HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO: FCC 47CFR part 15 subpart C § 15.247 (FHSS) and subpart B
RSS-247 issue 1, RSS-Gen issue 4, ICES-003 Issue 6:2016

FOR:

Visonic Ltd.
Power-G Modem Transceiver
Model: Power-G Modem
FCC ID:WP3RFDQOL
IC:1467C-RFDQOL

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1 Applicant information

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

2 Equipment under test attributes

Product name:	Power-G Modem Transceiver
Product type:	Transceiver
Model(s):	Power-G Modem
Serial number:	Prototype
Hardware version:	9-103552
Software release:	JS-703251
Receipt date	21-Jul-16

3 Manufacturer information

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

4 Test details

Project ID:	28482
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	26-Jul-16
Test completed:	11-Aug-16
Test specification(s):	FCC 47CFR part 15, subpart C, §15.247(FHSS) and subpart B; RSS-247 issue 1, RSS-Gen issue 4, ICES-003 issue 6:2016

5 Tests summary

Test	Status
Transmitter characteristics	
Section 15.247(a)1, (g), (h) / RSS-247 section 5.1, Frequency hopping requirements	Pass
Section 15.247(a)1/ RSS-247 section 5.1(3), 20 dB bandwidth	Pass
Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions	Pass
Section 15.247(a)1/ RSS-247 section 5.1(2), Frequency separation	Pass
Section 15.247(a)1/ RSS-247 section 5.1(3), Number of hopping frequencies	Pass
Section 15.247(a)1/ RSS-247 section 5.1(3), Average time of occupancy	Pass
Section 15.247(b) / RSS-247 section 5.4(1), Peak output power	Pass
Section 15.247(i)5/ RSS-102 section 2.5, RF exposure	Pass, the exhibit to the application of certification is provided
Section 15.247(d) / RSS-247 section 5.5, Emissions at band edges	Pass
Section 15.203/ RSS-Gen section 8.3, Antenna requirements	Pass
Section 15.207(a) / RSS-Gen section 8.8, Conducted emission	Not required
Unintentional emissions	
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.

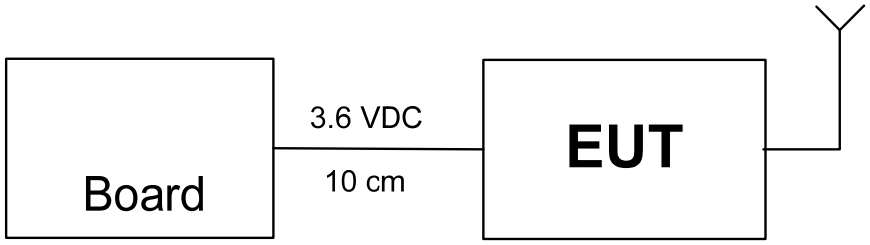
	Name and Title	Date	Signature
Tested by:	Mr. K. Zushchyk, test engineer	August 11, 2016	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	August 23, 2016	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	May 29, 2017	

6 EUT description

6.1 General information

The EUT is a RF module, operating in 902-928 MHz with FHSS modulation. The test report represents the results of the radiated emission measuremens with Foxconn antenna.

6.2 Test configuration



6.3 Changes made in EUT

No changes were implemented in the EUT during testing.

6.4 Transmitter characteristics

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

Intended use		**Condition of use**
	fixed	Always at a distance more than 2 m from all people
X	mobile	Always at a distance more than 20 cm from all people
	portable	May operate at a distance closer than 20 cm to human body

Assigned frequency ranges	902 – 928 MHz
Operating frequencies	912.750 – 919.108 MHz

Maximum rated output power	At transmitter 50 Ω RF output connector	dBm
	Peak output power	15.12 dBm

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

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

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
External	Foxconn	Zigbee Antenna	2 dBi

Transmitter aggregate data rate/s	50 kbps
Type of modulation	GFSK
Modulating test signal (baseband)	PRBS

Transmitter power source					
	Battery	**Nominal rated voltage**		Battery type	
X	DC	**Nominal rated voltage**	3.6 V to module		
	AC mains	**Nominal rated voltage**		Frequency	

Common power source for transmitter and receiver	X	yes	no

Spread spectrum technique used	X	Frequency hopping (FHSS)
		Digital transmission system (DTS)
		Hybrid

Spread spectrum parameters for transmitters tested per FCC 15.247 only		
FHSS	Total number of hops	50
	Bandwidth per hop	84.4 kHz
	Max. separation of hops	130.1 kHz

Test specification:	Section 15.247(a)1, (g), (h), RSS-247 section 5.1, Frequency hopping requirements		
Test procedure:			
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Jul-16		
Temperature: 26 ºC	Relative Humidity: 39 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

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

7.1 Frequency hopping requirements

The EUT was verified for compliance with frequency hopping requirements listed below:

- The EUT shall hop to channel frequencies that are selected from a pseudorandomly ordered list;
- Each hopping frequency shall be used equally on the average;
- The EUT receiver shall have input bandwidth that match the hopping channel bandwidth of the corresponding transmitter and shall shift frequencies in synchronization with the transmitted signals;
- The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

The rationale for compliance with the above requirements was either test results or supplier declaration. The summary of results is provided in Table 7.1.1.

Table 7.1.1 Frequency hopping requirements

Requirement	Rationale	Verdict
The EUT shall hop to channel frequencies that are selected from a pseudorandomly ordered list	Supplier declaration	Pass
Each hopping frequency shall be used equally on the average	Supplier declaration	Pass
The EUT receiver shall have input bandwidth that match the hopping channel bandwidth of the corresponding transmitter	Supplier declaration	Pass
The EUT receiver shall shift frequencies in synchronization with the transmitted signals	Supplier declaration	Pass
Each transmitter operates independently and there is no synchronization with other transmitters for purposes other than to avoid simultaneous channel occupancy	Supplier declaration	Pass

Test specification:	Section 15.247(a)1, RSS-247 section 5.1(3), 20 dB bandwidth		
Test procedure:	ANSI C63.10, section 7.8.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

7.2 20 dB bandwidth

7.2.1 General

This test was performed to measure 20 dB bandwidth of the transmitter hopping channel. Specification test limits are given in Table 7.2.1.

Table 7.2.1 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.

7.2.2 Test procedure

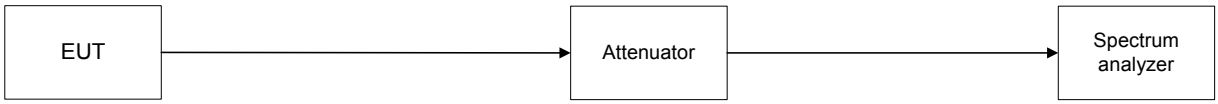
7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

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

7.2.2.3 The transmitter bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.2.2 and associated plot.

7.2.2.4 The test was repeated for each data rate and each modulation format.

Figure 7.2.1 The 20 dB bandwidth test setup



Test specification:	Section 15.247(a)1, RSS-247 section 5.1(3), 20 dB bandwidth		
Test procedure:	ANSI C63.10, section 7.8.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Table 7.2.2 The 20 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 902 – 928 MHz
DETECTOR USED: Peak
SWEEP TIME: Auto
VIDEO BANDWIDTH: ≥ RBW
MODULATING SIGNAL: PRBS
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
Low frequency							
912.750	GFSK	50.00	NA	84.16	250.00	-165.84	Pass
Mid frequency							
915.865	GFSK	50.00	NA	84.00	250.00	-166.00	Pass
High frequency							
919.108	GFSK	50.00	NA	84.42	250.00	-165.58	Pass

Carrier frequency, MHz	Type of modulation	Data rate, kbps	Symbol rate, Msymbols/s	99% bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
Low frequency							
912.750	GFSK	50.00	NA	86.83	250.00	-163.17	Pass
Mid frequency							
915.865	GFSK	50.00	NA	86.26	250.00	-163.74	Pass
High frequency							
919.108	GFSK	50.00	NA	86.57	250.00	-163.43	Pass

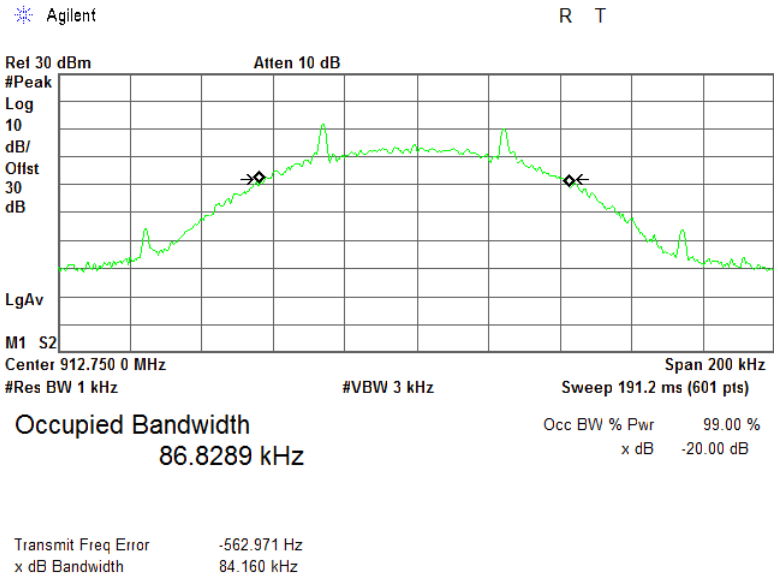
Reference numbers of test equipment used

HL 3818	HL 3901	HL 4068	HL 4756				

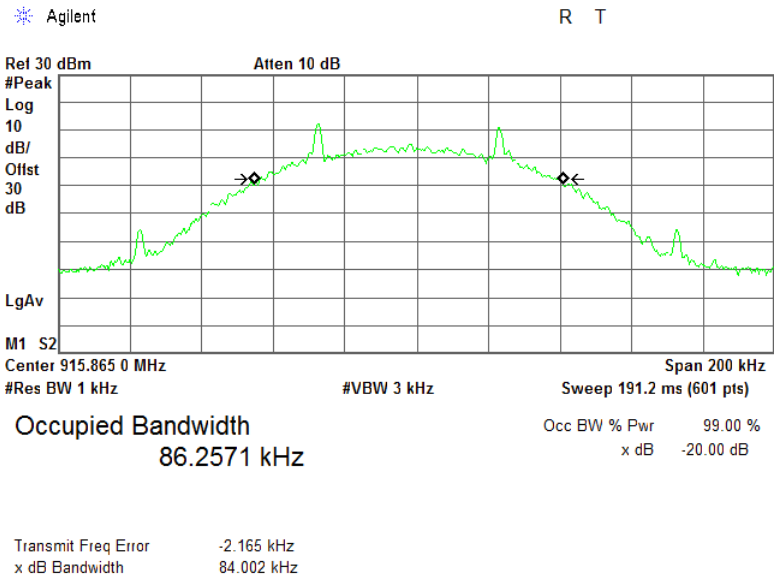
Full description is given in Appendix A.

Test specification:	Section 15.247(a)1, RSS-247 section 5.1(3), 20 dB bandwidth		
Test procedure:	ANSI C63.10, section 7.8.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.2.1 The 20 dB bandwidth test result at low frequency

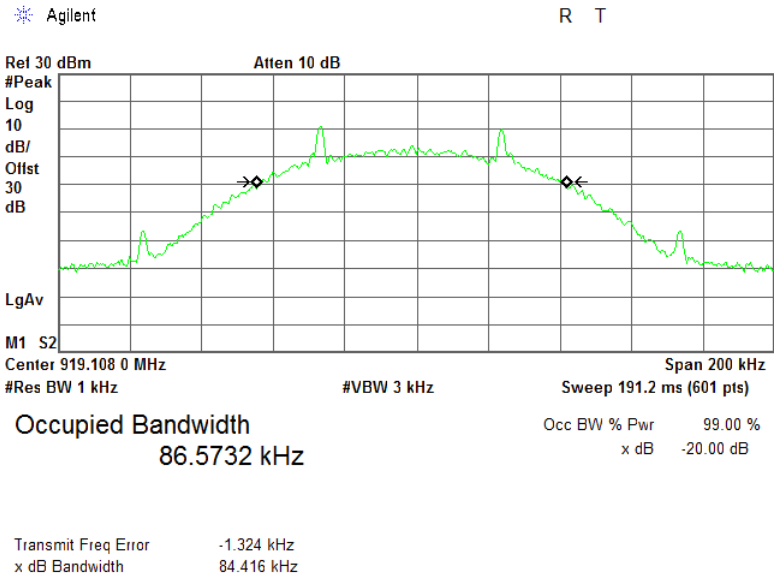


Plot 7.2.2 The 20 dB bandwidth test result at mid frequency



Test specification:	Section 15.247(a)1, RSS-247 section 5.1(3), 20 dB bandwidth		
Test procedure:	ANSI C63.10, section 7.8.7		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.2.3 The 20 dB bandwidth test result at high frequency



Test specification:	Section 15.247(a)1, RSS-247 section 5.1(2), Frequency separation		
Test procedure:	ANSI C63.10, section 7.8.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Jul-16		
Temperature: 26 ºC	Relative Humidity: 39 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

7.3 Carrier frequency separation

7.3.1 General

This test was performed to measure frequency separation between the peaks of adjacent channels. Specification test limits are given in Table 7.3.1.

Table 7.3.1 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		

7.3.2 Test procedure

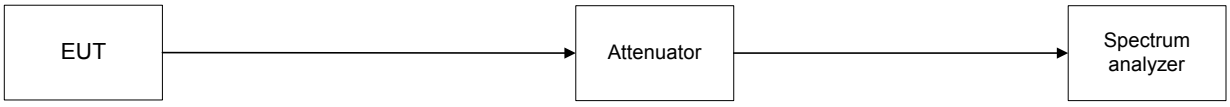
7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized with frequency hopping function enabled and its proper operation was checked.

7.3.2.2 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.

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

7.3.2.4 The frequency separation between the peaks of adjacent channels was measured as provided in Table 7.3.2 and associated plots.

Figure 7.3.1 Carrier frequency separation test setup



Test specification:	Section 15.247(a)1, RSS-247 section 5.1(2), Frequency separation		
Test procedure:	ANSI C63.10, section 7.8.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Jul-16		
Temperature: 26 ºC	Relative Humidity: 39 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Table 7.3.2 Carrier frequency separation test results

ASSIGNED FREQUENCY:	902 – 928 MHz
MODULATION:	GFSK
MODULATING SIGNAL:	PRBS
BIT RATE:	50 kbps
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	≥ 1% of the span
VIDEO BANDWIDTH:	≥ RBW
FREQUENCY HOPPING:	Enabled
20 dB BANDWIDTH:	84.16 kHz at Low carrier frequency 84.00 kHz at Mid carrier frequency 84.42 kHz at High carrier frequency

Carrier frequency separation, kHz	Limit, kHz	Margin*	Verdict
130.10	84.42	45.68	Pass

* - Margin = Carrier frequency separation – specification limit.

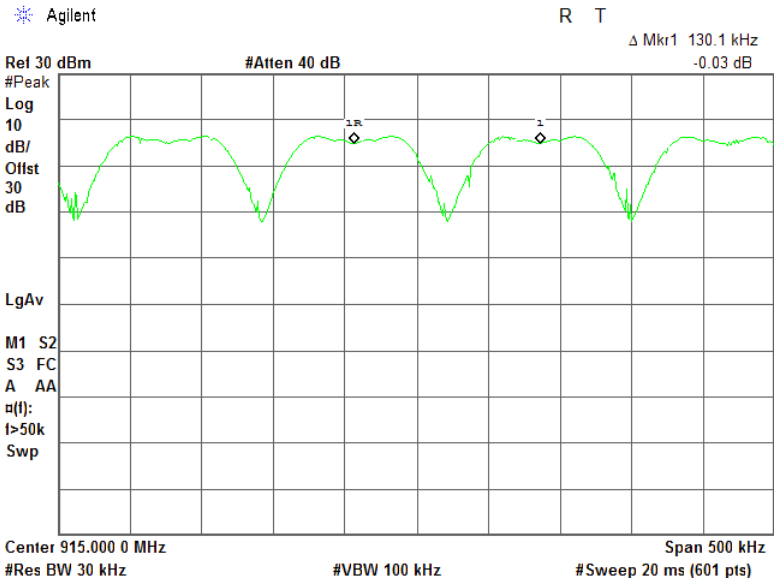
Reference numbers of test equipment used

HL 3818	HL 3901	HL 4068	HL 4756				

Full description is given in Appendix A.

