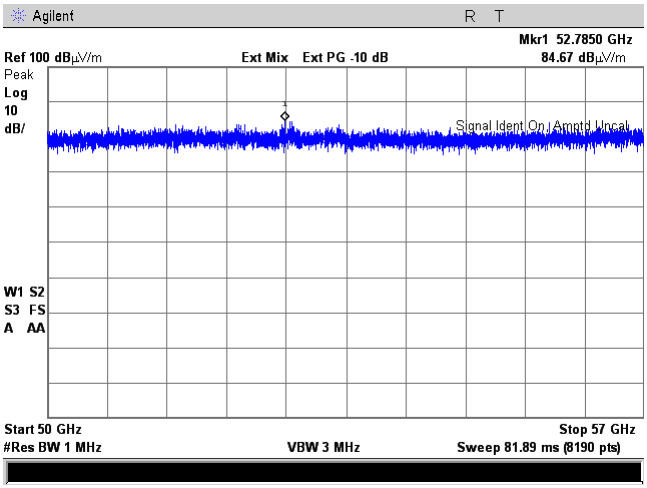
ANTENNA POLARIZATION: Horizontal
DETECTOR: Peak



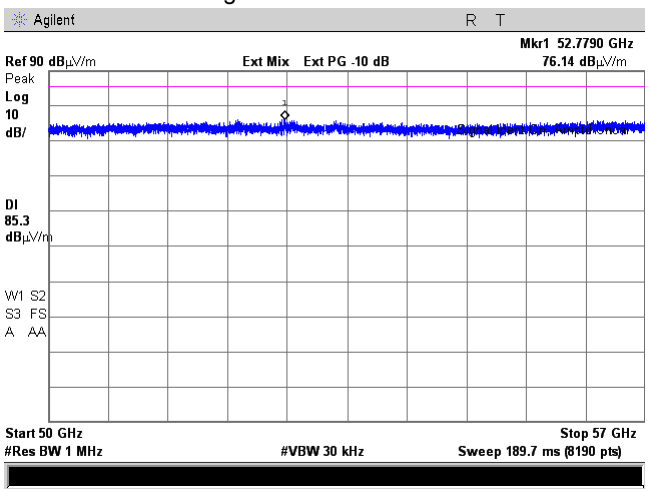
Peak limit 105.3 dBuV/m was applied.

Plot 7.5.6 Radiated emission measurements from 50 to 60 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



DETECTOR: Average

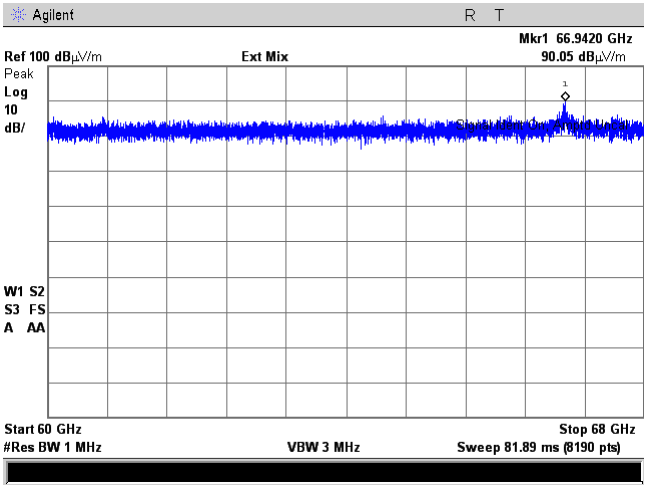


Peak limit 105.3 dBuV/m was applied.

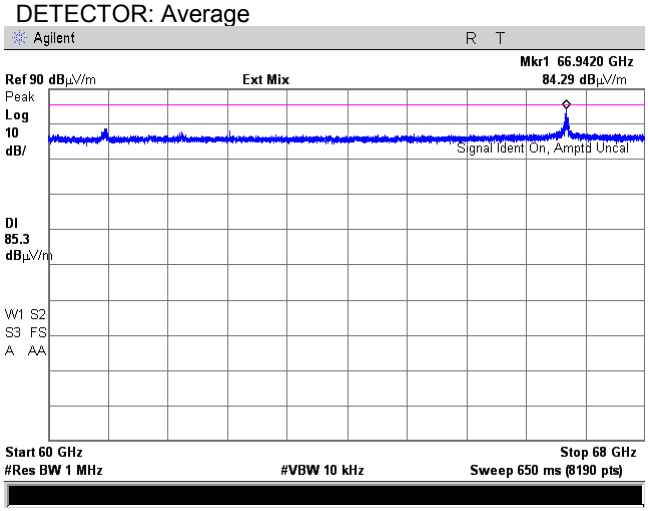
Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.7 Radiated emission measurements from 60 to 68 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 1 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



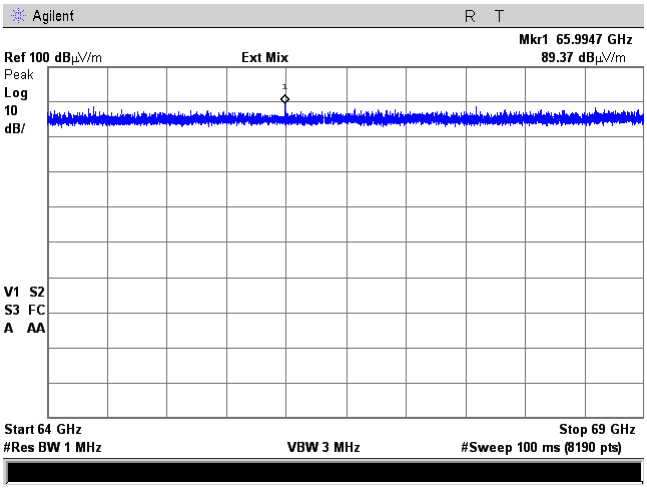
DETECTOR: Average



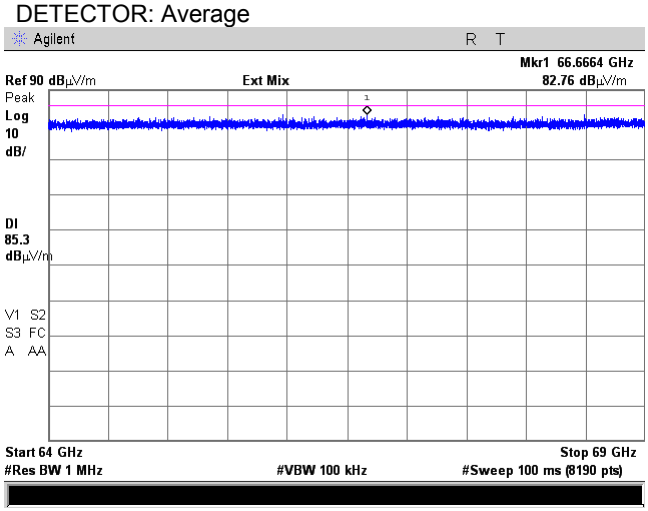
Peak limit 105.3 dBuV/m was applied.

Plot 7.5.8 Radiated emission measurements from 60 to 69 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 1 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



DETECTOR: Average

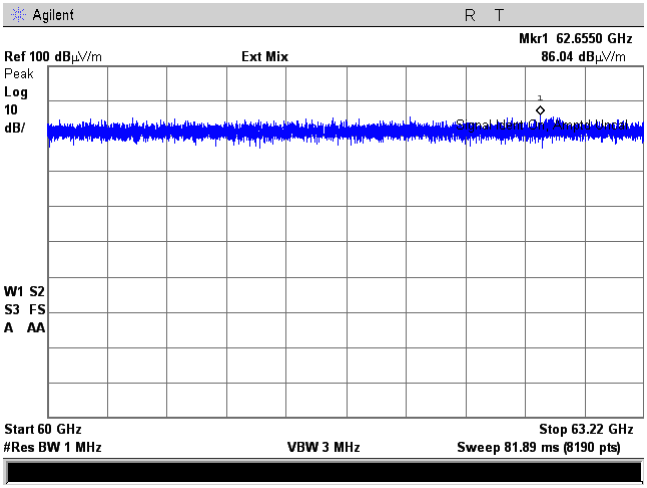


Peak limit 105.3 dBuV/m was applied.

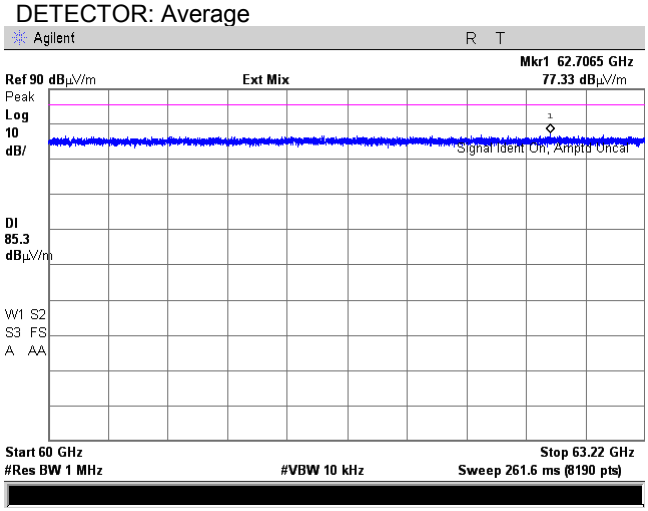
Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.9 Radiated emission measurements from 60 to 63 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 1 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



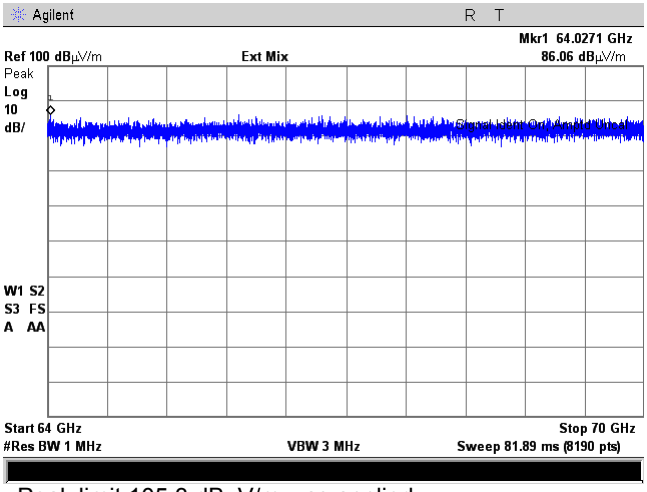
DETECTOR: Average



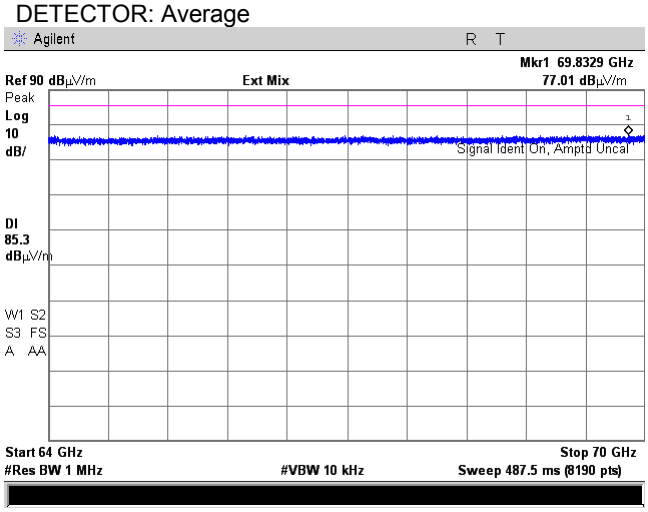
Peak limit 105.3 dBuV/m was applied.

Plot 7.5.10 Radiated emission measurements from 64 to 70 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 1 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



DETECTOR: Average

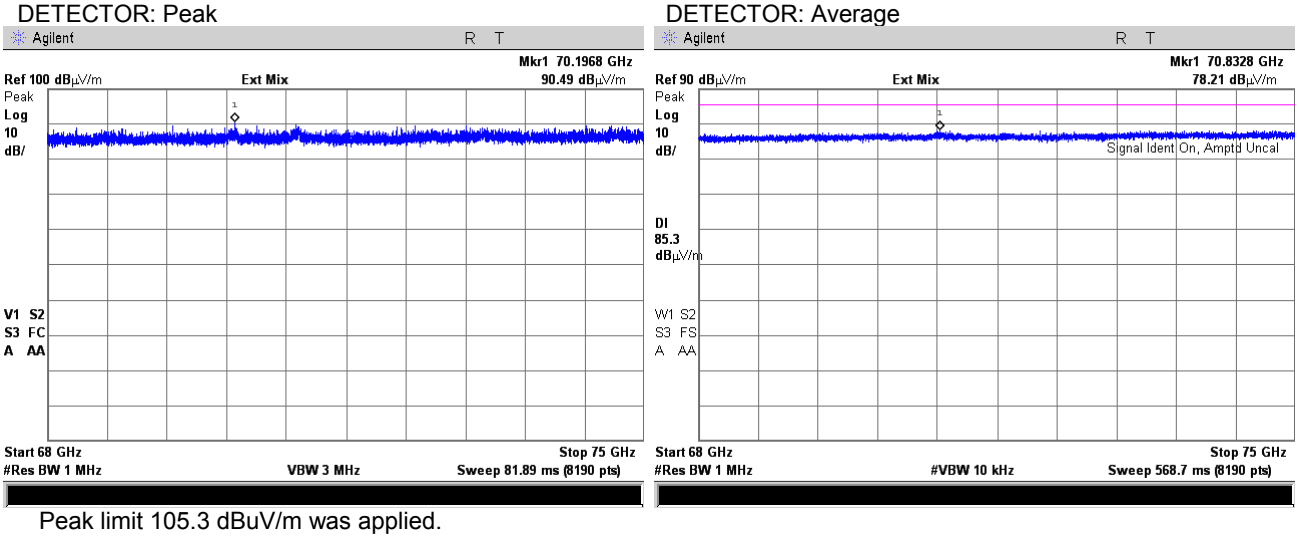


Peak limit 105.3 dBuV/m was applied.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.11 Radiated emission measurements from 68 to 75 GHz at the low frequency

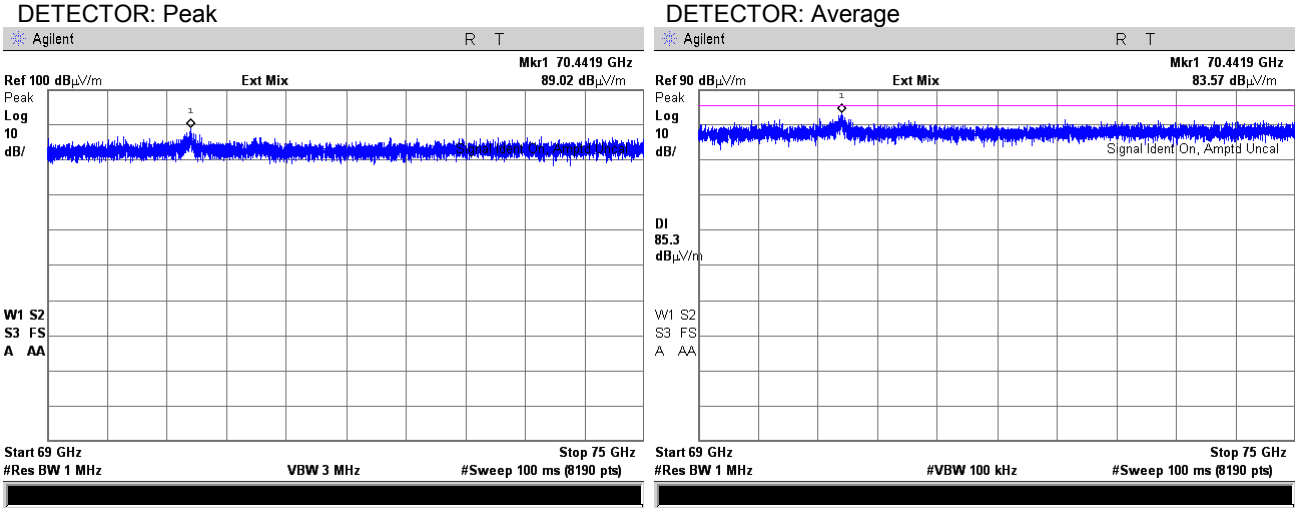
TEST SITE: OATS
TEST DISTANCE: 1 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak / DETECTOR: Average



Peak limit 105.3 dBuV/m was applied.

