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# TEST REPORT

**ACCORDING TO: FCC 47CFR part 15 subpart C § 15.247 (FHSS) and subpart B  
RSS-247 issue 2, RSS-Gen issue 4, ICES-003 Issue 6:2016**

FOR:

**Digital Security Controls Ltd.  
Carbon Monoxide Detector  
Model: PG9933  
FCC ID:F5317PG9933  
IC: 160A-PG9933**

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:** Digital Security Controls Ltd.  
**Address:** 3301 Langstaff Road, Concord, Ontario L4K 4L2, Canada  
**Telephone:** 905-760-3000  
**Fax:** 905-760-3020  
**E-mail:** dnita@dsc.com  
**Contact name:** Mr. Dan Nita

## 2 Equipment under test attributes

**Product name:** Carbon Monoxide Detector  
**Product type:** Transceiver  
**Model(s):** PG9933  
**Serial number:** 88-030615  
**Hardware version:** 90-208642  
**Software release:** JS-703281  
**Receipt date:** 27-Jul-17

## 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:** 29932  
**Location:** Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel  
**Test started:** 27-Jul-17  
**Test completed:** 16-Aug-17  
**Test specification(s):** FCC 47CFR part 15, subpart C, §15.247(FHSS) and subpart B;  
RSS-247 issue 2, RSS-Gen issue 4, ICES-003 issue 6:2016

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
Section 15.247(a)1/ RSS-247 section 5.1(c), 20 dB bandwidth	Pass
Section 15.247(a)1/ RSS-247 section 5.1(b), Frequency separation	Pass
Section 15.247(a)1/ RSS-247 section 5.1(c), Number of hopping frequencies	Pass
Section 15.247(a)1/ RSS-247 section 5.1(c), Average time of occupancy	Pass
Section 15.247(b) / RSS-247 section 5.4(a), Peak output power	Pass
Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions	Pass
Section 15.247(d) / RSS-247 section 5.5, Emissions at band edges	Pass
Section 15.247(i)5/ RSS-102 section 2.5, RF exposure	Pass, the exhibit to the application of certification is provided
Section 15.203/ RSS-Gen section 8.3, Antenna requirements	Pass
Section 15.207(a) / RSS-Gen section 8.8, Conducted emission	Not required
<b>Unintentional emissions</b>	
Section 15.107/ICES-003, Section 6.1, Class B, Conducted emission at AC power port	Not required
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:DSCRAD\_FCC.29932.

	Name and Title	Date	Signature
<b>Tested by:</b>	Mrs. E. Pitt, test engineer Mr. A. Morozov, test engineer	August 16, 2017	
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	August 28 , 2017	
<b>Approved by:</b>	Mr. S. Samokha, project manager	August 31, 2017	



## 6 EUT description

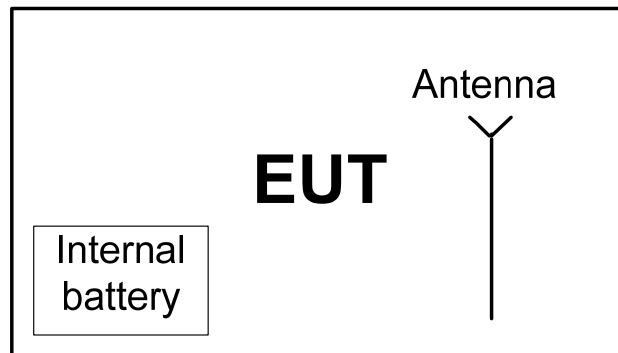
### 6.1 General information

The EUT is a carbon monoxide detector for PowerG Communications intended for the detection and measurement of combustible gases, toxic gases or oxygen. The EUT is equipped with an integral antenna.

### 6.2 Changes made in EUT

No changes were implemented in the EUT during the testing.

### 6.3 Test configuration





### 6.4 Transmitter characteristics

<b>Type of equipment</b>						
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)					
<b>Intended use</b>		<b>Condition of use</b>				
	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				
<b>Assigned frequency ranges</b>		902 – 928 MHz				
<b>Operating frequencies</b>		912.750 – 919.106 MHz				
<b>Maximum rated output power</b>		At transmitter 50 Ω RF output connector			dBm	
		Peak output power			13.6 dBm	
<b>Is transmitter output power variable?</b>		X	No			
			Yes	continuous variable		
			Yes	stepped variable with stepsize		
			Yes	minimum RF power		
			Yes	maximum RF power		
<b>Antenna connection</b>						
unique coupling		standard connector		X	integral	
				X	with temporary RF connector	
					without temporary RF connector	
<b>Antenna/s technical characteristics</b>						
Type	Manufacturer		Model number		Gain	
Integral	Ocean		H306097		-1 dBi	
<b>Transmitter aggregate data rate/s</b>		50 kbps				
<b>Type of modulation</b>		GFSK				
<b>Modulating test signal (baseband)</b>		PRBS				
<b>Transmitter power source</b>						
X	Battery	<b>Nominal rated voltage</b>	3.0 V	Battery type	CR123A	
	DC	<b>Nominal rated voltage</b>				
	AC mains	<b>Nominal rated voltage</b>		Frequency		
<b>Common power source for transmitter and receiver</b>				X	yes	
					no	
<b>Spread spectrum technique used</b>		X	Frequency hopping (FHSS)			
			Digital transmission system (DTS)			
			Hybrid			
<b>Spread spectrum parameters for transmitters tested per FCC 15.247 only</b>						
<b>FHSS</b>	Total number of hops		50			
	Bandwidth per hop		114.3 kHz			
	Max. separation of hops		407.5 kHz			



<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth			
<b>Test procedure:</b> ANSI C63.10, section 7.8.7			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

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

### 7.1 20 dB bandwidth

#### 7.1.1 General

This test was performed to measure the 20 dB bandwidth of the transmitter hopping channel. Specification test limits are given in Table 7.1.1.

Table 7.1.1 The 20 dB bandwidth limits

Assigned frequency, MHz	Maximum bandwidth, kHz	Modulation envelope reference points*, dBc
902.0 – 928.0	250	20
2400.0 – 2483.5	NA	
5725.0 – 5850.0	1000	

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

#### 7.1.2 Test procedure

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

7.1.2.2 The EUT was set to transmit modulated carrier at maximum data rate.

7.1.2.3 The transmitter bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.2 and associated plot.

Figure 7.1.1 The 20 dB bandwidth test setup





<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth			
<b>Test procedure:</b> ANSI C63.10, section 7.8.7			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Table 7.1.2 The 20 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 902-928 MHz  
DETECTOR USED: Peak  
SWEEP TIME: Auto  
VIDEO BANDWIDTH: ≥ RBW  
MODULATION ENVELOPE REFERENCE POINTS: 20.0 dBc  
FREQUENCY HOPPING: Disabled

Carrier frequency, MHz	Type of modulation	Data rate, kbps	Symbol rate, Msymbols/s	20 dB bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
912.750	GFSK	50	NA	114.268	250	-135.732	Pass
915.863				109.452	250	-140.548	Pass
919.106				112.918	250	-137.082	Pass

Reference numbers of test equipment used

HL 3001							
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Full description is given in Appendix A.

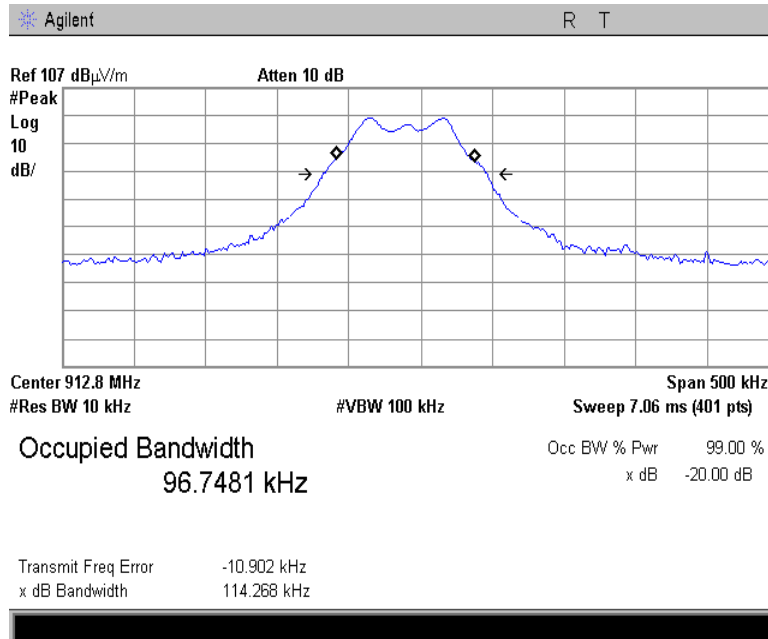




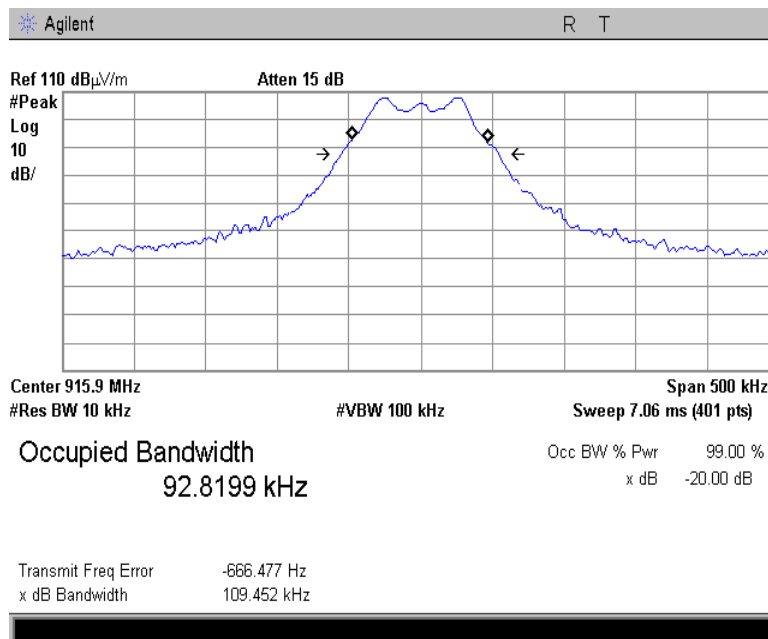
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<b>Test specification: Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth</b>			
<b>Test procedure:</b> ANSI C63.10, section 7.8.7			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.1.1 The 20 dB bandwidth test result at low frequency



Plot 7.1.2 The 20 dB bandwidth test result at mid frequency

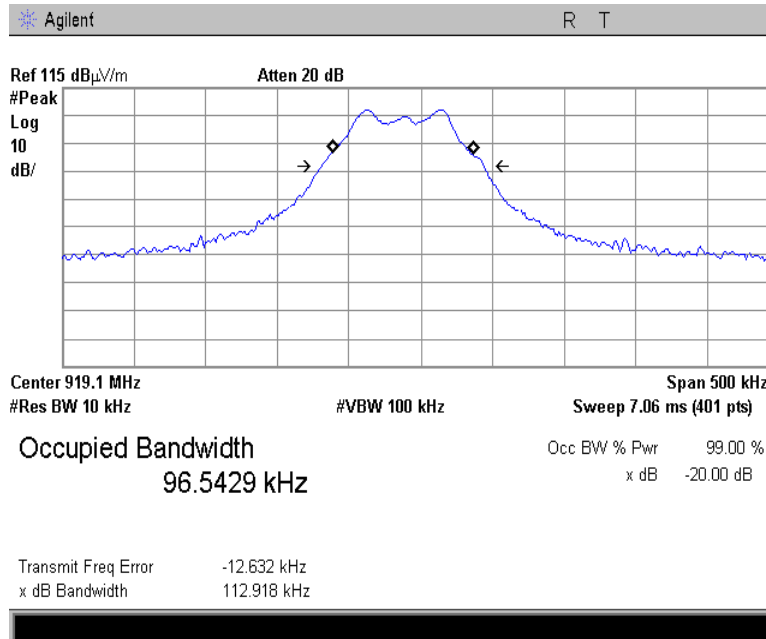




HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth			
<b>Test procedure:</b> ANSI C63.10, section 7.8.7			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.1.3 The 20 dB bandwidth test result at high frequency





<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(b), Frequency separation			
<b>Test procedure:</b> ANSI C63.10, section 7.8.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 31-Jul-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

## 7.2 Carrier frequency separation

### 7.2.1 General

This test was performed to measure frequency separation between the peaks of adjacent channels. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Carrier frequency separation limits

Assigned frequency range, MHz	Carrier frequency separation	
	Output power 30 dBm	Output power 21 dBm
902.0 – 928.0	25 kHz or 20 dB bandwidth of the hopping channel, whichever is greater	25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater
2400.0 – 2483.5		
5725.0 – 5850.0		

### 7.2.2 Test procedure

- 7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized with frequency hopping function enabled and its proper operation was checked.
- 7.2.2.2 The spectrum analyzer span was set to capture the carrier frequency and both of adjacent channels, the lower and the higher. The resolution bandwidth was set wider than 1 % of the frequency span.
- 7.2.2.3 The spectrum analyzer was set in max hold mode and allowed trace to stabilize.
- 7.2.2.4 The frequency separation between the peaks of adjacent channels was measured as provided in Table 7.2.2 and the associated plots.

Figure 7.2.1 Carrier frequency separation test setup





<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(b), Frequency separation			
<b>Test procedure:</b> ANSI C63.10, section 7.8.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 31-Jul-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Table 7.2.2 Carrier frequency separation test results

ASSIGNED FREQUENCY: 902-928 MHz  
 MODULATION: GFSK  
 BIT RATE: 50 kbps  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: ≥ 1% of the span  
 VIDEO BANDWIDTH: ≥ RBW  
 FREQUENCY HOPPING: Enabled  
 20 dB BANDWIDTH: 114.3 kHz

Carrier frequency separation, kHz	Limit, kHz	Margin*	Verdict
407.5	114.3	293.2	Pass

\* - Margin = Carrier frequency separation – specification limit.

Reference numbers of test equipment used

HL 3001	HL 4135						
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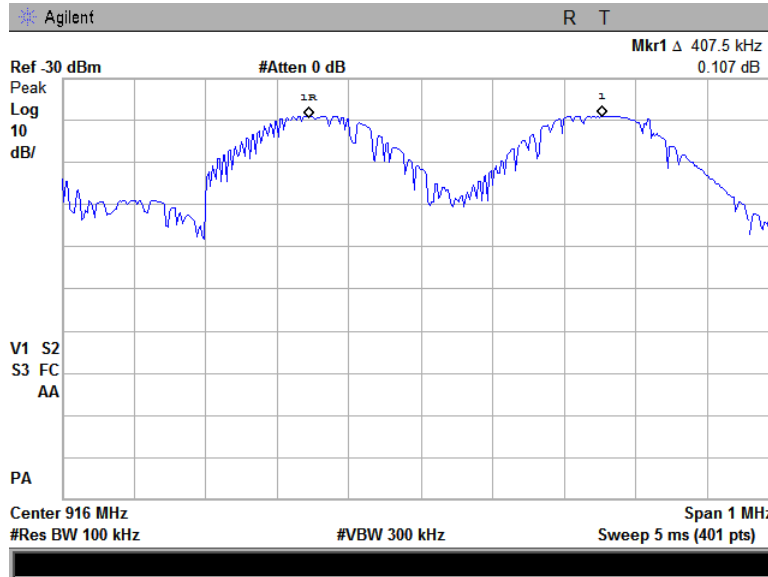
Full description is given in Appendix A.