Test specification:	Section 15.247(a)1, RSS-247 section 5.1(2), Frequency separation		
Test procedure:	ANSI C63.10, section 7.8.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Jul-16		
Temperature: 26 ºC	Relative Humidity: 39 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.3.1 Carrier frequency separation



Test specification:	Section 15.247(a)1, RSS-247 section 5.1(3), Number of hopping frequencies		
Test procedure:	ANSI C63.10, section 7.8.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Jul-16		
Temperature: 26 ºC	Relative Humidity: 39 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

7.4 Number of hopping frequencies

7.4.1 General

This test was performed to calculate the number of hopping frequencies used by the EUT. Specification test limits are given in Table 7.4.1.

Table 7.4.1 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

7.4.2 Test procedure

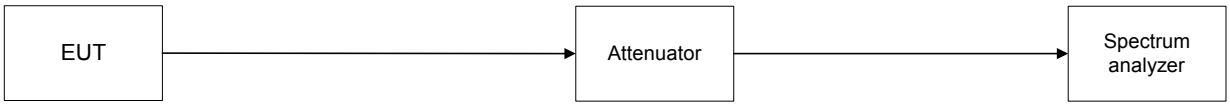
7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized with frequency hopping function enabled and its proper operation was checked.

7.4.2.2 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.

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

7.4.2.4 The number of frequency hopping channels was calculated as provided in Table 7.4.2 and associated plots.

Figure 7.4.1 Hopping frequencies test setup



Test specification:	Section 15.247(a)1, RSS-247 section 5.1(3), Number of hopping frequencies		
Test procedure:	ANSI C63.10, section 7.8.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Jul-16		
Temperature: 26 ºC	Relative Humidity: 39 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Table 7.4.2 Hopping frequencies test results

ASSIGNED FREQUENCY:	902 – 928 MHz
MODULATION:	GFSK
MODULATING SIGNAL:	PRBS
BIT RATE:	50 kbps
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	≥ RBW
FREQUENCY HOPPING:	Enabled

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

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

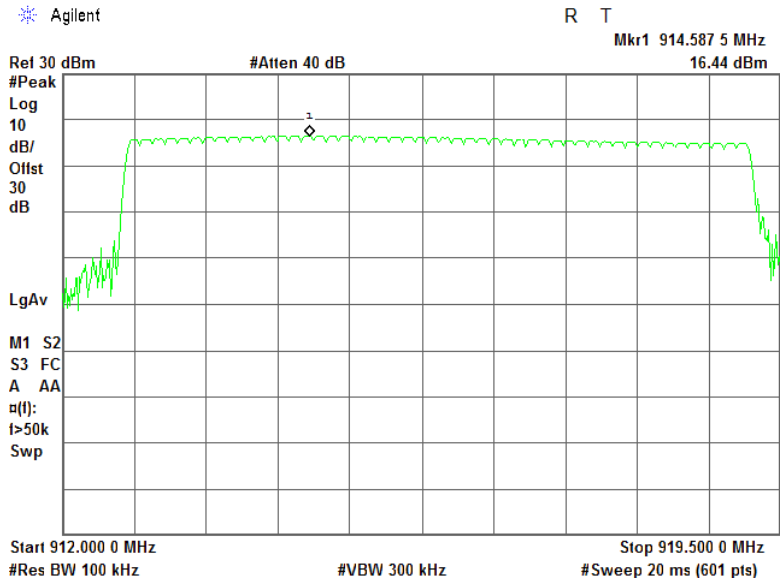
Reference numbers of test equipment used

HL 3818	HL 3903	HL 4068	HL 4756				

Full description is given in Appendix A.

Test specification:	Section 15.247(a)1, RSS-247 section 5.1(3), Number of hopping frequencies		
Test procedure:	ANSI C63.10, section 7.8.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Jul-16		
Temperature: 26 ºC	Relative Humidity: 39 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.4.1 Number of hopping frequencies



Test specification:	Section 15.247(a)1, RSS-247 section 5.1(3), Average time of occupancy		
Test procedure:	ANSI C63.10, section 7.8.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Jul-16		
Temperature: 26 ºC	Relative Humidity: 39 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

7.5 Average time of occupancy

7.5.1 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 7.5.1.

Table 7.5.1 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

7.5.2 Test procedure

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized with frequency hopping function enabled and its proper operation was checked.

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

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

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

7.5.2.5 The test was repeated at each data rate and modulation type as provided in Table 7.5.2 and associated plots.

Figure 7.5.1 Average time of occupancy test setup

Test specification:	**Section 15.247(a)1, RSS-247 section 5.1(3), Average time of occupancy**		
Test procedure:	ANSI C63.10, section 7.8.4		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	27-Jul-16		
Temperature: 26 ºC	**Relative Humidity:** 39 %	**Air Pressure:** 1005 hPa	**Power:** 3.6 VDC
Remarks:			

Table 7.5.2 Average time of occupancy test results

ASSIGNED FREQUENCY:	902 – 928 MHz
MODULATION:	GFSK
MODULATING SIGNAL:	PRBS
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	RBW
NUMBER OF HOPPING FREQUENCIES:	50
INVESTIGATED PERIOD:	20 s
FREQUENCY HOPPING:	Enabled

Carrier frequency, MHz	Single transmission duration, ms	Single transmission period, s	Average time of occupancy*, s	Bit rate, kbps	Symbol rate, Msymbol/s	Limit, s	Margin, s**	Verdict
919.12	4.3	255	0.0043	50	NA	0.400	-0.3957	Pass

* - Average time of occupancy = (Single transmission duration × Investigated period) / (Single transmission period × number of hopping channels).
** - Margin = Average time of occupancy – specification limit.

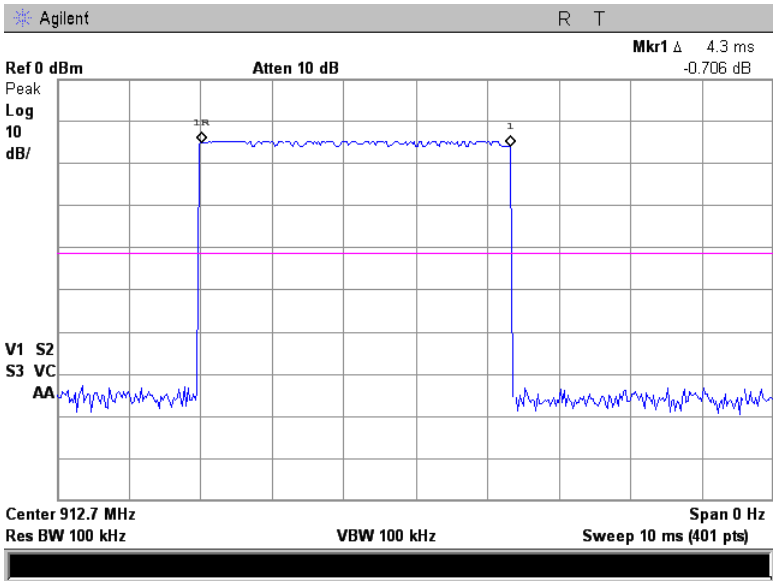
Reference numbers of test equipment used

HL 3818	HL 3903	HL 4068	HL 4756				

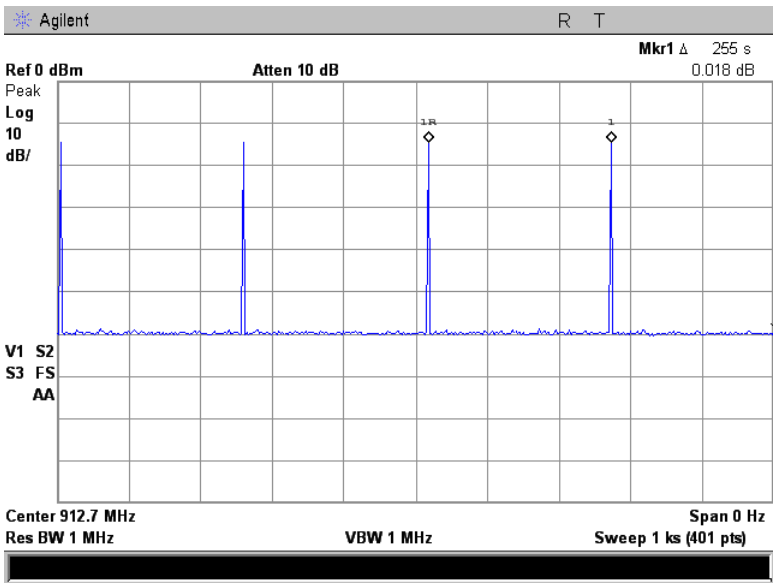
Full description is given in Appendix A.

Test specification:	Section 15.247(a)1, RSS-247 section 5.1(3), Average time of occupancy		
Test procedure:	ANSI C63.10, section 7.8.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	27-Jul-16		
Temperature: 26 ºC	Relative Humidity: 39 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.5.1 Single transmission duration



Plot 7.5.2 Single transmission period



Test specification:	Section 15.247(b), RSS-247 section 5.4(1), Peak output power		
Test procedure:	ANSI C63.10, section 7.8.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

7.6 Peak output power

7.6.1 General

This test was performed to measure the maximum peak output power at the transmitter RF antenna connector. Specification test limits are given in Table 7.6.1.

Table 7.6.1 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) 1.0 (≥50 hopping channels)	24.0(<50 hopping channels) 30.0 (≥50 hopping channels)	125.2 (<50 hopping channels) 131.2 (≥50 hopping channels)	6.0*
2400.0 – 2483.5	0.125 (<75 hopping channels) 1.0 (≥75 hopping channels)	21.0(<75 hopping channels) 30.0 (≥75 hopping channels)	122.2 (<75 hopping channels) 131.2 (≥75 hopping channels)	
5725.0 – 5850.0	1.0	30.0	131.2	

*- 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.

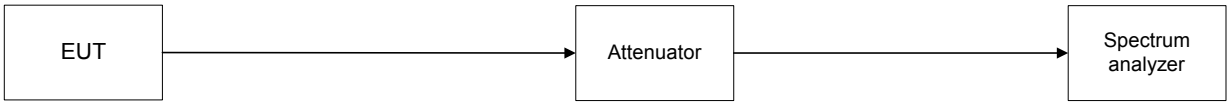
7.6.2 Test procedure

7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.

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

7.6.2.3 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. The spectrum analyzer trace was allowed to stabilize and the maximum peak output power was measured as provided in Table 7.6.2 and associated plots.

Figure 7.6.1 Peak output power test setup



Test specification:	**Section 15.247(b), RSS-247 section 5.4(1), Peak output power**		
Test procedure:	ANSI C63.10, section 7.8.5		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	**Relative Humidity:** 46 %	**Air Pressure:** 1006 hPa	**Power:** 3.6 VDC
Remarks:			

Table 7.6.2 Peak output power test results

ASSIGNED FREQUENCY: 902 – 928 MHz
MODULATION: GFSK
MODULATING SIGNAL: PRBS
BIT RATE: 50 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
EUT 20 dB BANDWIDTH: 84.16 kHz at Low carrier frequency
84.00 kHz at Mid carrier frequency
84.42 kHz at High carrier frequency
RESOLUTION BANDWIDTH: 120 kHz
VIDEO BANDWIDTH: 300 kHz
FREQUENCY HOPPING: Disabled
NUMBER OF FREQUENCY HOPPING CHANNELS: 50

Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	Cable loss, dB	Peak output power, dBm	Limit, dBm	Margin*, dB	Verdict
912.750	14.60	NA	NA	14.60	30.00	-15.40	Pass
915.865	15.06	NA	NA	15.12	30.00	-14.88	Pass
919.108	13.84	NA	NA	13.84	30.00	-16.16	Pass

* - Margin = Peak output power – specification limit.
Note: Maximum peak output power was obtained at U_{nom} input power voltage.

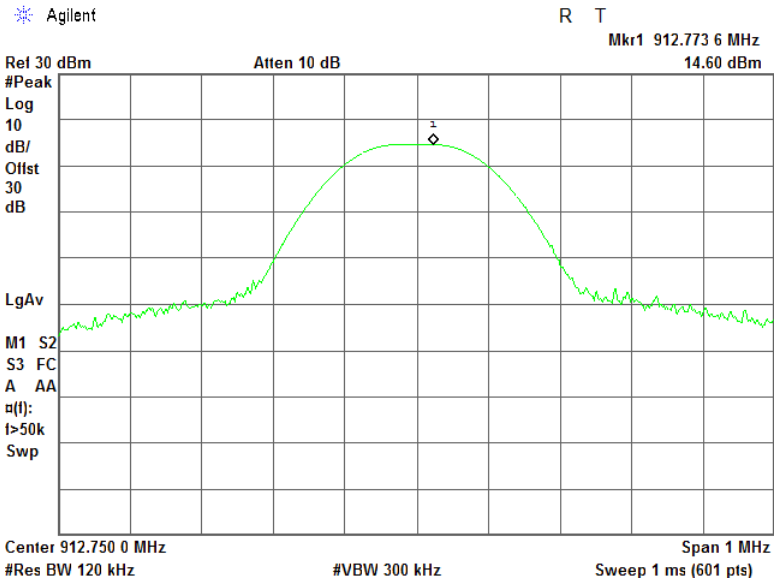
Reference numbers of test equipment used

HL 3818	HL 3901	HL 4068	HL 4756				

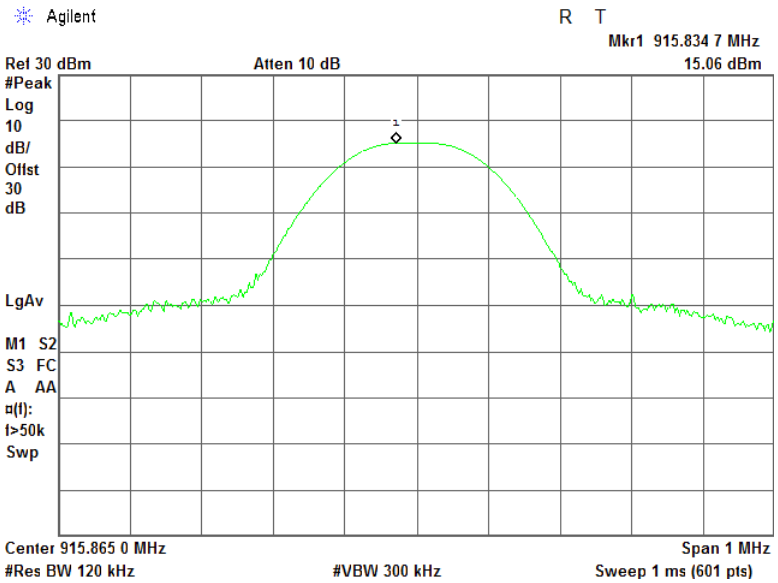
Full description is given in Appendix A.

