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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.  
Supervised Wireless PowerG  
Smoke Detector  
Model: PG9936  
FCC ID:F5317PG9936  
IC:160A-PG9936**

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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:** Supervised Wireless PowerG Smoke Detector  
**Product type:** Transceiver  
**Model(s):** PG9936  
**Serial number:** 0-500325  
**Hardware version:** 90-208631  
**Software release:** JS-703284  
**Receipt date:** 17-Aug-17

## 3 Manufacturer information

**Manufacturer name:** Visonic Ltd.  
**Address:** Habarzel street 24, 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:** 29963  
**Location:** Primary: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel  
Satellite: Hermon Laboratories Ltd. Hefetz-Haim 10, Tel Aviv 6744124, Israel  
**Test started:** 09-Aug-17  
**Test completed:** 29-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.

	Name and Title	Date	Signature
<b>Tested by:</b>	Mrs. E. Pitt, test engineer	August 29, 2017	
	Mr. I. Zilberstein, test engineer		
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	September 11, 2017	
<b>Approved by:</b>	Mr. S. Samokha, project manager	September 13, 2017	



## 6 EUT description

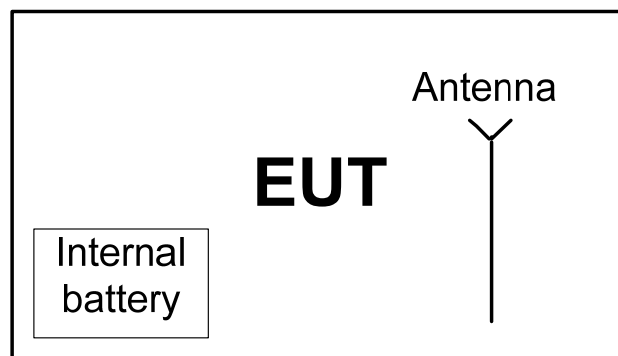
### 6.1 General information

The EUT is a Supervised Wireless PowerG Smoke Detector. The EUT is equipped with an integral antenna and is powered by 3 VDC internal battery.

### 6.2 Changes made in EUT

No changes were implemented in the EUT during the testing.

### 6.3 Test configuration



## 6.4 EUT test positions

Photograph 6.4.1 EUT in X-axis orthogonal position



Photograph 6.4.2 EUT in Y-axis orthogonal position





### 6.5 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	11.4 dBm	
<b>Is transmitter output power variable?</b>		X	No	
			Yes	
			continuous variable	
			stepped variable with stepsize	dB
			minimum RF power	dBm
	maximum RF power	dBm		
<b>Antenna connection</b>				
unique coupling	standard connector	X	integral	
			with temporary RF connector	
			X without temporary RF connector	
<b>Antenna/s technical characteristics</b>				
Type	Manufacturer	Model number	Gain	
Integral	Ocean	H306097	-2 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	
	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	103.3 kHz		
	Max. separation of hops	135 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> 27-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> 27-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
912.74	GFSK	50	NA	103.33	250	-146.67	Pass
915.85				101.59	250	-148.41	Pass
919.10				101.01	250	-148.99	Pass

Reference numbers of test equipment used

HL 4355	HL 4135	HL						
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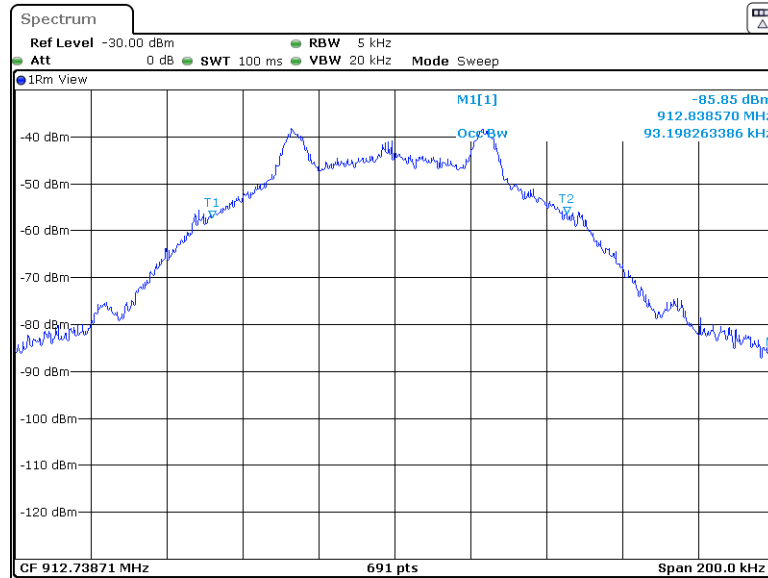
Full description is given in Appendix A.



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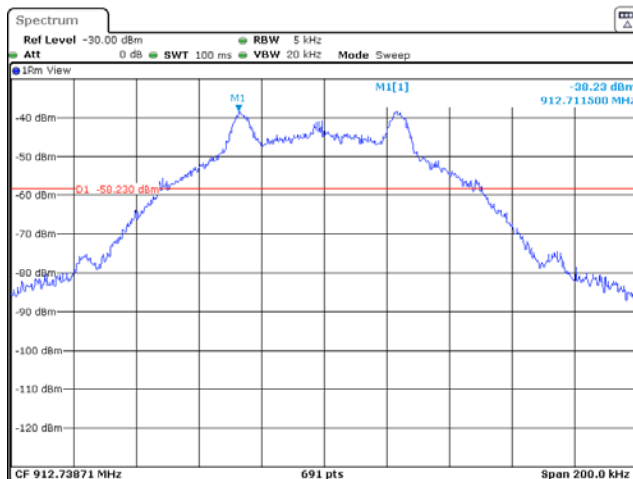
<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth			
<b>Test procedure:</b> ANSI C63.10, section 7.8.7			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 27-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.1.1 The 99% bandwidth test result at low frequency

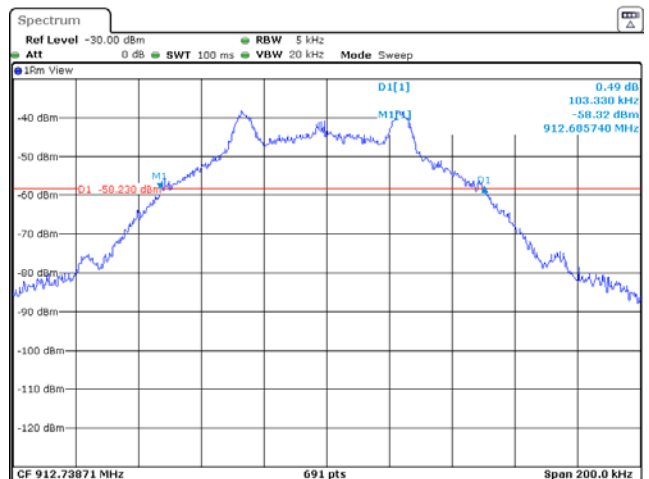


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Plot 7.1.2 The 20 dB bandwidth test result at low frequency



Date: 27.AUG.2017 11:43:40

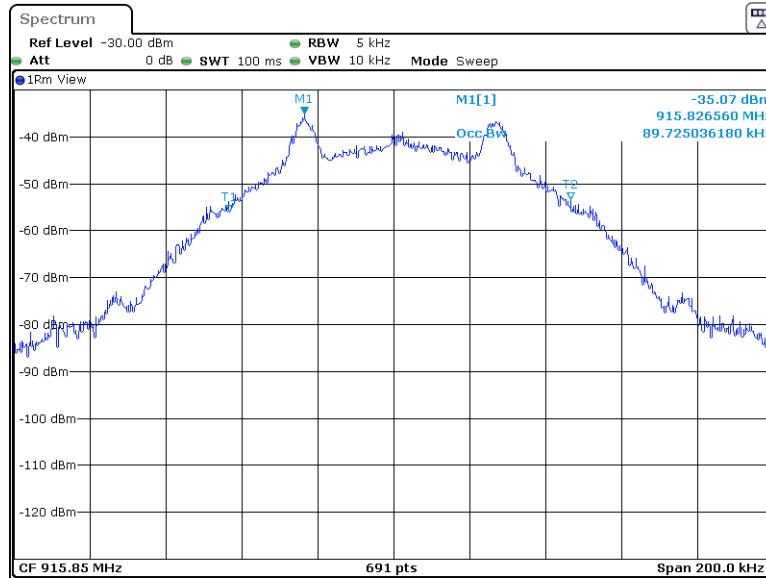


Date: 27.AUG.2017 11:45:17

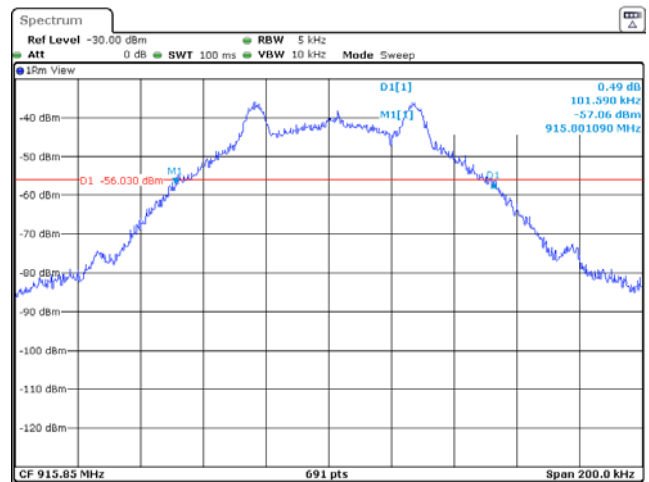
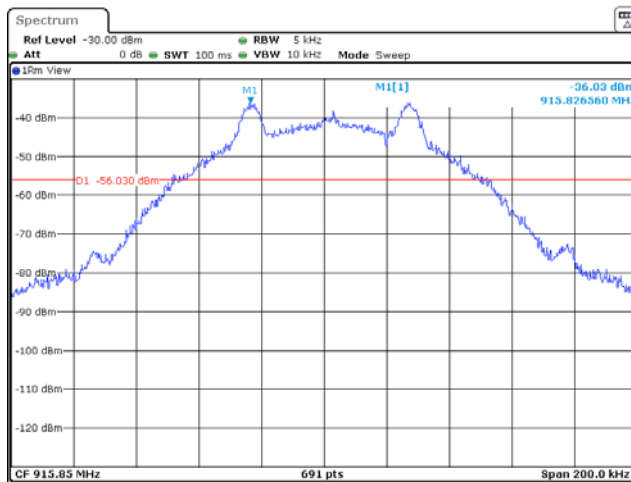


<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth			
<b>Test procedure:</b> ANSI C63.10, section 7.8.7			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 27-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.1.3 The 99% bandwidth test result at mid frequency



Plot 7.1.4 The 20 dB bandwidth test result at mid frequency

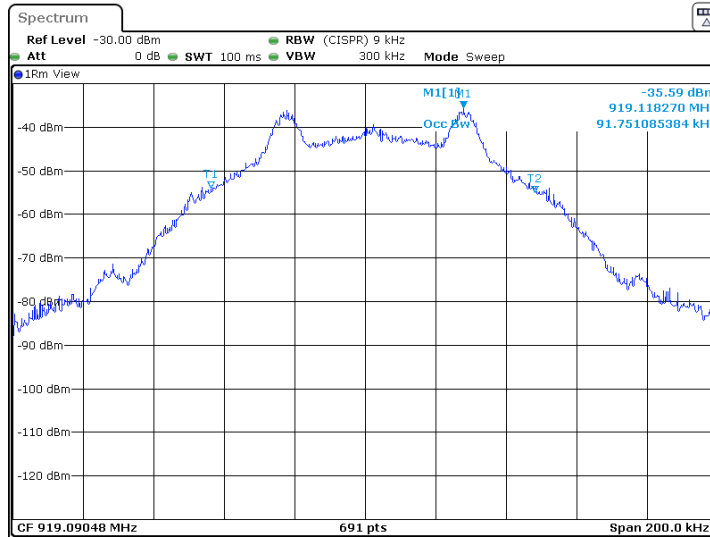




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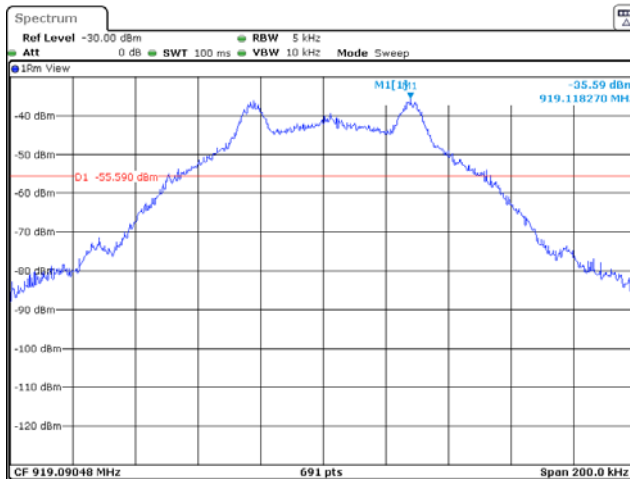
<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), 20 dB bandwidth			
<b>Test procedure:</b> ANSI C63.10, section 7.8.7			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 27-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1010 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.1.5 The 99% bandwidth test result at high frequency

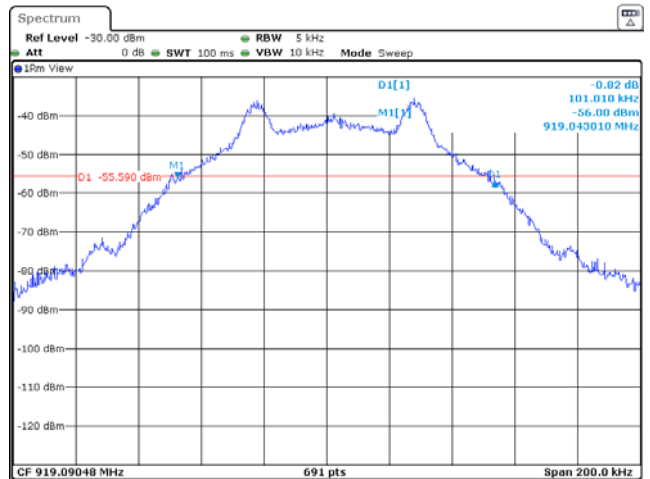


Date: 27.AUG.2017 12:26:25

Plot 7.1.6 The 20 dB bandwidth test result at high frequency



Date: 27.AUG.2017 12:45:38



Date: 27.AUG.2017 12:44:27



<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> 27-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>			

## 7.2 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 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> 27-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 7.2.2 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: 103.3 kHz

Carrier frequency separation, kHz	Limit, kHz	Margin*	Verdict
135	103.3	31.7	Pass

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

Reference numbers of test equipment used

HL 4135	HL 4355						
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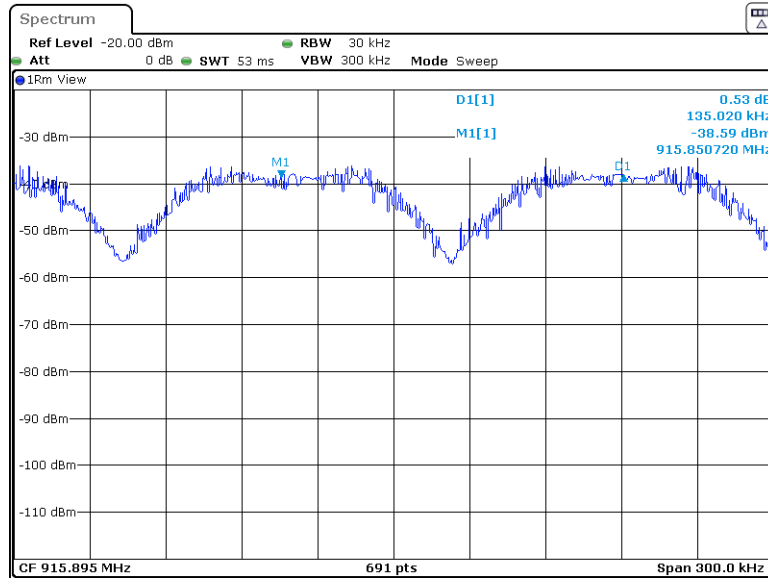
Full description is given in Appendix A.



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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> 27-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 7.2.1 Carrier frequency separation



Date: 27.AUG.2017 11:17:53



<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> 27-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>			

### 7.3 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> 27-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 7.3.2 Hopping frequencies test results**

ASSIGNED FREQUENCY: 902-928 MHz  
 MODULATION: GFSK  
 BIT RATE: 50 kbps  
 DETECTOR USED: Peak  
 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 4135	HL 4355						
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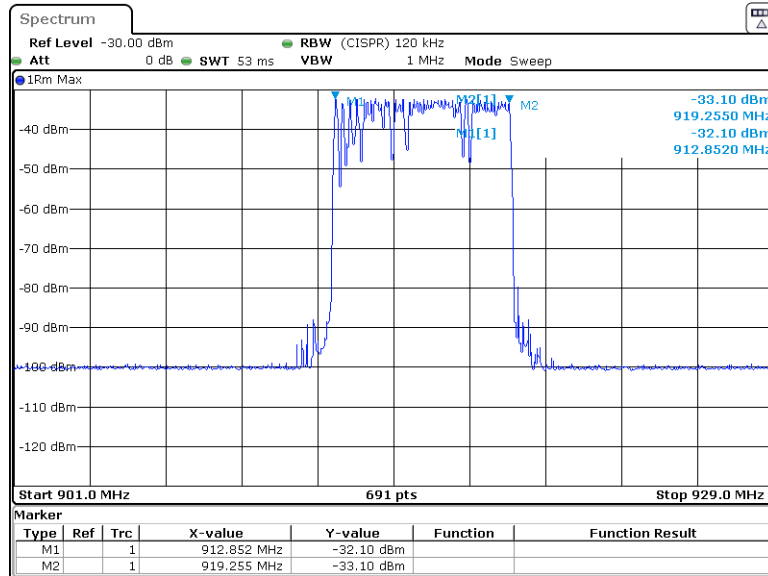
Full description is given in Appendix A.



