HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO: FCC 47CFR part 15 subpart C § 15.247 (DTS) and subpart B, RSS-247 issue 1, RSS-Gen issue 4, ICES-003 Issue 5:2012

FOR:

Visonic Ltd.
Wireless PIR Detector
Model: MP-840
FCC ID:WP3MP840
IC:1467C-MP840

Table of contents

1 Applicant information

Client name:	Visonic Ltd.
Address:	24 Habarzel street, Tel Aviv 69710, Israel
Telephone:	+972 3645 6832
Fax:	+972 3645 6788
E-mail:	zurir@tycoint.com
Contact name:	Mr. Zuri Rubin

2 Equipment under test attributes

Product name:	Wireless PIR Detector
Product type:	Transceiver
Model(s):	MP-840
Serial number:	0916582224
Hardware version:	90-208026
Software release:	JS-703129
Receipt date	02-Feb-16

3 Manufacturer information

Manufacturer name:	Visonic Ltd.
Address:	24 Habarzel street, Tel Aviv 69710, Israel
Telephone:	+972 3645 6832
Fax:	+972 3645 6788
E-Mail:	zurir@tycoint.com
Contact name:	Mr. Zuri Rubin

4 Test details

Project ID:	27985
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	02-Feb-16
Test completed:	08-Mar-16
Test specification(s):	FCC 47CFR part 15 subpart C § 15.247 (DTS); RSS-247 issue 1, RSS-Gen issue 4

5 Tests summary

Test	Status
Transmitter characteristics	
FCC section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth	Pass
FCC section 15.247(b)3/ RSS-247 section 5.4(4), Peak output power	Pass
FCC section 15.247(i) / RSS-102 section 2.5.2, RF exposure	Pass, the exhibit to the application of certification is provided
FCC section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions	Pass
FCC section 15.247(d)/ RSS-247 section 5.5, Emissions at band edges	Pass
FCC section 15.247(e) / RSS-247 section 5.2(2), Peak power density	Pass
FCC section 15.203 / RSS-Gen section 8.3, Antenna requirement	Pass
FCC section 15.207(a) / RSS-Gen section 8.8, Conducted emission	Not required
Unintentional emissions	
FCC section 15.107/ ICES-003, Section 6.1, Class B, Conducted emission at AC power port	Not required
FCC section 15.109/ RSS-Gen section 7.1.2 /ICES-003, Section 6.2, Class B, Radiated emission	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

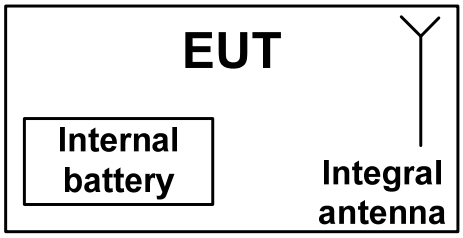
	Name and Title	Date	Signature
Tested by:	Mrs. E. Pitt, test engineer	March 8, 2016	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	March 17, 2016	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	April 19, 2016	

6 EUT description

6.1 General information

The EUT, MP-840, is a wireless PIR detector with RF module operating@2.4 GHz.

6.2 Test configuration



6.3 Changes made in the EUT

No changes were implemented in the EUT during the testing.

6.4 Transmitter characteristics

Type of equipment	
X	Stand-alone (Equipment with or without its own control provisions)
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)
	Plug-in card (Equipment intended for a variety of host systems)

Intended use		**Condition of use**
	fixed	Always at a distance more than 2 m from all people
X	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 ranges	2400 -2483.5 MHz
Operating frequencies	2405-2480 MHz

Maximum rated output power	At transmitter 50 Ω RF output connector	dBm
	Peak output power	16.28 dBm

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

Antenna connection					
unique coupling	standard connector	X	integral		with temporary RF connector
				X	without temporary RF connector

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Integral	Visonic	Printed	3 dBi

Transmitter aggregate data rate	250 kbps
Type of modulation	OQPSK

Transmitter power source					
X	Battery	**Nominal rated voltage**	3 VDC	Battery type	Lithium CR123
	DC	**Nominal rated voltage**			
	AC mains	**Nominal rated voltage**		Frequency	

Common power source for transmitter and receiver	X	yes		no

Test specification:	FCC section 15.247(a)(2), RSS-247 section 5.2(1), 6 dB bandwidth		
Test procedure:	ANSI C63.10 section 11.8.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C and RSS-247 requirements

7.1 Minimum 6 dB bandwidth

7.1.1 General

This test was performed to measure the 6 dB bandwidth of the EUT carrier frequency. Specification test limits are given in Table 7.1.1, Table 7.1.2.

Table 7.1.1 The 6 dB bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Minimum bandwidth, kHz
902.0 – 928.0	6.0	>500.0
2400.0 – 2483.5		
5725.0 – 5850.0		

* - Modulation envelope reference points provided in terms of attenuation below the peak of modulated carrier.

Table 7.1.2 The 99% bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points	Limit, kHz
902.0 – 928.0	99%	>500.0
2400.0 – 2483.5		
5725.0 – 5850.0		

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 set to transmit modulated carrier.

7.1.2.3 The transmitter minimum 6 dB bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.3 and the associated plots.

7.1.2.4 The 99% bandwidth results are provided in Table 7.1.4 and the associated plots.

Figure 7.1.1 The 6 dB bandwidth test setup

Test specification:	FCC section 15.247(a)(2), RSS-247 section 5.2(1), 6 dB bandwidth		
Test procedure:	ANSI C63.10 section 11.8.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Table 7.1.3 The 6 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 2400-2483.5 MHz
DETECTOR USED: Peak
SWEEP MODE: Max hold
SWEEP TIME: Auto
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 3 RBW
MODULATION: OQPSK
BIT RATE: 250 kbps

Carrier frequency, MHz	6 dB bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
2405	1592	500	1092	Pass
2445	1594	500	1094	Pass
2475	1593	500	1093	Pass
2480	1548	500	1048	Pass

Table 7.1.4 The 99% bandwidth test results

ASSIGNED FREQUENCY BAND: 2400-2483.5 MHz
DETECTOR USED: Peak
SWEEP MODE: Max hold
SWEEP TIME: Auto
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 3 RBW
MODULATION: OQPSK
BIT RATE: 250 kbps

Carrier frequency, MHz	99% bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
2405	2442	500	1942	Pass
2445	2442	500	1942	Pass
2475	2447	500	1947	Pass
2480	2429	500	1929	Pass

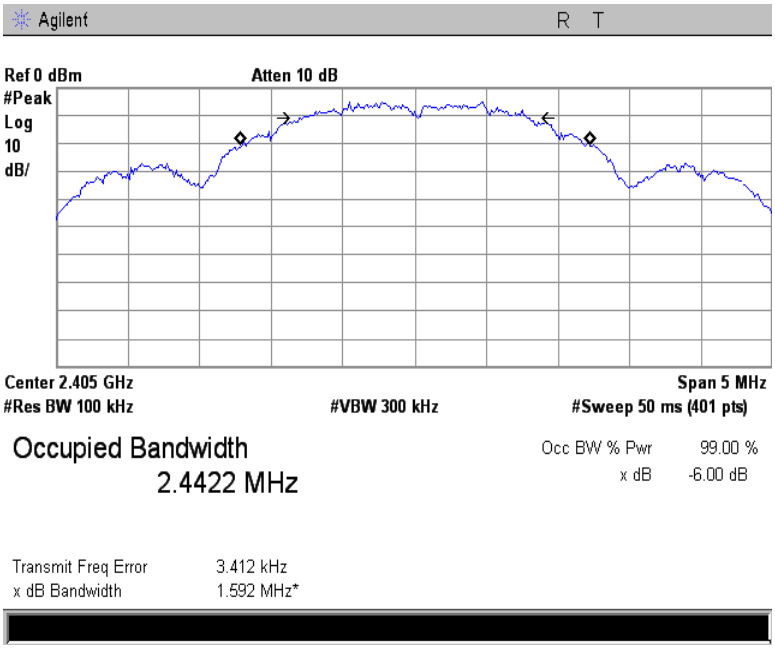
Reference numbers of test equipment used

HL 521	HL 1984	HL 4353	HL 4278					

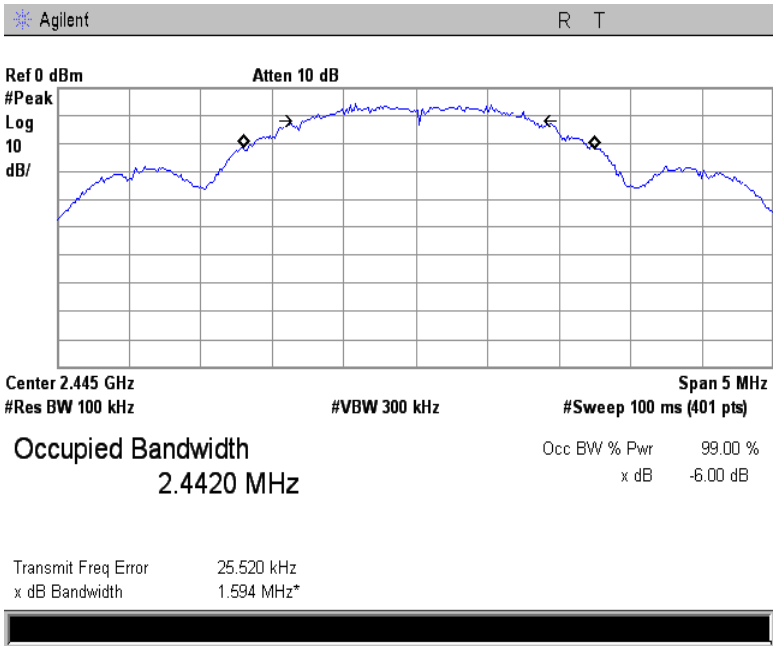
Full description is given in Appendix A.

Test specification:	FCC section 15.247(a)(2), RSS-247 section 5.2(1), 6 dB bandwidth		
Test procedure:	ANSI C63.10 section 11.8.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.1.1 The occupied bandwidth test result at low frequency ch.11

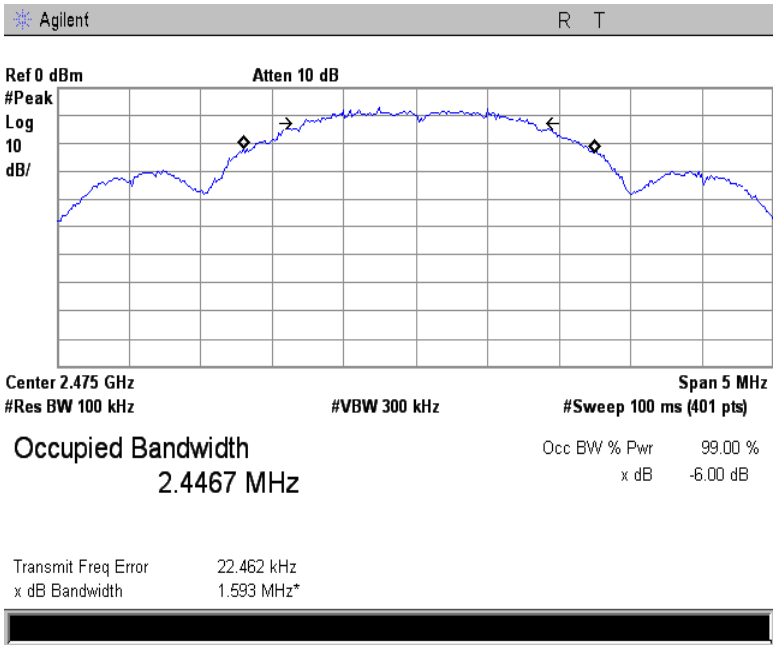


Plot 7.1.2 The occupied bandwidth test result at mid frequency ch.19

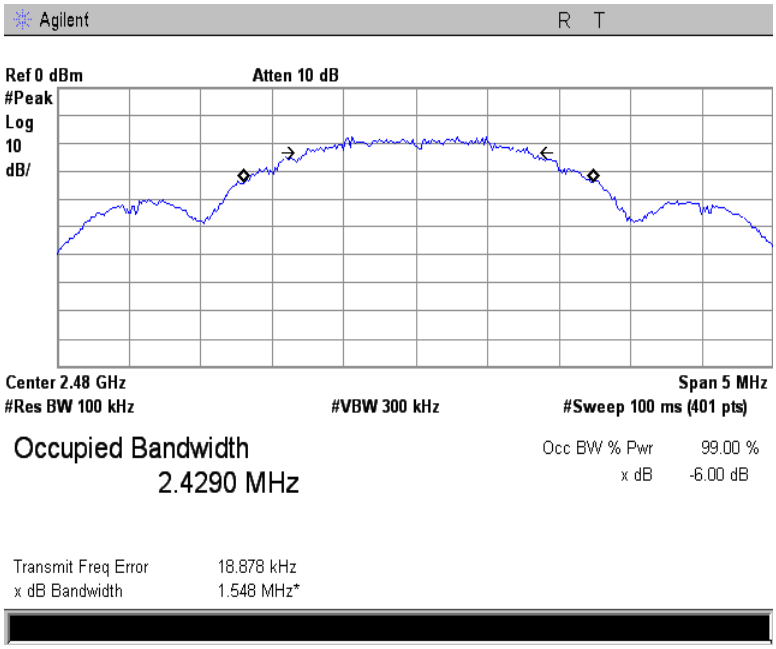


Test specification:	FCC section 15.247(a)(2), RSS-247 section 5.2(1), 6 dB bandwidth		
Test procedure:	ANSI C63.10 section 11.8.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.1.3 The occupied bandwidth test result at high frequency ch.25



Plot 7.1.4 The occupied bandwidth test result at high frequency ch.26



Test specification:	FCC section 15.247(b)(3), RSS-247 section 5.4(4), Peak output power (radiated)		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

7.2 Peak output power

7.2.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Peak output power limits

Assigned frequency range, MHz	Maximum antenna gain, dBi	Peak output power*		Equivalent field strength limit @ 3m, dB(μV/m)**
		W	dBm	
902.0 – 928.0	6.0	1.0	30.0	131.2
2400.0 – 2483.5				
5725.0 – 5850.0				

*- The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

**- Equivalent field strength limit was calculated from the peak output power as follows: E=sqrt(30×P×G)/r, where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

7.2.2 Test procedure

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

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

7.2.2.3 The resolution bandwidth of spectrum analyzer was set wider than 6 dB bandwidth of the EUT and the field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.2.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.2.2 and associated plots.

7.2.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

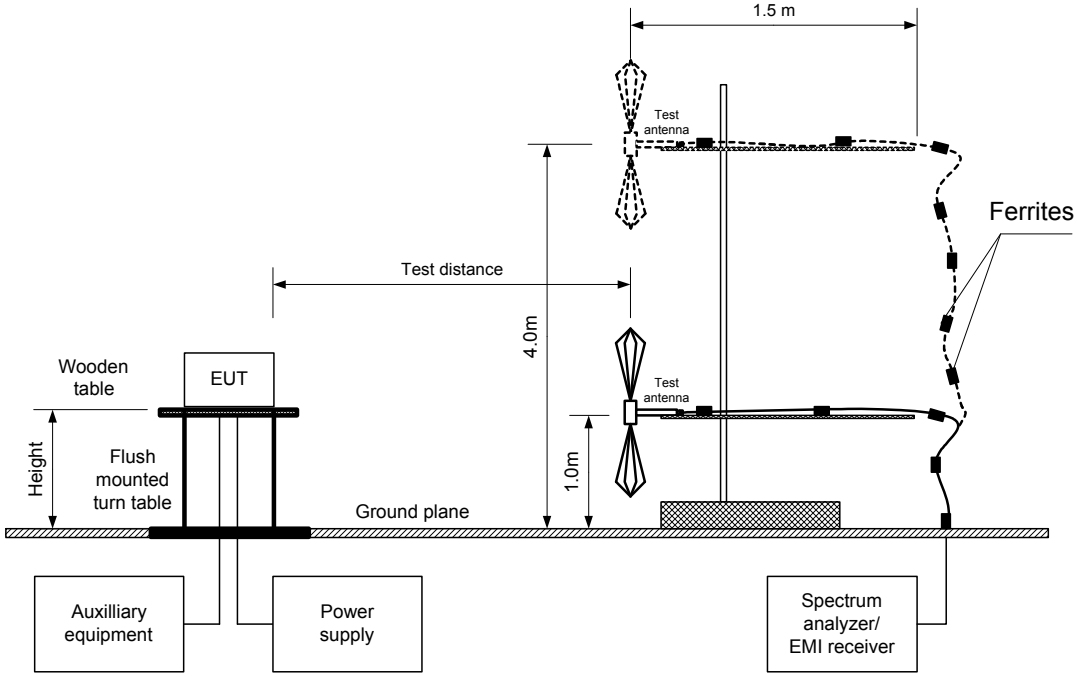
where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.
The above equation was converted in logarithmic units for 3 m test distance:

Peak output power in dBm = Field strength in dB(μV/m) - Transmitter antenna gain in dBi – 95.2 dB

7.2.2.6 The worst test results (the lowest margins) were recorded in Table 7.2.2.

Test specification:	FCC section 15.247(b)(3), RSS-247 section 5.4(4), Peak output power (radiated)		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Figure 7.2.1 Setup for carrier field strength measurements



Test specification:	FCC section 15.247(b)(3), RSS-247 section 5.4(4), Peak output power (radiated)		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Table 7.2.2 Peak output power test results

ASSIGNED FREQUENCY: 2400-2483.5 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 1.5 m
DETECTOR USED: Peak
TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATION: OQPSK
BIT RATE: 250 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
EUT 6 dB BANDWIDTH: 1.65 MHz
RESOLUTION BANDWIDTH: 3 MHz
VIDEO BANDWIDTH: 3 MHz

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2405	113.93	Horizontal	1.8	0	3	15.73	30	-14.27	Pass
2445	113.48	Horizontal	1.3	0	3	15.28	30	-14.72	Pass
2475	114.48	Horizontal	1.3	0	3	16.28	30	-13.72	Pass
2480	105.36	Horizontal	1.8	0	3	7.16	30	-22.84	Pass

*- EUT front panel refer to 0 degrees position of turntable.
**- Peak output power was calculated from the field strength of carrier as follows: $P = (E \times d)^2 / (30 \times G)$,
where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB(µV/m) - Transmitter antenna gain in dBi – 95.2 dB*
***- Margin = Peak output power – specification limit.

Reference numbers of test equipment used

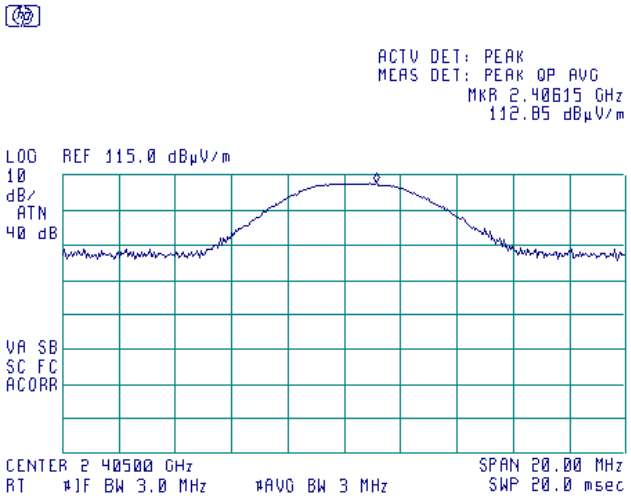
HL 0521	HL 1984	HL 4278	HL 4353				

Full description is given in Appendix A.