Test specification:	Section 15.247(b), RSS-247 section 5.4(1), Peak output power		
Test procedure:	ANSI C63.10, section 7.8.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.6.1 Peak output power at low frequency

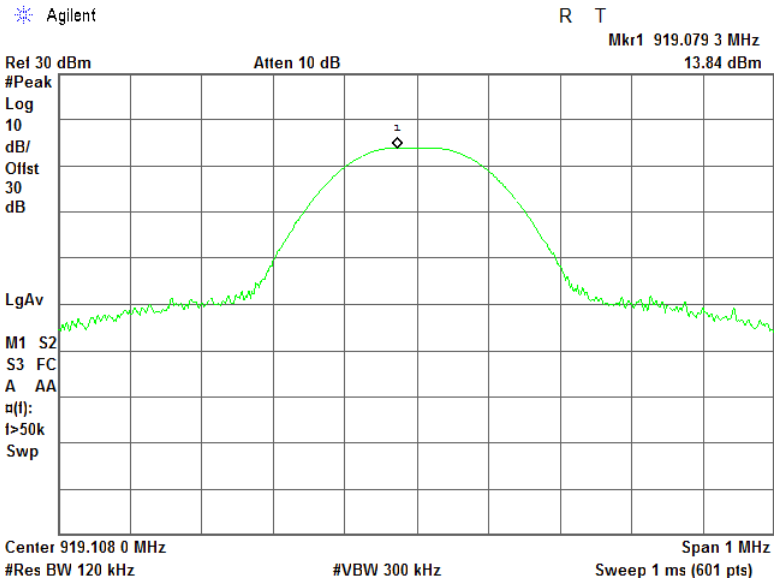


Plot 7.6.2 Peak output power at mid frequency



Test specification:	Section 15.247(b), RSS-247 section 5.4(1), Peak output power		
Test procedure:	ANSI C63.10, section 7.8.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Plot 7.6.3 Peak output power at high frequency



Test specification:	Section 15.247(d), RSS-247 section 5.5, Emissions at band edges		
Test procedure:	ANSI C63.10, section 7.8.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

7.7 Band edge emissions at RF antenna connector

7.7.1 General

This test was performed to measure band edge emissions at RF antenna connector. 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
902.0 – 928.0	20.0
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.

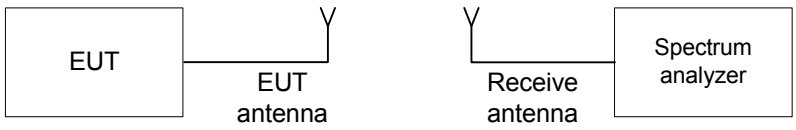
7.7.2.4 The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.

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



Test specification:	Section 15.247(d), RSS-247 section 5.5, Emissions at band edges		
Test procedure:	ANSI C63.10, section 7.8.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

Table 7.7.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 902 – 928 MHz
DETECTOR USED: Peak
MODULATION: GFSK
MODULATING SIGNAL: PRBS
BIT RATE: 50 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: ≥ RBW

Frequency, MHz	Band edge emission, dBm	Emission at carrier, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Frequency hopping disabled						
902.00	-37.36	15.03	52.39	20.0	32.39	Pass
928.00	-36.53	14.91	51.44		31.44	
Frequency hopping enabled						
902.00	-32.53	14.98	47.51	20.0	27.51	Pass
928.00	-28.66	14.85	43.51		23.51	

*- Margin = Attenuation below carrier – specification limit.

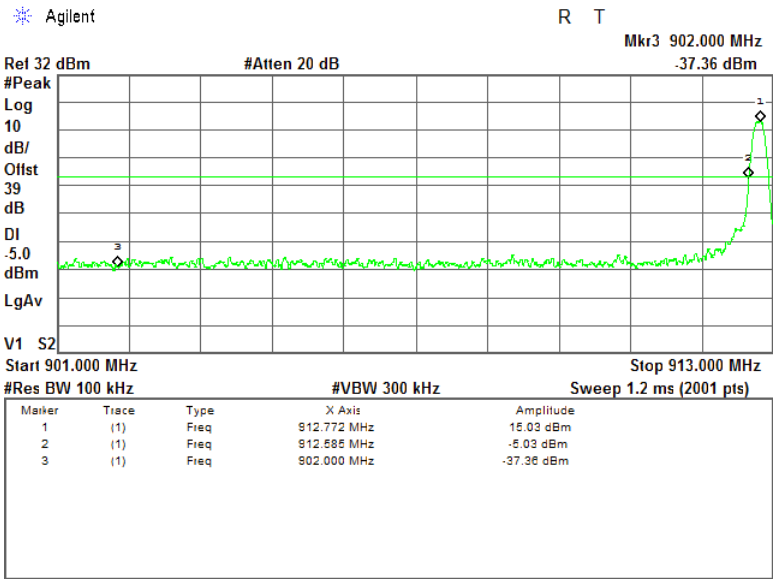
Reference numbers of test equipment used

HL 3810	HL 3818	HL 3903	HL 4068	HL 4756			

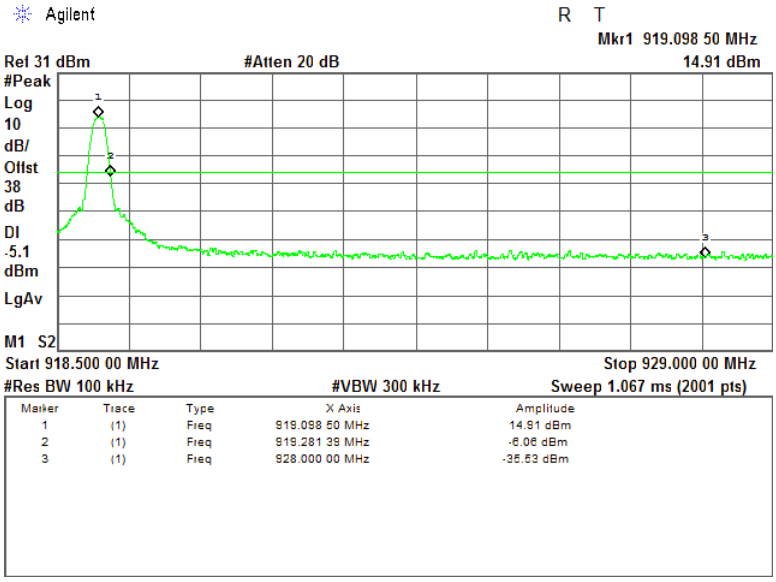
Full description is given in Appendix A.

Test specification:	Section 15.247(d), RSS-247 section 5.5, Emissions at band edges		
Test procedure:	ANSI C63.10, section 7.8.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

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

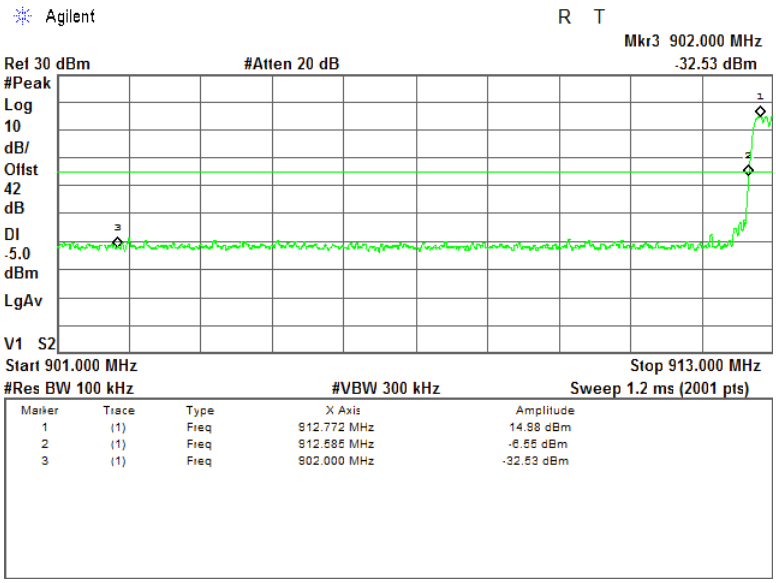


Plot 7.7.2 The highest band edge emission at high carrier frequency with hopping function disabled

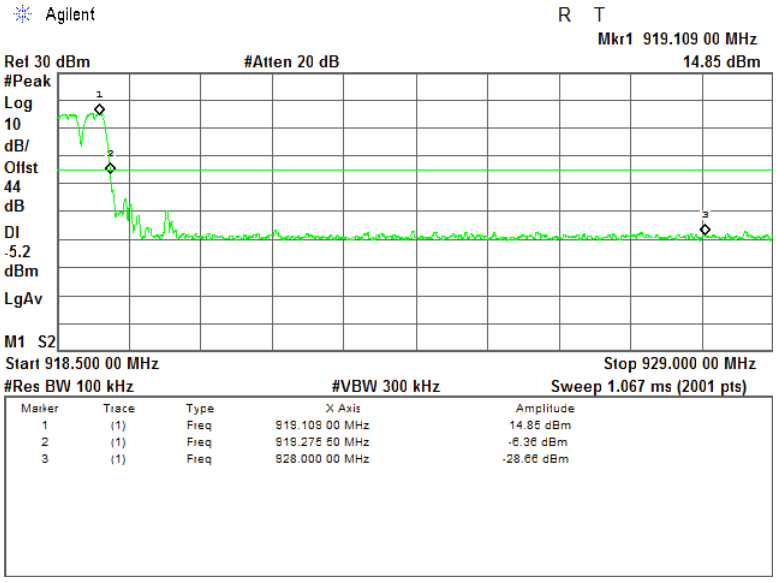


Test specification:	Section 15.247(d), RSS-247 section 5.5, Emissions at band edges		
Test procedure:	ANSI C63.10, section 7.8.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	28-Jul-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

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



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

7.8 Field strength of spurious emissions

7.8.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.8.1.

Table 7.8.1 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m)***			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc***
	Peak	Quasi Peak	Average	
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	20.0
0.090 – 0.110	NA	108.5 – 106.8**	NA	
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**	
0.490 – 1.705	NA	73.8 – 63.0**	NA	
1.705 – 30.0*		69.5		
30 – 88		40.0		
88 – 216		43.5		
216 – 960		46.0		
960 - 1000		54.0		
1000 – 10thharmonic	74.0	NA	54.0	

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

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

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

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

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

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

7.8.2.1 The EUT was set up as shown in Figure 7.8.1, energized and the performance check was conducted.

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

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

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

7.8.3.1 The EUT was set up as shown in Figure 7.8.2, energized and the performance check was conducted.

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

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

Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Figure 7.8.1 Setup for spurious emission field strength measurements below 30 MHz

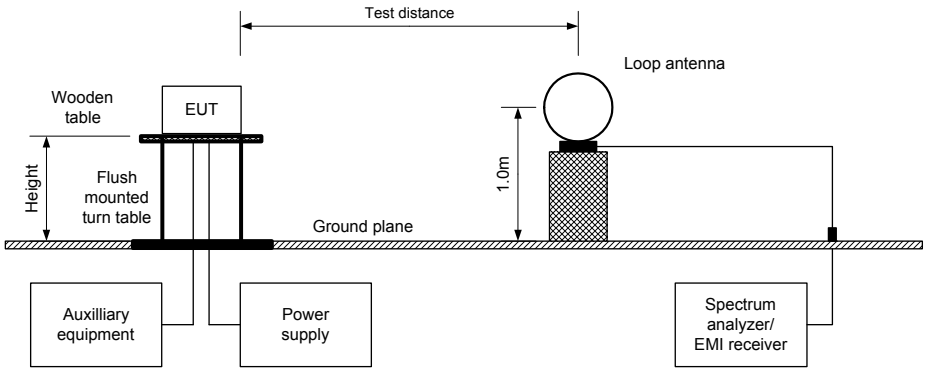
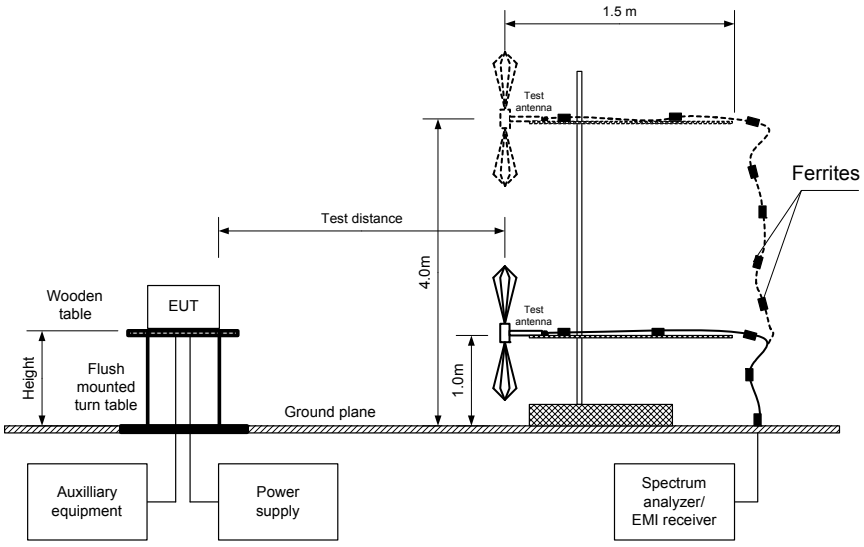


Figure 7.8.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Table 7.8.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY:	902.0 – 928.0 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 9500 MHz
TEST DISTANCE:	3 m
MODULATION:	GFSK
MODULATING SIGNAL:	PRBS
BIT RATE:	50 kbps
DUTY CYCLE:	100 %
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	300 kHz
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)
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
Low carrier frequency									
1825.44	43.45	Vertical	1.4	90	117.55	74.10	20.00	54.10	Pass
6389.42	50.12	Vertical	1.8	45		67.43		47.43	
Mid carrier frequency									
1831.77	45.05	Vertical	1.8	270	118.88	73.83	20.00	53.83	Pass
5495.32	55.08	Vertical	1.5	30		63.80		43.80	
6410.90	56.04	Vertical	1.9	180		62.84		42.84	
High carrier frequency									
1838.27	46.06	Vertical	1.5	80	116.27	70.21	20.00	50.21	Pass
6433.91	51.74	Vertical	1.8	270		64.53		44.53	

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

Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Table 7.8.3 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY:	902.0 – 928.0 MHz
INVESTIGATED FREQUENCY RANGE:	1000 – 9500 MHz
TEST DISTANCE:	3 m
MODULATION:	GFSK
MODULATING SIGNAL:	PRBS
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

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength (VBW=3 MHz)			Average field strength (VBW=3 MHz)				Verdict
	Polarization	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	Measured, dB(μV/m)	Calculated, dB(μV/m)	Limit, dB(μV/m)	Margin, dB***	
Low carrier frequency											
8214.62	Vertical	1.6	210	61.71	74.00	-12.29	61.71	34.38	54.00	-19.62	Pass
Mid carrier frequency											
2747.52	Vertical	1.5	0	50.48	74.00	-23.52	50.48	23.15	54.00	-30.85	Pass
3663.49	Vertical	1.7	160	52.88	74.00	-21.12	52.88	25.55	54.00	-28.45	
4579.23	Vertical	1.6	20	62.45	74.00	-11.55	62.45	35.12	54.00	-18.88	
7326.87	Vertical	1.8	0	59.05	74.00	-14.95	59.05	31.72	54.00	-22.28	
8243.00	Vertical	1.6	270	59.65	74.00	-14.35	59.65	32.32	54.00	-21.68	
High carrier frequency											
8271.92	Vertical	1.5	330	62.72	74.00	-11.28	62.72	35.39	54.00	-18.61	Pass

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

Table 7.8.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Number of pulses during 100 ms	Duration, ms	Period, ms		
4.3	1	NA	NA	NA	-27.33

*- Average factor was calculated as follows

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

for pulse train longer than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100\,ms} \times Number\ of\ bursts\ within\ 100\,ms\right)$$

Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Table 7.8.5 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY:	902.0 – 928.0 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
TEST DISTANCE:	3 m
MODULATION:	GFSK
MODULATING SIGNAL:	PRBS
BIT RATE:	50 kbps
DUTY CYCLE:	100 %
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
RESOLUTION BANDWIDTH:	1.0 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz)
FREQUENCY 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*				
Low carrier frequency								
No emissions were found								
Mid carrier frequency								
No emissions were found								
High carrier frequency								
No emissions were found								

Verdict: Pass

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

Reference numbers of test equipment used

HL 0446	HL 0521	HL 0604	HL 2432	HL 2697	HL 2780	HL 3818	HL 3901
HL 4277	HL 4278	HL 4293	HL 4353	HL 4932	HL 4933		

Full description is given in Appendix A.

Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Table 7.8.6 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	

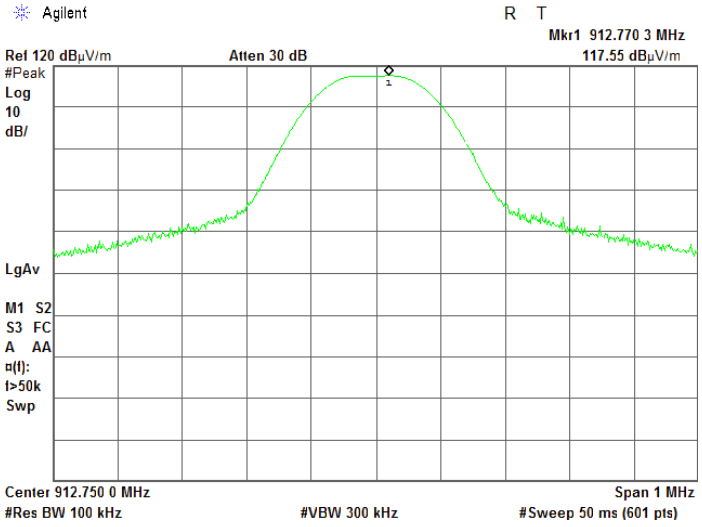
Table 7.8.7 Restricted bands according to RSS-Gen

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

Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

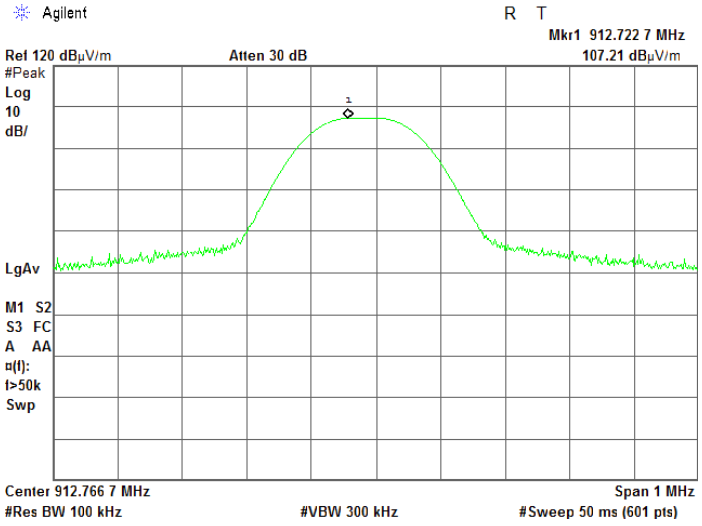
Plot 7.8.1 Radiated emission measurements at the low carrier frequency

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



Plot 7.8.2 Radiated emission measurements at the low carrier frequency

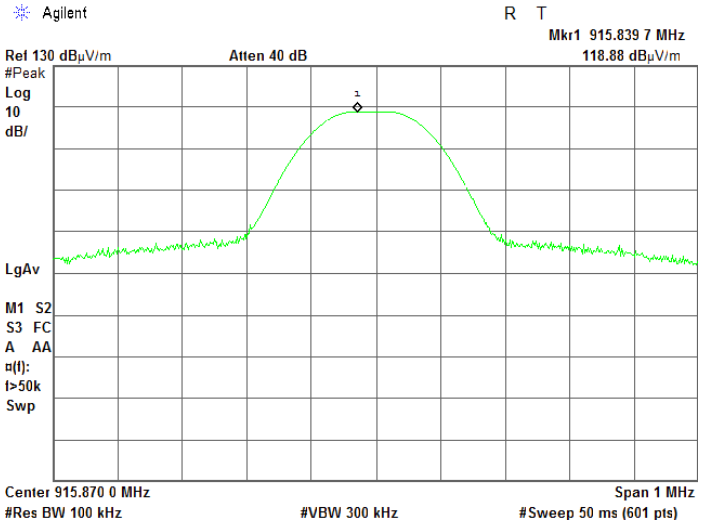
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

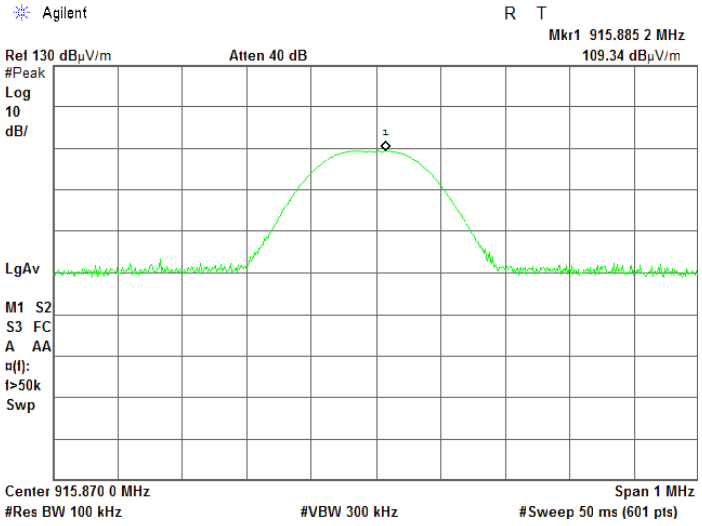
Plot 7.8.3 Radiated emission measurements at the mid carrier frequency

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



Plot 7.8.4 Radiated emission measurements at the mid carrier frequency

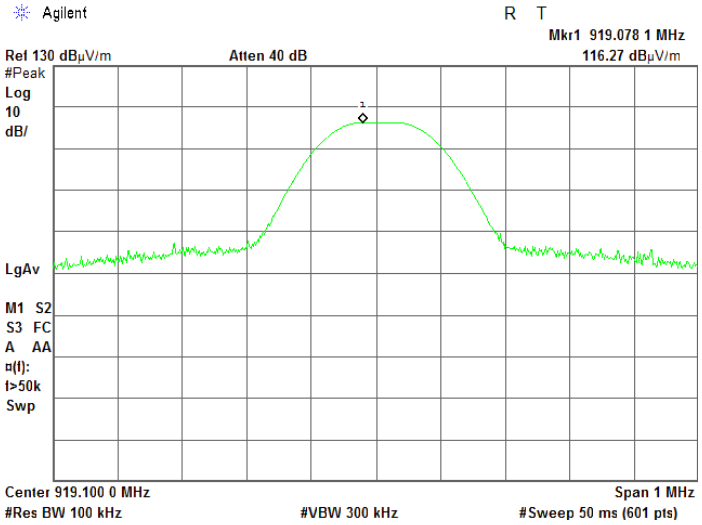
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

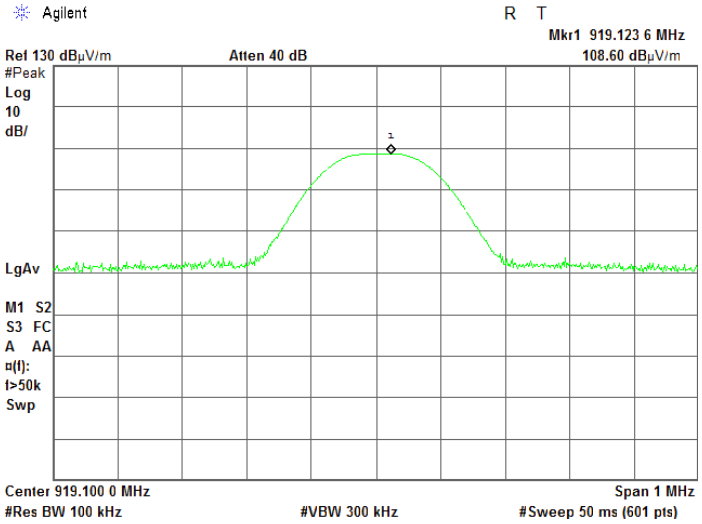
Plot 7.8.5 Radiated emission measurements at the high carrier frequency

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



Plot 7.8.6 Radiated emission measurements at the high carrier frequency

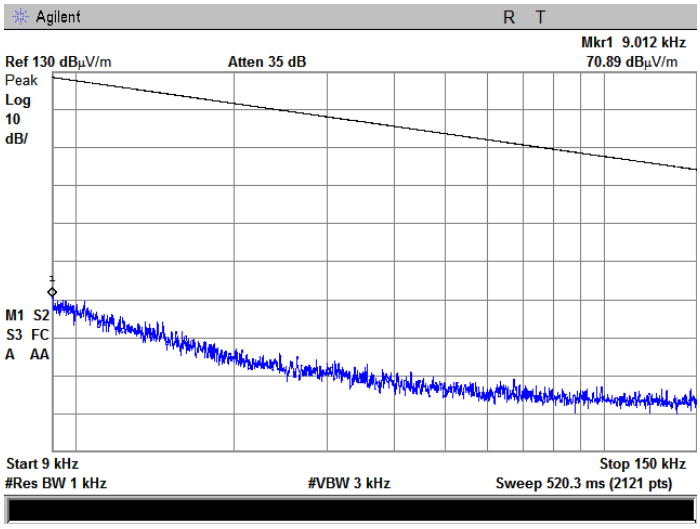
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

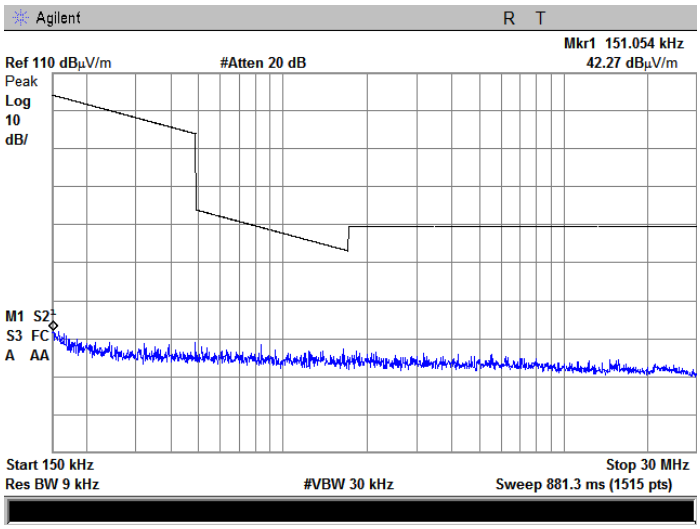
Plot 7.8.7 Radiated emission measurements from 9 to 150 kHz at the low, mid, high carrier frequency

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



Plot 7.8.8 Radiated emission measurements from 0.15 to 30 MHz at the low, mid, high carrier frequency

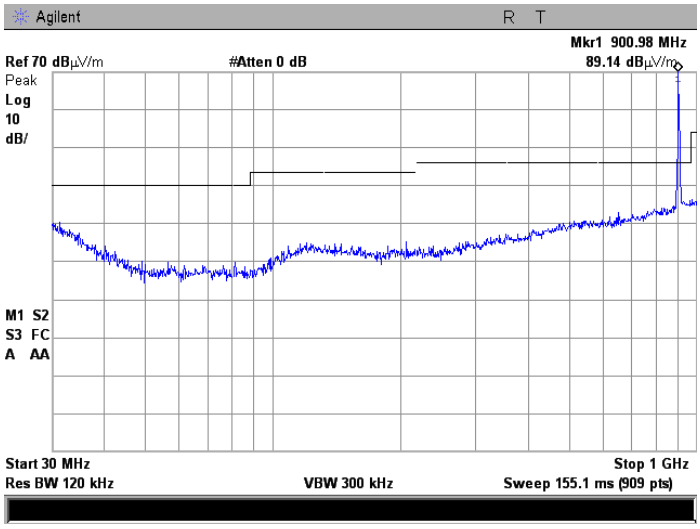
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

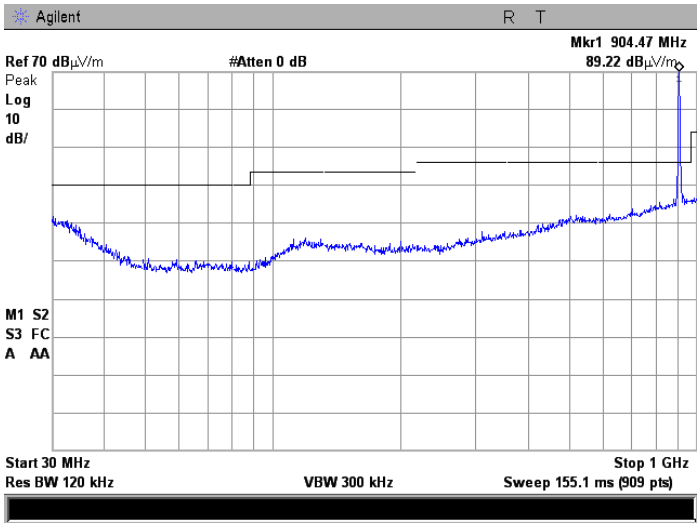
Plot 7.8.9 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency

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



Plot 7.8.10 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency

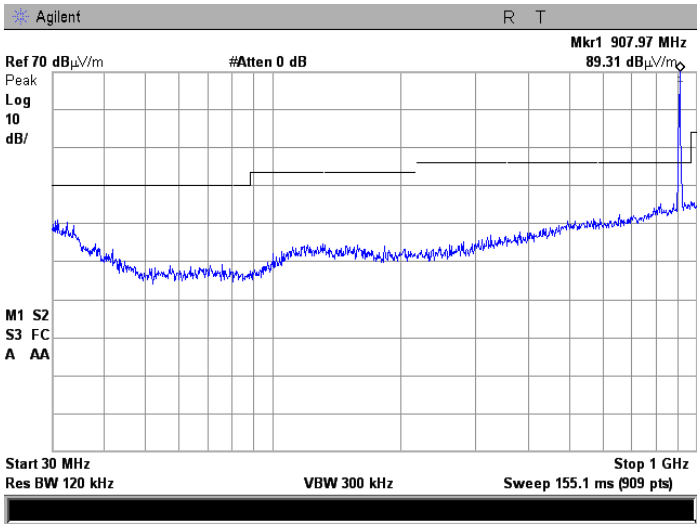
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

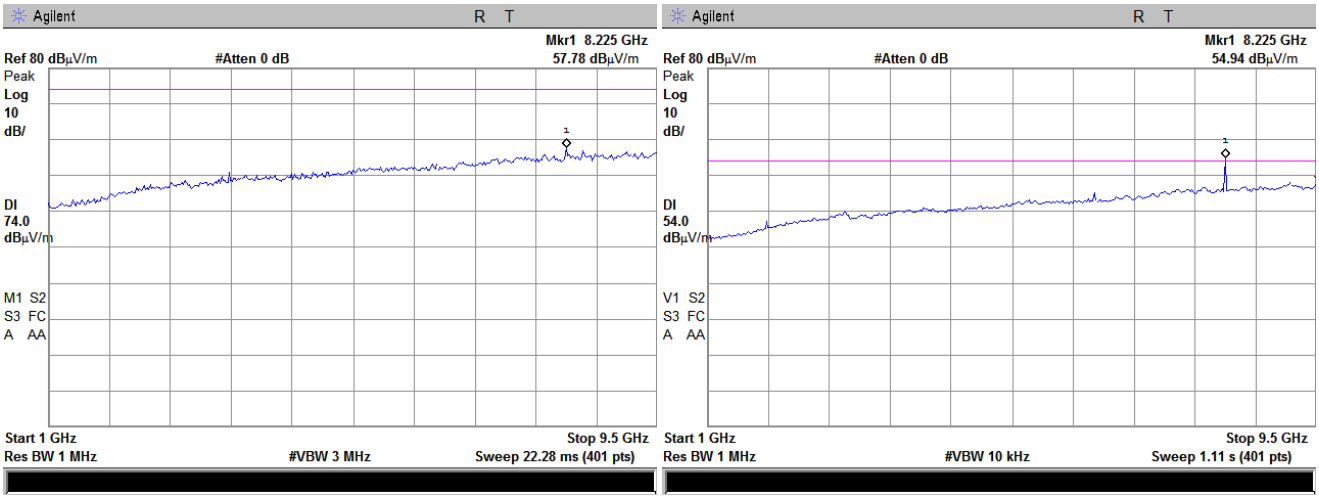
Plot 7.8.11 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency

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



Plot 7.8.12 Radiated emission measurements from 1000 to 9500 MHz at the low carrier frequency