Plot 7.5.12 Radiated emission measurements from 69 to 75 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 1 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak / DETECTOR: Average

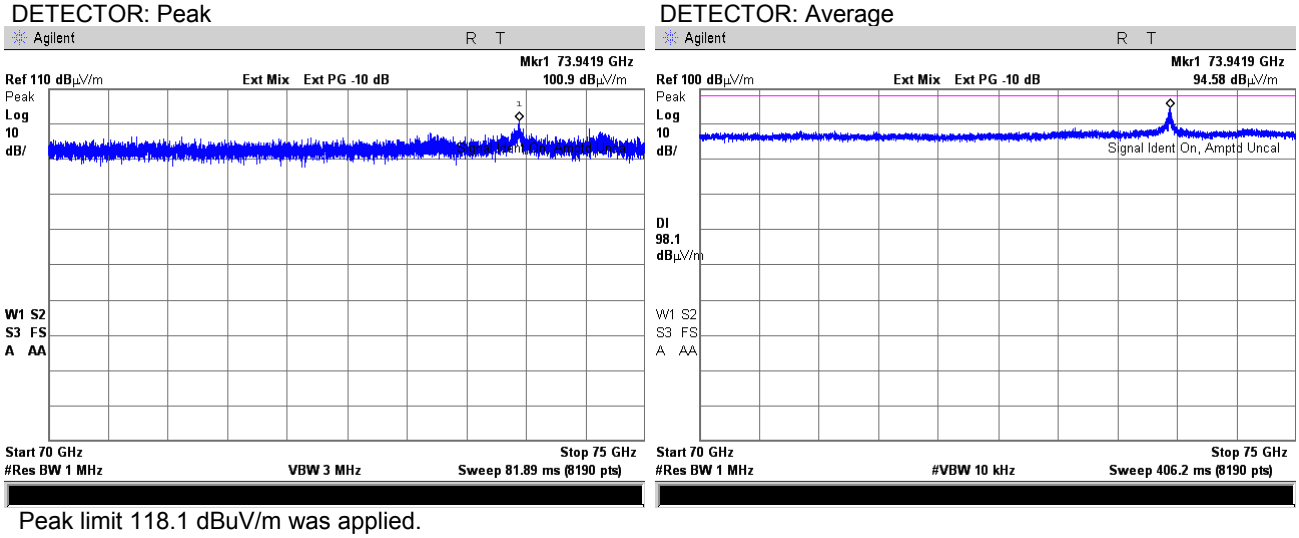


Peak limit 105.3 dBuV/m was applied.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.13 Radiated emission measurements from 70 to 75 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 1 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak / DETECTOR: Average

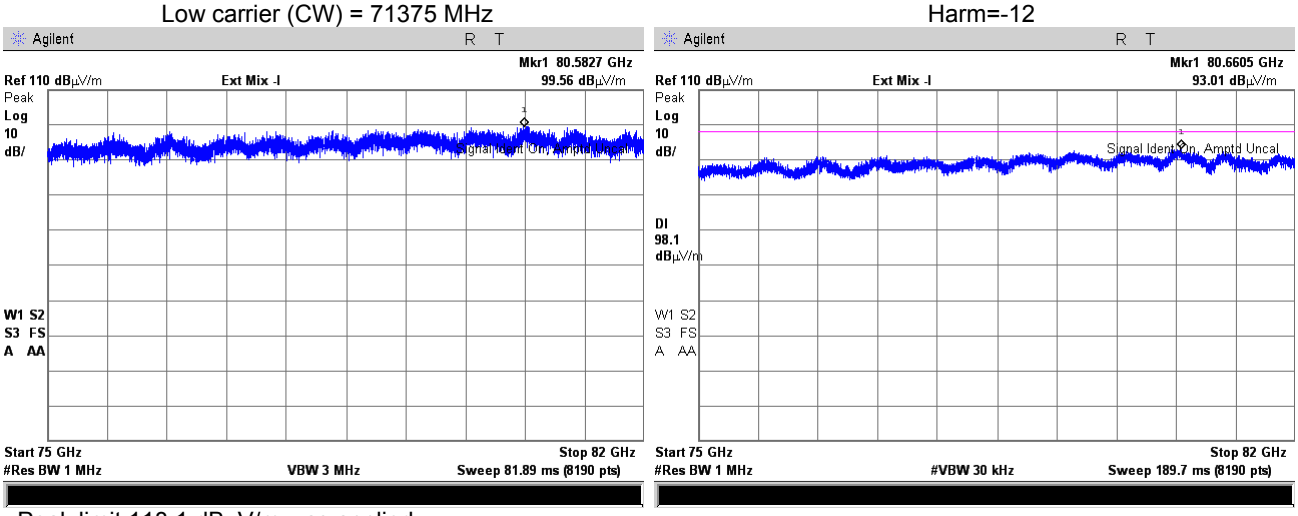


Peak limit 118.1 dBuV/m was applied.

Plot 7.5.14 Radiated emission measurements from 75 to 82 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.7 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak / DETECTOR: Average

Low carrier (CW) = 71375 MHz Harm=-12

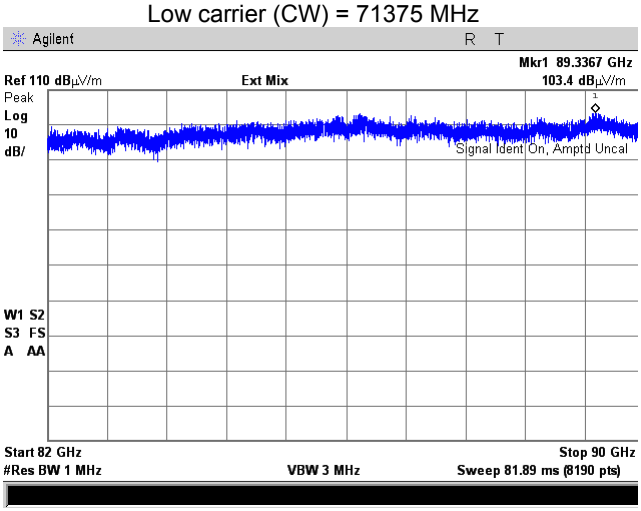


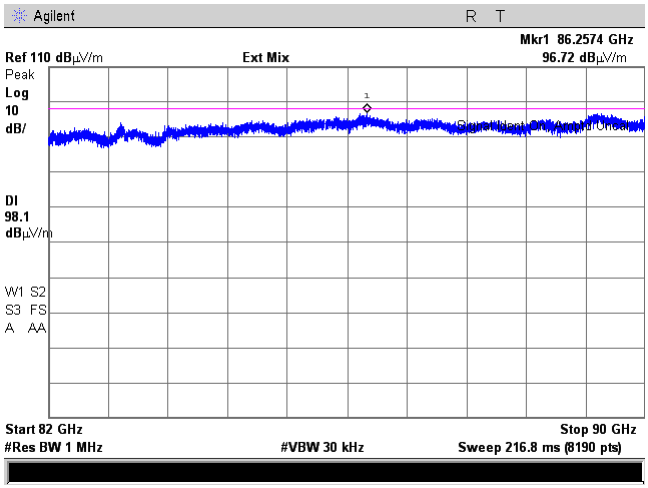
Peak limit 118.1 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.15 Radiated emission measurements from 82 to 90 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.7 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average
Low carrier (CW) = 71375 MHz Harm=-12

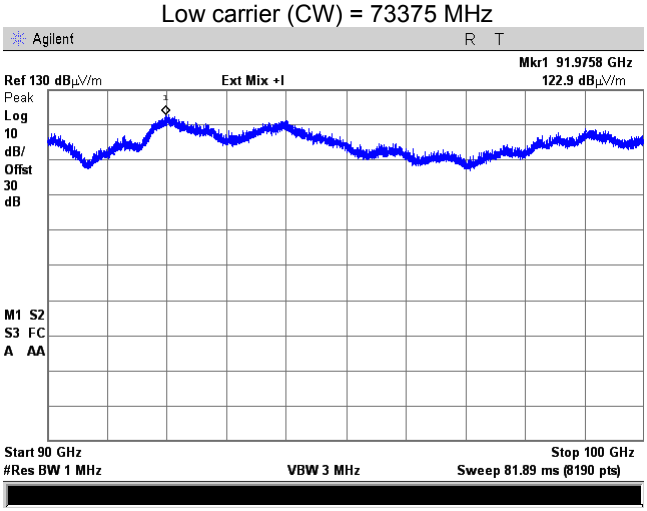


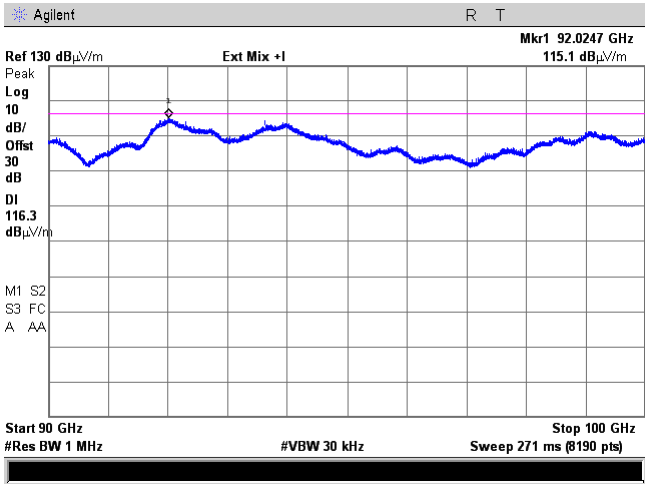


Peak limit 118.1 dBuV/m was applied.
No spurious were found.

Plot 7.5.16 Radiated emission measurements from 90 to 100 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average
Low carrier (CW) = 73375 MHz



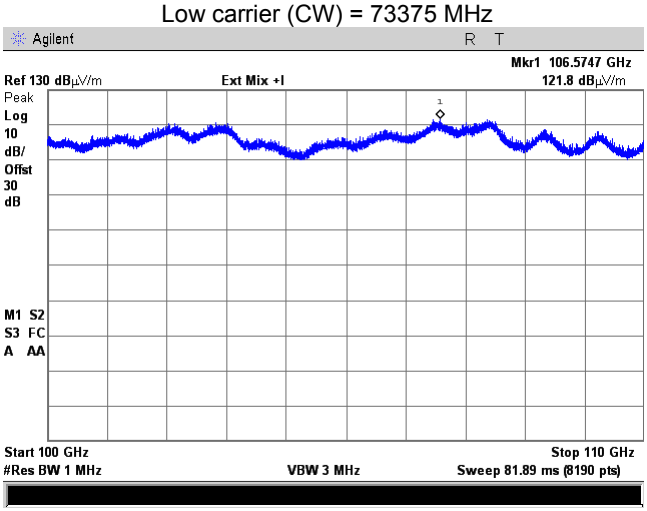


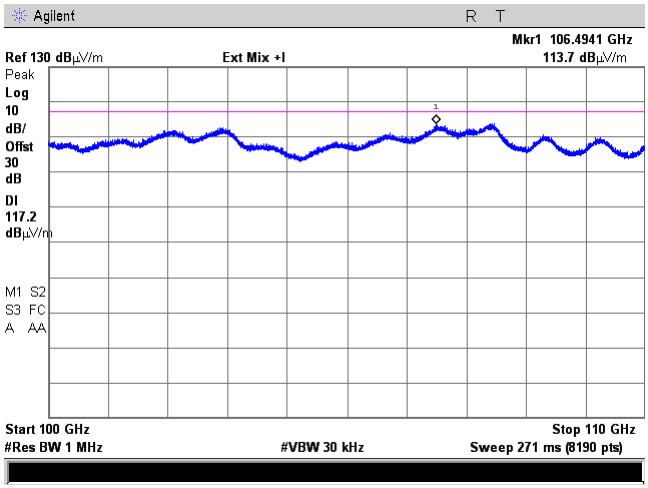
Peak limit 136.3 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.17 Radiated emission measurements from 100 to 110 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average
Low carrier (CW) = 73375 MHz

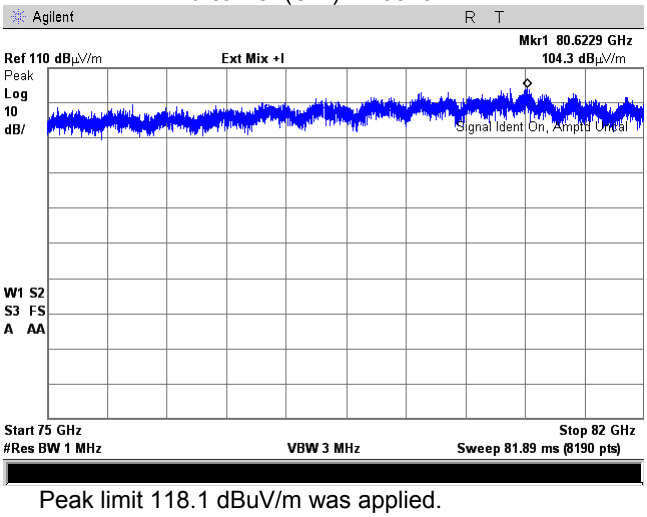


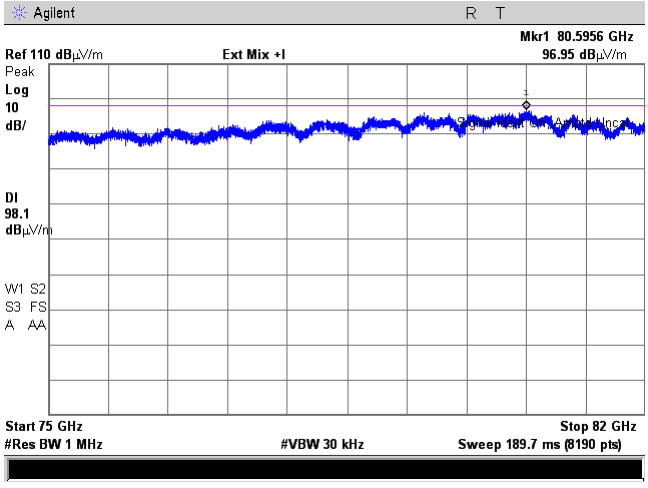


Peak limit 137.2 dBuV/m was applied.
No spurious were found.