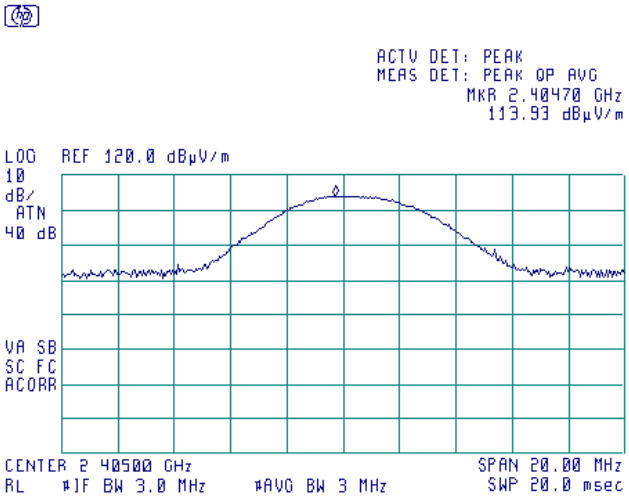
Test specification:	FCC section 15.247(b)(3), RSS-247 section 5.4(4), Peak output power (radiated)		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.2.1 Field strength of carrier at low frequency ch.11

ANTENNA POLARIZATION: Vertical

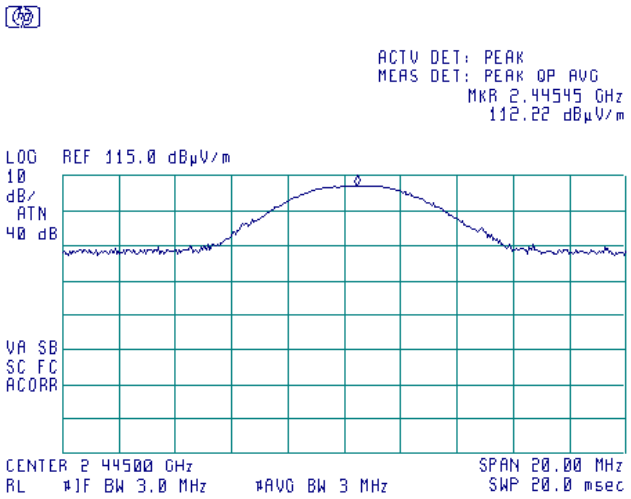


ANTENNA POLARIZATION: Horizontal

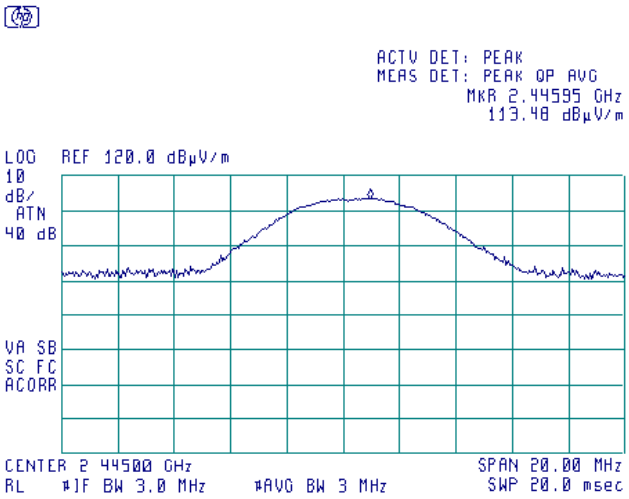


Plot 7.2.2 Field strength of carrier at mid frequency ch.19

ANTENNA POLARIZATION: Vertical



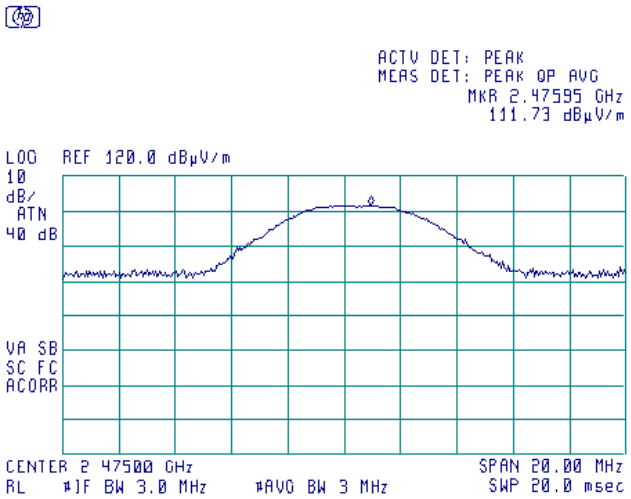
ANTENNA POLARIZATION: Horizontal



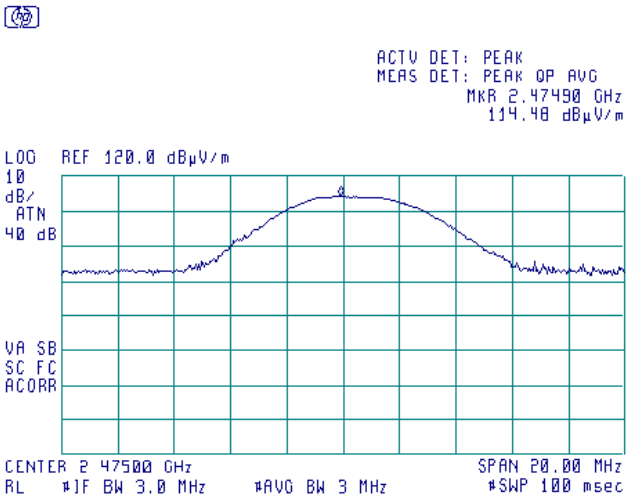
Test specification:	FCC section 15.247(b)(3), RSS-247 section 5.4(4), Peak output power (radiated)		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.2.3 Field strength of carrier at high frequency ch.25

ANTENNA POLARIZATION: Vertical

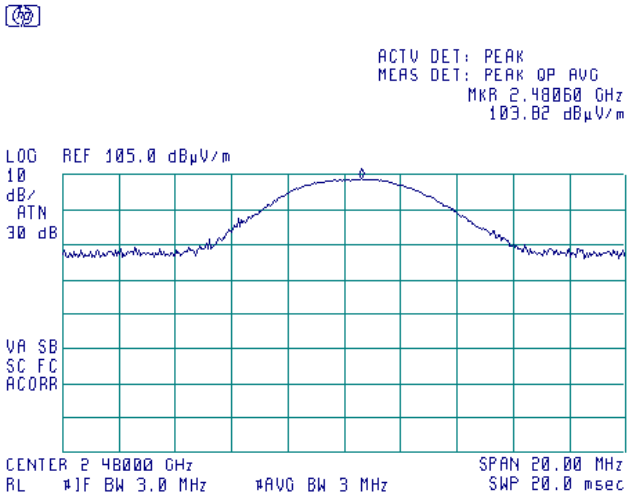


ANTENNA POLARIZATION: Horizontal

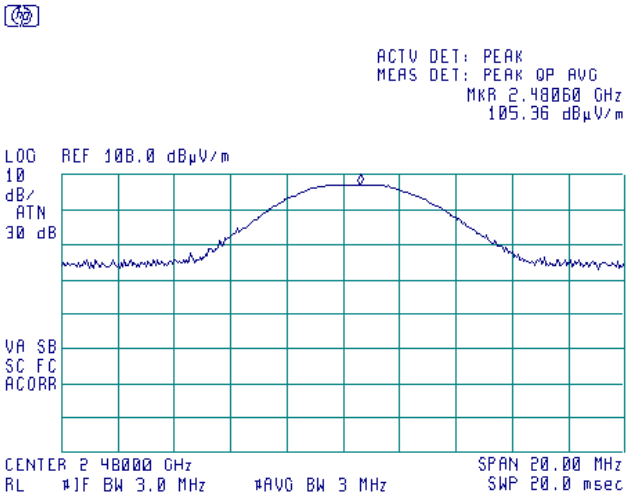


Plot 7.2.4 Field strength of carrier at high frequency ch.26

ANTENNA POLARIZATION: Vertical



ANTENNA POLARIZATION: Horizontal



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

7.3 Field strength of spurious emissions

7.3.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m)*			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc***
	Peak	Quasi Peak	Average	
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	20.0
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 - 1000		54.0		
1000 – 10thharmonic	74.0	NA	54.0	

*- 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.

*** - The 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.

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

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.

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

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

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

7.3.3.1 The EUT was set up as shown in Figure 7.3.2, energized and the performance check was conducted.

7.3.3.2 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.

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

Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Figure 7.3.1 Setup for spurious emission field strength measurements below 30 MHz

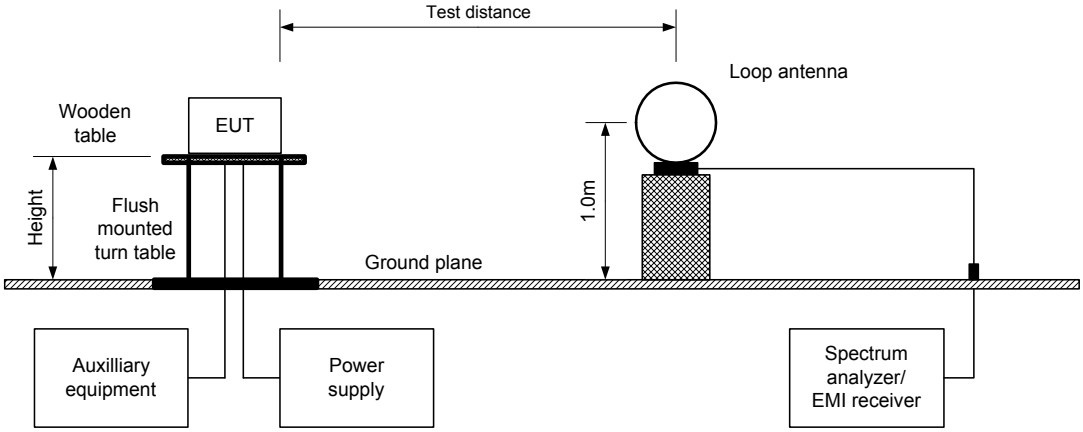
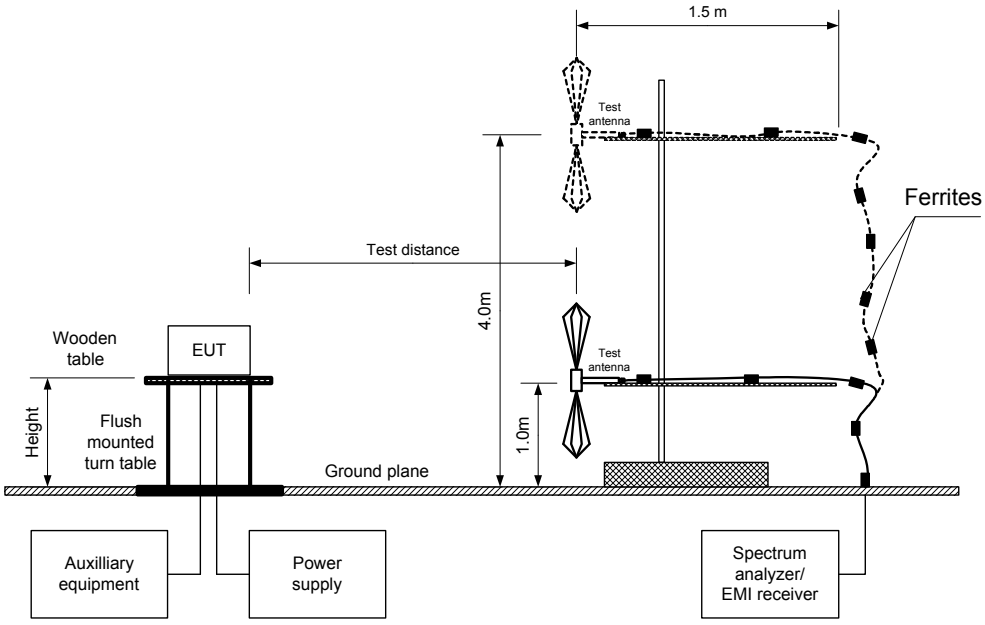


Figure 7.3.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Table 7.3.2 Field strength of emissions outside restricted bands

INVESTIGATED FREQUENCY RANGE: 0.009 -25000 MHz
TEST DISTANCE: 3 m
MODULATION: OQPSK
BIT RATE: 250 kbps
DUTY CYCLE: 100 %
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 300 kHz

Frequency, MHz	Field strength of spurious, dB(μV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(μV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
Low carrier frequency, channel 11									
9620	54.86	Horizontal	1.3	20	109.95	55.09	20.0	35.09	Pass
19240	47.57	Horizontal	1.4	70		62.38		42.38	
Mid carrier frequency, channel 19									
9780	57.65	Horizontal	1.3	20	109.59	51.94	20.0	31.94	Pass
19560	51.61	Horizontal	1.4	70		57.98		37.98	
High carrier frequency, channel 25									
9900	55.91	Horizontal	1.3	30	110.56	54.65	20.0	34.65	Pass
19800	48.54	Horizontal	1.4	70		62.02		42.02	
High carrier frequency, channel 26									
No emissions were found									Pass

*- EUT front panel refers to 0 degrees position of turntable.
**- Margin = Attenuation below carrier – specification limit.

Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Table 7.3.3 Field strength of spurious emissions above 1 GHz within restricted bands

INVESTIGATED FREQUENCY RANGE: 1000 – 25000 MHz
TEST DISTANCE: 3 m
MODULATION: OQPSK
BIT RATE: 250 kbps
DUTY CYCLE: 100 %
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=10 Hz)				Verdict
	Polarization	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured, dB(μV/m)	Calculated, dB(μV/m)	Limit, dB(μV/m)	Margin, dB***	
Low carrier frequency, channel 11											
4810	Horizontal	1.2	0	47.12	74	-26.88	36.39	23.82	54	-30.18	Pass
12025	Horizontal	1.4	80	66.83	74	-7.17	57.74	45.17	54	-8.83	
Mid carrier frequency, channel 19											
4890	Horizontal	1.2	0	48.21	74	-25.79	38.17	25.60	54	-28.40	Pass
12225	Horizontal	1.4	80	67.77	74	-6.23	58.02	45.45	54	-8.55	
High carrier frequency, channel 25											
4950	Horizontal	1.2	0	49.17	74	-24.83	39.98	27.41	54	-26.59	Pass
12380	Horizontal	14	80	66.58	74	-7.42	57.50	44.93	54	-9.07	
High carrier frequency, channel 26											
No emissions were found											Pass

*- EUT front panel refers to 0 degrees position of turntable.
**- Margin = Measured field strength - specification limit.
***- Margin = Calculated field strength - specification limit,
where Calculated field strength = Measured field strength + average factor.

Table 7.3.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Number of pulses during 100 msec	Duration, ms	Period, ms		
1.96	12	NA	NA	NA	-12.57

*- Average factor was calculated as follows
Average factor =20 log (1.96 x 12/100) = -12.57

Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Table 7.3.5 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY:	2400-2483.5 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
TEST DISTANCE:	3 m
MODULATION:	OQPSK
MODULATING SIGNAL:	PRBS
BIT RATE:	250 kbps
DUTY CYCLE:	100 %
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
RESOLUTION BANDWIDTH:	0.2 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 polariz.	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
No signals were found								Pass

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

Reference numbers of test equipment used

HL 0446	HL 0604	HL 1984	HL 2780	HL 3347	HL 3818	HL 3901	HL 4278
HL 4338	HL 4353	HL 4932	HL 4933	HL 4956			

Full description is given in Appendix A.

Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Table 7.3.6 Restricted bands according to FCC section 15.205

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2690 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 – 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 – 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	Above 38.6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	

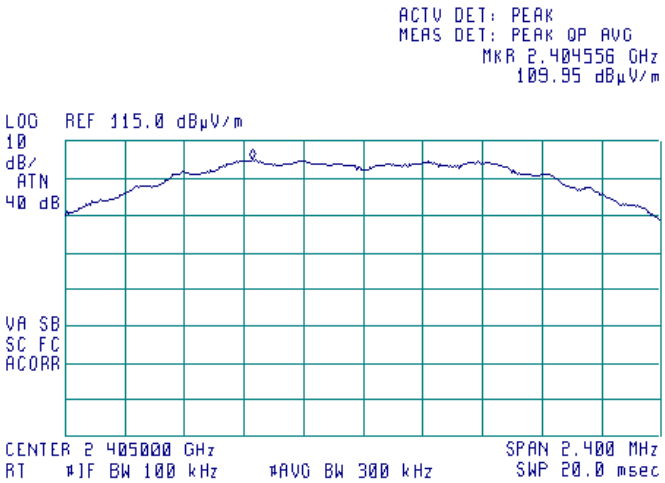
Table 7.3.7 Restricted bands according to RSS-Gen

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.291 - 8.294	16.80425 - 16.80475	399.9 - 410	3260 - 3267	10.6 - 12.7
2.1735 - 2.1905	8.362 - 8.366	25.5 - 25.67	608 - 614	3332 – 3339	13.25 - 13.4
3.020 – 3.026	8.37625 - 8.38675	37.5 - 38.25	960 – 1427	3345.8 – 3358	14.47 – 14.5
4.125 – 4.128	8.41425 - 8.41475	73 - 74.6	1435 – 1626.5	3500 – 4400	15.35 – 16.2
4.17725 – 4.17775	12.29 – 12.293	74.8 - 75.2	1645.5 – 1646.5	4500 – 5150	17.7 – 21.4
4.20725 – 4.20775	12.51975 – 12.52025	108 – 138	1660 - 1710	5350 – 5460	22.01 – 23.12
5.677 – 5.683	12.57675 – 12.57725	156.52475 – 156.52525	1718.8 - 1722.2	7250 - 7750	23.6 - 24
6.215 - 6.218	13.36 – 13.41	156.7 - 156.9	2200 - 2300	8025 – 8500	31.2 - 31.8
6.26775 - 6.26825	16.42 - 16.423	240 - 285	2310 - 2390	9000 - 9200	36.43 - 36.5
6.31175 - 6.31225	16.69475 - 16.69525	322 - 335.4	2655 - 2900	9300 - 9500	Above 38.6

Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

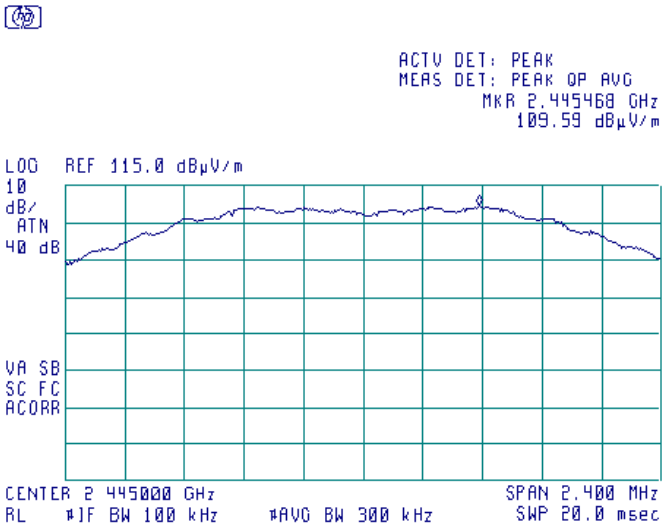
Plot 7.3.1 Radiated emission measurements at the low carrier frequency ch.11

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal



Plot 7.3.2 Radiated emission measurements at the mid carrier frequency ch.19

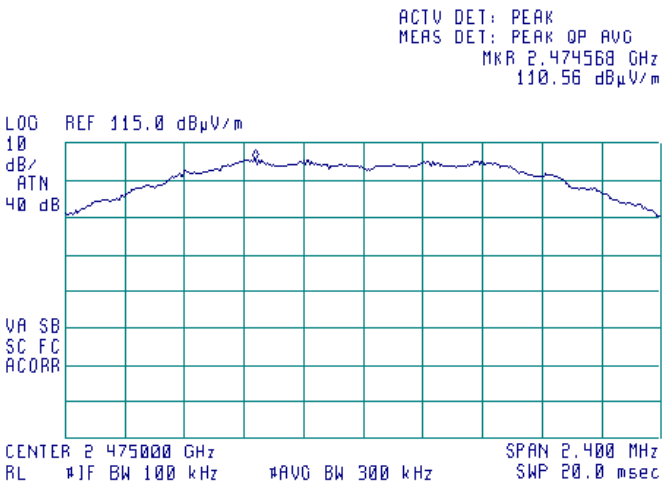
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

