

# 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 6:2016**

FOR:

**Visonic Ltd.**

**Acoustic Glass Break detector  
with ZigBee protocol**

**Model: GB-540**

**FCC ID:WP3GB540**

**IC:1467C-GB540**

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

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## 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:** Acoustic Glass Break detector with ZigBee protocol  
**Product type:** Transceiver  
**Model:** GB-540  
**Serial number:** 0616394612  
**Hardware version:** 90-207523  
**Software release:** JS-702934  
**Receipt date:** 02-May-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:** 28348  
**Location:** Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel  
**Test started:** 02-May-16  
**Test completed:** 05-May-16  
**Test specifications:** FCC 47CFR part 15 subpart C § 15.247 (DTS);  
RSS-247 issue 1, RSS-Gen issue 4, ICES-003: 2016 Issue 6

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
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
<b>Unintentional emissions</b>	
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.

This test report supersedes the previously issued test report identified by Doc ID:VISRAD\_FCC.28348.

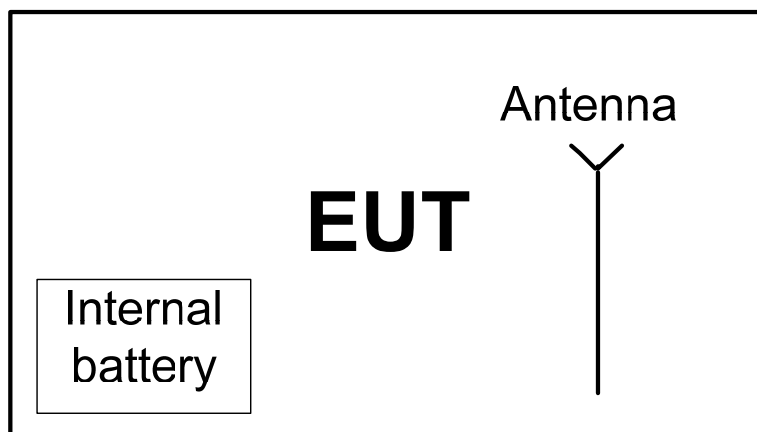
	Name and Title	Date	Signature
<b>Tested by:</b>	Mrs. E. Pitt, test engineer	May 5, 2016	
<b>Reviewed by:</b>	Ms. N. Averin, certification engineer	May 9, 2016	
<b>Approved by:</b>	Mr. M. Nikishin, EMC and Radio group manager	May 26, 2016	

## 6 EUT description

### 6.1 General information

The EUT, GB-540, is a ZigBee acoustic glass-break detector that can be used with any ZigBee Home Automation 1.2 enabled home security panel. You can mount the detector on walls or ceilings to detect the breaking of framed glass on any exterior wall. The detector senses the sound of breaking plate, tempered, laminated, wired, coated, and sealed insulated glass. The detector is pre-calibrated, requires no adjustment during the installation and supports the measurement of ambient room temperature. The EUT is powered by 3V internal battery.

### 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			20.07 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	
				X	with temporary RF connector	
				X	without temporary RF connector	
Antenna/s technical characteristics						
Type		Manufacturer		Model number		
Integral antenna		Visonic		Printed		
				Gain		
				0 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	



<b>Test specification:</b>	<b>Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.8.2		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	02-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

## 7 Transmitter tests according to 47CFR part 15 subpart C and RSS-210 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.

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 automatically with spectrum analyzer and provided in Table 7.1.2 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 DTS bandwidth test setup





<b>Test specification:</b>	<b>Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.8.2		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	02-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

Table 7.1.2 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: 100kHz  
 VIDEO BANDWIDTH: 3 RBW  
 MODULATION ENVELOPE REFERENCE POINTS: 6.0 dBc  
 MODULATION: OQPSK  
 BIT RATE: 250 kbps

Carrier frequency, MHz	6 dB bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
2405	1593	500	1093.0	Pass
2445	1600	500	1100.0	Pass
2475	1602	500	1102.0	Pass
2480	1606	500	1106.0	Pass

Table 7.1.3 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	2436.0	500	1936.0	Pass
2445	2443.1	500	1943.1	Pass
2475	2424.1	500	1924.1	Pass
2480	2451.7	500	1951.7	Pass

## Reference numbers of test equipment used

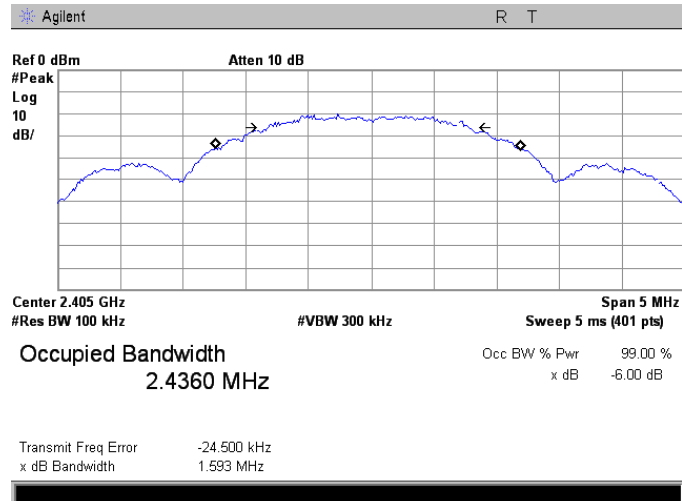
HL 2909								
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Full description is given in Appendix A.

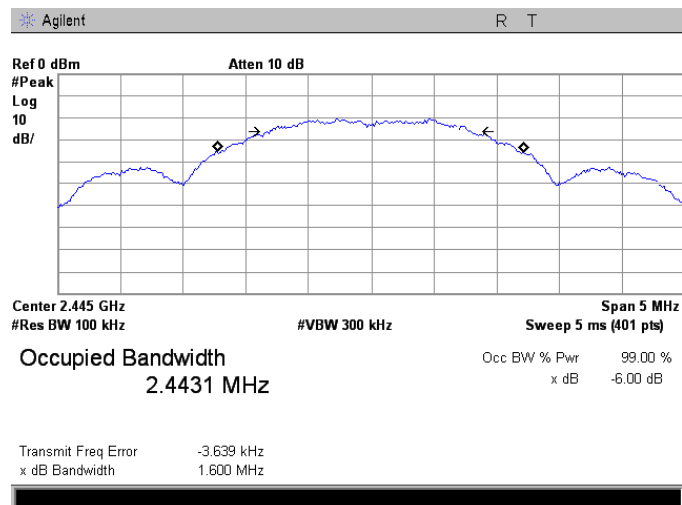


Test specification:	Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth		
Test procedure:	ANSI C63.10 section 11.8.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.1.1 The 6 dB / 99% bandwidth test result at low frequency ch.11



Plot 7.1.2 The 6 dB / 99% bandwidth test result at mid frequency ch.19

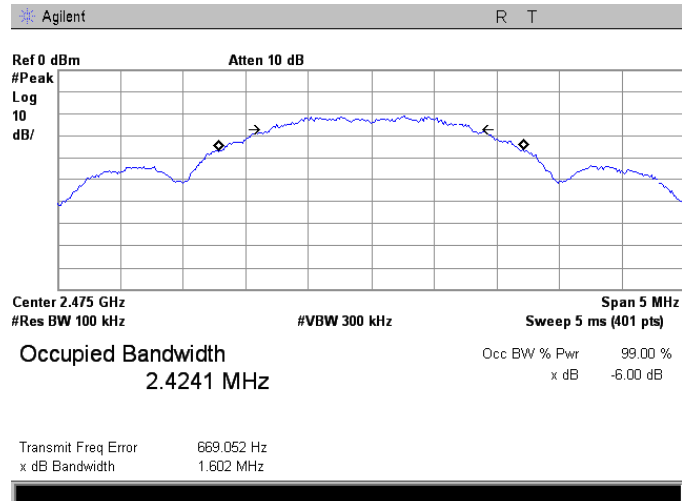




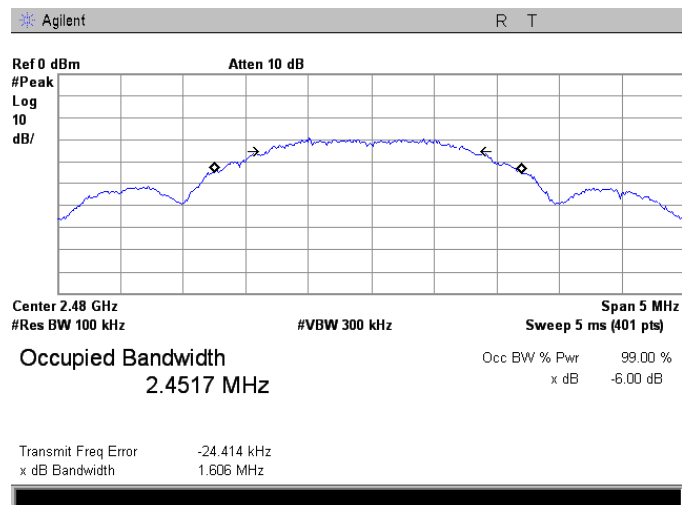


Test specification:	Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth		
Test procedure:	ANSI C63.10 section 11.8.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.1.3 The 6 dB / 99% bandwidth test result at high frequency 1 ch.25



Plot 7.1.4 The 6 dB / 99% bandwidth test result at high frequency 2 ch.26





<b>Test specification:</b>	<b>Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.9		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	02-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

## 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:  $E = \sqrt{30 \times P \times G} / r$ , 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° 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:

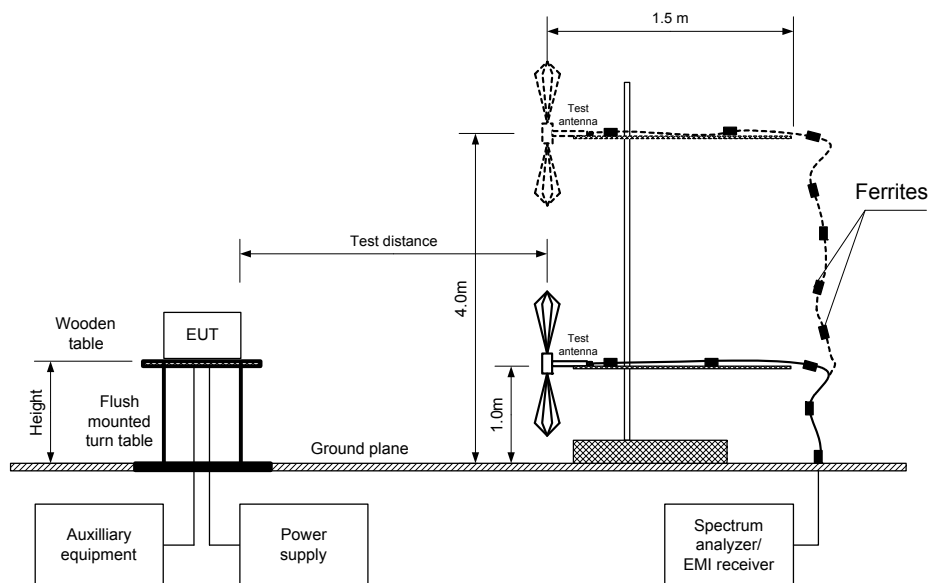
$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V/m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

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



Test specification:	Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 3V battery
Remarks:			

Figure 7.2.1 Setup for carrier field strength measurements





<b>Test specification:</b>	<b>Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.9		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	02-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

**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: Double ridged guide  
 MODULATION: OQPSK  
 BIT RATE: 250 kbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 EUT 6 dB BANDWIDTH: 1.6 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	115.27	Horizontal	1.6	30	0	20.07	30.0	-9.93	Pass
2445	114.10	Horizontal	1.9	80	0	18.90	30.0	-11.10	Pass
2475	115.04	Horizontal	1.8	30	0	19.84	30.0	-10.16	Pass
2480	107.22	Horizontal	1.1	40	0	12.02	30.0	-17.98	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				
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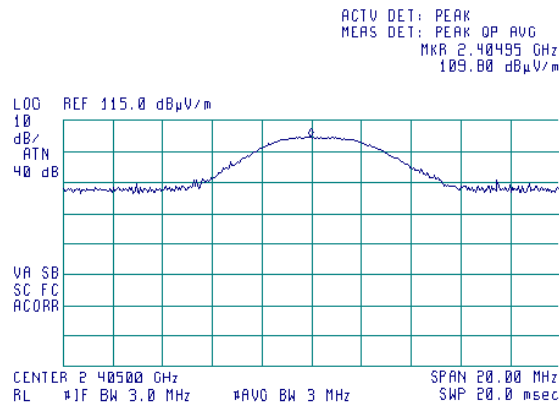
Full description is given in Appendix A.



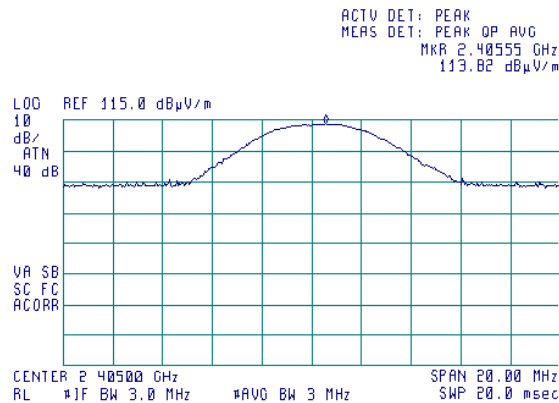
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Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 3V battery
Remarks:			

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

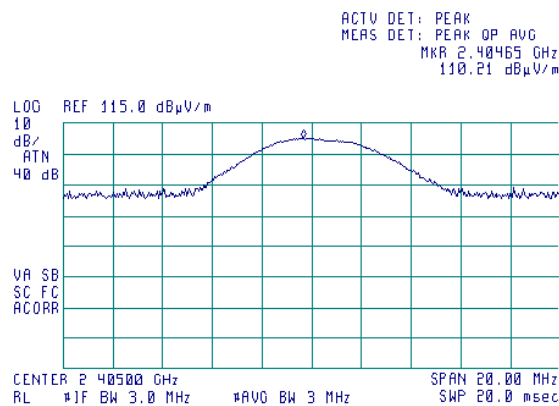
ANTENNA POLARIZATION: Vertical



EUT Position X



EUT Position Y



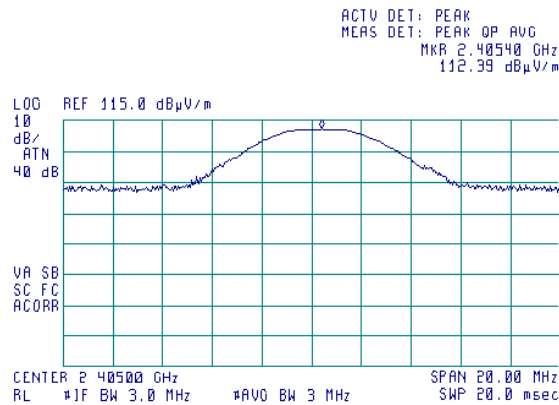
EUT Position Z



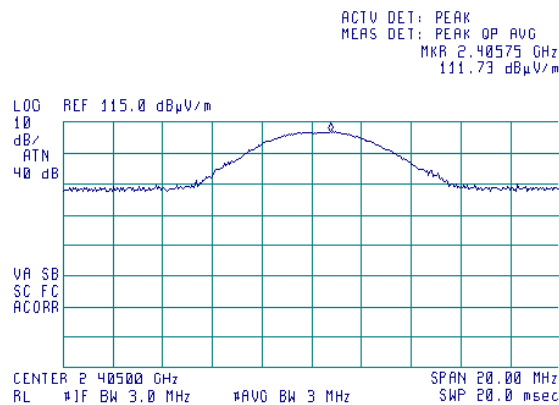
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Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 3V battery
Remarks:			

## Plot 7.2.2 Field strength of carrier at low frequency ch.11

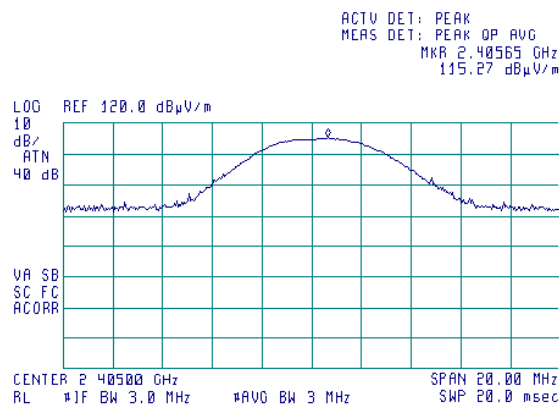
ANTENNA POLARIZATION: Horizontal



EUT Position X



EUT Position Y



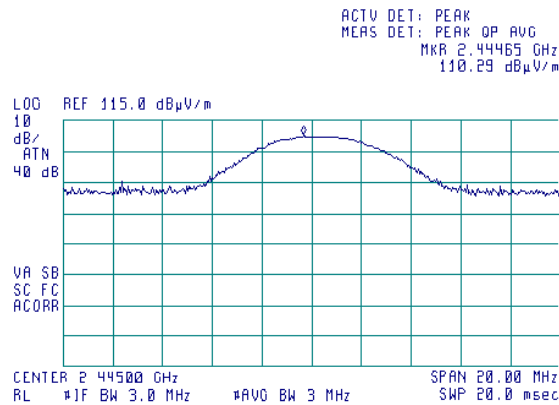
EUT Position Z



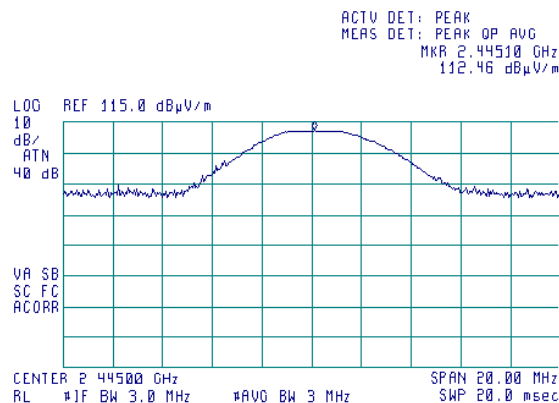
Test specification:	Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 3V battery
Remarks:			

## Plot 7.2.3 Field strength of carrier at mid frequency ch.19

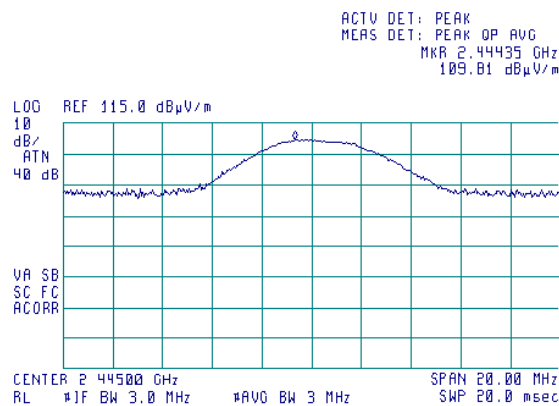
ANTENNA POLARIZATION: Vertical



EUT Position X



EUT Position Y



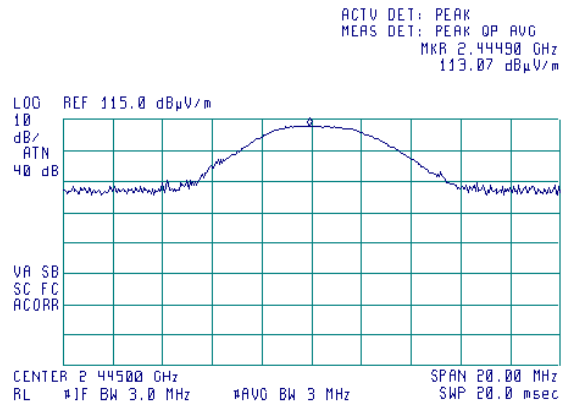
EUT Position Z



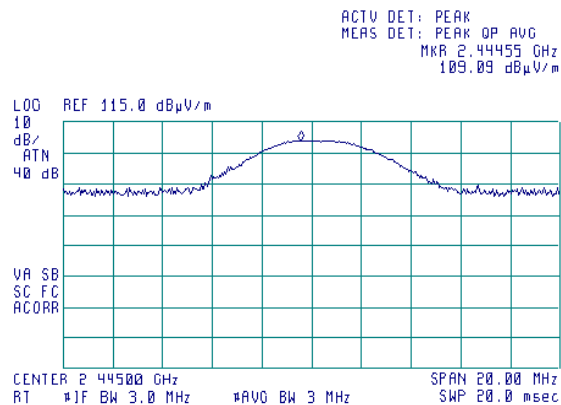
Test specification:	Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 3V battery
Remarks:			

**Plot 7.2.4 Field strength of carrier at mid frequency ch.19**

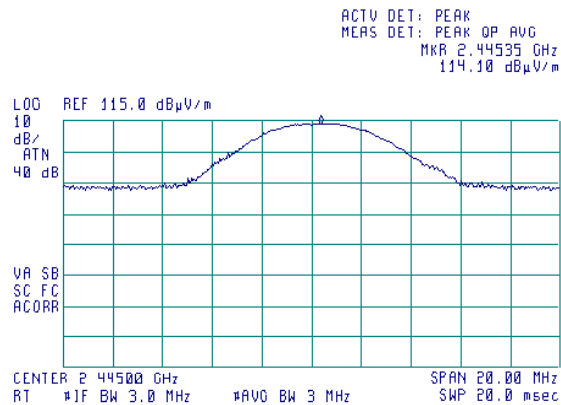
ANTENNA POLARIZATION: Horizontal



EUT Position X



EUT Position Y



EUT Position Z

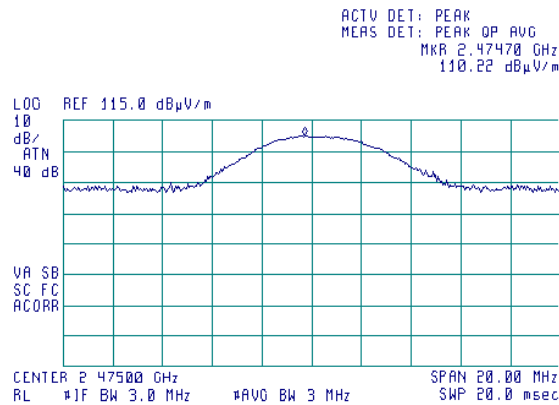




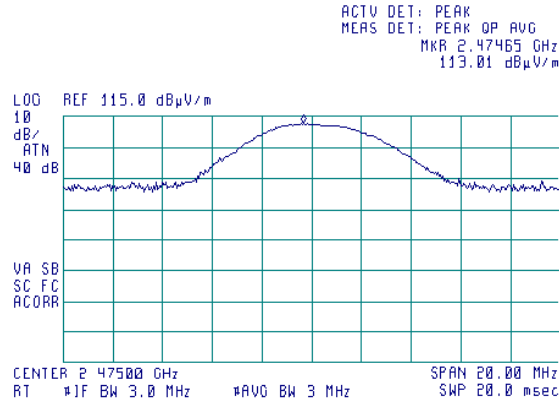
Test specification:	Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 3V battery
Remarks:			