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<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(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> 27-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 7.3.1 Number of hopping frequencies

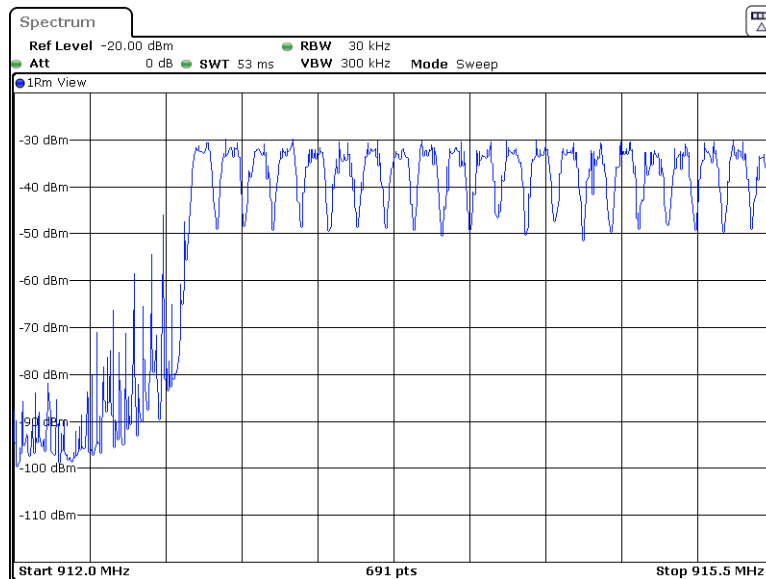


Date: 27.AUG.2017 08:43:06



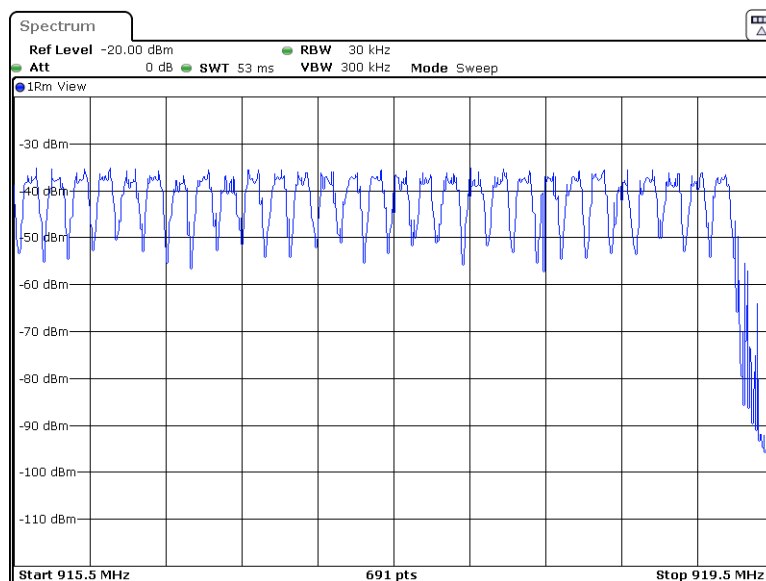
<b>Test specification: Section 15.247(a)1, RSS-247 section 5.1(c), Number of hopping frequencies</b>			
<b>Test procedure: ANSI C63.10, section 7.8.3</b>			
<b>Test mode: Compliance</b>		<b>Verdict: PASS</b>	
<b>Date(s): 27-Aug-17</b>			
<b>Temperature: 23 °C</b>	<b>Relative Humidity: 55 %</b>	<b>Air Pressure: 1010 hPa</b>	<b>Power: Battery</b>
<b>Remarks:</b>			

Plot 7.3.2 Number of hopping frequencies (21 channels)



Date: 27.AUG.2017 09:13:58

Plot 7.3.3 Number of hopping frequencies (29 channels)



Date: 27.AUG.2017 09:54:24



<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 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.

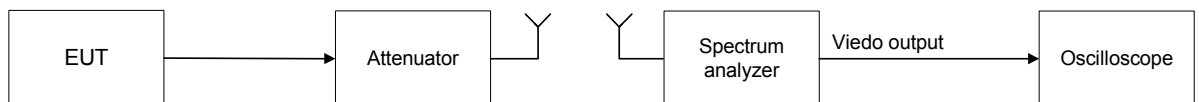
7.4.2.2 The spectrum analyzer span was set to zero centered on a hopping channel.

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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 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	Number of pulses during 20 sec	Average time of occupancy, ms	Bit rate, kbps	Symbol rate, Msymbol/s	Limit, s	Margin, s*	Verdict
912.75	4.75	1	4.75	50	NA	0.4	-0.39525	Pass

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

Reference numbers of test equipment used

HL 4135	HL 4355						
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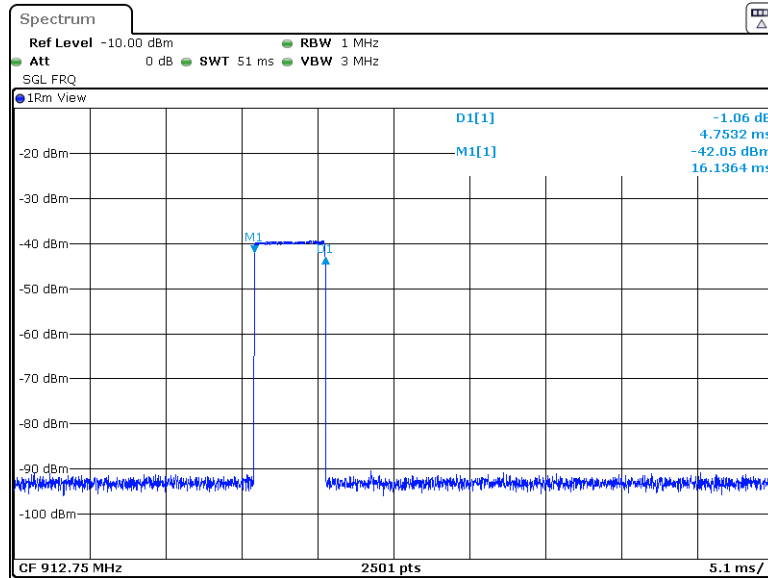
Full description is given in Appendix A.



HERMON LABORATORIES

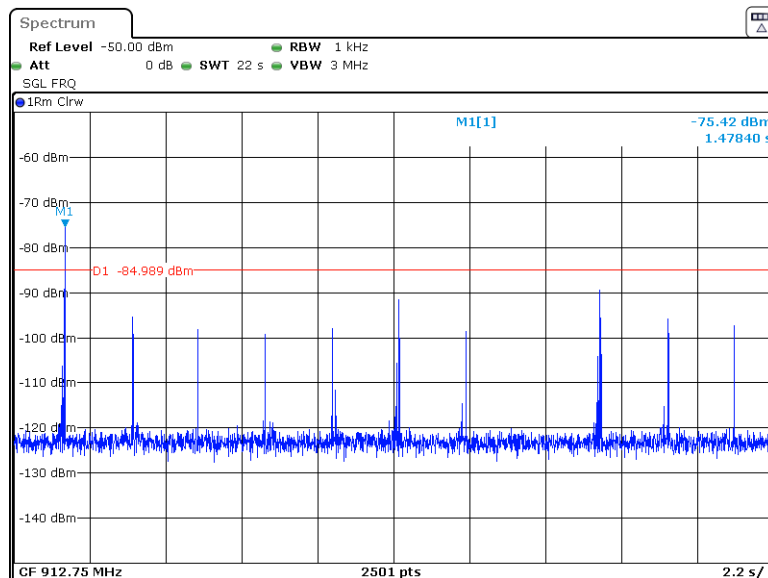
<b>Test specification:</b> Section 15.247(a)1, RSS-247 section 5.1(c), Average time of occupancy			
<b>Test procedure:</b> ANSI C63.10, section 7.8.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.4.1 Single transmission duration



Date: 28.AUG.2017 08:40:35

Plot 7.4.2 Single transmission period



Date: 28.AUG.2017 08:36:51



<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> 09-Aug-17			
<b>Temperature:</b> 25.4 °C	<b>Relative Humidity:</b> 52 %	<b>Air Pressure:</b> 1008 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:

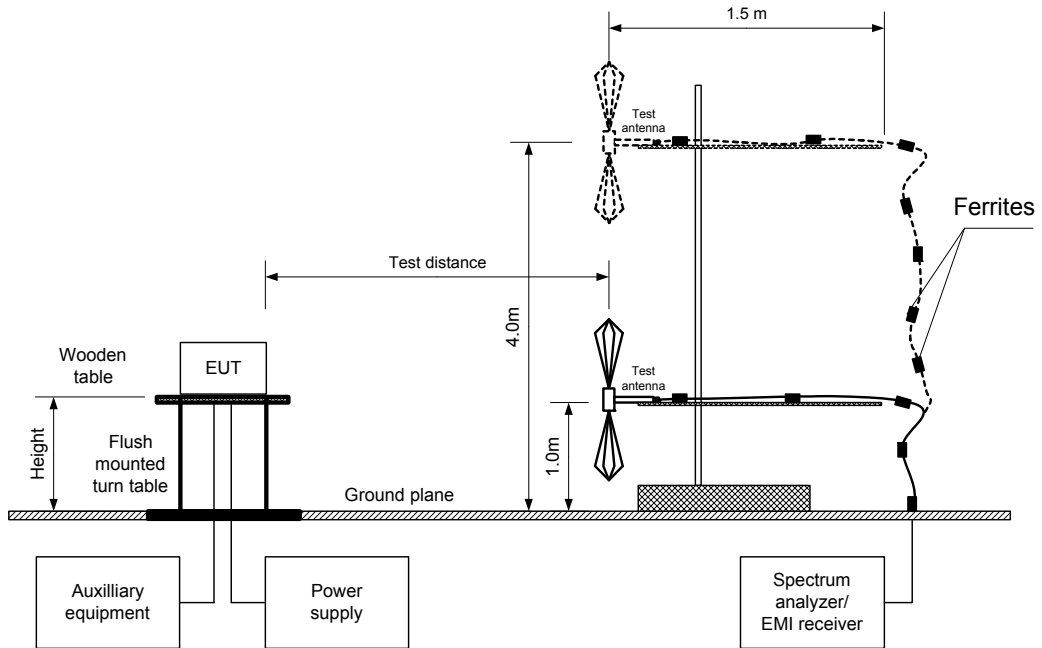
$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V/m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

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



<b>Test specification: 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:</b> PASS	
<b>Date(s):</b> 09-Aug-17			
<b>Temperature:</b> 25.4 °C	<b>Relative Humidity:</b> 52 %	<b>Air Pressure:</b> 1008 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> 09-Aug-17			
<b>Temperature:</b> 25.4 °C	<b>Relative Humidity:</b> 52 %	<b>Air Pressure:</b> 1008 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)
MODULATION:	GFSK
BIT RATE:	50 kbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	120 MHz
VIDEO BANDWIDTH:	300 MHz
FREQUENCY HOPPING:	Disabled

**Retest after changes**

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
912.764	104.57	H	1.0	360	-2.0	11.37	30.0	-15.63	Pass
915.837	104.14	V	1.4	360	-2.0	10.94	30.0	-16.04	Pass
919.072	104.25	V	1.1	0	-2.0	11.05	30.0	-15.95	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.

Note: Maximum peak output power was obtained in Y-axis orthogonal position.

**Reference numbers of test equipment used**

HL 4541	HL 4542	HL 4575	HL 4604	HL 5102	HL 5105		
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Full description is given in Appendix A.

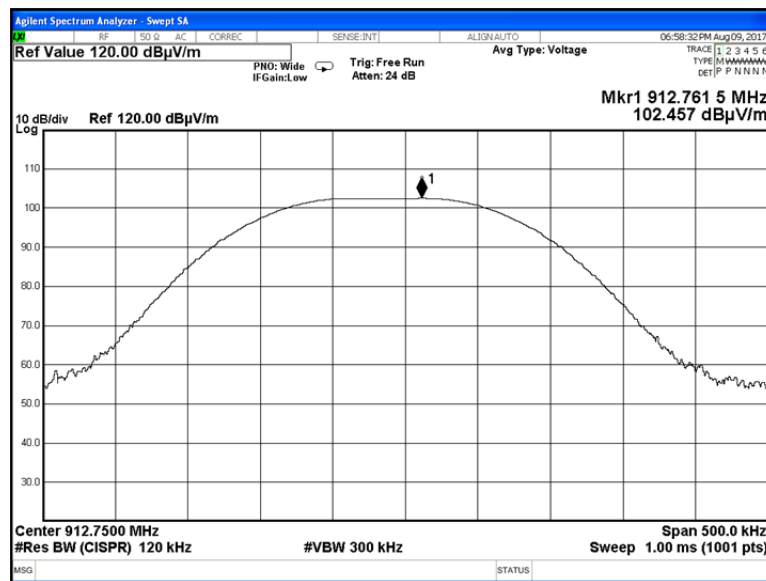


HERMON LABORATORIES

<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> 09-Aug-17			
<b>Temperature:</b> 25.4 °C	<b>Relative Humidity:</b> 52 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

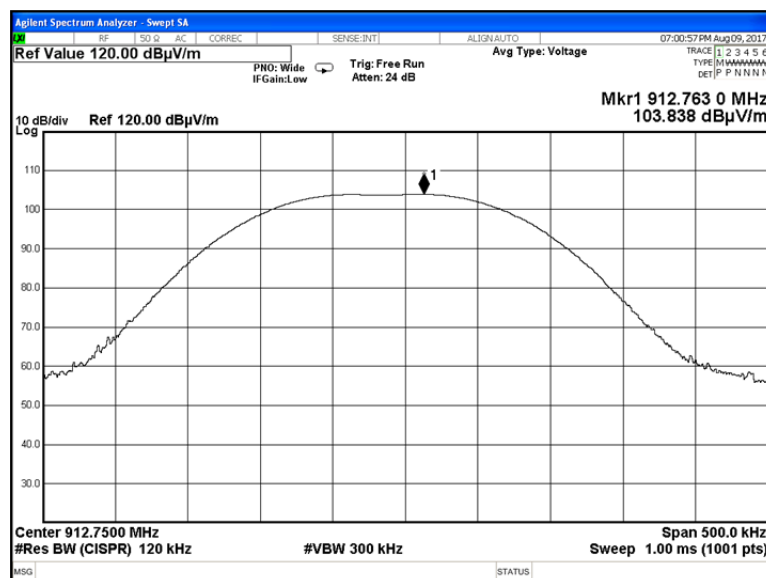
Plot 7.5.1 Field strength of carrier at low frequency and Unom

Antenna polarization: Vertical  
EUT position: X-axis



Plot 7.5.2 Field strength of carrier at low frequency and Unom

Antenna polarization: Horizontal  
EUT position: X-axis



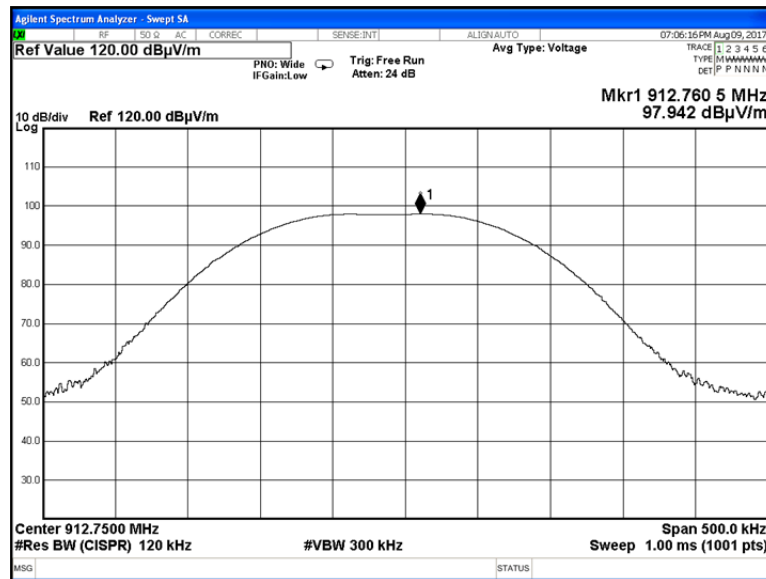


HERMON LABORATORIES

<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> 09-Aug-17			
<b>Temperature:</b> 25.4 °C	<b>Relative Humidity:</b> 52 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

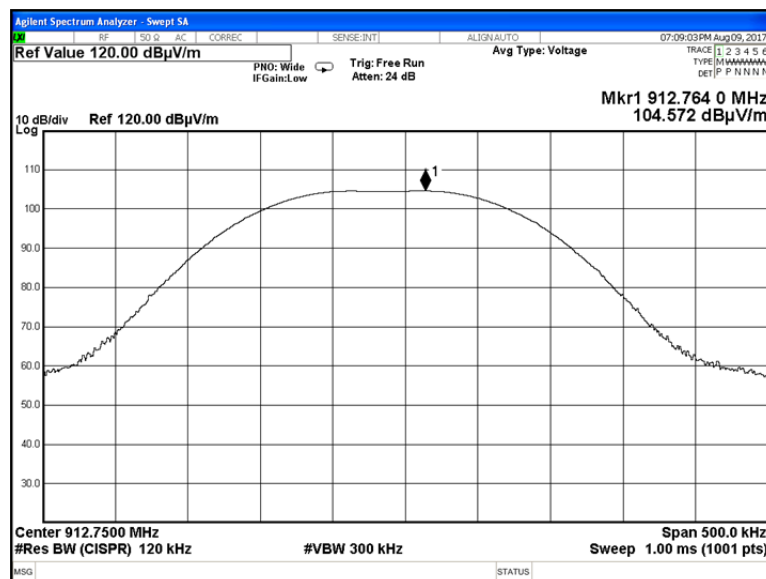
Plot 7.5.3 Field strength of carrier at low frequency and Unom

Antenna polarization: Vertical  
EUT position: Y-axis



Plot 7.5.4 Field strength of carrier at low frequency and Unom

Antenna polarization: Horizontal  
EUT position: Y-axis



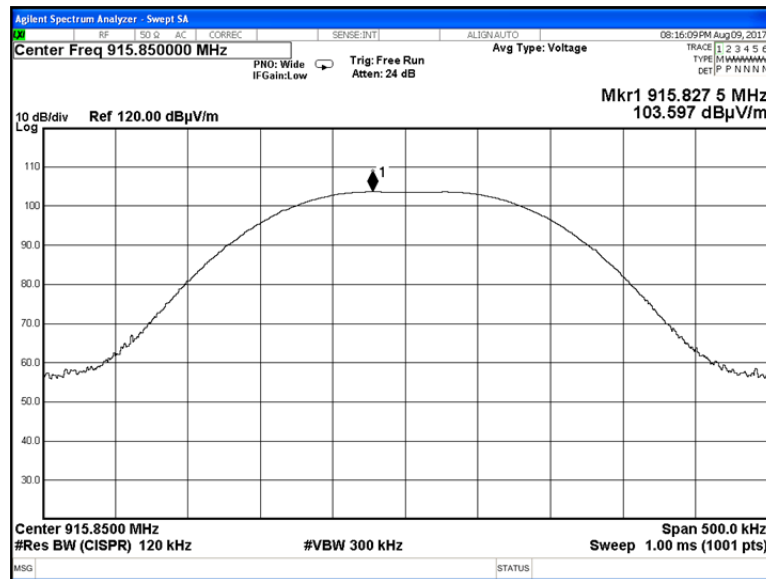


HERMON LABORATORIES

<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> 09-Aug-17			
<b>Temperature:</b> 25.4 °C	<b>Relative Humidity:</b> 52 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