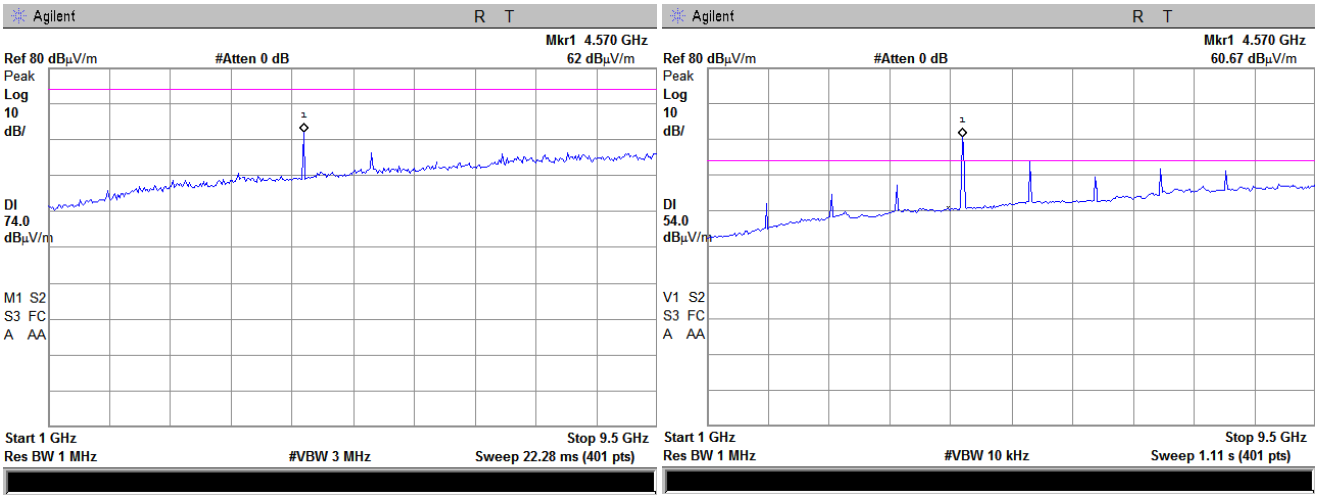
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

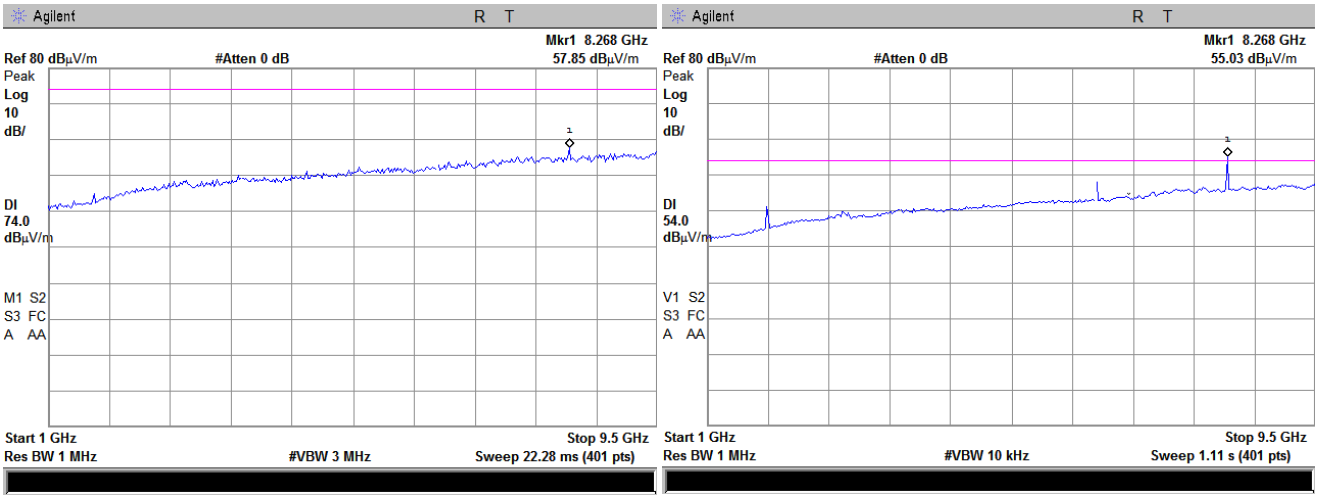
Plot 7.8.13 Radiated emission measurements from 1000 to 9500 MHz at the mid carrier frequency

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



Plot 7.8.14 Radiated emission measurements from 1000 to 9500 MHz at the high carrier frequency

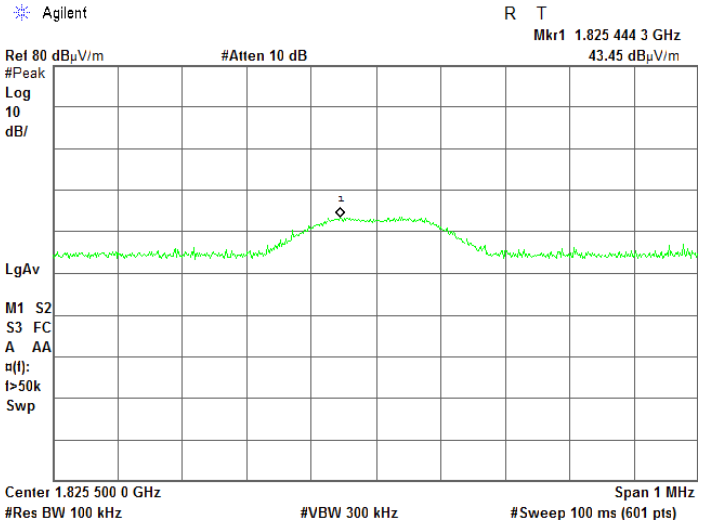
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

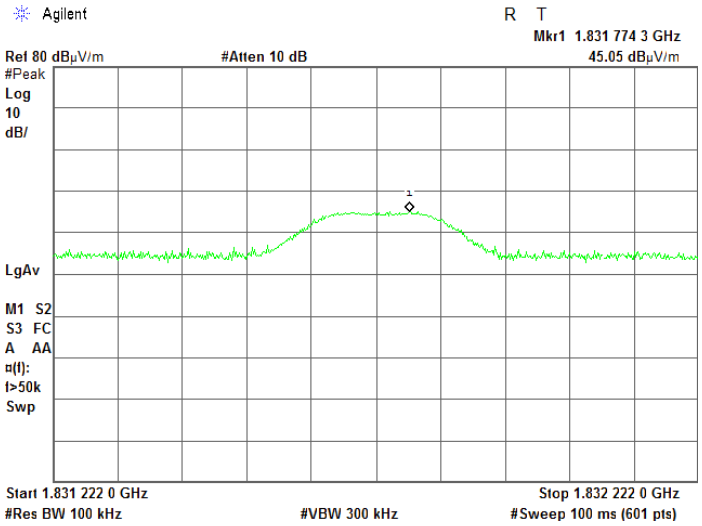
Plot 7.8.15 Radiated emission measurements at the second harmonic of low carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.8.16 Radiated emission measurements at the second harmonic of mid carrier frequency

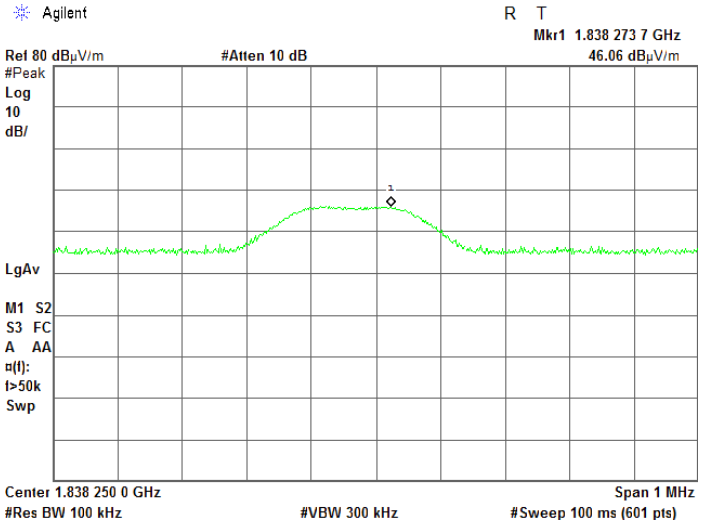
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

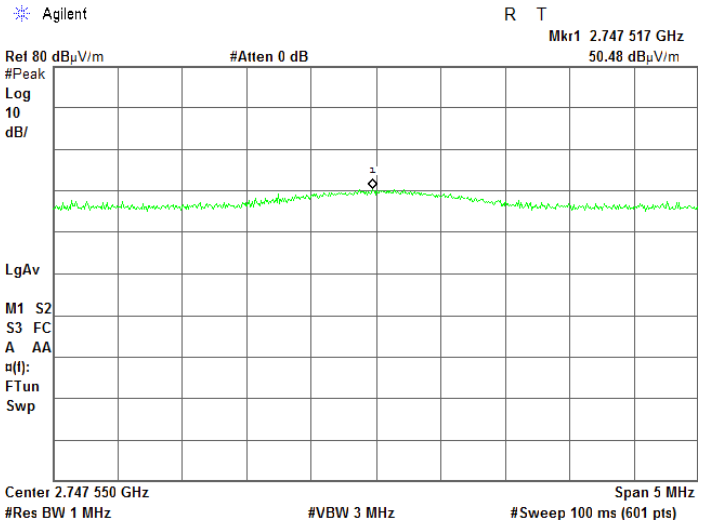
Plot 7.8.17 Radiated emission measurements at the second harmonic of high carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.8.18 Radiated emission measurements at the third harmonic of mid carrier frequency

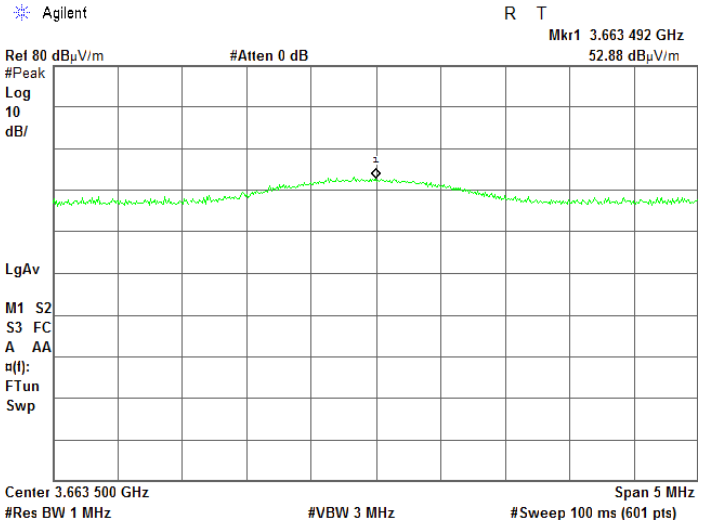
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

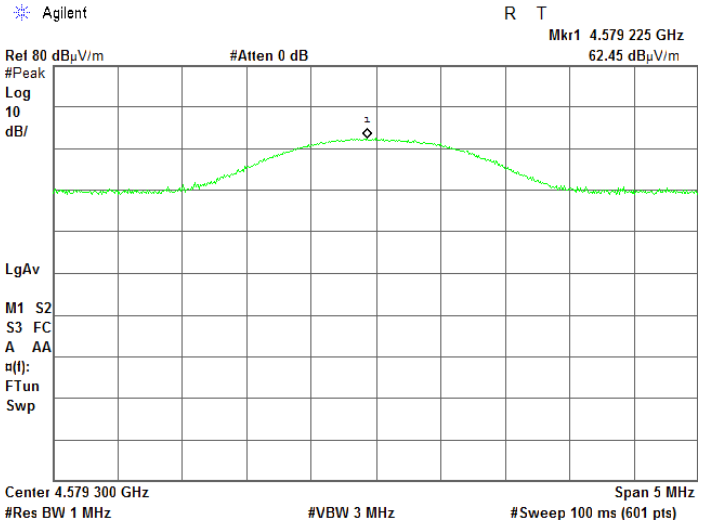
Plot 7.8.19 Radiated emission measurements at the fourth harmonic of mid carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.8.20 Radiated emission measurements at the fifth harmonic of mid carrier frequency

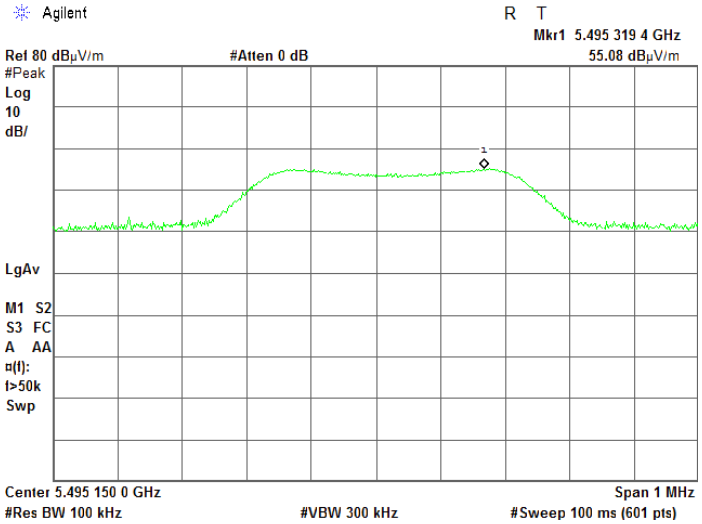
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

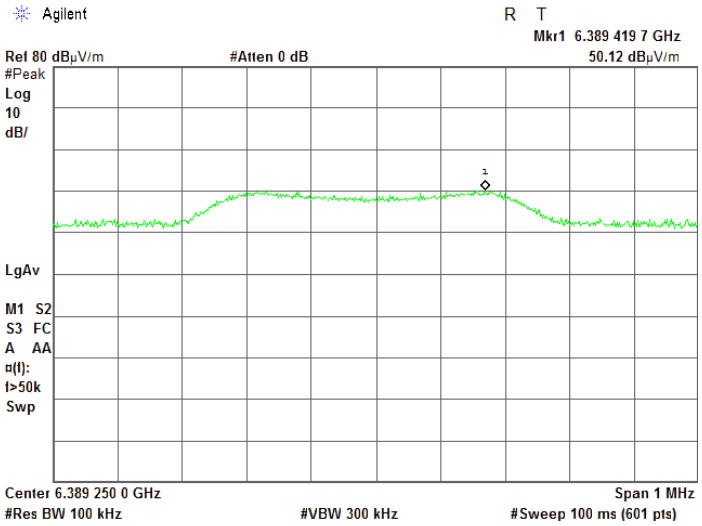
Plot 7.8.21 Radiated emission measurements at the sixth harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.8.22 Radiated emission measurements at the seventh harmonic of low carrier frequency

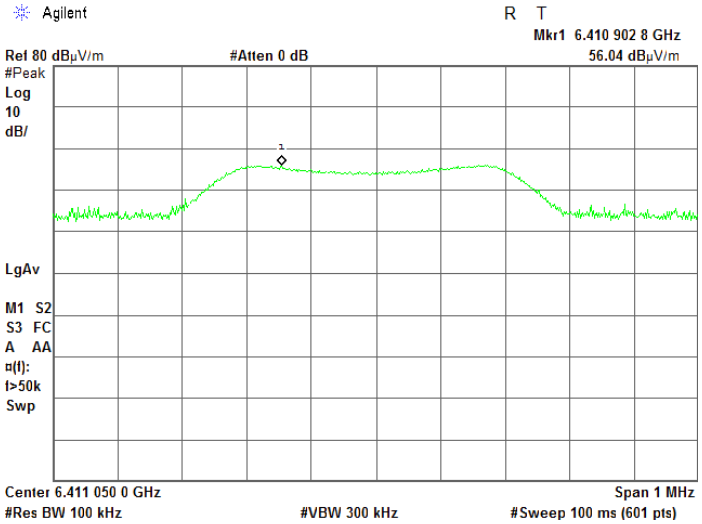
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