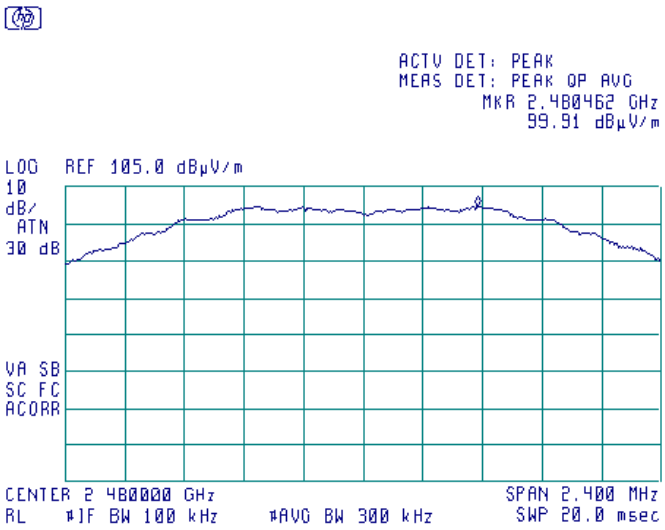
Plot 7.3.3 Radiated emission measurements at the high carrier frequency ch.25

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal



Plot 7.3.4 Radiated emission measurements at the high carrier frequency ch.26

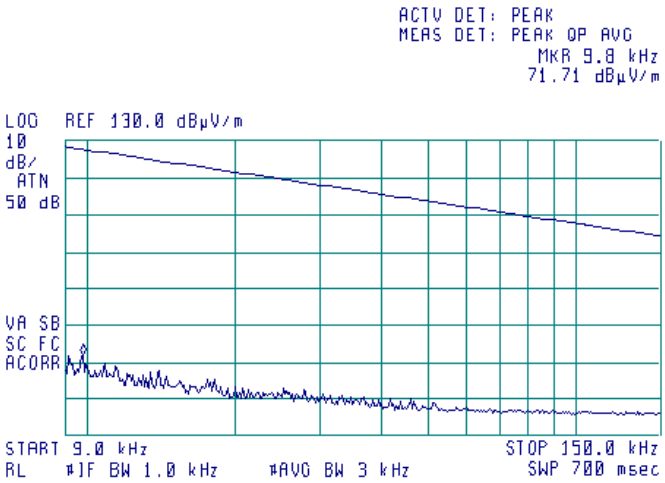
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

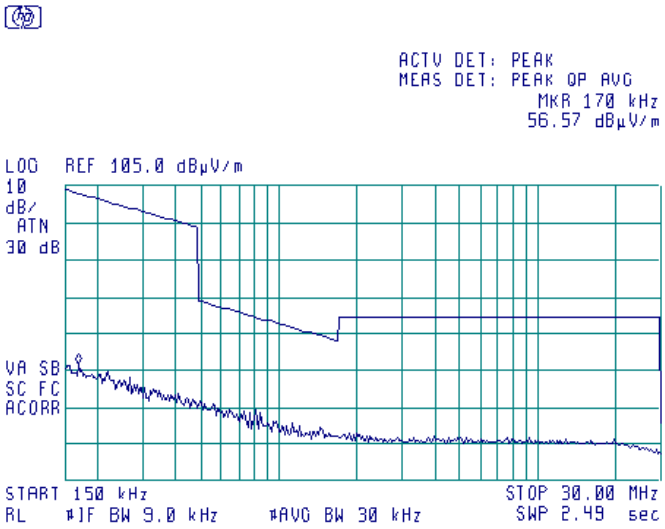
Plot 7.3.5 Radiated emission measurements from 9 to 150 kHz at the low, mod, high carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Plot 7.3.6 Radiated emission measurements from 0.15 to 30 MHz at the low, mid, high carrier frequency

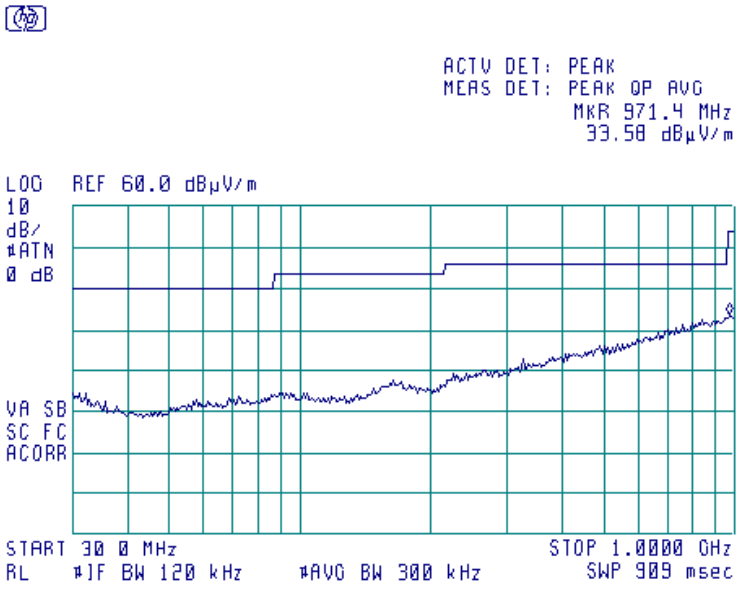
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.3.7 Radiated emission measurements from 30 to 1000 MHz at the low, mid, high carrier frequency

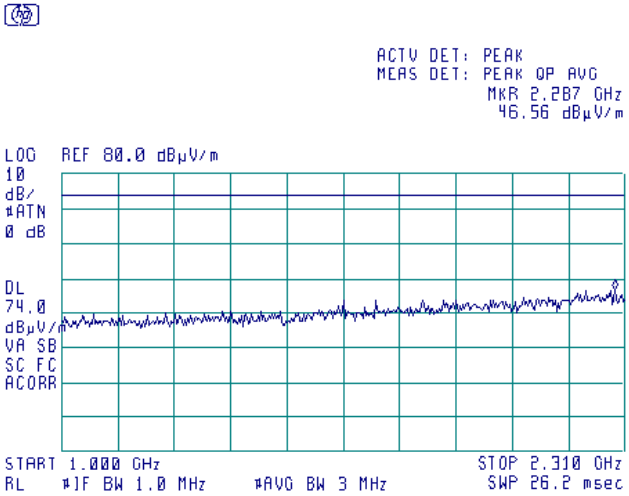
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

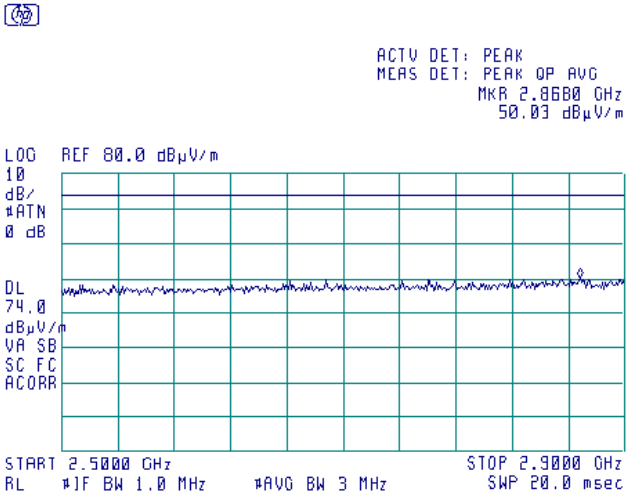


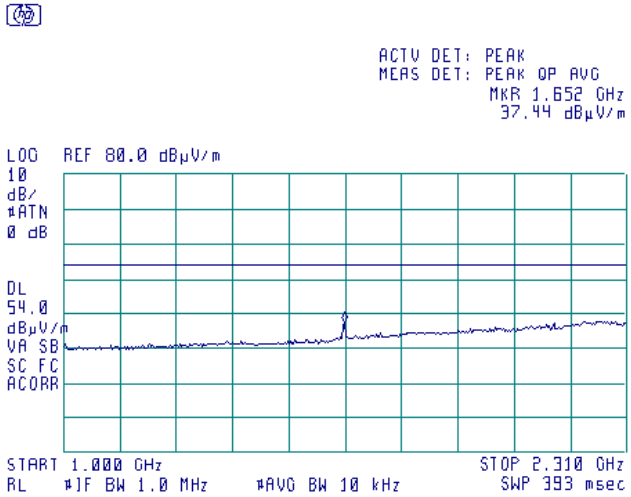
Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

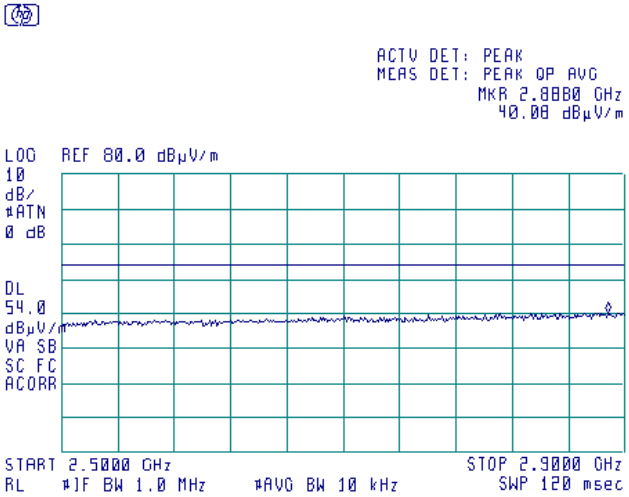
Plot 7.3.8 Radiated emission measurements from 1000 to 2900 MHz at the low carrier frequency ch.11

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





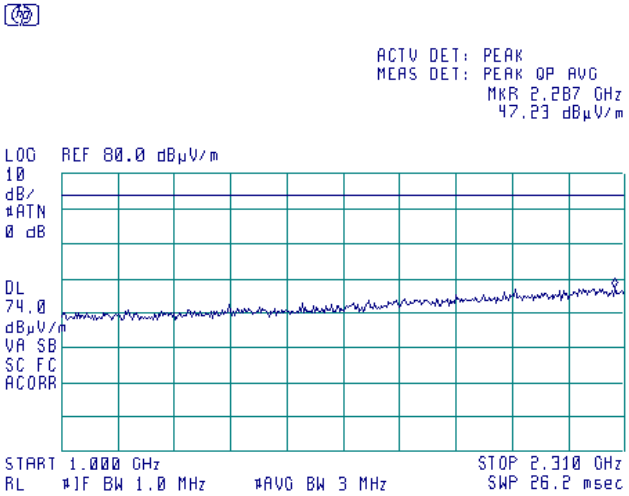


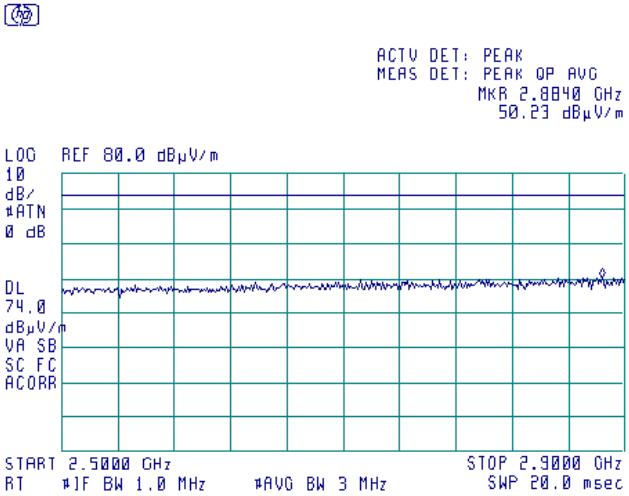


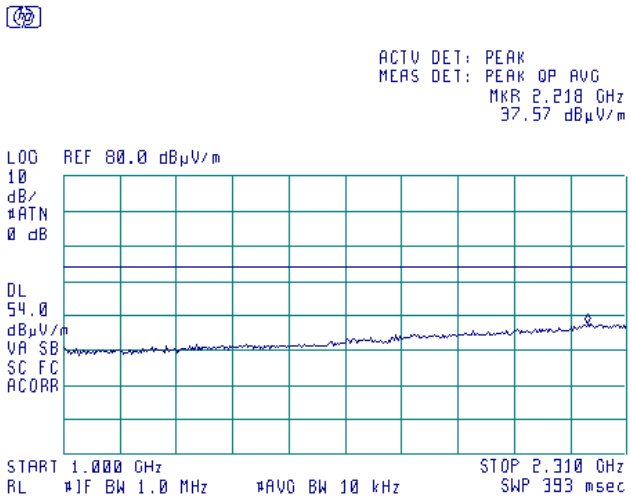
Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

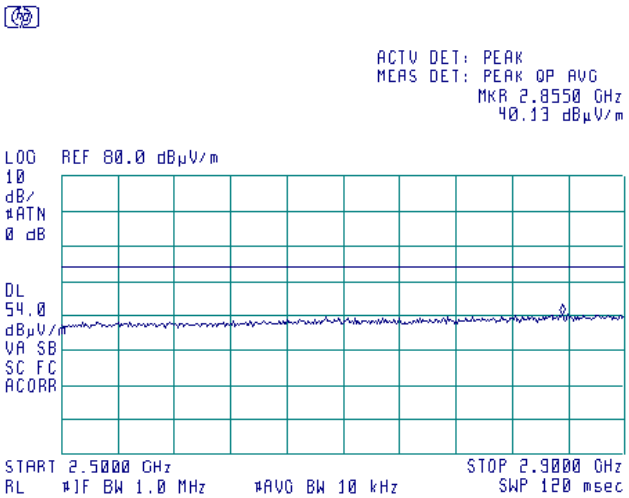
Plot 7.3.9 Radiated emission measurements from 1000 to 2900 MHz at the mid carrier frequency ch.19

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





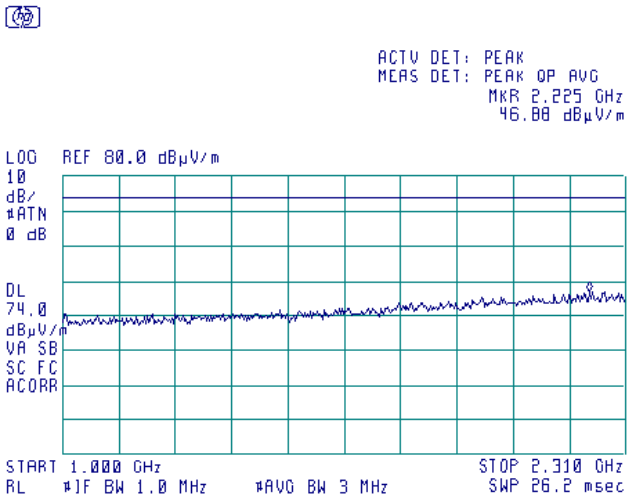


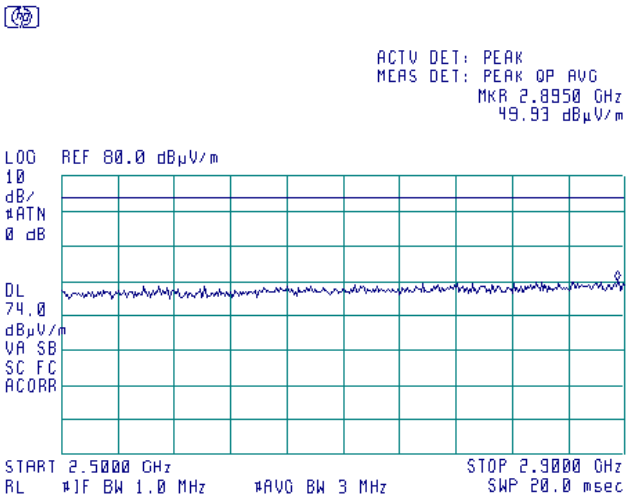


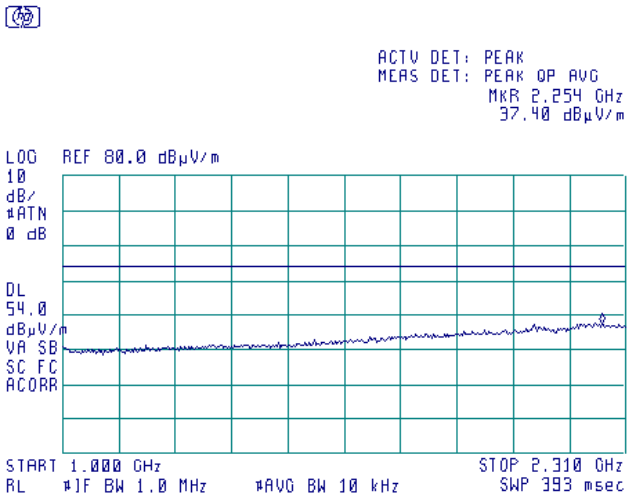
Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

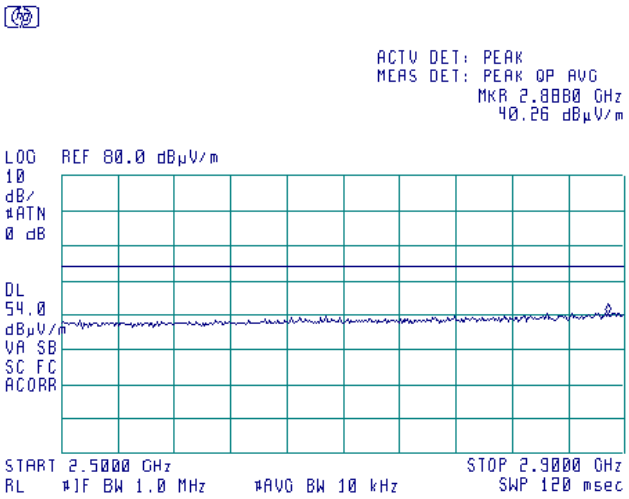
Plot 7.3.10 Radiated emission measurements from 1000 to 2900 MHz at the high carrier frequency ch.25

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





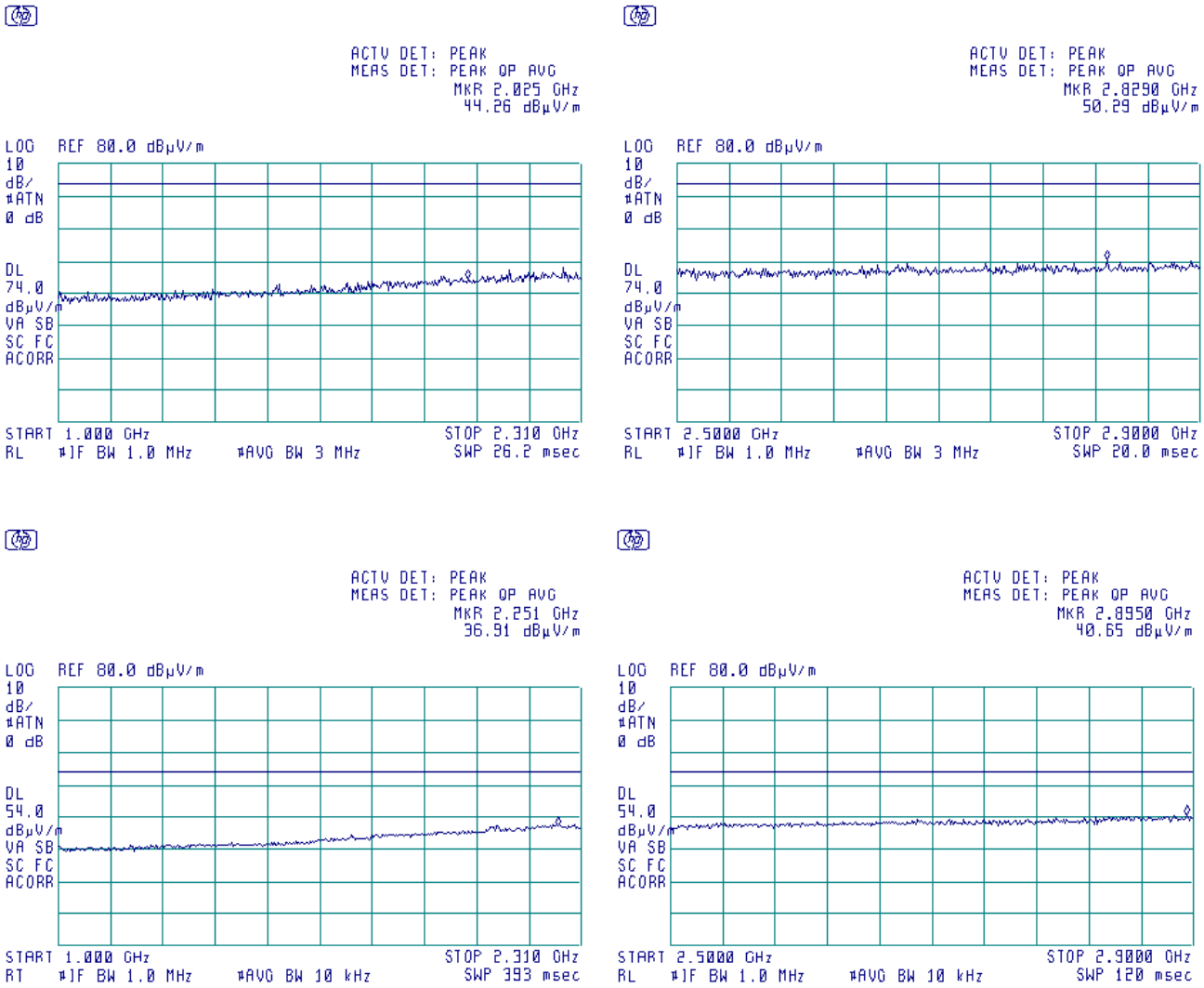




Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.3.11 Radiated emission measurements from 1000 to 2900 MHz at the high carrier frequency ch.26