Plot 7.5.18 Radiated emission measurements from 75 to 82 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.7 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average
Mid carrier (CW) = 73375 MHz



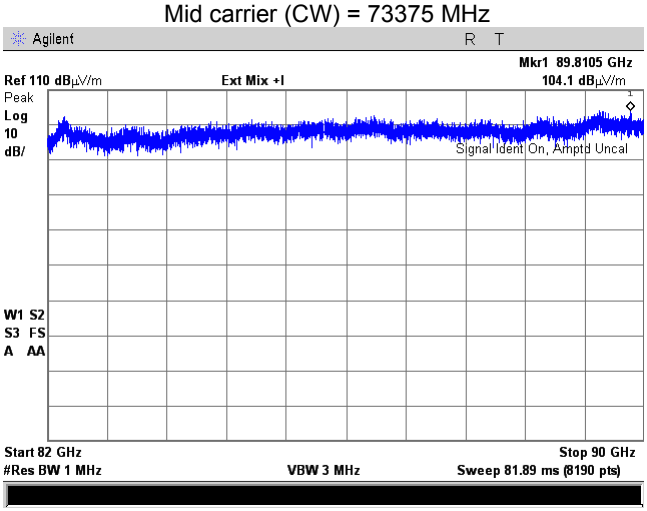


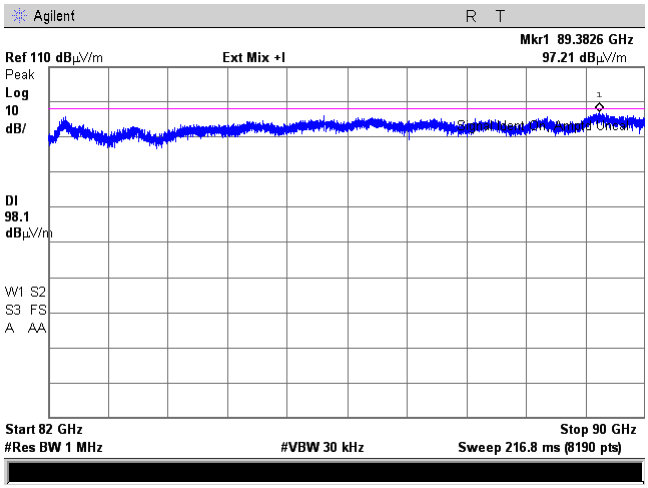
Peak limit 118.1 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.19 Radiated emission measurements from 82 to 90 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.7 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average
Mid carrier (CW) = 73375 MHz

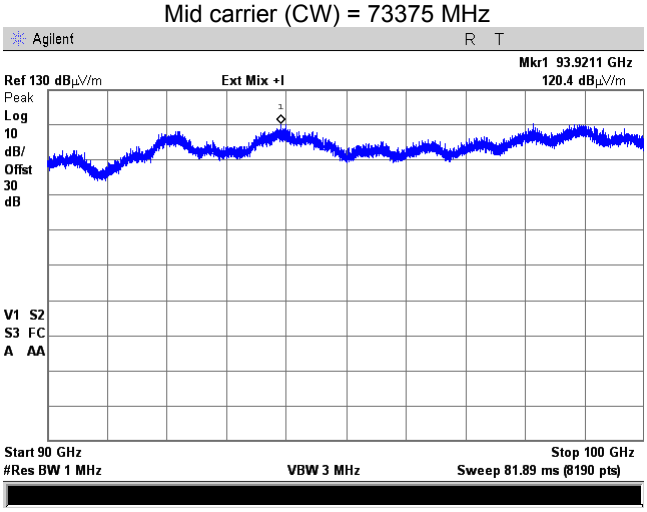


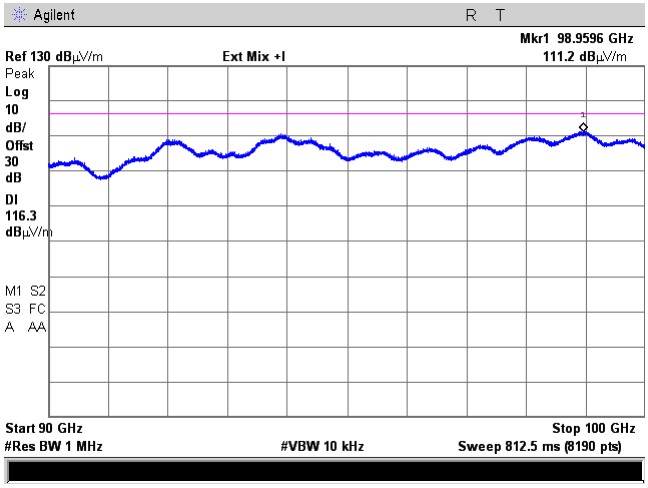


Peak limit 118.1 dBuV/m was applied.
No spurious were found.

Plot 7.5.20 Radiated emission measurements from 90 to 100 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average
Mid carrier (CW) = 73375 MHz



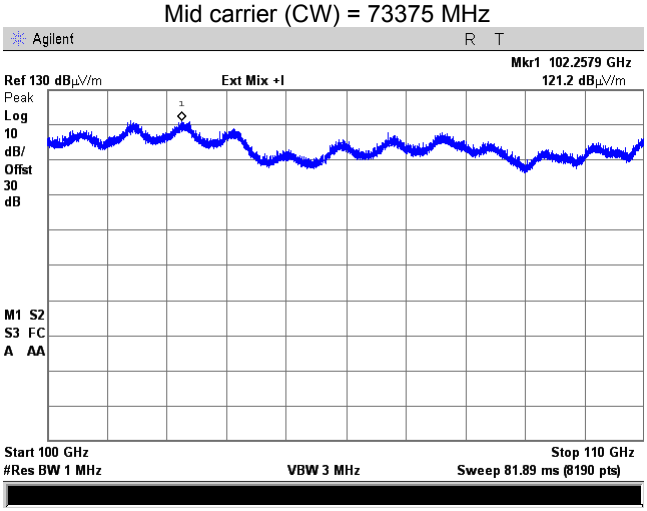


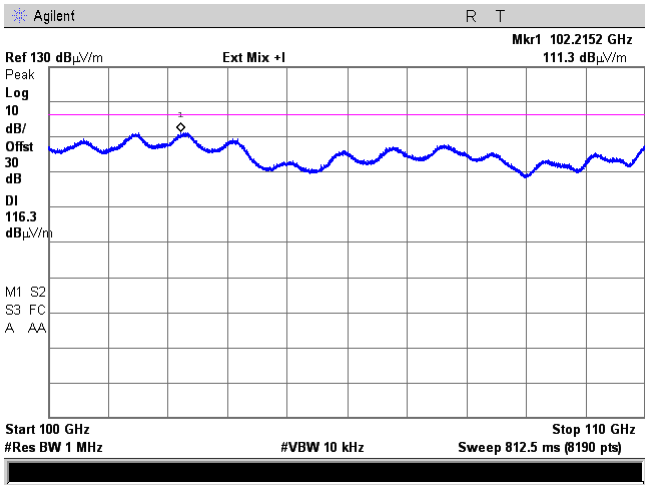
Peak limit 136.3 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.21 Radiated emission measurements from 100 to 110 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average
Mid carrier (CW) = 73375 MHz

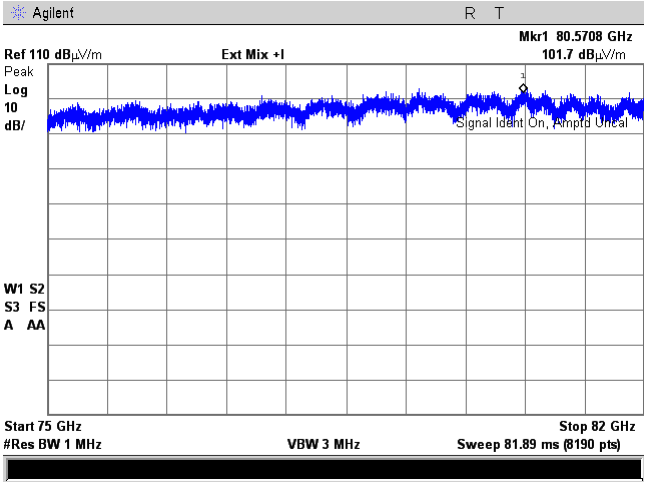


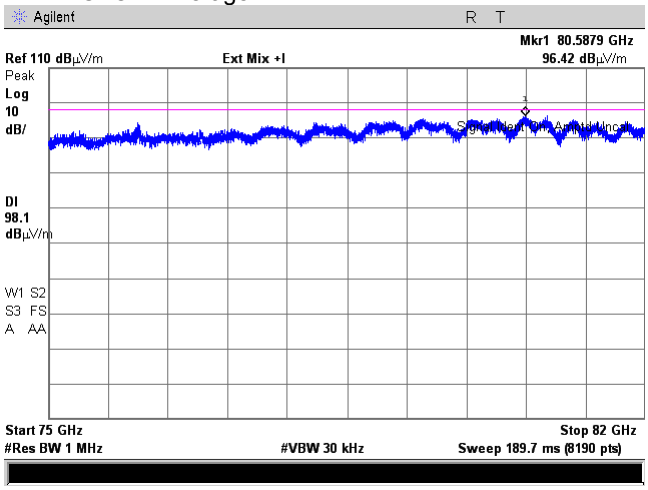


Peak limit 136.3 dBuV/m was applied.
No spurious were found.

Plot 7.5.22 Radiated emission measurements from 75 to 82 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.7 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average



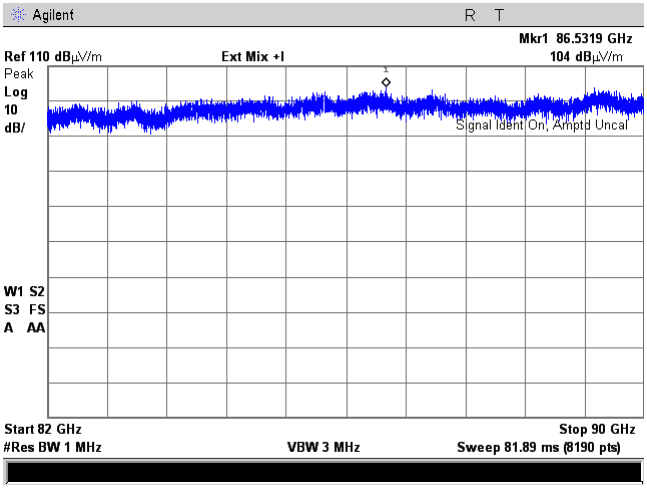


Peak limit 118.1 dBuV/m was applied.
No spurious were found.

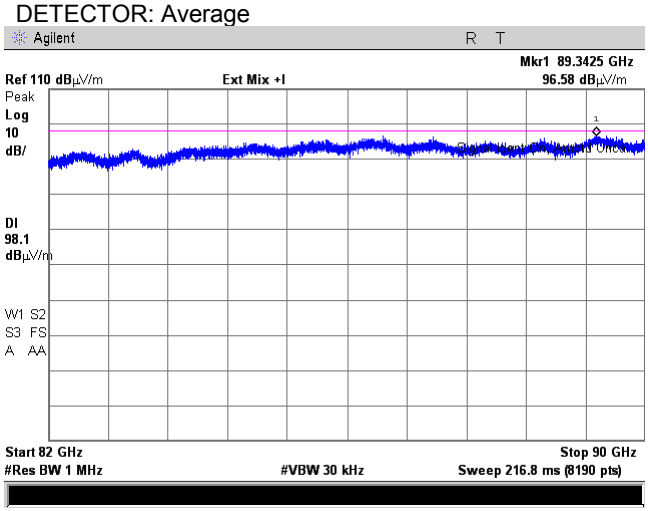
Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.23 Radiated emission measurements from 82 to 90 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.7 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



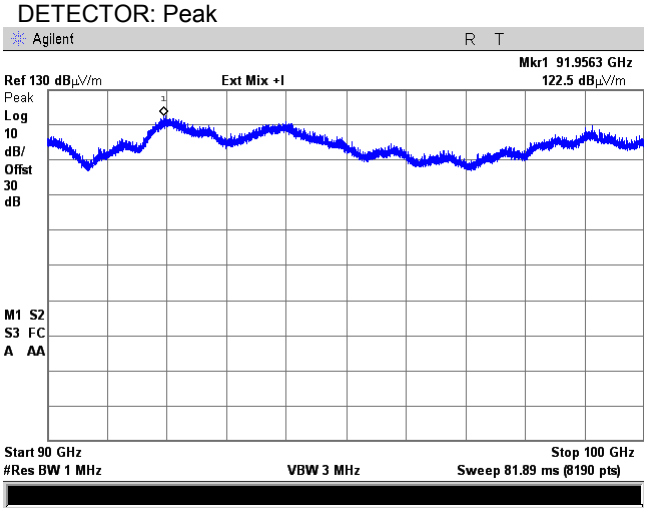
DETECTOR: Average



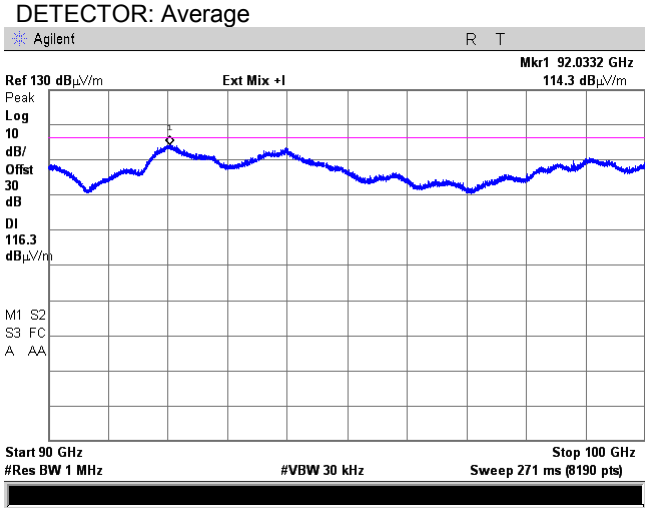
Peak limit 118.1 dBuV/m was applied.
No spurious were found.

Plot 7.5.24 Radiated emission measurements from 90 to 100 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



DETECTOR: Average

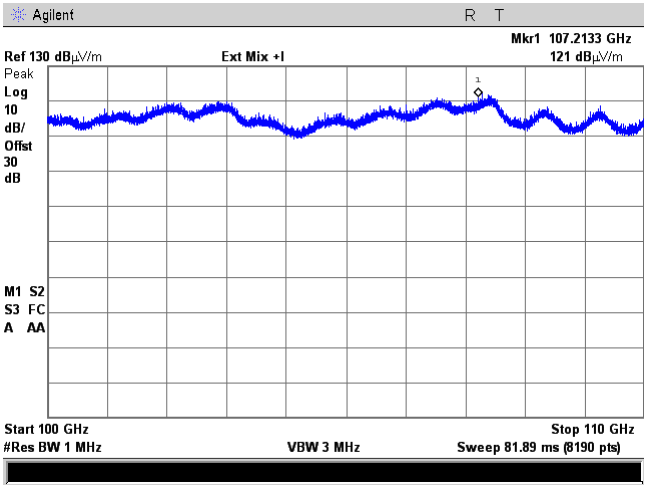


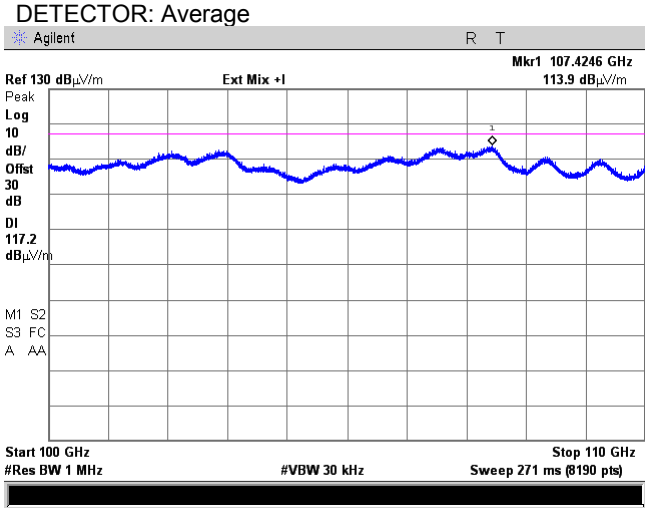
Peak limit 136.3 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.25 Radiated emission measurements from 100 to 110 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

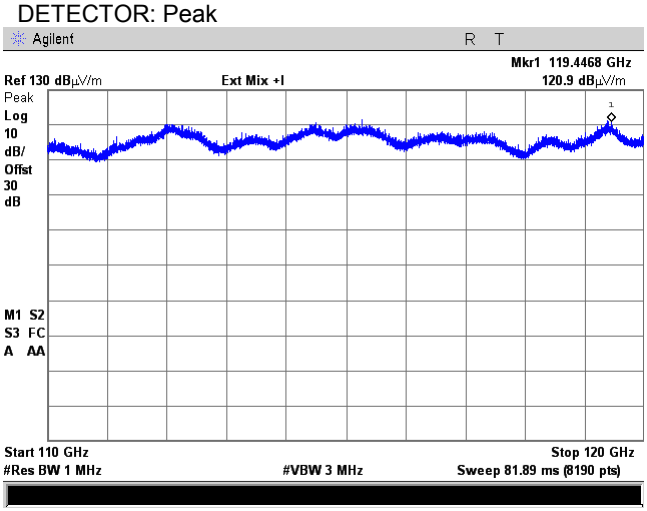


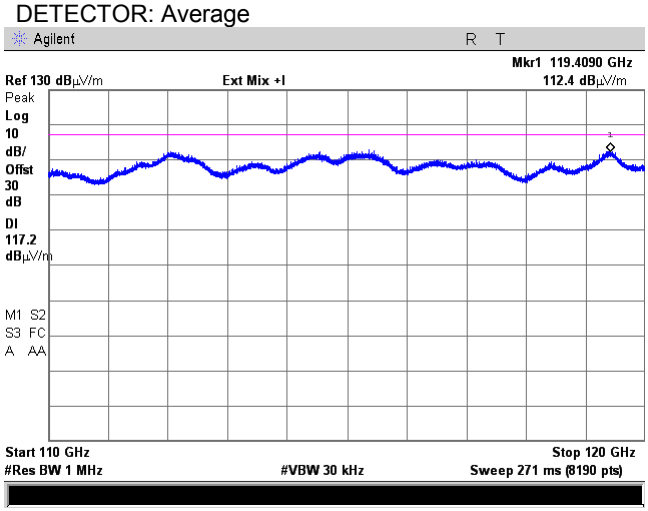


Peak limit 137.2 dBuV/m was applied.
No spurious were found.