## Plot 7.2.5 Field strength of carrier at high frequency 1 ch.25

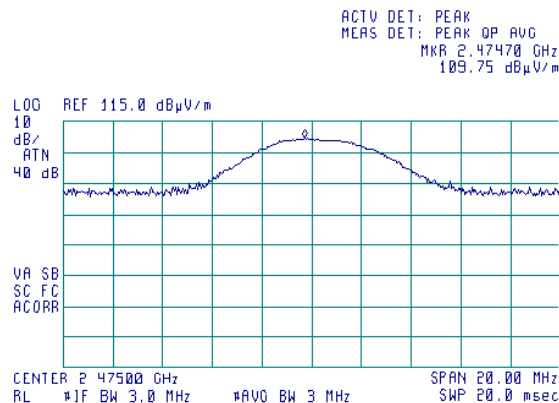
ANTENNA POLARIZATION: Vertical



EUT Position X



EUT Position Y



EUT Position Z

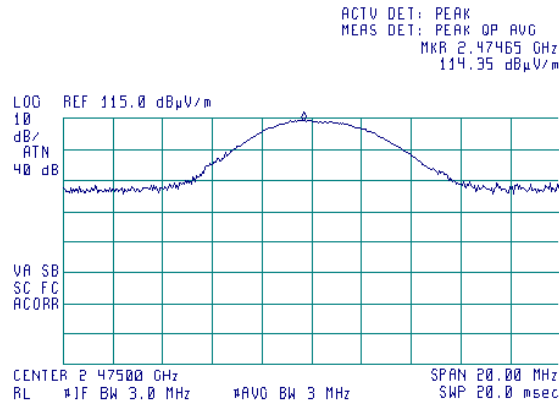


Test specification:	Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 3V battery
Remarks:			

## Plot 7.2.6 Field strength of carrier at high frequency 1 ch.25

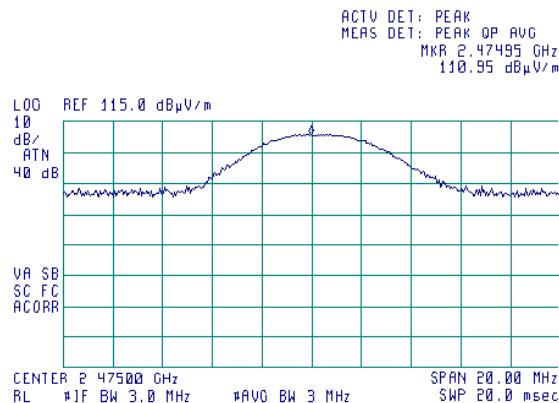
ANTENNA POLARIZATION: Horizontal

(32)



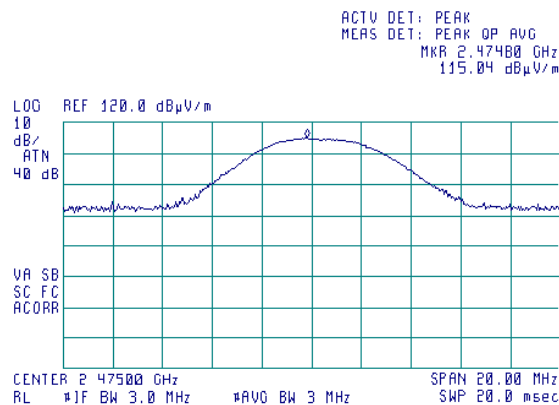
EUT Position X

(32)



EUT Position Y

(32)



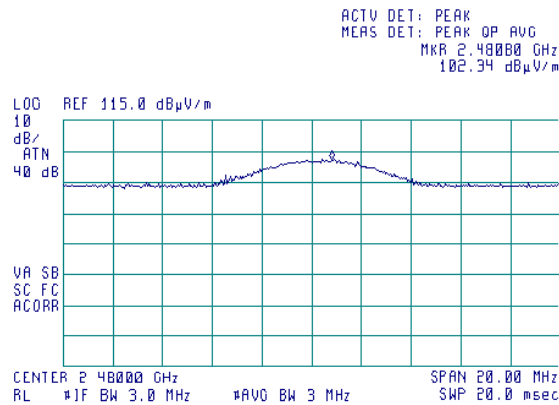
EUT Position Z



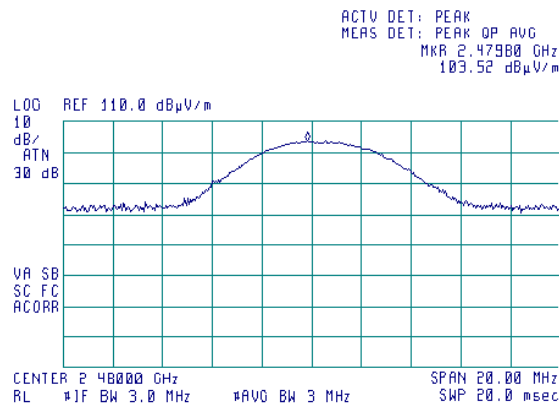
Test specification:	Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 3V battery
Remarks:			

## Plot 7.2.7 Field strength of carrier at high frequency 2 ch.26

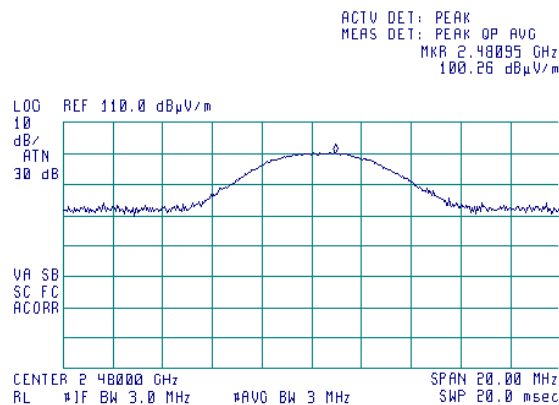
ANTENNA POLARIZATION: Vertical



EUT Position X



EUT Position Y



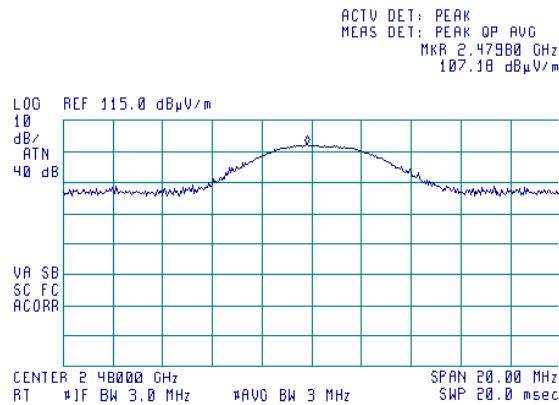
EUT Position Z



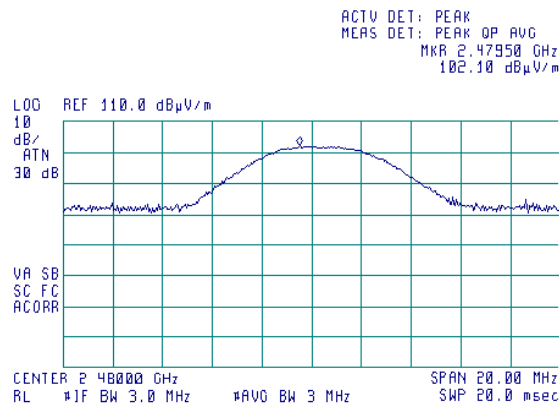
Test specification:	Section 15.247(b)3 / RSS-247 section 5.4(4), Peak output power		
Test procedure:	ANSI C63.10 section 11.9		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 48 %	Power Supply: 3V battery
Remarks:			

## Plot 7.2.8 Field strength of carrier at high frequency 2 ch.26

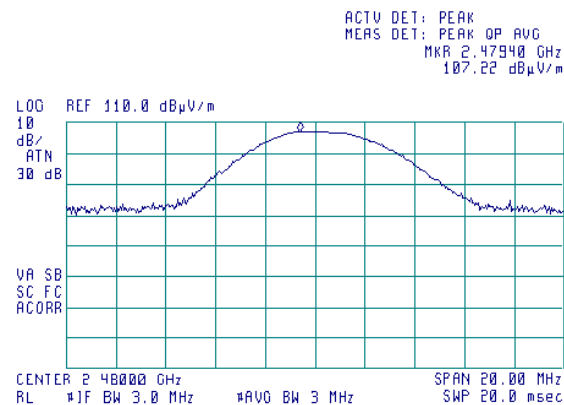
ANTENNA POLARIZATION: Horizontal



EUT Position X



EUT Position Y



EUT Position Z

<b>Test specification:</b>	<b>Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.12.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1009 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

## 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 – 10 <sup>th</sup> harmonic	74.0	NA	54.0	

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

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

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° 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°, 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:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

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

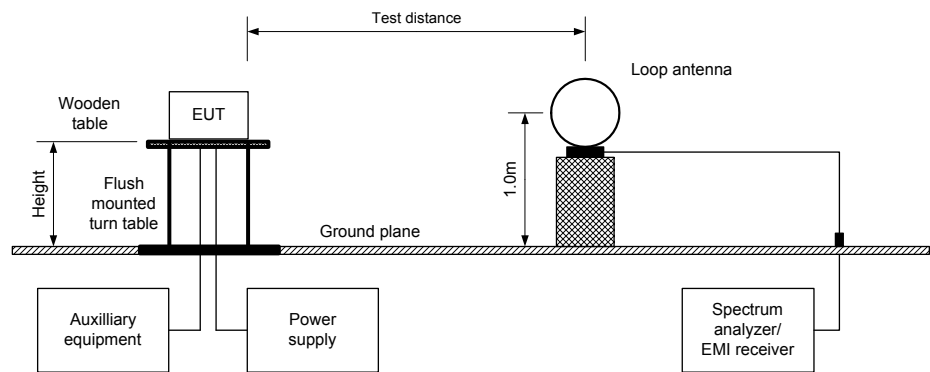
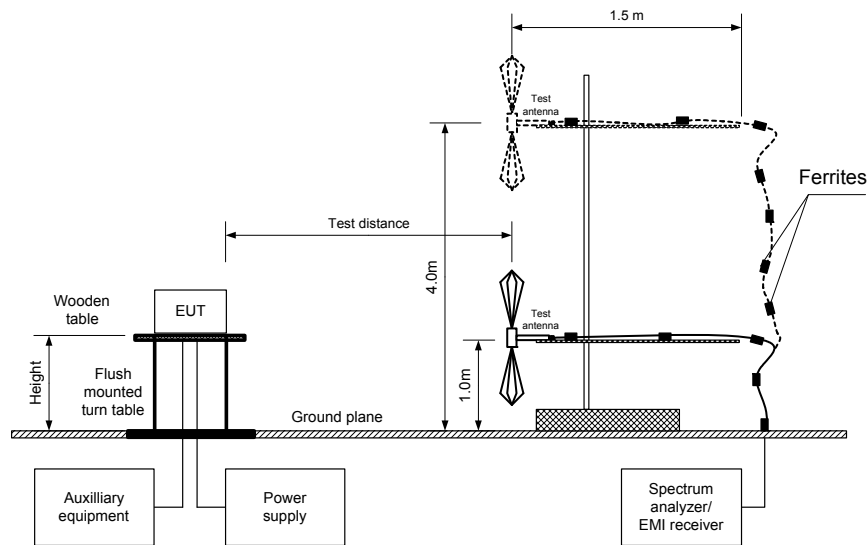


Figure 7.3.2 Setup for spurious emission field strength measurements above 30 MHz



<b>Test specification:</b>	<b>Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.12.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1009 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

**Table 7.3.2 Field strength of emissions outside restricted bands**

ASSIGNED FREQUENCY: 2400 – 2483.5 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 - 25000 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: OQPSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 250 kbps  
 DUTY CYCLE: 100 %  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)

Basic rated grade (above 1000 MHz)									
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									
7216.47	60.78	Horizontal	1.8	80	111.3	50.52	20.0	30.52	Pass
9617.91	53.97	Horizontal	1.4	160		57.33		37.33	
1442.69	45.49	Horizontal	1.4	160		65.81		45.81	
16838.19	48.87	Horizontal	1.4	170		62.43		42.43	
Mid carrier frequency, Channel 19									
9777.99	56.88	Horizontal	1.5	100	110.3	53.42	20.0	33.42	Pass
14666.96	49.22	Horizontal	1.5	170		61.08		41.08	
17111.37	45.66	Horizontal	1.5	130		64.64		44.64	
High carrier frequency 1, Channel 25									
9901.93	53.87	Horizontal	1.9	10	111.1	57.23	20.0	37.23	Pass
14852.93	49.46	Horizontal	1.5	30		61.64		41.64	
17328.63	44.81	Horizontal	1.3	80		66.29		46.29	
High carrier frequency 2, Channel 26									
No emissions were found.									Pass

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

\*\* - Margin = Attenuation below carrier – specification limit.

<b>Test specification:</b>	<b>Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.12.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1009 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

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

ASSIGNED FREQUENCY: 2400 – 2483.5 MHz  
 INVESTIGATED FREQUENCY RANGE: 1000 - 25000 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: OQPSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 250 kbps  
 DUTY CYCLE: 100 %  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 1000 kHz  
 TEST ANTENNA TYPE: Double ridged guide

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 2405 MHz											
4810.95	Horizontal	1.5	30	66.59	74.0	-7.41	58.46	45.89	54.0	-8.11	Pass
12022.34	Horizontal	1.4	30	50.95	74.0	-23.05	42.41	29.84	54.0	-24.16	
19235.87	Horizontal	1.5	30	52.94	74.0	-21.06	41.50	28.93	54.0	-25.07	
Mid carrier frequency 2445 MHz											
4889.05	Horizontal	1.5	30	66.70	74.0	-7.30	58.00	45.43	54.0	-8.57	Pass
7336.38	Horizontal	1.4	80	66.02	74.0	-7.98	56.77	44.20	54.0	-9.80	
12222.40	Horizontal	1.4	90	52.40	74.0	-21.60	43.29	30.72	54.0	-23.28	
19563.67	Horizontal	1.3	70	55.97	74.0	-18.03	45.39	32.82	54.0	-21.18	
High carrier frequency 1 2475 MHz											
4949.03	Horizontal	1.5	80	63.68	74.0	-10.32	54.95	42.38	54.0	-11.62	Pass
7426.400	Horizontal	1.6	80	65.99	74.0	-8.01	55.49	42.92	54.0	-11.08	
12372.40	Horizontal	1.7	30	58.52	74.0	-15.48	47.89	35.32	54.0	-18.68	
19803.93	Horizontal	1.5	60	56.37	74.0	-17.63	46.15	33.58	54.0	-20.42	
High carrier frequency 2 2480 MHz											
All emissions were found below limit average.											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 pulse during 100 ms	Duration, ms	Period, ms		
1.96	12	NA	NA	NA	-12.57

\*- Average factor was calculated as follows:

Avr.Factor=20 Log (1.96 x12/100)=-12.57 dB



<b>Test specification:</b>	<b>Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.12.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1009 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

**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: 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 carrier frequency 2405 MHz								
No emissions were found								Pass
Mid carrier frequency 2445 MHz								
No emissions were found								Pass
High carrier frequency1 2475 MHz								
No emissions were found								Pass
High carrier frequency 2 2480 MHz								
No emissions were found								Pass

\*- Margin = Measured emission - specification limit.

\*- Margin = Measured emission - specification limit.

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

**Table 7.3.6 Restricted bands**

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	

**Reference numbers of test equipment used**

HL 0446	HL 0521	HL 0604	HL 1984	HL 2780	HL 3818	HL 3901	HL 4278
HL 4222	HL 4338	HL 4353	HL 4933	HL 4956			

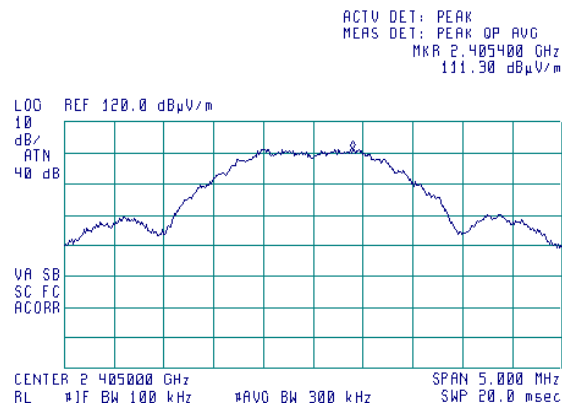
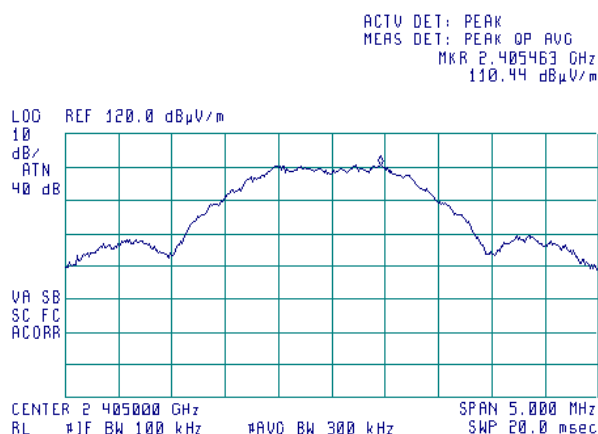
Full description is given in Appendix A.

Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

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

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical

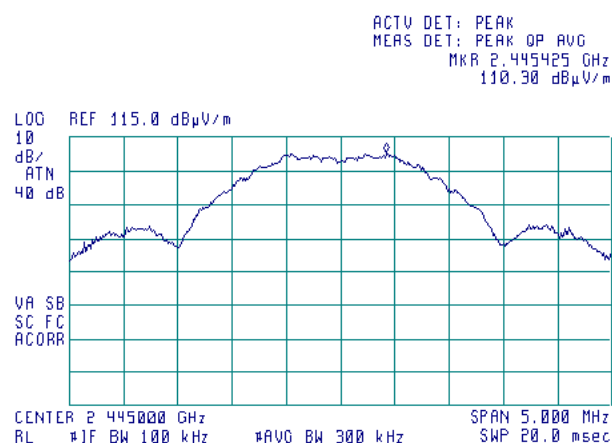
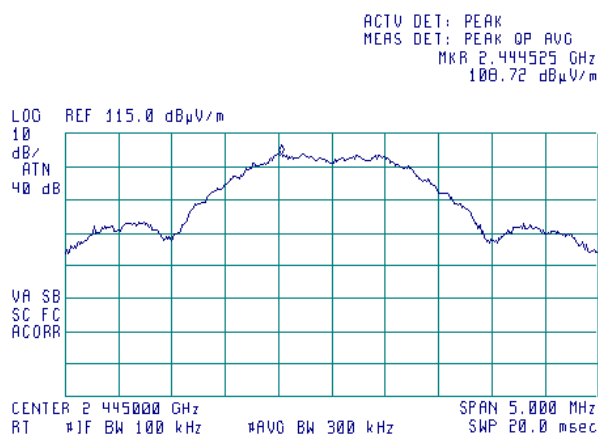
Semi anechoic chamber  
3 m  
ANTENNA POLARIZATION: Horizontal



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

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical

Semi anechoic chamber  
3 m  
ANTENNA POLARIZATION: Horizontal

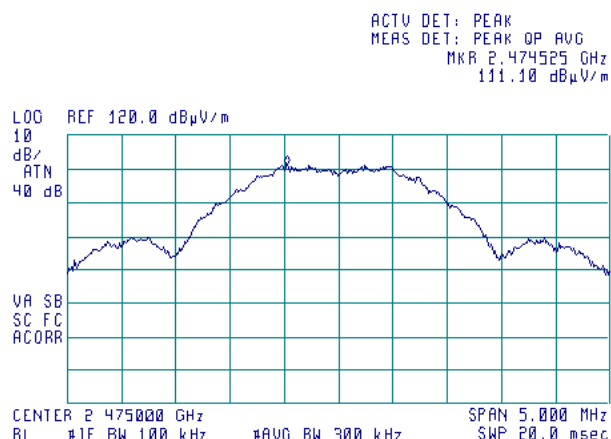
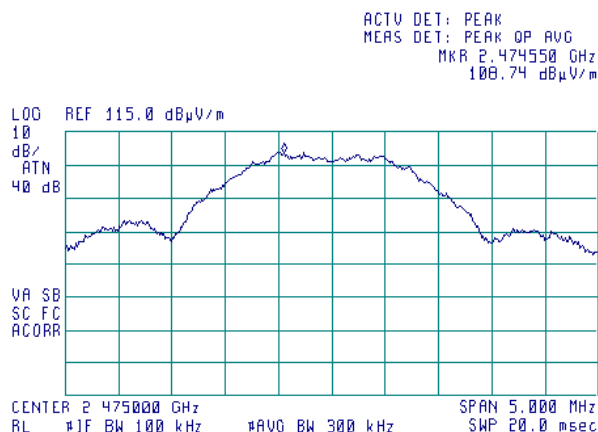


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.3 Radiated emission measurements at the high carrier frequency 1 Ch. 25