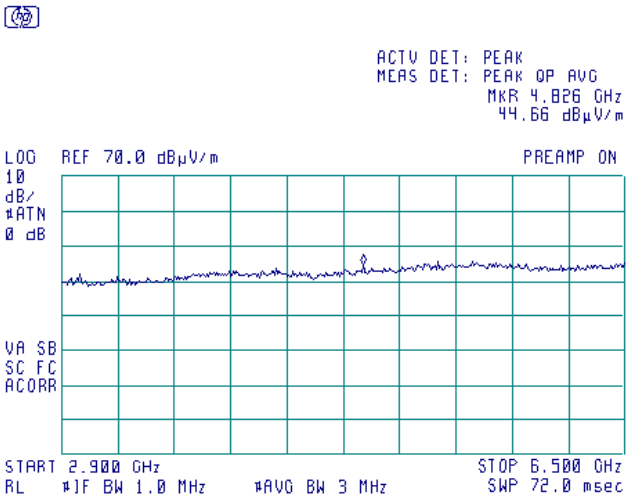
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

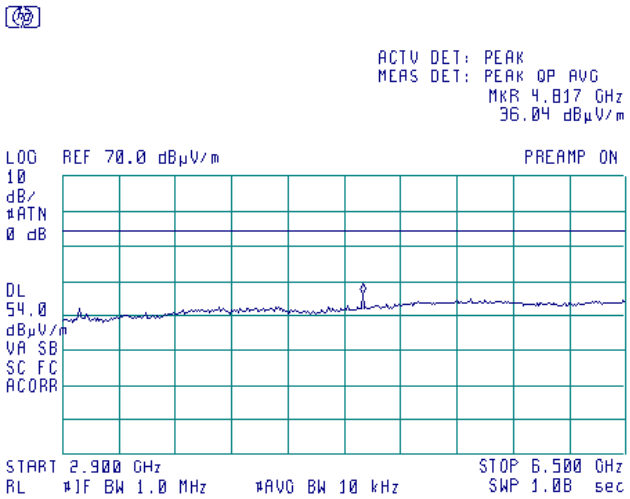


Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.3.12 Radiated emission measurements from 2900 to 6500 MHz at the low carrier frequency ch.11

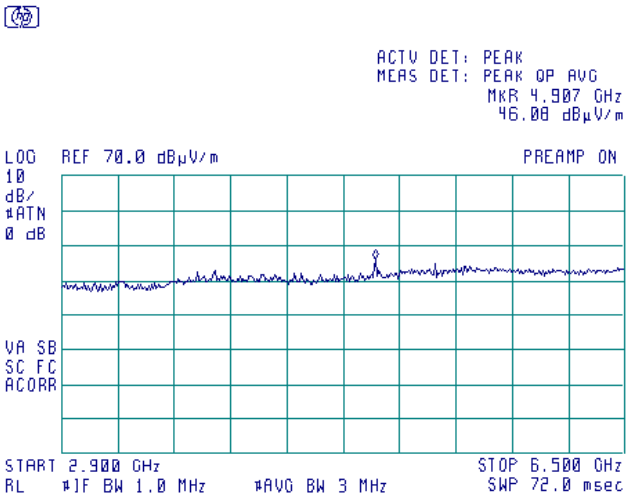
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

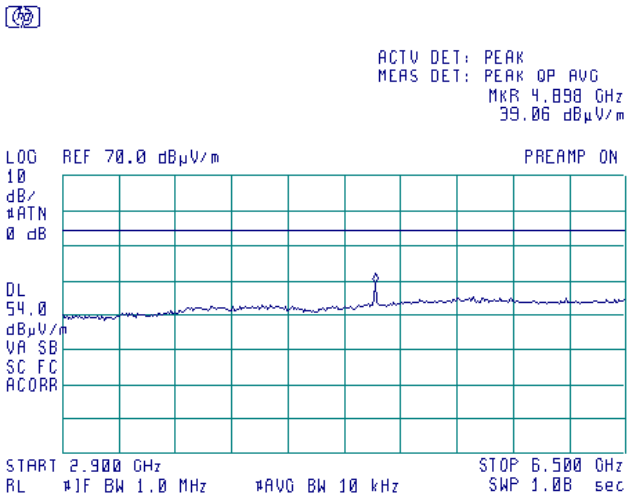




Plot 7.3.13 Radiated emission measurements from 2900 to 6500 MHz at the mid carrier frequency ch.19

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

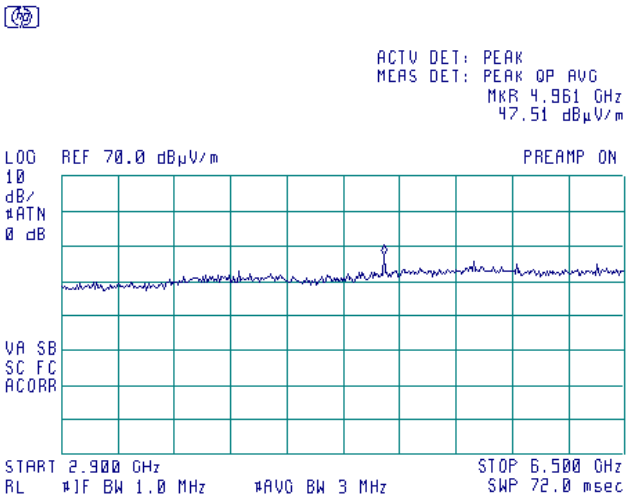


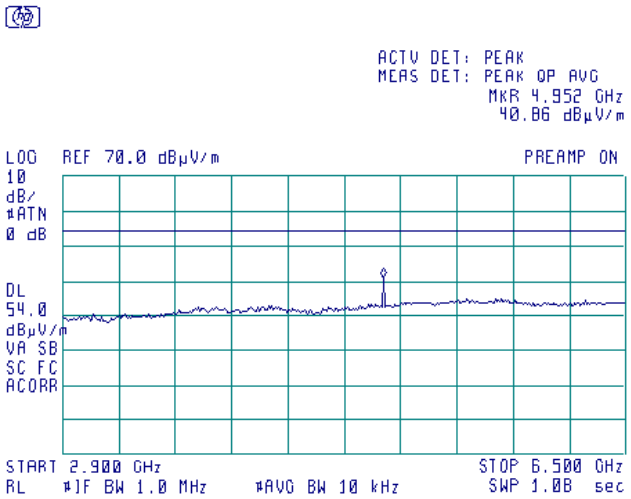


Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.3.14 Radiated emission measurements from 2900 to 6500 MHz at the high carrier frequency ch.25

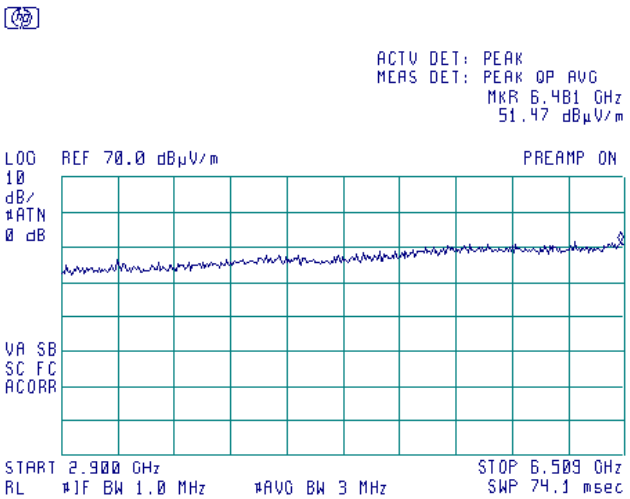
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

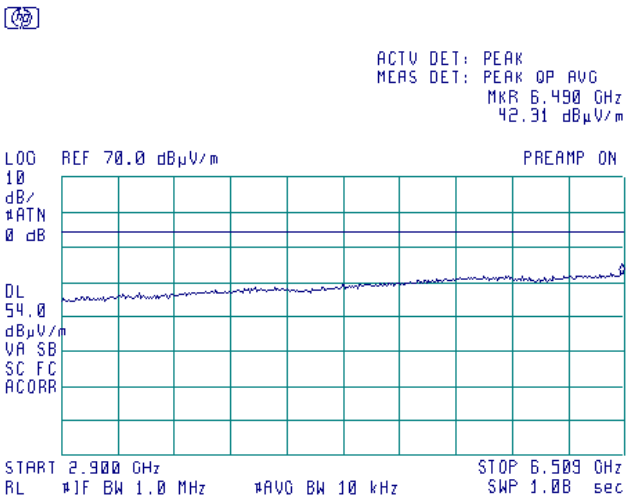




Plot 7.3.15 Radiated emission measurements from 2900 to 6500 MHz at the high carrier frequency ch.26

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

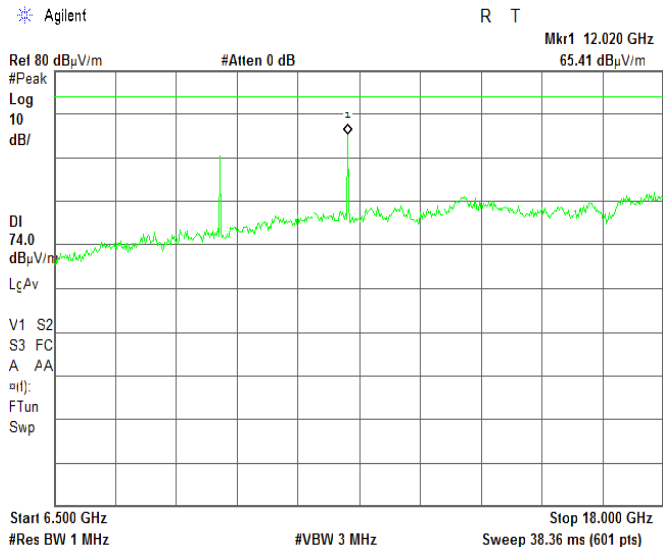


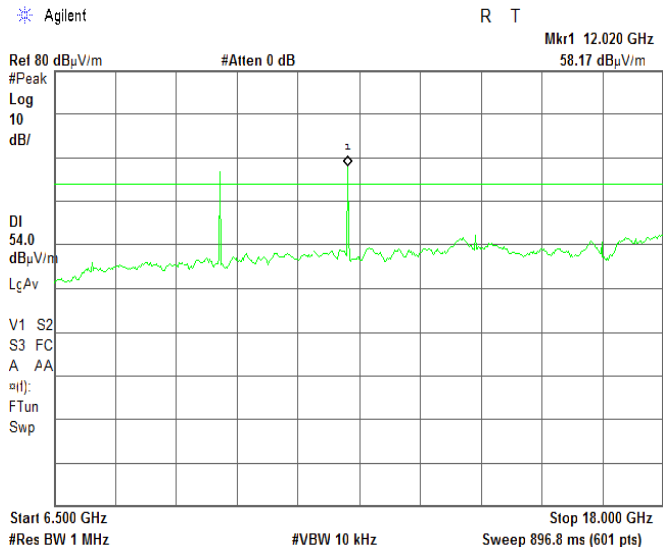


Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.3.16 Radiated emission measurements from 6500 to 18000 MHz at the low carrier frequency ch.11

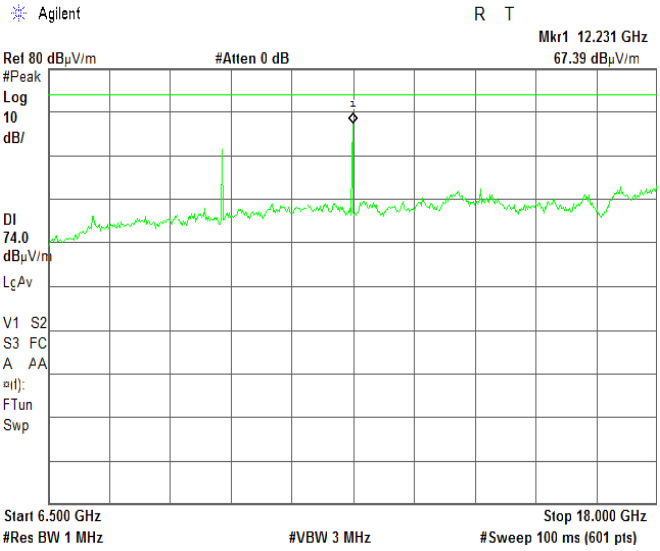
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

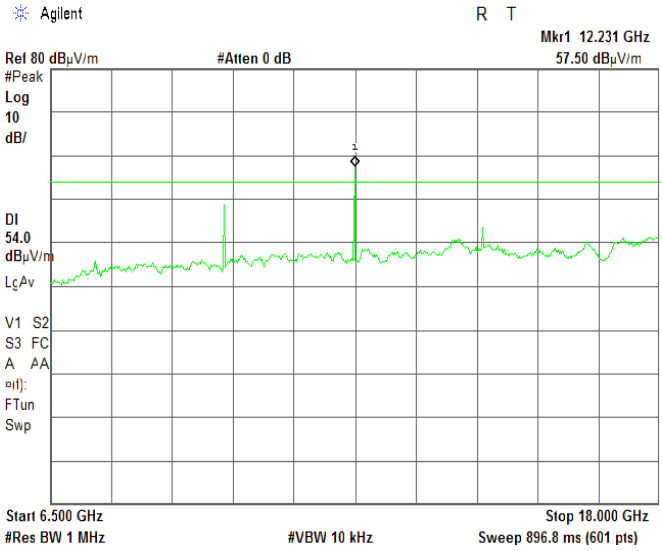




Plot 7.3.17 Radiated emission measurements from 6500 to 18000 MHz at the mid carrier frequency ch.19

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

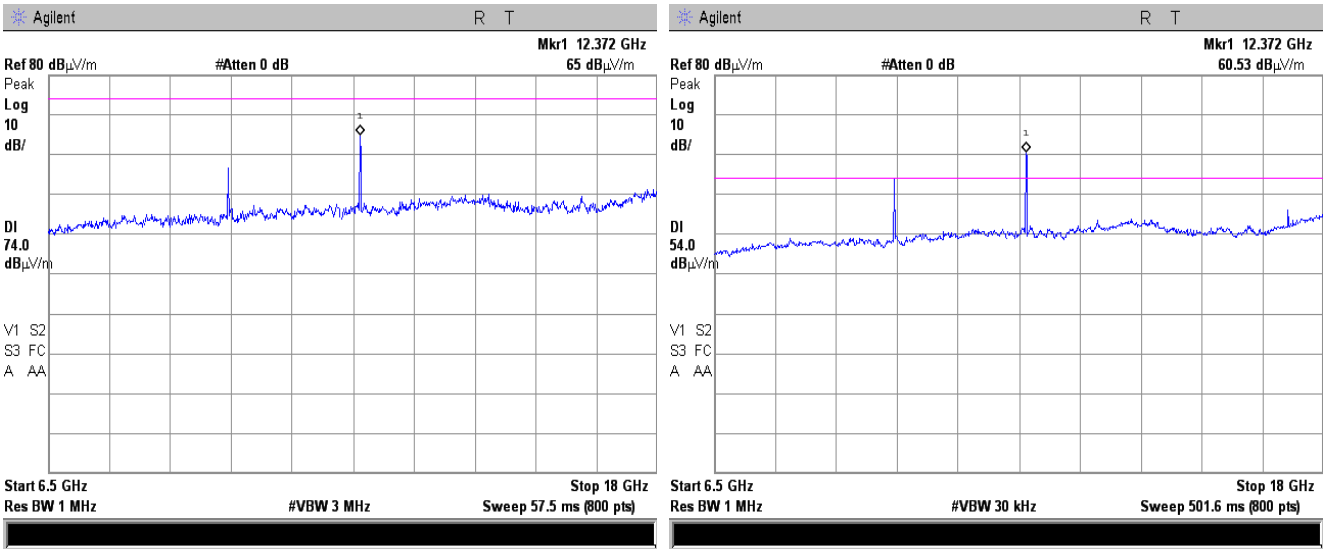




Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

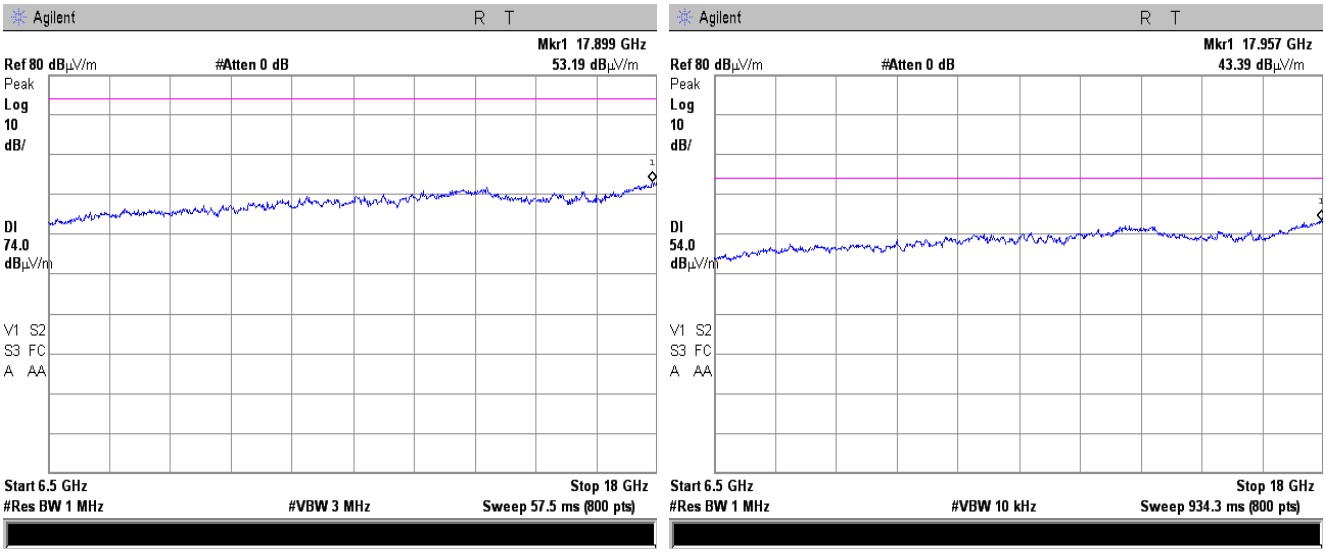
Plot 7.3.18 Radiated emission measurements from 6500 to 18000 MHz at the high carrier frequency ch.25

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



Plot 7.3.19 Radiated emission measurements from 6500 to 18000 MHz at the high carrier frequency ch.26

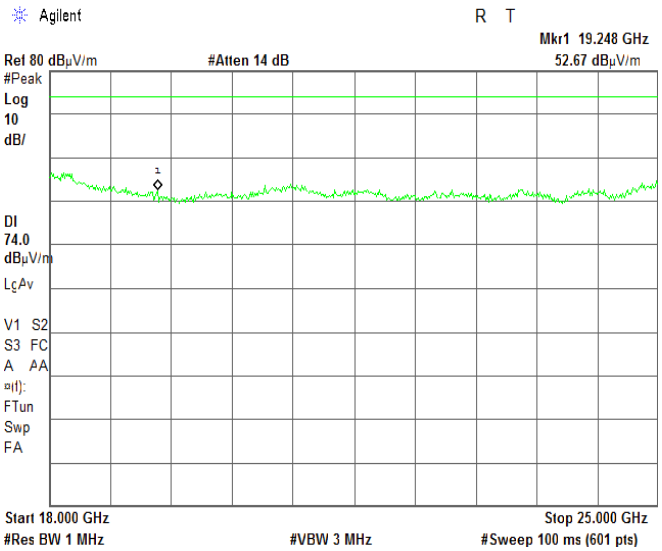
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