Plot 7.5.26 Radiated emission measurements from 110 to 120 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and horizontal
DETECTOR: Peak DETECTOR: Average



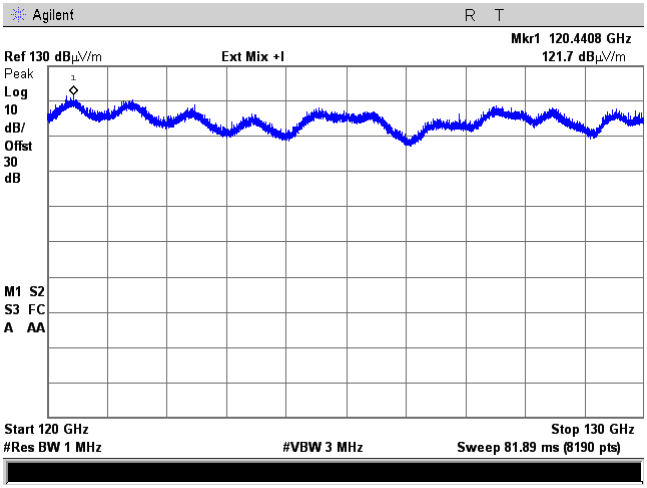


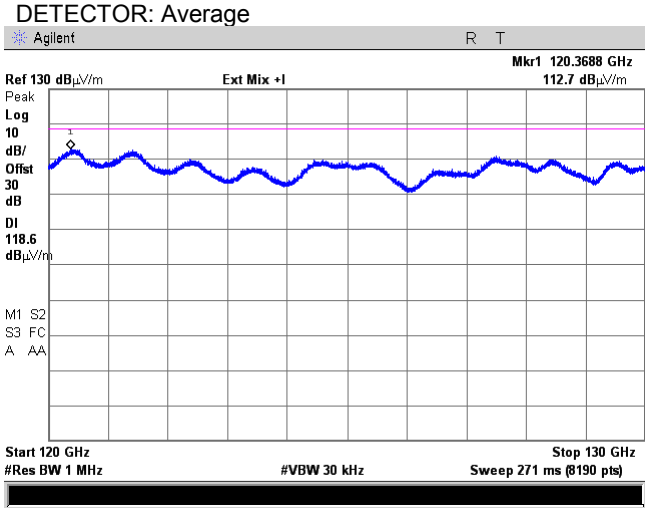
Peak limit 137.2 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.27 Radiated emission measurements from 120 to 130 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and horizontal
DETECTOR: Peak / DETECTOR: Average

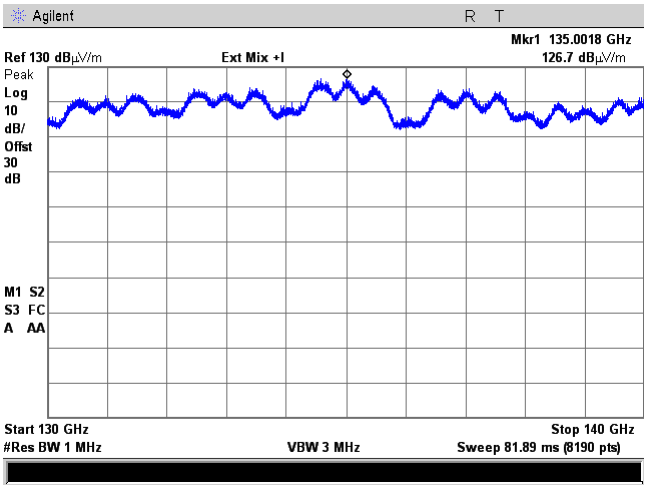


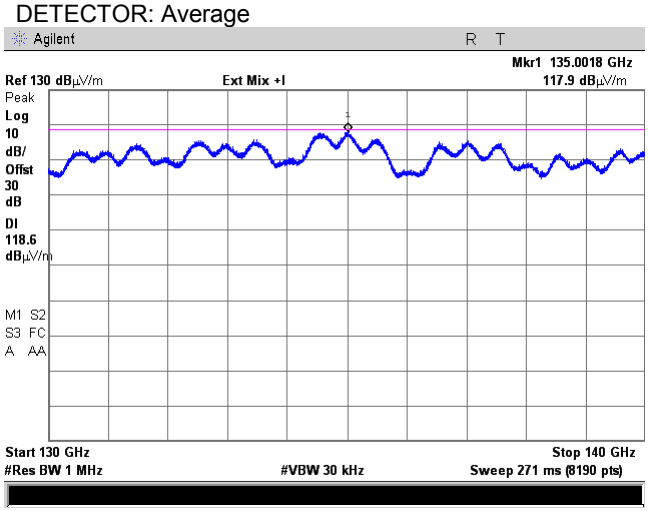


Peak limit 136.3 dBuV/m was applied.
No spurious were found.

Plot 7.5.28 Radiated emission measurements from 130 to 140 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and horizontal
DETECTOR: Peak / DETECTOR: Average



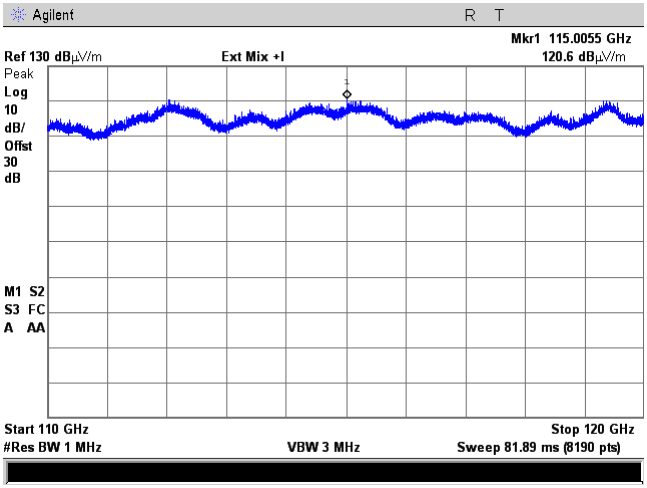


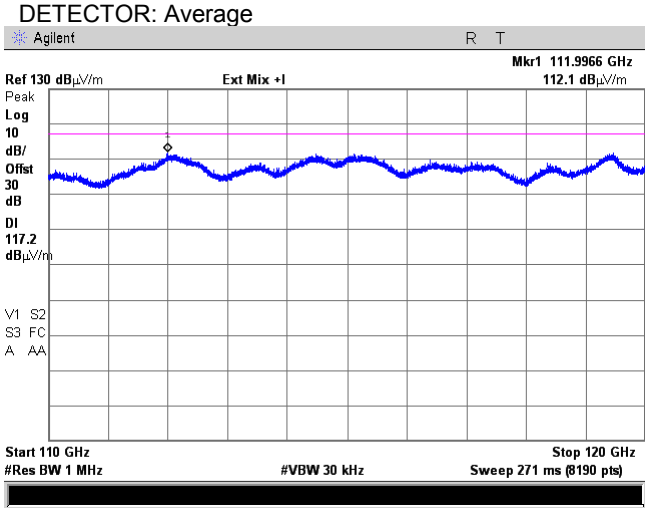
Peak limit 136.3 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.29 Radiated emission measurements from 110 to 120 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and horizontal
DETECTOR: Peak DETECTOR: Average

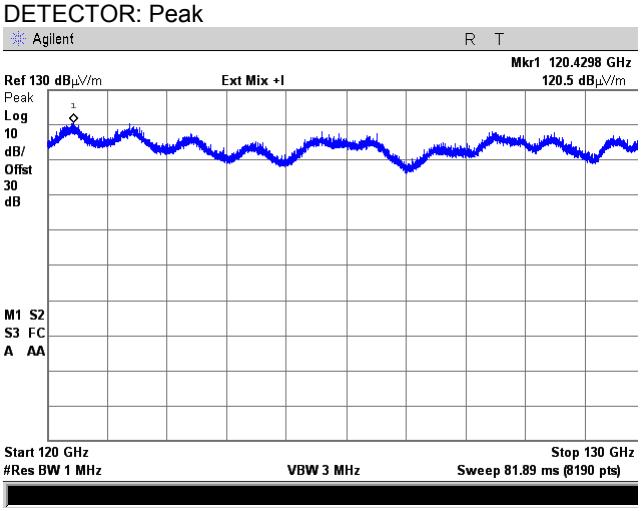


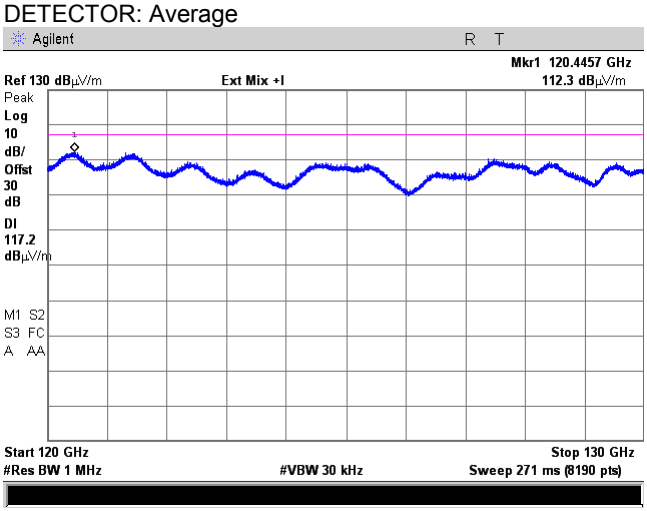


Peak limit 137.2 dBuV/m was applied.
No spurious were found.

Plot 7.5.30 Radiated emission measurements from 120 to 130 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and horizontal
DETECTOR: Peak DETECTOR: Average



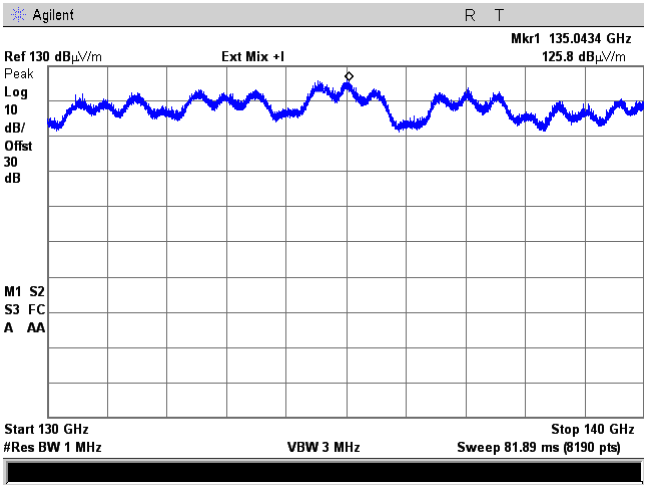


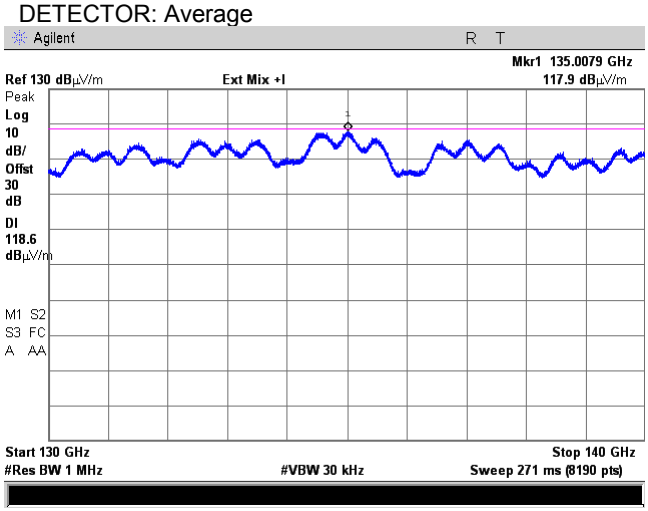
Peak limit 137.2 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.31 Radiated emission measurements from 130 to 140 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and horizontal
DETECTOR: Peak DETECTOR: Average

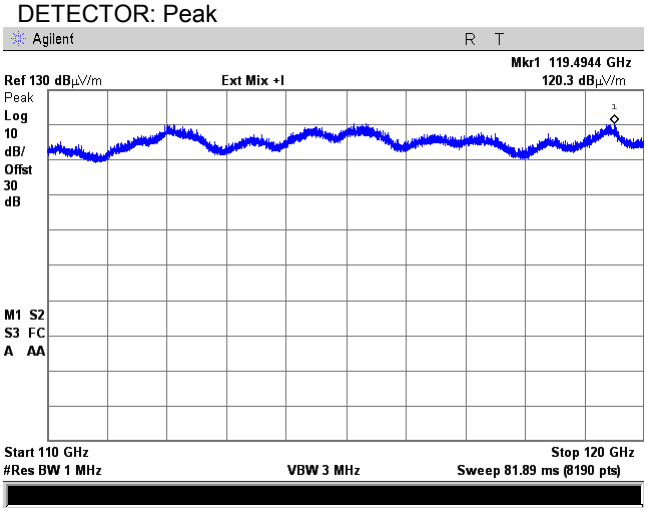


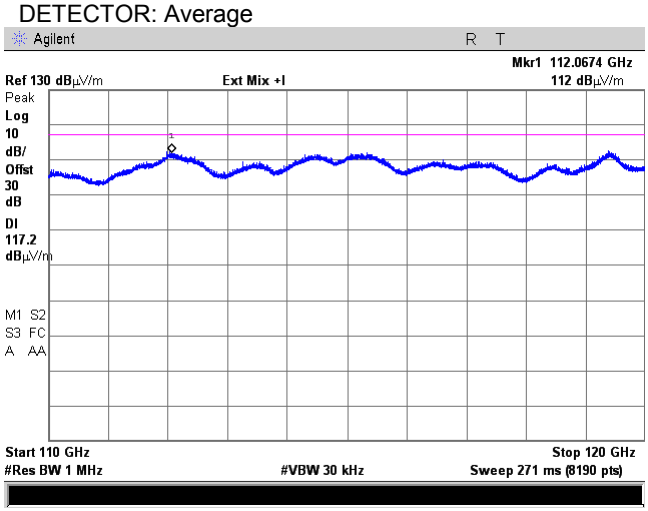


Peak limit 136.3 dBuV/m was applied.
No spurious were found.