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical

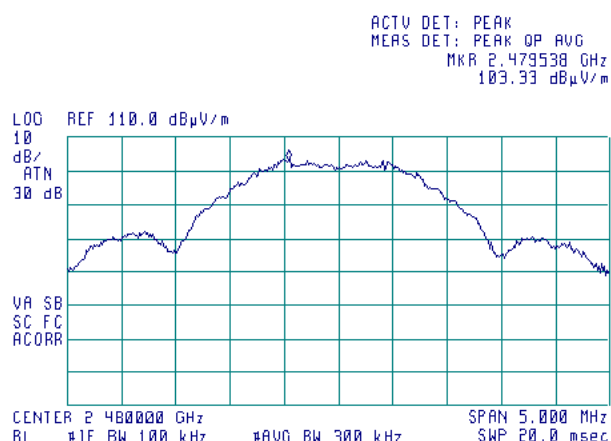
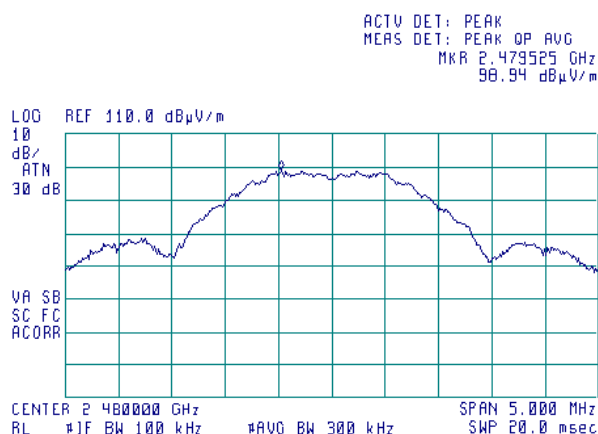
Semi anechoic chamber  
3 m  
ANTENNA POLARIZATION: Horizontal



Plot 7.3.4 Radiated emission measurements at the high carrier frequency 2 Ch.26

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical

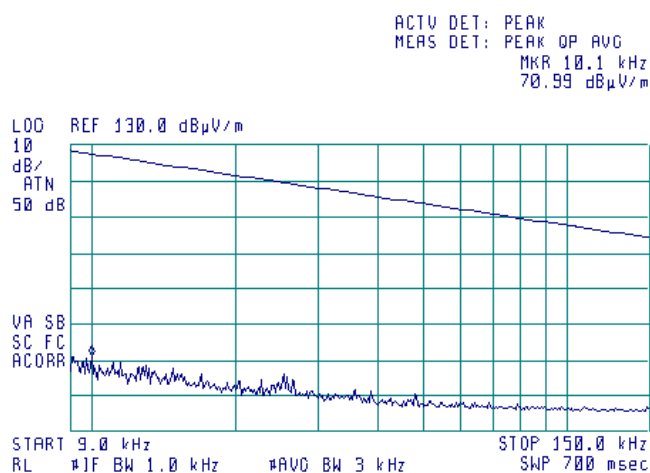
OATS  
3 m  
ANTENNA POLARIZATION: Horizontal



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

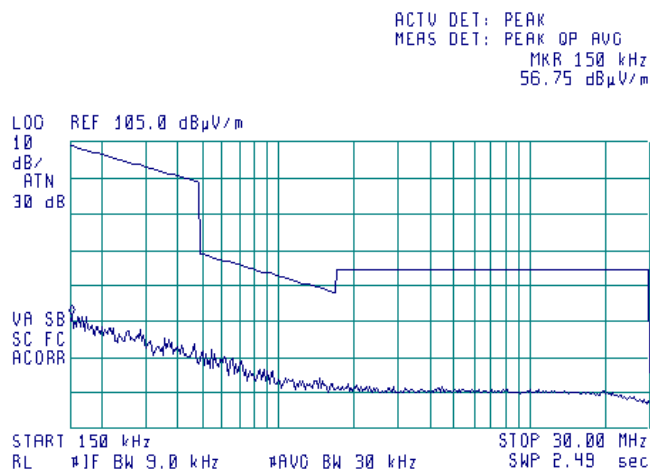
**Plot 7.3.5 Radiated emission measurements from 9 to 150 kHz at the low; mid; high carrier frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



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

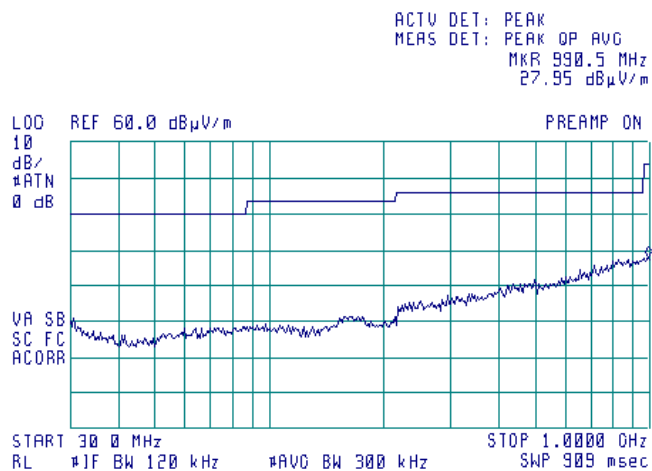
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V 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

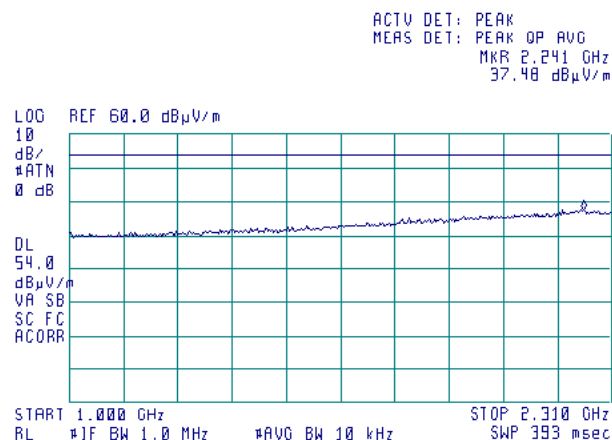
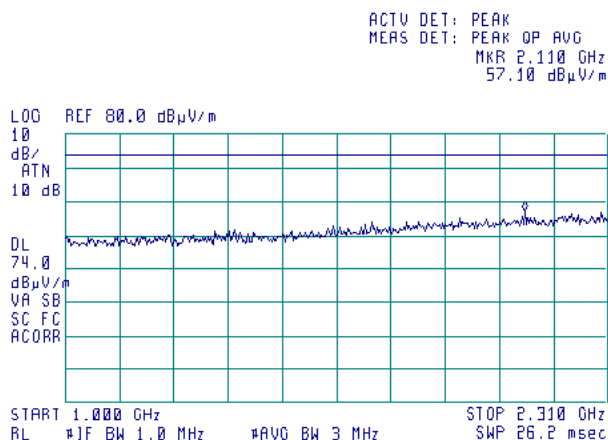


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.8 Radiated emission measurements from 1000 to 2310 MHz at the low carrier frequency ch.11

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

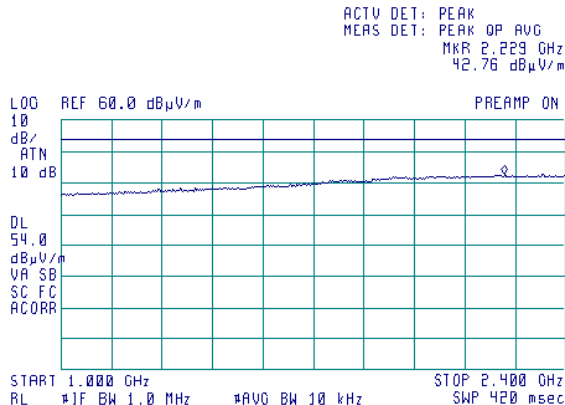
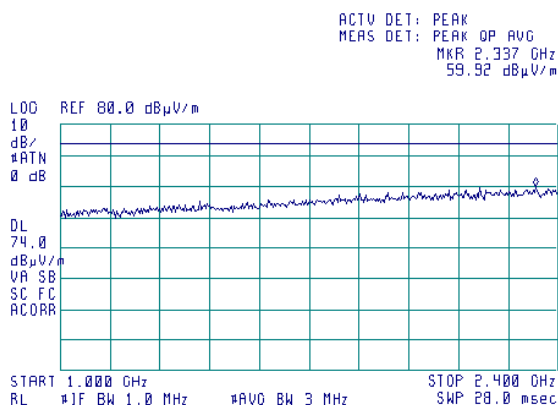
Semi anechoic chamber  
3 m  
Vertical and Horizontal



Plot 7.3.9 Radiated emission measurements from 1000 to 2400 MHz at the mid carrier frequency ch.19

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

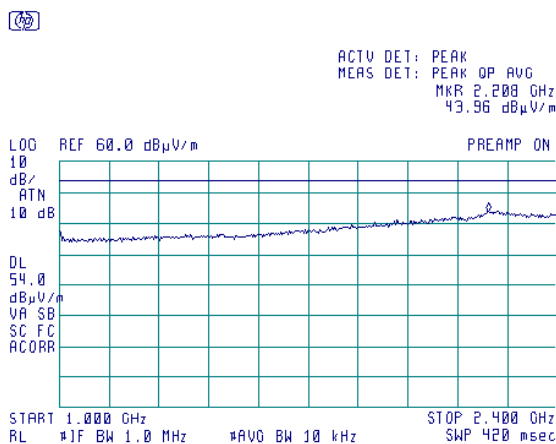
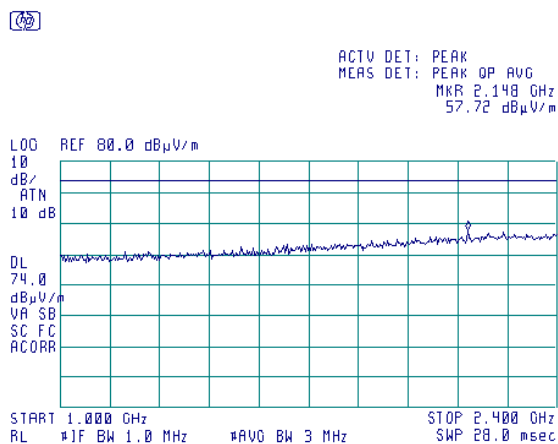
Semi anechoic chamber  
3 m  
Vertical and Horizontal



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

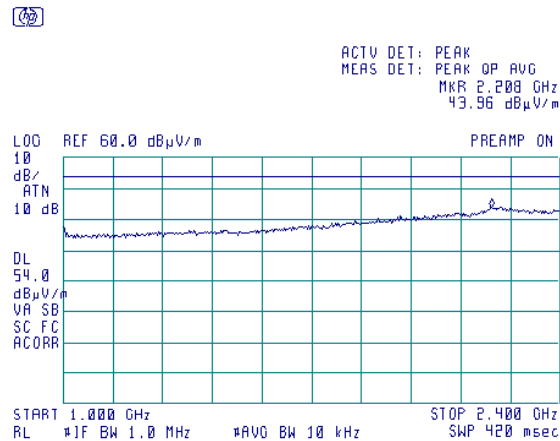
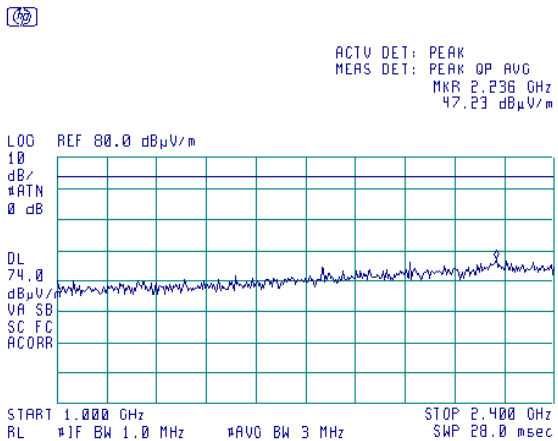
Plot 7.3.10 Radiated emission measurements from 1000 to 2400 MHz at the high carrier frequency 1 ch.25

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



Plot 7.3.11 Radiated emission measurements from 1000 to 2400 MHz at the high carrier frequency 2 ch.26

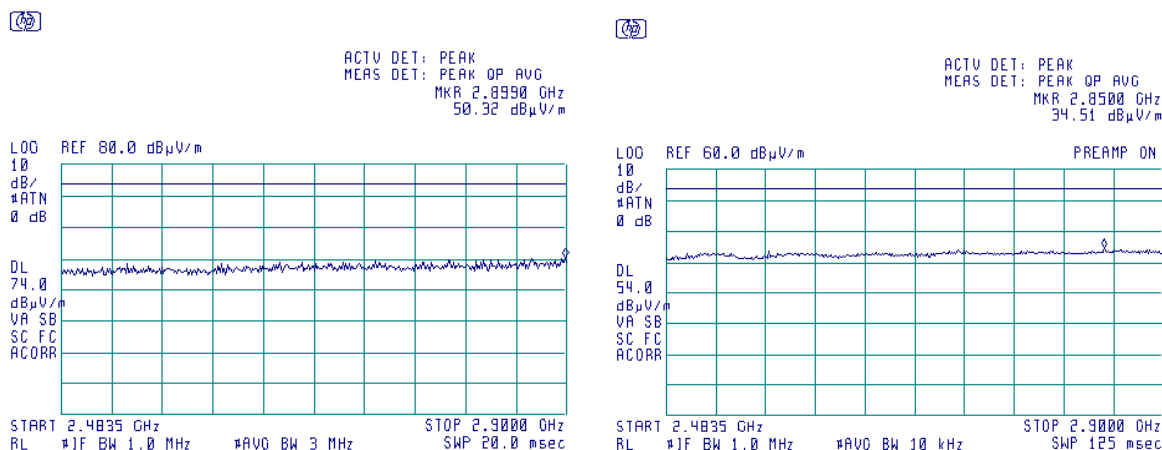
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

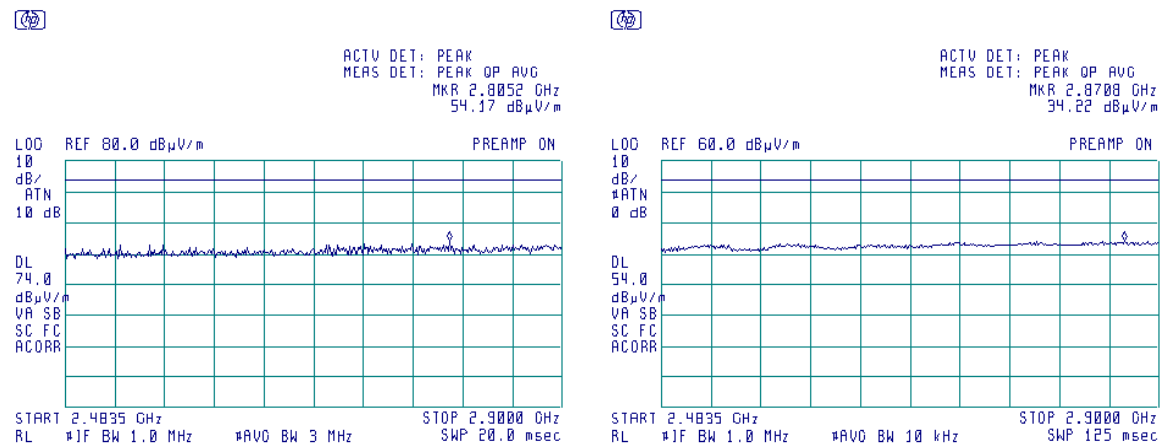
Plot 7.3.12 Radiated emission measurements from 2483.5 to 2900 MHz at the low carrier frequency ch.11

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



Plot 7.3.13 Radiated emission measurements from 2483.5 to 2900 MHz at the mid carrier frequency ch.19

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

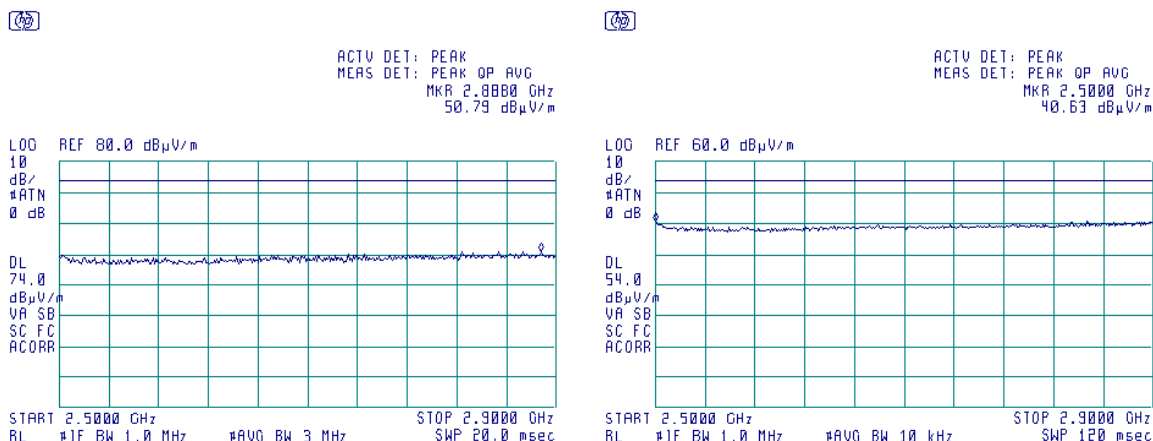




Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

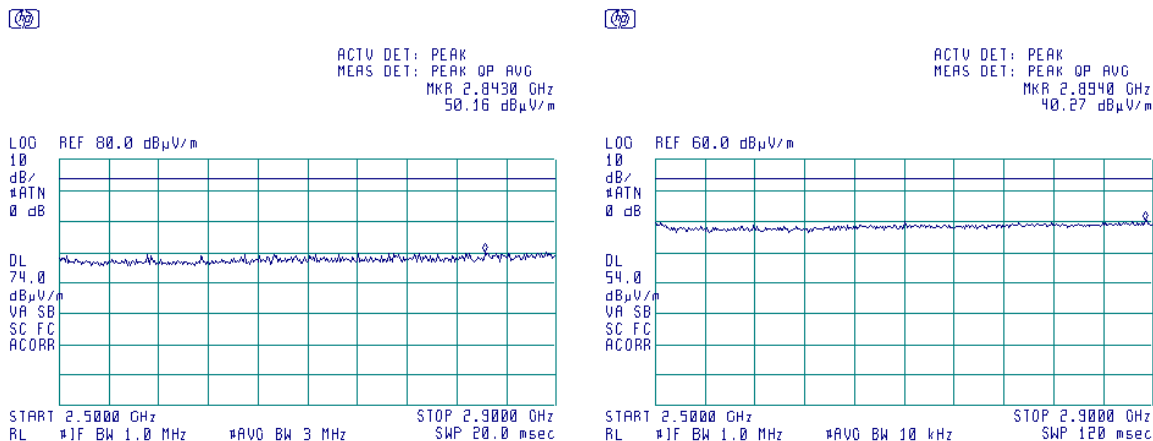
Plot 7.3.14 Radiated emission measurements from 2500 to 2900 MHz at the high carrier frequency 1 ch.25

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



Plot 7.3.15 Radiated emission measurements from 2500 to 2900 MHz at the high carrier frequency 2 ch.26

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

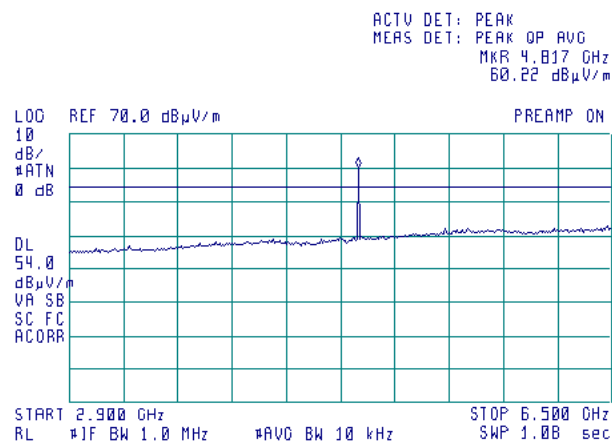
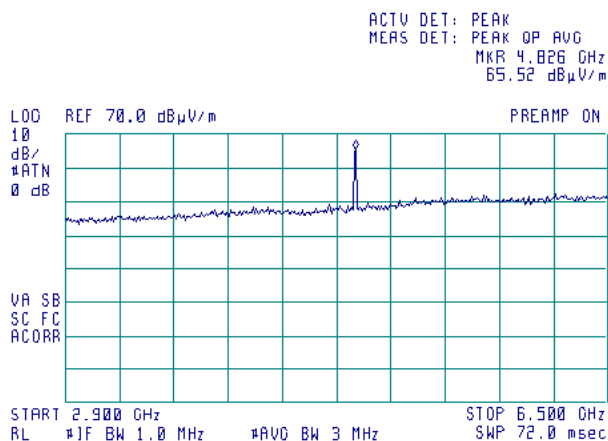


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.16 Radiated emission measurements from 2900 to 6500 MHz at the low carrier frequency ch.11

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

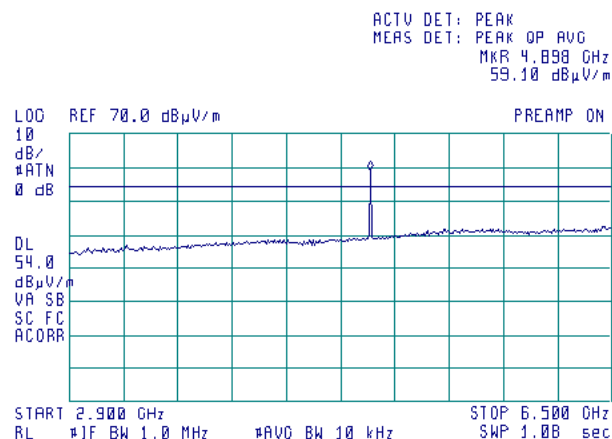
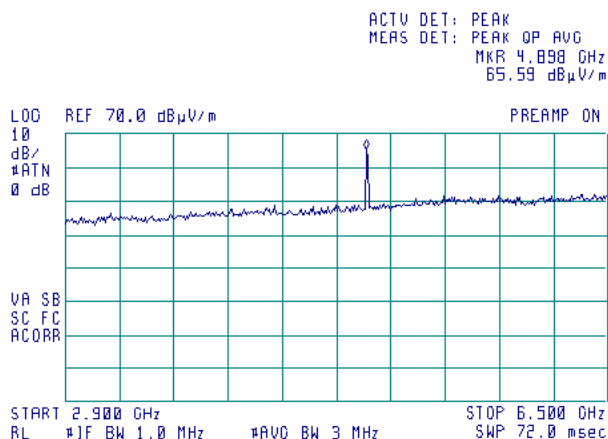
Semi anechoic chamber  
3 m  
Vertical and Horizontal



Plot 7.3.17 Radiated emission measurements from 2900 to 6500 MHz at the mid carrier frequency ch.19