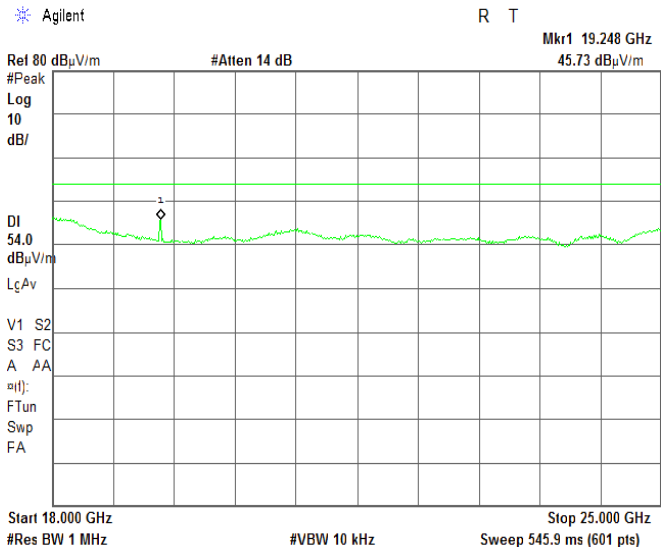


Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.3.20 Radiated emission measurements from 18000 to 25000 MHz at the low carrier frequency ch.11

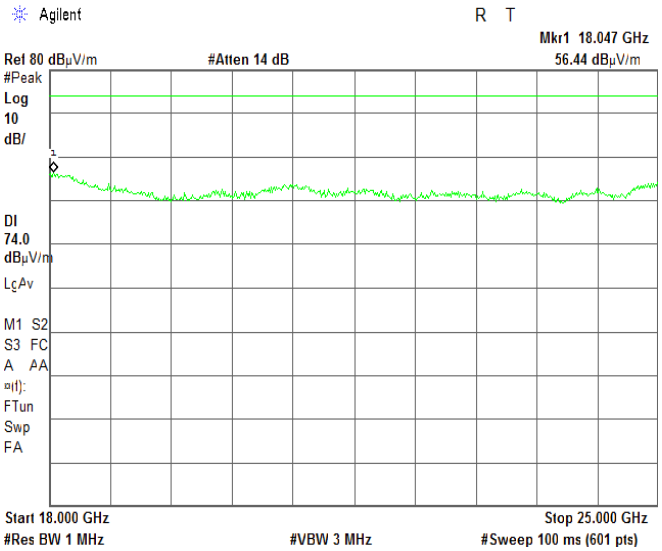
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

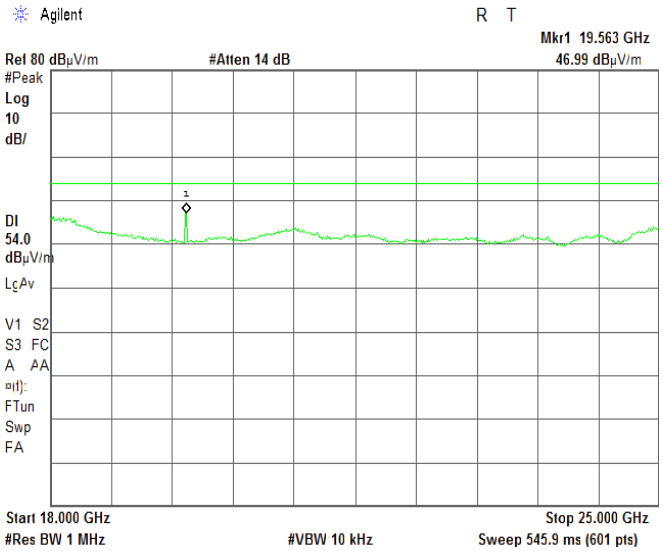




Plot 7.3.21 Radiated emission measurements from 18000 to 25000 MHz at the mid carrier frequency ch.19

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

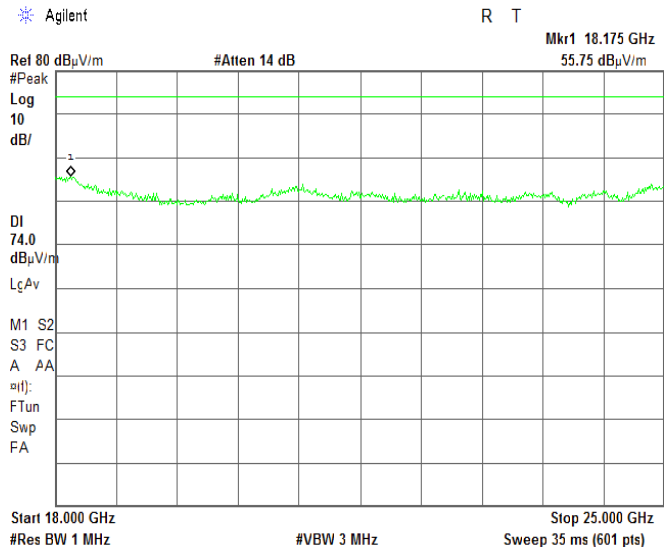


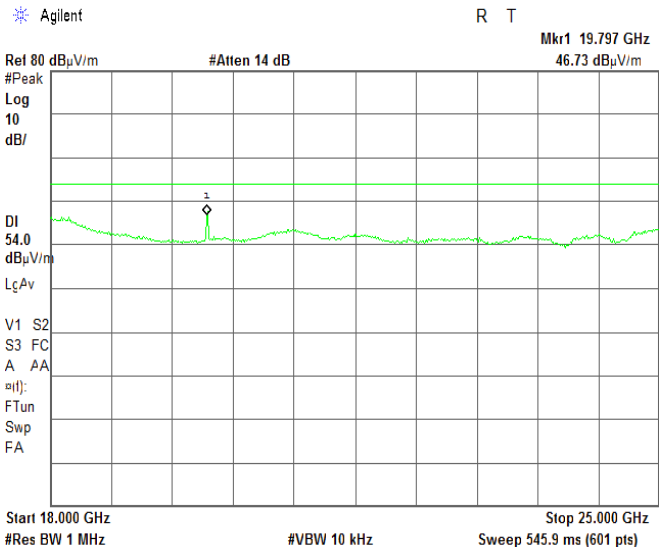


Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.3.22 Radiated emission measurements from 18000 to 25000 MHz at the high carrier frequency ch.25

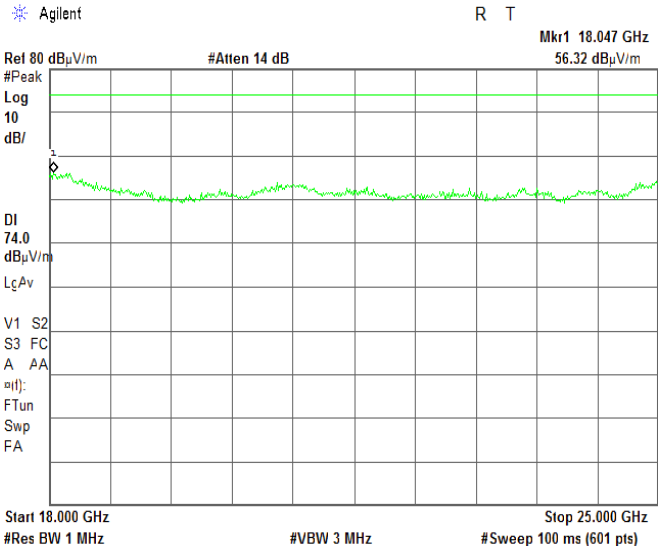
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

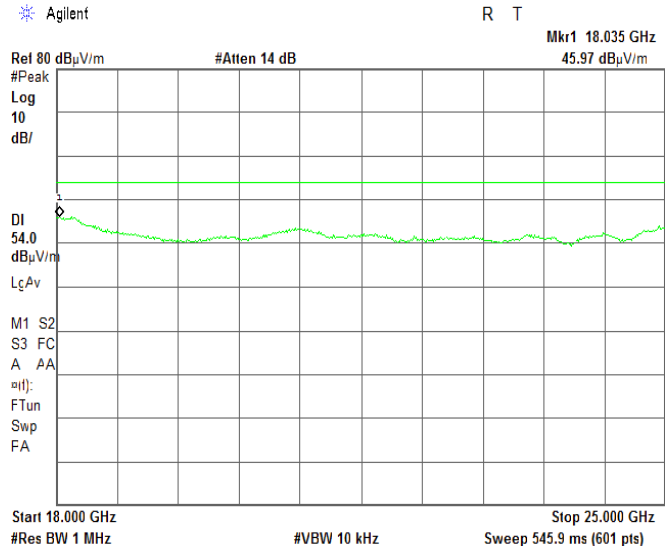




Plot 7.3.23 Radiated emission measurements from 18000 to 25000 MHz at the high carrier frequency ch.26

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

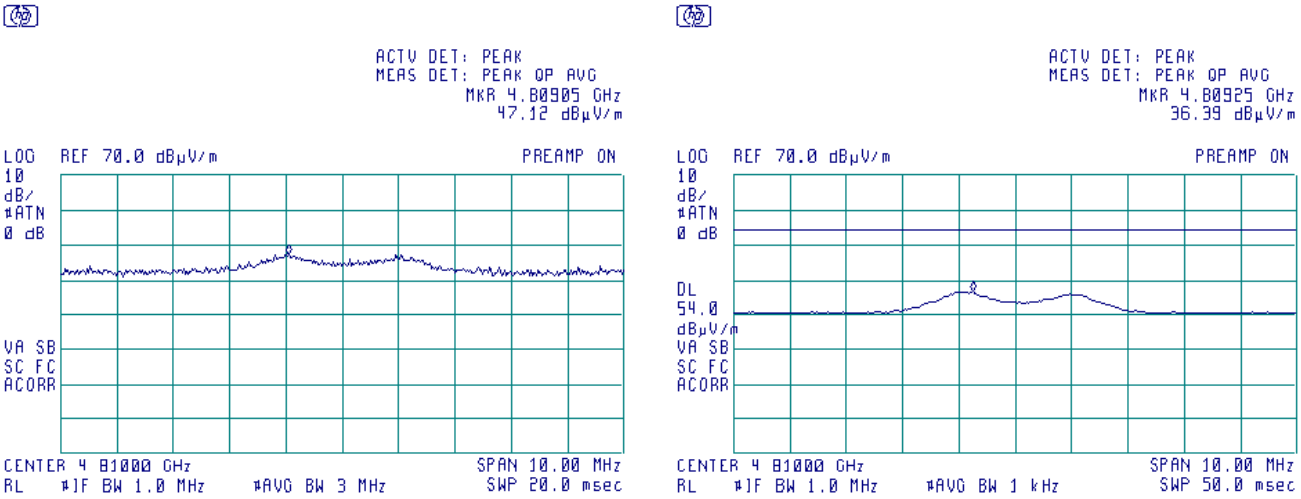




Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

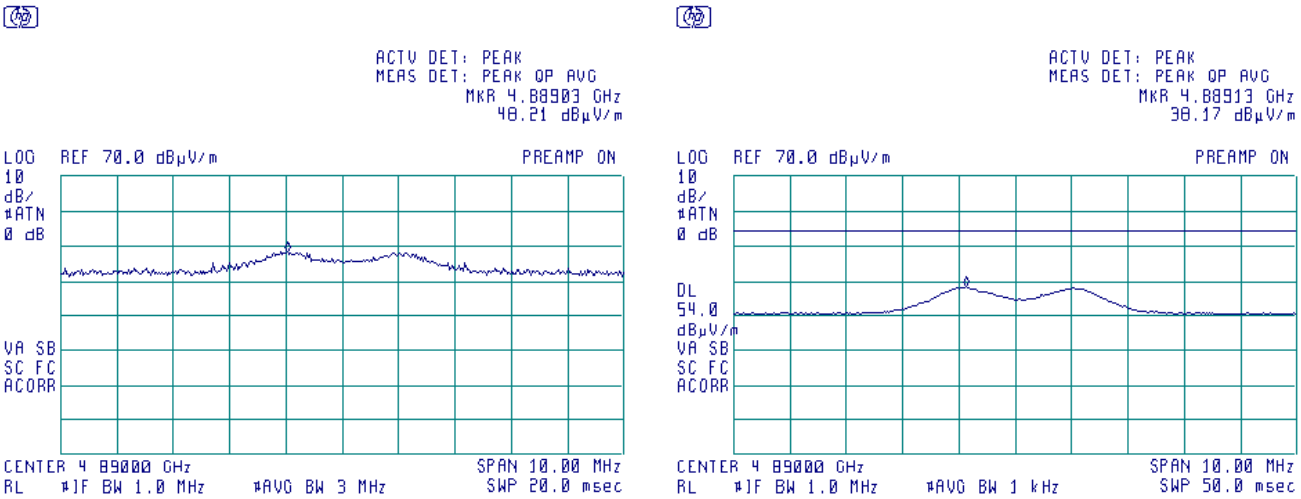
Plot 7.3.24 Radiated emission measurements at the second harmonic of low carrier frequency ch.11

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.3.25 Radiated emission measurements at the second harmonic of mid carrier frequency ch.19

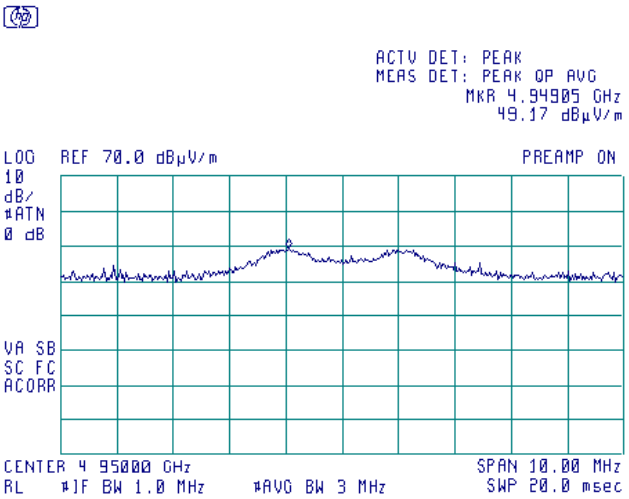
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m

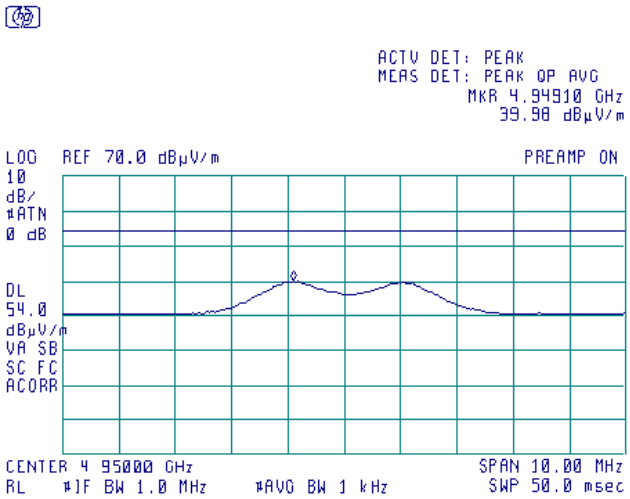


Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.3.26 Radiated emission measurements at the second harmonic of high carrier frequency ch 25

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m

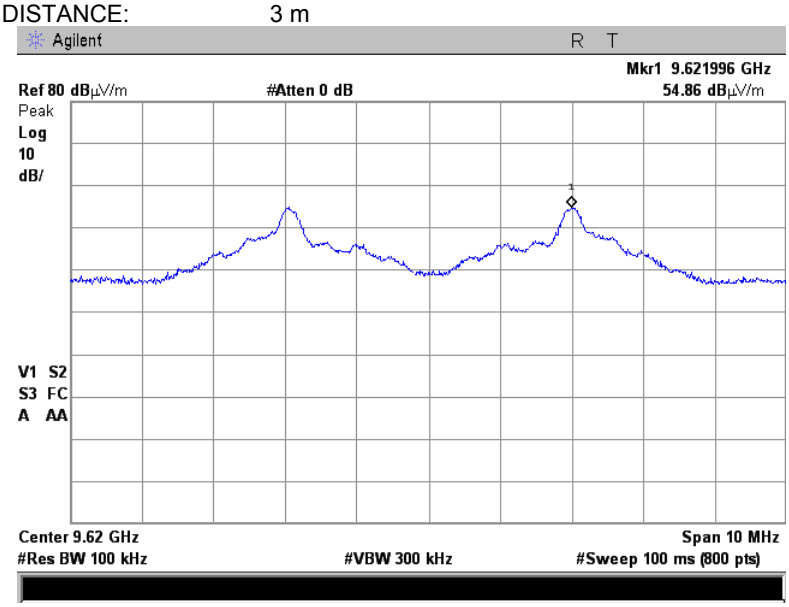




Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

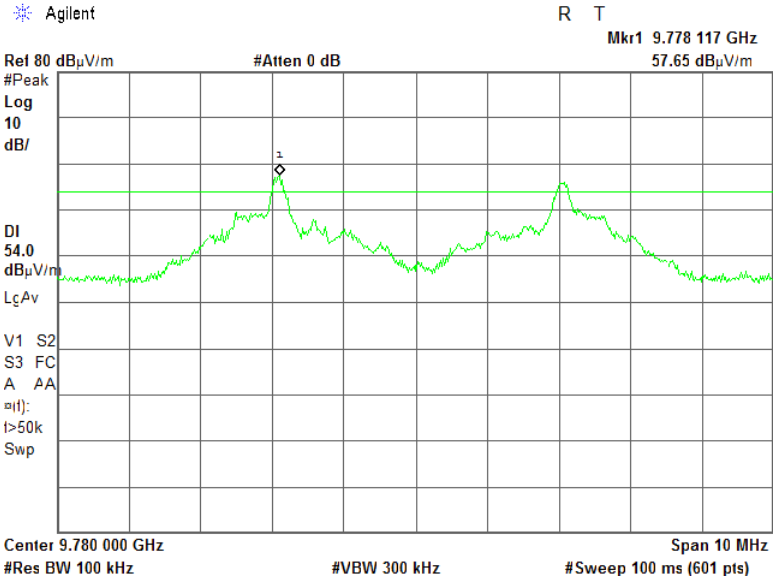
Plot 7.3.27 Radiated emission measurements at the fourth harmonic of low carrier frequency ch.11

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.3.28 Radiated emission measurements at the fourth harmonic of mid carrier frequency ch.19

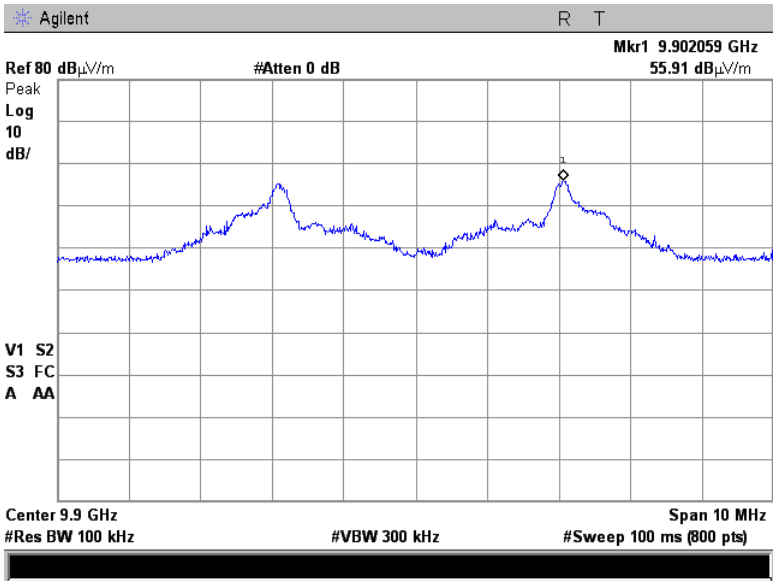
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.3.29 Radiated emission measurements at the fourth harmonic of high carrier frequency ch.25