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<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(b), Frequency separation			
<b>Test procedure:</b> ANSI C63.10, section 7.8.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 31-Jul-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.2.1 Carrier frequency separation





<b>Test specification: Section 15.247(a)1, RSS-247 section 5.1(c), Number of hopping frequencies</b>			
<b>Test procedure:</b> ANSI C63.10, section 7.8.3			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 31-Jul-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

### 7.3 Number of hopping frequencies

#### 7.3.1 General

This test was performed to calculate the number of hopping frequencies used by the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Minimum number of hopping frequencies

Assigned frequency range, MHz	Number of hopping frequencies
902.0 – 928.0	50 (if the 20 dB bandwidth is less than 250 kHz) 25 (if the 20 dB bandwidth is 250 kHz or greater)
2400.0 – 2483.5	15
5725.0 – 5850.0	75

#### 7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized with frequency hopping function enabled and its proper operation was checked.

7.3.2.2 Initially the spectrum analyzer span was set equal to frequency band of operation and the resolution bandwidth was set wider than 1 % of the frequency span. If the separate hopping channels were not clearly resolved the frequency band of operation was broken to sections and the resolution bandwidth was set wider than 1 % of the frequency span of each section.

7.3.2.3 The spectrum analyzer was set in max hold mode and allowed trace to stabilize.

7.3.2.4 The number of frequency hopping channels was calculated as provided in Table 7.3.2 and the associated plots.

Figure 7.3.1 Hopping frequencies test setup





<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Number of hopping frequencies			
<b>Test procedure:</b> ANSI C63.10, section 7.8.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 31-Jul-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Table 7.3.2 Hopping frequencies test results

ASSIGNED FREQUENCY: 902-928 MHz  
 MODULATION: GFSK  
 BIT RATE: 50 kbps  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: ≥ 1% of the span  
 VIDEO BANDWIDTH: ≥ RBW  
 FREQUENCY HOPPING: Enabled

Number of hopping frequencies	Minimum number of hopping frequencies	Margin*	Verdict
50	50	0	Pass

\* - Margin = Number of hopping frequencies – Minimum number of hopping frequencies.

Reference numbers of test equipment used

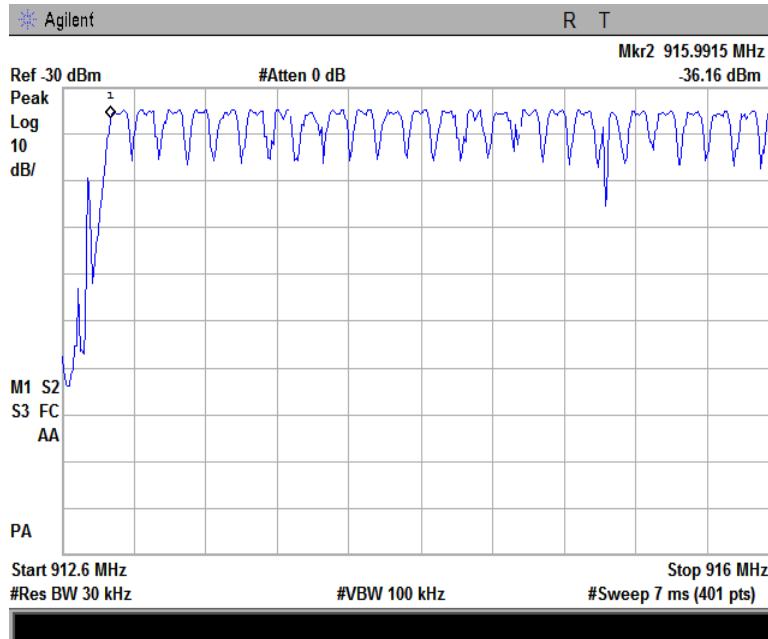
HL 3001	HL 4135						
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Full description is given in Appendix A.

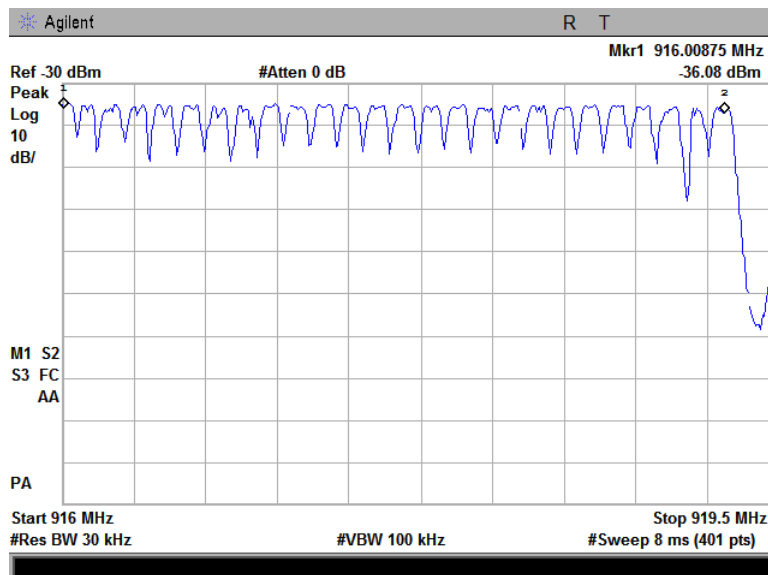


<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Number of hopping frequencies			
<b>Test procedure:</b> ANSI C63.10, section 7.8.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 31-Jul-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.3.1 Number of hopping frequencies



Plot 7.3.2 Number of hopping frequencies







<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Average time of occupancy			
<b>Test procedure:</b> ANSI C63.10, section 7.8.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

## 7.4 Average time of occupancy

### 7.4.1 General

This test was performed to calculate the average time of occupancy (dwell time) on any frequency channel of the EUT. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Average time of occupancy limits

Assigned frequency range, MHz	Maximum average time of occupancy, s	Investigated period, s	Number of hopping frequencies
902.0 – 928.0	0.4	20.0	≥ 50
902.0 – 928.0	0.4	10.0	< 50
2400.0 – 2483.5	0.4	0.4 × N	N (≥ 15)
5725.0 – 5850.0	0.4	30.0	≥ 75

### 7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized with frequency hopping function enabled and its proper operation was checked.

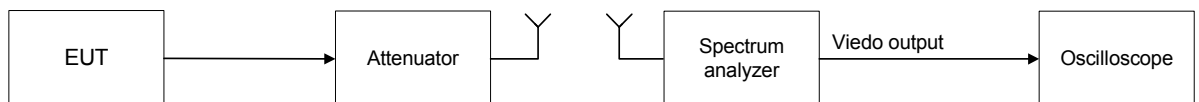
7.4.2.2 The spectrum analyzer span was set to zero centered on a hopping channel.

7.4.2.3 The single transmission duration and period were measured with oscilloscope.

7.4.2.4 The average time of occupancy was calculated as the single transmission time multiplied by the investigated period and divided by the single transmission period.

7.4.2.5 The test was repeated at each data rate and modulation type as provided in Table 7.4.2 and the associated plots.

Figure 7.4.1 Average time of occupancy test setup





<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Average time of occupancy			
<b>Test procedure:</b> ANSI C63.10, section 7.8.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Table 7.4.2 Average time of occupancy test results

ASSIGNED FREQUENCY: 902-928 MHz  
 MODULATION: GFSK  
 DETECTOR USED: Peak  
 NUMBER OF HOPPING FREQUENCIES: 50  
 INVESTIGATED PERIOD: 20 s  
 FREQUENCY HOPPING: Enabled

Carrier frequency, MHz	Single transmission duration, ms	Single transmission period, s	Average time of occupancy*, s	Bit rate, kbps	Symbol rate, Msymbol/s	Limit, s	Margin, s**	Verdict
915.863	5.7	9.735	0.02	50	NA	0.4	-0.38	Pass

\* - Average time of occupancy = 5.7 ms × 3 pulses (max in 20 s Investigated period).

\*\* - Margin = Average time of occupancy – specification limit.

Reference numbers of test equipment used

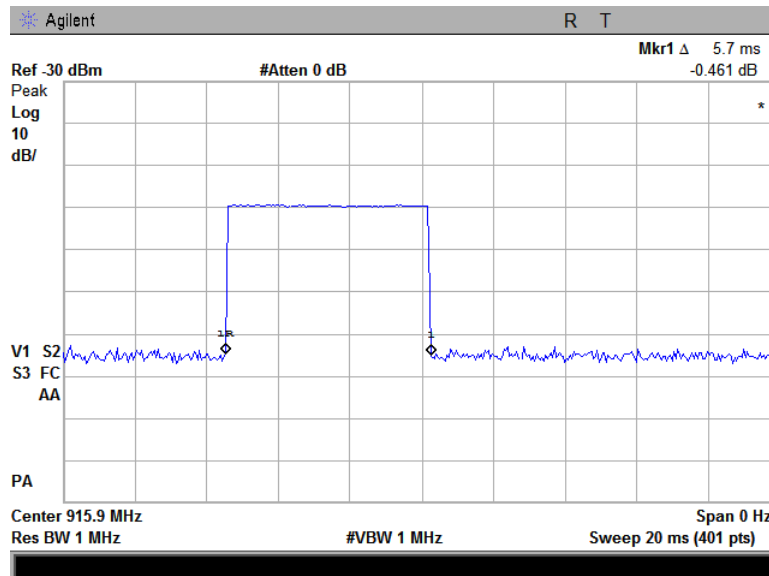
HL 3001	HL 4135						
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Full description is given in Appendix A.

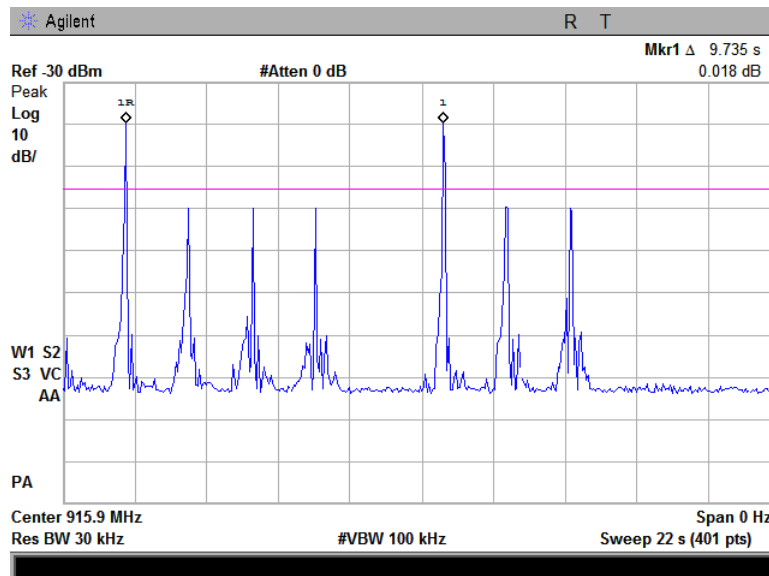


<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Average time of occupancy			
<b>Test procedure:</b> ANSI C63.10, section 7.8.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.4.1 Single transmission duration



Plot 7.4.2 Single transmission period





<b>Test specification: Section 15.247(b), RSS-247 section 5.4(a), Peak output power</b>			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 27-Jul-17 - 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

## 7.5 Peak output power

### 7.5.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Peak output power limits

Assigned frequency range, MHz	Peak output power*		Equivalent field strength limit @ 3m, dB(µV/m)*	Maximum antenna gain, dBi
	W	dBm		
902.0 – 928.0	0.25 (<50 hopping channels)	24.0(<50 hopping channels)	125.2 (<50 hopping channels)	6.0*
	1.0 (≥50 hopping channels)	30.0 (≥50 hopping channels)	131.2 (≥50 hopping channels)	
2400.0 – 2483.5	0.125 (<75 hopping channels)	21.0(<75 hopping channels)	122.2 (<75 hopping channels)	
	1.0 (≥75 hopping channels)	30.0 (≥75 hopping channels)	131.2 (≥75 hopping channels)	
5725.0 – 5850.0	1.0	30.0	131.2	

\*- 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.

\*\* - 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.

### 7.5.2 Test procedure

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 frequency span of spectrum analyzer was set approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. 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 maximum field strength of the EUT carrier frequency was measured as provided in Table 7.5.2 and associated plots.

7.5.2.5 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:

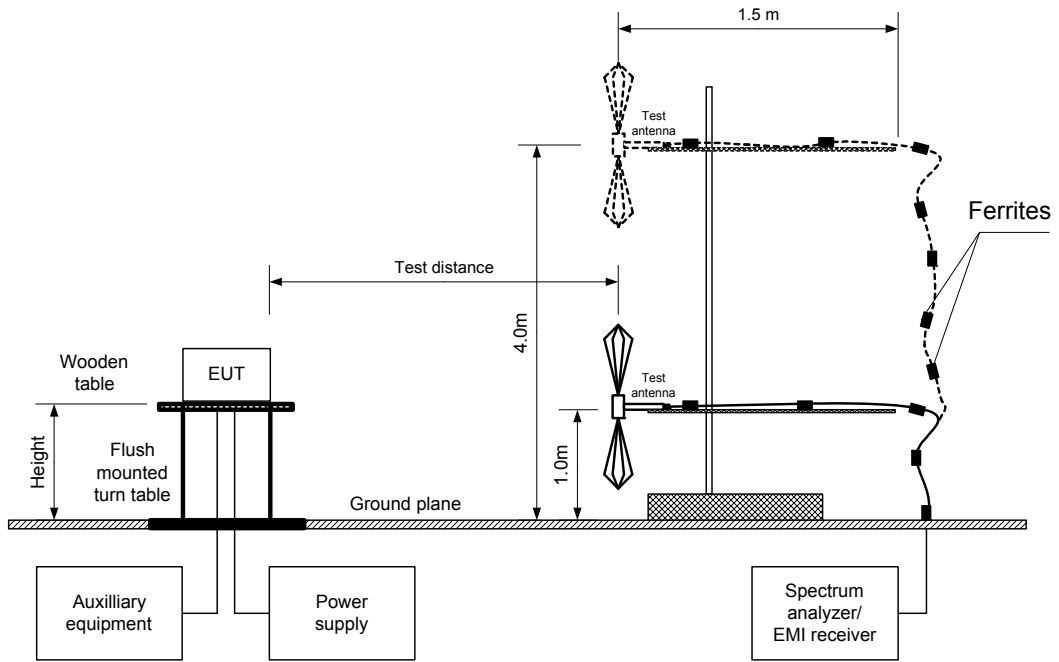
$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V/m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

7.5.2.6 The worst test results (the lowest margins) were recorded in Table 7.5.2.



<b>Test specification:</b> Section 15.247(b), RSS-247 section 5.4(a), Peak output power			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 27-Jul-17 - 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Figure 7.5.1 Setup for carrier field strength measurements





<b>Test specification:</b> Section 15.247(b), RSS-247 section 5.4(a), Peak output power			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 27-Jul-17 - 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Table 7.5.2 Peak output power test results

ASSIGNED FREQUENCY: 902-928 MHz  
TEST DISTANCE: 3 m  
TEST SITE: Semi anechoic chamber  
EUT HEIGHT: 0.8 m  
DETECTOR USED: Peak  
TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)  
Double ridged guide (above 1000 MHz)  
MODULATION: GFSK  
BIT RATE: 50 kbps  
DETECTOR USED: Peak  
EUT 20 dB BANDWIDTH: 114.3 kHz  
RESOLUTION BANDWIDTH: 120 MHz  
VIDEO BANDWIDTH: 300 MHz  
FREQUENCY HOPPING: Disabled  
NUMBER OF FREQUENCY HOPPING CHANNELS: 50

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
912.750	107.2	Horizontal	1.0	143	-1	13.0	30	-17.0	Pass
915.863	107.8	Horizontal	1.0	120	-1	13.6	30	-16.4	Pass
919.106	107.5	Horizontal	1.4	180	-1	13.3	30	-16.7	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 0604	HL 4280	HL 4353				
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Full description is given in Appendix A.