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

Semi anechoic chamber  
3 m  
Vertical and Horizontal

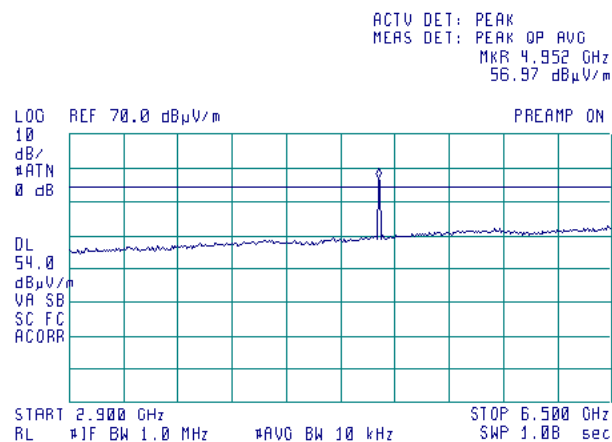
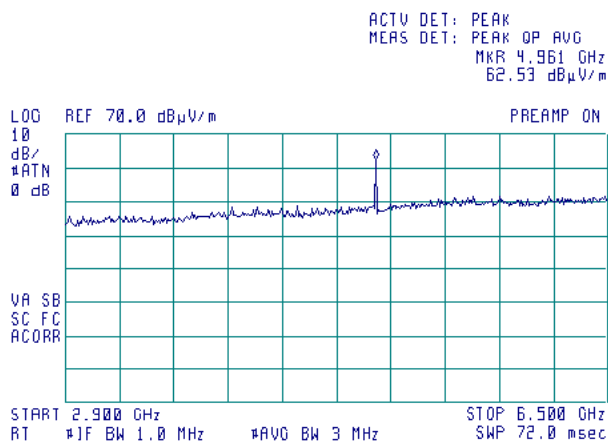


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.18 Radiated emission measurements from 2900 to 6500 MHz at the high carrier frequency 1 ch.25

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

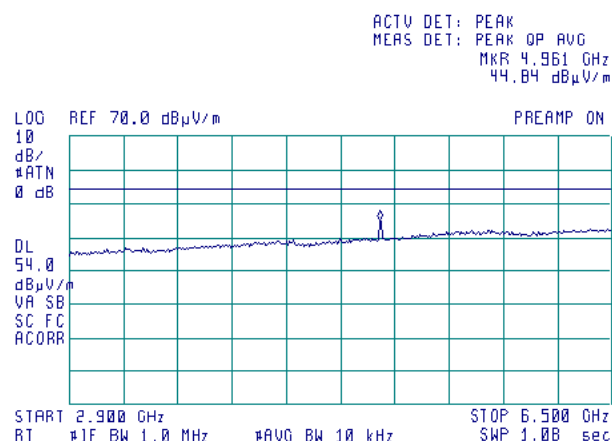
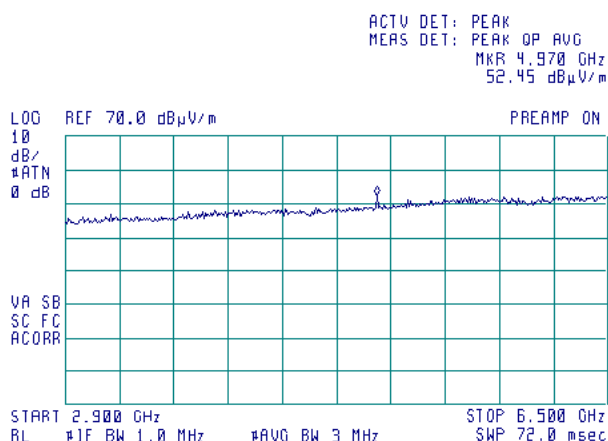
Semi anechoic chamber  
3 m  
Vertical and Horizontal



Plot 7.3.19 Radiated emission measurements from 2900 to 6500 MHz at the high carrier frequency 2 ch.26

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

Semi anechoic chamber  
3 m  
Vertical and Horizontal

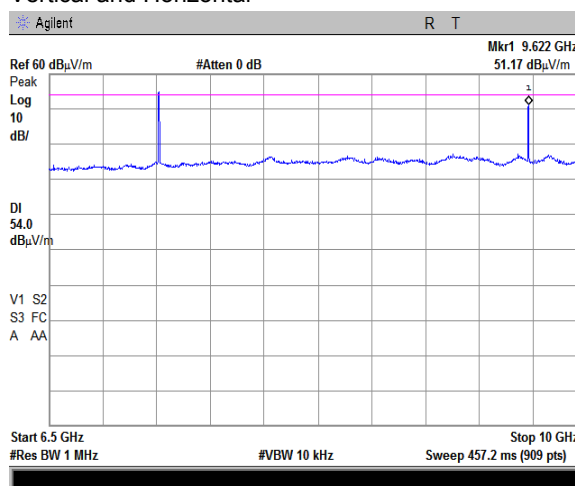
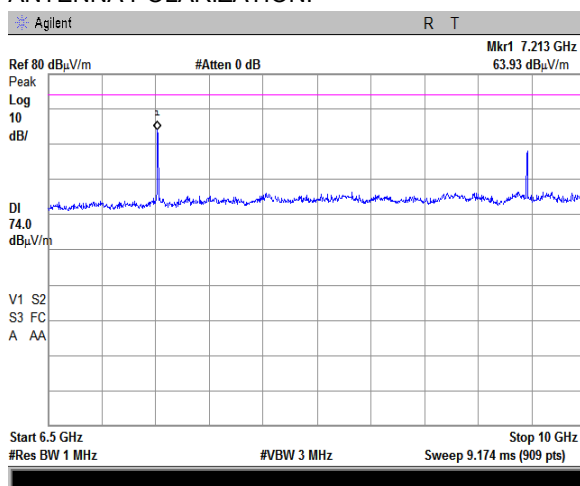


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.20 Radiated emission measurements from 6500 to 10000 MHz at the low carrier frequency ch.11

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

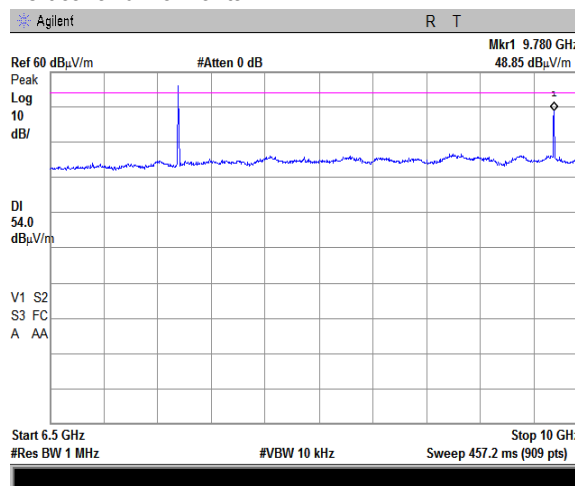
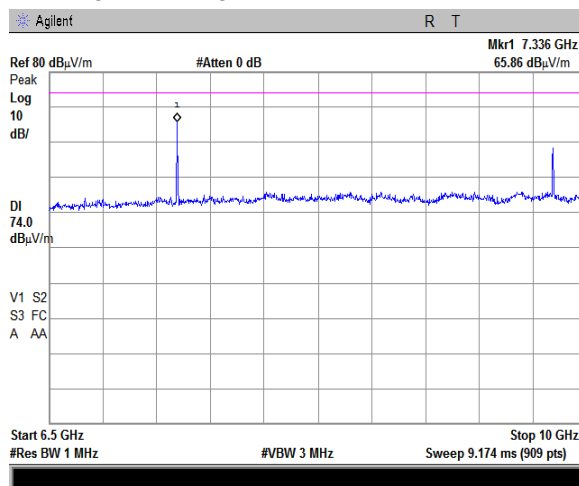
Semi anechoic chamber  
3 m  
Vertical and Horizontal



Plot 7.3.21 Radiated emission measurements from 6500 to 10000 MHz at the mid carrier frequency ch.19

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

Semi anechoic chamber  
3 m  
Vertical and Horizontal

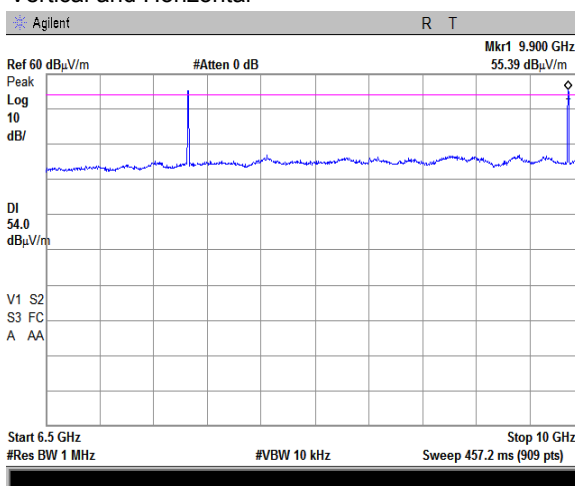
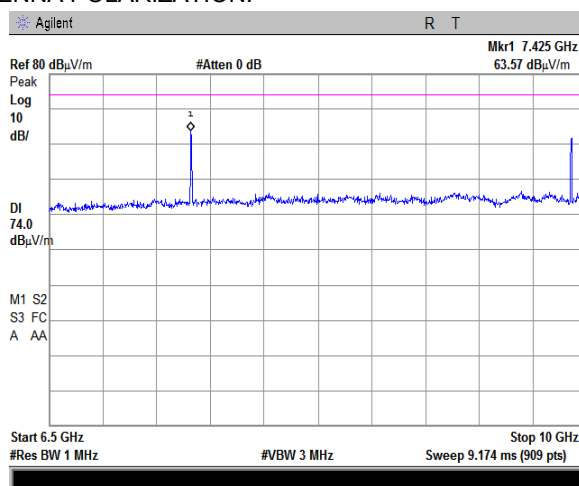


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.22 Radiated emission measurements from 6500 to 10000 MHz at the high carrier frequency 1 ch.25

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

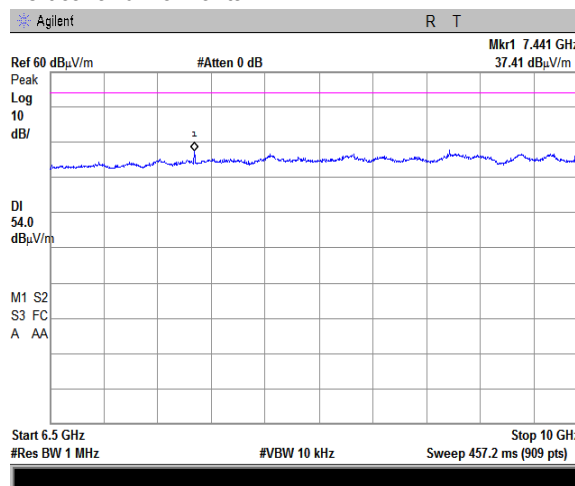
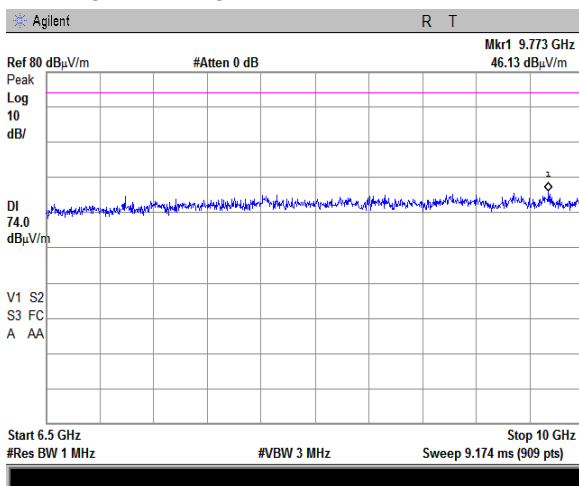
Semi anechoic chamber  
3 m  
Vertical and Horizontal



Plot 7.3.23 Radiated emission measurements from 6500 to 10000 MHz at the high carrier frequency 2 ch.26

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

Semi anechoic chamber  
3 m  
Vertical and Horizontal

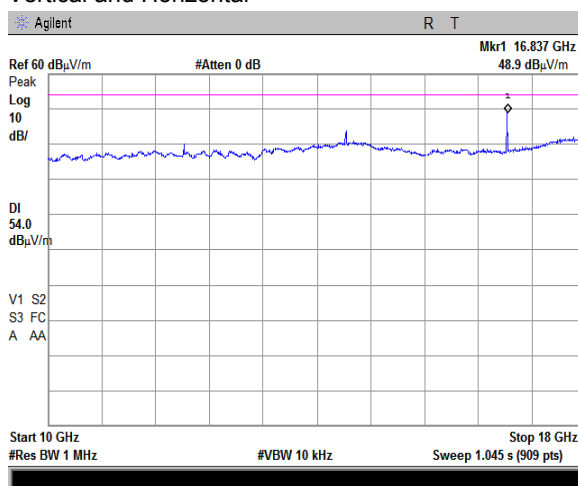
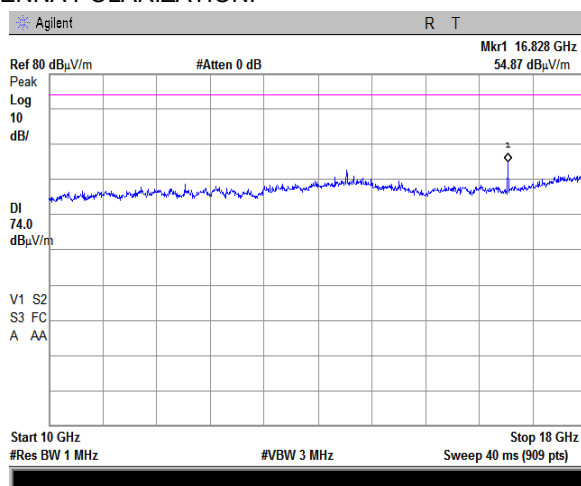


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

#### Plot 7.3.24 Radiated emission measurements from 10000 to 18000 MHz at the low carrier frequency ch.11

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

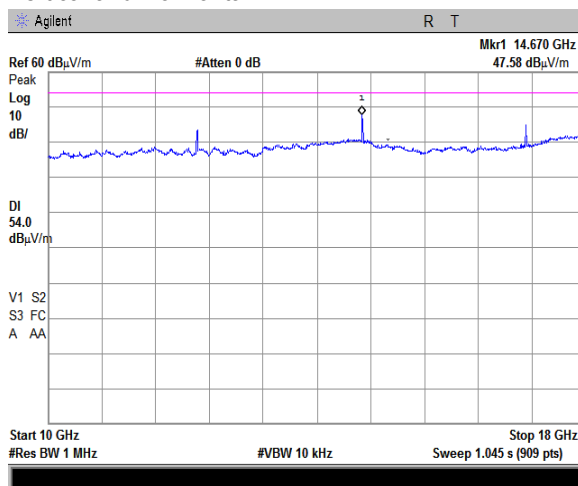
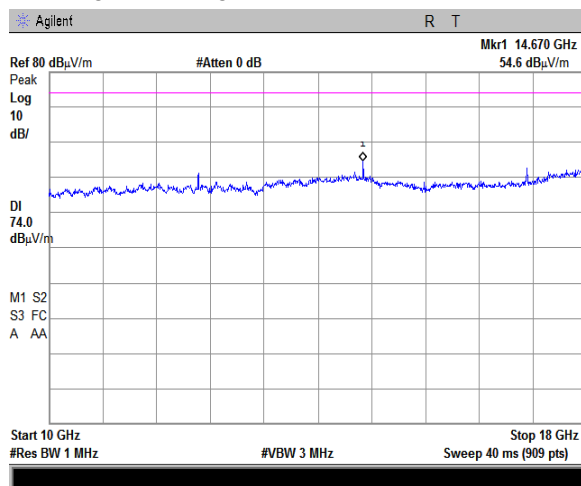
Semi anechoic chamber  
3 m  
Vertical and Horizontal



#### Plot 7.3.25 Radiated emission measurements from 10000 to 18000 MHz at the mid carrier frequency ch.19

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

Semi anechoic chamber  
3 m  
Vertical and Horizontal

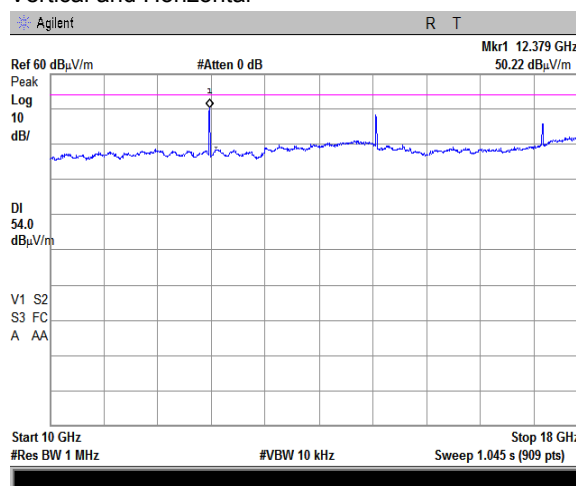
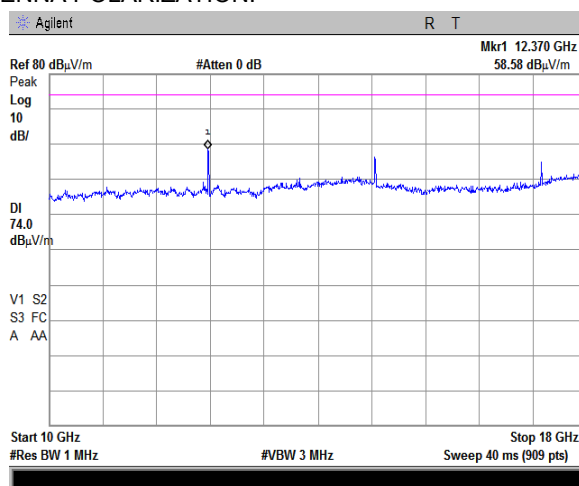


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.26 Radiated emission measurements from 10000 to 18000 MHz at the high carrier frequency 1 ch.25

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

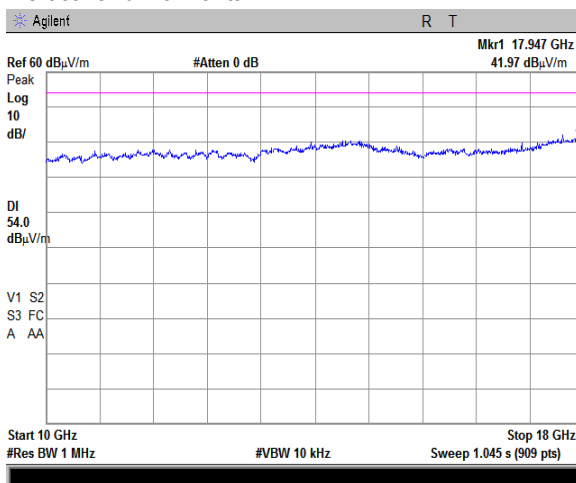
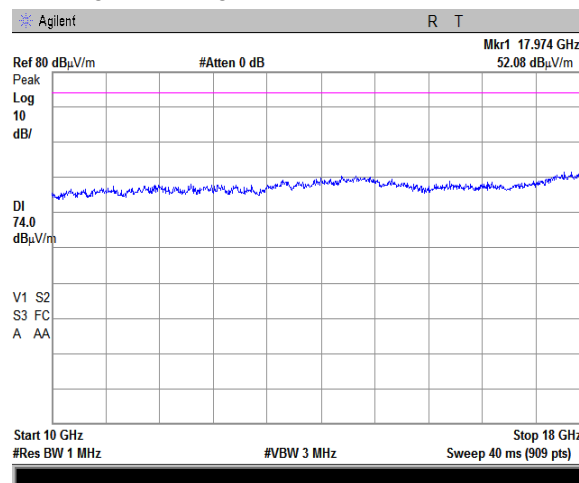
Semi anechoic chamber  
3 m  
Vertical and Horizontal



Plot 7.3.27 Radiated emission measurements from 10000 to 18000 MHz at the high carrier frequency 2 ch.26

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

Semi anechoic chamber  
3 m  
Vertical and Horizontal

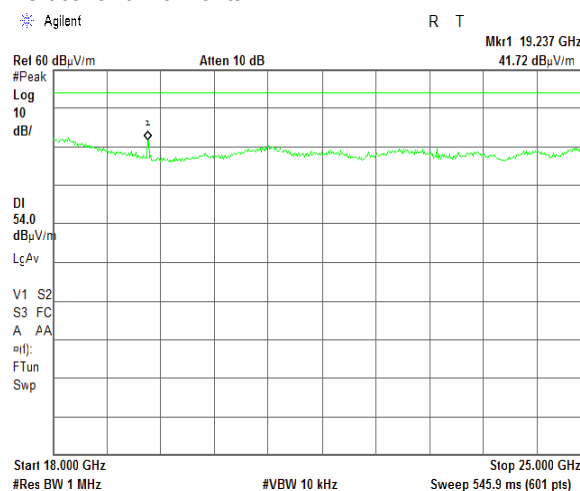
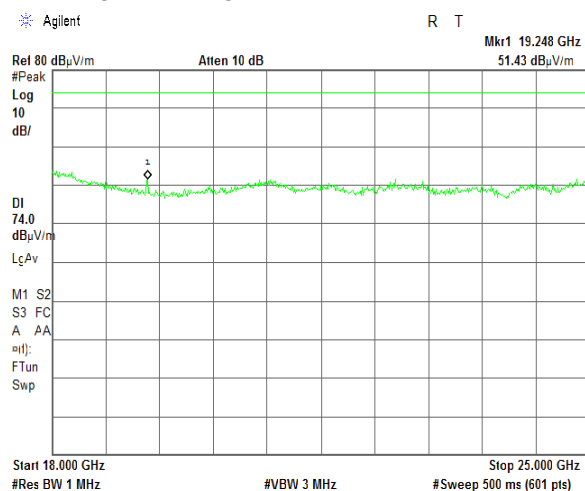