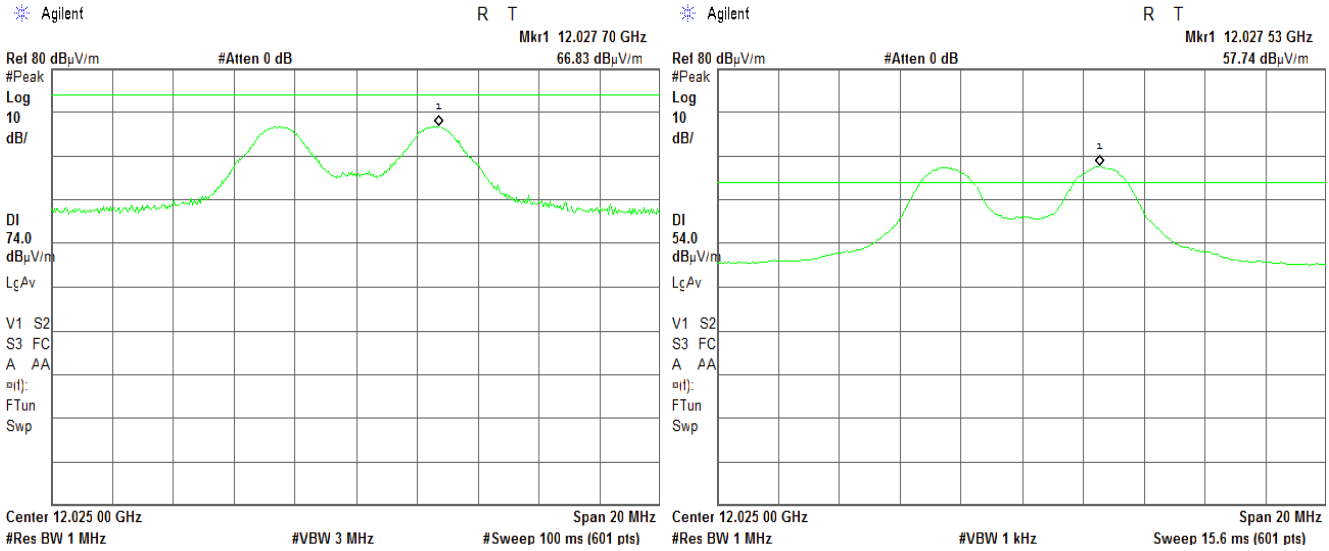
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

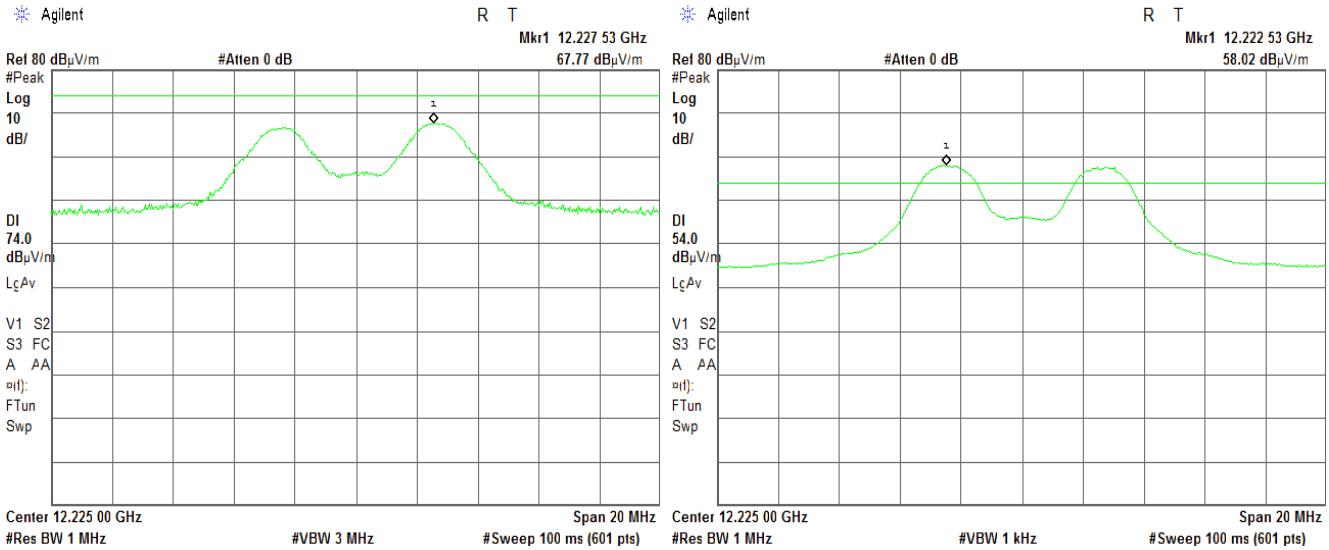
Plot 7.3.30 Radiated emission measurements at the fifth harmonic of low carrier frequency ch.11

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.3.31 Radiated emission measurements at the fifth harmonic of mid carrier frequency ch.19

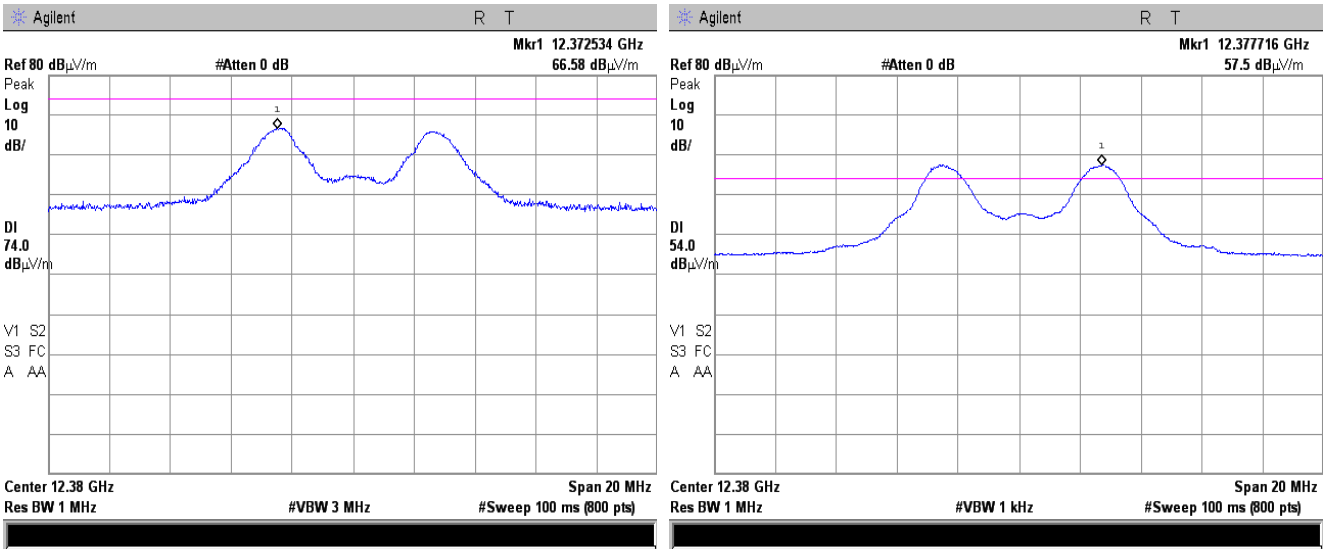
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

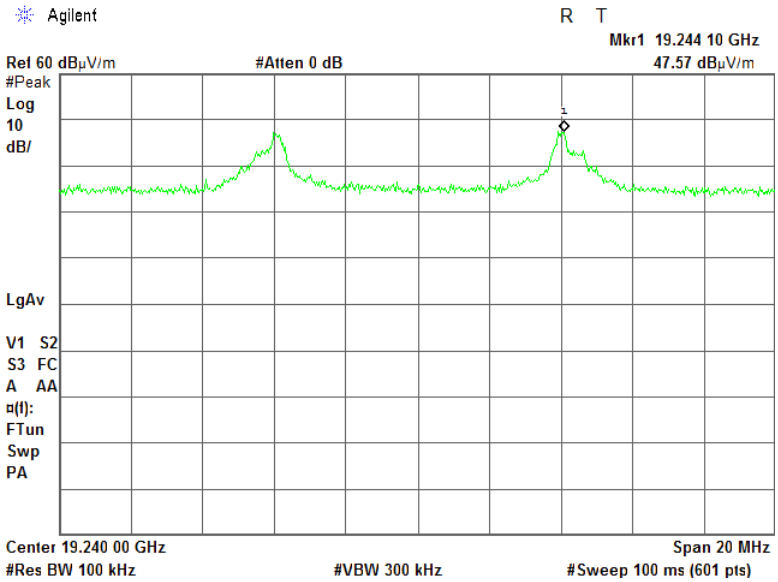
Plot 7.3.32 Radiated emission measurements at the fifth harmonic of high carrier frequency ch.25

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.3.33 Radiated emission measurements at the eighth harmonic of low carrier frequency ch.11

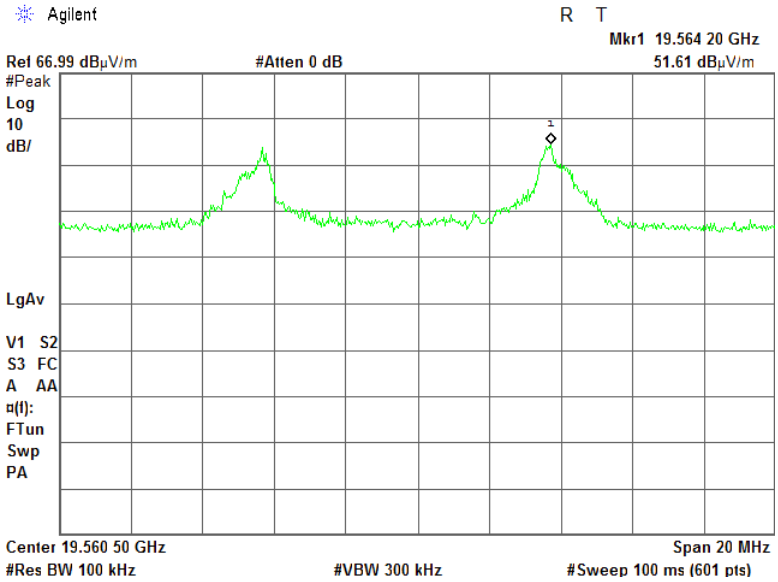
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

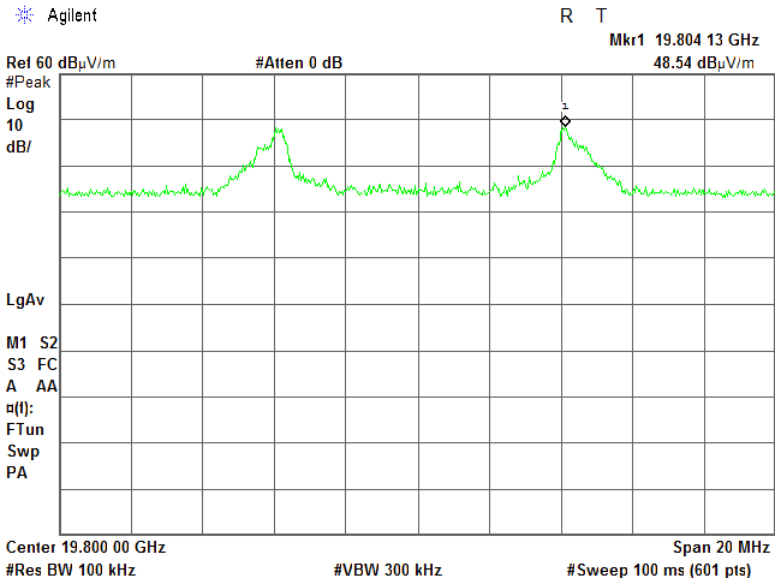
Plot 7.3.34 Radiated emission measurements at the eighth harmonic of mid carrier frequency ch.19

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



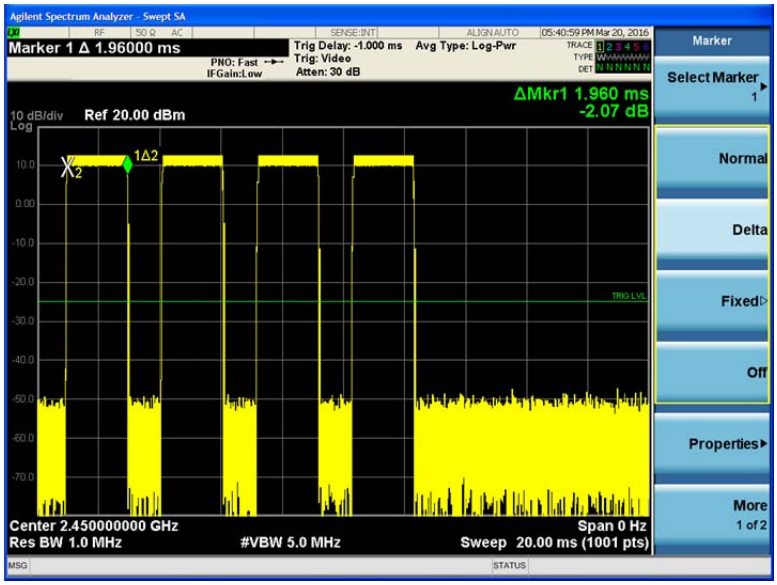
Plot 7.3.35 Radiated emission measurements at the eighth harmonic of high carrier frequency ch.25

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m

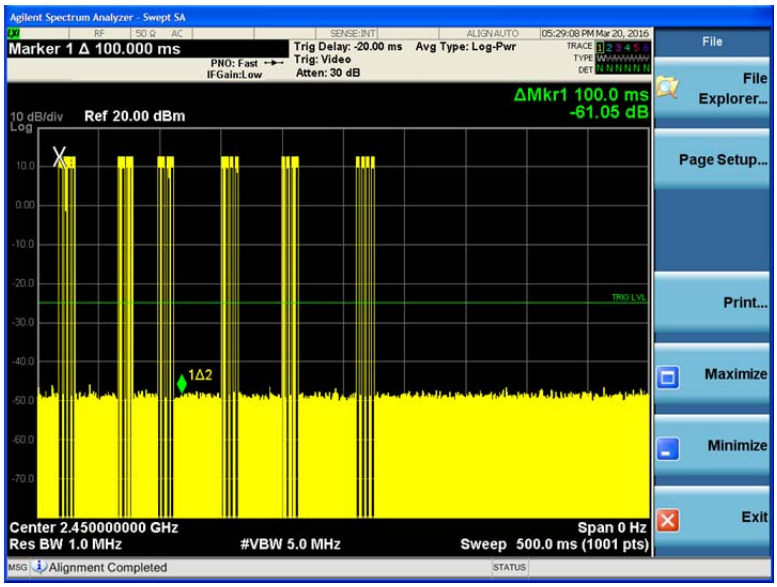


Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16 - 08-Mar-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.3.36 Transmission pulse duration



Plot 7.3.37 Transmission pulse period



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Band edge emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

7.4 Band edge radiated emissions

7.4.1 General

This test was performed to measure emissions, radiated from the EUT at the assigned frequency band edges. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Band edge emission limits

Output power	Assigned frequency, MHz	Attenuation below carrier*, dBc	Field strength at 3 m within restricted bands, dB(μV/m)	
			Peak	Average
Peak	902.0 – 928.0	20.0	74.0	54.0
	2400.0 – 2483.5			
	5725.0 – 5850.0			
Averaged over a time interval	902.0 – 928.0	30.0	74.0	54.0
	2400.0 – 2483.5			
	5725.0 – 5850.0			

* - Band edge emission limit is provided in terms of attenuation below the peak of modulated carrier measured with the same resolution bandwidth.

7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized normally modulated at the maximum data rate and its proper operation was checked.

7.4.2.2 The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.

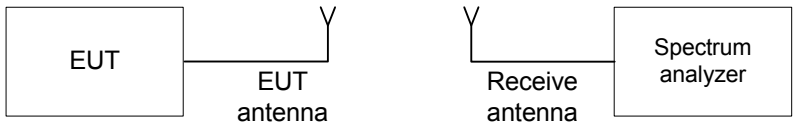
7.4.2.3 The spectrum analyzer span was set to capture the carrier frequency and associated modulation products. The resolution bandwidth was set wider than 1 % of the frequency span.

7.4.2.4 The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.

7.4.2.5 The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.4.2 and associated plots and referenced to the highest emission level measured within the authorized band.

7.4.2.6 The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.

Figure 7.4.1 Band edge emission test setup



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Band edge emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Table 7.4.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 2400-2483.5 MHz
DETECTOR USED: Peak
MODULATION: OQPSK
BIT RATE: 250 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
VIDEO BANDWIDTH: ≥ RBW

Frequency, MHz	Band edge emission, peak, dBµV/m	Limit, dBµV/m	Margin, dB**	Band edge emission, average, dBµV/m	Calculated band edge emission,** dBµV/m	Limit, dBµV/m	Margin, dB**	Verdict
Ch.11 2400.0	69.17	109.82	-40.65	NA	NA	NA	NA	Pass
Ch.25.2483.5	65.03	74.00	-8.97	54.96	42.39	54	-11.61	
Ch.26 2483.5	72.65	74.00	-1.35	64.02	51.45	54	-2.55	

*- Margin = Measured emission – specification limit.
**- Average factor (-12.57 dB) was applied.

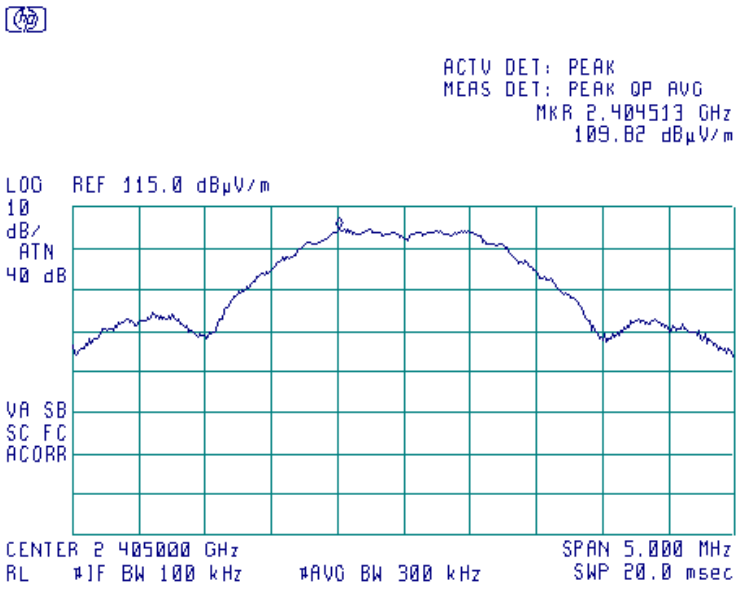
Reference numbers of test equipment used

HL 0521	HL 1984	HL 4278	HL 4353				

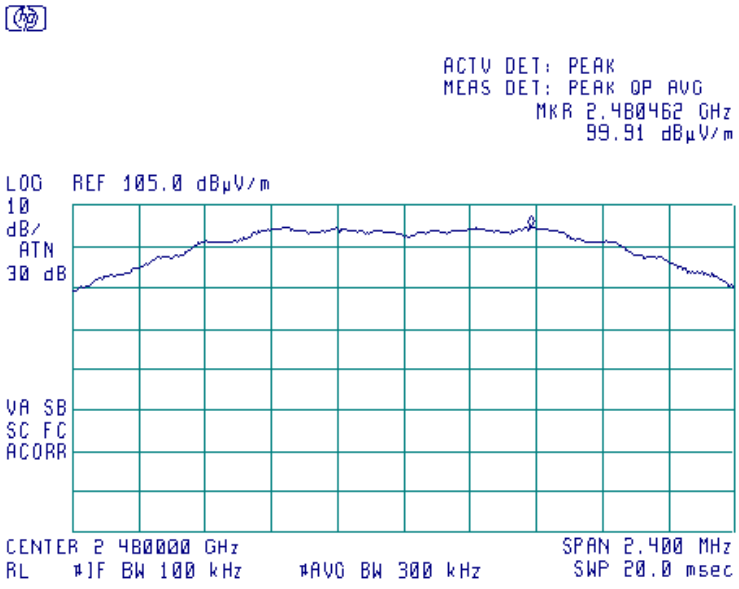
Full description is given in Appendix A.

Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Band edge emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.4.1 The highest emission level within the assigned band at low carrier frequency

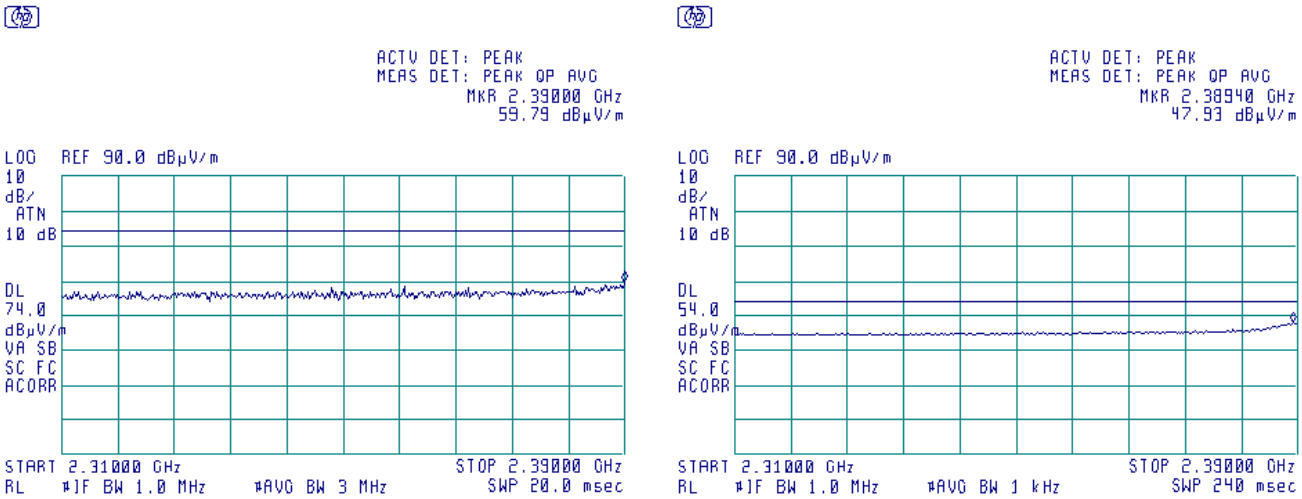


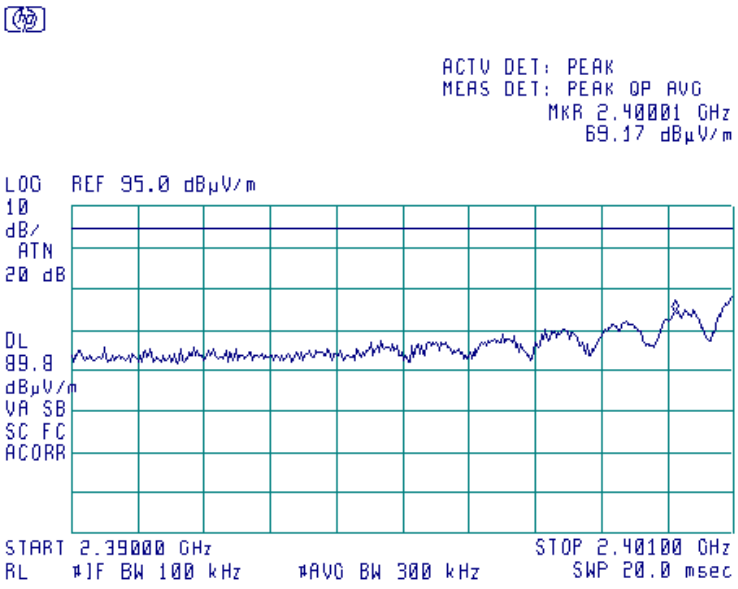
Plot 7.4.2 The highest emission level within the assigned band at high carrier frequency ch.26



Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Band edge emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

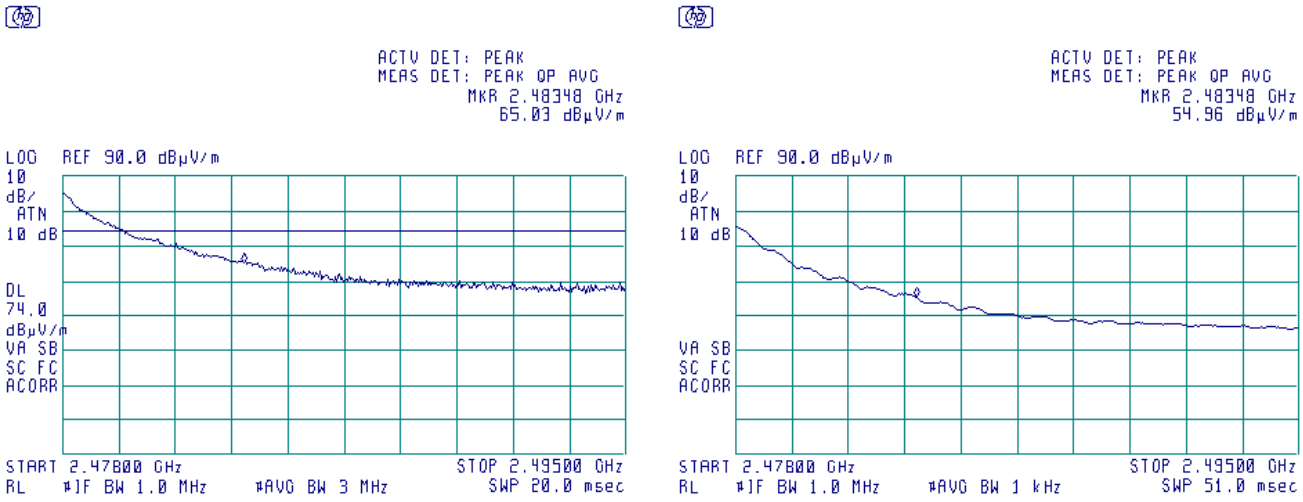
Plot 7.4.3 The highest band edge emission at low carrier frequency ch.11



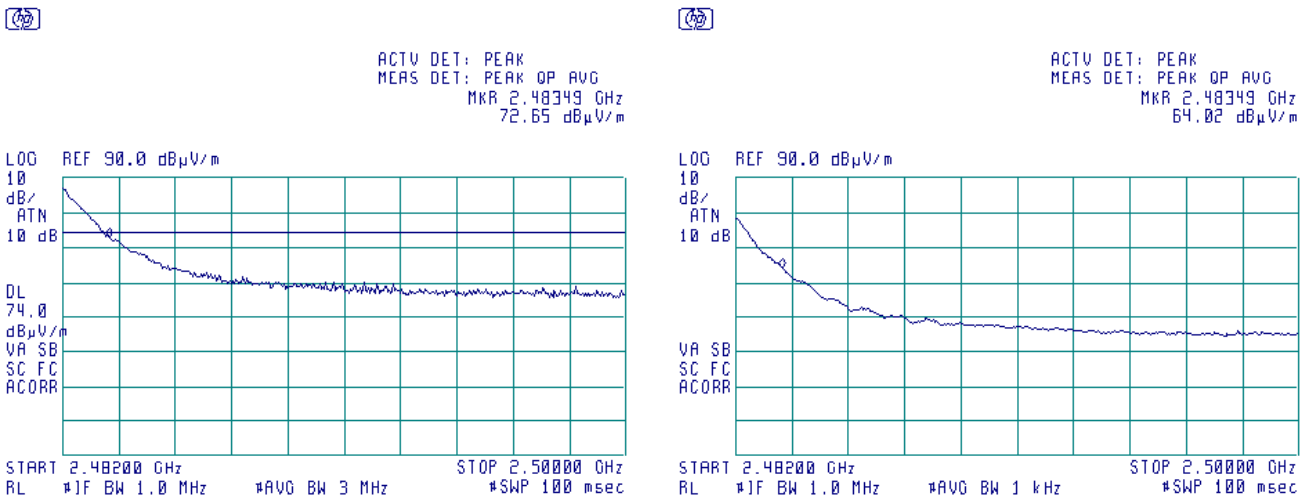


Test specification:	FCC section 15.247(d), RSS-247 section 5.5, Band edge emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.4.4 The highest band edge emission at high carrier frequency ch.25



Plot 7.4.5 The highest band edge emission at high carrier frequency ch.26



Test specification:	FCC section 15.247(e), RSS-247 section 5.2(2), Peak power spectral density		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

7.5 Peak spectral power density

7.5.1 General

This test was performed to measure the peak spectral power density radiated by the transmitter RF antenna. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, kHz	Peak spectral power density, dBm	Equivalent field strength limit @ 3m, dB(μV/m)*
902.0 – 928.0	3.0	8.0	103.2
2400.0 – 2483.5			
5725.0 – 5850.0			

* - Equivalent field strength limit was calculated from the peak spectral power density as follows: E=sqrt(30×P)/r, where P is peak spectral power density and r is antenna to EUT distance in meters.

7.5.2 Test procedure for field strength measurements

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

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

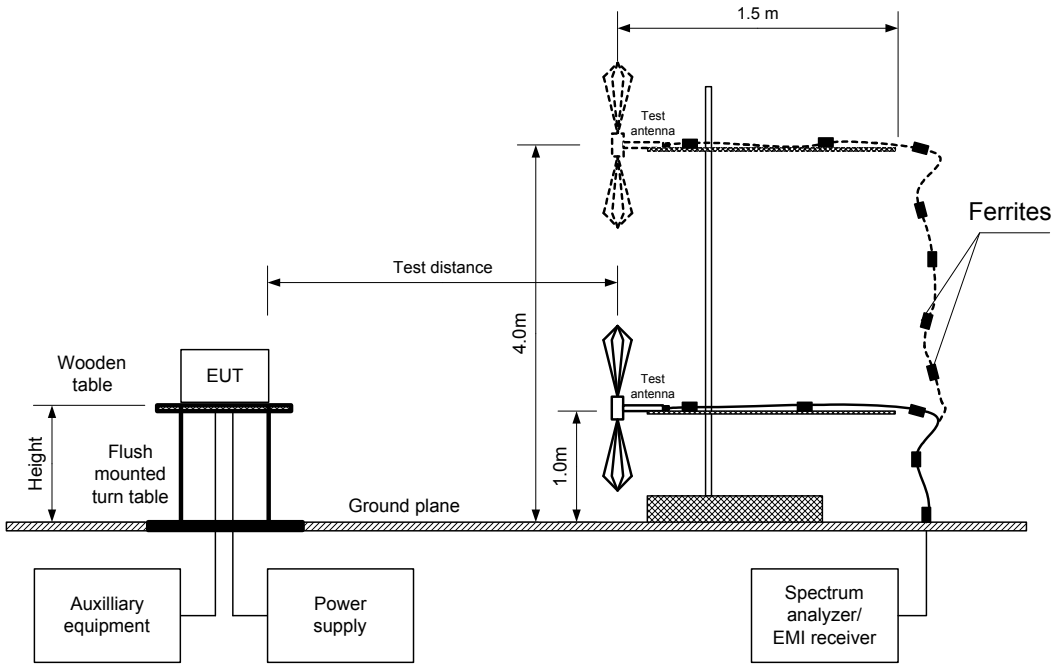
7.5.2.3 The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.5.2.4 The frequency span of spectrum analyzer was set to capture the entire 6 dB band of the transmitter, in peak hold mode with resolution bandwidth set to 3.0 kHz, video bandwidth wider than resolution bandwidth, auto sweep time and sufficient number of sweeps was allowed for trace stabilization. The spectrum lines spacing was verified to be wider than 3 kHz. Otherwise the resolution bandwidth was reduced until individual spectrum lines were resolved and the power of individual spectrum lines was integrated over 3 kHz band.

7.5.2.5 The peak of emission was zoomed with span set just wide enough to capture the emission peak area and sweep time was set equal to span width divided by resolution bandwidth. Spectrum analyzer was set in peak hold mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.5.2 and associated plots.

Test specification:	FCC section 15.247(e), RSS-247 section 5.2(2), Peak power spectral density		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Figure 7.5.1 Setup for carrier field strength measurements



Test specification:	FCC section 15.247(e), RSS-247 section 5.2(2), Peak power spectral density		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Table 7.5.2 Field strength measurement of peak spectral power density

ASSIGNED FREQUENCY: 2400-2483.5 MHz
TEST DISTANCE: 3 m
TEST SITE: OATS
EUT HEIGHT: 1.5 m
DETECTOR USED: Peak
TEST ANTENNA TYPE: Double ridged guide (above 1000 MHz)
MODULATION: OQPSK
BIT RATE: 250 kbps

Frequency, MHz	Field strength, dB(μV/m)	EUT antenna gain, dBi	Limit, dB(μV/m)	Margin, dB*	Antenna polarization	Antenna height, m	RBW kHz	Verdict
2405	98.20	3	103.2	-8.00	Horizontal	1.8	3	Pass
2445	98.55	3	103.2	-7.65	Horizontal	1.3	3	Pass
2475	98.05	3	103.2	-17.05	Horizontal	1.3	3	Pass
2480	89.15	3	103.2	-17.05	Horizontal	1.8	3	Pass

*- Margin = Field strength - EUT antenna gain - calculated field strength limit.
**- EUT front panel refer to 0 degrees position of turntable.

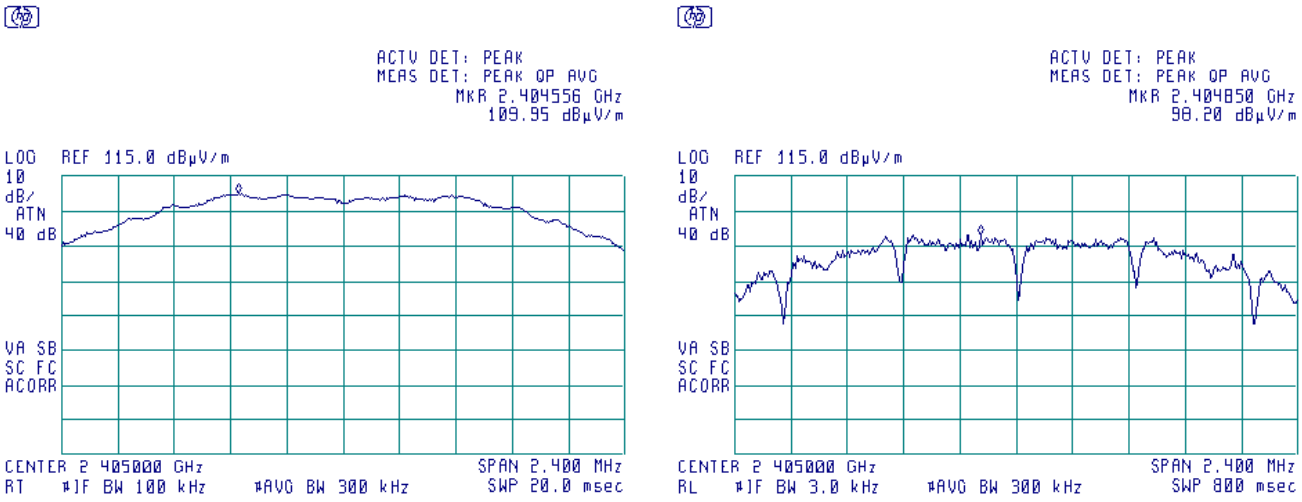
Reference numbers of test equipment used

HL 0521	HL 1984	HL 4278	HL 4353				

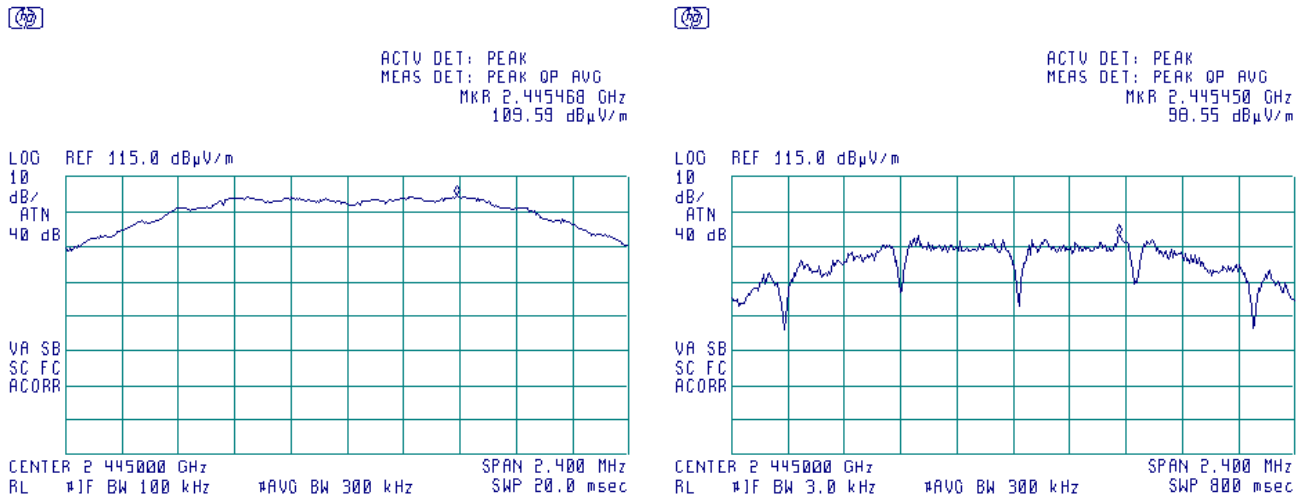
Full description is given in Appendix A.