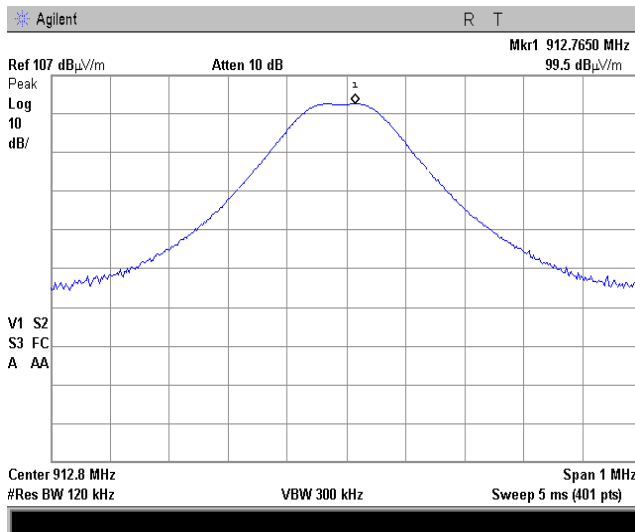


HERMON LABORATORIES

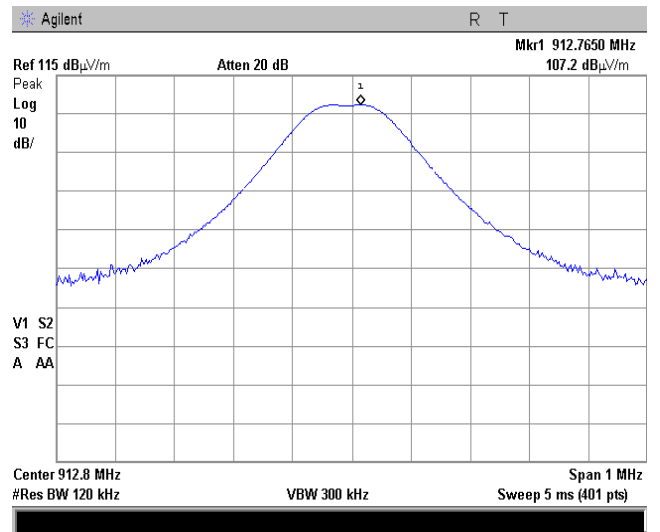
<b>Test specification:</b> Section 15.247(b), RSS-247 section 5.4(a), Peak output power			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 27-Jul-17 - 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.5.1 Field strength of carrier at low frequency

EUT Position – Horizontal

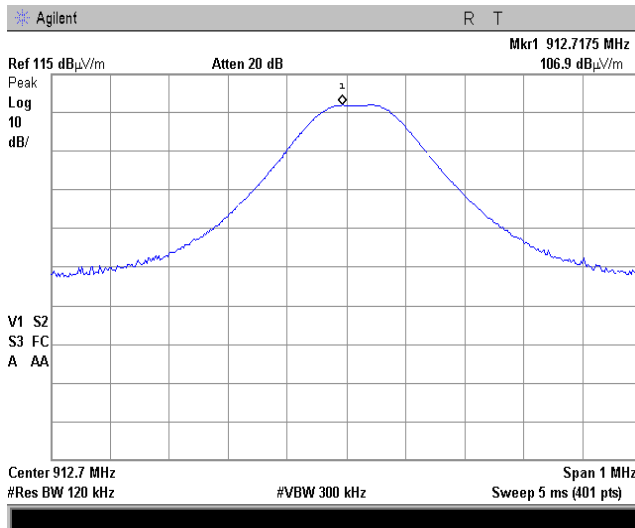


Vertical Antenna Polarization

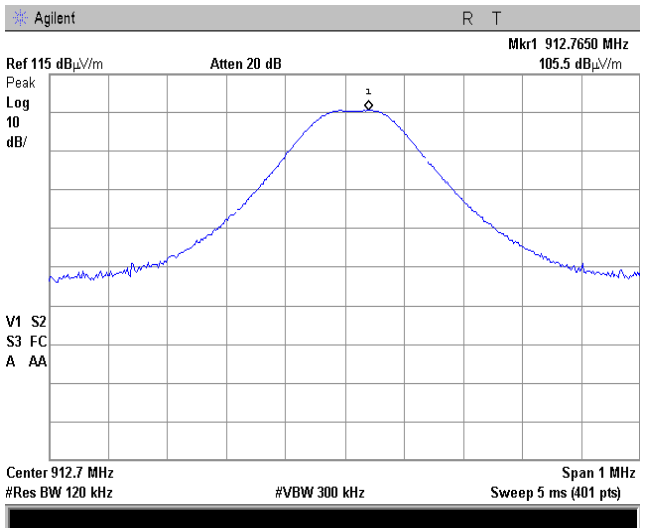


Horizontal antenna polarization

EUT Position – Vertical



Vertical Antenna Polarization



Horizontal antenna polarization

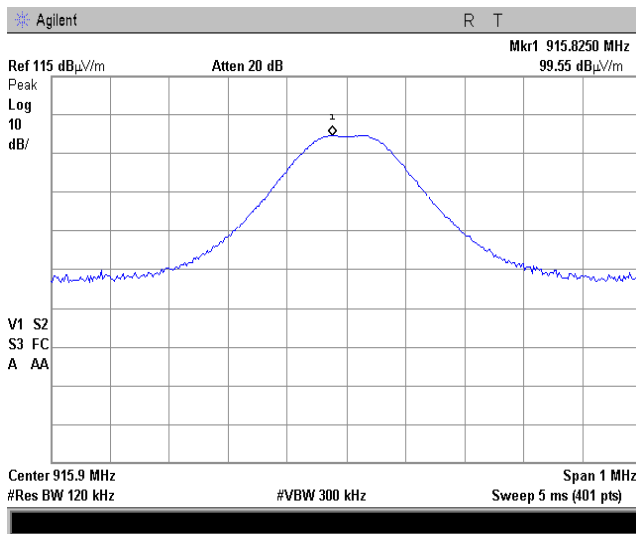


HERMON LABORATORIES

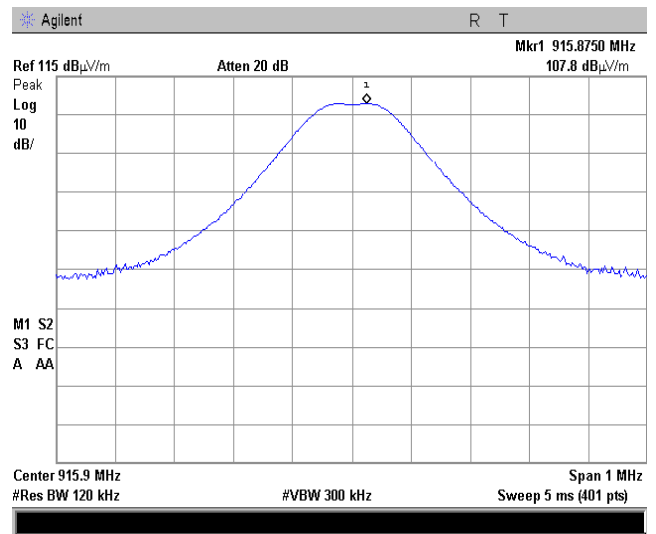
<b>Test specification:</b> Section 15.247(b), RSS-247 section 5.4(a), Peak output power			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 27-Jul-17 - 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.5.2 Field strength of carrier at mid frequency

EUT Position – Horizontal

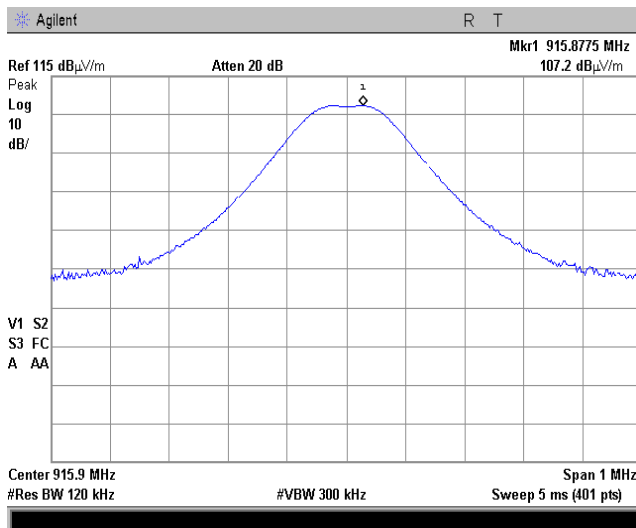


Vertical Antenna Polarization

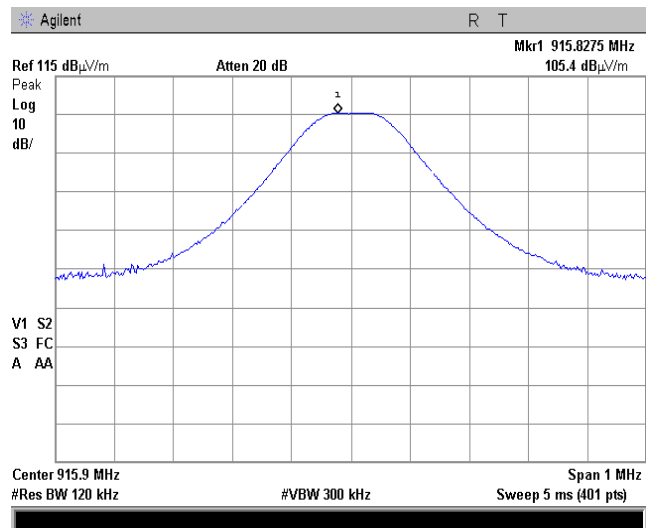


Horizontal antenna polarization

EUT Position – Vertical



Vertical Antenna Polarization



Horizontal antenna polarization



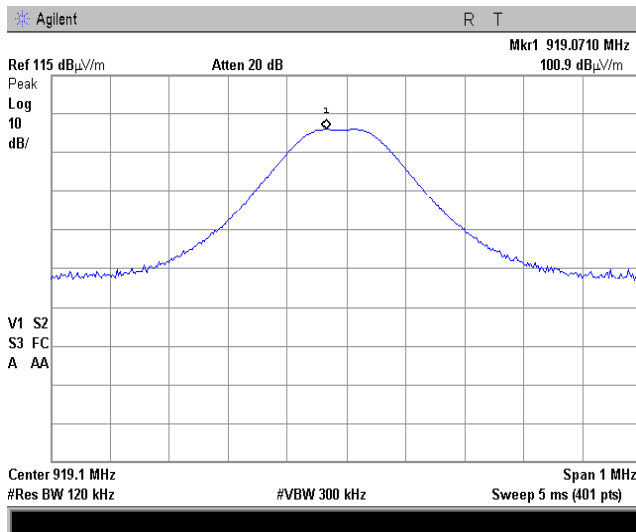


HERMON LABORATORIES

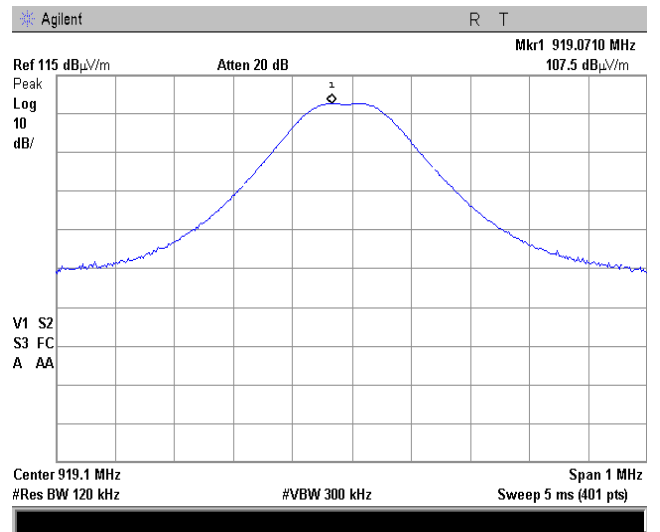
<b>Test specification:</b> Section 15.247(b), RSS-247 section 5.4(a), Peak output power			
<b>Test procedure:</b> ANSI C63.10, section 7.8.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 27-Jul-17 - 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.5.3 Field strength of carrier at high frequency

EUT Position – Horizontal

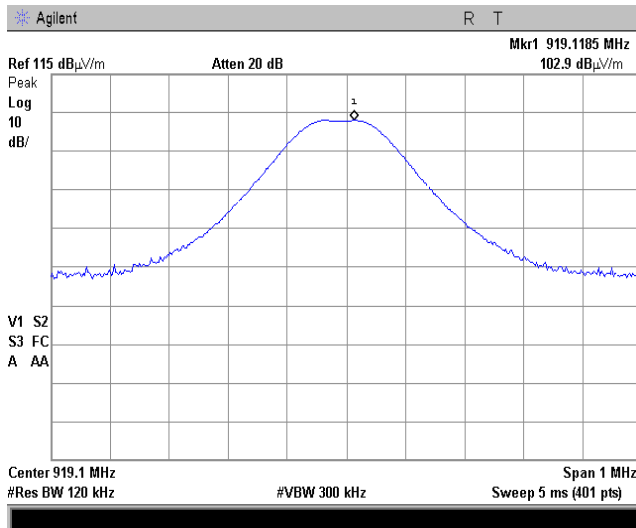


Vertical Antenna Polarization

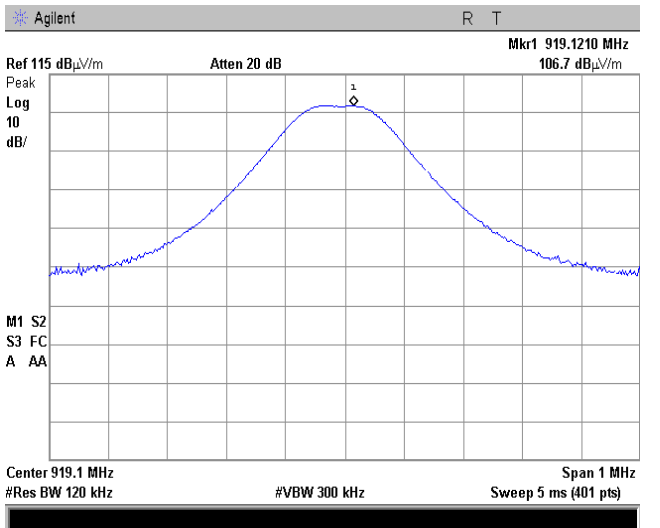


Horizontal antenna polarization

EUT Position – Vertical



Vertical Antenna Polarization



Horizontal antenna polarization



<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

## 7.6 Field strength of spurious emissions

### 7.6.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m) <sup>***</sup>			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc <sup>***</sup>
	Peak	Quasi Peak	Average	
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5 <sup>**</sup>	20.0
0.090 – 0.110	NA	108.5 – 106.8 <sup>**</sup>	NA	
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8 <sup>**</sup>	
0.490 – 1.705	NA	73.8 – 63.0 <sup>**</sup>	NA	
1.705 – 30.0 <sup>*</sup>		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:

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

where S<sub>1</sub> and S<sub>2</sub> – 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.