Plot 7.5.32 Radiated emission measurements from 110 to 120 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and horizontal
DETECTOR: Peak DETECTOR: Average



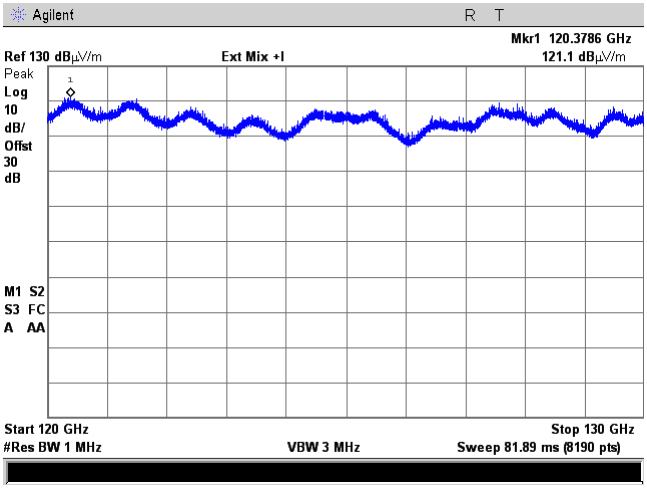


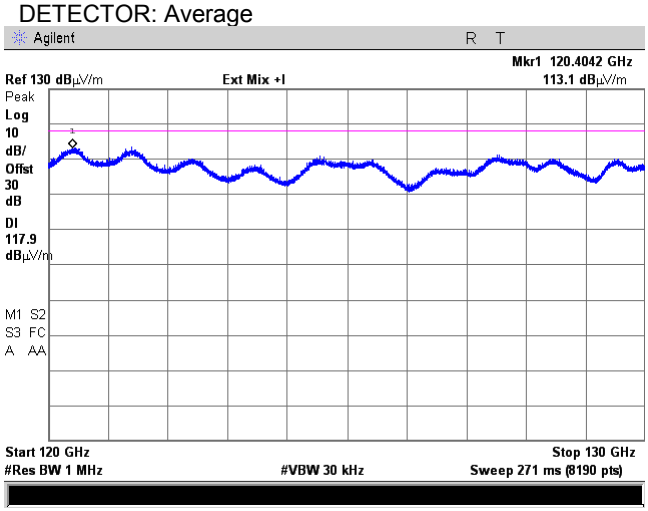
Peak limit 137.2 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.33 Radiated emission measurements from 120 to 130 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and horizontal
DETECTOR: Peak DETECTOR: Average

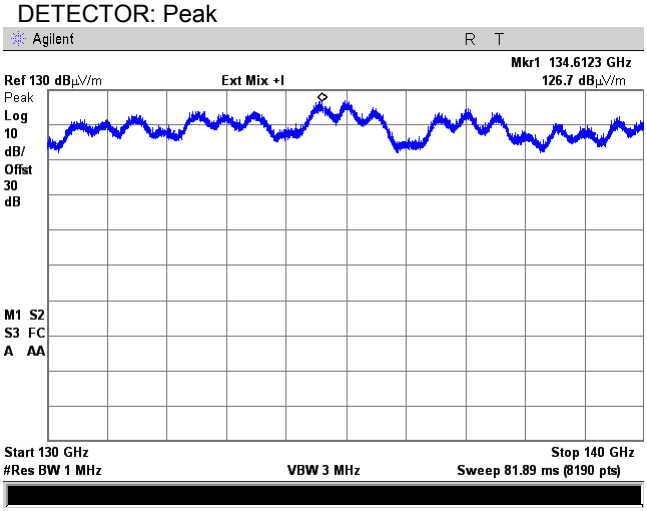


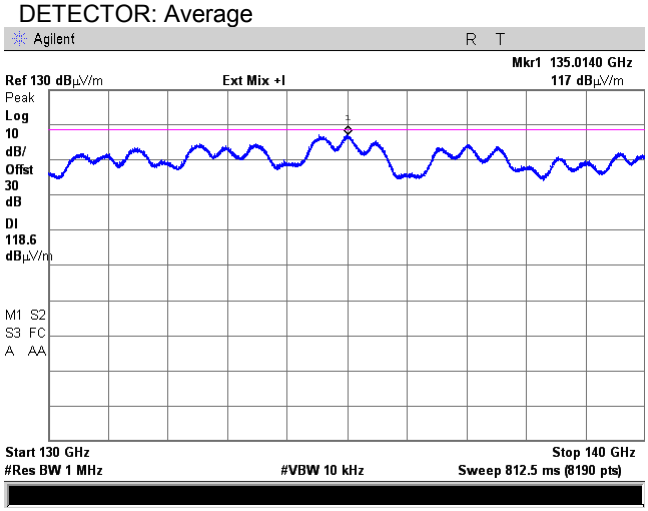


Peak limit 137.9 dBuV/m was applied.
No spurious were found.

Plot 7.5.34 Radiated emission measurements from 130 to 140 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.15 m
ANTENNA POLARIZATION: Vertical and horizontal
DETECTOR: Peak DETECTOR: Average



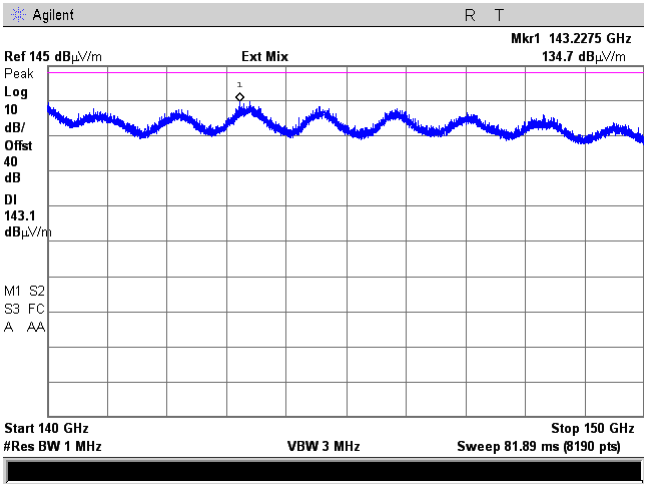


Peak limit 138.6 dBuV/m was applied.
No spurious were found.

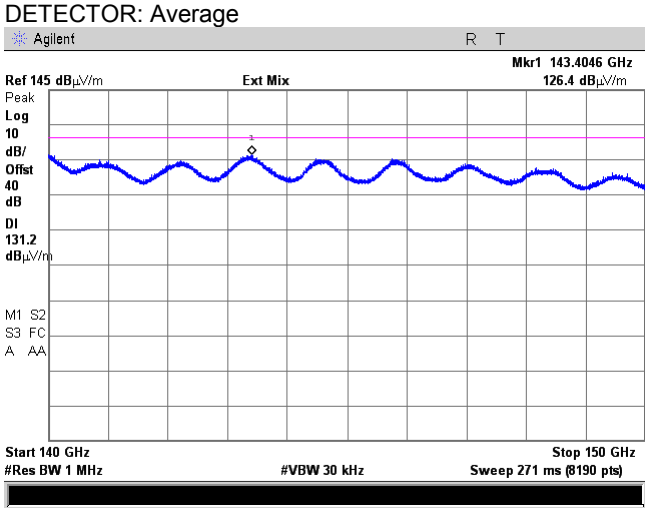
Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.35 Radiated emission measurements from 140 to 150 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.25 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



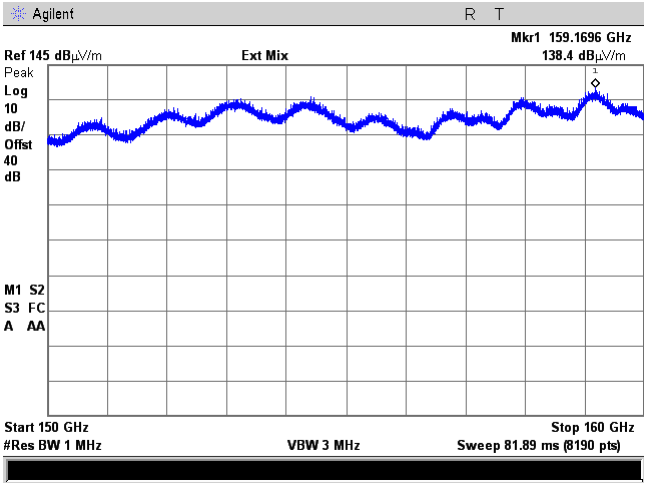
DETECTOR: Average



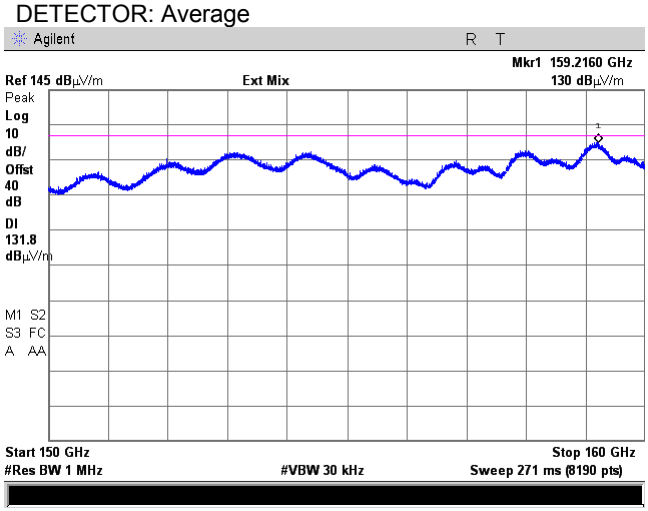
Peak limit 151.2 dBuV/m was applied.
No spurious were found.

Plot 7.5.36 Radiated emission measurements from 150 to 160 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.25 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



DETECTOR: Average

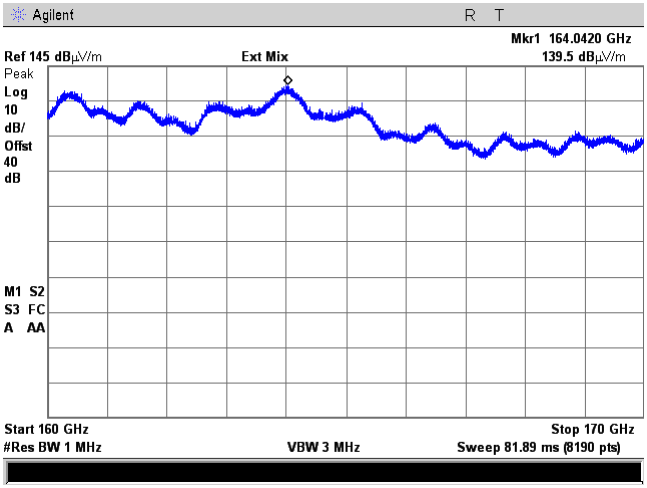


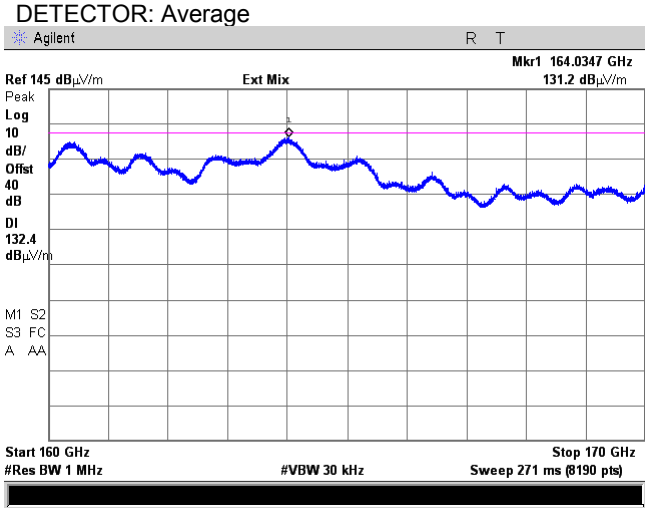
Peak limit 151.8 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.37 Radiated emission measurements from 160 to 170 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.25 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

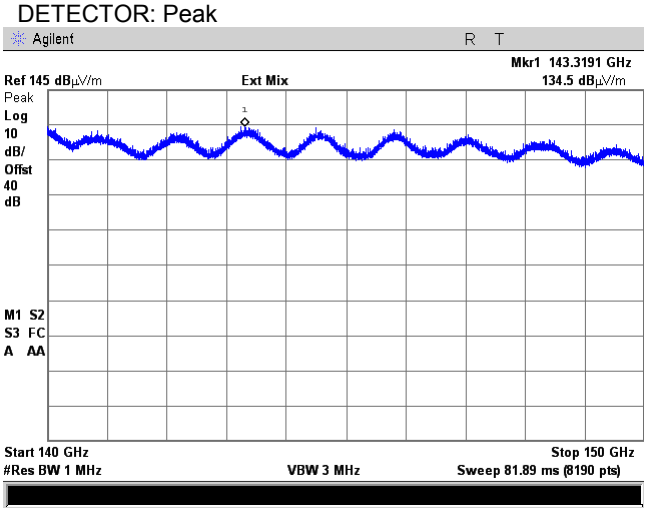


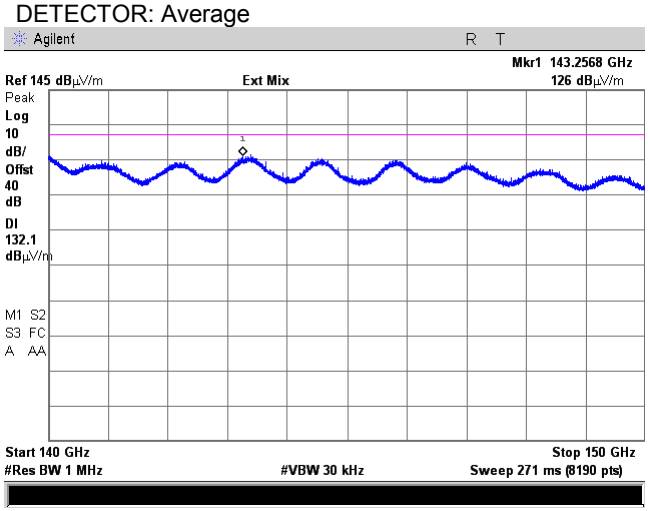


Peak limit 152.4 dBuV/m was applied.
No spurious were found.