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

### Plot 7.3.28 Radiated emission measurements from 18000 to 25000 MHz at the low carrier frequency ch.11

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

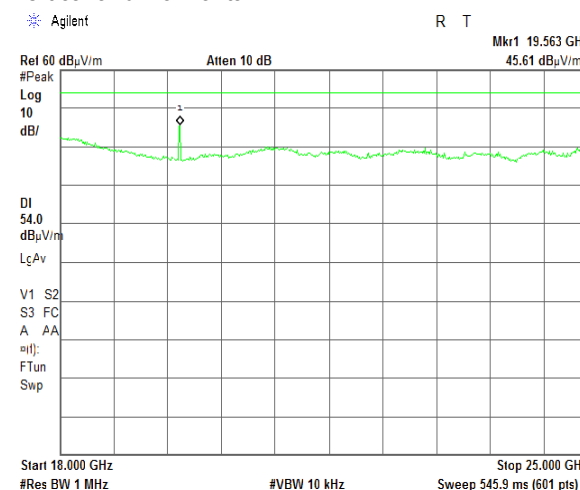
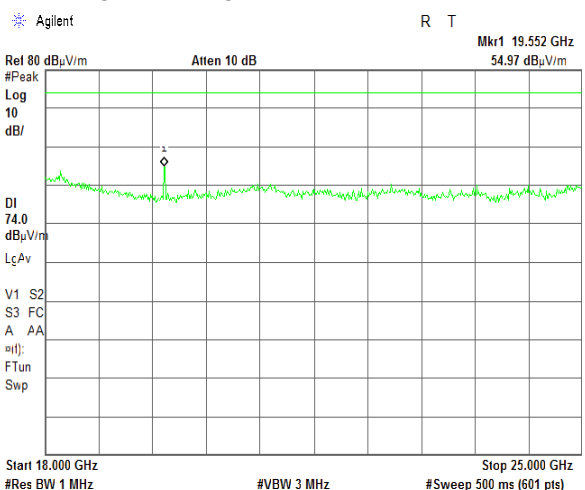
OATS  
3 m  
Vertical and Horizontal



### Plot 7.3.29 Radiated emission measurements from 18000 to 25000 MHz at the mid carrier frequency ch.19

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

OATS  
3 m  
Vertical and Horizontal



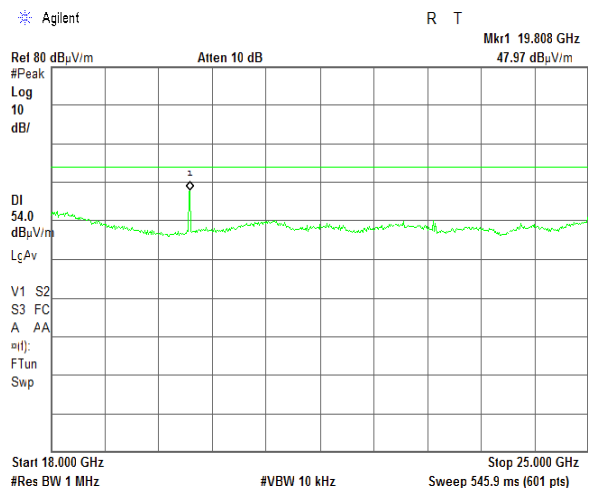
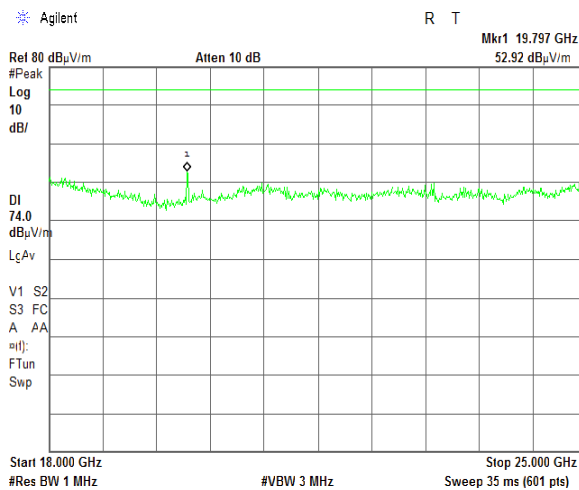


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.30 Radiated emission measurements from 18000 to 25000 MHz at the high carrier frequency 1 ch.25

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

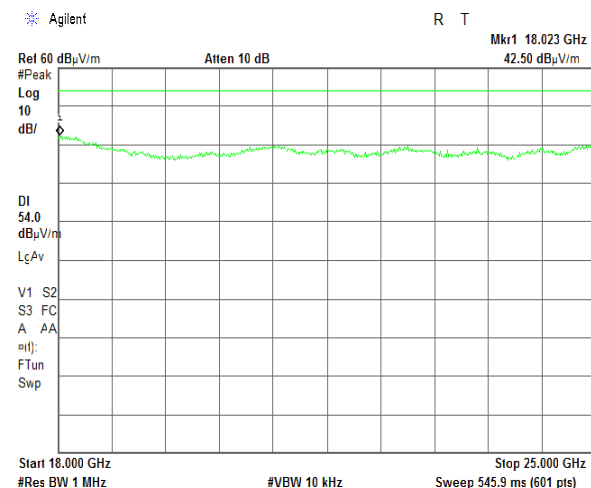
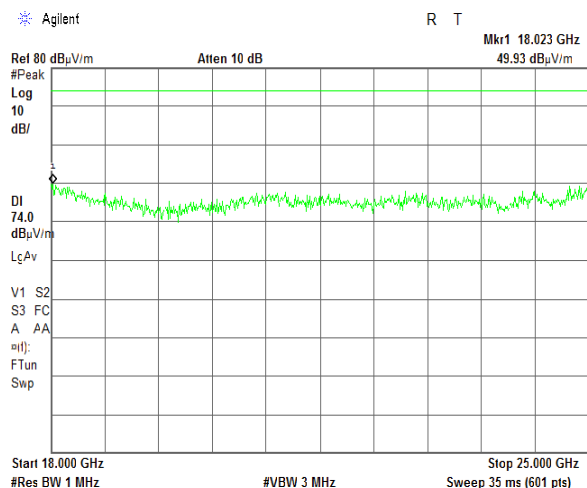
OATS  
3 m  
Vertical and Horizontal



Plot 7.3.31 Radiated emission measurements from 18000 to 25000 MHz at the high carrier frequency 2 ch.26

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:

OATS  
3 m  
Vertical and Horizontal

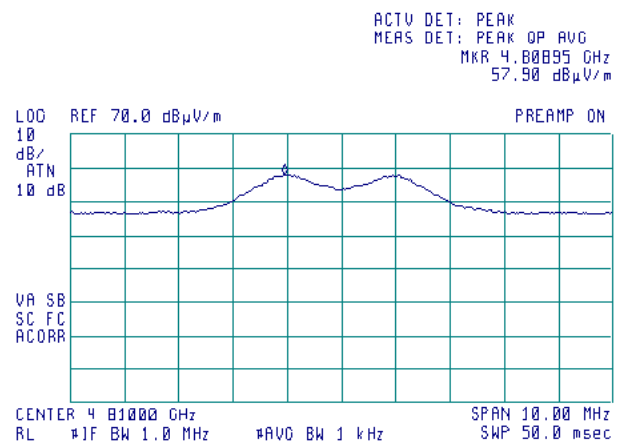
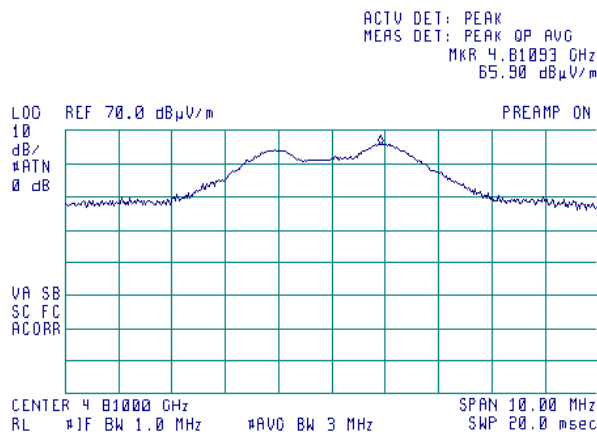


<b>Test specification:</b>	<b>Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.12.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1009 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

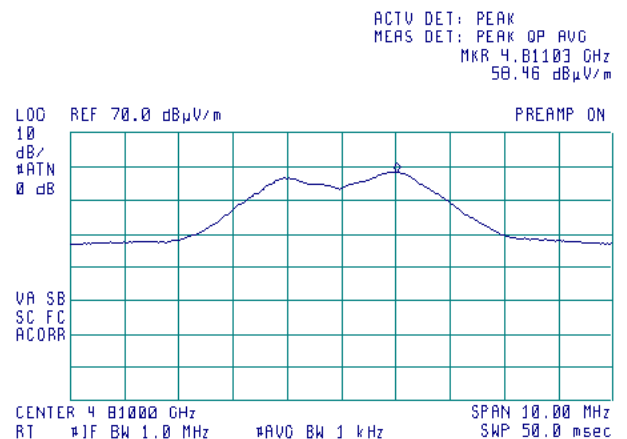
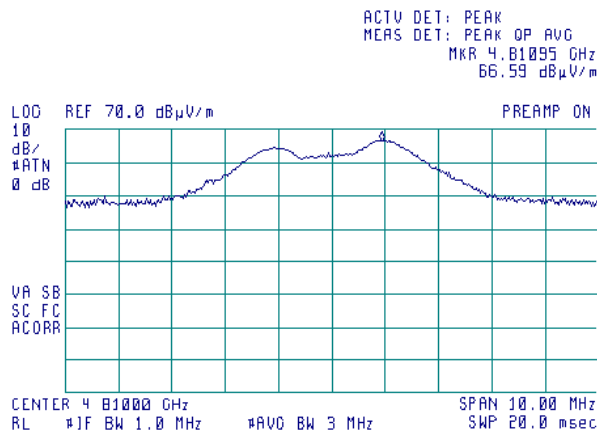
**Plot 7.3.32 Radiated emission measurements at the second harmonic of low carrier frequency ch.11**

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical

Semi anechoic chamber  
3 m



ANTENNA POLARIZATION: Horizontal

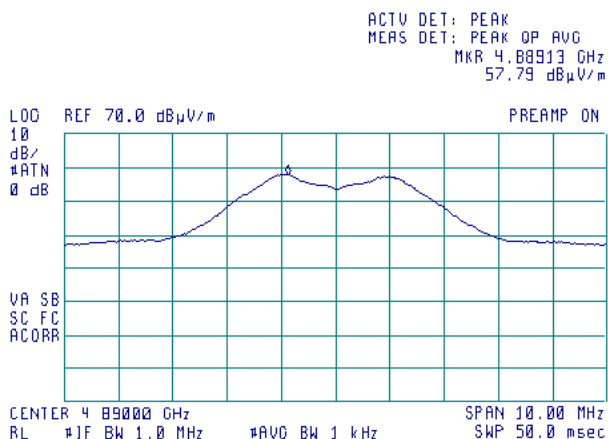
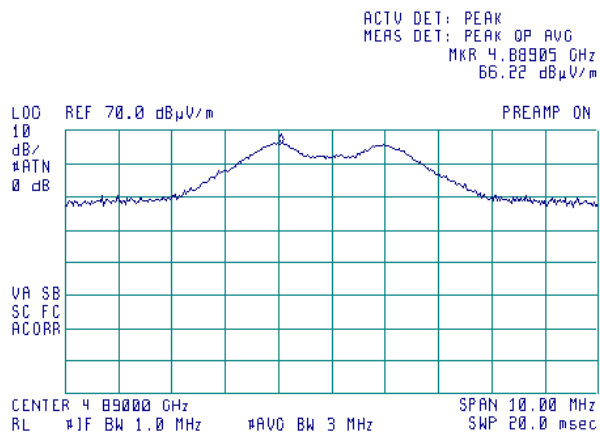


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

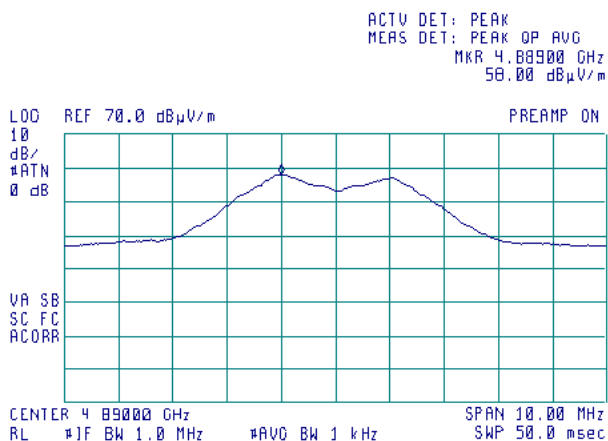
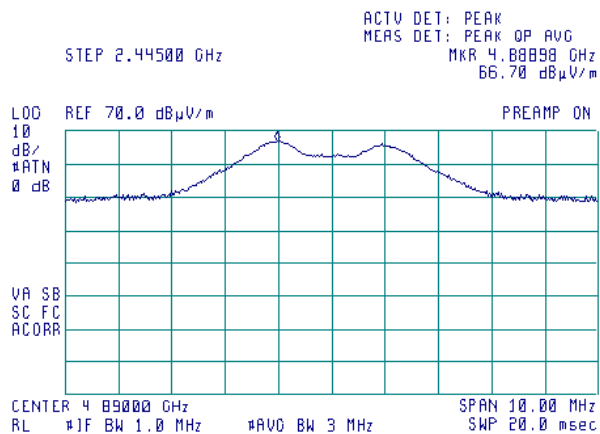
**Plot 7.3.33 Radiated emission measurements at the second harmonic of mid carrier frequency ch.19**

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical

Semi anechoic chamber  
3 m



ANTENNA POLARIZATION: Horizontal

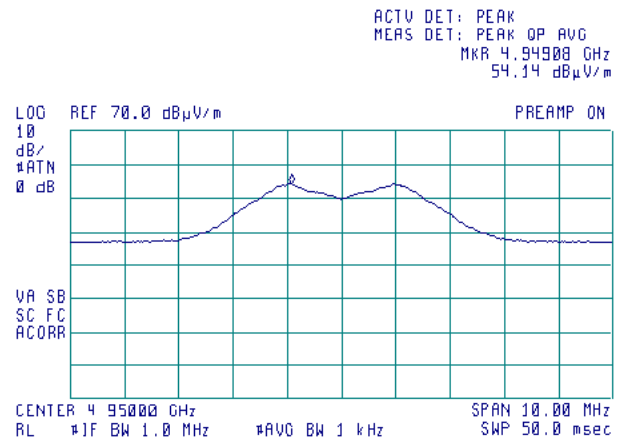
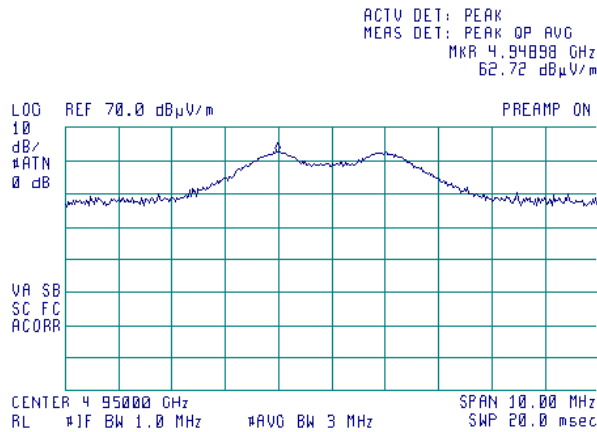


<b>Test specification:</b>	<b>Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.12.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1009 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

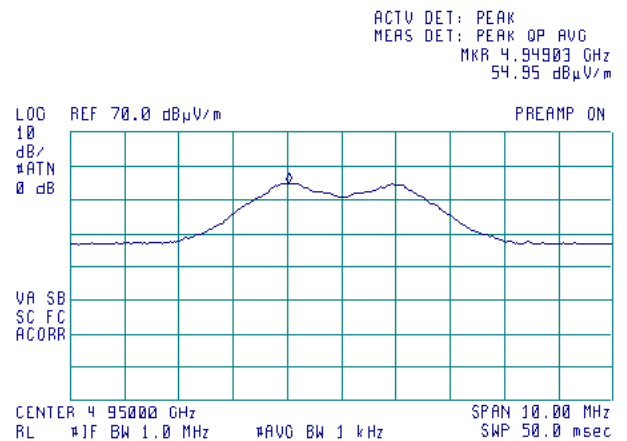
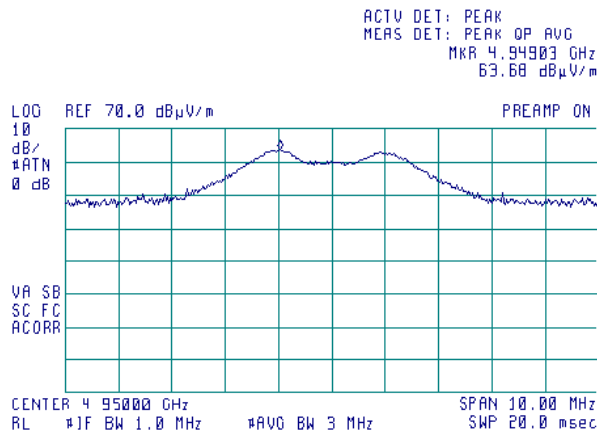
**Plot 7.3.34 Radiated emission measurements at the second harmonic of high carrier frequency 1 ch.25**

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical

Semi anechoic chamber  
3 m



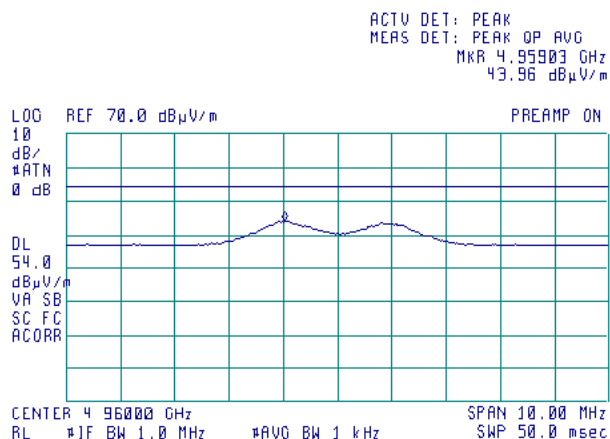
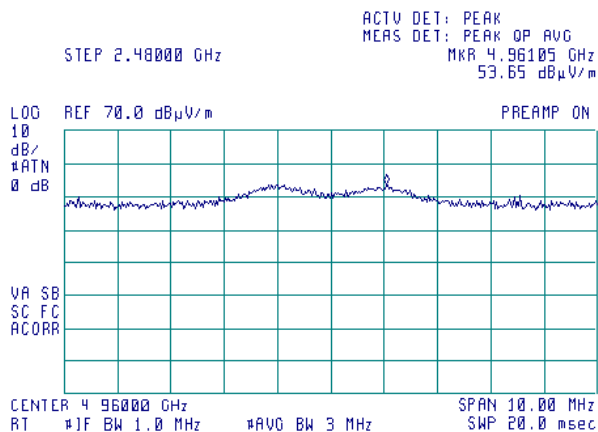
ANTENNA POLARIZATION: Horizontal



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.35 Radiated emission measurements at the second harmonic of high carrier frequency 2 ch.26

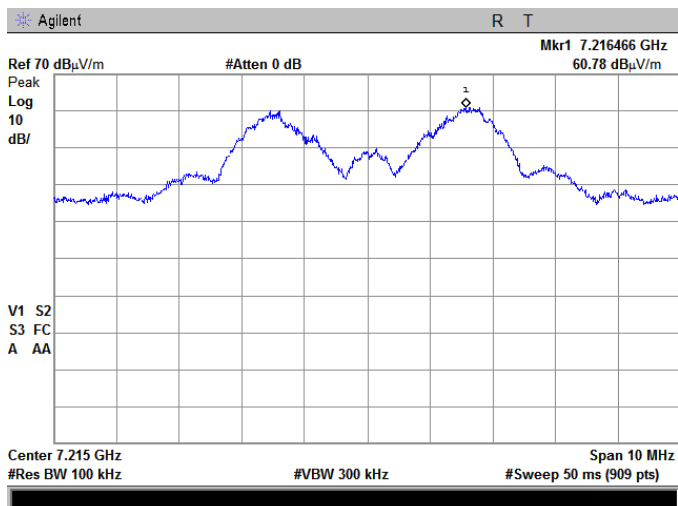
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

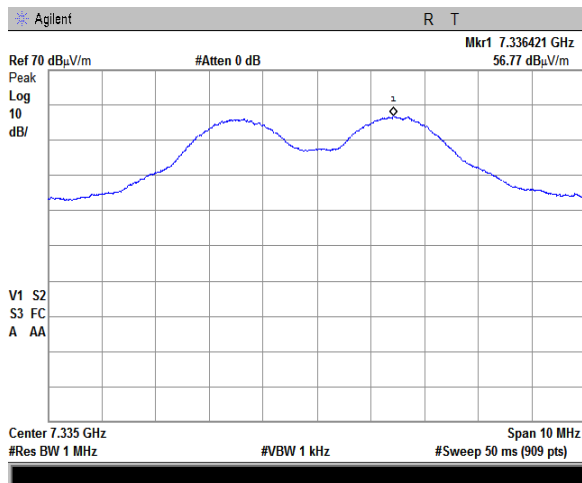
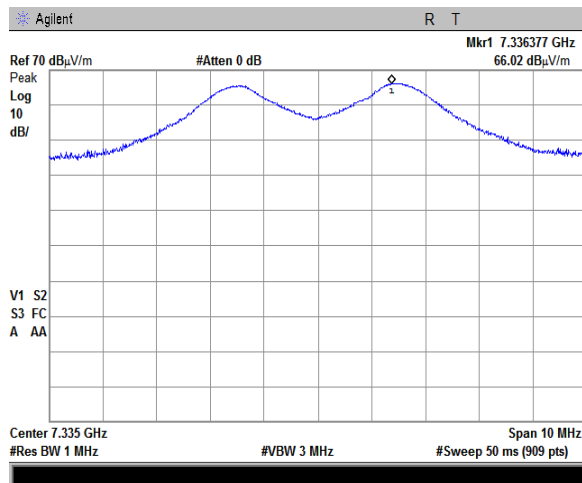
Plot 7.3.36 Radiated emission measurements at the third harmonic of low carrier frequency ch.11

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



Plot 7.3.37 Radiated emission measurements at the third harmonic of mid carrier frequency ch.19

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.38 Radiated emission measurements at the third harmonic of high carrier frequency 1 ch.25