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

7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and the performance check was conducted.

7.6.2.2 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.

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

### 7.6.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.6.3.1 The EUT was set up as shown in Figure 7.6.2, Figure 7.6.3, energized and the performance check was conducted.

7.6.3.2 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.

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



<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Figure 7.6.1 Setup for spurious emission field strength measurements below 30 MHz

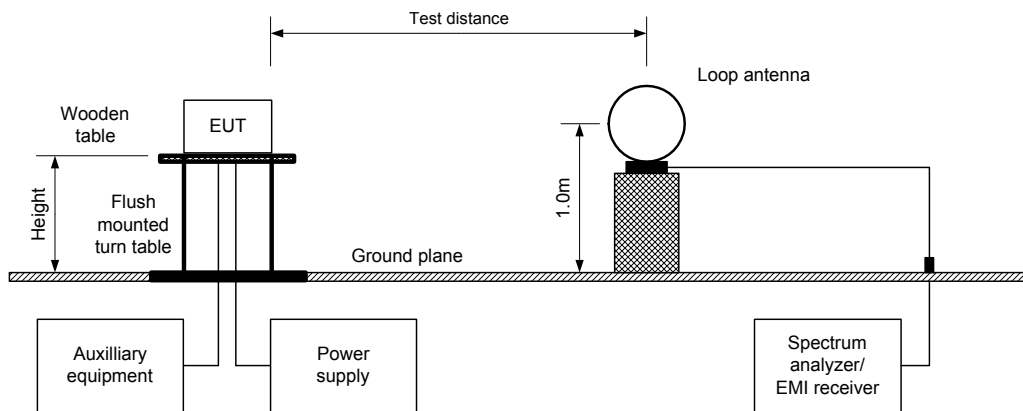
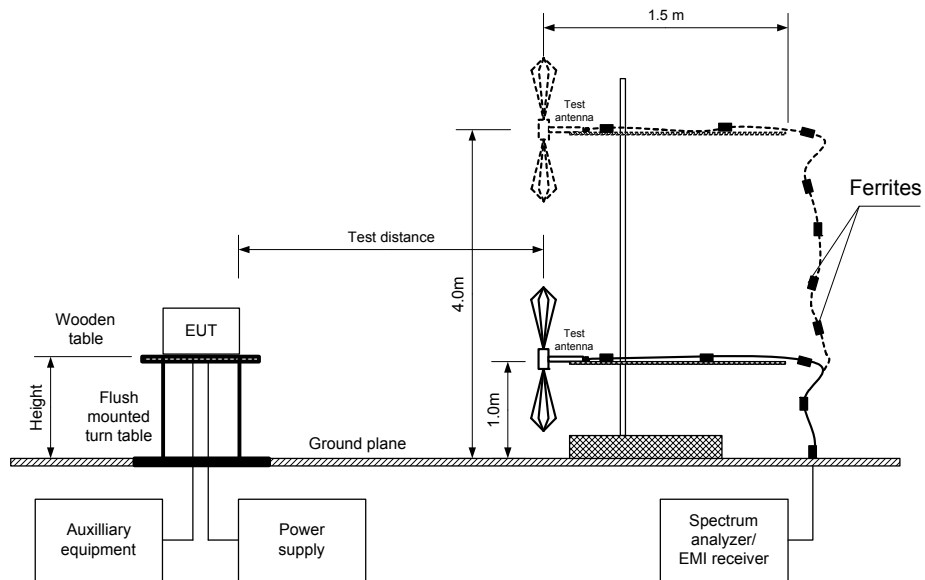


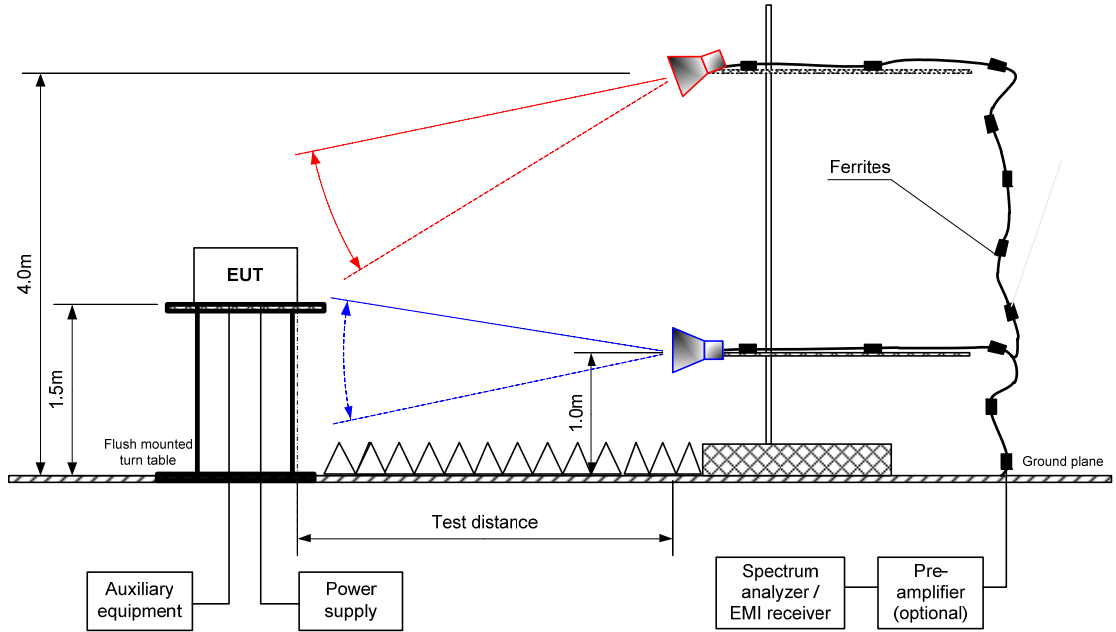
Figure 7.6.2 Setup for spurious emission field strength measurements from 30 to 1000 MHz





<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Figure 7.6.3 Setup for spurious emission field strength measurements above 1000 MHz





<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Table 7.6.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY: 902-928 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 9200 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 50 kbps  
 DUTY CYCLE: 100 %  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconical (30 MHz – 200 MHz)  
 Log periodic (200 MHz – 1000 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)  
 FREQUENCY HOPPING: Disabled

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
<b>Low carrier frequency</b>									
1825.5125	54.07	Horizontal	1.3	308	107.2	53.13	20.0	33.13	Pass
<b>Mid carrier frequency</b>									
1831.7000	55.59	Horizontal	1.4	80	107.7	52.11	20.0	32.11	Pass
<b>High carrier frequency</b>									
1838.1660	52.61	Horizontal	1.0	0	107.6	54.99	20.0	34.99	Pass

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



<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

**Table 7.6.3 Field strength of spurious emissions above 1 GHz within restricted bands**

ASSIGNED FREQUENCY: 902-928 MHz  
 INVESTIGATED FREQUENCY RANGE: 1000 - 9200 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 50 kbps  
 DUTY CYCLE: 100 %  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 1000 kHz  
 TEST ANTENNA TYPE: Double ridged guide  
 FREQUENCY HOPPING: Disabled

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***	
<b>Low carrier frequency</b>											
2738.2625	Horizontal	1.3	214	63.68	74	-10.32	63.68	35.68	54	-18.32	Pass
3650.9625	Horizontal	1.0	207	50.82	74	-23.18	50.82	22.82	54	-31.18	
4563.5000	Horizontal	1.1	220	51.69	74	-22.31	51.69	23.69	54	-30.31	
<b>Mid carrier frequency</b>											
2747.5875	Horizontal	1.4	83	63.87	74	-10.13	63.87	35.87	54	-18.13	Pass
3663.2875	Horizontal	1.2	268	44.94	74	-29.06	44.94	16.94	54	-37.06	
4579.2750	Horizontal	1.4	288	52.18	74	-21.82	52.18	24.18	54	-29.82	
<b>High carrier frequency</b>											
2757.197	Horizontal	1.0	74	61.96	74	-12.04	61.96	33.96	54	-20.04	Pass
3676.478	Horizontal	1.0	230	51.29	74	-22.71	51.29	23.29	54	-30.71	
4595.459	Horizontal	1.0	180	51.26	74	-22.74	51.26	23.26	54	-30.74	

\*- 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 7.6.4 Average factor calculation**

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Number of pulses during 100 msec	Duration, ms	Period, ms		
4	1	NA	NA	NA	-28

\*- Average factor was calculated as follows  
 for pulse train shorter than 100 ms:  $Average\ factor = 20 \times \log_{10} \left( \frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{Train\ duration} \times Number\ of\ bursts\ within\ pulse\ train \right)$   
 for pulse train longer than 100 ms:  $Average\ factor = 20 \times \log_{10} \left( \frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100\ ms} \times Number\ of\ bursts\ within\ 100\ ms \right)$

**Reference numbers of test equipment used**

HL 0446	HL 0521	HL 0604	HL 2432	HL 2909	HL 4278	HL 4353	HL 4932
HL 4933							

Full description is given in Appendix A.



<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Table 7.6.5 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY: 902-928 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 50 kbps  
 DUTY CYCLE: 100 %  
 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 HOPPING: Disabled

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

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

Reference numbers of test equipment used

HL 0446	HL 0521	HL 0604	HL 2909	HL 4278	HL 4353	HL 4932	
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Full description is given in Appendix A.



<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Table 7.6.6 Restricted bands according to FCC section 15.205

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

Table 7.6.7 Restricted bands according to RSS-Gen

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



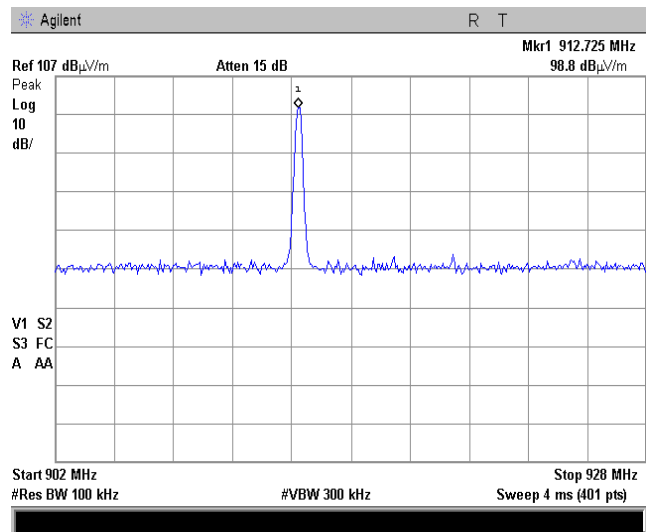
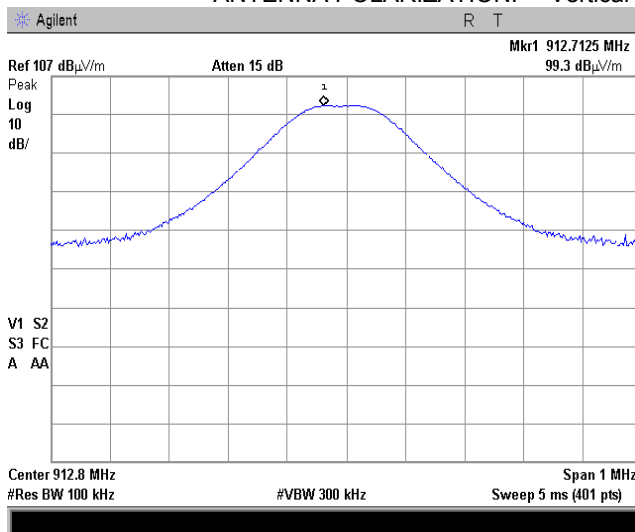


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

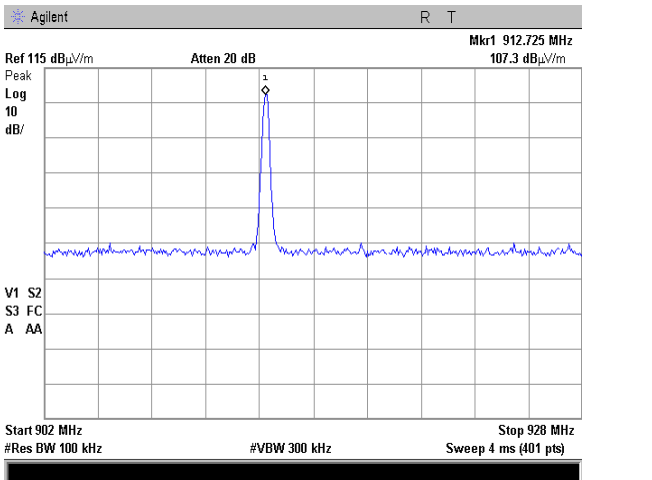
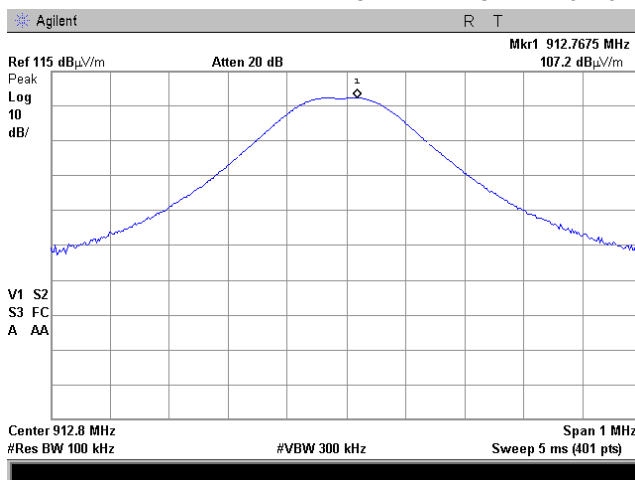
Plot 7.6.1 Radiated emission measurements at the low carrier frequency