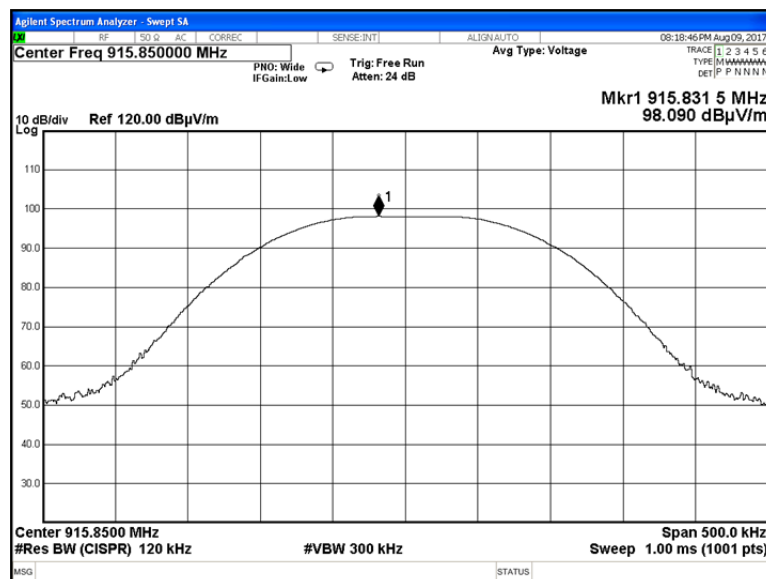
**Plot 7.5.5 Field strength of carrier at mid frequency and Unom**

Antenna polarization: Vertical  
EUT position: X-axis



**Plot 7.5.6 Field strength of carrier at mid frequency and Unom**

Antenna polarization: Horizontal  
EUT position: X-axis



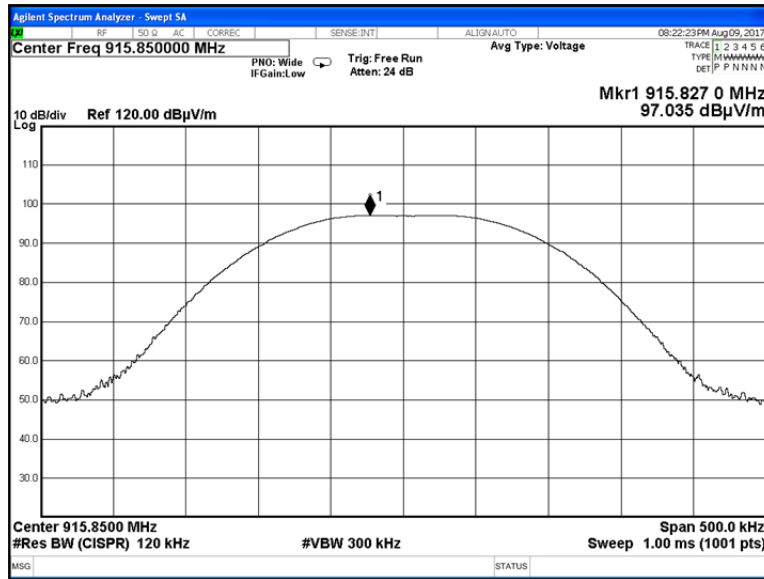


HERMON LABORATORIES

<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> 09-Aug-17			
<b>Temperature:</b> 25.4 °C	<b>Relative Humidity:</b> 52 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

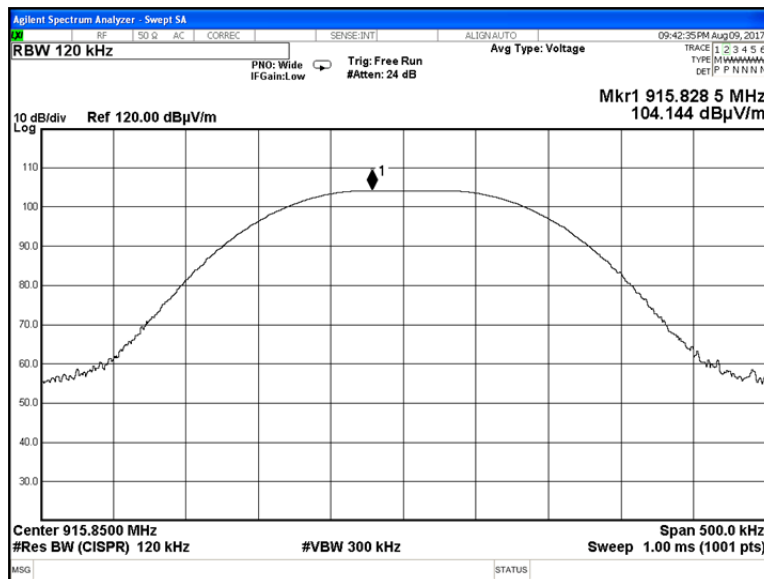
Plot 7.5.7 Field strength of carrier at mid frequency and Unom

Antenna polarization: Vertical  
EUT position: Y-axis



Plot 7.5.8 Field strength of carrier at mid frequency and Unom

Antenna polarization: Horizontal  
EUT position: Y-axis



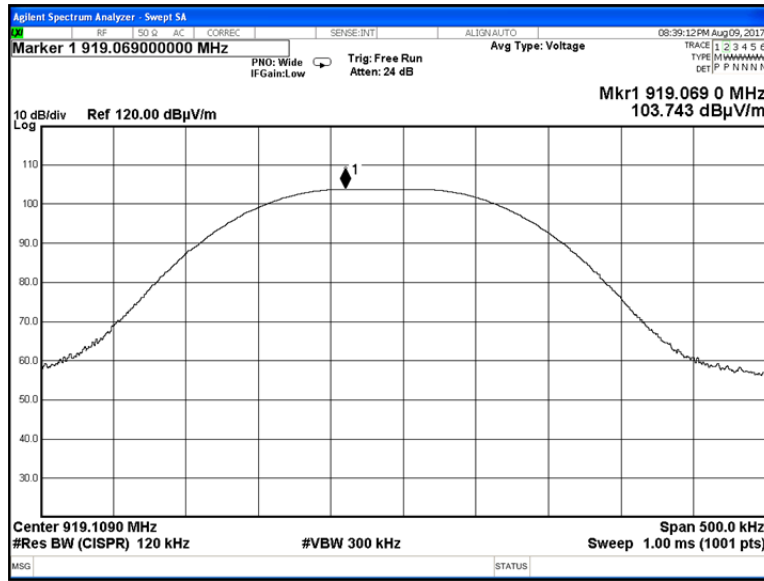


HERMON LABORATORIES

<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> 09-Aug-17			
<b>Temperature:</b> 25.4 °C	<b>Relative Humidity:</b> 52 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

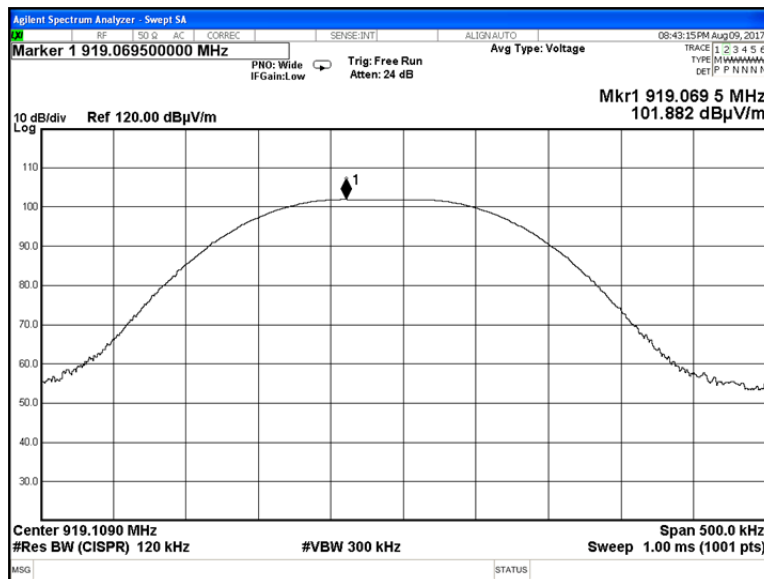
Plot 7.5.9 Field strength of carrier at high frequency and Unom

Antenna polarization: Vertical  
EUT position: X-axis



Plot 7.5.10 Field strength of carrier at high frequency and Unom

Antenna polarization: Horizontal  
EUT position: X-axis



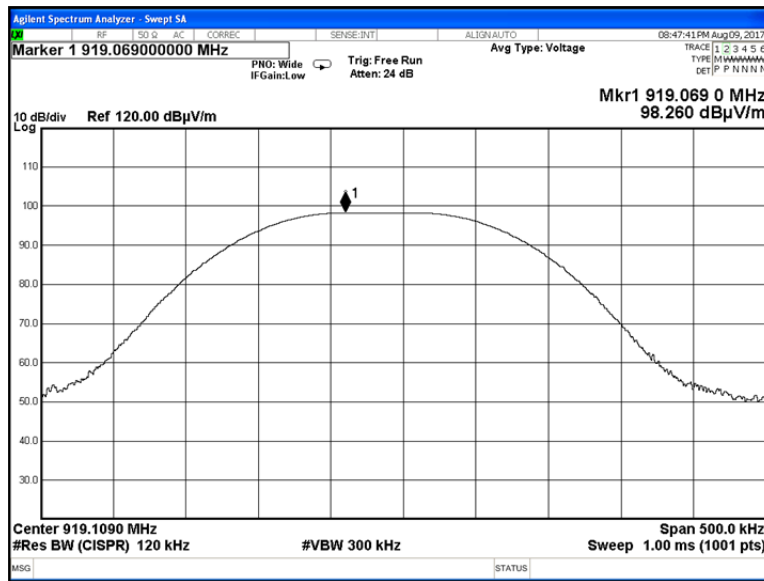


HERMON LABORATORIES

<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> 09-Aug-17			
<b>Temperature:</b> 25.4 °C	<b>Relative Humidity:</b> 52 %	<b>Air Pressure:</b> 1008 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

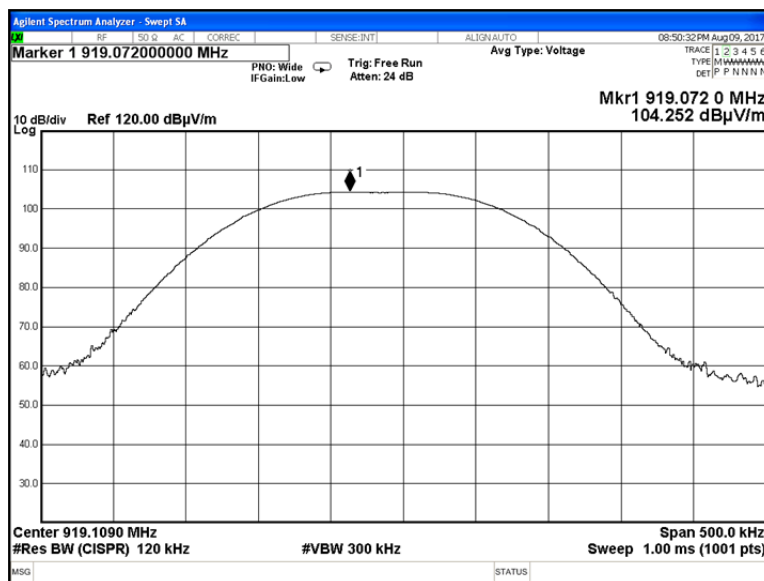
Plot 7.5.11 Field strength of carrier at high frequency and Unom

Antenna polarization: Vertical  
EUT position: Y-axis



Plot 7.5.12 Field strength of carrier at high frequency and Unom

Antenna polarization: Horizontal  
EUT position: Y-axis





<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

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

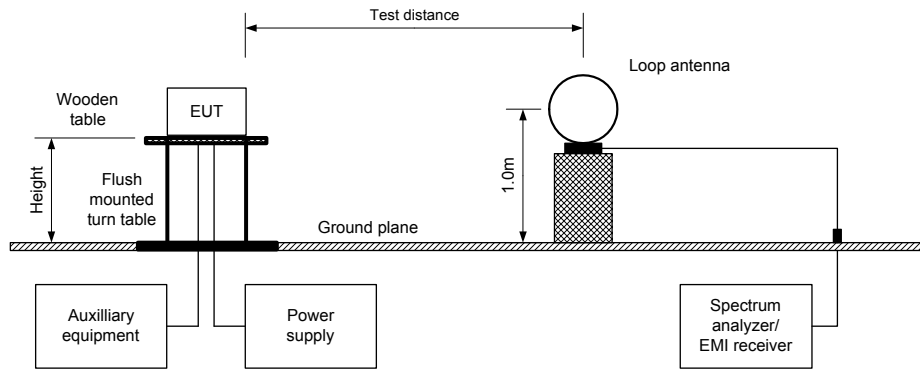
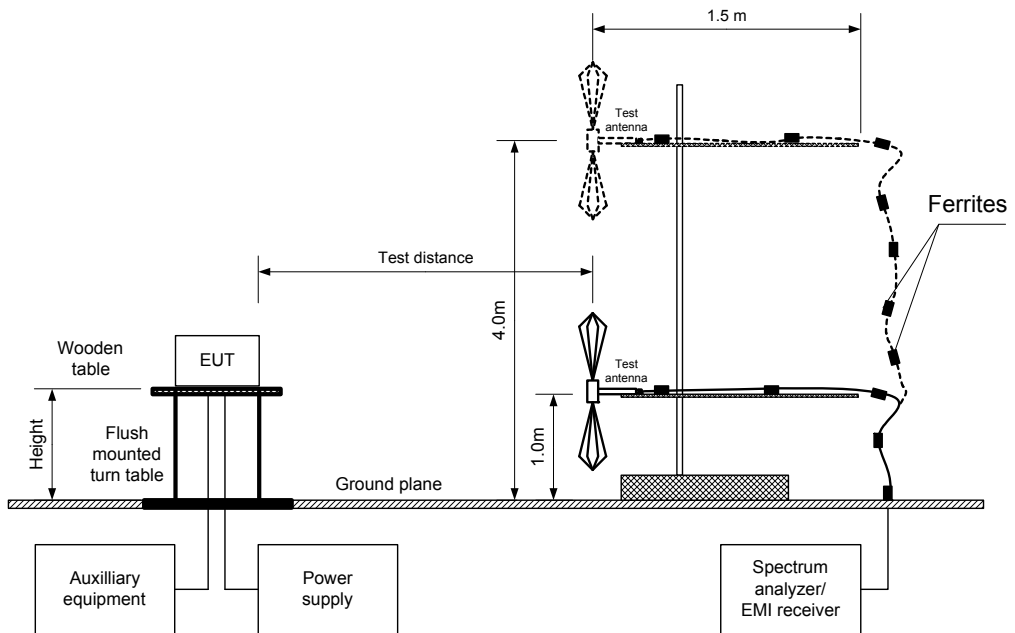


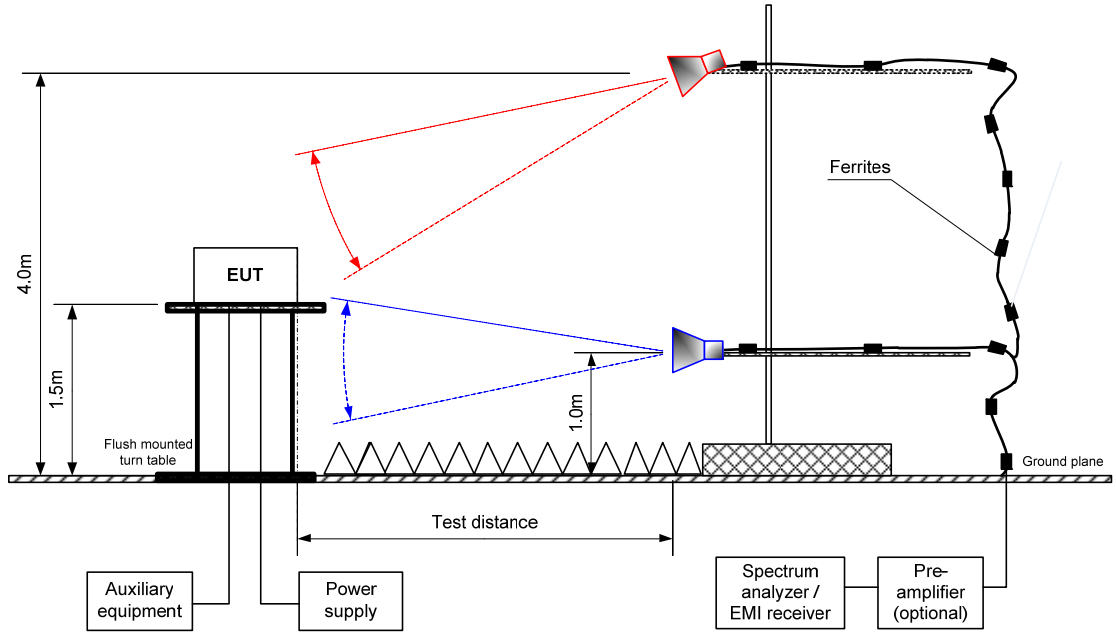
Figure 7.6.2 Setup for spurious emission field strength measurements above 30 MHz





<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 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 -9500 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 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)  
 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>									
1825.50	53.79	Horizontal	1.3	0.0	103.876	48.68	20.0	28.68	Pass
5476.50	36.18	Horizontal	1.4	0.0		74.11		54.11	
<b>Mid carrier frequency</b>									
1831.70	55.61	Horizontal	1.7	0	104.291	48.68	20.0	28.68	Pass
5495.10	30.18	Horizontal	1.4	0.0		74.11		54.11	
<b>High carrier frequency</b>									
1838.22	57.36	Horizontal	1.9	0	104.191	46.83	20.0	26.83	Pass
5514.65	32.98	Horizontal	1.4	0.0		71.21		51.21	

\*- 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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 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 -9500 MHz  
 TEST DISTANCE: 3 m  
 MODULATION: GFSK  
 BIT RATE: 50 kbps  
 DUTY CYCLE: 100 %  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 1000 kHz  
 TEST ANTENNA TYPE: Double ridged guide  
 FREQUENCY HOPPING: Disabled  
 ASSIGNED FREQUENCY: 902-928 MHz

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>											
2738.25	Vertical	1.7	0	57.11	74.0	-16.89	57.11	40.11	54.0	-13.89	Pass
3651.00	Vertical	1.5	0	42.36	74.0	-31.64	42.36	25.36	54.0	-28.64	
4563.75	Vertical	1.5	0	45.65	74.0	-28.35	45.65	28.65	54.0	-25.35	
<b>Mid carrier frequency</b>											
2747.55	Vertical	1.4	272	59.32	74.0	-14.68	59.32	42.32	54.0	-11.68	Pass
3663.40	Vertical	1.5	0	45.07	74.0	-28.93	45.07	28.07	54.0	-25.93	
4579.25	Vertical	1.5	0	48.57	74.0	-25.43	48.57	31.57	54.0	-22.43	
<b>High carrier frequency</b>											
2757.33	Vertical	1.7	0	56.46	74.0	-17.54	56.46	39.46	54.0	-14.54	Pass
3676.44	Vertical	1.5	0	39.40	74.0	-34.6	39.40	22.40	54.0	-31.60	
4595.55	Vertical	1.7	0	48.59	74.0	-25.41	48.59	31.59	54.0	-22.41	

\*- 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	Period, ms	Duration, ms	Period, ms		
4.66	39.1	NA	NA	NA	-17

\*- Average factor was calculated as follows for pulse train longer than 100 ms:

$$Average\ factor = 20 \times \log_{10} \left( \frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100ms} \times Number\ of\ bursts\ within\ 100ms \right)$$