Test specification:	FCC section 15.247(e), RSS-247 section 5.2(2), Peak power spectral density		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.5.1 Peak spectral power density at low frequency zoomed at the peak, ch.11

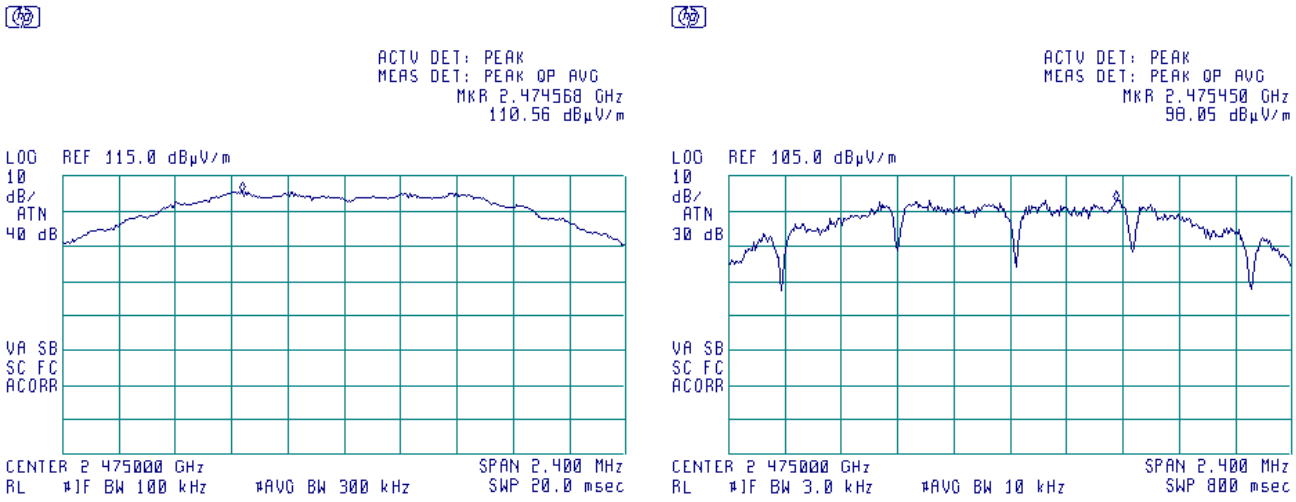


Plot 7.5.2 Peak spectral power density at mid frequency zoomed at the peak, ch.19

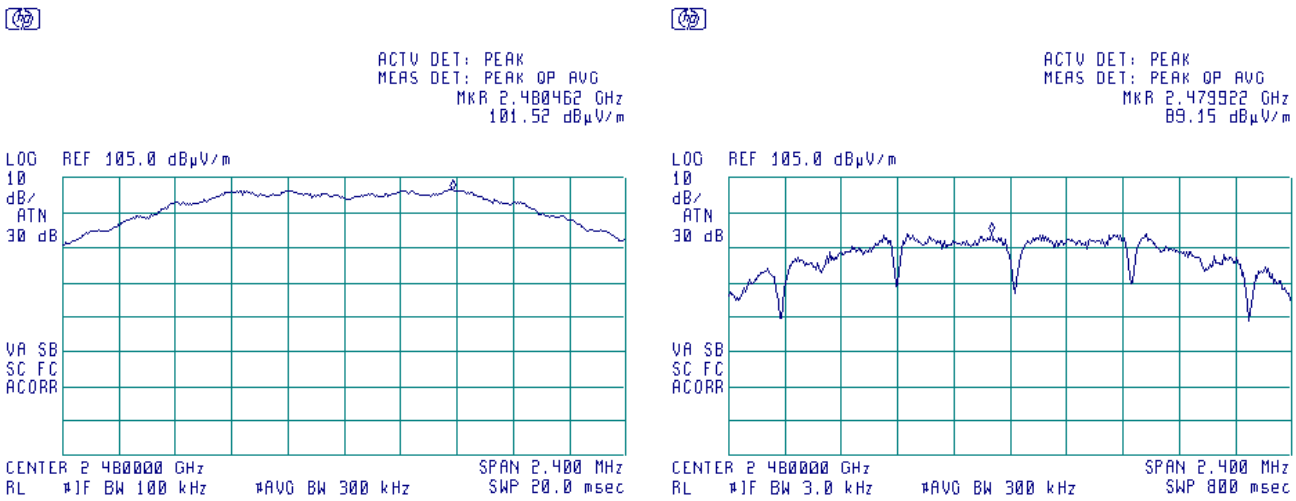


Test specification:	FCC section 15.247(e), RSS-247 section 5.2(2), Peak power spectral density		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Feb-16		
Temperature: 23 ºC	Air Pressure: 1021 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 7.5.3 Peak spectral power density at high frequency zoomed at the peak, ch.25



Plot 7.5.4 Peak spectral power density at high frequency zoomed at the peak, ch.26



Test specification:	FCC section 15.203, RSS-Gen section 8.3, Antenna requirement		
Test procedure:	Visual inspection		
Test mode:	Compliance	Verdict:	PASS
Date(s):	08-Mar-16		
Temperature: 23 ºC	Air Pressure: hPa	Relative Humidity: 55 %	Power Supply: Battery
Remarks:			

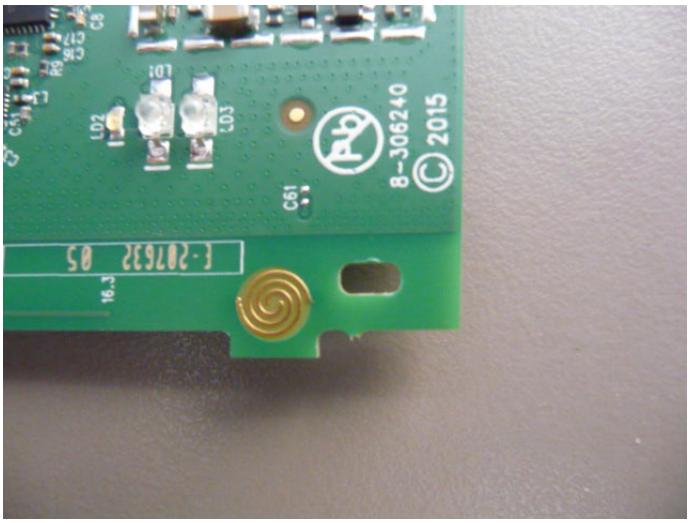
7.6 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.
The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.6.1.

Table 7.6.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	Visual inspection	Comply
The transmitter employs a unique antenna connector	NA	
The transmitter requires professional installation	NA	

Photograph 7.6.1 Antenna assembly



Test specification:	FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-16 - 22-Feb-16		
Temperature: 22 ºC	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

8 Unintentional emissions

8.1 Radiated emission measurements

8.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.1.1, Table 8.1.2.

Table 8.1.1 Radiated emission limits according to FCC Part 15, Section 109

Frequency, MHz	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 88	29.5*	40.0	39.0	49.5*
88 - 216	33.0*	43.5	43.5	54.0*
216 - 960	35.5*	46.0	46.4	56.9*
960 - 5th harmonic**	43.5*	54.0	49.5	60.0*

* - The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

Table 8.1.2 Radiated emission limits according to RSS-Gen, Section 7.1.2

Frequency, MHz	Field strength limit at 3 m test distance, dB(μV/m)
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
960 - 5th harmonic**	54.0

** - harmonic of the highest frequency the EUT generates, uses, operates or tunes to.

8.1.2 Test procedure

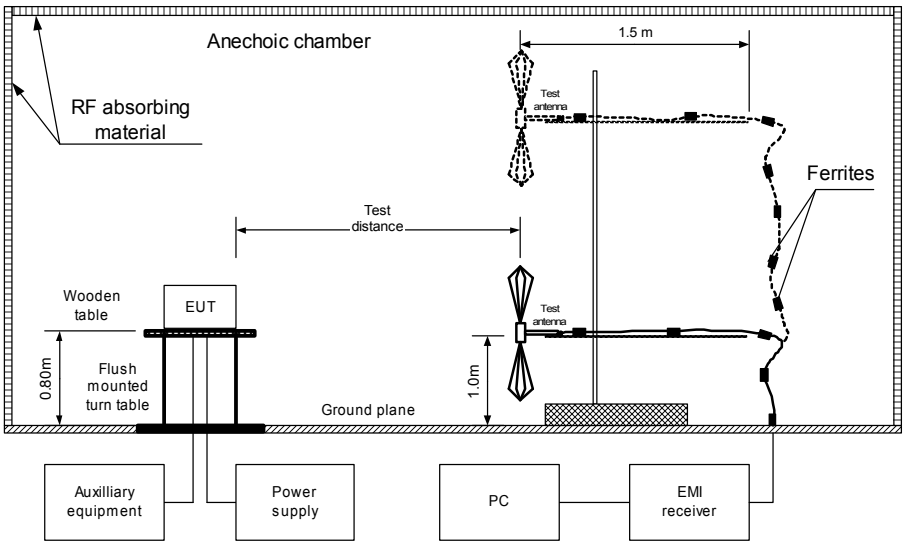
8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photographs, energized and the performance check was conducted.

8.1.2.2 The specified frequency range was investigated with biconilog antenna connected to 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 and the EUT cables position was varied.

8.1.2.3 The worst test results (the lowest margins) were provided in the associated tables and plots.

Test specification:	FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-16 - 22-Feb-16		
Temperature: 22 ºC	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Figure 8.1.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Photograph 8.1.1 Setup for radiated emission measurements

Test specification:	**FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	21-Feb-16 - 22-Feb-16		
Temperature: 22 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 54 %	**Power Supply:** Battery
Remarks:			

Table 8.1.3 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 30 MHz – 1000 MHz
RESOLUTION BANDWIDTH: 120 kHz

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***				
No signals were found								Pass

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 13000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	**Peak**			**Average**			**Antenna polarization**	**Antenna height, m**	**Turn-table position**, degrees**	**Verdict**
	Measured emission, dB(μV/m)	**Limit, dB(μV/m)**	**Margin, dB***	**Measured emission, dB(μV/m)**	**Limit, dB(μV/m)**	**Margin, dB***				
No signals were found										Pass

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

Reference numbers of test equipment used

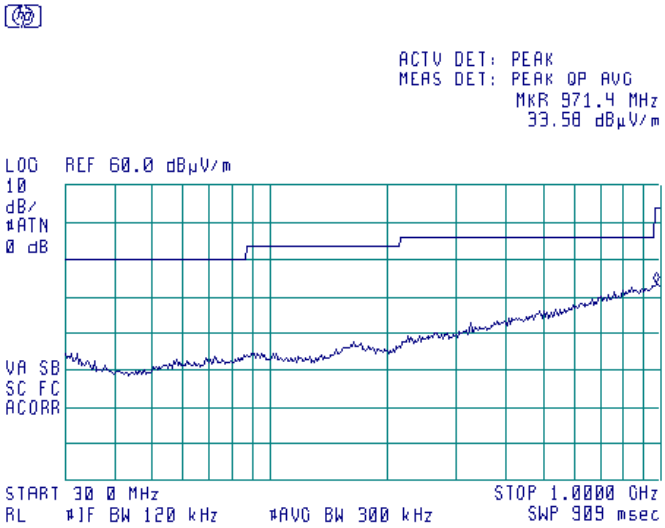
HL 0521	HL 0604	HL 3818	HL 4276	HL 4353	HL 4720	HL 4933	

Full description is given in Appendix A.

Test specification:	FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-16 - 22-Feb-16		
Temperature: 22 ºC	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

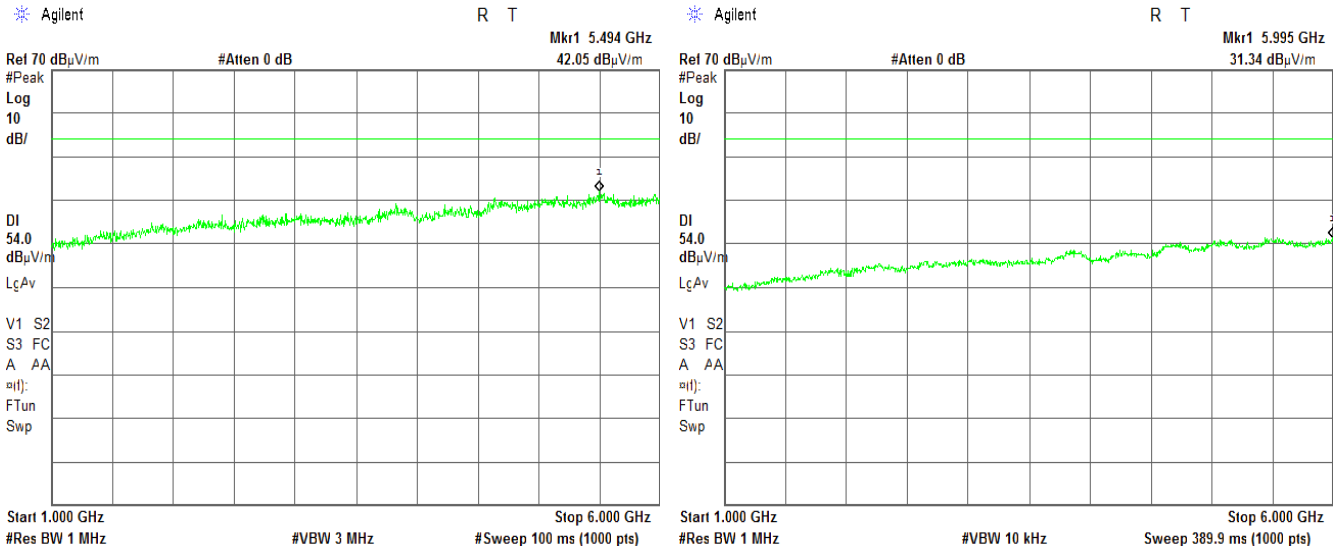
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



Plot 8.1.2 Radiated emission measurements in 1-6 GHz range, vertical & horizontal antenna polarization

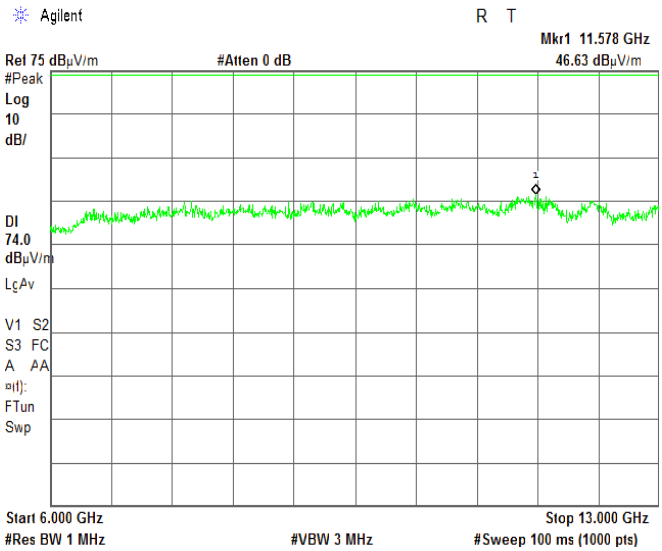
TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive

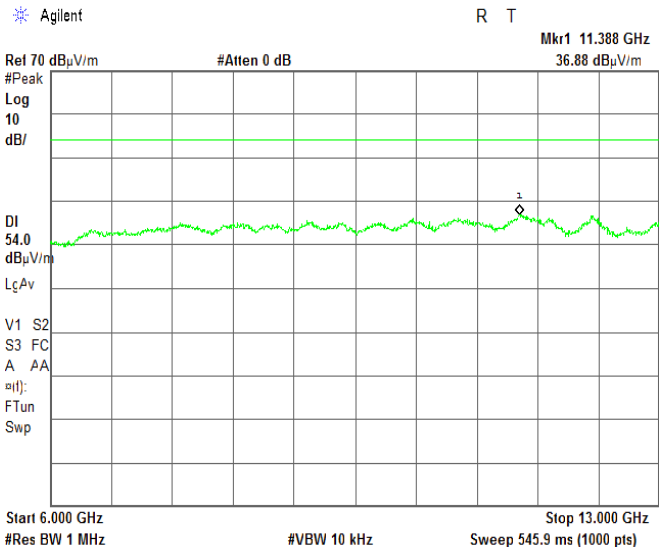


Test specification:	FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	21-Feb-16 - 22-Feb-16		
Temperature: 22 ºC	Air Pressure: 1010 hPa	Relative Humidity: 54 %	Power Supply: Battery
Remarks:			

Plot 8.1.3 Radiated emission measurements in 6-13 GHz range, vertical & horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive





9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	18-Jan-16	18-Jan-17
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Oct-15	27-Oct-16
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	15-May-15	15-May-16
1984	Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz, 300 W	EMC Test Systems	3115	9911-5964	17-Apr-15	17-Apr-16
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY451024 62	08-Sep-15	08-Sep-16
3347	High Pass Filter, 50 Ohm, 6000 to 11500 MHz.	Mini-Circuits	VHF-5500+	NA	01-Oct-15	01-Oct-17
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	29-Apr-15	29-Apr-16
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	15-Feb-16	15-Feb-17
4278	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0755A	22-Nov-15	22-Nov-16
4338	Reject Band Filter, 50 Ohm, 0 to 2170 and 3000 to 18000 MHz, SMA-FM / SMA-M	Micro-Tronics	BRM 50702-02	023	05-May-15	05-May-16
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101 003	15-Mar-15	15-Mar-16
4720	Low Loss Armored Test Cable, DC - 18 GHz, 4.5 m, N type-M/N type-M	MegaPhase	NC29-N1N1-177	51300101 002	30-Dec-15	30-Dec-16
4932	Microwave preamplifier, 500 MHz to 18 GHz, 40 dB Gain	Com-Power Corporation	PAM-118A	551029	19-Nov-15	19-Nov-16
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	04-Sep-15	04-Sep-16
4956	Active horn antenna, 18 to 40 GHz	Com-Power Corporation	AHA-840	105004	09-Nov-15	09-Nov-16

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted carrier power at RF antenna connector	Below 12.4 GHz: ± 1.7 dB 12.4 GHz to 40 GHz: ± 2.3 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Occupied bandwidth	± 8.0 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 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.

11 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 number IC 2186A-1 for OATS), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01). The FCC Designation Number is IL1001.

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Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

FCC 47CFR part 15: 2015	Radio Frequency Devices
ANSI C63.10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications
ANSI C63.4: 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
RSS-247 Issue 1: 2015	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence- Exempt Local Area Network (LE-LAN) Devices
RSS-Gen Issue 4: 2014	General Requirements for Compliance of Radio Apparatus

13 APPENDIX E Test equipment correction factors

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

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

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

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

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

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

Antenna factor, HL 4933

COM-POWER CORPORATION

Active Horn Antenna Factor Calibration

1 GHz to 18 GHz

Equipment:	**ACTIVE HORN ANTENNA**
Model:	**AHA-118**
Serial Number:	**701046**
Calibration Distance:	**3 Meter**
Polarization:	**Horizontal**
Calibration Date:	**11/12/2014**

Frequency (GHz)	*Preamplifier Gain (dB)*	*Antenna Factor with pre-amp (dB/m)*	*Frequency (GHz)*	*Preamplifier Gain (dB)*	*Antenna Factor with pre-amp (dB/m)*
1	40.96	-16.47	10	40.94	-1.97
1.5	41.21	-14.53	10.5	40.63	-1.06
2	41.44	-13.30	11	40.74	-1.50
2.5	41.71	-12.87	11.5	40.65	-0.52
3	41.96	-12.26	12	40.76	-0.15
3.5	42.14	-11.77	12.5	41.03	-0.85
4	42.13	-10.91	13	41.37	-0.81
4.5	41.79	-9.41	13.5	41.18	0.05
5	41.44	-7.54	14	40.98	0.36
5.5	40.91	-6.47	14.5	40.81	1.26
6	40.69	-5.48	15	40.65	0.25
6.5	40.64	-5.53	15.5	40.93	-1.05
7	40.76	-4.12	16	41.31	-1.44
7.5	40.94	-3.12	16.5	40.96	-0.80
8	40.68	-1.69	17	40.64	-0.02
8.5	40.08	-1.71	17.5	40.57	1.81
9	40.41	-1.86	18	40.08	3.63
9.5	41.21	-2.73			

Calibration according to ARP 958

Antenna Factor to be added to receiver reading:

Meter Reading (dBuV) + Antenna Factor (dB/m) = Corrected Reading (dBuV/m)

Antenna factor, HL 4956

COM-POWER CORPORATION

Active Horn Antenna Factor Calibration

18 GHz to 40 GHz

Equipment:	**ACTIVE HORN ANTENNA**
Model:	**AHA-840**
Serial Number:	**105004**
Calibration Distance:	**3 meter**
Polarization:	**Horizontal**
Calibration Date:	**1/26/2015**

Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)	Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)
18	38.83	-1.06	29.5	42.47	-5.33
18.5	39.34	-2.65	30	41.91	-4.86
19	39.71	-3.88	30.5	41.60	-4.64
19.5	39.87	-4.35	31	41.52	-4.60
20	39.98	-3.97	31.5	41.56	-4.79
20.5	40.42	-3.68	32	41.80	-5.21
21	41.12	-4.06	32.5	42.29	-5.54
21.5	41.74	-5.46	33	42.79	-5.63
22	42.14	-6.22	33.5	42.88	-5.38
22.5	42.35	-6.42	34	42.62	-4.76
23	42.50	-6.59	34.5	42.63	-4.84
23.5	42.65	-6.82	35	43.15	-5.13
24	42.81	-7.01	35.5	43.91	-5.83
24.5	42.86	-7.37	36	44.59	-6.39
25	42.73	-7.53	36.5	45.04	-6.64
25.5	42.77	-7.45	37	45.08	-6.40
26	42.85	-7.21	37.5	44.82	-5.75
26.5	42.98	-7.17	38	44.16	-4.58
27	43.14	-7.22	38.5	42.90	-2.66
27.5	43.18	-7.32	39	42.39	-1.71
28	43.04	-7.10	39.5	43.76	-2.49
28.5	43.01	-6.73	40	45.98	-5.21

Calibration per ANSI C63.5: 2006

Standard Site Method, Equations 1-6 (3-antenna)

Corrected Reading (dBµV/m) = Meter Reading (dBµV) + AFE(dB/m)

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

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

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

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

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

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

Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 4.5 m, N type-M/N type-M, NC29-N1N1-177, S/N 51300101 002
HL 4720

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.14	9000	2.10
100	0.21	9500	2.26
300	0.36	10000	2.39
500	0.46	10500	2.36
1000	0.66	11000	2.36
1500	0.81	11500	2.44
2000	0.93	12000	2.51
2500	1.05	12500	2.71
3000	1.15	13000	2.71
3500	1.25	13500	2.69
4000	1.34	14000	2.78
4500	1.42	14500	2.84
5000	1.52	15000	2.85
5500	1.60	15500	2.98
6000	1.66	16000	3.02
6500	1.78	16500	3.09
7000	1.82	17000	3.11
7500	1.86	17500	3.16
8000	1.95	18000	3.32
8500	2.01		

14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
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
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
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
WB	wideband

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