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



Plot 7.6.2 Radiated emission measurements at the low carrier frequency

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



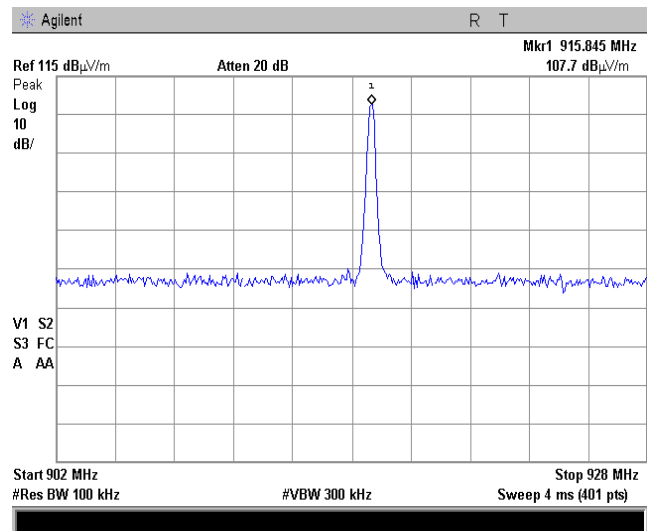
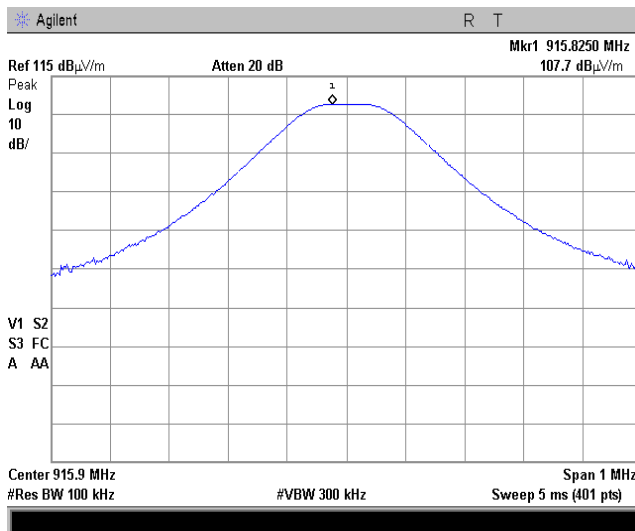


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

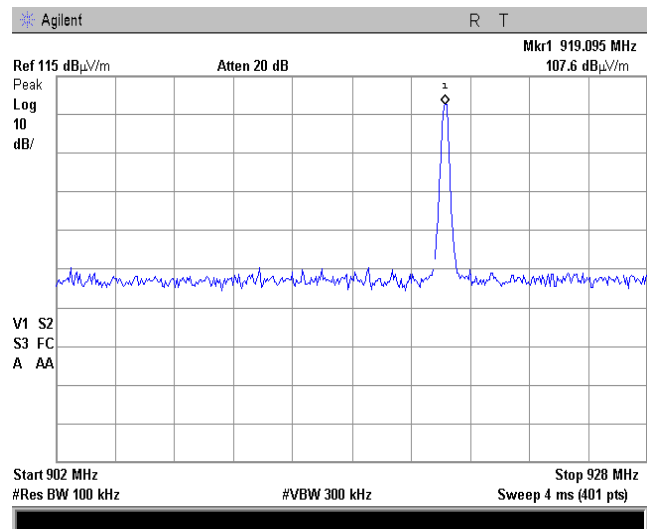
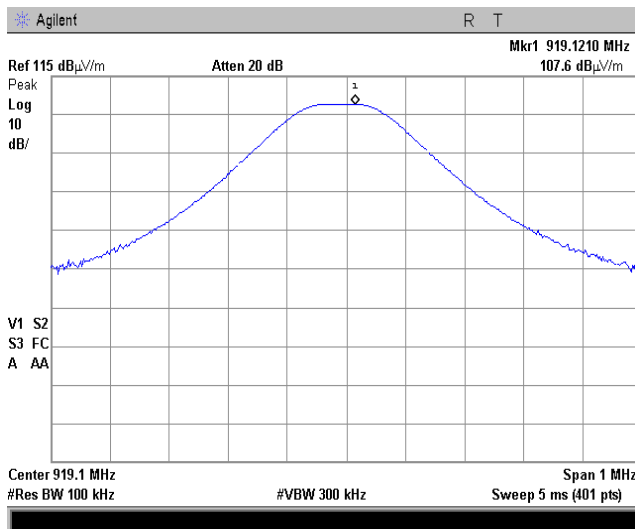
Plot 7.6.3 Radiated emission measurements at the mid carrier frequency

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



Plot 7.6.4 Radiated emission measurements at the high carrier frequency

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





HERMON LABORATORIES

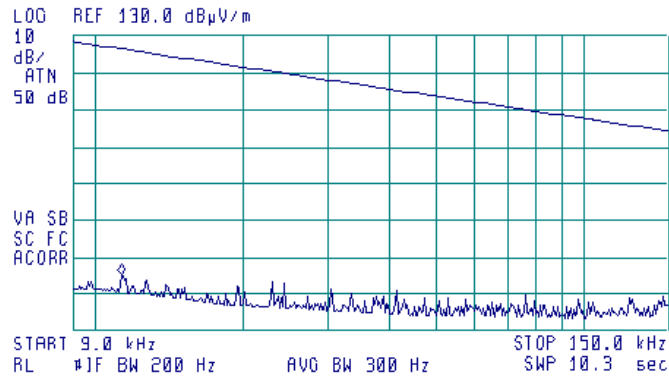
<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Aug-17			
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1010 hPa	Power: Battery
Remarks:			

Plot 7.6.5 Radiated emission measurements from 9 to 150 kHz at the low, mid, high carrier frequency

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



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 11.4 kHz  
65.28 dBµV/m

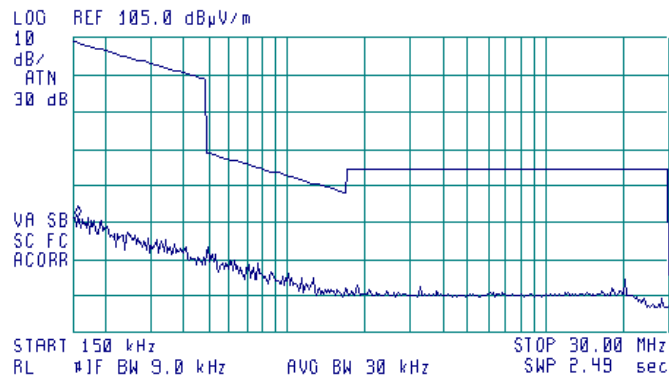


Plot 7.6.6 Radiated emission measurements from 0.15 to 30 MHz at the low, mid, high carrier frequency

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



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 160 kHz  
56.27 dBµV/m



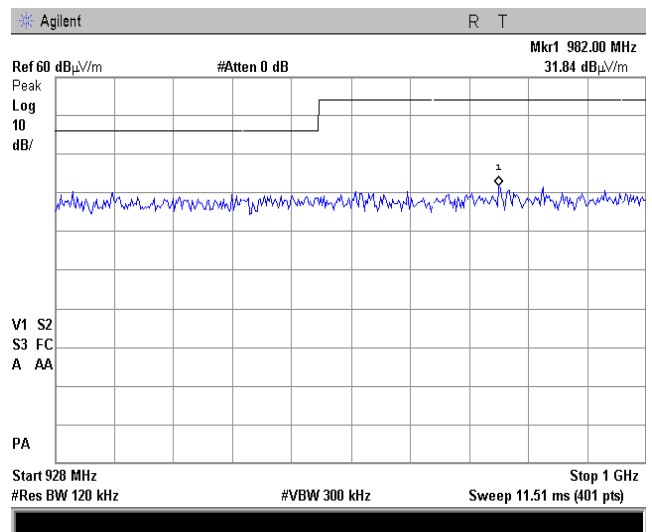
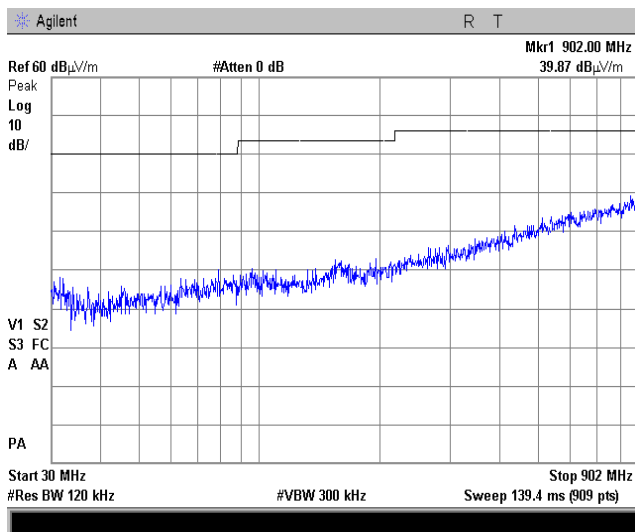


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

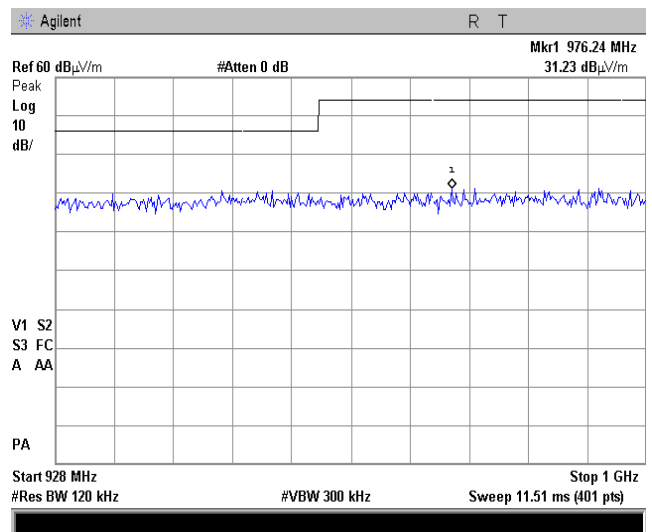
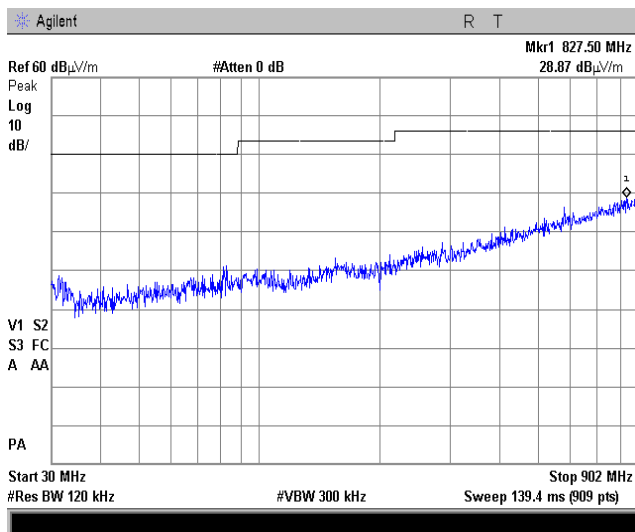
Plot 7.6.7 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency

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



Plot 7.6.8 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency

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



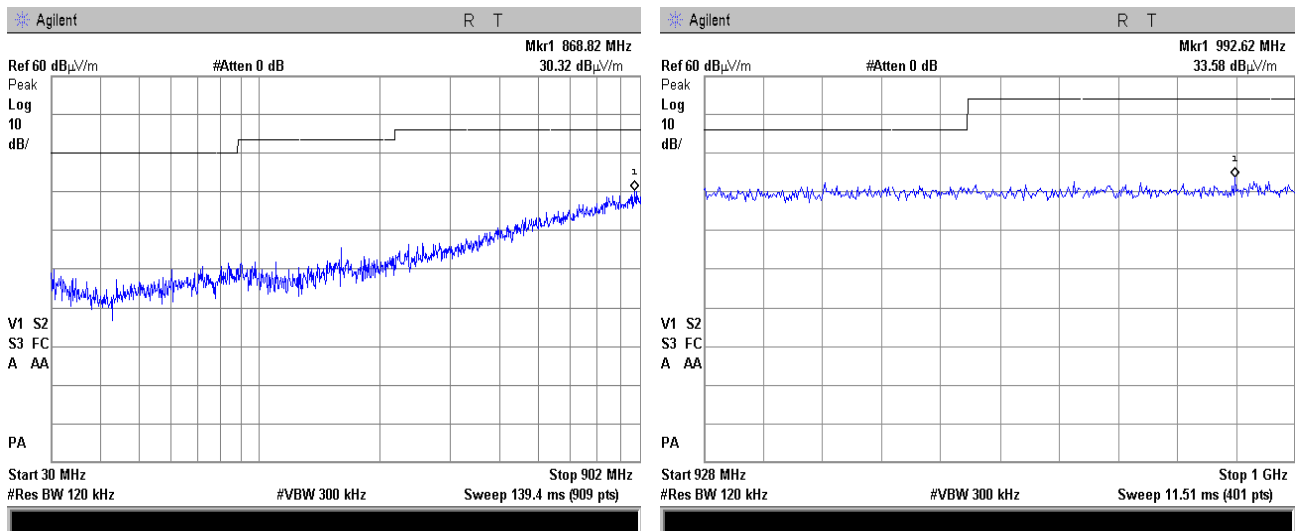


HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

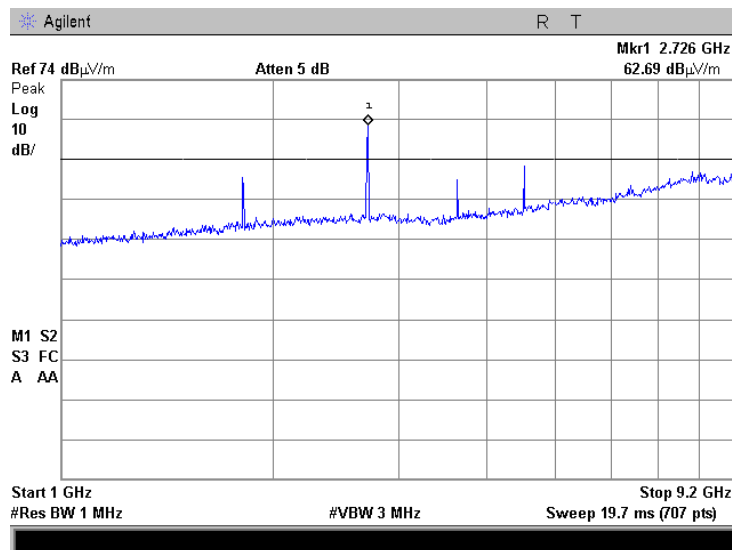
Plot 7.6.9 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency

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



Plot 7.6.10 Radiated emission measurements from 1000 to 9200 MHz at the low carrier frequency

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



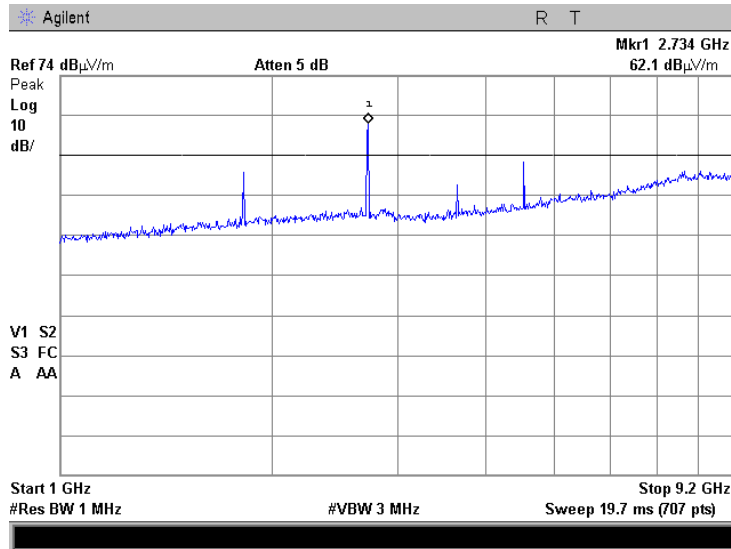


HERMON LABORATORIES

<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Aug-17			
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1010 hPa	Power: Battery
Remarks:			