<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 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
ASSIGNED FREQUENCY:	902-928 MHz
BIT RATE:	Mbps
DUTY CYCLE:	100 %
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
RESOLUTION BANDWIDTH:	0.2 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz)
FREQUENCY 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 1915	HL 3818	HL 4222	HL 4294	HL 4295	HL 4535	HL 4541	HL 4542
HL 4543	HL 4549	HL 4575	HL 4603	HL 4604	HL 4933	HL 5105	HL 5111

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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 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

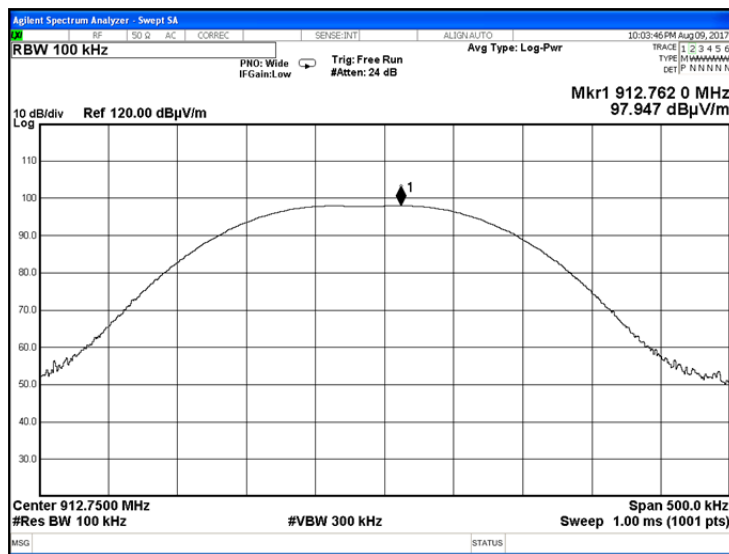


HERMON LABORATORIES

<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure: ANSI C63.10, sections 6.5, 6.6</b>			
<b>Test mode: Compliance</b>		<b>Verdict: PASS</b>	
<b>Date(s): 28-Aug-17</b>			
<b>Temperature: 23 °C</b>	<b>Relative Humidity: 55 %</b>	<b>Air Pressure: 1012 hPa</b>	<b>Power: Battery</b>
<b>Remarks:</b>			

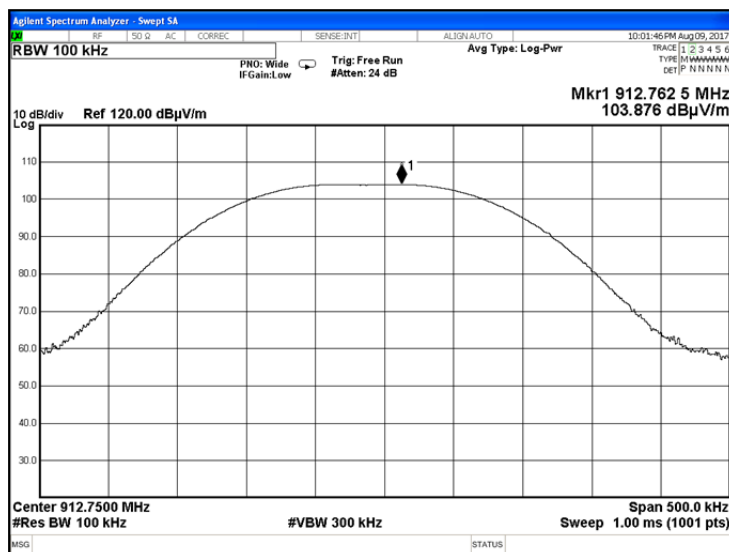
Plot 7.6.1 Radiated emission measurements at the low carrier frequency

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



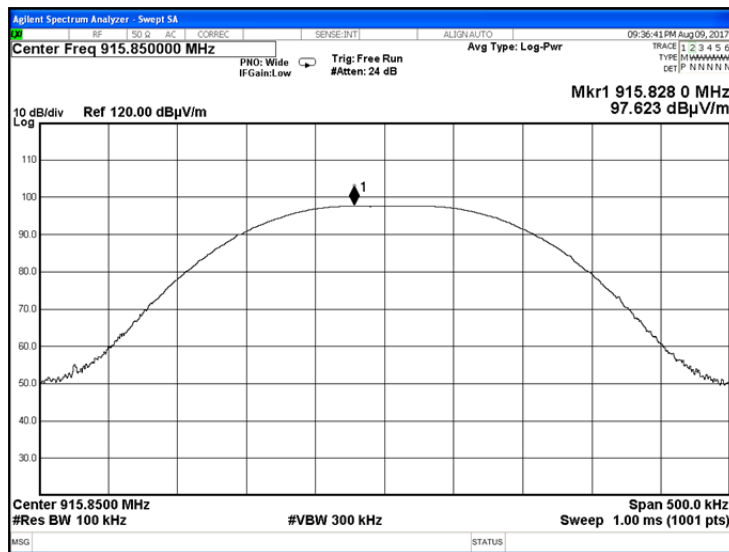


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

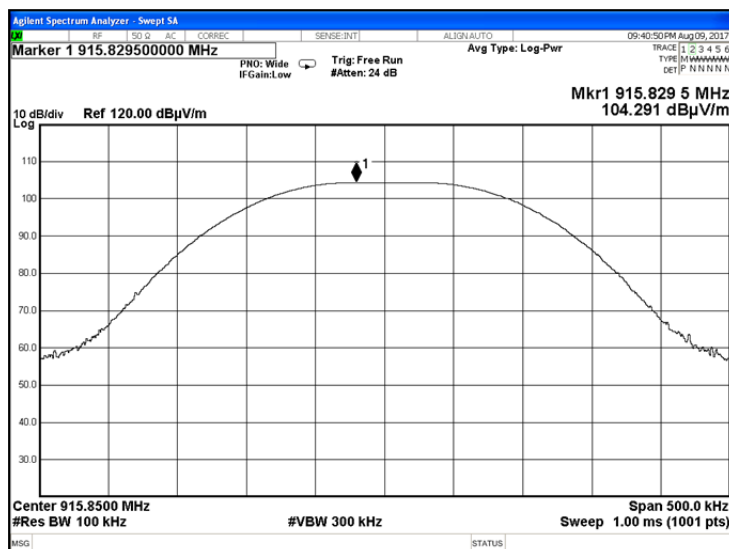
Plot 7.6.3 Radiated emission measurements at the mid carrier frequency

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



Plot 7.6.4 Radiated emission measurements at the mid carrier frequency

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





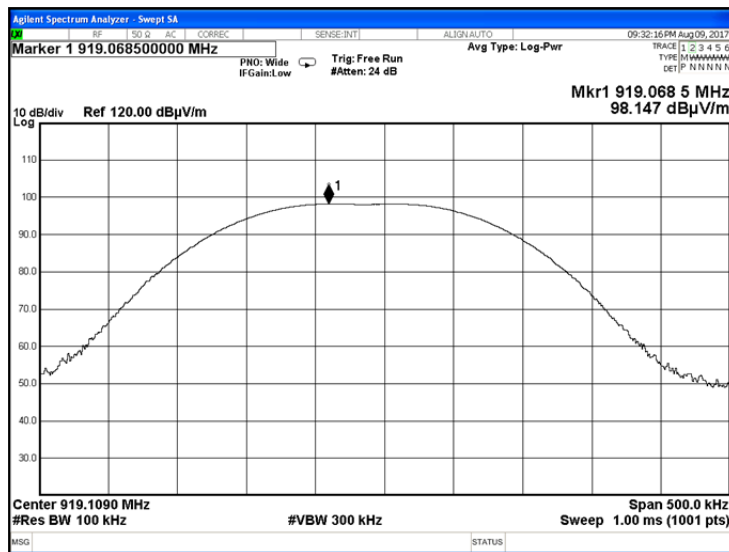


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

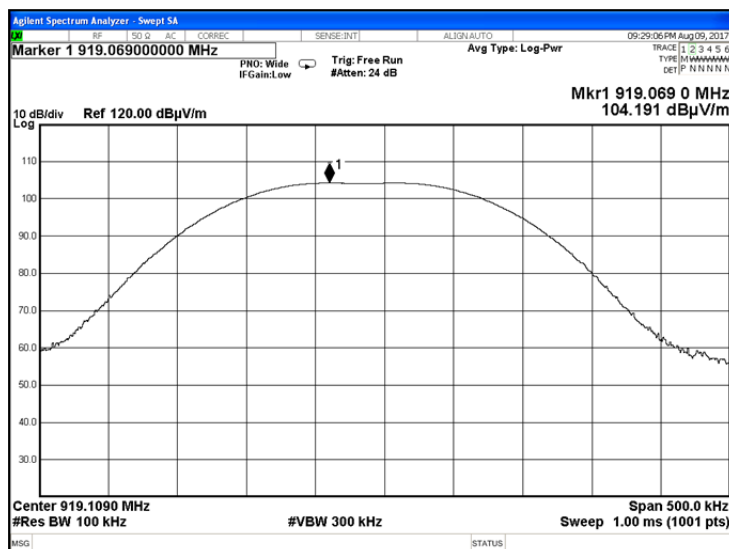
Plot 7.6.5 Radiated emission measurements at the high carrier frequency

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



Plot 7.6.6 Radiated emission measurements at the high carrier frequency

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



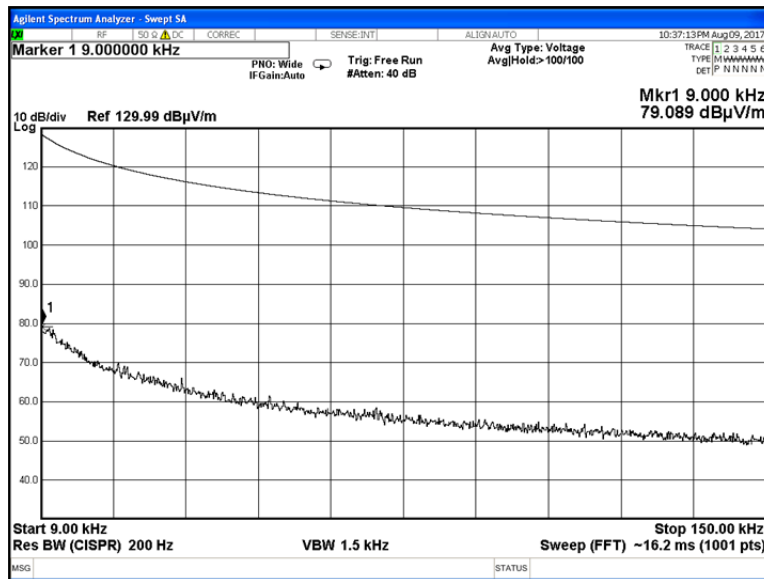


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

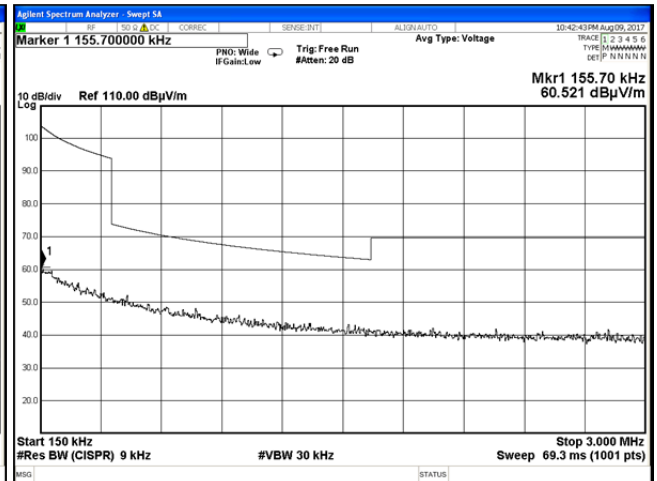
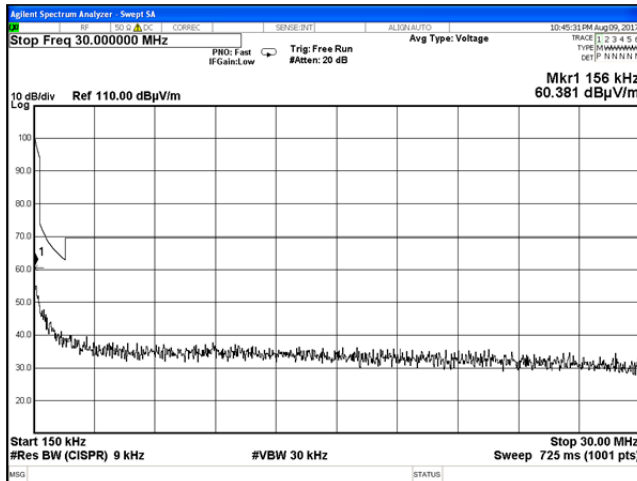
Plot 7.6.7 Radiated emission measurements from 9 to 150 kHz at the low, mid and high carrier frequency

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



Plot 7.6.8 Radiated emission measurements from 0.15 to 30 MHz at the low, mid and high carrier frequency

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

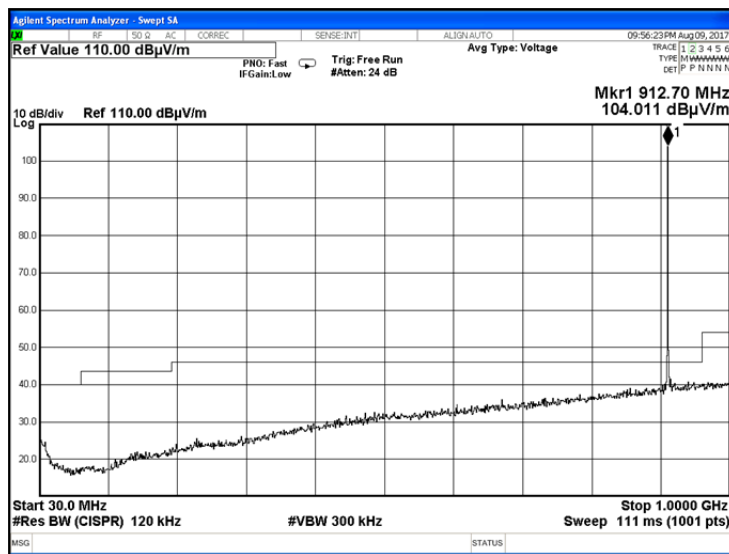




<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.6.9 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 7.6.10 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



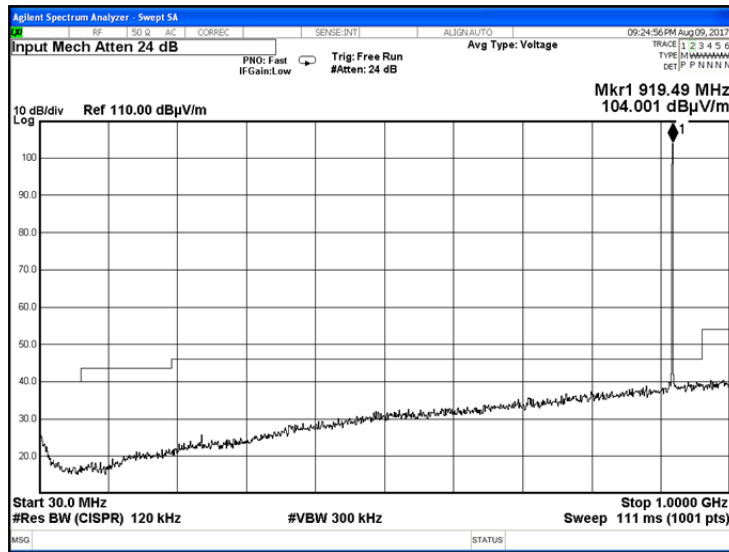


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.6.11 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



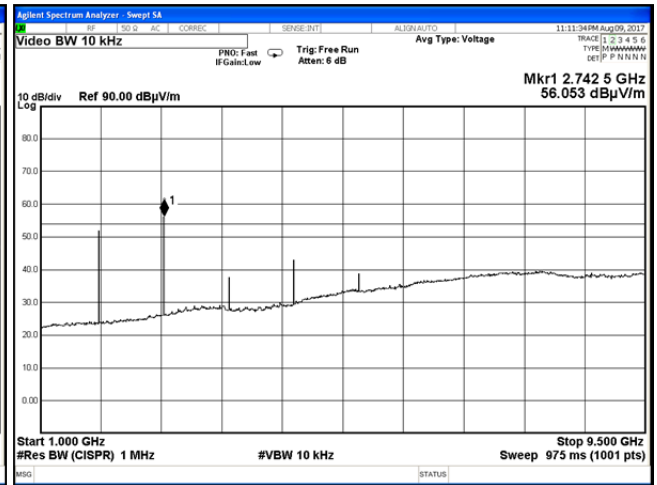
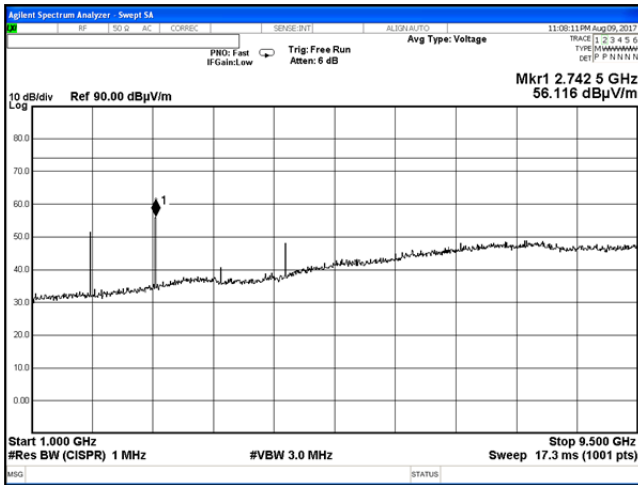


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

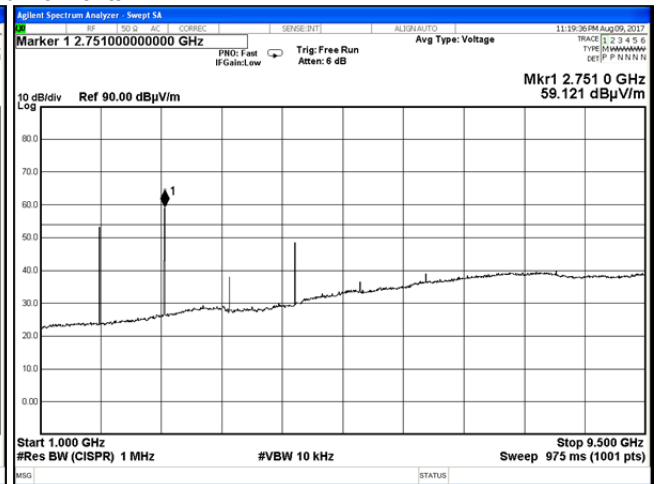
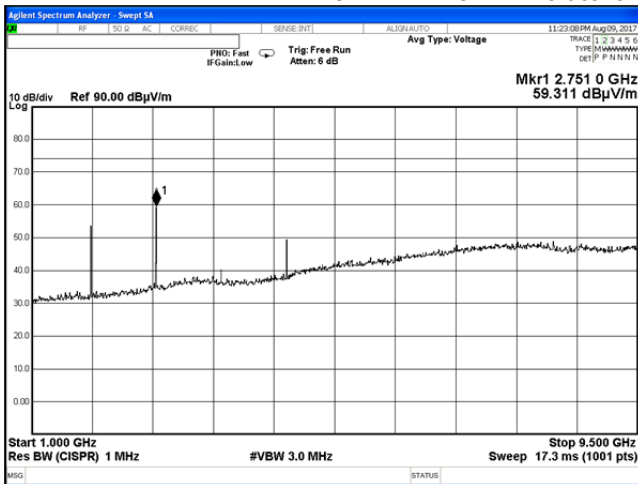
Plot 7.6.12 Radiated emission measurements from 1000 to 9500 MHz at the low carrier frequency