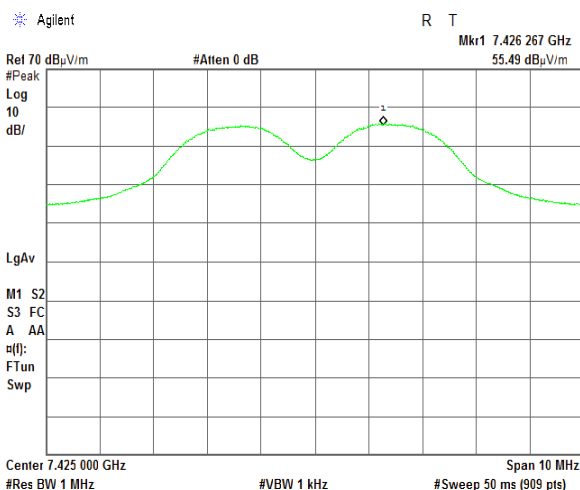
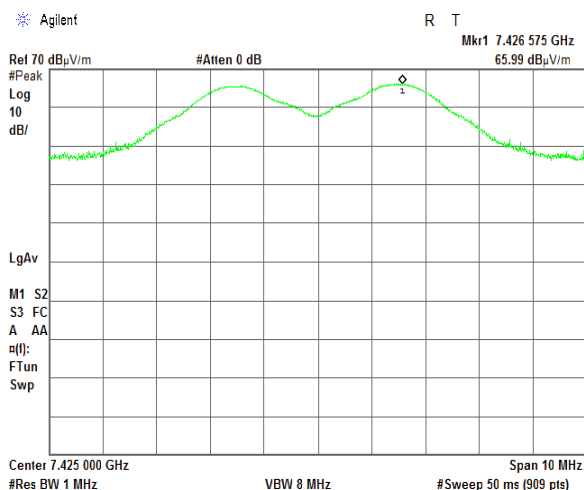
TEST SITE:

TEST DISTANCE:

ANTENNA POLARIZATION: Vertical & Horizontal

OATS

3 m



Plot 7.3.39 Radiated emission measurements at the third harmonic of high carrier frequency 2 ch.26

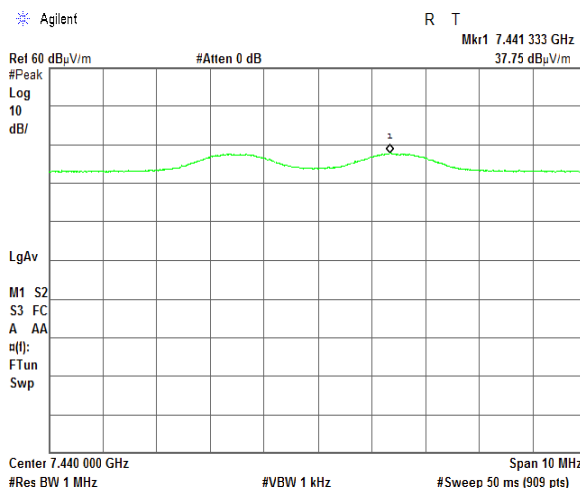
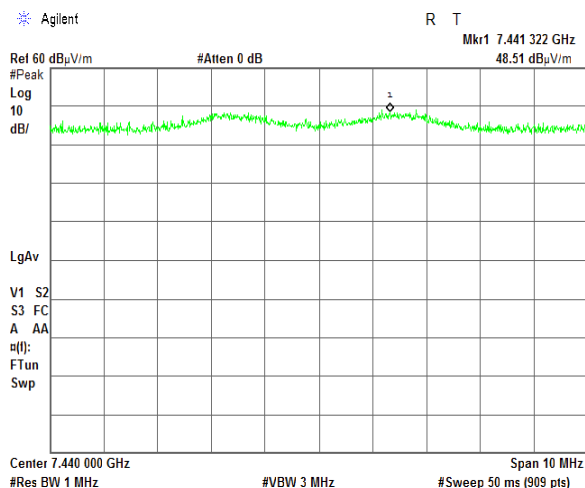
TEST SITE:

TEST DISTANCE:

ANTENNA POLARIZATION: Vertical & Horizontal

OATS

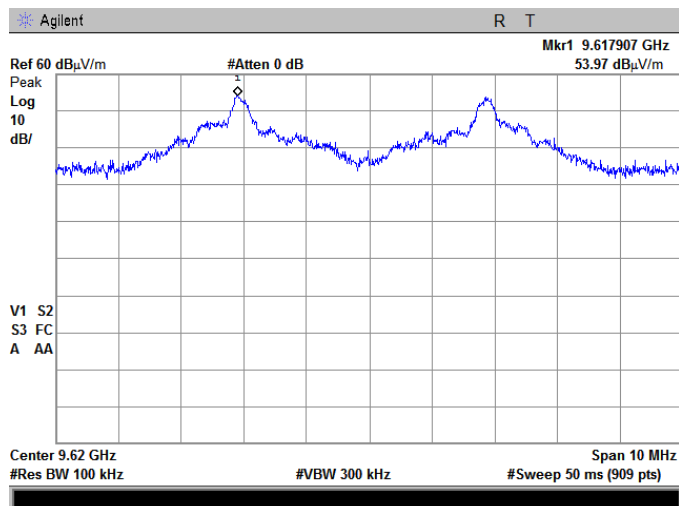
3 m



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

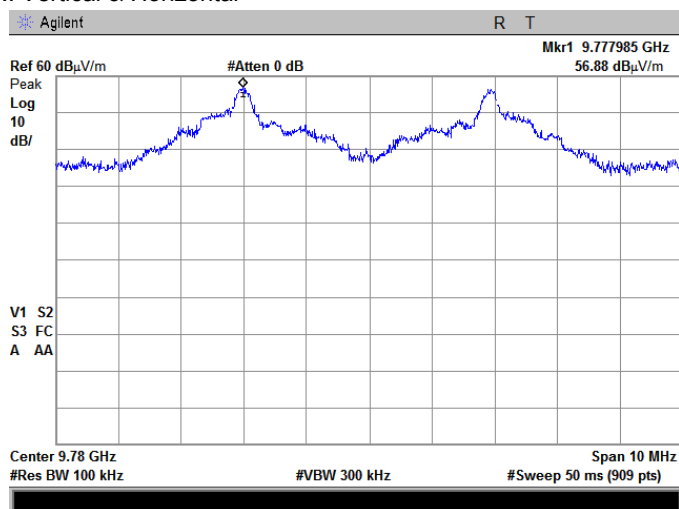
#### Plot 7.3.40 Radiated emission measurements at the 4th harmonic of low carrier frequency ch.11

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



#### Plot 7.3.41 Radiated emission measurements at the 4th harmonic of mid carrier frequency ch.19

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal

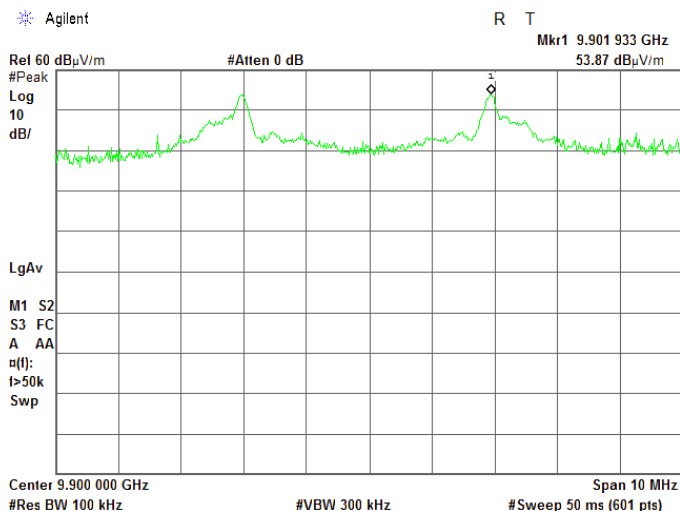




Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.42 Radiated emission measurements at the 4th harmonic of high carrier frequency 1 ch.25

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal

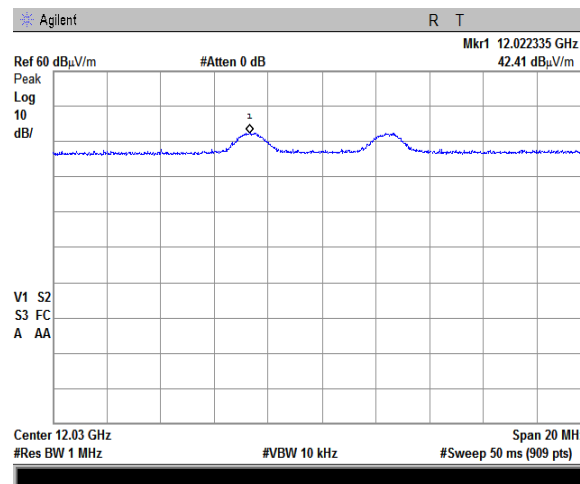
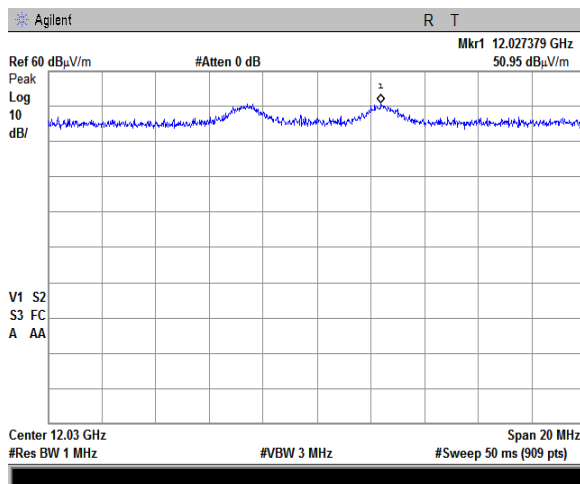


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.43 Radiated emission measurements at the 5th harmonic of low carrier frequency ch.11

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical & Horizontal

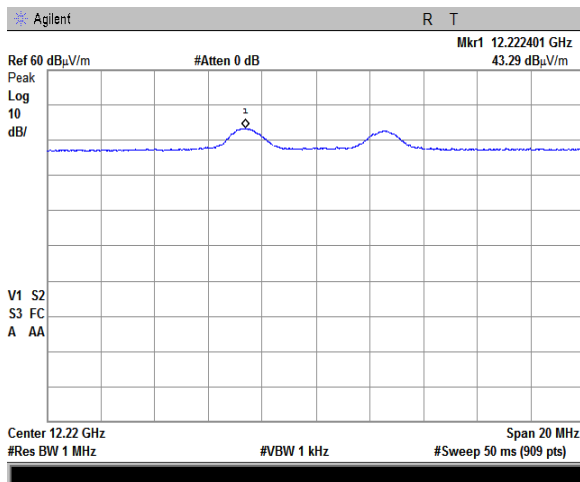
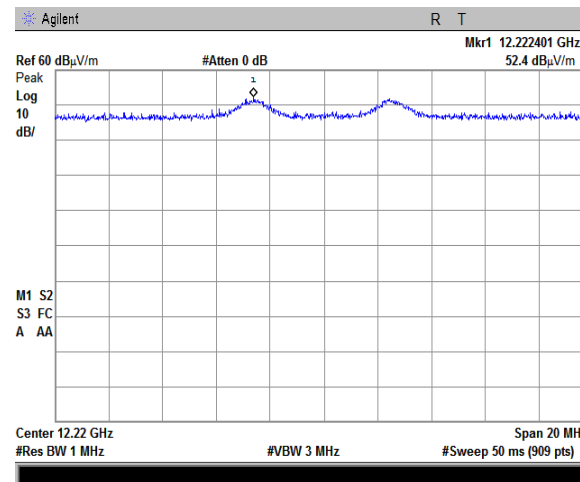
OATS  
3 m



Plot 7.3.44 Radiated emission measurements at the 5th harmonic of mid carrier frequency ch.19

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical & Horizontal

OATS  
3 m



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.45 Radiated emission measurements at the 5th harmonic of high carrier frequency 1 ch.25

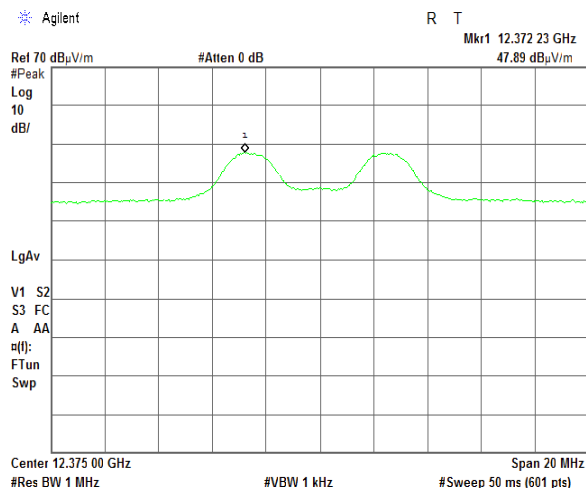
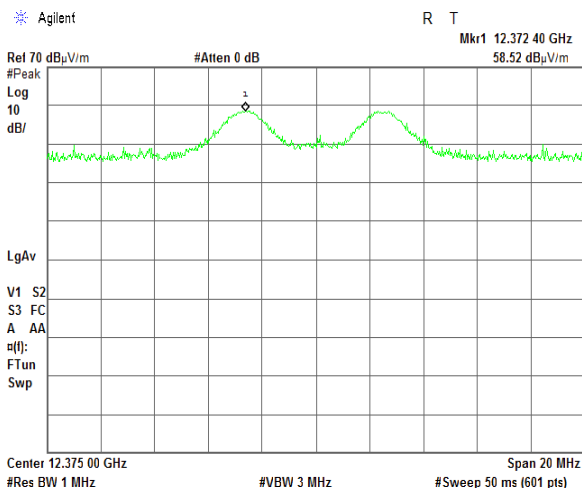
TEST SITE:

TEST DISTANCE:

ANTENNA POLARIZATION: Vertical & Horizontal

OATS

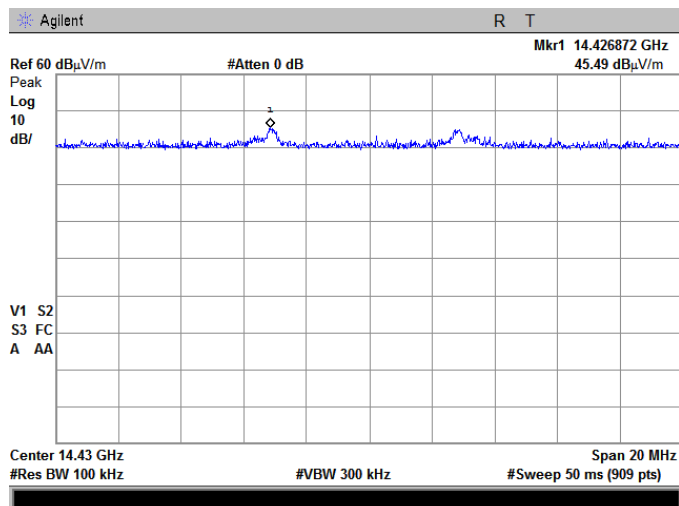
3 m



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

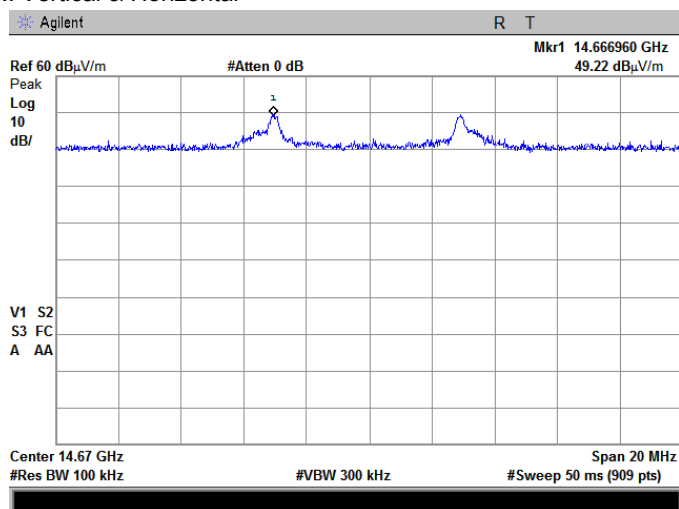
#### Plot 7.3.46 Radiated emission measurements at the 6th harmonic of low carrier frequency ch.11

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



#### Plot 7.3.47 Radiated emission measurements at the 6th harmonic of mid carrier frequency ch.19

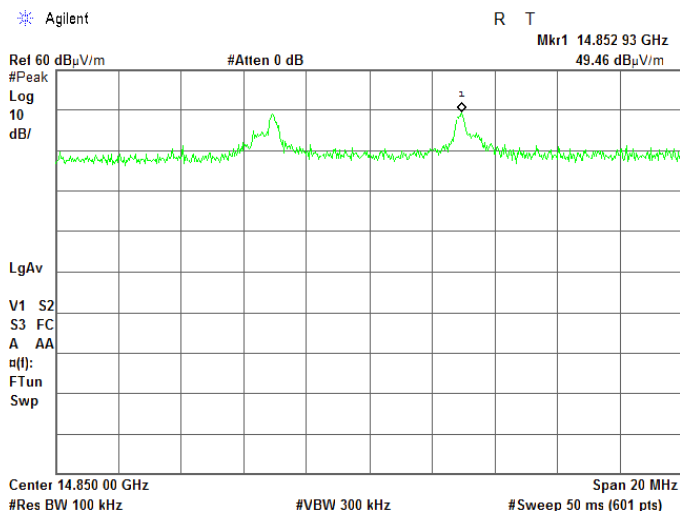
TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.48 Radiated emission measurements at the 6th harmonic of high carrier frequency 1 ch.25

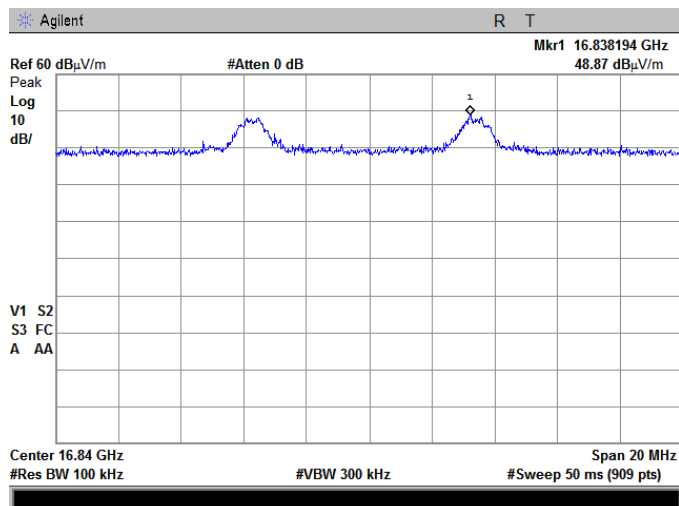
TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

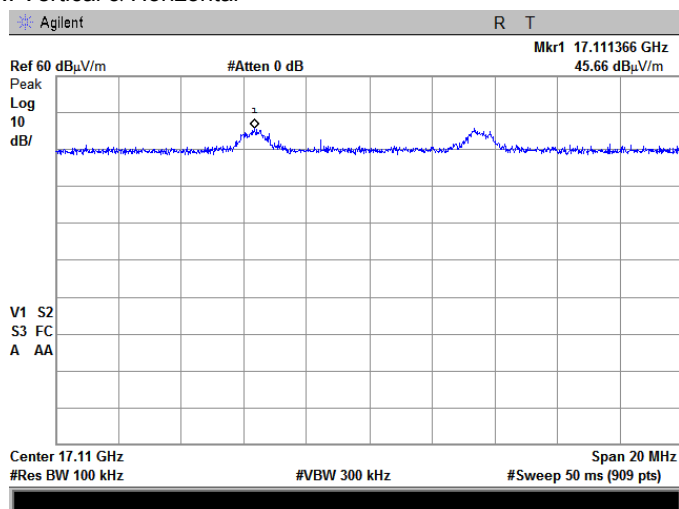
Plot 7.3.49 Radiated emission measurements at the 7th harmonic of low carrier frequency ch.11

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



Plot 7.3.50 Radiated emission measurements at the 7th harmonic of mid carrier frequency ch.19

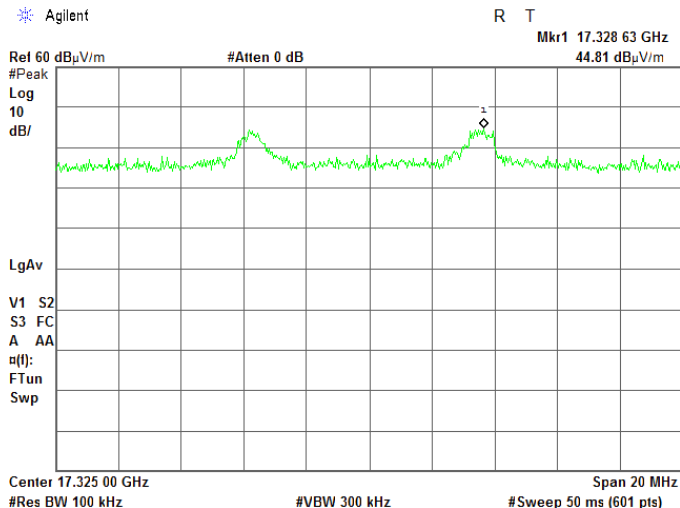
TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal



Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.51 Radiated emission measurements at the 7th harmonic of high carrier frequency 1 ch.25

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal

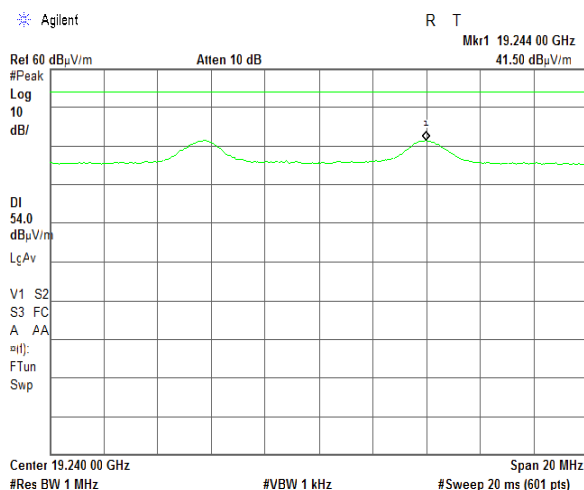
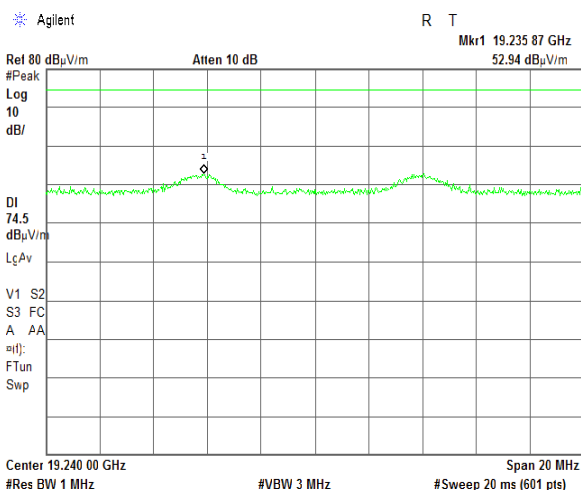