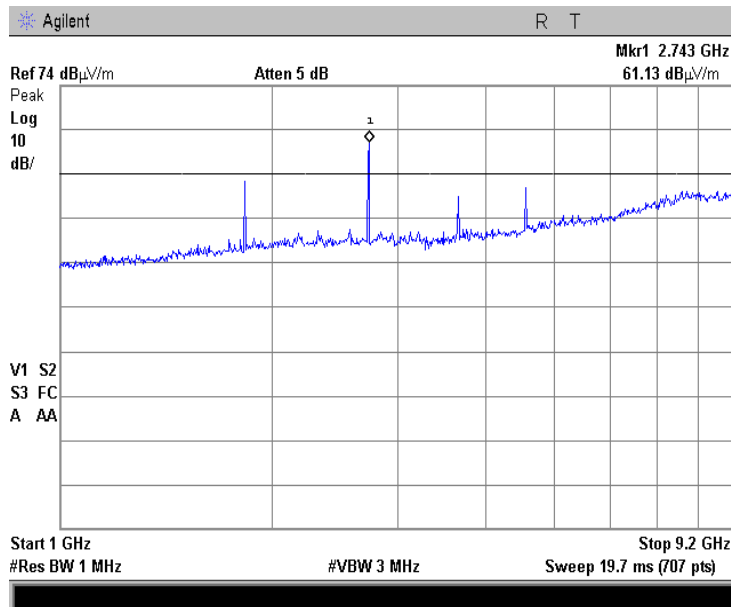
Plot 7.6.11 Radiated emission measurements from 1000 to 9200 MHz at the mid carrier frequency

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



Plot 7.6.12 Radiated emission measurements from 1000 to 9200 MHz at the high carrier frequency

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

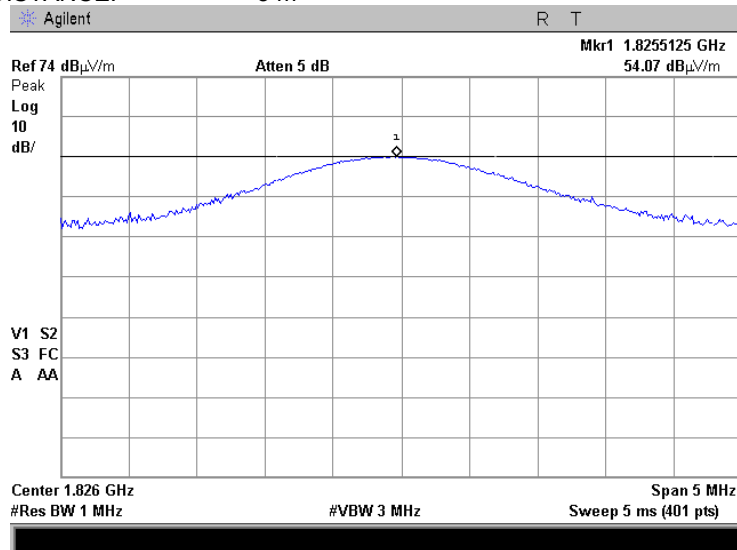




<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Aug-17			
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1010 hPa	Power: Battery
Remarks:			

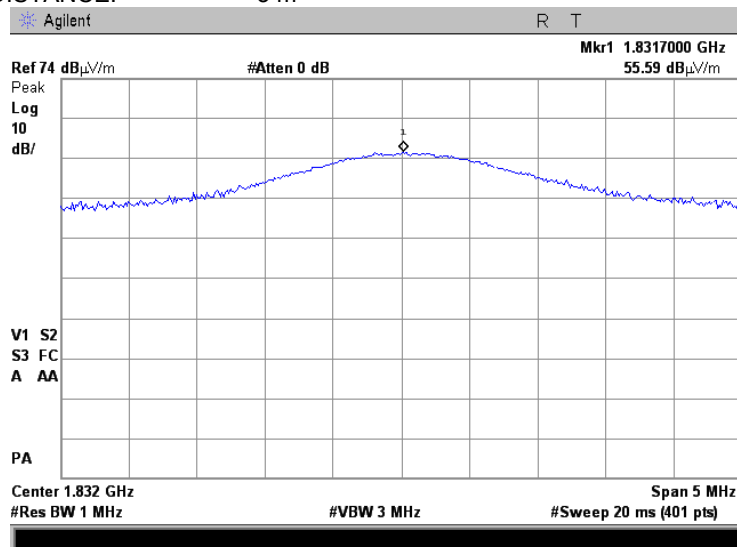
Plot 7.6.13 Radiated emission measurements at the second harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.6.14 Radiated emission measurements at the second harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

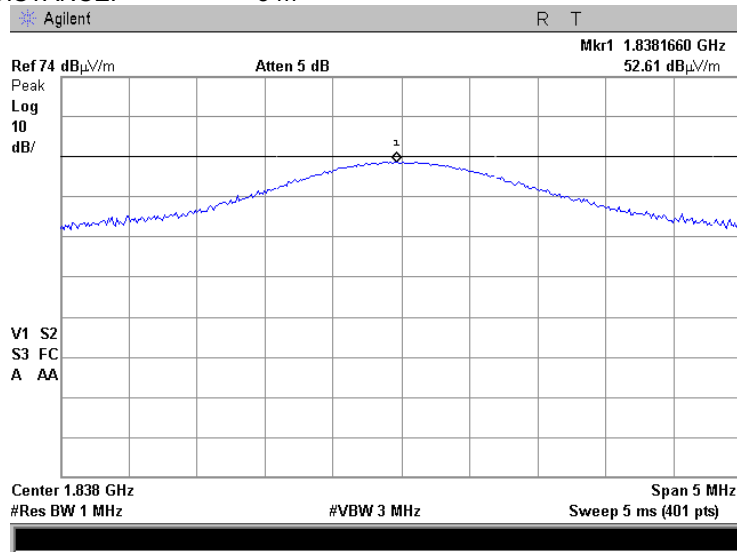




<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Aug-17			
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1010 hPa	Power: Battery
Remarks:			

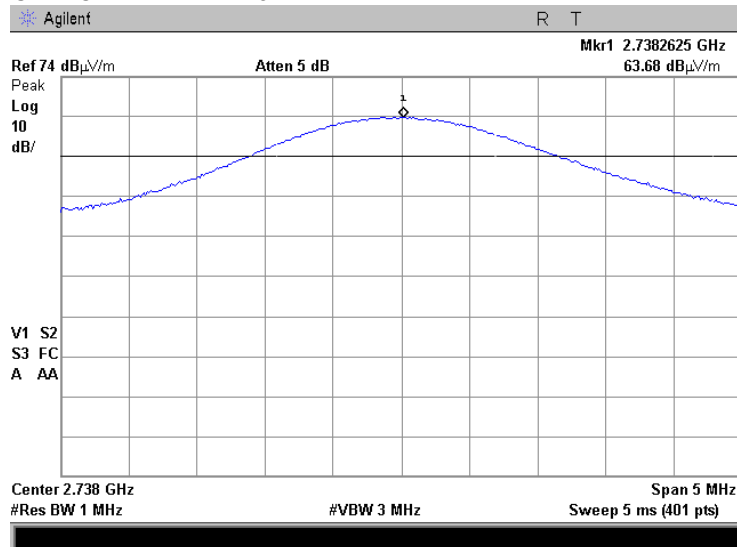
Plot 7.6.15 Radiated emission measurements at the second harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.6.16 Radiated emission measurements at the third harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



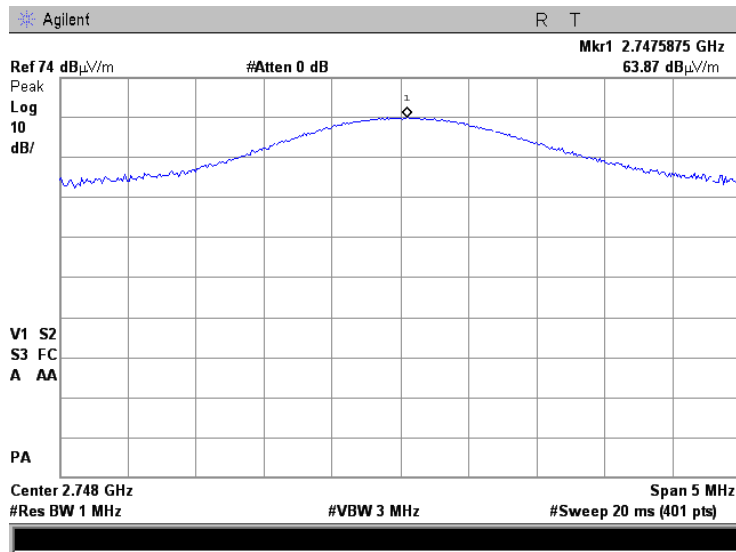




<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Aug-17			
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1010 hPa	Power: Battery
Remarks:			

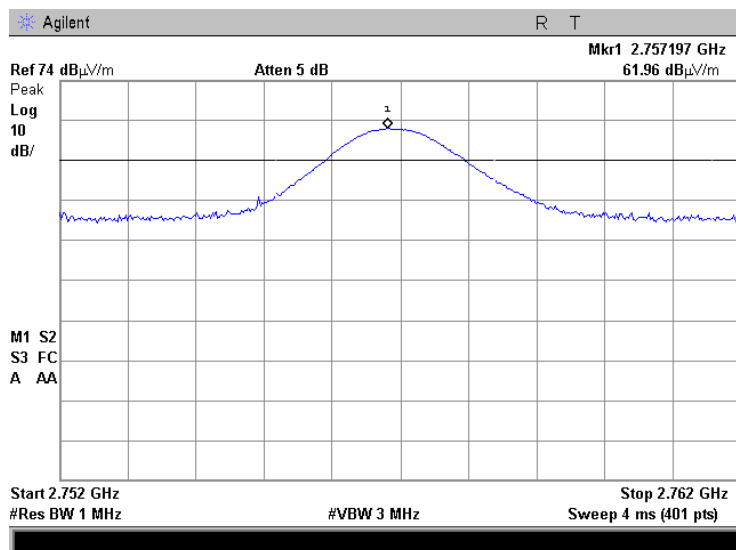
Plot 7.6.17 Radiated emission measurements at the third harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.6.18 Radiated emission measurements at the third harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



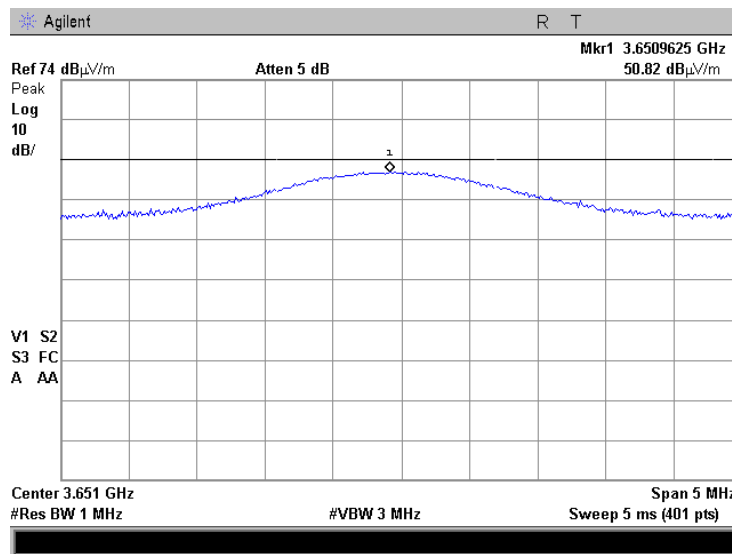


HERMON LABORATORIES

<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Aug-17			
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1010 hPa	Power: Battery
Remarks:			

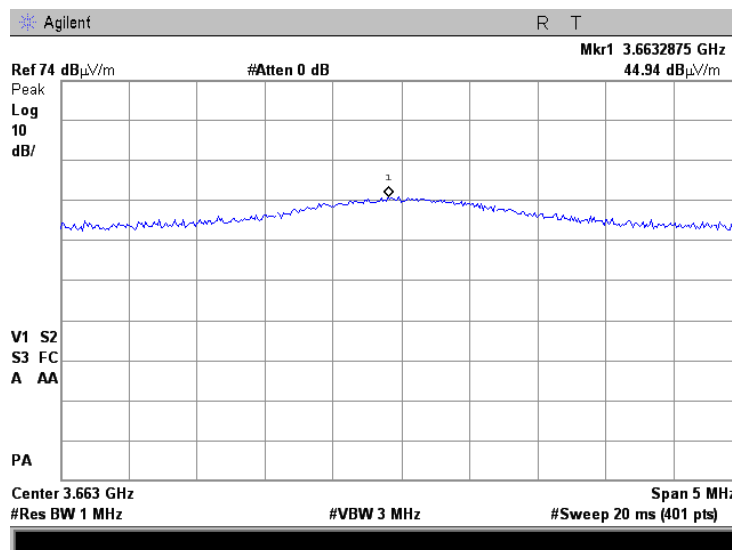
Plot 7.6.19 Radiated emission measurements at the fourth harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.6.20 Radiated emission measurements at the fourth harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

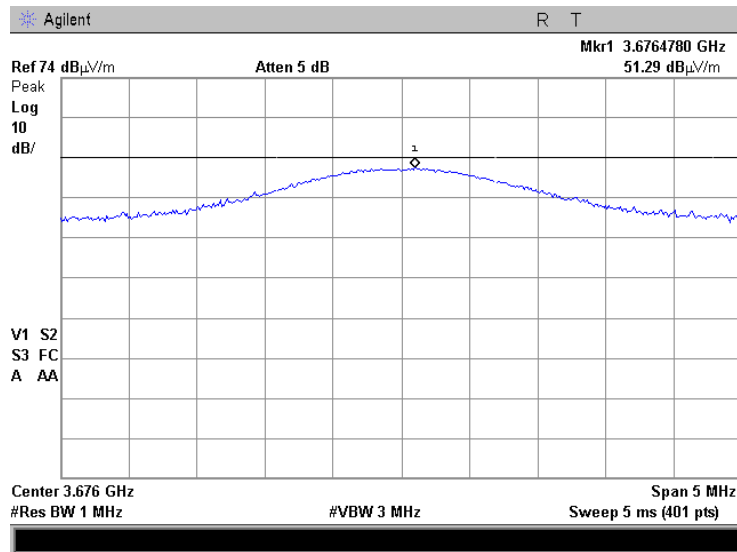




<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Aug-17			
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1010 hPa	Power: Battery
Remarks:			