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



Plot 7.6.13 Radiated emission measurements from 1000 to 9500 MHz at the mid carrier frequency

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



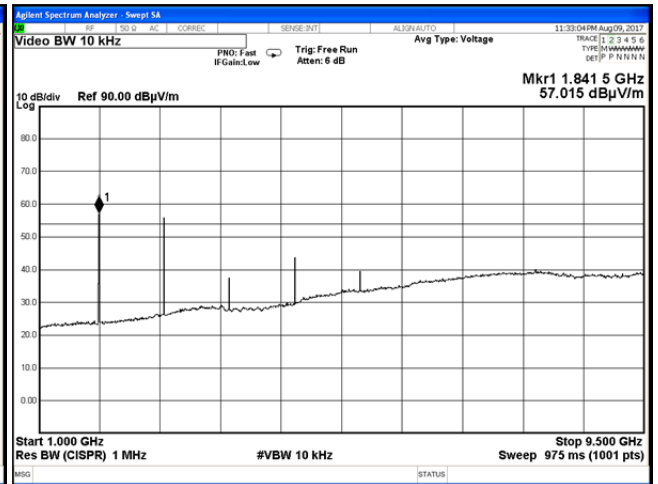
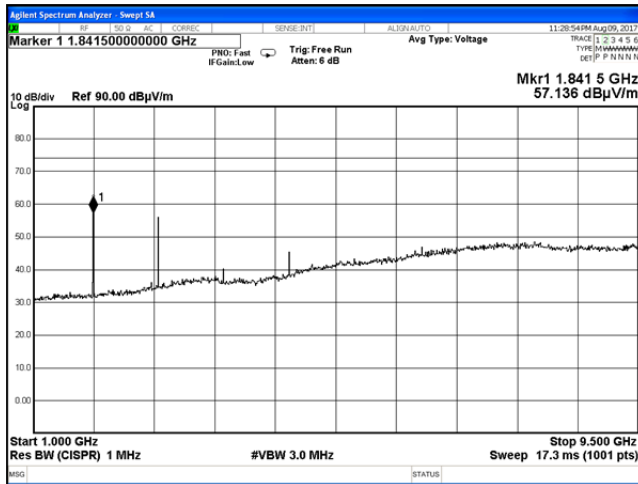


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.6.14 Radiated emission measurements from 1000 to 9500 MHz at the high carrier frequency

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



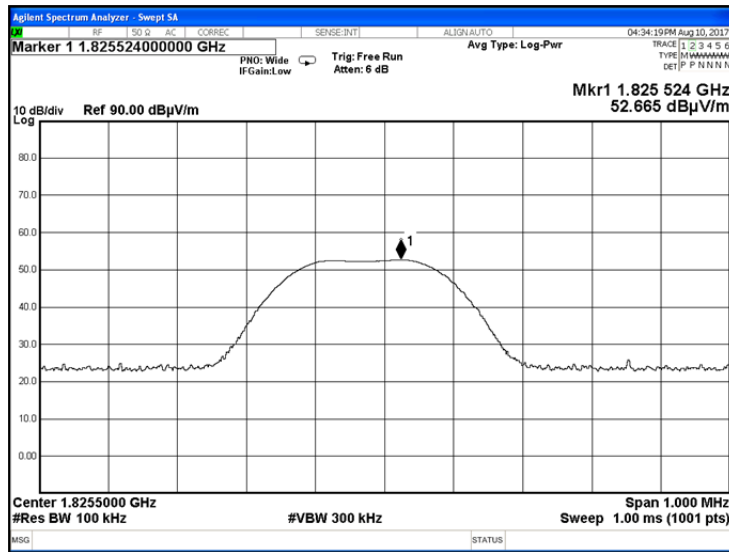


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

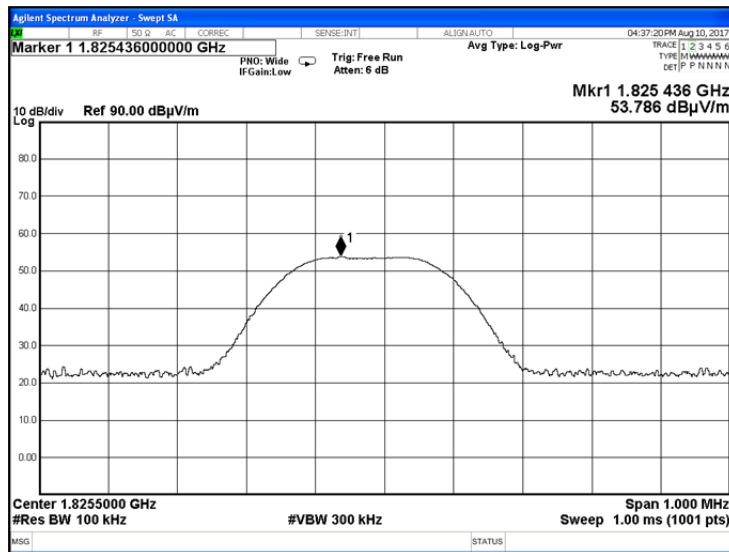
Plot 7.6.15 Radiated emission measurements at the second harmonic of low carrier frequency

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



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

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



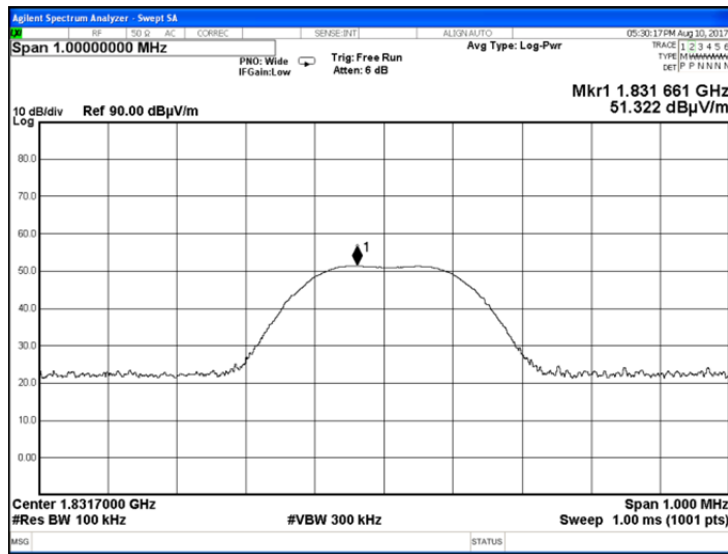


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

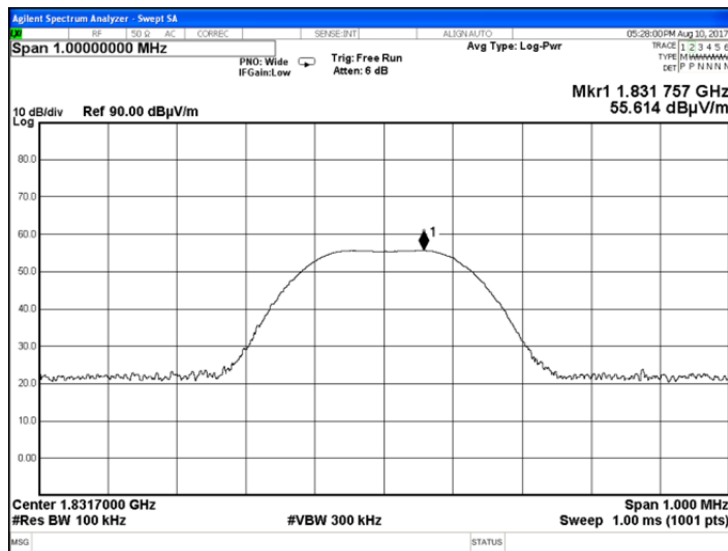
Plot 7.6.17 Radiated emission measurements at the second harmonic of mid carrier frequency

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



Plot 7.6.18 Radiated emission measurements at the second harmonic of mid carrier frequency

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



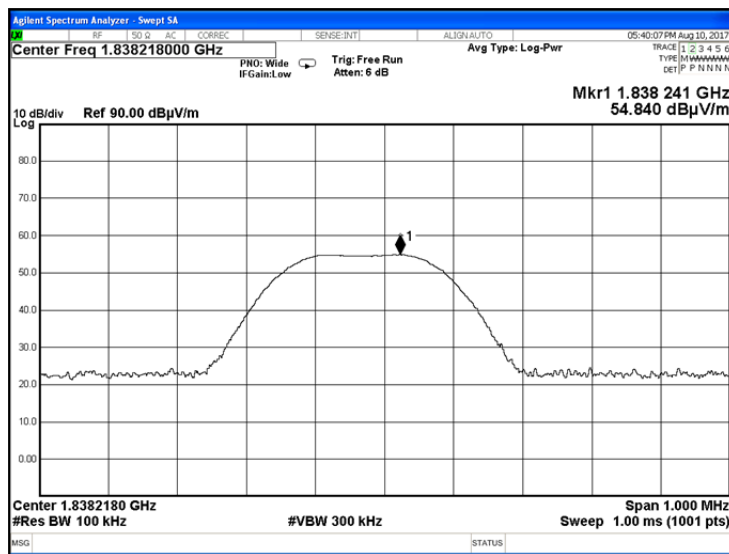




<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure: ANSI C63.10, sections 6.5, 6.6</b>			
<b>Test mode: Compliance</b>		<b>Verdict: PASS</b>	
<b>Date(s): 28-Aug-17</b>			
<b>Temperature: 23 °C</b>	<b>Relative Humidity: 55 %</b>	<b>Air Pressure: 1012 hPa</b>	<b>Power: Battery</b>
<b>Remarks:</b>			

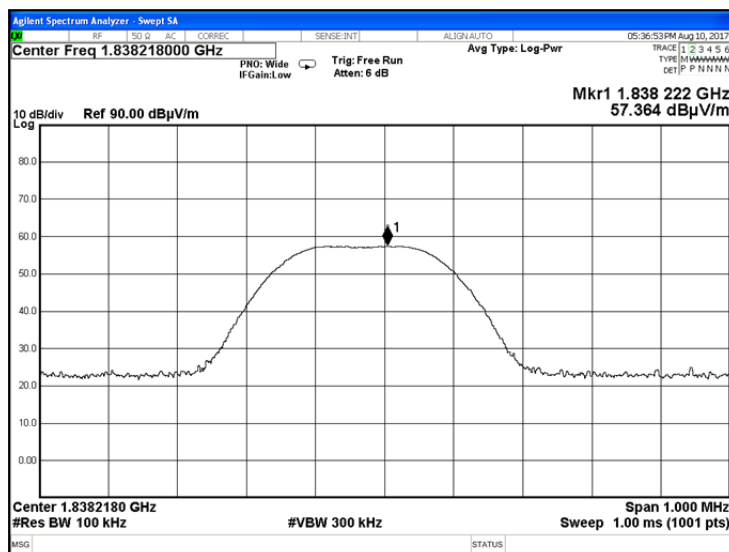
Plot 7.6.19 Radiated emission measurements at the second harmonic of high carrier frequency

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



Plot 7.6.20 Radiated emission measurements at the second harmonic of high carrier frequency

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



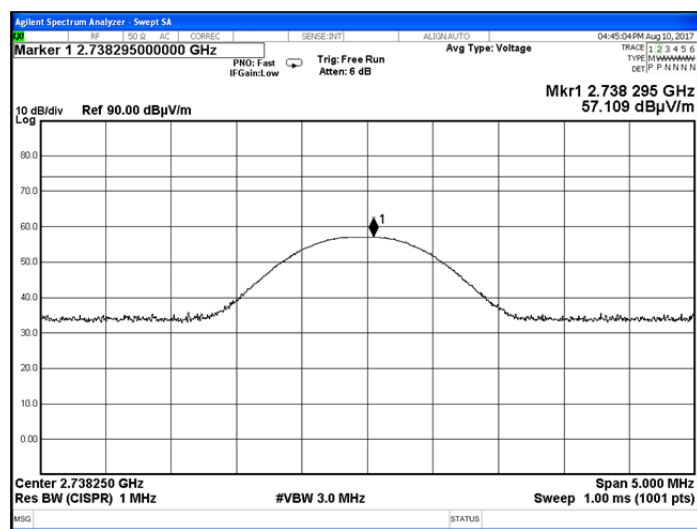


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

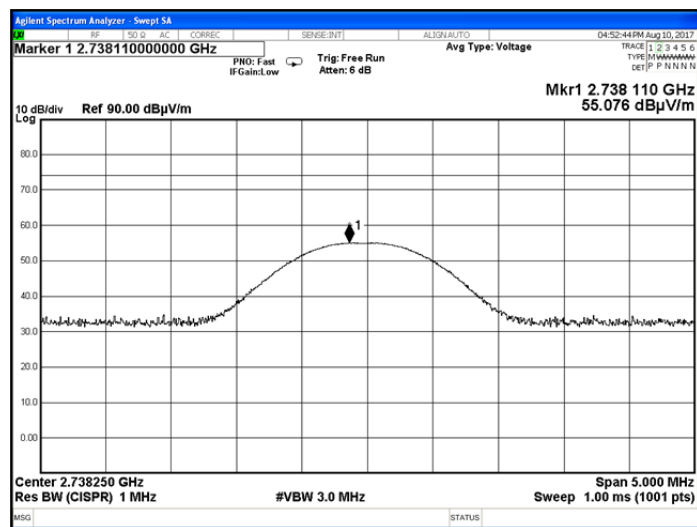
Plot 7.6.21 Radiated emission measurements at the third harmonic of low carrier frequency

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
DETECTOR: Peak



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

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
DETECTOR: Peak



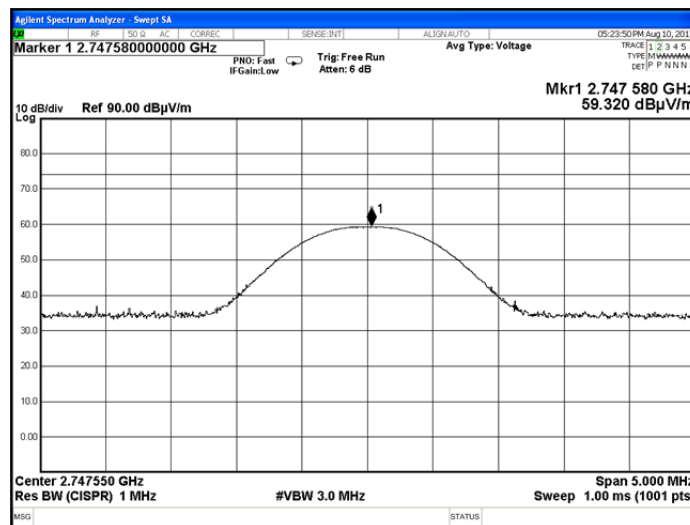


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

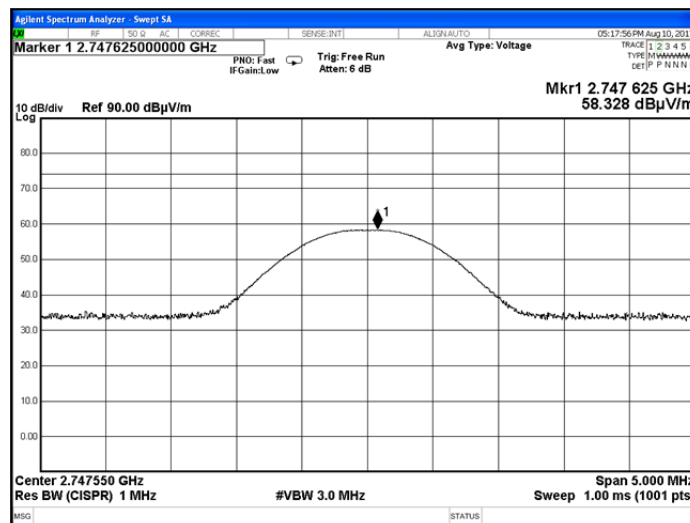
Plot 7.6.23 Radiated emission measurements at the third harmonic of mid carrier frequency

TEST SITE: Semi Anechoic Chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
DETECTOR: Peak



Plot 7.6.24 Radiated emission measurements at the third harmonic of mid carrier frequency

TEST SITE: Semi Anechoic Chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal  
DETECTOR: Peak



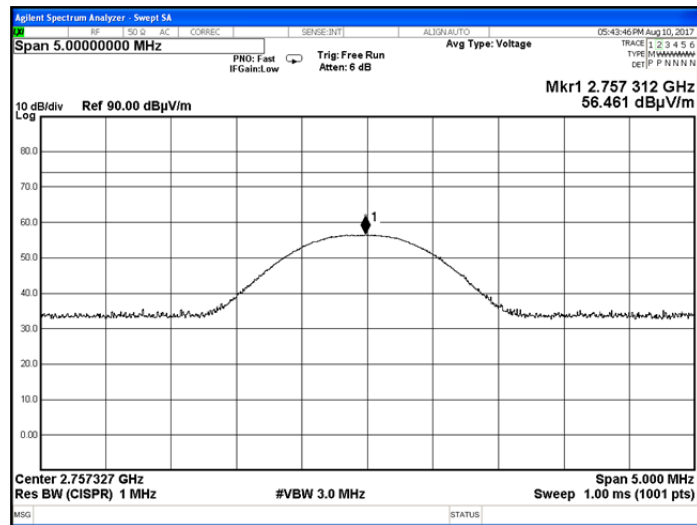


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

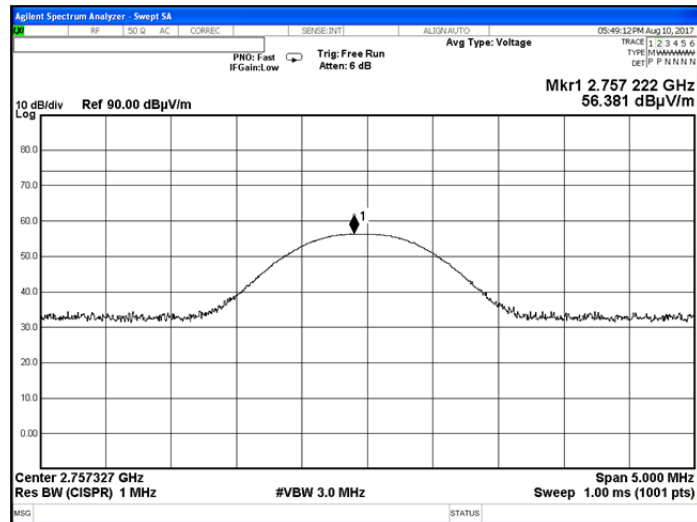
Plot 7.6.25 Radiated emission measurements at the third harmonic of high carrier frequency