Plot 7.5.38 Radiated emission measurements from 140 to 150 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.25 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average



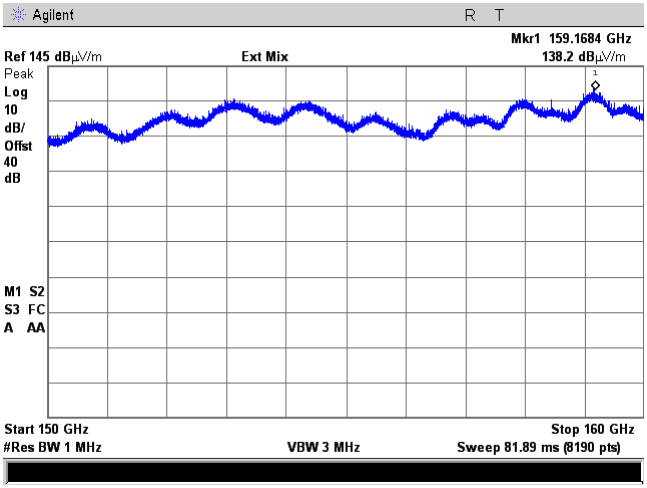


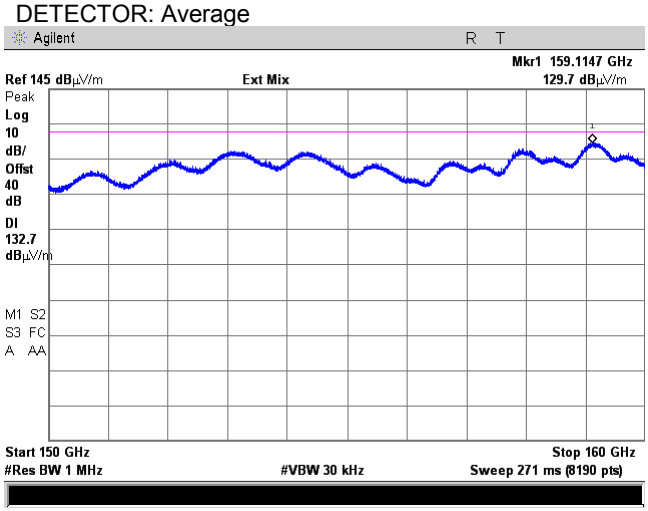
Peak limit 152.1 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.39 Radiated emission measurements from 150 to 160 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.25 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

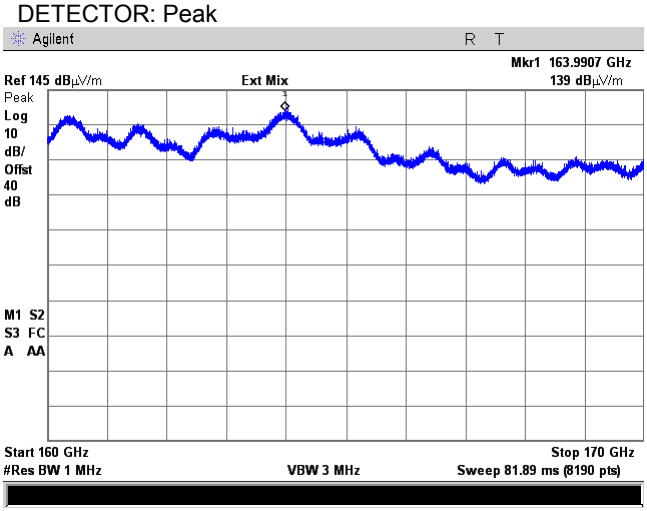


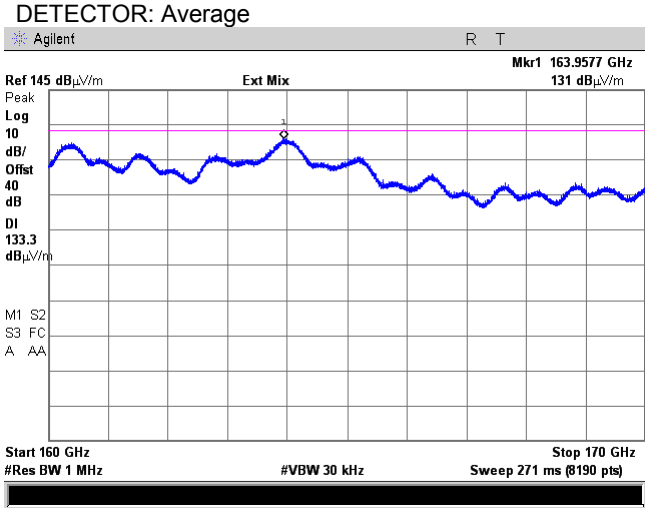


Peak limit 152.1 dBuV/m was applied.
No spurious were found.

Plot 7.5.40 Radiated emission measurements from 160 to 170 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.25 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average



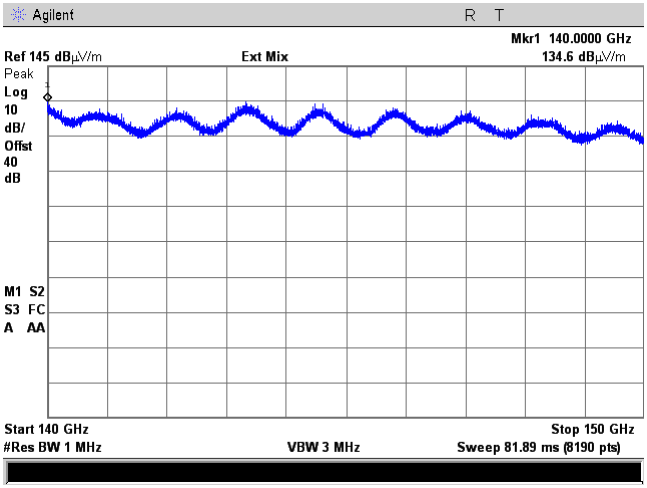


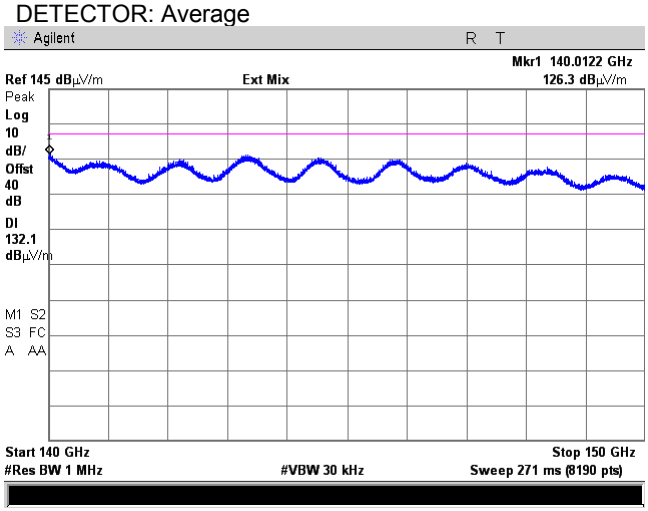
Peak limit 153.3 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.41 Radiated emission measurements from 140 to 150 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.05 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

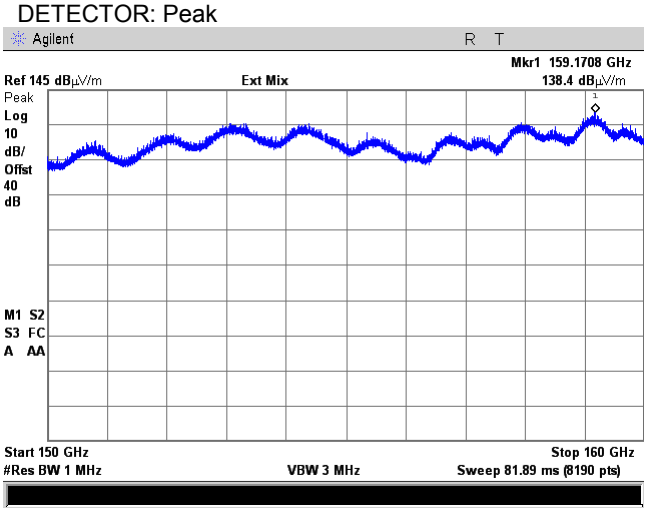


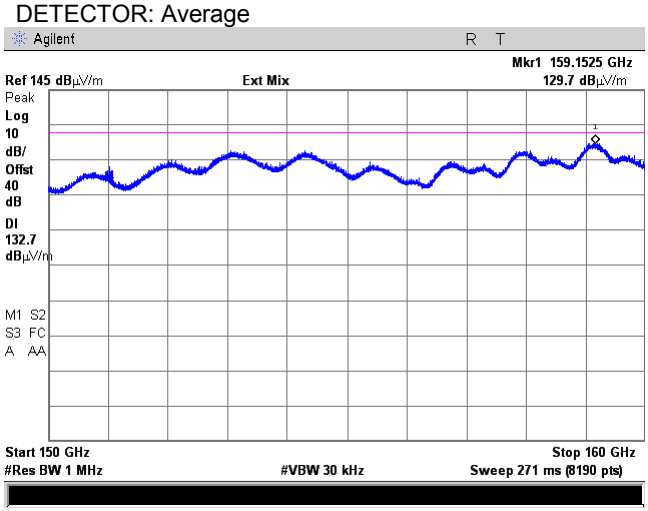


Peak limit 152.1 dBuV/m was applied.
No spurious were found.

Plot 7.5.42 Radiated emission measurements from 150 to 160 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.05 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average



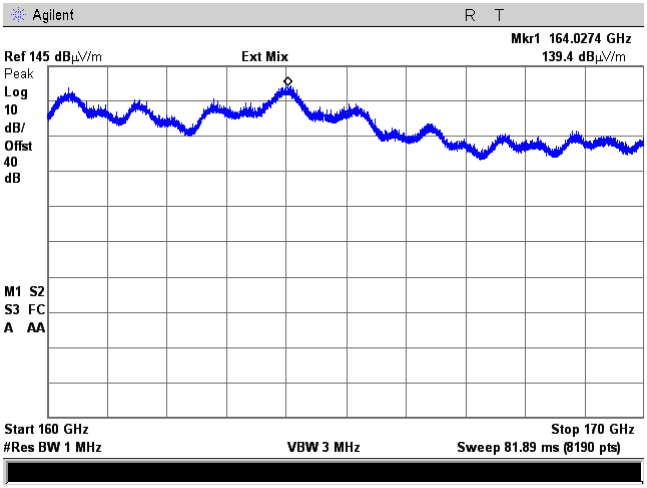


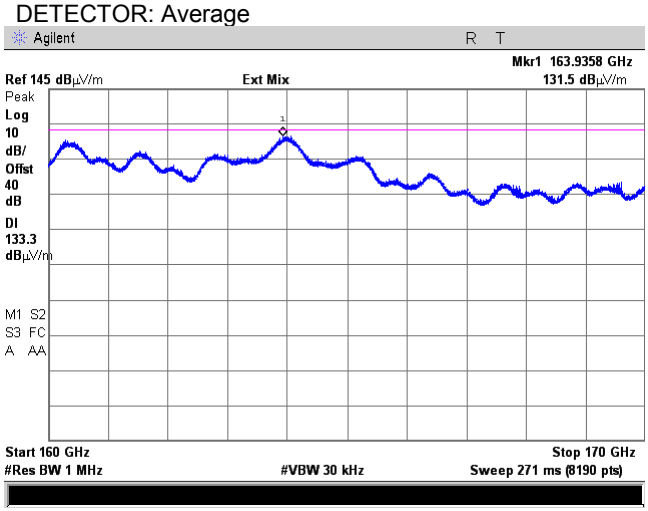
Peak limit 152.7 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.43 Radiated emission measurements from 160 to 170 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.05 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

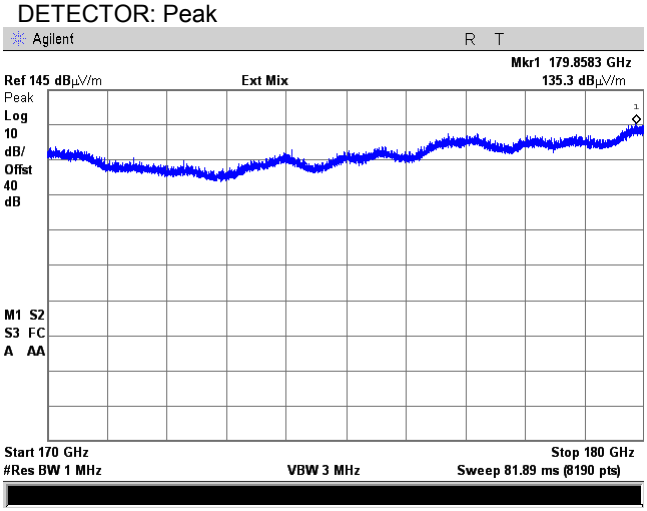


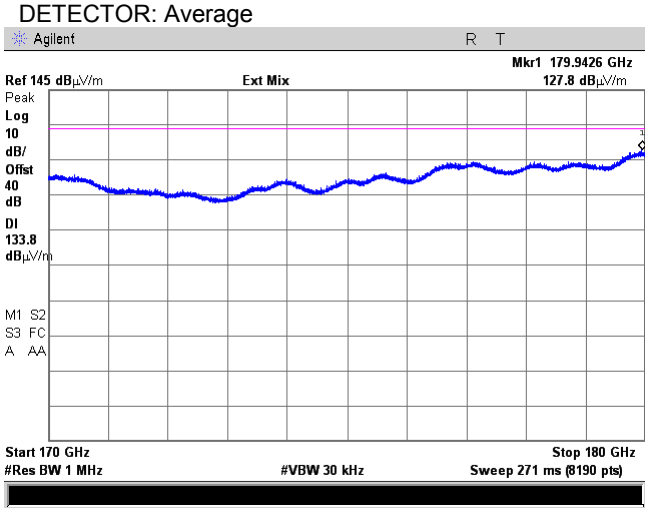


Peak limit 153.3 dBuV/m was applied.
No spurious were found.