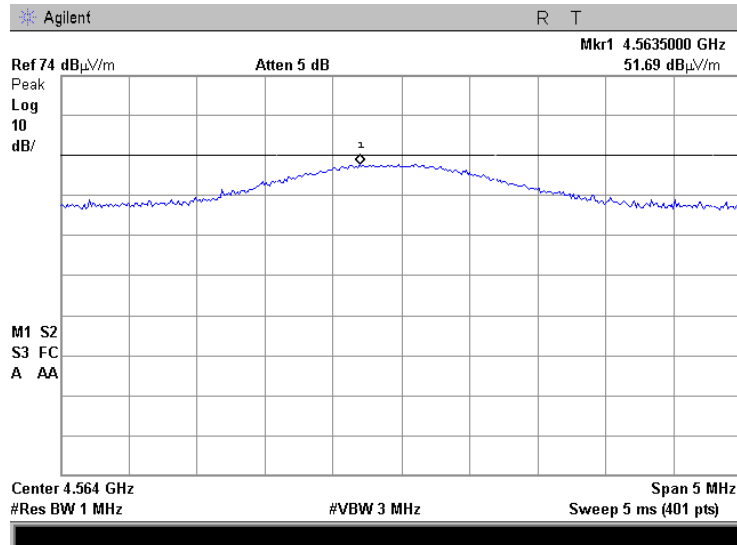
Plot 7.6.21 Radiated emission measurements at the fourth harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.6.22 Radiated emission measurements at the fifth harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m

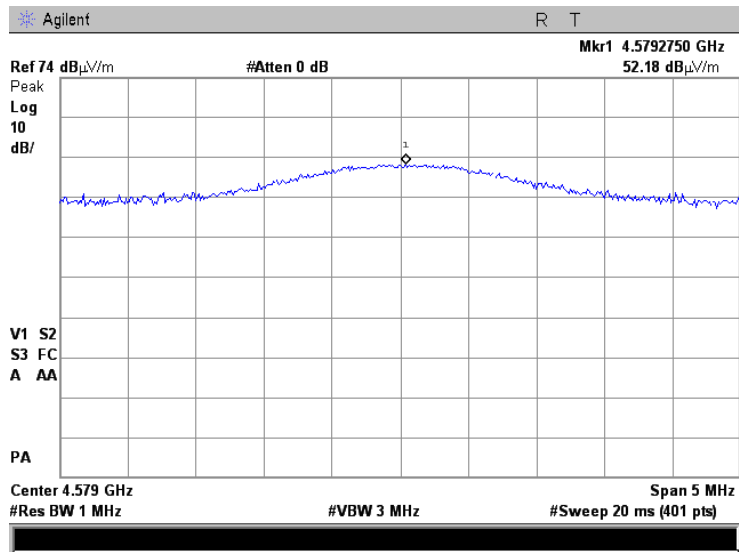




<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
Test procedure: ANSI C63.10, sections 6.5, 6.6			
Test mode: Compliance		Verdict: PASS	
Date(s): 01-Aug-17			
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1010 hPa	Power: Battery
Remarks:			

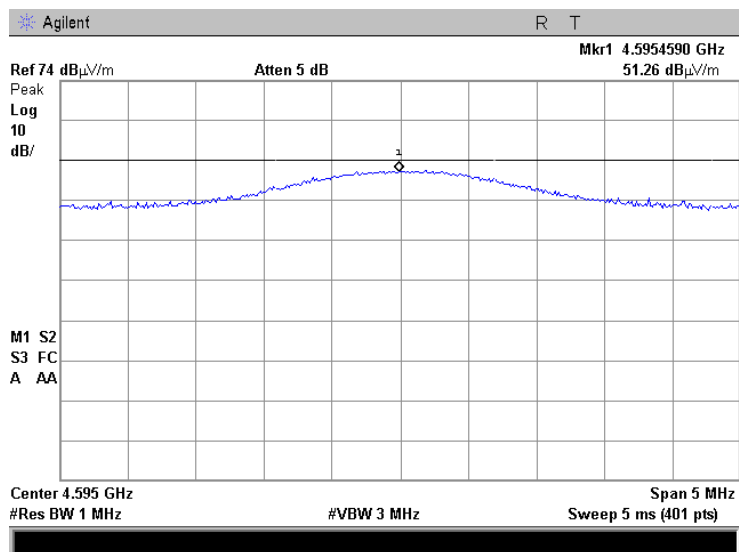
Plot 7.6.23 Radiated emission measurements at the fifth harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



Plot 7.6.24 Radiated emission measurements at the fifth harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



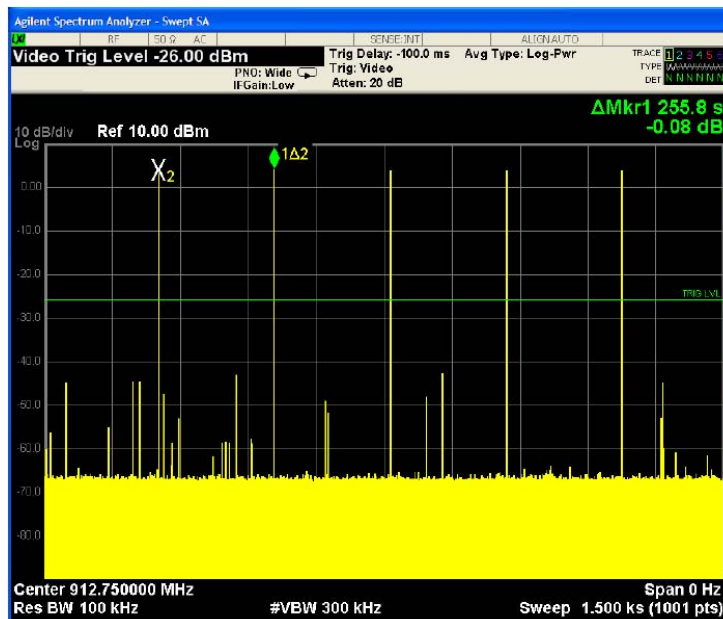


<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.6.25 Transmission pulse duration



Plot 7.6.26 Transmission pulse period





<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Emissions at band edges			
<b>Test procedure:</b> ANSI C63.10, section 7.8.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

## 7.7 Band edge radiated emissions

### 7.7.1 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 7.7.1.

Table 7.7.1 Band edge emission limits

Assigned frequency, MHz	Attenuation below carrier*, dBc	Field strength at 3 m within restricted bands, dB(µV/m)	
		Peak	Average
902.0 – 928.0	20.0	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.

### 7.7.2 Test procedure

- 7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized normally modulated at the maximum data rate with its hopping function disabled and its proper operation was checked.
- 7.7.2.2 The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.
- 7.7.2.3 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.
- 7.7.2.4 The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.
- 7.7.2.5 The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.7.2 and associated plots and referenced to the highest emission level measured within the authorized band.
- 7.7.2.6 The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.
- 7.7.2.7 The above procedure was repeated with the frequency hopping function enabled.

Figure 7.7.1 Band edge emission test setup





<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Emissions at band edges			
<b>Test procedure:</b> ANSI C63.10, section 7.8.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Table 7.7.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 902-928 MHz  
DETECTOR USED: Peak  
MODULATION: GFSK  
BIT RATE: 50 kbps  
RESOLUTION BANDWIDTH: ≥ 1% of the span  
VIDEO BANDWIDTH: ≥ RBW

Frequency, MHz	Band edge emission, dBm	Emission at carrier, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
<b>Frequency hopping disabled</b>						
912.750	-86.69	-27.39	59.30	20.0	39.30	Pass
919.106	-85.75	-31.13	54.62		34.62	
<b>Frequency hopping enabled</b>						
912.750	-85.32	-29.31	56.01	20.0	36.01	Pass
919.106	-83.14	-30.31	52.83		32.83	

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

Reference numbers of test equipment used

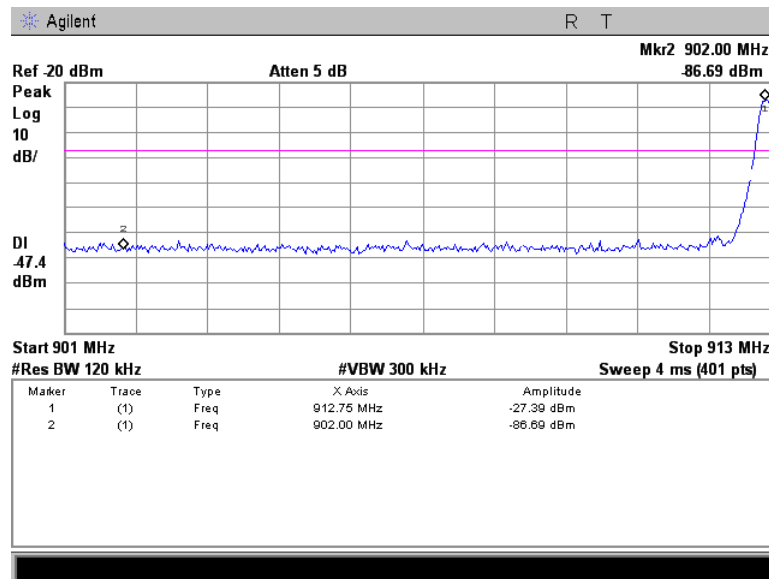
HL 2909	HL 3001	HL 4135				
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Full description is given in Appendix A.

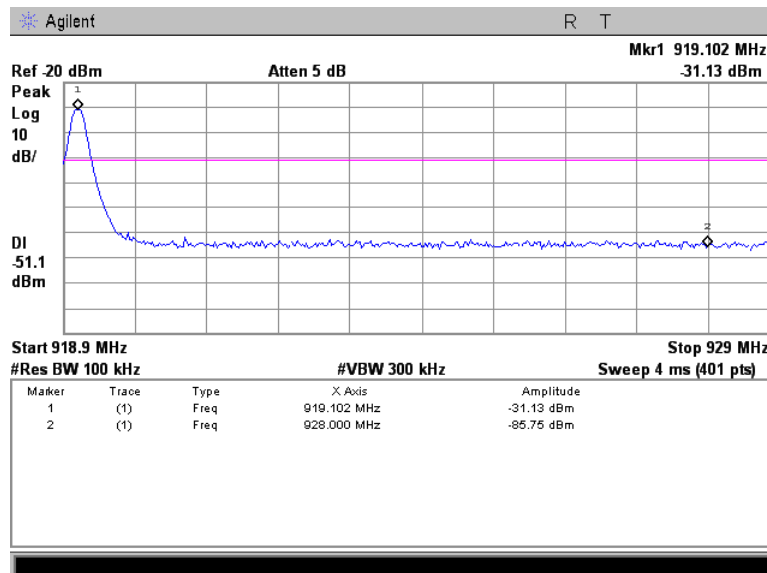


<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Emissions at band edges			
<b>Test procedure:</b> ANSI C63.10, section 7.8.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.7.1 The highest band edge emission at low carrier frequency with hopping function disabled



Plot 7.7.2 The highest band edge emission at high carrier frequency with hopping function disabled



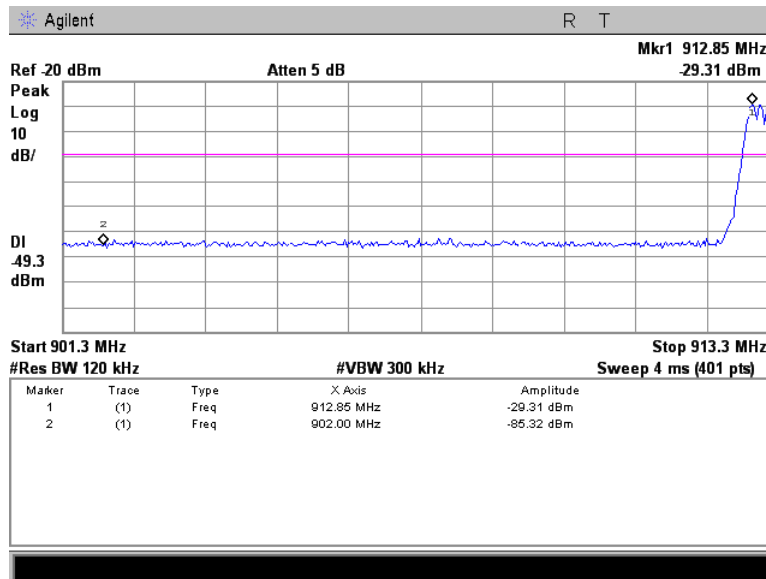




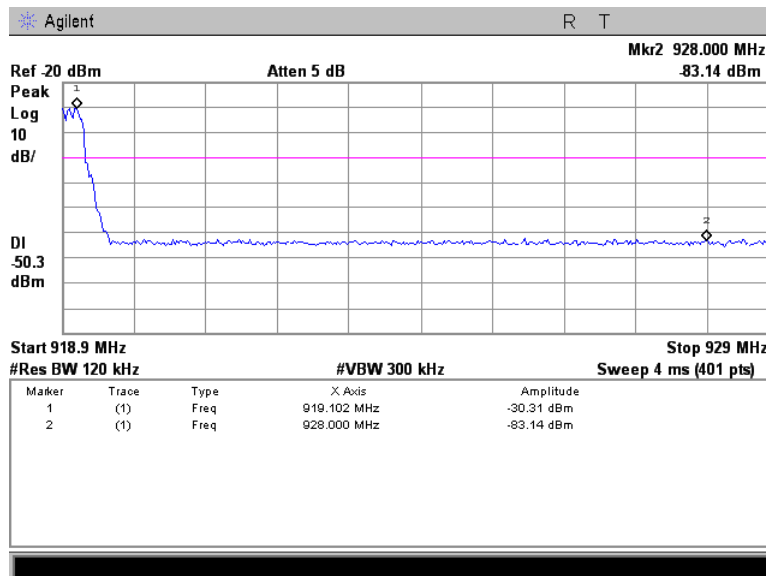
HERMON LABORATORIES

<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Emissions at band edges			
<b>Test procedure:</b> ANSI C63.10, section 7.8.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.7.3 The highest band edge emission at low carrier frequency with hopping function enabled



Plot 7.7.4 The highest band edge emission at high carrier frequency with hopping function enabled





<b>Test specification:</b> Section 15.203, RSS-Gen, Section 7.1.4, Antenna requirements			
<b>Test procedure:</b> Visual inspection			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

### 7.8 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 7.8.1.

Table 7.8.1 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	



<b>Test specification:</b> Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

## 8 Unintentional emissions

### 8.1 Radiated emission measurements

#### 8.1.1 General

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

Table 8.1.1 Radiated emission 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:  $Lim_{S2} = Lim_{S1} + 20 \log(S1/S2)$ , where  $S1$  and  $S2$  – standard defined and test distance respectively in meters.