TEST SITE:	Semi Anechoic Chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
DETECTOR: Peak	



Plot 7.6.26 Radiated emission measurements at the third harmonic of high carrier frequency

TEST SITE:	Semi Anechoic Chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Horizontal
DETECTOR: Peak	



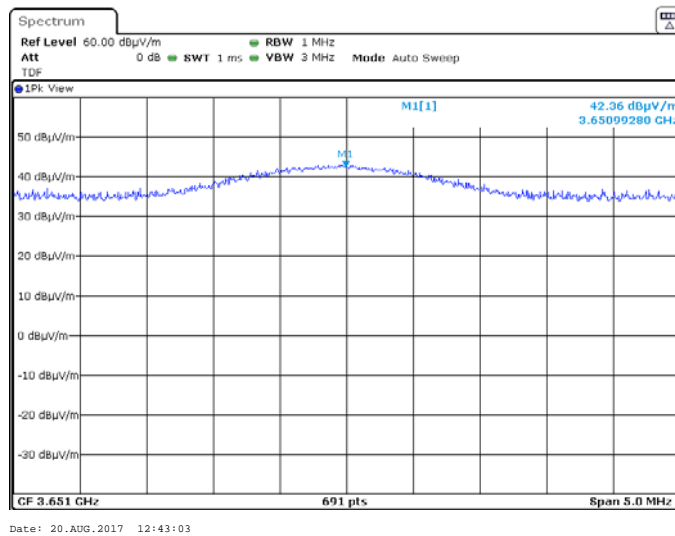


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

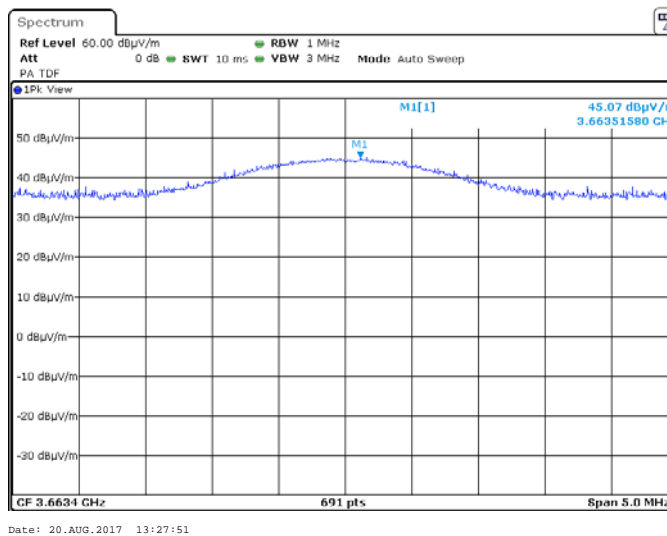
Plot 7.6.27 Radiated emission measurements at the fourth harmonic of low carrier frequency

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



Plot 7.6.28 Radiated emission measurements at the fourth harmonic of mid carrier frequency

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



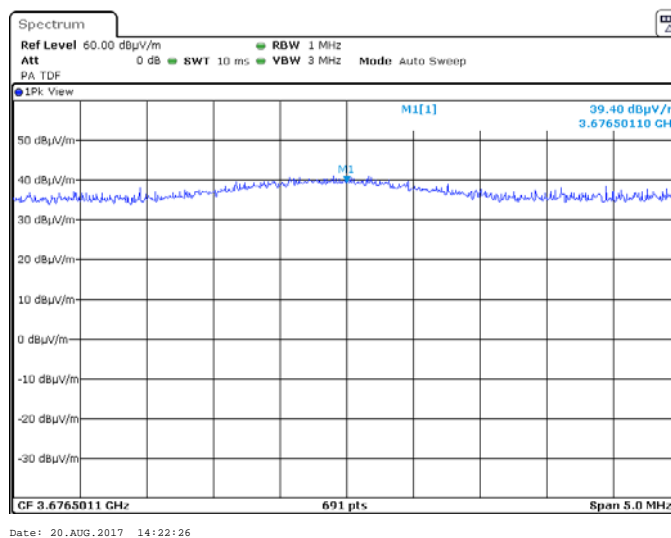


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

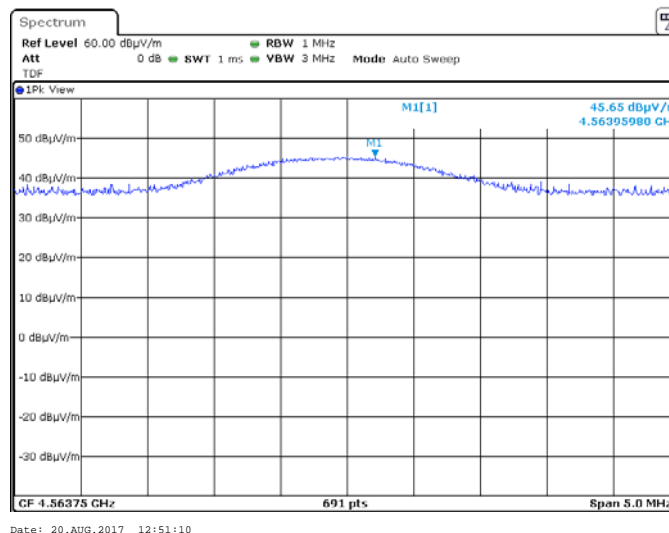
Plot 7.6.29 Radiated emission measurements at the fourth harmonic of high carrier frequency

TEST SITE:	Semi Anechoic Chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
DETECTOR: Peak	



Plot 7.6.30 Radiated emission measurements at the fifth harmonic of low carrier frequency

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



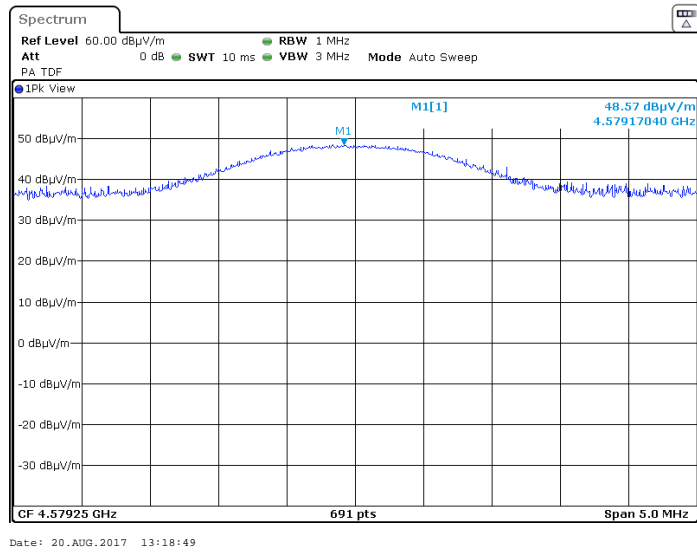


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

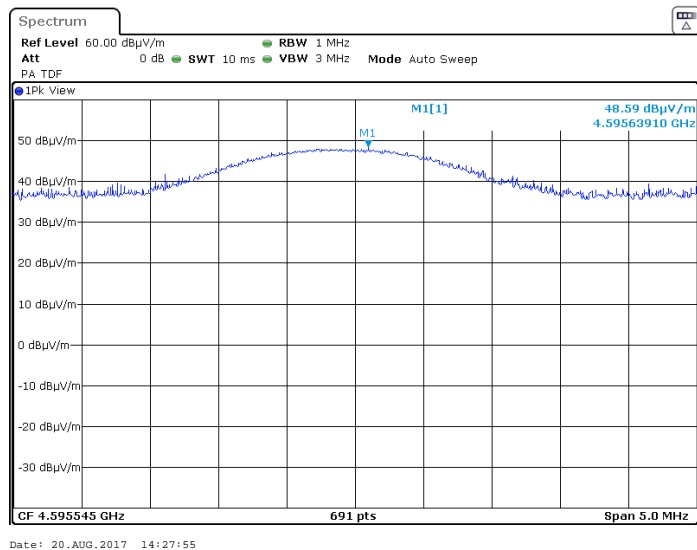
Plot 7.6.31 Radiated emission measurements at the fifth harmonic of mid carrier frequency

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



Plot 7.6.32 Radiated emission measurements at the fifth harmonic of high carrier frequency

TEST SITE:	Semi Anechoic Chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
DETECTOR: Peak	



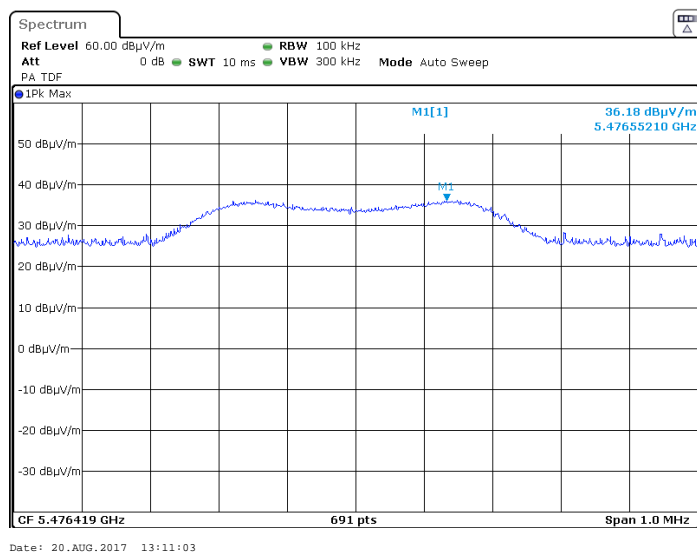


HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

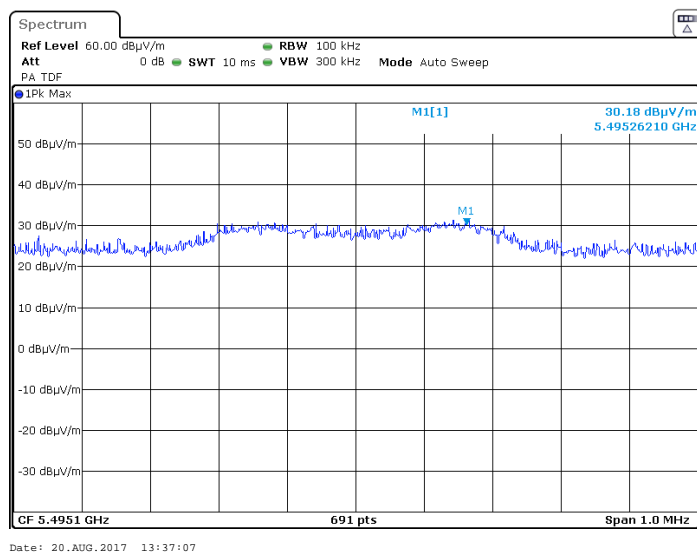
Plot 7.6.33 Radiated emission measurements at the sixth harmonic of low carrier frequency

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



Plot 7.6.34 Radiated emission measurements at the sixth harmonic of mid carrier frequency

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







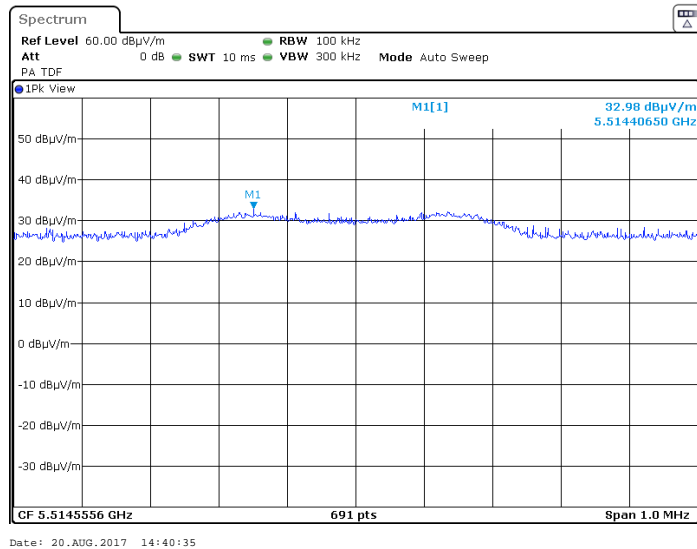
HERMON LABORATORIES

<b>Test specification: Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions</b>			
<b>Test procedure:</b> ANSI C63.10, sections 6.5, 6.6			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

**Plot 7.6.35 Radiated emission measurements at the sixth harmonic of high carrier frequency**

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION: Vertical

Semi Anechoic Chamber  
3 m  
ANTENNA POLARIZATION: Horizontal

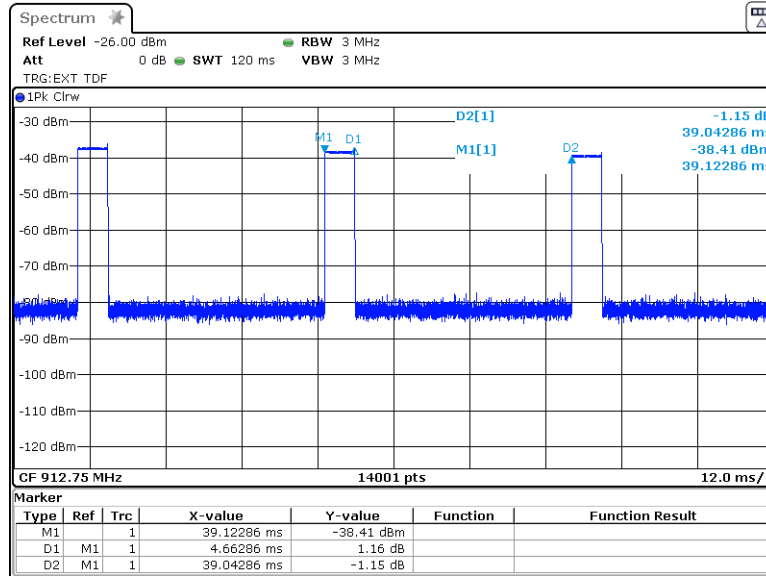




HERMON LABORATORIES

<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> 28-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

Plot 7.6.36 Transmission pulse duration and 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> 27-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> 27-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  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 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	-101.62	-37.58	64.04	20.0	44.04	Pass
919.109	-102.85	-32.42	70.43		50.43	
<b>Frequency hopping enabled</b>						
912.750	-101.72	-37.56	64.16	20.0	44.16	Pass
919.109	-101.36	-29.00	72.36		52.36	

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

**Reference numbers of test equipment used**

HL 4135	HL 4355					
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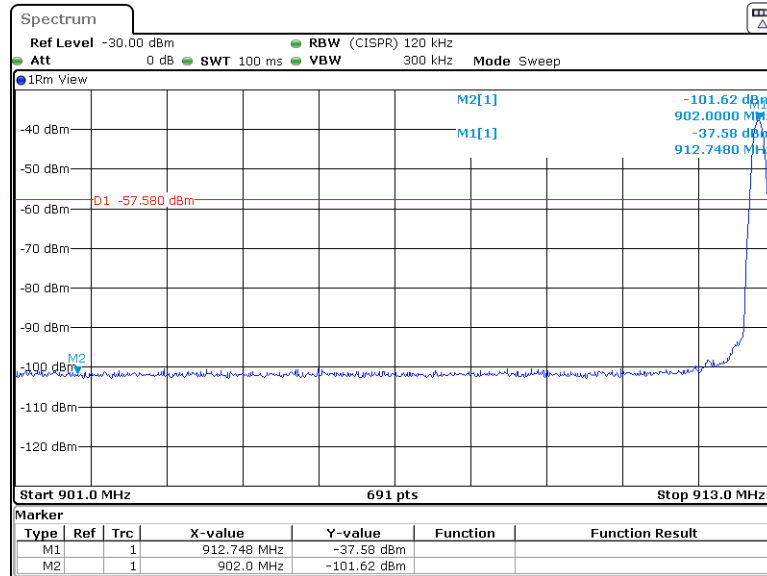
Full description is given in Appendix A.