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.52 Radiated emission measurements at the 8th harmonic of low carrier frequency ch.11

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical & Horizontal

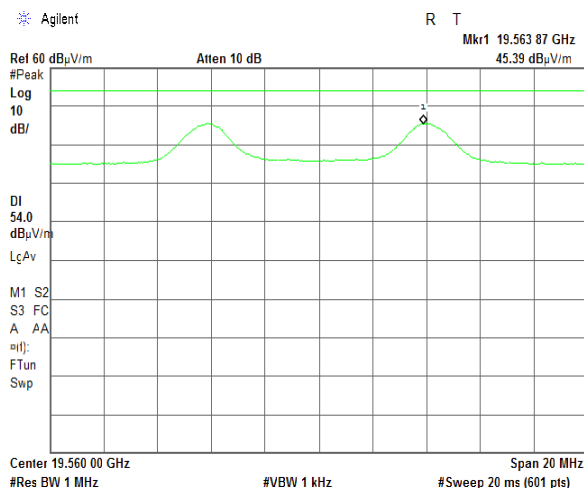
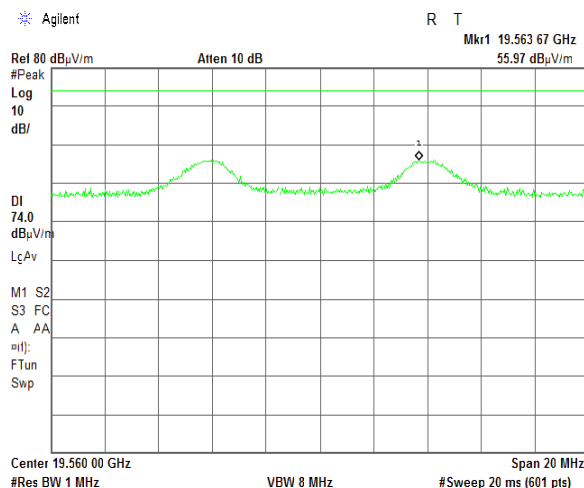
OATS  
3 m



Plot 7.3.53 Radiated emission measurements at the 8th harmonic of mid carrier frequency ch.19

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical & Horizontal

OATS  
3 m





Test specification:	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):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.54 Radiated emission measurements at the 8th harmonic of high carrier frequency 1 ch.25

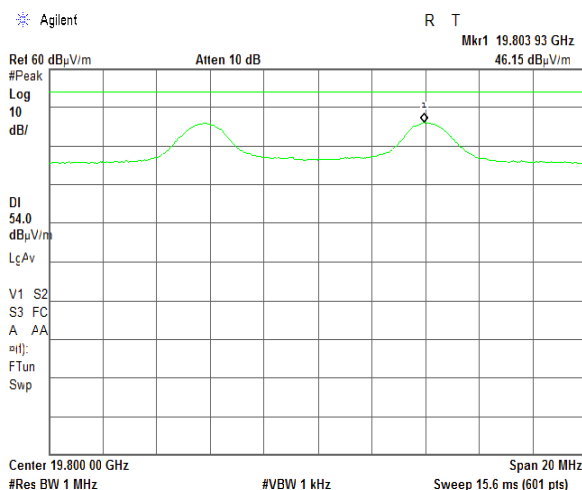
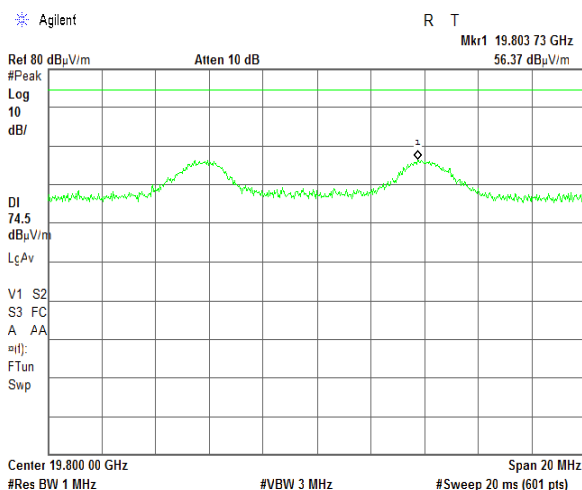
TEST SITE:

TEST DISTANCE:

ANTENNA POLARIZATION: Vertical & Horizontal

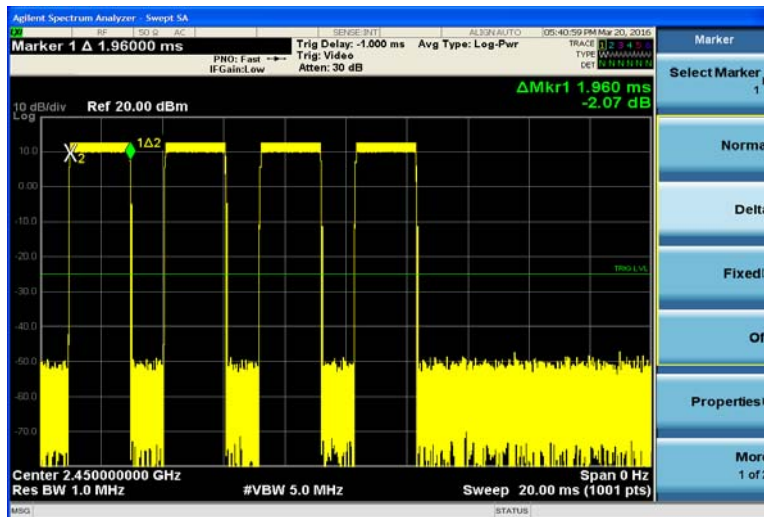
OATS

3 m

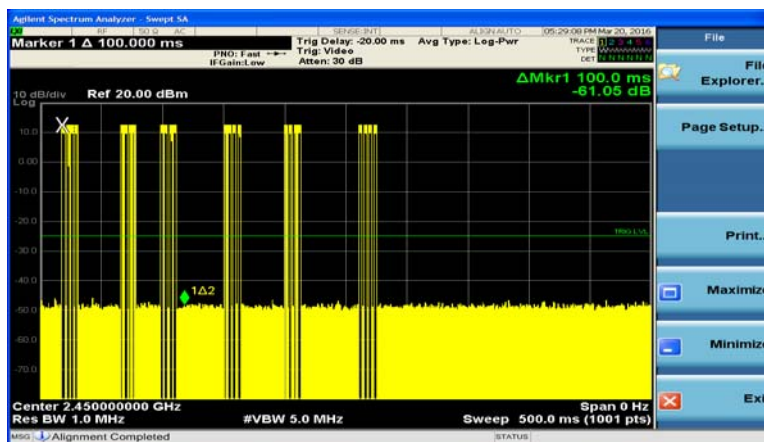


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1009 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.3.55 Transmission pulse duration



Plot 7.3.56 Transmission pulse period



<b>Test specification:</b>	<b>Section 15.247(d) / RSS-247 section 5.5, Band edge emissions</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.12.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	02-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

## 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			

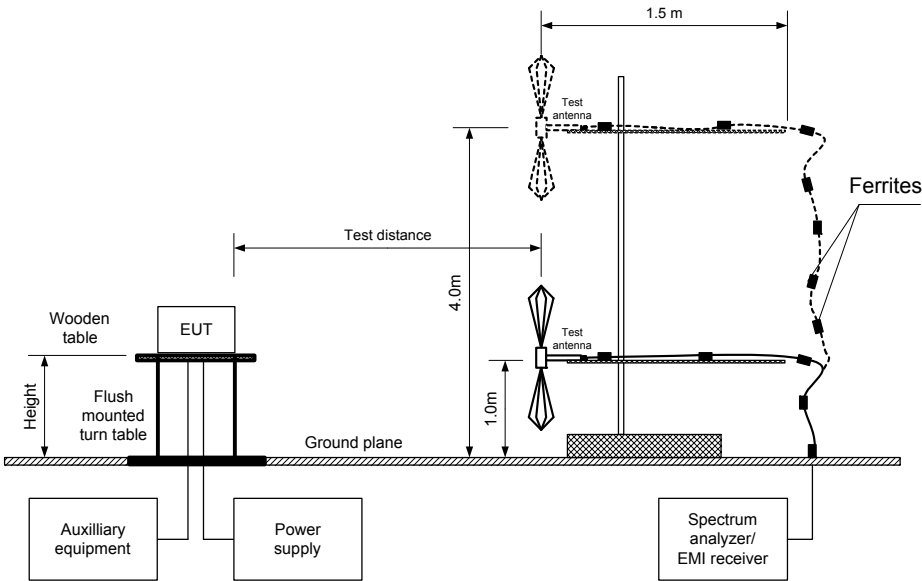
\* - Band edge emission limit is provided in terms of attenuation below the peak of modulated carrier measured with the same resolution bandwidth.

### 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.

Test specification:	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-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Figure 7.4.1 Band edge emission test setup



<b>Test specification:</b>	<b>Section 15.247(d) / RSS-247 section 5.5, Band edge emissions</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.12.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	02-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

**Table 7.4.2 Band edge emissions test results**

ASSIGNED FREQUENCY RANGE: 2400 - 2483.5 MHz  
DETECTOR USED: Peak  
MODULATION: OQPSK  
MODULATING SIGNAL: PRBS  
BIT RATE: 250 kbps  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
RESOLUTION BANDWIDTH: 100 kHz  
VIDEO BANDWIDTH: ≥ RBW

Frequency, MHz	Band edge emission, dBuV/m	Emission at carrier, dBuV/m	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
2400	71.86	111.30	39.44	20	19.44	Pass

\*- Margin = Attenuation below carrier – specification limit.

**Table 7.4.3 Band edge emissions above 1 GHz within restricted bands**

ASSIGNED FREQUENCY: 2400 - 2483.5 MHz  
TEST DISTANCE: 3 m  
MODULATION: OQPSK  
MODULATING SIGNAL: PRBS  
BIT RATE: 250 kbps  
DUTY CYCLE: 100 %  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
DETECTOR USED: Peak  
RESOLUTION BANDWIDTH: 1000 kHz  
TEST ANTENNA TYPE: Double ridged guide

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=1kHz)				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											
2389.8	Horizontal	1.6	30	61.12	74.0	-12.88	45.84	33.27	54.0	-20.73	Pass
High carrier frequency 1: Channel 25											
2483.5	Horizontal	1.9	30	66.09	74.0	-7.91	53.60	41.03	54.0	-12.97	Pass
High carrier frequency 2: Channel 26											
2483.5	Horizontal	1.1	40	73.28	74.0	-0.72	64.20	51.63	54.0	-2.37	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.

**Reference numbers of test equipment used**

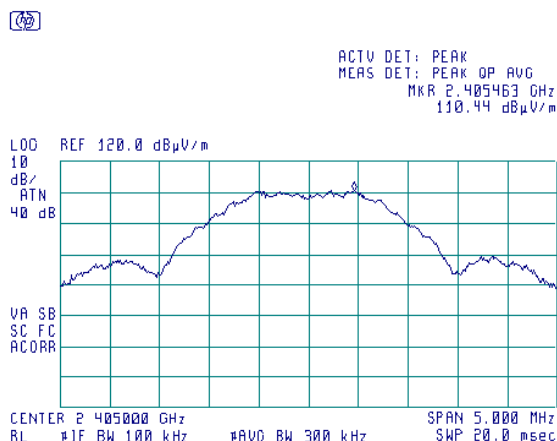
HL 0521	HL 1984	HL 3818	HL 4278	HL 4353			
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Full description is given in Appendix A.

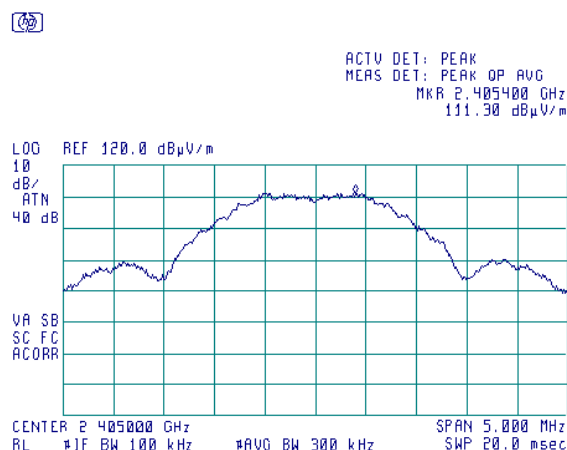
Test specification:	Section 15.247(d) / RSS-247 section 5.5, Band edge emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.4.1 The highest emission level within the assigned band at low carrier frequency ch.11

Antenna Polarization – Vertical



Antenna Polarization - Horizontal



Plot 7.4.2 The highest band edge emission at low carrier frequency ch.11

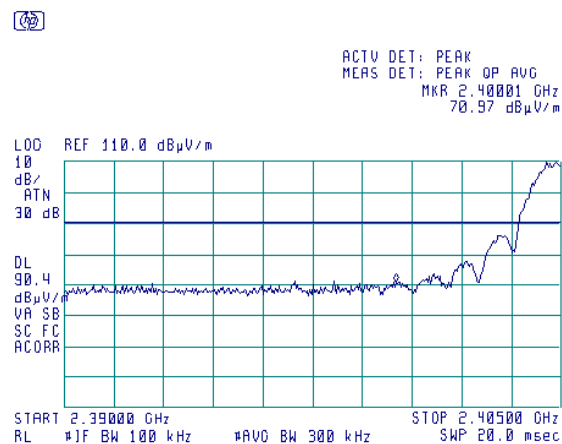
FREQUENCY RANGE:

2390 – 2400 MHz

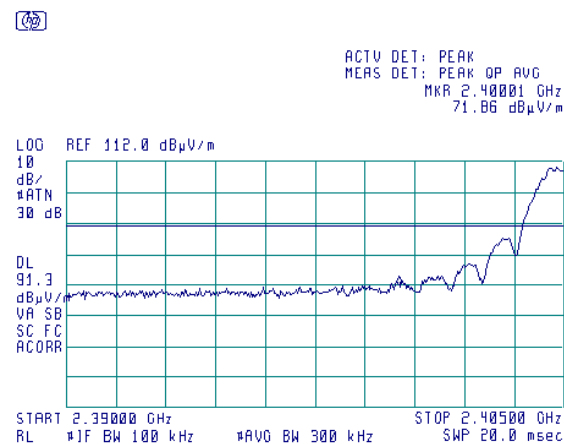
TEST DISTANCE:

3 m

Antenna Polarization – Vertical



Antenna Polarization - Horizontal

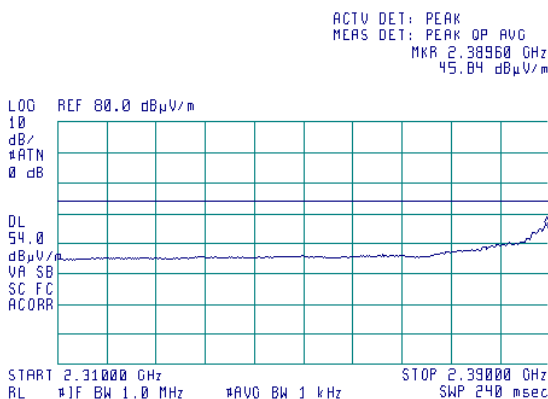
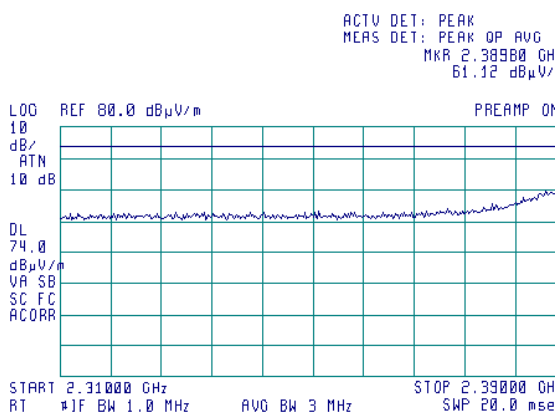


Test specification:	Section 15.247(d) / RSS-247 section 5.5, Band edge emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

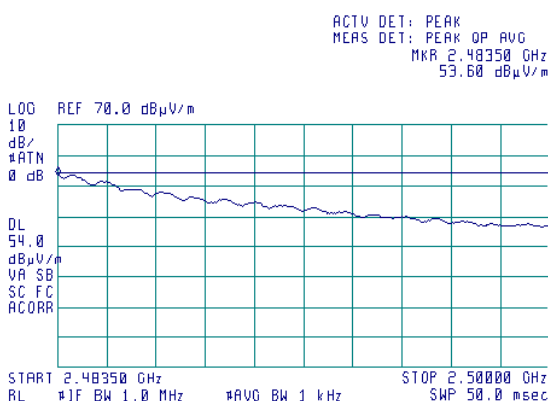
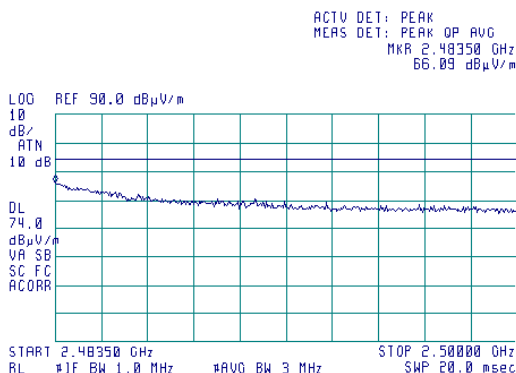
Plot 7.4.3 The highest band edge emission at low carrier frequency ch.11

FREQUENCY RANGE:  
TEST DISTANCE:

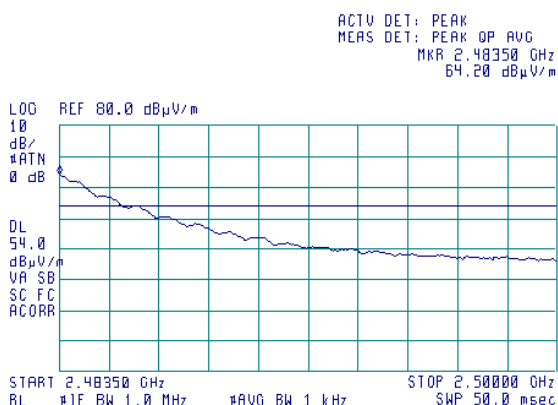
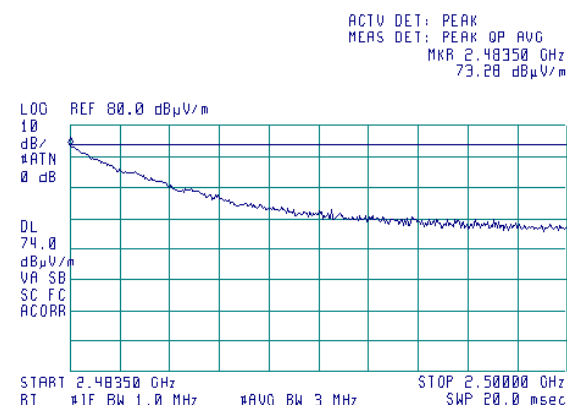
2310 – 2390 MHz  
3 m



Plot 7.4.4 The highest band edge emission at high carrier frequency 1 ch.25



Plot 7.4.5 The highest band edge emission at high carrier frequency 2 ch.26



<b>Test specification:</b>	<b>Section 15.247(e) / RSS-247 section 5.2(2), Peak power density</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.10.2		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	02-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

## 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:  $E = \sqrt{30 \times P} / r$ , 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° and the measuring antenna height was swept in both vertical and horizontal polarizations.

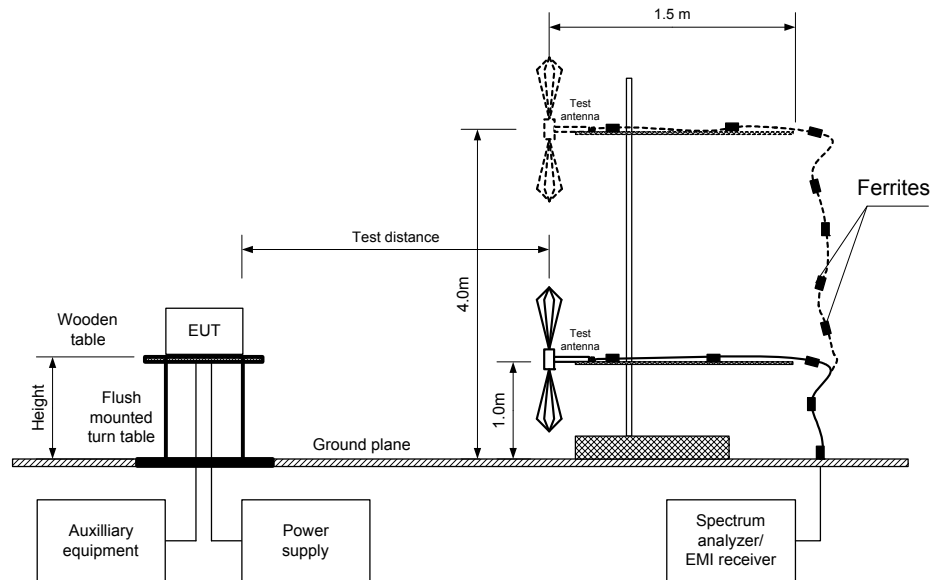
**7.5.2.4** The frequency span of spectrum analyzer was set to capture the entire 6 dB band of the transmitter, in peak hold mode with resolution bandwidth set to 3.0 kHz, video bandwidth wider than resolution bandwidth, auto sweep time and sufficient number of sweeps was allowed for trace stabilization. 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.