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

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

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

#### 8.1.2 Test procedure

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

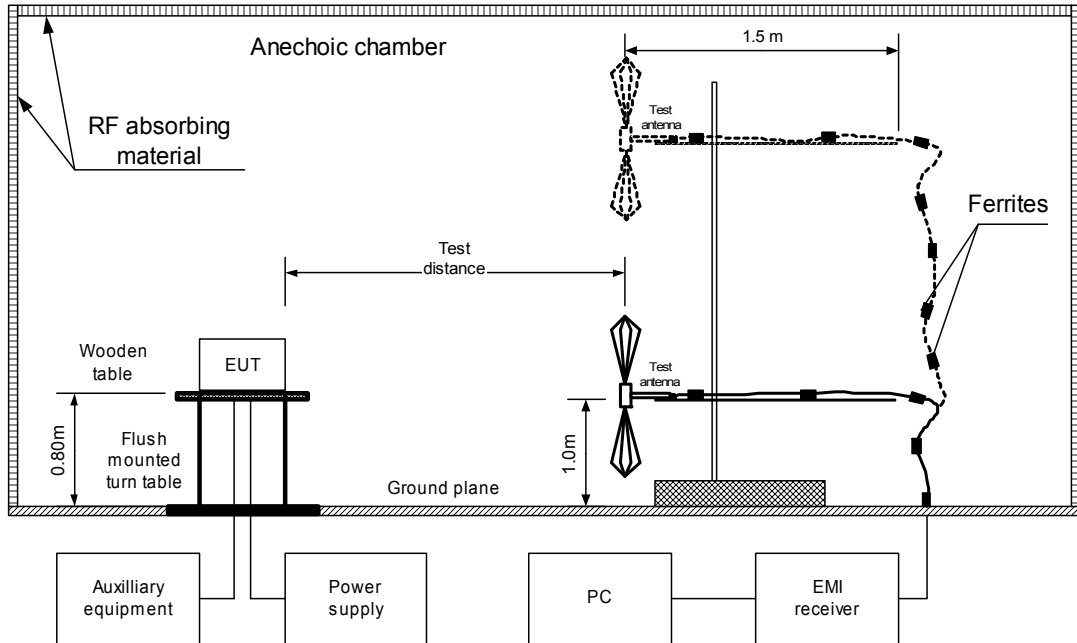
8.1.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

8.1.2.3 The worst test results (the lowest margins) were recorded in Table 8.1.3 and shown in the associated plots.



<b>Test specification:</b> Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

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





<b>Test specification:</b> Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Photograph 8.1.1 Setup for radiated emission measurements in 30-1000 MHz



Photograph 8.1.2 Setup for radiated emission measurements above 1 GHz





<b>Test specification:</b> Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Table 8.1.3 Radiated emission test results

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

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

TEST SITE: SEMI ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
DETECTORS USED: PEAK / AVERAGE  
FREQUENCY RANGE: 1000 MHz – 3000 MHz  
RESOLUTION BANDWIDTH: 1000 kHz

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

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

Reference numbers of test equipment used

HL 0521	HL 0604	HL 2909	HL 4278	HL 4353	HL 4932	HL 4933	
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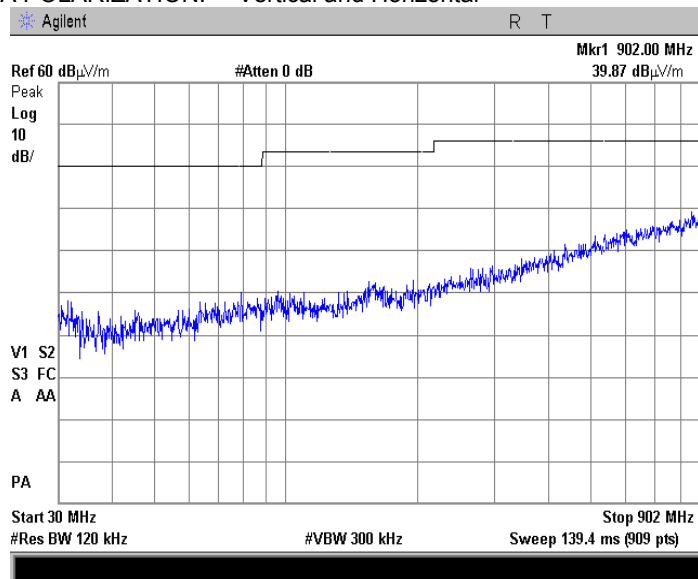
Full description is given in Appendix A.



<b>Test specification:</b> Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

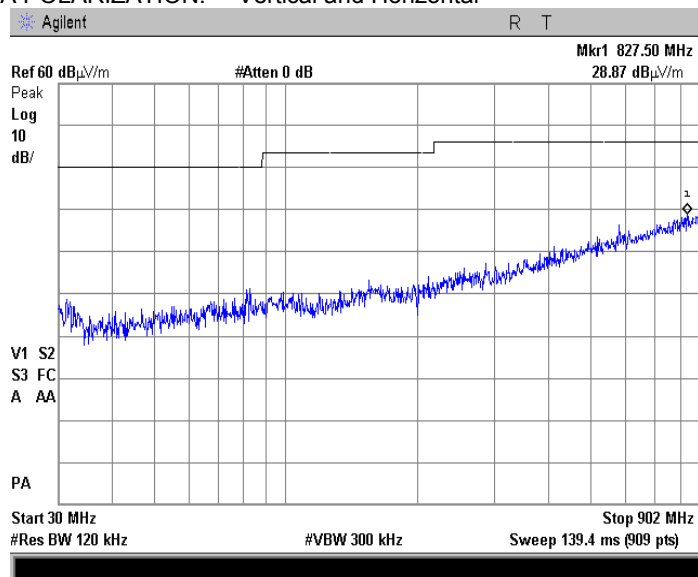
**Plot 8.1.1 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency**

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



**Plot 8.1.2 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency**

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



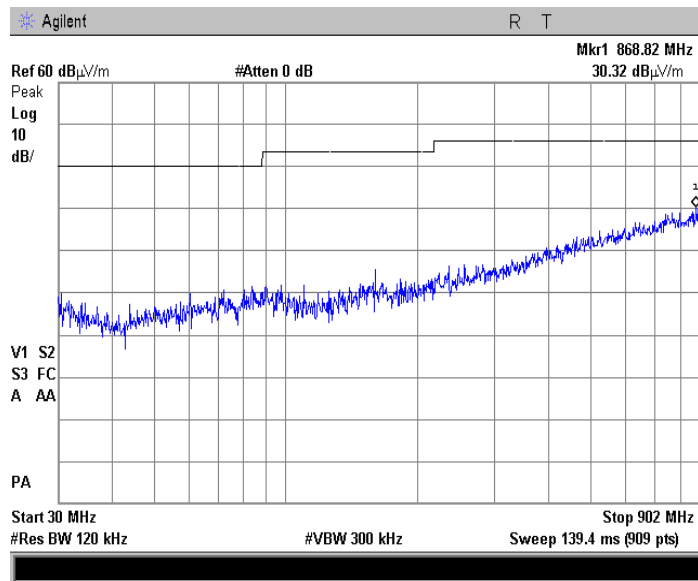


HERMON LABORATORIES

<b>Test specification:</b> Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 01-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

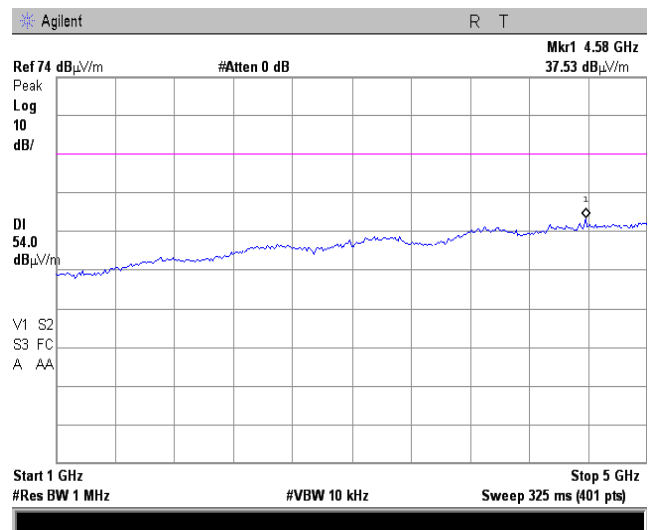
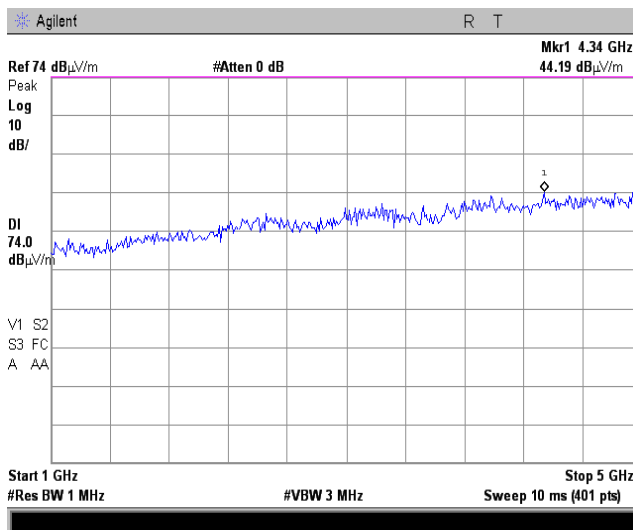
Plot 8.1.3 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency

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



Plot 8.1.4 Radiated emission measurements above 1000 MHz

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





**9 APPENDIX A Test equipment and ancillaries used for tests**

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	19-Jan-17	19-Jan-18
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Oct-16	27-Oct-17
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	12-May-17	12-May-18
2432	Antenna, Double-Ridged Waveguide Horn 1 to 18 GHz	EMC Test Systems	3115	00027177	07-Feb-17	07-Feb-18
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	09-Mar-17	09-Mar-18
3001	EMC Analyzer, 9 kHz to 3 GHz	Agilent Technologies	E7402A	US394401 80	11-Jun-17	11-Jun-18
4135	Shield Box	TESCOM CO., LTD	TC-5916A	5916A000 136	06-Apr-17	06-Apr-18
4278	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0755A	26-Sep-16	26-Sep-17
4280	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0763A	27-Sep-16	27-Sep-17
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101 003	15-Mar-17	15-Mar-18
4932	Microwave preamplifier, 500 MHz to 18 GHz, 40 dB Gain	COM-POWER CORPORATION	PAM-118A	551029	01-Sep-16	01-Sep-17
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	14-Oct-16	14-Oct-17



## 10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted carrier power at RF antenna connector	Below 12.4 GHz: $\pm 1.7$ 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	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
Vertical polarization	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.

## 11 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for 1, 2, 15, 18 parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; registered by Industry Canada for electromagnetic emissions, file number IC 2186A-1 for OATS, certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-869 for RE measurements above 1 GHz, C-845 for conducted emissions site and T-1606 for conducted emissions at telecommunication ports).

The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

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Telephone: +972 4628 8001  
Fax: +972 4628 8277  
e-mail: mail@hermonlabs.com  
website: www.hermonlabs.com

Person for contact: Mr. Michael Nikishin, EMC&Radio group manager

## 12 APPENDIX D Specification references

FCC 47CFR part 15: 2016	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 2: 2017	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



### 13 APPENDIX E Test equipment correction factors

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

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

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



**Antenna factor**  
**Double-ridged guide horn antenna**  
**Model 3115, serial number: 00027177, HL 2432**

Frequency, MHz	Antenna factor. dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.8
2500.0	28.9
3000.0	30.7
3500.0	31.8
4000.0	33.0
4500.0	32.8
5000.0	34.2
5500.0	34.9
6000.0	35.2
6500.0	35.4
7000.0	36.3
7500.0	37.3
8000.0	37.5
8500.0	38.0
9000.0	38.3
9500.0	38.3
10000.0	38.7
10500.0	38.7
11000.0	38.9
11500.0	39.5
12000.0	39.5
12500.0	39.4
13000.0	40.5
13500.0	40.8
14000.0	41.5
14500.0	41.3
15000.0	40.2
15500.0	38.7
16000.0	38.5
16500.0	39.8
17000.0	41.9
17500.0	45.8
18000.0	49.1

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



Antenna factor, HL 4933



### Active Horn Antenna Factor Calibration

1 GHz to 18 GHz

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

Calibration according to ARP 958

**Antenna Factor to be added to receiver reading:**

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



**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**  
Test cable, Mini-Circuits, S/N 0763A, 18 GHz, 4.6 m, N/M - N/M  
APC-15FT-NMNM+, HL 4280

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.21	5000	4.27	10200	6.50	15400	8.49
30	0.26	5100	4.32	10300	6.55	15500	8.50
50	0.34	5200	4.35	10400	6.59	15600	8.55
100	0.51	5300	4.41	10500	6.62	15700	8.58
200	0.63	5400	4.43	10600	6.65	15800	8.61
300	0.73	5500	4.49	10700	6.66	15900	8.64
400	0.91	5600	4.54	10800	6.68	16000	8.68
500	1.07	5700	4.58	10900	6.70	16100	8.72
600	1.21	5800	4.63	11000	6.71	16200	8.73
700	1.33	5900	4.67	11100	6.72	16300	8.75
800	1.45	6000	4.73	11200	6.74	16400	8.77
900	1.55	6100	4.76	11300	6.77	16500	8.80
1000	1.65	6200	4.81	11400	6.81	16600	8.80
1100	1.75	6300	4.86	11500	6.84	16700	8.82
1200	1.85	6400	4.89	11600	6.87	16800	8.83
1300	1.94	6500	4.94	11700	6.89	16900	8.87
1400	2.03	6600	4.95	11800	6.94	17000	8.92
1500	2.11	6700	4.99	11900	7.00	17100	8.96
1600	2.19	6800	5.04	12000	7.05	17200	9.01
1700	2.27	6900	5.04	12100	7.10	17300	9.07
1800	2.34	7000	5.09	12200	7.17	17400	9.09
1900	2.42	7100	5.15	12300	7.23	17500	9.14
2000	2.49	7200	5.19	12400	7.29	17600	9.17
2100	2.56	7300	5.25	12500	7.34	17700	9.21
2200	2.63	7400	5.33	12600	7.38	17800	9.24
2300	2.69	7500	5.39	12700	7.44	17900	9.28
2400	2.76	7600	5.42	12800	7.48	18000	9.31
2500	2.83	7700	5.51	12900	7.55		
2600	2.89	7800	5.58	13000	7.58		
2700	2.95	7900	5.62	13100	7.63		
2800	3.02	8000	5.68	13200	7.67		
2900	3.08	8100	5.73	13300	7.72		
3000	3.15	8200	5.78	13400	7.76		
3100	3.21	8300	5.83	13500	7.81		
3200	3.27	8400	5.87	13600	7.85		
3300	3.33	8500	5.92	13700	7.88		
3400	3.38	8600	5.96	13800	7.93		
3500	3.44	8700	6.00	13900	7.97		
3600	3.49	8800	6.04	14000	8.01		
3700	3.55	8900	6.10	14100	8.05		
3800	3.60	9000	6.13	14200	8.09		
3900	3.65	9100	6.17	14300	8.12		
4000	3.71	9200	6.22	14400	8.15		
4100	3.75	9300	6.25	14500	8.19		
4200	3.81	9400	6.28	14600	8.22		
4300	3.86	9500	6.32	14700	8.26		
4400	3.93	9600	6.36	14800	8.29		
4500	3.98	9700	6.37	14900	8.32		
4600	4.03	9800	6.41	15000	8.36		
4700	4.08	9900	6.42	15100	8.40		
4800	4.13	10000	6.45	15200	8.43		
4900	4.18	10100	6.48	15300	8.44		



**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		



## 14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB( $\mu$ 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

END OF DOCUMENT