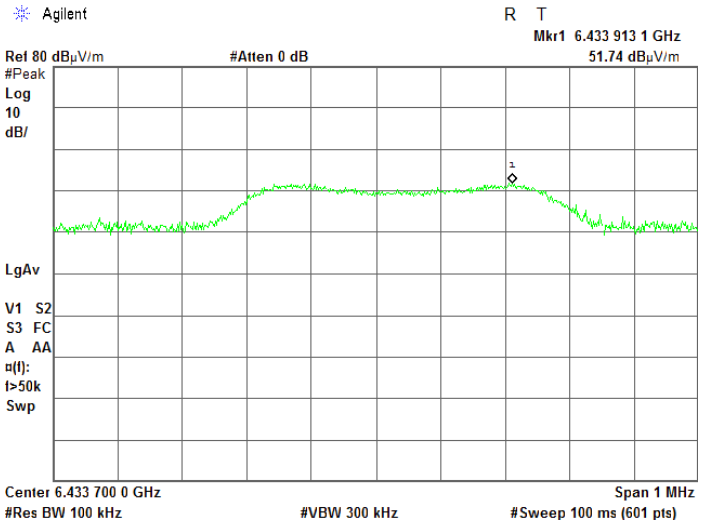
Plot 7.8.23 Radiated emission measurements at the seventh harmonic of mid carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.8.24 Radiated emission measurements at the seventh harmonic of high carrier frequency

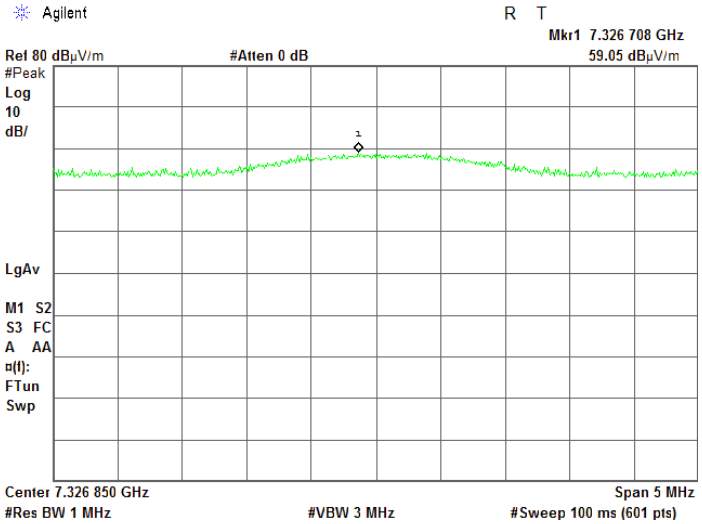
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

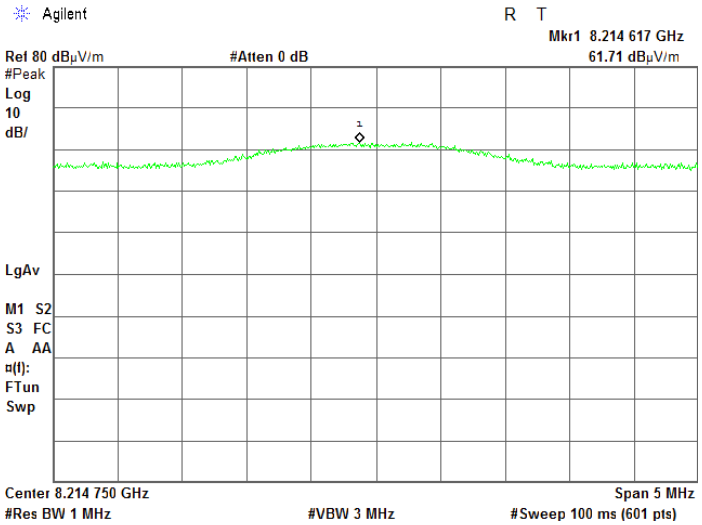
Plot 7.8.25 Radiated emission measurements at the eighth harmonic of mid carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.8.26 Radiated emission measurements at the ninths harmonic of low carrier frequency

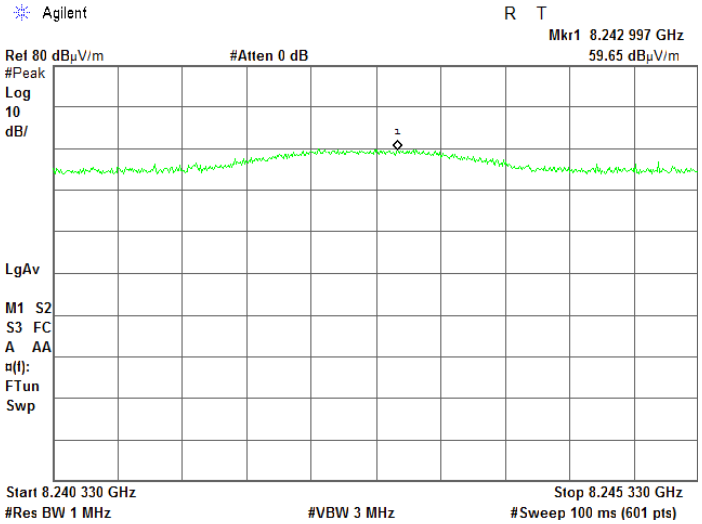
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.247(d), RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10, sections 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

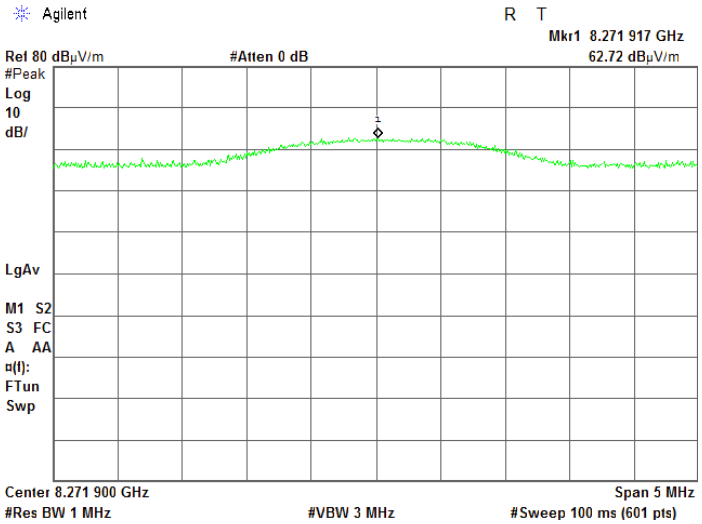
Plot 7.8.27 Radiated emission measurements at the ninths harmonic of mid carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.8.28 Radiated emission measurements at the ninths harmonic of high carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.203, RSS-Gen, Section 7.1.4, Antenna requirements		
Test procedure:	Visual inspection		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11-Aug-16		
Temperature: 26 ºC	Relative Humidity: 46 %	Air Pressure: 1006 hPa	Power: 3.6 VDC
Remarks:			

7.9 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 7.9.1.

Table 7.9.1 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 7.9.1 Antenna assembly

Test specification:	Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Section 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

8 Unintentional emissions

8.1 Radiated emission measurements

8.1.1 General

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

Table 8.1.1 Radiated emission 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: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

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

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

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

8.1.2 Test procedure

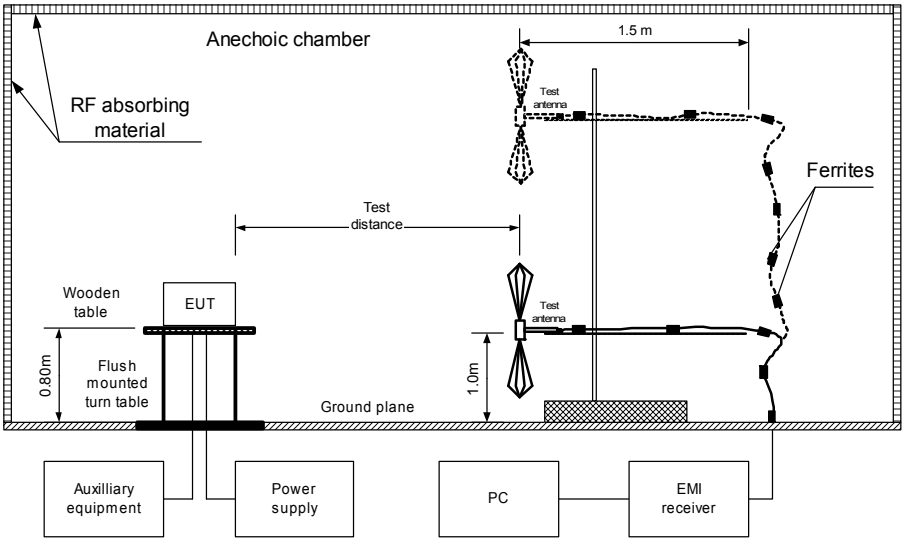
8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photograph/s, energized and the performance check was conducted.

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 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

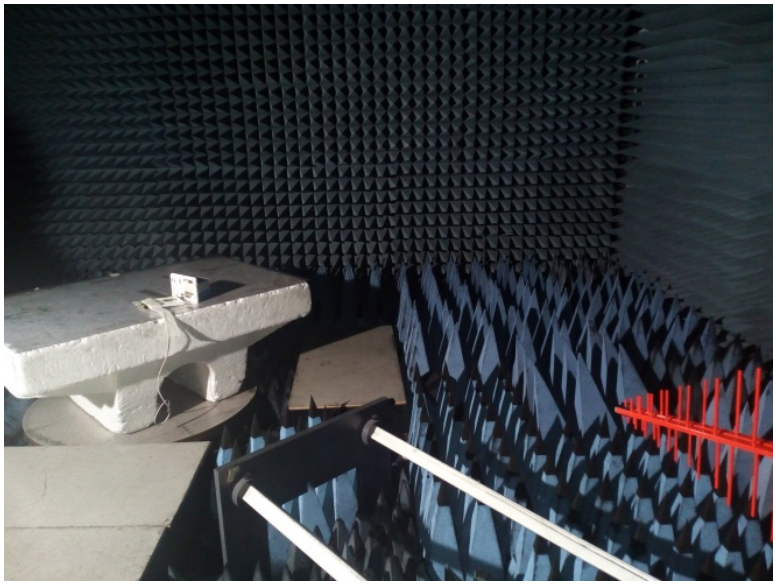
8.1.2.3 The worst test results (the lowest margins) were recorded in Table 8.1.3 and shown in the associated plots.

Test specification:	Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Section 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

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

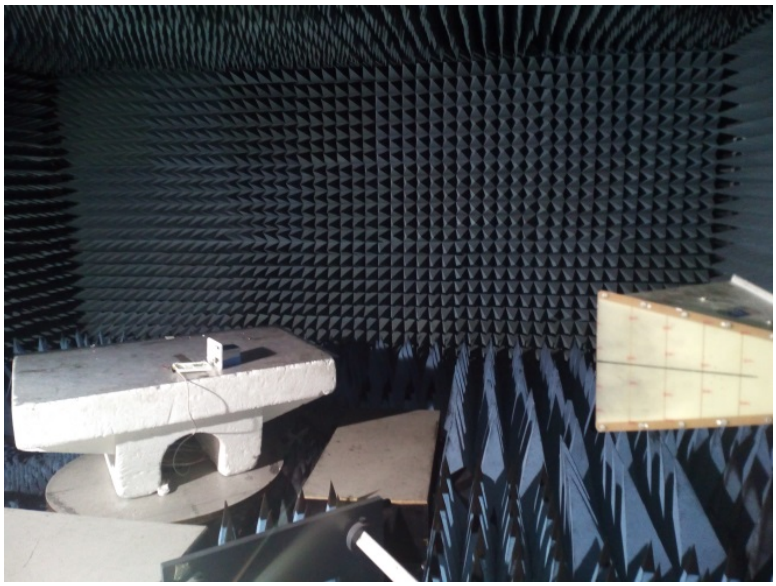


Photograph 8.1.1 Setup for radiated emission measurements

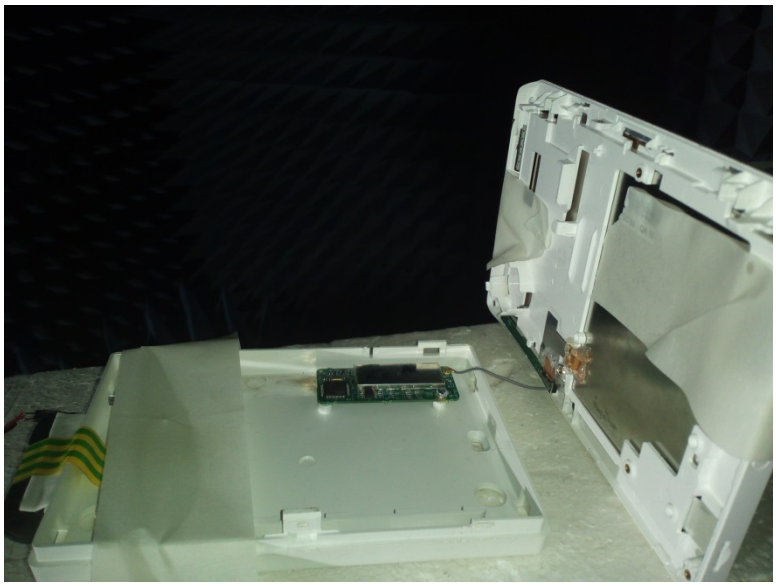


Test specification:	Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Section 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

Photograph 8.1.2 Setup for radiated emission measurements



Photograph 8.1.3 Setup for radiated emission measurements, EUT cabling



Test specification:	**Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission**		
Test procedure:	ANSI C63.4, Section 12.2.5		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	**Relative Humidity:** 44 %	**Air Pressure:** 1005 hPa	**Power:** 3.6 VDC
Remarks:			

Table 8.1.3 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive
TEST SITE: 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: ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 9500 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

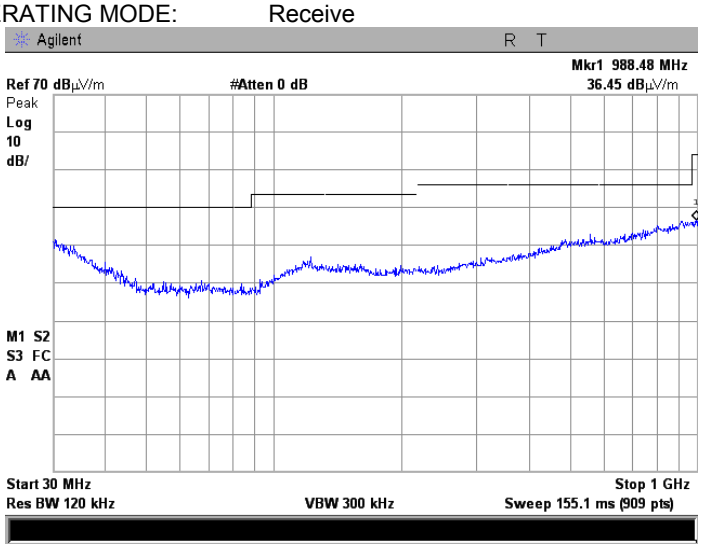
HL 2432	HL 2697	HL 2772	HL 2780	HL 4277	HL 4293		

Full description is given in Appendix A.