HERMON LABORATORIES

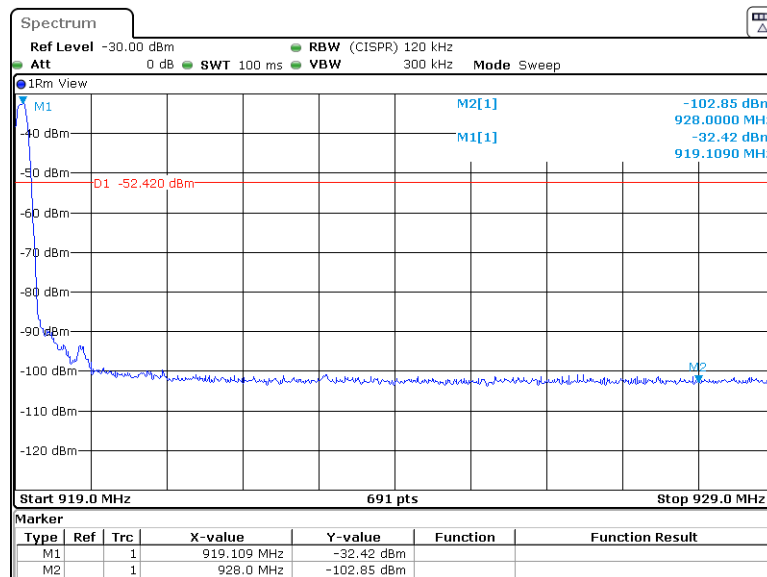
<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Emissions at band edges			
<b>Test procedure:</b> ANSI C63.10, section 7.8.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 27-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</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



Date: 27.AUG.2017 12:10:47

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

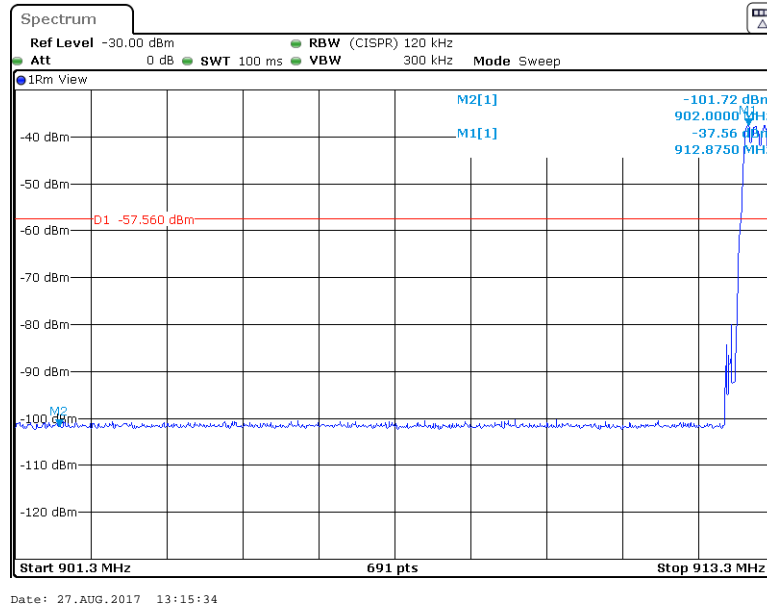


Date: 27.AUG.2017 12:20:58

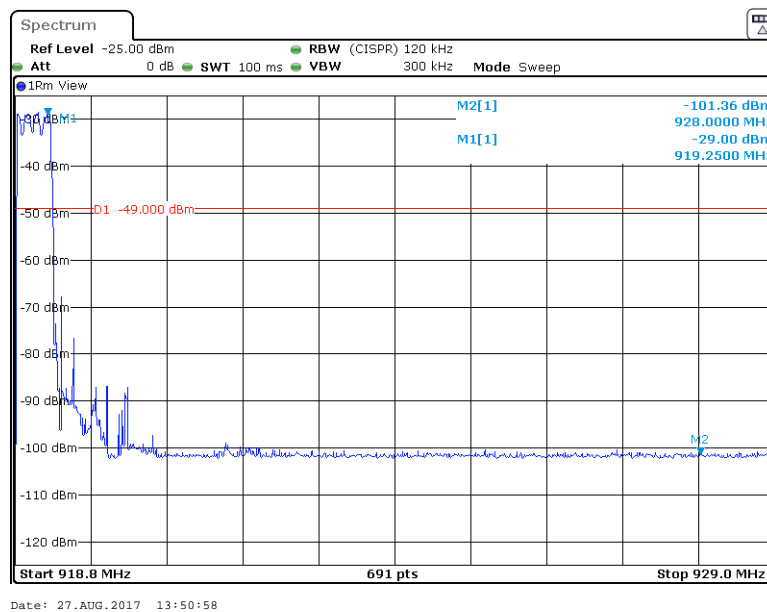


<b>Test specification:</b> Section 15.247(d), RSS-247 section 5.5, Emissions at band edges			
<b>Test procedure:</b> ANSI C63.10, section 7.8.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 27-Aug-17			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 55 %	<b>Air Pressure:</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> 27-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>			

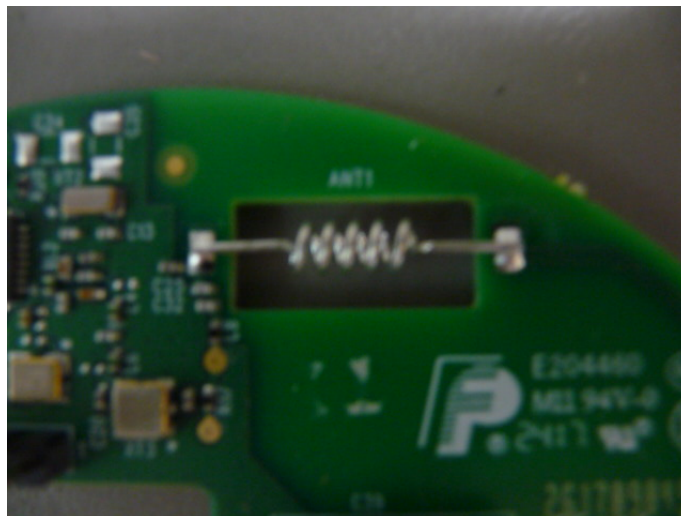
### 7.8 Antenna requirements

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	

Photograph 7.8.1 Antenna assembly





<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> 29-Aug-17			
<b>Temperature:</b> 28 °C	<b>Relative Humidity:</b> 45 %	<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.

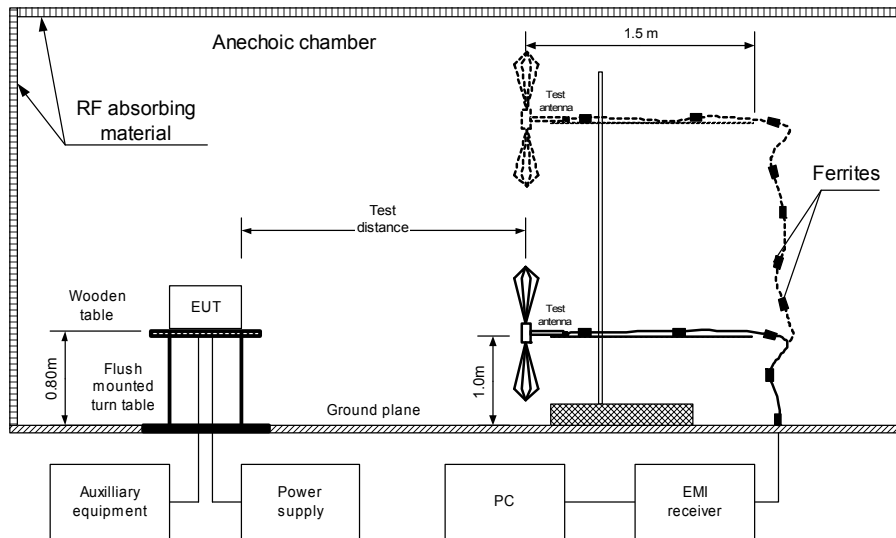
**8.1.2.3** The worst test results (the lowest margins) were recorded in Table 8.1.3 and shown in the associated plots.





<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> 29-Aug-17			
<b>Temperature:</b> 28 °C	<b>Relative Humidity:</b> 45 %	<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



Photograph 8.1.1 Setup for radiated emission measurements





<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> 29-Aug-17			
<b>Temperature:</b> 28 °C	<b>Relative Humidity:</b> 45 %	<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 emissions were found								Pass

TEST SITE: SEMI ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
DETECTORS USED: PEAK / AVERAGE  
FREQUENCY RANGE: 1000 MHz – 5000 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 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 0604	HL 2909	HL 3615	HL 4277	HL 4353	HL 4933		
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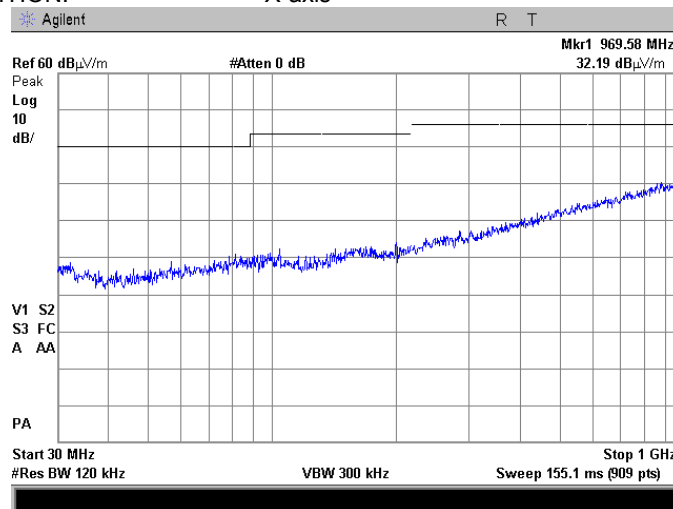
Full description is given in Appendix A.



<b>Test specification: Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B,Radiated emission</b>			
<b>Test procedure: ANSI C63.4, Section 12.2.5</b>			
<b>Test mode: Compliance</b>		<b>Verdict: PASS</b>	
<b>Date(s): 29-Aug-17</b>			
<b>Temperature: 28 °C</b>	<b>Relative Humidity: 45 %</b>	<b>Air Pressure: 1006 hPa</b>	<b>Power: Battery</b>
<b>Remarks:</b>			

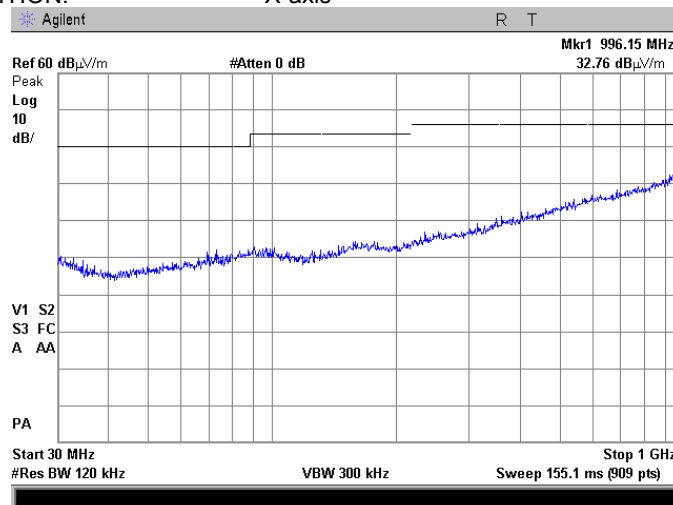
**Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization**

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by  
EUT POSITION: X-axis



**Plot 8.1.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization**

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by  
EUT POSITION: X-axis

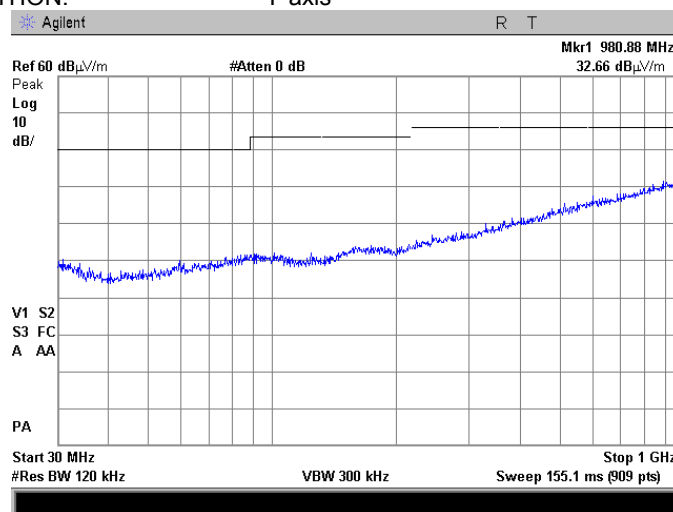




<b>Test specification:</b> Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B,Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 29-Aug-17			
<b>Temperature:</b> 28 °C	<b>Relative Humidity:</b> 45 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

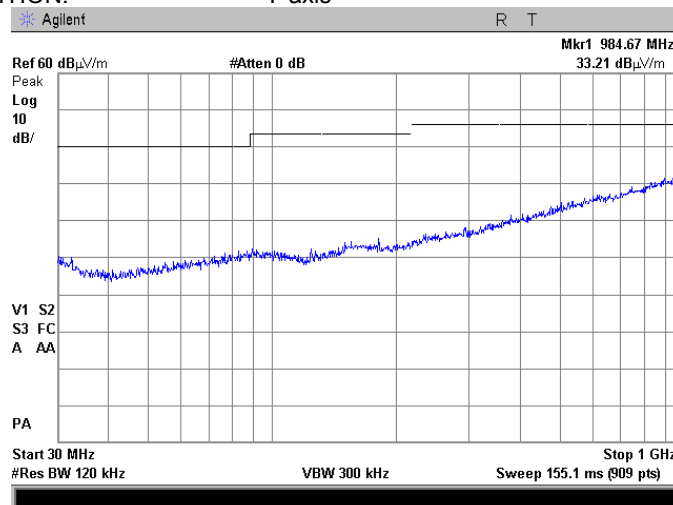
Plot 8.1.3 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by  
EUT POSITION: Y-axis



Plot 8.1.4 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive / Stand-by  
EUT POSITION: Y-axis

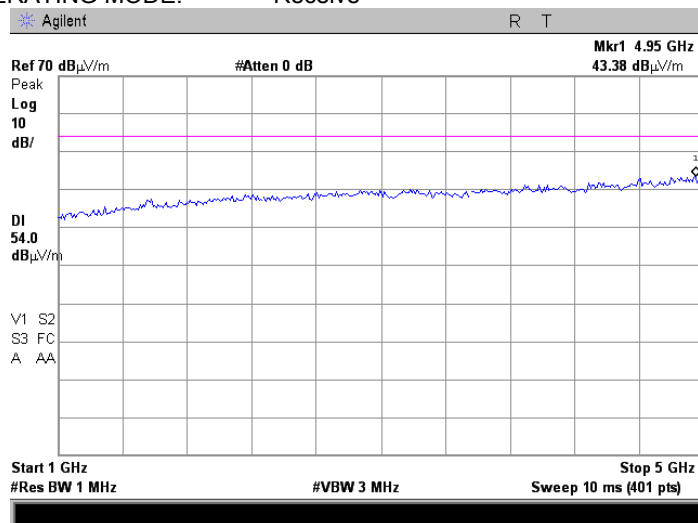




<b>Test specification:</b> Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Class B,Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Section 12.2.5			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 29-Aug-17			
<b>Temperature:</b> 28 °C	<b>Relative Humidity:</b> 45 %	<b>Air Pressure:</b> 1006 hPa	<b>Power:</b> Battery
<b>Remarks:</b>			

**Plot 8.1.5 Radiated emission measurements in 1000-5000 MHz range**

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & Horizontal  
EUT OPERATING MODE: Receive





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

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	12-May-17	12-May-18
1915	Antenna, Loop, Active Receiving, 1 kHz - 30 MHz	EMC Test Systems	6507	1457	19-Jan-17	19-Jan-18
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	09-Mar-17	09-Mar-18
3615	Cable RF, 6.5 m, N type-N type, DC-6 GHz	Suhner Switzerland	RG 214/U	NA	04-Jun-17	04-Jun-18
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	07-May-17	07-May-18
4135	Shield Box	TESCOM CO., LTD	TC-5916A	5916A000 136	06-Apr-17	06-Apr-18
4222	High Pass Filter, 50 Ohm, 3150 to 6500 MHz	Mini-Circuits	VHF-2700+	NA	01-Oct-15	01-Oct-17
4277	Test Cable , DC-18 GHz, 3.05 m, N/M - N/M	Mini-Circuits	APC-10FT-NMNM+	0748A	26-Sep-16	26-Sep-17
4294	Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA	Huber-Suhner	Sucoflex P103	NA	18-Dec-16	18-Dec-17
4295	Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA	Huber-Suhner	Sucoflex P103	NA	16-Oct-16	16-Oct-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
4355	Signal and Spectrum Analyzer, 9 kHz to 7 GHz	Rohde & Schwarz	FSV 7	191000086 881	20-Apr-17	20-Apr-18
4535	Microwave Cable Assembly, 6.5 GHz, 5.0 m, N/M type-N/M type	Suhner Switzerland	214-U	NA	04-Jun-17	04-Jun-18
4541	Microwave Cable Assembly, 4.0 GHz, 1.0 m, N/M type-N/M type	Suhner Switzerland	214-U	NA	25-Sep-16	25-Sep-17
4542	Amplifier, 9 kHz to 1 GHz, 32 dB gain	Sonoma Instrument	310	0002A056 39	15-Mar-17	15-Mar-18
4543	Broadband preamplifier, 0.5 to 18 GHz, 35 dB gain	Schwarzbeck mess-elektronik	BBV 9718	9718-134	15-Mar-17	15-Mar-18
4549	Cable RF, 6.8 m, N/N - type, up to 3 GHz	Suhner Switzerland	NA	07262	14-Mar-17	14-Mar-18
4575	EXA Signal Analyzer, 9 kHz - 26.5 GHz	Agilent Technologies	N9010A	MY480301 10	06-Apr-17	06-Apr-18
4603	Horn Antenna, 1 - 18 GHz	Schwarzbeck mess-elektronik	BBHA 9120 D	9120D-611	14-Oct-16	14-Oct-17
4604	Biconilog Antenna, 26 - 2000 MHz	EMCO	3142B	9909-1421	12-May-17	12-May-18
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	14-Oct-16	14-Oct-17
5102	RF cable, 18 GHz, 6 m, N-type	Huber-Suhner	SF106A/1 1N/11N/6 000MM	500848/6A	27-Jul-17	27-Jul-18
5105	RF cable, 18 GHz, 6 m, N-type	Huber-Suhner	SF106A/1 1N/11N/6 000MM	500851/6A	27-Jul-17	27-Jul-18
5111	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/ 11SK/11S K/5500M M	502493/2E A	27-Jul-17	27-Jul-18

**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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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  
EMC Test Systems  
Model 6507, S/N 1457, HL 1915

Frequency, kHz	Measured antenna factor, dBS/m
10	-22.7
20	-27.6
50	-31.3
75	-31.8
100	-32.2
150	-32.3
250	-32.6
500	-32.8
750	-33.0
1000	-33.1
2000	-33.4
3000	-33.7
4000	-34.0
5000	-34.3
10000	-34.9
15000	-35.6
20000	-35.9
25000	-36.1
30000	-36.7

The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ A/m.



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

Frequency, MHz	Antenna Factor, dB(1/m)
26	7.8
28	7.8
30	7.8
40	7.2
60	7.1
70	8.5
80	9.4
90	9.8
100	9.7
110	9.3
120	8.8
130	8.7
140	9.2
150	9.8
160	10.2
170	10.4
180	10.4
190	10.3
200	10.6
220	11.6
240	12.4
260	12.8
280	13.7
300	14.7
320	15.2
340	15.4
360	16.1
380	16.4
400	16.6
420	16.7
440	17.0
460	17.7
480	18.1
500	18.5
520	19.1
540	19.5
560	19.8
580	20.6
600	21.3
620	21.5
640	21.2
660	21.4
680	21.9
700	22.2
720	22.2
740	22.1
760	22.3
780	22.6
800	22.7
820	22.9
840	23.1
860	23.4
880	23.8
900	24.1
920	24.1

Frequency, MHz	Antenna Factor, dB(1/m)
940	24.0
960	24.1
980	24.5
1000	24.9
1020	25.0
1040	25.2
1060	25.4
1080	25.6
1100	25.7
1120	26.0
1140	26.4
1160	27.0
1180	27.0
1200	26.7
1220	26.5
1240	26.5
1260	26.5
1280	26.6
1300	27.0
1320	27.8
1340	28.3
1360	28.2
1380	27.9
1400	27.9
1420	27.9
1440	27.8
1460	27.8
1480	28.0
1500	28.5
1520	28.9
1540	29.6
1560	29.8
1580	29.6
1600	29.5
1620	29.3
1640	29.2
1660	29.4
1680	29.6
1700	29.8
1720	30.3
1740	30.8
1760	31.1
1780	31.0
1800	30.9
1820	30.7
1840	30.6
1860	30.6
1880	30.6
1900	30.6
1920	30.7
1940	30.9
1960	31.2
1980	31.6
2000	32.0

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



**Antenna factor**  
**Horn antenna**  
Schwarzbeck mess-elektronik, Model BBHA 9120 D, serial number: 9120D-611, HL 4603

Frequency, MHz	Measured antenna factor, dB/m
1000	25.2
1500	25.7
2000	26.1
2500	27.5
3000	28.3
3500	29.0
4000	30.0
4500	30.8
5000	31.9
5500	32.2
6000	33.1
6500	34.6
7000	35.9
7500	36.6
8000	37.2
8500	36.6
9000	36.9
9500	37.5
10000	38.4
10500	39.5
11000	40.3
11500	40.0
12000	39.2
12500	38.7
13000	39.6
13500	40.8
14000	41.6
14500	42.1
15000	41.2
15500	39.1
16000	38.5
16500	39.9
17000	41.0
17500	44.1
18000	55.6

The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.