Plot 7.5.44 Radiated emission measurements from 170 to 180 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.05 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average



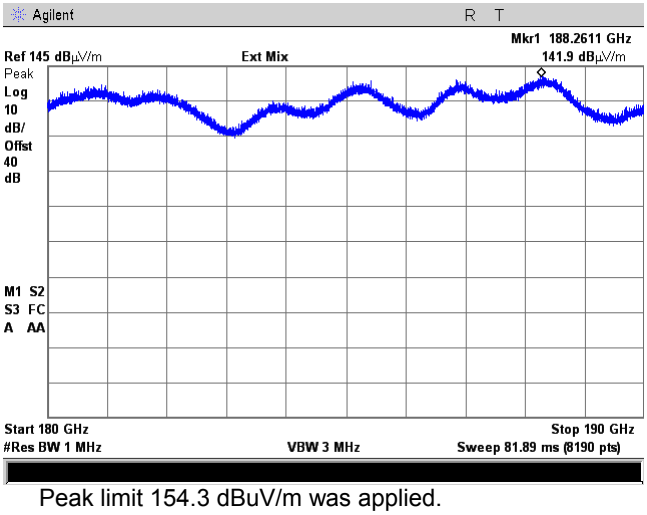


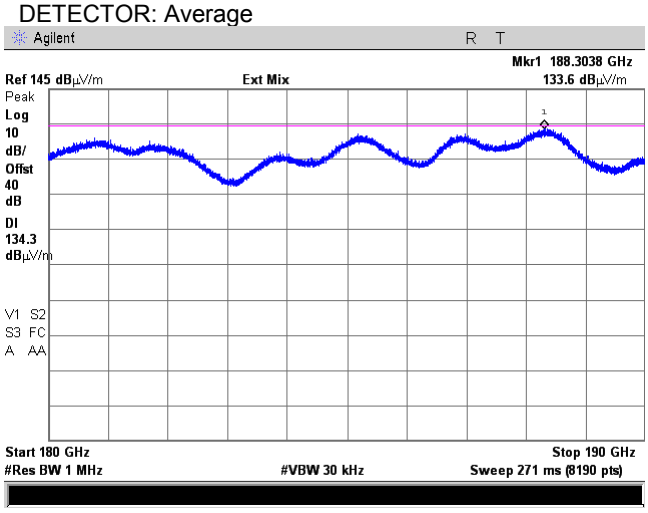
Peak limit 153.8 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.45 Radiated emission measurements from 180 to 190 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.05 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

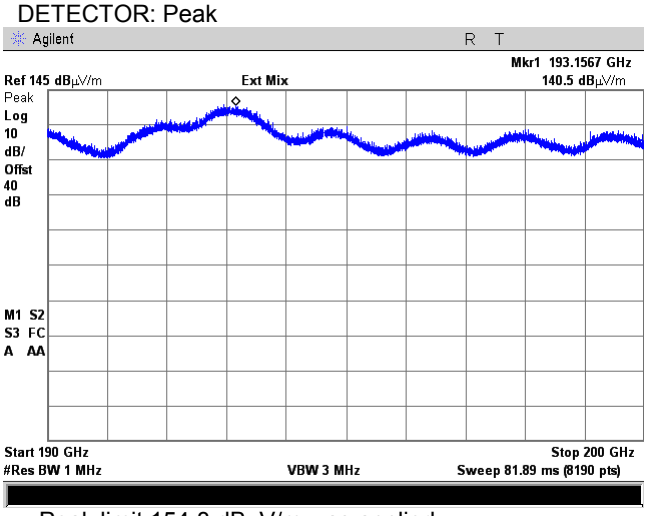


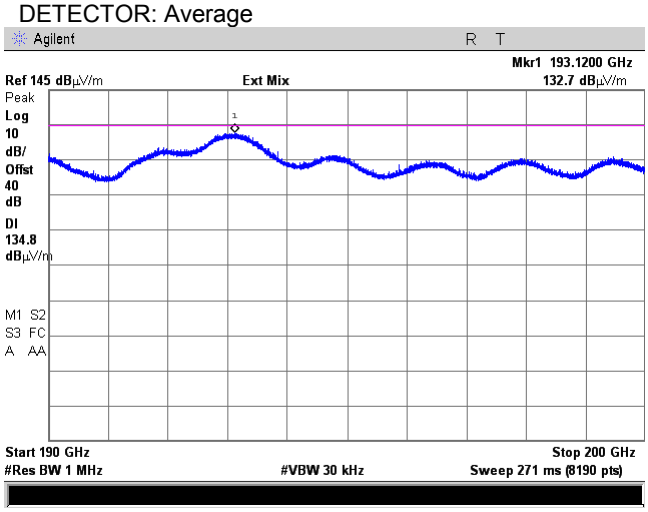


Peak limit 154.3 dBuV/m was applied.
No spurious were found

Plot 7.5.46 Radiated emission measurements from 190 to 200 GHz at the low frequency

TEST SITE: OATS
TEST DISTANCE: 0.05 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average



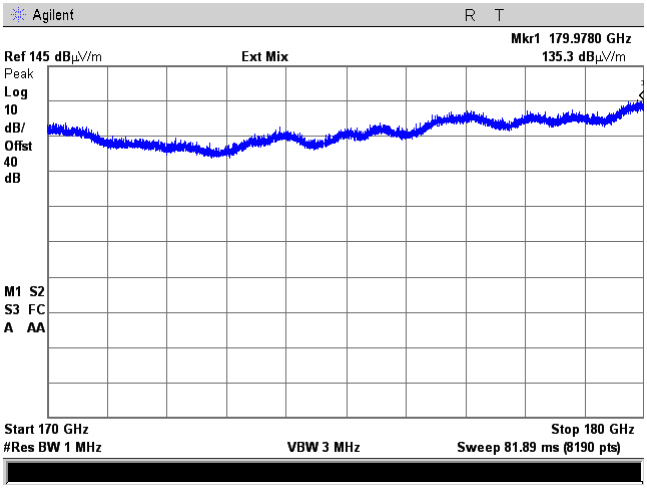


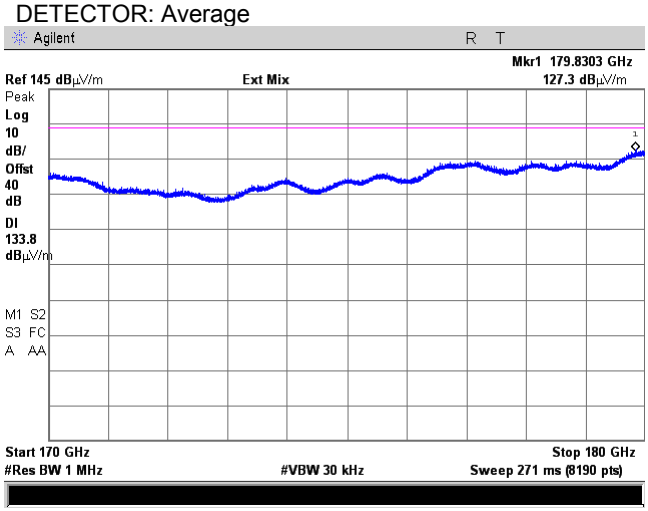
Peak limit 154.8 dBuV/m was applied.
No spurious were found

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.47 Radiated emission measurements from 170 to 180 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.05 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

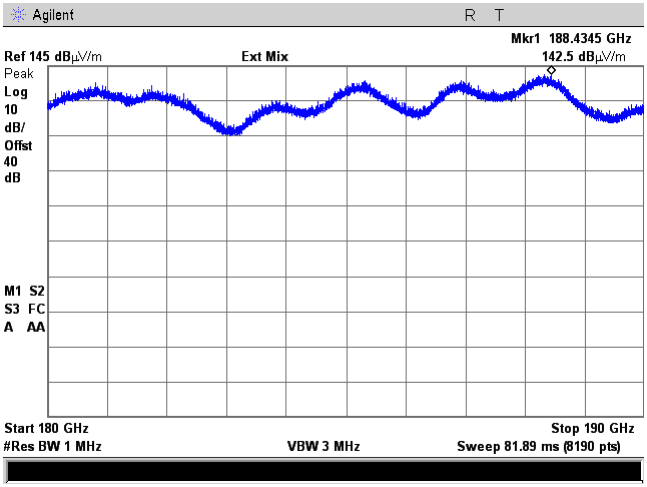


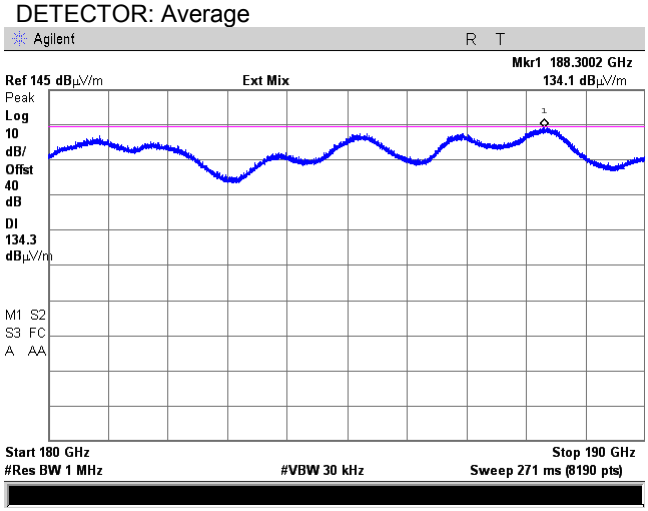


Peak limit 153.8 dBuV/m was applied.
No spurious were found.

Plot 7.5.48 Radiated emission measurements from 180 to 190 GHz at the mid frequency

TEST SITE: OATS
TEST DISTANCE: 0.05 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average



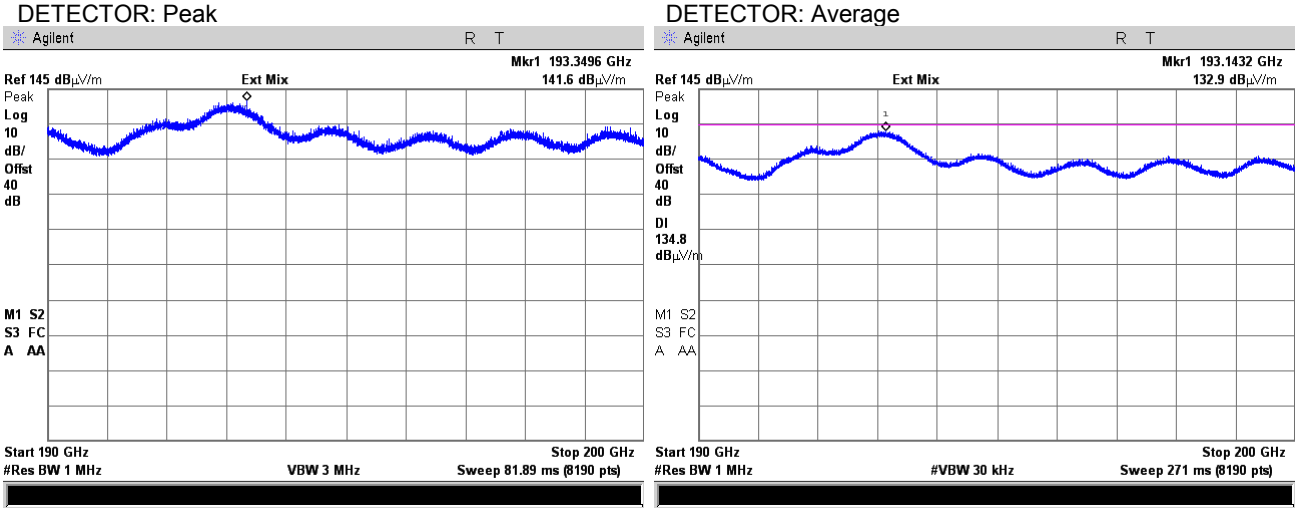


Peak limit 154.3 dBuV/m was applied.
No spurious were found

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.49 Radiated emission measurements from 190 to 200 GHz at the mid frequency

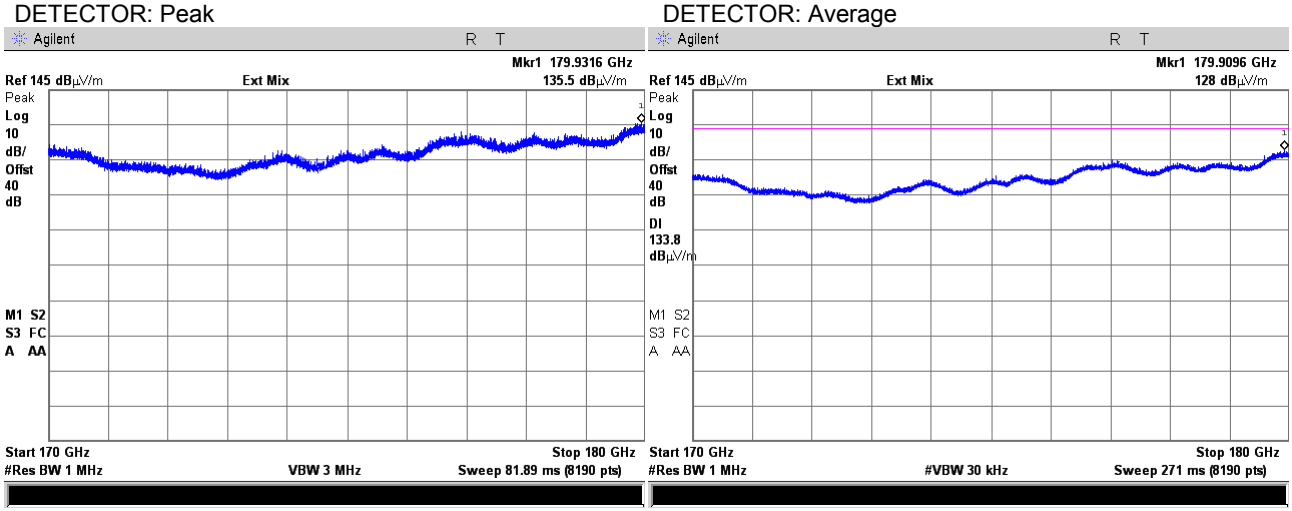
TEST SITE: OATS
TEST DISTANCE: 0.05 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average



Peak limit 154.8 dBuV/m was applied.
No spurious were found

Plot 7.5.50 Radiated emission measurements from 170 to 180 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.09 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

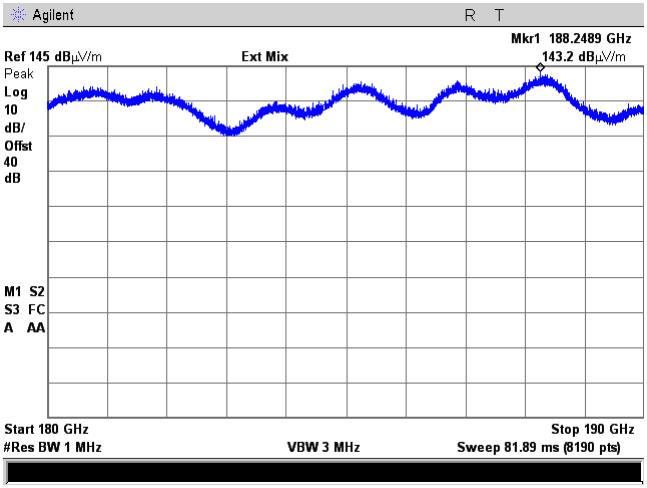


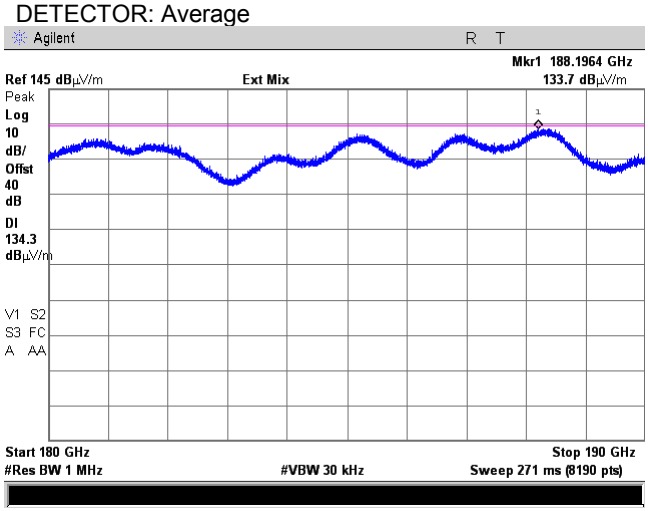
Peak limit 153.8 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(c)(3), Out of band radiated emissions above 40 GHz		
Test procedure:	FCC Millimeter wave test procedures; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	7/07/2014-7/22/2014		
Temperature: 28.9ºC	Air Pressure: 1011 hPa	Relative Humidity: 51%	Power Supply: 48 VDC
Remarks:			

Plot 7.5.51 Radiated emission measurements from 180 to 190 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.06 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average

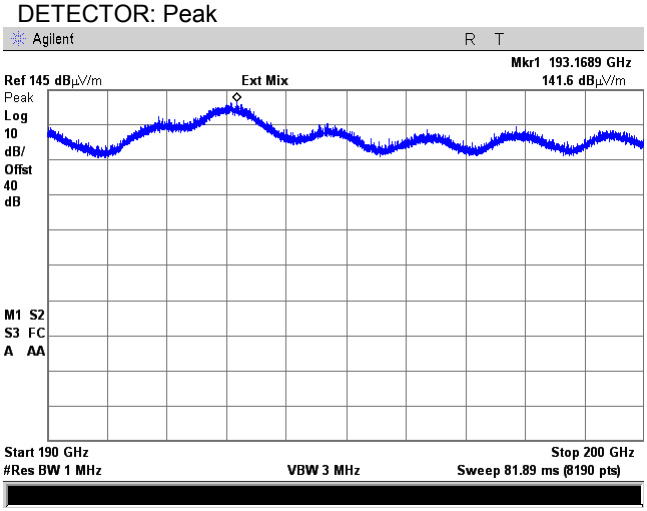


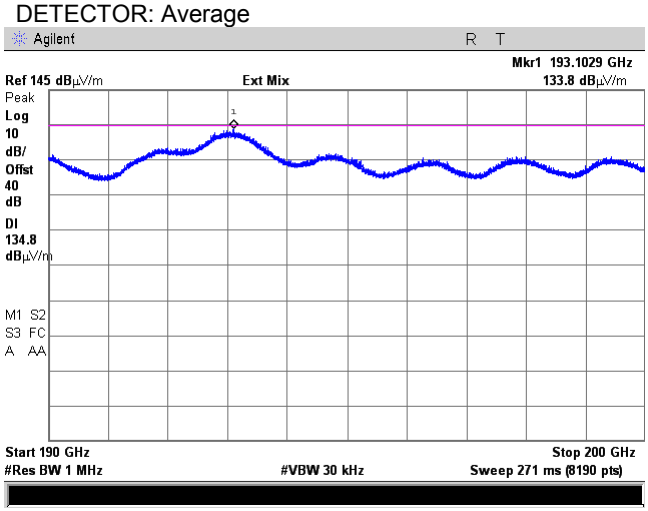


Peak limit 154.3 dBuV/m was applied.
No spurious were found

Plot 7.5.52 Radiated emission measurements from 190 to 200 GHz at the high frequency

TEST SITE: OATS
TEST DISTANCE: 0.05 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak DETECTOR: Average





Peak limit 154.8 dBuV/m was applied.
No spurious were found.