<b>Test specification:</b>	<b>Section 15.247(e) / RSS-247 section 5.2(2), Peak power density</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.10.2		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	02-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

**Figure 7.5.1 Setup for carrier field strength measurements**



<b>Test specification:</b>	<b>Section 15.247(e) / RSS-247 section 5.2(2), Peak power density</b>		
<b>Test procedure:</b>	ANSI C63.10 section 11.10.2		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	02-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

**Table 7.5.2 Field strength measurement of peak spectral power density**

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: Double ridged guide  
 MODULATION: OQPSK  
 BIT RATE: 250 kbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 EUT 6 dB BANDWIDTH: 1.6 MHz  
 RESOLUTION BANDWIDTH: 3 kHz  
 VIDEO BANDWIDTH: 10 kHz

Frequency, MHz	Field strength, dB(μV/m)	EUT antenna gain, dBi	Limit, dB(μV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
2405	99.87	0	103.23	-3.36	Horizontal	1.6	30	Pass
2445	98.49	0	103.23	-4.74	Horizontal	1.9	80	Pass
2475	99.15	0	103.23	-4.08	Horizontal	1.9	30	Pass
2480	91.26	0	103.23	-11.97	Horizontal	1.1	40	Pass

\*- Margin = Field strength - EUT antenna gain - calculated field strength limit.

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

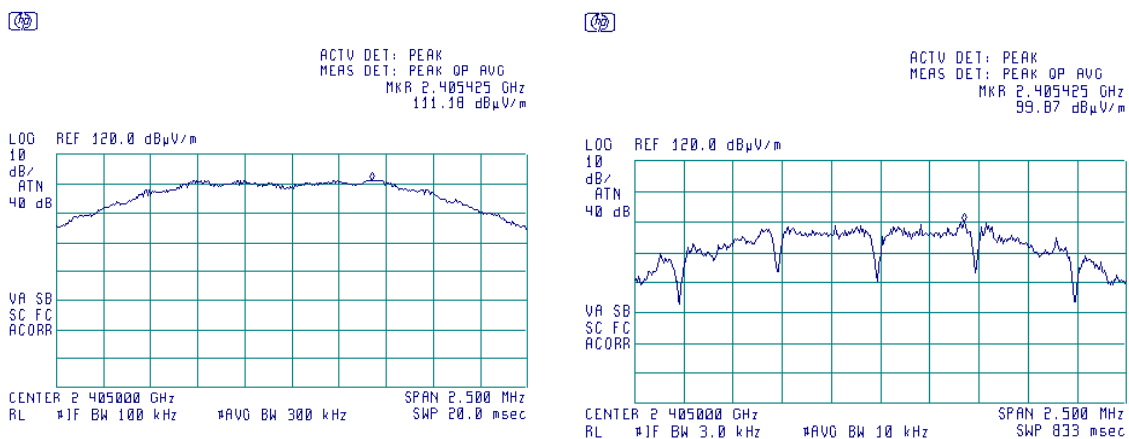
**Reference numbers of test equipment used**

HL 0521	HL 1984	HL 4278	HL 4353				
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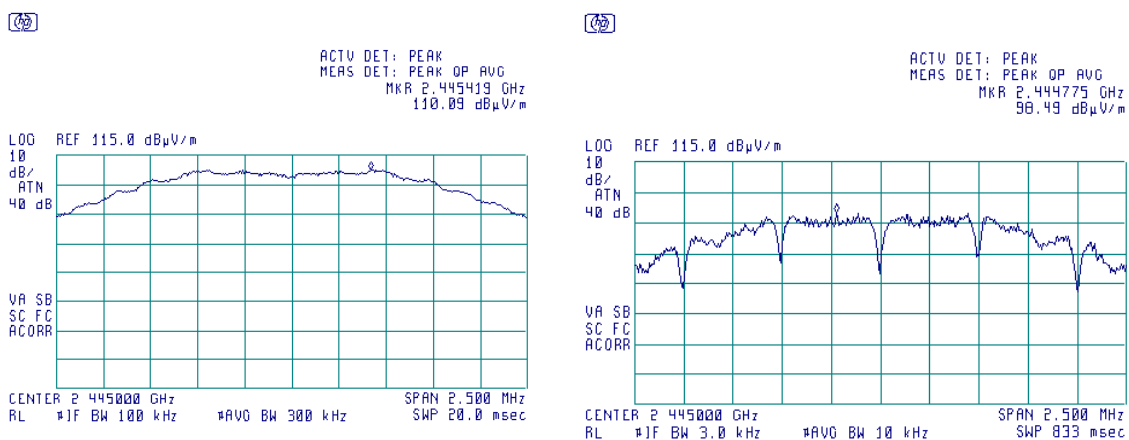
Full description is given in Appendix A.

Test specification:	Section 15.247(e) / RSS-247 section 5.2(2), Peak power density		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

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

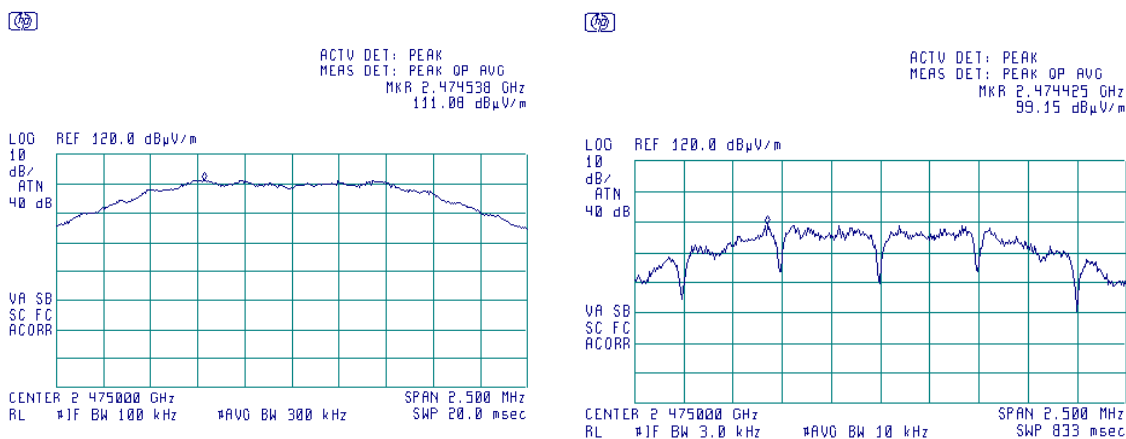


Plot 7.5.2 Peak spectral power density at mid frequency at the peak ch.19

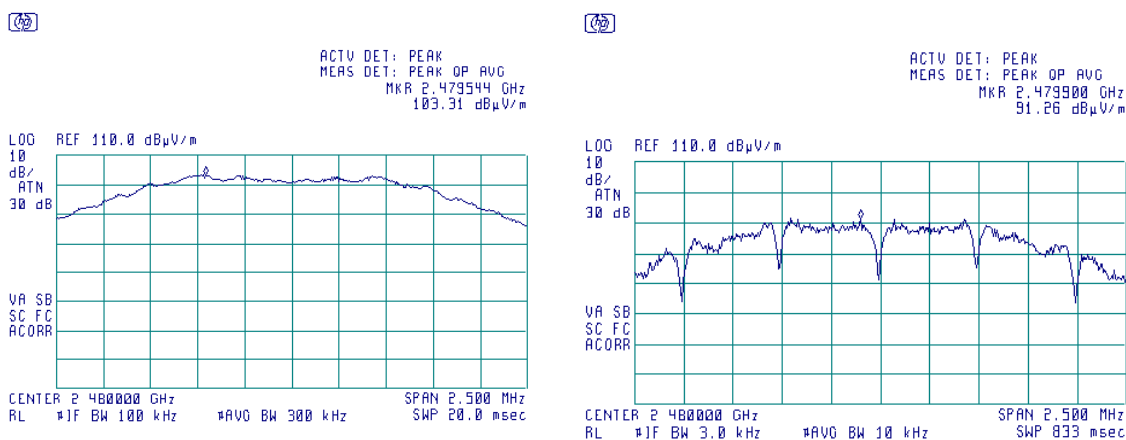


Test specification:	Section 15.247(e) / RSS-247 section 5.2(2), Peak power density		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.5.3 Peak spectral power density at high frequency 1 at the peak ch.25



Plot 7.5.4 Peak spectral power density at high frequency 2 at the peak ch.26



Test specification:	Section 15.203, RSS-Gen section 8.3, Antenna requirements		
Test procedure:			
Test mode:	Compliance	Verdict:	PASS
Date(s):	05-May-16		
Temperature: 23 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

## 7.6 Antenna requirements

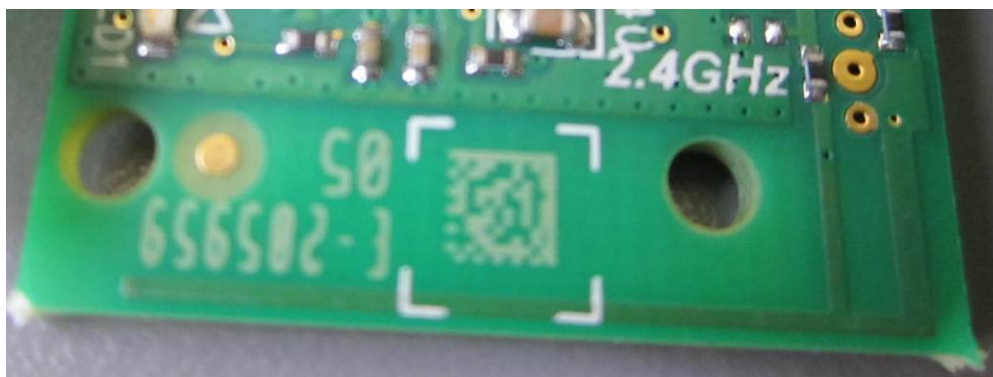
The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed 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.

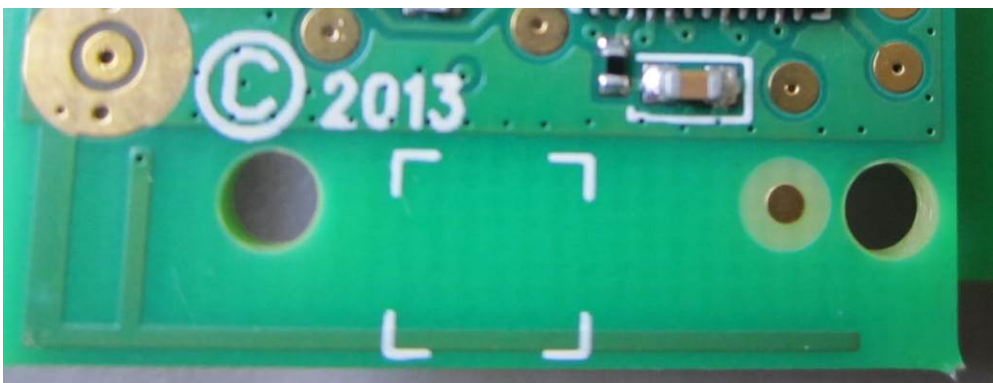
Table 7.6.1 Antenna requirements

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



Photograph 7.6.2 Antenna



<b>Test specification:</b>	<b>FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Class B, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	03-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

## 7.7 Radiated emission measurements

### 7.7.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 7.7.1, Table 7.6.2.

**Table 7.7.1 Radiated emission test limits**

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*
Above 960	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:  $\text{Lim}_{S2} = \text{Lim}_{S1} + 20 \log(S_1/S_2)$ , where  $S_1$  and  $S_2$  – standard defined and test distance respectively in meters.

**Table 7.7.2 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 - 5 <sup>th</sup> harmonic**	54.0

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

### 7.7.2 Test procedure

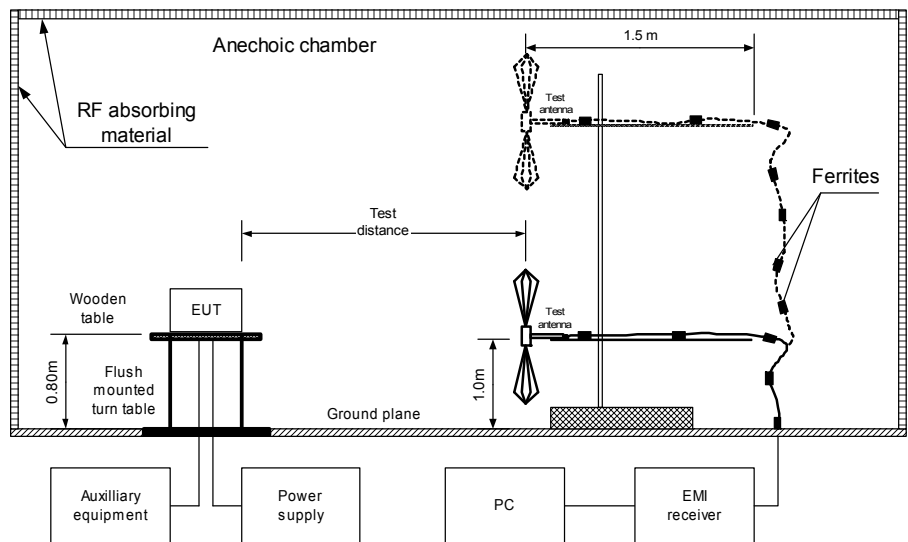
**7.7.2.1** The EUT was set up as shown in Figure 7.7.1, energized and the performance check was conducted.

**7.7.2.2** The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, 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.

**7.7.2.3** The worst test results (the lowest margins) were recorded in Table 7.7.3 and shown in the associated plots.

Test specification:	FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Class B, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	03-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Figure 7.7.1 Setup for radiated emission measurements in semi anechoic chamber, table-top equipment



Photograph 7.7.1 Setup for radiated emission measurements



<b>Test specification:</b>	<b>FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Class B, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	03-May-16 - 05-May-16		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1011 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3V battery
<b>Remarks:</b>			

**Table 7.7.3 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  
DETECTORS USED: PEAK / QUASI-PEAK  
RESOLUTION BANDWIDTH: 120 kHz

RECESSION BANDWIDTH:					125 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 emissions were found.								Pass

FREQUENCY RANGE: 1000 MHz – 13000 MHz  
DETECTORS USED: PEAK / AVERAGE  
RESOLUTION BANDWIDTH: 1000 kHz

Resolution Bandwidth:				1000 kHz			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
Frequency, MHz	Peak			Average						
	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
No emissions 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 1984	HL 4278	HL 4353	HL 4933		
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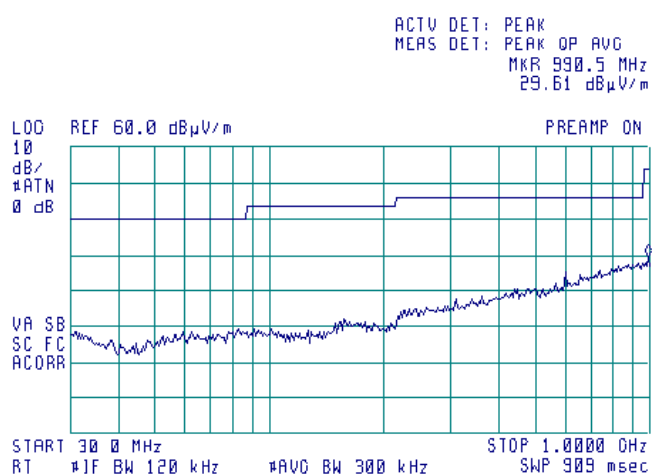
Full description is given in Appendix A.



Test specification:	FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Class B, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	03-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

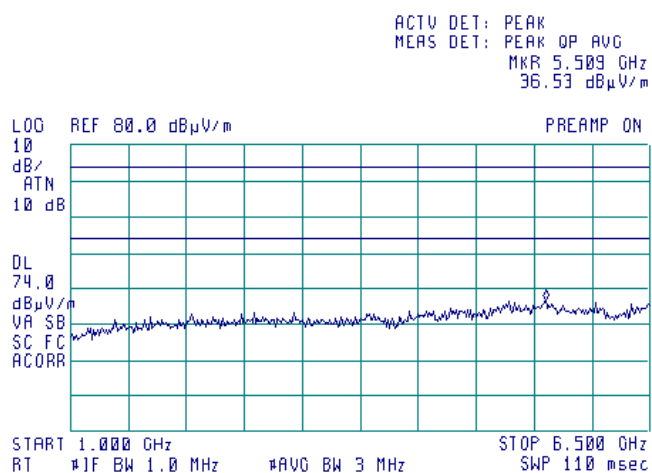
#### Plot 7.7.1 Radiated emission measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization

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



#### Plot 7.7.2 Radiated emission measurements in 1-6.5 GHz range, vertical & horizontal antenna polarization

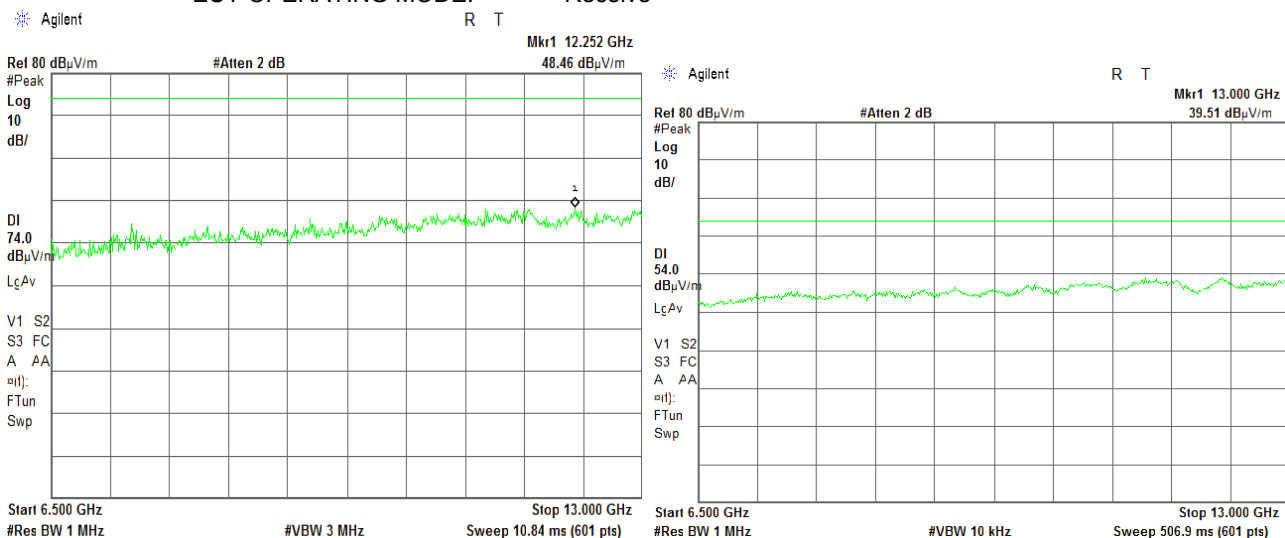
TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive



Test specification:	FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2 / ICES-003, Section 6.2, Class B, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	03-May-16 - 05-May-16		
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 50 %	Power Supply: 3V battery
Remarks:			

Plot 7.7.3 Radiated emission measurements in 6.5 - 13 GHz range, vertical & horizontal antenna polarization

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



## 8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./Check	Due Cal./Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	18-Jan-16	18-Jan-17
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A00319, 3448A00253	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	28-Mar-16	28-Mar-17
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY45102462	08-Sep-15	08-Sep-16
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	21-Feb-16	21-Feb-17
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	03-May-16	03-May-17
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	15-Feb-16	15-Feb-17
4222	High Pass Filter, 50 Ohm, 3150 to 6500 MHz	Mini-Circuits	VHF-2700+	NA	01-Oct-15	01-Oct-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	12025101003	15-Mar-16	15-Mar-17
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	04-Sep-15	04-Sep-16
4956	Active horn antenna, 18 to 40 GHz	COM-POWER CORPORATION	AHA-840	105004	09-Nov-15	09-Nov-16

## 9 APPENDIX B 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.

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.

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

## 11 APPENDIX D Test equipment correction factors

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

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

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

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

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

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

**Antenna factor**  
**Double-ridged 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( $\mu$ V) to convert it into field strength in dB( $\mu$ V/m).



Horn antenna factor  
COM-POWER CORPORATION, Model ANA-118  
Serial number 701046, HL 4933

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
1000	-16.0
1500	-13.9
2000	-12.1
2500	-12.0
3000	-11.4
3500	-10.9
4000	-10.1
4500	-8.8
5000	-6.3
5500	-5.4
6000	-4.8
6500	-3.1
7000	-2.7
7500	-1.8
8000	-1.0
8500	-0.5
9000	-0.8
9500	-1.3
10000	-0.6
10500	0.5
11000	0.5
11500	1.6
12000	0.5
12500	0.7
13000	0.0
13500	0.6
14000	1.1
14500	2.3
15000	0.9
15500	-0.6
16000	0.1
16500	0.0
17000	0.3
17500	2.7
18000	4.1

Antenna factor is to be added to receiver meter reading in dB( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).

Antenna factor, HL 4956



## Active Horn Antenna Factor Calibration

18 GHz to 40 GHz

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

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		

## 12 APPENDIX E 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: $\pm 1.7$ dB 12.4 GHz to 40 GHz: $\pm 2.3$ dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: $\pm 2.6$ dB 2.9 GHz to 6.46 GHz: $\pm 3.5$ dB 6.46 GHz to 13.2 GHz: $\pm 4.3$ dB 13.2 GHz to 22.0 GHz: $\pm 5.0$ dB 22.0 GHz to 26.8 GHz: $\pm 5.5$ dB 26.8 GHz to 40.0 GHz: $\pm 4.8$ dB
Occupied bandwidth	$\pm 8.0$ %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0$ %
Conducted emissions with LISN	9 kHz to 150 kHz: $\pm 3.9$ dB 150 kHz to 30 MHz: $\pm 3.8$ dB
Radiated emissions at 3 m measuring distance Horizontal polarization  Vertical polarization	Biconilog antenna: $\pm 5.3$ dB Biconical antenna: $\pm 5.0$ dB Log periodic antenna: $\pm 5.3$ dB Double ridged horn antenna: $\pm 5.3$ dB Biconilog antenna: $\pm 6.0$ dB Biconical antenna: $\pm 5.7$ dB Log periodic antenna: $\pm 6.0$ dB Double ridged horn antenna: $\pm 6.0$ 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.

## 13 APPENDIX F 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: 2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
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
ICES-003: 2016, Issue 6	Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement

END OF DOCUMENT