**Antenna factor**  
**Biconilog Antenna, 26 - 2000 MHz**  
**EMCO, Model 3142B, serial number: 9909-1421, HL 4604**

Frequency, MHz	Measured, dB/m
30	17.9
35	14.8
40	12.1
45	10.0
50	8.7
60	8.1
70	7.3
80	6.6
90	7.6
100	7.9
120	7.0
140	7.7
160	9.6
180	10.0
200	10.2
250	12.7
300	13.4
400	16.7
500	18.2
600	20.2
700	22.0
800	22.7
900	24.1
1000	25.0

The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m



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**  
**Cable coaxial, RG-214/U, N type-N type, 6.5 m**  
**Suhner Switzerland, HL 3615**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.13	1750	2.47	3550	4.10	5350	5.76
30	0.24	1800	2.53	3600	4.17	5400	5.84
50	0.31	1850	2.59	3650	4.21	5450	5.88
100	0.47	1900	2.61	3700	4.23	5500	5.90
150	0.58	1950	2.66	3750	4.33	5550	5.96
200	0.68	2000	2.74	3800	4.36	5600	6.02
250	0.77	2050	2.76	3850	4.38	5650	6.02
300	0.86	2100	2.80	3900	4.46	5700	6.09
350	0.94	2150	2.84	3950	4.52	5750	6.14
400	1.01	2200	2.89	4000	4.48	5800	6.15
450	1.08	2250	2.94	4050	4.52	5850	6.22
500	1.16	2300	2.98	4100	4.64	5900	6.29
550	1.21	2350	3.03	4150	4.62	5950	6.32
600	1.28	2400	3.07	4200	4.69	6000	6.39
650	1.35	2450	3.11	4250	4.75	6050	6.40
700	1.41	2500	3.15	4300	4.79	6100	6.48
750	1.48	2550	3.21	4350	4.83	6150	6.57
800	1.54	2600	3.25	4400	4.90	6200	6.62
850	1.58	2650	3.29	4450	4.95	6250	6.68
900	1.65	2700	3.33	4500	4.98	6300	6.74
950	1.67	2750	3.39	4550	5.04	6350	6.79
1000	1.74	2800	3.45	4600	5.08	6400	6.82
1050	1.79	2850	3.48	4650	5.12	6450	6.83
1100	1.84	2900	3.51	4700	5.15	6500	6.91
1150	1.91	2950	3.58	4750	5.22		
1200	1.94	3000	3.62	4800	5.26		
1250	1.99	3050	3.65	4850	5.29		
1300	2.06	3100	3.69	4900	5.33		
1350	2.11	3150	3.75	4950	5.36		
1400	2.16	3200	3.77	5000	5.38		
1450	2.21	3250	3.80	5050	5.46		
1500	2.25	3300	3.85	5100	5.49		
1550	2.30	3350	3.90	5150	5.56		
1600	2.35	3400	3.94	5200	5.58		
1650	2.38	3450	4.00	5250	5.64		
1700	2.42	3500	4.03	5300	5.69		



**Cable loss**  
**Test cable, Mini-Circuits, S/N 0748A, 18 GHz, 3.05 m, N/M - N/M**  
**APC-10FT-NMNM+, HL 4277**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.12	4400	3.19	9000	4.82	13600	5.97
30	0.21	4500	3.24	9100	4.87	13700	6.01
50	0.28	4600	3.29	9200	4.90	13800	6.04
100	0.40	4700	3.34	9300	4.96	13900	6.09
200	0.59	4800	3.37	9400	4.99	14000	6.12
300	0.73	4900	3.41	9500	5.03	14100	6.16
400	0.86	5000	3.45	9600	5.07	14200	6.20
500	0.97	5100	3.48	9700	5.11	14300	6.22
600	1.07	5200	3.52	9800	5.13	14400	6.26
700	1.15	5300	3.56	9900	5.15	14500	6.29
800	1.23	5400	3.58	10000	5.17	14600	6.33
900	1.31	5500	3.62	10100	5.19	14700	6.33
1000	1.39	5600	3.65	10200	5.19	14800	6.35
1100	1.46	5700	3.69	10300	5.21	14900	6.38
1200	1.54	5800	3.72	10400	5.22	15000	6.38
1300	1.60	5900	3.76	10500	5.22	15100	6.40
1400	1.67	6000	3.80	10600	5.22	15200	6.42
1500	1.74	6100	3.84	10700	5.25	15300	6.46
1600	1.79	6200	3.89	10800	5.25	15400	6.51
1700	1.86	6300	3.92	10900	5.26	15500	6.55
1800	1.92	6400	3.96	11000	5.29	15600	6.56
1900	1.98	6500	4.00	11100	5.30	15700	6.59
2000	2.04	6600	4.04	11200	5.31	15800	6.60
2100	2.09	6700	4.07	11300	5.35	15900	6.64
2200	2.14	6800	4.11	11400	5.36	16000	6.65
2300	2.20	6900	4.14	11500	5.39	16100	6.65
2400	2.25	7000	4.17	11600	5.41	16200	6.67
2500	2.31	7100	4.21	11700	5.45	16300	6.69
2600	2.36	7200	4.23	11800	5.48	16400	6.71
2700	2.42	7300	4.27	11900	5.51	16500	6.72
2800	2.46	7400	4.30	12000	5.53	16600	6.73
2900	2.51	7500	4.34	12100	5.56	16700	6.75
3000	2.56	7600	4.37	12200	5.59	16800	6.80
3100	2.60	7700	4.40	12300	5.61	16900	6.82
3200	2.65	7800	4.44	12400	5.62	17000	6.85
3300	2.70	7900	4.47	12500	5.65	17100	6.90
3400	2.75	8000	4.49	12600	5.68	17200	6.96
3500	2.80	8100	4.53	12700	5.71	17300	7.02
3600	2.85	8200	4.57	12800	5.73	17400	7.07
3700	2.90	8300	4.60	12900	5.76	17500	7.06
3800	2.95	8400	4.63	13000	5.80	17600	7.06
3900	2.98	8500	4.67	13100	5.83	17700	7.08
4000	3.02	8600	4.69	13200	5.86	17800	7.09
4100	3.07	8700	4.73	13300	5.88	17900	7.07
4200	3.10	8800	4.76	13400	5.91	18000	7.08
4300	3.14	8900	4.79	13500	5.94		



**Cable loss**  
**Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA, Huber-Suhner,**  
**Sucoflex P103, HL 4294**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.11	4900	2.09	10000	2.90	15100	3.61
30	0.17	5000	2.10	10100	2.92	15200	3.67
50	0.22	5100	2.14	10200	2.95	15300	3.63
100	0.30	5200	2.16	10300	2.96	15400	3.64
200	0.42	5300	2.17	10400	2.99	15500	3.68
300	0.51	5400	2.19	10500	2.99	15600	3.71
400	0.59	5500	2.19	10600	3.03	15700	3.74
500	0.66	5600	2.22	10700	3.03	15800	3.71
600	0.72	5700	2.24	10800	3.04	15900	3.74
700	0.77	5800	2.23	10900	3.05	16000	3.71
800	0.82	5900	2.26	11000	3.09	16100	3.73
900	0.88	6000	2.27	11100	3.07	16200	3.76
1000	0.93	6100	2.26	11200	3.08	16300	3.82
1100	0.98	6200	2.29	11300	3.11	16400	3.90
1200	1.02	6300	2.30	11400	3.12	16500	3.81
1300	1.06	6400	2.34	11500	3.11	16600	3.88
1400	1.10	6500	2.34	11600	3.15	16700	3.87
1500	1.14	6600	2.36	11700	3.16	16800	3.89
1600	1.19	6700	2.36	11800	3.18	16900	3.95
1700	1.23	6800	2.39	11900	3.19	17000	4.02
1800	1.27	6900	2.39	12000	3.23	17100	4.04
1900	1.30	7000	2.44	12100	3.25	17200	3.99
2000	1.35	7100	2.46	12200	3.22	17300	4.03
2100	1.38	7200	2.44	12300	3.25	17400	4.03
2200	1.42	7300	2.48	12400	3.25	17500	4.06
2300	1.45	7400	2.47	12500	3.28	17600	4.05
2400	1.48	7500	2.48	12600	3.27	17700	4.12
2500	1.51	7600	2.50	12700	3.27	17800	4.14
2600	1.55	7700	2.53	12800	3.30	17900	4.18
2700	1.59	7800	2.56	12900	3.30	18000	4.14
2800	1.62	7900	2.55	13000	3.27		
2900	1.65	8000	2.56	13100	3.32		
3000	1.66	8100	2.56	13200	3.32		
3100	1.69	8200	2.57	13300	3.32		
3200	1.71	8300	2.59	13400	3.35		
3300	1.74	8400	2.62	13500	3.38		
3400	1.76	8500	2.67	13600	3.39		
3500	1.78	8600	2.65	13700	3.42		
3600	1.80	8700	2.68	13800	3.47		
3700	1.85	8800	2.68	13900	3.45		
3800	1.88	8900	2.68	14000	3.49		
3900	1.90	9000	2.74	14100	3.50		
4000	1.91	9100	2.74	14200	3.55		
4100	1.93	9200	2.76	14300	3.59		
4200	1.96	9300	2.78	14400	3.58		
4300	1.97	9400	2.79	14500	3.56		
4400	1.99	9500	2.80	14600	3.57		
4500	2.02	9600	2.83	14700	3.57		
4600	2.02	9700	2.84	14800	3.57		
4700	2.04	9800	2.86	14900	3.64		
4800	2.05	9900	2.92	15000	3.64		





**Cable loss**  
**Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA, Huber-Suhner, S/N 4295,**  
**Sucoflex P103, HL 4295**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.11	5000	2.09	10200	2.97	15400	3.63
30	0.18	5100	2.12	10300	3.01	15500	3.65
50	0.23	5200	2.13	10400	3.00	15600	3.63
100	0.31	5300	2.16	10500	3.05	15700	3.64
200	0.38	5400	2.19	10600	3.09	15800	3.64
300	0.43	5500	2.21	10700	3.05	15900	3.66
400	0.52	5600	2.21	10800	3.09	16000	3.71
500	0.60	5700	2.24	10900	3.10	16100	3.67
600	0.67	5800	2.24	11000	3.08	16200	3.71
700	0.72	5900	2.25	11100	3.11	16300	3.70
800	0.78	6000	2.27	11200	3.12	16400	3.71
900	0.83	6100	2.25	11300	3.12	16500	3.72
1000	0.89	6200	2.29	11400	3.20	16600	3.84
1100	0.94	6300	2.34	11500	3.16	16700	3.78
1200	0.98	6400	2.37	11600	3.16	16800	3.85
1300	1.03	6500	2.33	11700	3.20	16900	3.88
1400	1.06	6600	2.34	11800	3.19	17000	3.85
1500	1.11	6700	2.39	11900	3.21	17100	3.88
1600	1.14	6800	2.46	12000	3.28	17200	3.92
1700	1.19	6900	2.45	12100	3.23	17300	3.90
1800	1.22	7000	2.44	12200	3.26	17400	4.00
1900	1.26	7100	2.43	12300	3.30	17500	4.02
2000	1.30	7200	2.44	12400	3.25	17600	4.00
2100	1.34	7300	2.51	12500	3.26	17700	3.96
2200	1.37	7400	2.54	12600	3.30	17800	4.01
2300	1.40	7500	2.49	12700	3.26	17900	4.02
2400	1.44	7600	2.52	12800	3.34	18000	4.08
2500	1.47	7700	2.59	12900	3.37		
2600	1.50	7800	2.57	13000	3.30		
2700	1.55	7900	2.55	13100	3.35		
2800	1.58	8000	2.57	13200	3.31		
2900	1.60	8100	2.58	13300	3.33		
3000	1.63	8200	2.64	13400	3.42		
3100	1.64	8300	2.70	13500	3.43		
3200	1.67	8400	2.65	13600	3.40		
3300	1.69	8500	2.66	13700	3.47		
3400	1.73	8600	2.68	13800	3.45		
3500	1.74	8700	2.70	13900	3.43		
3600	1.76	8800	2.74	14000	3.52		
3700	1.79	8900	2.74	14100	3.51		
3800	1.82	9000	2.76	14200	3.54		
3900	1.85	9100	2.82	14300	3.55		
4000	1.87	9200	2.79	14400	3.52		
4100	1.90	9300	2.82	14500	3.52		
4200	1.92	9400	2.83	14600	3.56		
4300	1.93	9500	2.83	14700	3.55		
4400	1.94	9600	2.86	14800	3.55		
4500	1.97	9700	2.93	14900	3.59		
4600	1.99	9800	2.89	15000	3.56		
4700	2.01	9900	2.91	15100	3.59		
4800	2.02	10000	2.94	15200	3.59		
4900	2.04	10100	2.94	15300	3.59		



**Cable loss**  
**Microwave Cable Assembly, 6.5 GHz, 5.0 m, N/M type-N/M type**  
**Suhner Switzerland, HL 4535**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.10	1700	1.79	4400	3.53
15	0.13	1800	1.86	4500	3.60
20	0.15	1900	1.93	4600	3.72
30	0.18	2000	2.00	4700	3.80
40	0.21	2100	2.06	4800	3.87
50	0.24	2200	2.13	4900	3.94
60	0.26	2300	2.19	5000	3.99
70	0.29	2400	2.25	5100	4.06
80	0.31	2500	2.32	5200	4.12
90	0.33	2600	2.38	5300	4.17
100	0.35	2700	2.45	5400	4.25
150	0.43	2800	2.51	5500	4.31
200	0.50	2900	2.57	5600	4.40
300	0.63	3000	2.64	5700	4.47
400	0.74	3100	2.73	5800	4.54
500	0.85	3200	2.79	5900	4.64
600	0.94	3300	2.86	6000	4.73
700	1.03	3400	2.91	6100	4.79
800	1.12	3500	2.97	6200	4.89
900	1.20	3600	3.02	6300	5.00
1000	1.28	3700	3.07	6400	5.06
1100	1.35	3800	3.14	6500	5.13
1200	1.43	3900	3.20		
1300	1.50	4000	3.25		
1400	1.58	4100	3.32		
1500	1.65	4200	3.38		
1600	1.72	4300	3.46		



**Cable loss**  
**Microwave Cable Assembly, 4.0 GHz, 1.0 m, N/M type-N/M type**  
**Suhner Switzerland, HL 4541**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.02	1700	0.45
15	0.03	1800	0.46
20	0.03	1900	0.48
30	0.04	2000	0.49
40	0.04	2100	0.52
50	0.05	2200	0.54
60	0.06	2300	0.55
70	0.06	2400	0.56
80	0.07	2500	0.58
90	0.07	2600	0.59
100	0.08	2700	0.61
150	0.10	2800	0.63
200	0.12	2900	0.64
300	0.15	3000	0.67
400	0.18	3100	0.70
500	0.20	3200	0.74
600	0.23	3300	0.77
700	0.25	3400	0.80
800	0.28	3500	0.82
900	0.30	3600	0.86
1000	0.31	3700	0.88
1100	0.33	3800	0.94
1200	0.35	3900	0.95
1300	0.37	4000	0.99
1400	0.39		
1500	0.41		
1600	0.43		



**Cable loss**  
**RF Cable, Huber-Suhner, 18 GHz, 6 m, N- type,**  
**SF106A/11N/11N/6000MM, S/N 500848/6A**  
**HL 5102**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
0.1	0.00	5500	2.43
50	0.23	6000	2.54
100	0.31	6500	2.65
200	0.44	7000	2.76
300	0.54	7500	2.87
400	0.62	8000	2.98
500	0.69	8500	3.06
600	0.76	9000	3.16
700	0.82	9500	3.27
800	0.87	10000	3.36
900	0.94	10500	3.45
1000	0.98	11000	3.55
1100	1.03	11500	3.63
1200	1.08	12000	3.72
1300	1.13	12500	3.82
1400	1.17	13000	3.90
1500	1.21	13500	3.99
1600	1.25	14000	4.06
1700	1.30	14500	4.15
1800	1.33	15000	4.24
1900	1.37	15500	4.30
2000	1.41	16000	4.37
2500	1.59	16500	4.45
3000	1.75	17000	4.53
3500	1.90	17500	4.62
4000	2.04	18000	4.67
4500	2.17		
5000	2.30		



**Cable loss**  
**RF Cable, Huber-Suhner, 18 GHz, 6 m, N- type,**  
**SF106A/11N/11N/6000MM, S/N 500851/6A**  
**HL 5105**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
0.1	0.01	5500	2.41
50	0.22	6000	2.53
100	0.31	6500	2.64
200	0.43	7000	2.75
300	0.53	7500	2.85
400	0.61	8000	2.96
500	0.68	8500	3.05
600	0.75	9000	3.15
700	0.81	9500	3.26
800	0.87	10000	3.34
900	0.93	10500	3.44
1000	0.98	11000	3.53
1100	1.03	11500	3.61
1200	1.07	12000	3.71
1300	1.12	12500	3.81
1400	1.16	13000	3.89
1500	1.21	13500	3.97
1600	1.25	14000	4.05
1700	1.28	14500	4.13
1800	1.32	15000	4.21
1900	1.37	15500	4.29
2000	1.40	16000	4.36
2500	1.58	16500	4.43
3000	1.74	17000	4.49
3500	1.89	17500	4.58
4000	2.03	18000	4.67
4500	2.17		
5000	2.29		



**Cable loss**  
**RF Cable, Huber-Suhner, 40 GHz, 5.5 m, K type,**  
**SF102EA/11SK/11SK/5500MM, S/N 502493/2EA**  
**HL 5111**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
100	0.68	20500	10.17
200	0.97	21000	10.30
300	1.18	21500	10.43
500	1.52	22000	10.58
1000	2.14	22500	10.73
1500	2.62	23000	10.85
2000	3.03	23500	10.98
2500	3.39	24000	11.11
3000	3.72	24500	11.20
3500	4.03	25000	11.32
4000	4.32	25500	11.47
4500	4.59	26000	11.59
5000	4.84	26500	11.72
5500	5.09	27000	11.83
6000	5.32	27500	11.94
6500	5.55	28000	12.04
7000	5.77	28500	12.16
7500	5.99	29000	12.28
8000	6.19	29500	12.40
8500	6.40	30000	12.50
9000	6.60	30500	12.59
9500	6.79	31000	12.68
10000	6.98	31500	12.80
10500	7.16	32000	12.94
11000	7.34	32500	13.09
11500	7.51	33000	13.23
12000	7.68	33500	13.32
12500	7.84	34000	13.44
13000	8.00	34500	13.54
13500	8.15	35000	13.68
14000	8.31	35500	13.81
14500	8.46	36000	13.90
15000	8.62	36500	13.99
15500	8.76	37000	14.12
16000	8.91	37500	14.22
16500	9.06	38000	14.33
17000	9.21	38500	14.47
17500	9.35	39000	14.54
18000	9.49	39500	14.62
18500	9.62	40000	14.75
19000	9.76		
19500	9.90		
20000	10.05		



## 14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
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

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