Test specification:	Section 15.255(f), Frequency tolerance		
Test procedure:	47 CFR, Section 2.1055; KDB 200433 D02		
Test mode:	Compliance	Verdict:	PASS
Date:	6/12/2014		
Temperature: 24.3ºC	Air Pressure: 1012 hPa	Relative Humidity: 42%	Power Supply: 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
57375	NA
60375	
63375	

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.

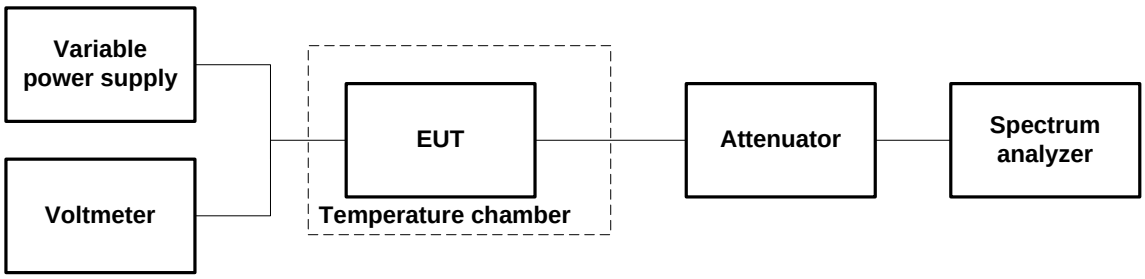
7.6.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

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 compared with the limit as provided in Table 7.6.2.

Figure 7.6.1 Frequency stability test setup



Test specification:	**Section 15.255(f), Frequency tolerance**		
Test procedure:	47 CFR, Section 2.1055; KDB 200433 D02		
Test mode:	Compliance	**Verdict:**	PASS
Date:	6/12/2014		
Temperature: 24.3ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 42%	**Power Supply:** 48 VDC
Remarks:			

Table 7.6.2 Frequency stability test results

OPERATING FREQUENCY: 57000 – 64000 MHz
NOMINAL POWER VOLTAGE: 48 V
TEMPERATURE STABILIZATION PERIOD: 20 min
POWER DURING TEMPERATURE TRANSITION: Off
SPECTRUM ANALYZER MODE: Counter
RESOLUTION BANDWIDTH: 3 kHz
VIDEO BANDWIDTH: 10 kHz
MODULATION: Unmodulated

T, ºC	Voltage, V	Frequency, MHz							Max frequency drift, kHz		Max frequency drift, ppm	
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative	Positive	Negative
Low frequency 57375 MHz												
-20	nominal	57374.40773	57374.40933	57374.40869	57374.40848	57374.40908	57374.40984	57374.41459	615.399	0.000	1.07	0.00
-10	nominal	57374.21985	NA	NA	NA	NA	NA	57374.21904	420.662	0.000	0.73	0.00
0	nominal	57373.98543	57373.98876	57373.98586	57373.98433	57373.98361	57373.98341	57373.98377	189.568	0.000	0.33	0.00
10	nominal	57373.83279	NA	NA	NA	NA	NA	57373.83293	33.744	0.000	0.06	0.00
20	+15%	57373.81902	NA	NA	NA	NA	NA	57373.79898	19.829	-0.207	0.03	0.00
20	nominal	57373.81725	NA	NA	NA	NA	NA	57373.79919	18.065	0.000	0.03	0.00
20	-15%	57373.81891	NA	NA	NA	NA	NA	57373.79914	19.722	-0.048	0.03	0.00
30	nominal	57373.94892	57373.95264	57373.95415	57373.95494	57373.95635	57373.95794	57373.96277	163.579	0.000	0.29	0.00
40	nominal	57374.09630	NA	NA	NA	NA	NA	57374.13977	340.581	0.000	0.59	0.00
50	nominal	57374.66465	NA	NA	NA	NA	NA	57374.69324	894.057	0.000	1.56	0.00
Mid frequency 60375 MHz												
-20	nominal	60374.34444	60374.35092	60374.35223	60374.35516	60374.35715	60374.35983	60374.37092	628.939	0.000	1.04	0.00
-10	nominal	60374.16881	NA	NA	NA	NA	NA	60374.17344	431.456	0.000	0.71	0.00
0	nominal	60373.92277	60373.92763	60373.92647	60373.92611	60373.92629	60373.92673	60373.92886	186.877	0.000	0.31	0.00
10	nominal	60373.76876	NA	NA	NA	NA	NA	60373.77094	28.956	0.000	0.05	0.00
20	+15%	60373.74198	NA	NA	NA	NA	NA	60373.74251	0.525	0.000	0.00	0.00
20	nominal	60373.74135	NA	NA	NA	NA	NA	60373.74198	0.000	-0.633	0.00	0.00
20	-15%	60373.74260	NA	NA	NA	NA	NA	60373.74277	0.789	0.000	0.00	0.00
30	nominal	60373.89347	60373.90627	60373.90719	60373.90811	60373.90911	60373.91033	60373.91425	172.272	0.000	0.29	0.00
40	nominal	60374.09336	NA	NA	NA	NA	NA	60374.11128	369.298	0.000	0.61	0.00
50	nominal	60374.67176	NA	NA	NA	NA	NA	60374.69282	950.841	0.000	1.57	0.00
High frequency 63375 MHz												
-20	nominal	63374.24886	63374.25228	63374.25633	63374.26154	63374.26821	63374.27428	63374.30281	624.745	0.000	0.99	0.00
-10	nominal	63374.12283	NA	NA	NA	NA	NA	63374.12584	447.774	0.000	0.71	0.00
0	nominal	63373.85453	63373.85666	63373.85764	63373.85884	63373.86032	63373.86157	63373.86759	189.525	0.000	0.30	0.00
10	nominal	63373.69459	NA	NA	NA	NA	NA	63373.70539	27.325	0.000	0.04	0.00
20	+15%	63373.67806	NA	NA	NA	NA	NA	63373.67827	0.204	0.000	0.00	0.00
20	nominal	63373.67782	NA	NA	NA	NA	NA	63373.67806	0.000	-0.243	0.00	0.00
20	-15%	63373.67827	NA	NA	NA	NA	NA	63373.67841	0.345	0.000	0.00	0.00
30	nominal	63373.85677	63373.853212	63373.857239	63373.859359	63373.860634	63373.861293	63373.86339	185.329	0.000	0.29	0.00
40	nominal	63374.06455	NA	NA	NA	NA	NA	63374.07665	398.591	0.000	0.63	0.00
50	nominal	63374.66860	NA	NA	NA	NA	NA	63374.68372	1005.65	0.000	1.59	0.00

* - Reference frequency

Reference numbers of test equipment used

HL 1303	HL 2358	HL 2909	HL 3291	HL 3295	HL 3305	HL 3433	HL 3434

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	21-Jan-14	21-Jan-15
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	28-Oct-13	28-Oct-14
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	22-May-14	22-May-15
0747	Mixer, Millimeter Wave Harmonic 90 - 140 GHz	Oleson Microwave Labs	M08HW	F80429-1	08-Nov-13	08-Nov-16
0748	Mixer Millimeter Wave Harmonic 60 - 90 GHz	Oleson Microwave Labs	M12 HW	E 804 29-1	08-Nov-13	08-Nov-16
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	12-Dec-12	12-Dec-15
0769	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, 25 dB gain	Quinstar Technology	QWH-2800-BA	112	12-Dec-12	12-Dec-15
0770	Antenna Standard Gain Horn, 40-60 GHz WR-19, U-band Gain - 25 dB	Quinstar Technology	QWH-1900-AA	118	20-Jul-14	20-Jul-15
0771	Antenna Standard Gain Horn, 60-90 GHz, WR-12, Gain - 25 dB	Quinstar Technology	QWH-1200-AA	111	20-Jul-14	20-Jul-15
0772	Antenna Standard Gain Horn, 75-110 GHz, WR-10, Gain - 25 dB	Quinstar Technology	QWH-0800-AA	110	20-Jul-14	20-Jul-15
1295	Adapter 35WR28Kf, 26.5-40 GHz	Wiltron	35WR28KF	1295	03-Sep-13	03-Sep-16
1299	Transition waveguide ET28S -19R	Custom Microwave	ET28S -19R	1299	02-Aug-12	02-Aug-15
1300	Transition waveguide ET28S -19R	Custom Microwave	ET28S -19R	1300	02-Aug-12	02-Aug-15
1303	Transition waveguide ET28S -12R	Custom Microwave	ET28S -12R	S0951	02-Aug-12	02-Aug-15
1304	Transition waveguide ET28S - 8R	Custom Microwave	ET28S - 8R	1304	02-Aug-12	02-Aug-15
1306	Transition waveguide ET28S - 5R	Custom Microwave	ET28S - 5R	1306	02-Aug-12	02-Aug-15
1312	Mixer Millimeter Wave Harmonic 140-220 GHz	Oleson Microwave Labs	M05HWD	G91112-1	08-Nov-13	08-Nov-16
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	10-Oct-13	10-Oct-14
2358	Power Supply, 2 X 0-36VDC / 5A, 5VDC / 5A	Horizon Electronics	DHR3655D	767469	01-Jan-14	01-Jan-15
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	23-Dec-13	23-Dec-14
3235	Harmonic mixer 40 to 60 GHz	Agilent Technologies	11970U	MY300301 82	23-Jul-13	23-Jul-16
3290	Attenuator, direct reading, 40 to 60 GHz, 0.4 W	Quinstar Technology	QAD-U00000	10381008	11-Dec-12	11-Dec-14
3291	Attenuator, direct reading, 60 to 90 GHz, 0.2 W	Quinstar Technology	QAD-E00000	10381009	11-Dec-12	11-Dec-14
3294	Tapered transition, WR-28, UG-599 to WR-15, UG-385 (26.5-40 GHz to 50-75 GHz)	Quinstar Technology	QWP-AV0000	10381004	04-Aug-14	04-Aug-15

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
3295	Tapered transition, WR-28, UG-599 to WR-15, UG-385 (26.5-40 GHz to 50-75 GHz)	Quinstar Technology	QWP-AV0000	10381005	02-Aug-14	02-Aug-15
3297	Tapered transition, WR-28, UG-599 to WR-10, UG-387 (26.5-40 GHz to 75-100 GHz)	Quinstar Technology	QWP-AW0000	10381007	02-Aug-14	02-Aug-15
3305	Harmonic mixer 50 to 75 GHz	Agilent Technologies	11970V	MY30030149	23-Jul-13	23-Jul-16
3329	Antenna Standard Gain Horn, 140-220 GHz, WR-5, Gain - 25 dB	Quinstar Technology	NA	3329	20-Jul-14	20-Jul-15
3433	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25679	10-Mar-14	10-Mar-15
3434	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25683	10-Mar-14	10-Mar-15
3455	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 20 dB, 5 W	Aeroflex / Weinschel	75A-20-12	1182	09-Mar-14	09-Mar-15
3535	Amplifier, low noise, 18 to 40 GHz	Quinstar Technology	QLJ-18404537-J0	11159003001	08-Oct-13	08-Oct-14
3536	Antenna Standard Gain Horn, 90-140 GHz, WR-8, Midband Gain - 24 dB	Quinstar Technology	QWH-FPRR00	11159004001	10-Jun-14	10-Jun-15
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	06-Feb-14	06-Feb-15
4023	Diplexer for use OML mixers with Agilent spectrum analyzer	Oleson Microwave Labs	DPL.26	NA	11-Dec-12	11-Dec-14
4114	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz	ETS Lindgren	3117	00123515	27-Dec-13	27-Dec-14
4150	Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type(f) in, N-type(m) out.	Agilent Technologies	87405C	MY47010591	01-Jan-14	01-Jan-15
4352	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101002	01-Jan-14	01-Jan-15
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101003	16-Mar-14	16-Mar-15

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Frequency error	± 0.56 ppm
Carrier power conducted	± 1.7 dB
Spurious emissions conducted at RF antenna connector	30 MHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 12.75 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
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.
Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.
In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

10 APPENDIX C Test laboratory 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 numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), 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 US1003.

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 15: 2013	Radio Frequency Devices.
FCC 47CFR part 2: 2013	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: 2003	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.
KDB200433 D02 RF Detector Method v01	Guidelines for compliance testing of millimeter wave devices subject to the RF detector measurement in sections 15.255 and 15.257

12 APPENDIX E Test equipment correction factors

Antenna Factor
Active Loop Antenna
EMC Test Systems, model 6502, S/N 2857, HL 0446

Frequency, MHz	Magnetic Antenna Factor, dB(S/m)	Electric Antenna Factor, dB(1/m)
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	9.7
0.750	-41.9	9.6
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.1
4.000	-41.4	10.1
5.000	-41.5	10.0
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(S/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μA/m).
Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Antenna factor
Standard gain horn antenna
Quinstar Technology
Model QWH
Ser.No.112, HL 0768, 0769, 0770, 0771, 0772

Frequency min, GHz	Frequency max, GHz	Antenna factor, dB(1/m)
18.000	26.500	32.01
26.500	40.000	35.48
40.000	60.000	39.03
60.000	90.000	42.55
90.000	140.000	46.23
140.000	220.000	50.11

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

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

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

Antenna factor is to be added to receiver meter reading in dB(μV) to convert to field strength in dB(μV/meter)

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

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

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

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

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

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

Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,
NC29-N1N1-244S/N 12025101 002,
HL 4352

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.20	9000	2.81
100	0.28	9500	2.89
300	0.49	10000	3.00
500	0.63	10500	3.07
1000	0.90	11000	3.15
1500	1.10	11500	3.23
2000	1.28	12000	3.30
2500	1.44	12500	3.38
3000	1.57	13000	3.47
3500	1.71	13500	3.55
4000	1.85	14000	3.61
4500	1.95	14500	3.68
5000	2.05	15000	3.76
5500	2.14	15500	3.86
6000	2.27	16000	3.92
6500	2.38	16500	3.97
7000	2.47	17000	4.03
7500	2.58	17500	4.10
8000	2.65	18000	4.18
8500	2.74		

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
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
CBW	channel bandwidth
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
DC	direct current
EBW	emission bandwidth
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
μs	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere

END OF DOCUMENT