Test specification:	Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Section 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

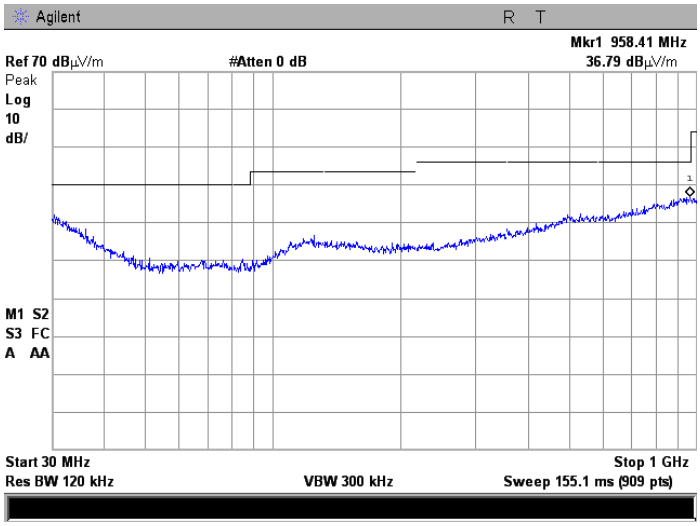
Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

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



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

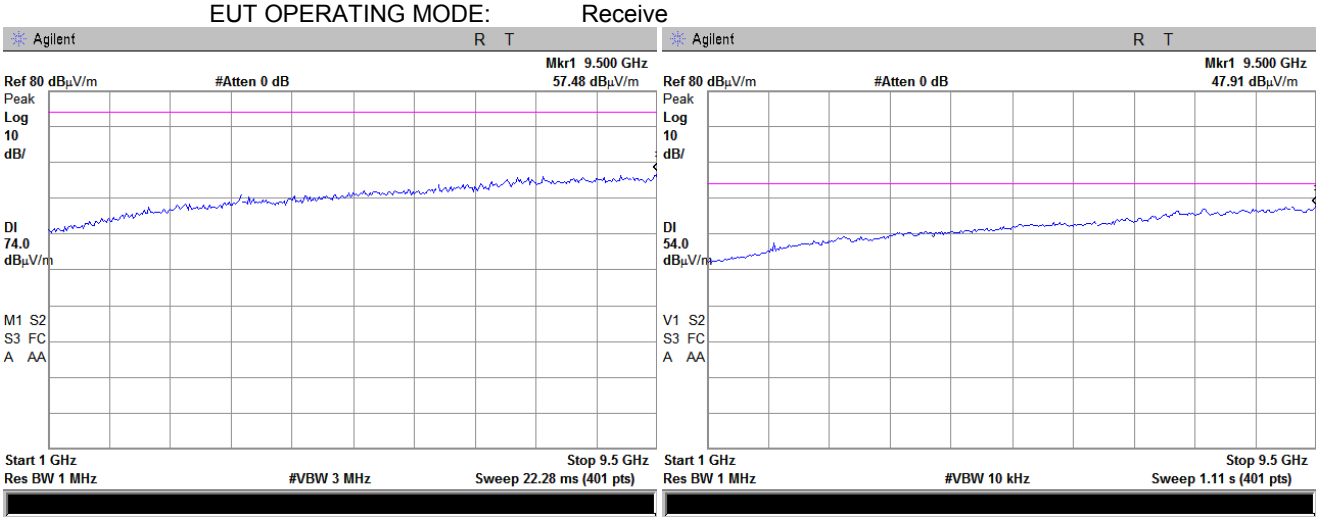
TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



Test specification:	Section 15.109, RSS-Gen, Section 7.1.2, ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Section 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	26-Jul-16		
Temperature: 25 ºC	Relative Humidity: 44 %	Air Pressure: 1005 hPa	Power: 3.6 VDC
Remarks:			

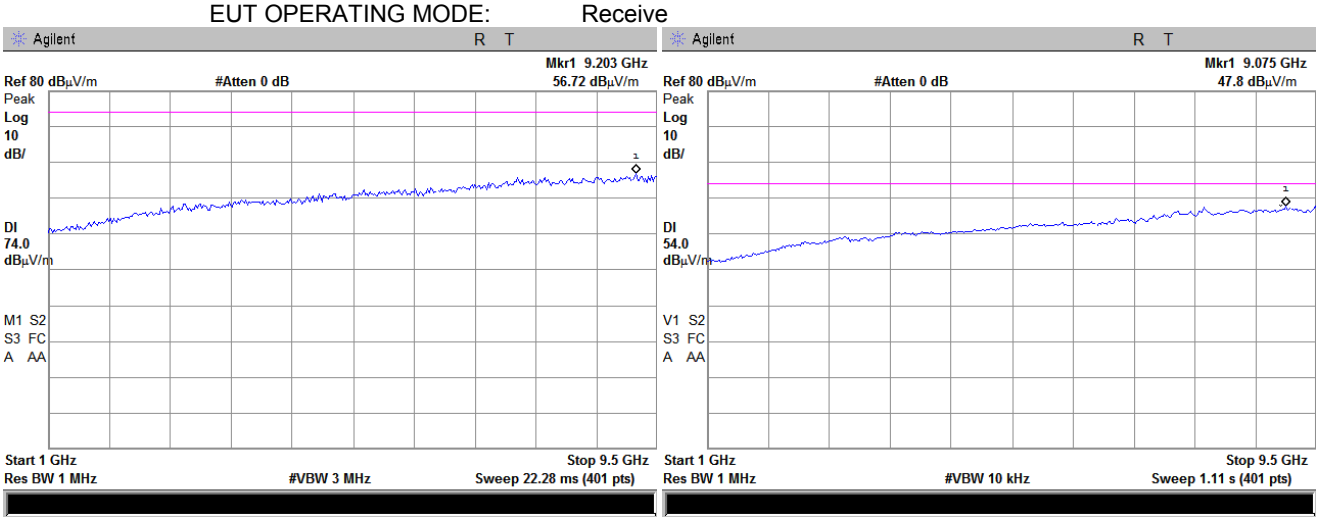
Plot 8.1.3 Radiated emission measurements above 1000 MHz, vertical antenna polarization

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



Plot 8.1.4 Radiated emission measurements above 1000 MHz, horizontal antenna polarization

TEST SITE: Anechoic chamber
LIMIT: ClassB
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	18-Jan-16	18-Jan-17
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A00253	27-Oct-15	27-Oct-16
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	10-May-16	10-May-17
2432	Antenna, Double-Ridged Waveguide Horn 1 to 18 GHz	EMC Test Systems	3115	00027177	28-Mar-16	28-Mar-17
2697	Antenna, 30 MHz - 3.0 GHz	Sunol Sciences. Corp. Pleasanton, California USA	JB3	A022805	10-May-16	10-May-17
2772	HygroThermometer, Min/Max Memory	Delta TRAK	13301	NA	19-Jun-16	19-Jun-17
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY45102462	08-Sep-15	08-Sep-16
3810	Near-Field Probe Set, Hand held, 6 probes	EMC Test Systems	7405	9706-3927	30-Dec-15	30-Dec-16
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	03-May-16	03-May-17
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	15-Feb-16	15-Feb-17
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1226/2A	15-Feb-16	15-Feb-17
4068	Attenuator, SMA, 30 dB, DC to 12.4 GHz	Midwest Microwave	ATT-0527-30-SMA-07	NA	17-Jul-16	17-Jul-17
4277	Test Cable , DC-18 GHz, 3.05 m, N/M - N/M	Mini-Circuits	APC-10FT-NMNM+	0748A	22-Nov-15	22-Nov-16
4278	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0755A	22-Nov-15	22-Nov-16
4293	Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA	Huber-Suhner	Sucoflex P103	NA	01-Feb-16	01-Feb-17
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101003	15-Mar-16	15-Mar-17
4756	Digital Hygrometer / Thermometer, (0 to +50) deg., (20 to 99) %RH	WESTERN Humidor Corporation	Caliber 4	NA	02-Nov-15	02-Nov-16
4932	Microwave preamplifier, 500 MHz to 18 GHz, 40 dB Gain	Com-Power Corporation	PAM-118A	551029	19-Nov-15	19-Nov-16
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	04-Sep-15	04-Sep-16

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

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

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

11 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.
Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file number IC 2186A-1 for OATS), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01). The FCC Designation Number is IL1001.

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Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

FCC 47CFR part 15: 2015	Radio Frequency Devices
ANSI C63.10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications
ANSI C63.4: 2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
RSS-247 Issue 1: 2015	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence- Exempt Local Area Network (LE-LAN) Devices
RSS-Gen Issue 4: 2014	General Requirements for Compliance of Radio Apparatus
ICES-003: 2016, Issue 6	Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement

13 APPENDIX E Test equipment correction factors

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

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

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

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

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

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

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

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

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

Antenna calibration
Sunol Sciences Inc., model JB3, serial number A022805, HL 2697

Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain
30	22.2	-22.5	0.01	620	19.7	6.3	4.27	1215	24.9	7.0	5.05	1810	28.3	7.1	5.08	2405	30.9	6.9	4.93
35	18.5	-17.4	0.02	625	19.7	6.5	4.42	1220	24.9	7.0	4.99	1815	28.5	6.9	4.91	2410	30.9	6.9	4.89
40	14.7	-12.5	0.06	630	19.6	6.6	4.57	1225	25.1	6.9	4.91	1820	28.6	6.8	4.74	2415	31.0	6.9	4.85
45	11.3	-8.1	0.16	635	19.7	6.5	4.48	1230	25.2	6.8	4.82	1825	28.7	6.8	4.75	2420	31.0	6.8	4.82
45	11.3	-8.1	0.16	640	19.9	6.4	4.40	1235	25.1	7.0	4.96	1830	28.7	6.8	4.76	2425	31.1	6.8	4.81
50	8.9	-4.7	0.34	645	19.9	6.5	4.45	1240	25.0	7.1	5.09	1835	28.7	6.7	4.72	2430	31.0	6.9	4.87
55	7.9	-2.8	0.52	650	19.9	6.5	4.51	1245	25.0	7.1	5.12	1840	28.8	6.7	4.69	2435	31.0	6.9	4.88
60	7.8	-2.1	0.62	655	19.9	6.6	4.60	1250	25.0	7.1	5.15	1845	28.6	6.9	4.90	2440	31.2	6.8	4.74
65	8.5	-2.0	0.63	660	19.9	6.7	4.69	1255	25.0	7.2	5.25	1850	28.4	7.1	5.12	2445	31.1	6.9	4.91
70	9.0	-1.9	0.64	665	19.9	6.7	4.70	1260	24.9	7.3	5.36	1855	28.5	7.0	5.07	2450	31.0	7.0	4.96
75	8.8	-1.1	0.78	670	20.0	6.7	4.71	1265	25.0	7.3	5.31	1860	28.6	7.0	5.01	2455	31.0	7.0	5.01
80	8.4	-0.2	0.97	675	20.1	6.7	4.71	1270	25.1	7.2	5.26	1865	28.5	7.1	5.17	2460	30.9	7.2	5.19
85	8.0	0.8	1.20	680	20.1	6.7	4.71	1275	25.3	7.0	5.05	1870	28.4	7.3	5.33	2465	31.1	6.9	4.95
90	8.2	1.1	1.29	685	20.1	6.8	4.79	1280	25.5	6.8	4.84	1875	28.4	7.2	5.28	2470	31.3	6.8	4.76
95	9.2	0.5	1.13	690	20.1	6.9	4.88	1285	25.4	7.0	4.97	1880	28.5	7.2	5.22	2475	31.4	6.7	4.69
100	10.6	-0.4	0.92	695	20.2	6.8	4.82	1290	25.3	7.1	5.10	1885	28.5	7.2	5.22	2480	31.3	6.8	4.79
110	12.6	-1.6	0.70	705	20.4	6.8	4.75	1300	25.2	7.3	5.33	1895	28.6	7.2	5.24	2490	31.1	7.0	4.99
120	13.9	-2.1	0.62	715	20.5	6.8	4.80	1310	25.5	7.1	5.09	1905	28.5	7.3	5.36	2500	30.9	7.2	5.27
125	14.2	-2.0	0.63	720	20.5	6.9	4.85	1315	25.4	7.2	5.23	1910	28.5	7.4	5.45	2505	31.1	7.1	5.15
130	14.2	-1.7	0.68	725	20.6	6.8	4.81	1320	25.3	7.3	5.36	1915	28.5	7.3	5.38	2510	31.0	7.2	5.22
140	13.4	-0.3	0.94	735	20.9	6.7	4.65	1330	25.6	7.0	5.06	1925	28.6	7.3	5.35	2520	31.2	7.0	5.05
150	12.9	0.8	1.21	745	21.0	6.6	4.59	1340	25.7	7.1	5.09	1935	28.5	7.4	5.54	2530	31.0	7.3	5.37
160	12.7	1.6	1.44	755	21.0	6.8	4.74	1350	25.7	7.1	5.17	1945	28.5	7.5	5.59	2540	31.2	7.1	5.09
165	12.5	2.0	1.59	760	21.0	6.8	4.83	1355	25.8	7.0	5.06	1950	28.6	7.4	5.48	2545	31.0	7.3	5.43
170	12.2	2.6	1.83	765	21.1	6.8	4.73	1360	25.9	6.9	4.95	1955	28.6	7.5	5.57	2550	31.0	7.3	5.39
175	11.8	3.3	2.13	770	21.3	6.7	4.64	1365	26.0	6.9	4.95	1960	28.6	7.5	5.65	2555	31.1	7.2	5.30
180	11.6	3.7	2.36	775	21.3	6.7	4.68	1370	26.0	7.0	4.96	1965	28.7	7.4	5.47	2560	31.0	7.4	5.47
185	11.5	4.0	2.54	780	21.3	6.7	4.72	1375	26.0	7.0	5.01	1970	28.9	7.2	5.29	2565	30.8	7.6	5.70
190	11.6	4.2	2.61	785	21.3	6.8	4.77	1380	26.0	7.0	5.06	1975	28.9	7.2	5.22	2570	31.1	7.3	5.37
200	13.1	3.2	2.07	795	21.4	6.8	4.79	1390	26.1	6.9	4.92	1985	29.1	7.1	5.11	2580	31.6	6.9	4.87
205	12.0	4.4	2.76	800	21.5	6.8	4.77	1395	26.2	6.9	4.94	1990	29.1	7.0	5.06	2585	31.6	6.8	4.79
210	11.0	5.6	3.66	805	21.6	6.7	4.71	1400	26.2	7.0	4.96	1995	29.1	7.1	5.09	2590	31.6	6.9	4.88
215	11.3	5.6	3.59	810	21.7	6.7	4.65	1405	26.1	7.0	5.02	2000	29.1	7.1	5.11	2595	31.5	7.0	4.97
220	11.6	5.5	3.52	815	21.7	6.7	4.72	1410	26.1	7.1	5.09	2005	29.1	7.1	5.16	2600	31.6	6.9	4.86
225	11.7	5.5	3.55	820	21.7	6.8	4.80	1415	26.2	7.0	5.02	2010	29.1	7.1	5.15	2605	31.3	7.2	5.30
230	11.9	5.5	3.57	825	21.7	6.8	4.82	1420	26.3	7.0	4.96	2015	29.2	7.1	5.13	2610	31.4	7.1	5.15
235	12.1	5.5	3.56	830	21.7	6.9	4.85	1425	26.2	7.1	5.10	2020	29.2	7.1	5.18	2615	31.7	6.9	4.88
240	12.3	5.5	3.54	835	21.8	6.8	4.82	1430	26.1	7.2	5.25	2025	29.3	7.1	5.08	2620	31.6	7.0	4.97
245	12.3	5.7	3.71	840	21.9	6.8	4.80	1435	26.1	7.2	5.24	2030	29.3	7.0	5.05	2625	31.4	7.1	5.17
250	12.3	5.9	3.88	845	21.9	6.8	4.83	1440	26.2	7.2	5.24	2035	29.3	7.1	5.07	2630	31.6	7.0	5.00
255	12.5	5.9	3.85	850	21.9	6.9	4.86	1445	26.3	1	5.11	2040	29.3	7.1	5.13	2635	31.8	6.8	4.82
260	12.7	5.8	3.83	855	22.0	6.8	4.80	1450	26.5	7.0	4.98	2045	29.2	7.2	5.23	2640	31.7	7.0	4.98
265	13.2	5.5	3.54	860	22.1	6.8	4.74	1455	26.4	7.1	5.07	2050	29.2	7.2	5.27	2645	31.7	6.9	4.93
270	13.7	5.2	3.27	865	22.0	6.9	4.92	1460	26.4	7.1	5.17	2055	29.3	7.2	5.21	2650	31.8	6.9	4.85
275	13.7	5.3	3.39	870	21.9	7.1	5.11	1465	26.4	7.2	5.19	2060	29.5	7.0	5.02	2655	31.8	6.9	4.85
280	13.7	5.4	3.50	875	22.0	7.1	5.08	1470	26.4	7.2	5.22	2065	29.4	7.1	5.08	2660	31.7	7.0	5.02
285	13.7	5.6	3.61	880	22.1	7.0	5.05	1475	26.4	7.1	5.17	2070	29.4	7.1	5.10	2665	32.0	6.7	4.71
290	13.7	5.7	3.72	885	22.1	7.0	5.06	1480	26.5	7.1	5.12	2075	29.5	7.0	5.01	2670	32.0	6.7	4.67
295	13.8	5.8	3.77	890	22.1	7.0	5.06	1485	26.5	7.1	5.14	2080	29.8	6.8	4.76	2675	31.9	6.8	4.81
300	13.9	5.8	3.81	895	22.2	7.1	5.09	1490	26.5	7.1	5.17	2085	29.7	6.9	4.89	2680	31.7	7.0	5.04
305	14.0	5.9	3.85	900	22.2	7.1	5.12	1495	26.5	7.2	5.24	2090	29.7	6.9	4.86	2685	31.9	6.8	4.83
310	14.1	5.9	3.88	905	22.3	7.1	5.09	1500	26.5	7.2	5.31	2095	29.8	6.8	4.78	2690	32.1	6.7	4.72
315	14.3	5.9	3.89	910	22.3	7.0	5.05	1505	26.5	7.2	5.27	2100	29.9	6.8	4.75	2695	32.1	6.7	4.71
320	14.4	5.9	3.90	915	22.4	7.0	4.99	1510	26.6	7.2	5.23	2105	29.8	6.8	4.81	2700	32.0	6.8	4.81
325	14.5	5.9	3.92	920	22.6	6.9	4.92	1515	26.6	7.2	5.30	2110	29.9	6.8	4.78	2705	32.0	6.8	4.80
330	14.6	5.9	3.93	925	22.7	6.9	4.85	1520	26.5	7.3	5.38	2115	29.9	6.8	4.76	2710	32.1	6.8	4.79
335	14.7	6.0	4.02	930	22.8	6.8	4.77	1525	26.6	7.3	5.37	2120	29.9	6.8	4.84	2715	32.1	6.7	4.71
340	14.7	6.2	4.12	935	22.8	6.8	4.83	1530	26.6	7.3	5.36	2125	29.9	6.9	4.89	2720	32.4	6.5	4.47
345	14.9	6.1	4.06	940	22.8	6.9	4.89	1535	26.6	7.4	5.44	2130	29.9	6.9	4.90	2725	32.2	6.7	4.63
350	15.1	6.0	3.99	945	22.8	6.9	4.87	1540	26.5	7.4	5.53	2135	29.8	6.9	4.94	2730	31.9	7.0	5.05
355	15.3	5.9	3.88	950	22.9	6.9	4.85	1545	26.5	7.5	5.58	2140	29.8	7.1	5.08	2735	31.6	7.4	5.44
360	15.6	5.8	3.78	955	23.0	6.8	4.81	1550	26.5	7.5	5.63	2145	29.9	6.9	4.92	2740	31.6	7.1	5.46
365	15.5	5.9	3.89	960	23.1	6.8	4.77	1555	26.7	7.3	5.39	2150	29.9	7.0	4.98	2745	31.9	7.0	5.06
370	15.5	6.0	4.01	965	23.1	6.7	4.73	1560	26.9	7.1	5.16	2155	29.8	7.1	5.10	2750	32.0	6.9	4.94
375	15.6	6.1	4.03	970	23.2	6.7	4.69	1565	26.9	7.2	5.23	2160	29.8	7.1	5.09	2755	32.0	7.0	4.98
380	15.7	6.1	4.05	975	23.3	6.6	4.62	1570	26.9	7.2	5.30	2165	29.9	7.0	5.00	2760	32.0	7.0	5.06
385	15.7	6.2	4.15	980	23.5	6.6	4.54	1575	27.0	7.2	5.23	2170	29.9	7.1	5.07	2765	32.2	6.8	4.80
390	15.7	6.3	4.25	985	23.5	6.6	4.52	1580	27.0	7.1	5.17	2175	29.8	7.2	5.20	2770	32.3	6.8	4.73
395	15.9	6.3	4.22	990	23.6	6.5	4.50	1585	27.0	7.2	5.20	2180	29.8	7.2	5.27	2775	32.3	6.8	4.77
400	16.0	6.2	4.18	995	23.6	6.5	4.48	1590	27.0	7.2	5.22	2185	29.8	7.2	5.27	2780	32.3	6.8	4.82
405	16.3	6.1	4.07	1000	23.7	6.5	4.46	1595	27.0	7.2	5.29	2190	29.8	7.2	5.28	2785	32.7	6.4	4.41
410	16.5	6.0	3.96	1005	23.7	6.5	4.51	1600	27.0	7.3	5.36	2195	29.8	7.2	5.30	2790	32.8	6.3	4.25
415	16.5	6.0	4.00	1010	23.7	6.6	4.57	1605	27.0	7.3	5.38	2200	29.7	7.3	5.38	2795	32.8	6.4	4.33
420	16.6	6.1	4.03	1015	23.7	6.6	4.55	1610	27.0	7.3	5.41	2205	29.7	7.3	5.41	2800	32.5	6.7	4.66
425	16.6	6.1	4.10	1020	23.8	6.6	4.54	1615	27.1	7.3	5.33	2210	29.7	7.4	5.47	2805	32.5	6.6	4.62
430	16.7	6.2	4.16	1025	23.8	6.6	4.62	1620	27.2	7.2	5.27	2215	29.7	7.4	5.54	2810	32.5	6.7	4.70
435	16.9	6.1	4.05	1030	23.7	6.7	4.70	1625	27.2	7.2	5.30	2220	29.7	7.5	5.57	2815	32.3	6.9	4.85
440	17.1	5.9	3.93	1035	23.7	6.8	4.81	1630	27.2	7.3	5.33	2225	29.8	7.3	5.43	2820	32.2	7.0	5.01
445	17.2	6.0	3.97	1040	23.6	6.9	4.92	1635	27.2	7.3	5.35	2230	29.8	7.4	5.45	2825	32.3	7.0	4.96
450	17.2	6.0	4.00	1045	23.7	6.9	4.91	1640	27.2	7.3	5.36	2235	29.7	7.5	5.61	2830	32.4	6.8	4.80
455	17.3	6.1	4.04	1050	23.7	6.9	4.91	1645	27.3	7.2	5.22	2240	29.5	7.7	5.86	2835	32.5	6.7	4.68
460	17.4	6.1	4.07	1055	23.7	7.0	5.01	1650	27.5	7.1	5.09	2245	29.8	7.4	5.53	2840	32.5	6.8	4.78
465	17.5	6.1	4.05	1060	23.6	7.1	5.11	1655	27.5	7.1	5.11	2250	30.0	7.3	5.35	2845	32.6	6.6	4.62
470	17.6	6.1	4.04	1065	23.7	7.0	5.06	1660	27.5	7.1	5.13	2255	30.0	7.2	5.28	2850	32.6	6.7	4.70
475	17.7	6.0	3.99	1070	23.8	7.0	5.01	1665	27.6	7.0	5.06	2260	30.1	7.2	5.24	2855	32.4	6.9	4.88
480	17.9	5.9	3.93	1075	23.8	7.0	5.01	1670	27.7	7.0	4.99	2265	30.1	7.2	5.20	2860	32.4	7.0	4.98
485	18.0	5.9	3.88	1080	23.9	7.0	5.01	1675	27.7	7.0	5.02	2270	30.2	7.1	5.12	2865	32.8	6.5	4.52
490	18.2	5.8	3.82	1085	24.0	7.0	4.96	1680	27.7	7.0	5.05	2275	30.3	7.0	5.05	2870	33.0	6.3	4.30
495	18.0	6.0	4.02	1090	24.0	6.9	4.91	1685	27.7	7.0	5.01	2280	30.0	7.0	5.06	2875	33.0	6.4	4.38
500	17.9	6.3	4.23	1095	24.1	6.9	4.86	1690	27.8	7.0	4.98	2285	30.3	7.0	5.05	2880	32.5	6.9	4.87
505	17.9	6.3	4.29	1100	24.2	6.8	4.82	1695	27.8	7.0	5.01	2290	30.3	7.1	5.07	2885	33.0	6.4	4.40
510	18.0	6.4	4.36	1105	24.3	6.8	4.80	1700	27.8	7.0	5.03	2295	30.3	7.1	5.13	2890	33.1	6.3	4.28
515	18.1	6.4	4.34	1110	24.3	6.8	4.78	1705	27.8	7.1	5.09	2300	30.2	7.2	5.23	2895	33.1	6.4	4.34
520	18.2	6.4	4.32	1115	24.3	6.8	4.79	1710	27.7	7.1	5.16	2305	30.3	7.2	5.20	2900	33.0	6.4	4.41
525	18.2	6.4	4.36	1120	24.4	6.8	4.80	1715	27.8	7.1	5.08	2310	30.2	7.3	5.35	2905	32.9	6.6	4.58
530	18.3	6.4	4.39	1125	24.3	6.9	4.90	1720	27.9	7.0	5.00	2315	30.1	7.4	5.45	2910	32.9	6.5	4.51
535	18.3	6.4	4.41	1130	24.3	7.0	5.00	1725	28.0	7.0	4.99	2320	30.3	7.2	5.27	2915	33.1	6.4	4.33
540	18.4	6.4	4.41	1135	24.4	6.9	4.90	1730	28.0	7.0	4.98	2325	304	7.2	5.22	2920	33.3	6.2	4.16
545	18.4	6.5	4.47	1140	24.5	6.8	4.81	1735	28.0	7.0	5.02	2330	30.4	7.1	5.13	2925	33.0	6.5	4.45
550	18.4	6.6	4.53	1145	24.6	6.8	4.76	1740	28.0	7.1	5.07	2335	30.5	7.0	5.07	2930	33.0	6.5	4.51
555	18.6	6.5	4.45	1150	24.7	6.7	4.71	1745	28.0	7.0	5.04	2340	30.5	7.1	5.11	2935	33.0	6.5	4.48
560	18.8	6.4	4.37	1155	24.7	6.8	4.76	1750	28.1	7.0	5.01	2345	30.6	7.0	5.07	2940	33.0	6.5	4.52
565	18.9	6.4	4.33	1160	24.7	6.8	4.80	1755	27.9	7.1	5.17	2350	30.5	7.1	5.12	2945	33.1	6.5	4.42
570	19.0	6.3	4.28	1165	24.7	6.8	4.81	1760	27.8	7.3	5.34	2355	30.6	7.1	5.08	2950	33.2	6.4	4.32
575	19.1	6.3	4.31	1170	24.7	6.8	4.81	1765	27.9	7.3	5.31	2360	30.9	6.8	4.79	2955	33.3	6.3	4.27
580	19.1	6.4	4.33	1175	24.8	6.8	4.84	1770	27.9	7.2	5.28	2365	31.0	6.7	4.66	2960	33.3	6.3	4.30
590	19.1	6.6	4.52	1185	24.8	6.9	4.92	1780	27.9	7.3	5.35	2375	31.1	6.6	4.60	2970	33.3	6.4	4.36
595	19.0	6.6	4.62	1190	24.7	7.0	4.99	1785	28.1	7.2	5.21	2380	31.1	6.6	4.61	2975	33.0	6.6	4.60
600	19.0	6.7	4.72	1195	24.7	7.0	5.02	1790	28.2	7.0	5.07	2385	31.1	6.7	4.62	2980	32.9	6.8	4.74
610	19.1	6.8	4.76	1205	24.08	7.1	5.08	1800	28.3	7.0	5.06	2395	31.2	6.6	4.60	2990	32.9	6.8	4.82
615	19.4	6.5	4.51	1210	24.8	7.1	5.11	1805	28.3	7.1	5.07	2400	30.9	6.9	4.93	3000	33.4	6.4	4.33

Antenna factor, HL 4933

COM-POWER CORPORATION

Active Horn Antenna Factor Calibration

1 GHz to 18 GHz

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

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

Calibration according to ARP 958

Antenna Factor to be added to receiver reading:

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

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

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

Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 1.5 m, SMA-SMA, S/N 1226/2A
HL 3903

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	-0.02	9500	1.84	21000	2.98
100	0.15	10000	1.86	22000	3.07
500	0.38	10500	1.93	23000	3.13
1000	0.56	11000	1.99	24000	3.21
1500	0.69	11500	2.04	25000	3.26
2000	0.82	12000	2.10	26000	3.48
2500	0.90	12500	2.15	27000	3.44
3000	0.98	13000	2.21	28000	3.53
3500	1.06	13500	2.25	29000	3.59
4000	1.11	14000	2.29	30000	3.66
4500	1.17	14500	2.34	31000	3.70
5000	1.24	15000	2.36	32000	3.79
5500	1.32	15500	2.40	33000	3.88
6000	1.40	16000	2.45	34000	3.94
6500	1.50	16500	2.48	35000	3.91
7000	1.56	17000	2.56	36000	4.05
7500	1.62	17500	2.58	37000	4.22
8000	1.68	18000	2.60	38000	4.25
8500	1.74	19000	2.84	39000	4.27
9000	1.78	20000	2.88	40000	4.33

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

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

Cable loss
Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA, Huber-Suhner, Sucoflex P103, HL 4293

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.20	4900	2.01	9800	2.94	14700	3.85
100	0.28	5000	2.03	9900	2.95	14800	3.87
200	0.39	5100	2.06	10000	2.98	14900	3.89
300	0.48	5200	2.08	10100	3.01	15000	3.94
400	0.55	5300	2.07	10200	3.04	15100	3.94
500	0.61	5400	2.12	10300	3.04	15200	3.91
600	0.68	5500	2.12	10400	3.04	15300	3.93
700	0.73	5600	2.16	10500	3.07	15400	3.94
800	0.78	5700	2.16	10600	3.10	15500	3.96
900	0.83	5800	2.22	10700	3.11	15600	3.96
1000	0.88	5900	2.24	10800	3.12	15700	3.97
1100	0.92	6000	2.28	10900	3.15	15800	4.00
1200	0.96	6100	2.31	11000	3.22	15900	4.01
1300	1.00	6200	2.32	11100	3.20	16000	4.03
1400	1.04	6300	2.34	11200	3.19	16100	4.02
1500	1.07	6400	2.37	11300	3.21	16200	4.05
1600	1.11	6500	2.38	11400	3.26	16300	4.06
1700	1.15	6600	2.38	11500	3.27	16400	4.08
1800	1.19	6700	2.40	11600	3.27	16500	4.07
1900	1.22	6800	2.42	11700	3.28	16600	4.10
2000	1.25	6900	2.43	11800	3.32	16700	4.14
2100	1.28	7000	2.44	11900	3.34	16800	4.12
2200	1.34	7100	2.48	12000	3.34	16900	4.13
2300	1.35	7200	2.46	12100	3.35	17000	4.13
2400	1.39	7300	2.51	12200	3.39	17100	4.19
2500	1.40	7400	2.53	12300	3.44	17200	4.22
2600	1.44	7500	2.50	12400	3.44	17300	4.20
2700	1.47	7600	2.53	12500	3.43	17400	4.21
2800	1.50	7700	2.63	12600	3.45	17500	4.19
2900	1.54	7800	2.62	12700	3.47	17600	4.22
3000	1.56	7900	2.58	12800	3.51	17700	4.24
3100	1.59	8000	2.64	12900	3.51	17800	4.23
3200	1.62	8100	2.66	13000	3.52	17900	4.26
3300	1.64	8200	2.67	13100	3.56	18000	4.27
3400	1.67	8300	2.63	13200	3.57		
3500	1.69	8400	2.64	13300	3.58		
3600	1.72	8500	2.65	13400	3.60		
3700	1.74	8600	2.68	13500	3.61		
3800	1.78	8700	2.72	13600	3.66		
3900	1.80	8800	2.73	13700	3.68		
4000	1.83	8900	2.74	13800	3.67		
4100	1.84	9000	2.77	13900	3.68		
4200	1.86	9100	2.79	14000	3.73		
4300	1.89	9200	2.82	14100	3.74		
4400	1.92	9300	2.81	14200	3.74		
4500	1.94	9400	2.85	14300	3.76		
4600	1.97	9500	2.89	14400	3.78		
4700	1.97	9600	2.90	14500	3.81		
4800	2.01	9700	2.92	14600	3.83		

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

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

14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
WB	wideband

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