

TEST REPORT

ACCORDING TO:

**FCC CFR 47 Part 15 subpart C, section 15.231 and subpart B, Class B;
RSS-210, Annex 1 and ICES-003, Class B**

FOR:

Essence Smartcare Ltd.

Voice panic Detector

Model: ES700VPD-MH

FCC ID: 2ARFP-ES700VPDMH

IC: 24417-ES700VPDMH

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested.
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1 Applicant information

Client name: Essence Smartcare Ltd.
Address: 12 Abba Eban Avenue, Ackerstein Towers Bldg. D, Herzliya 4612001, Israel
Telephone: +972 73 244 77 77
Fax: +972 9 772 99 62
E-mail: talco@essence-grp.com
Contact name: Mr. Tal Cohen

2 Equipment under test attributes

Product name: Voice panic Detector
Product type: Transceiver
Model: ES700VPD-MH
Serial number: NA (Sample)
Hardware version: 3.0
Software release: 3.01
Condition of equipment: Prototype
Receipt date: 01-Jul-18

3 Manufacturer information

Manufacturer name: Essence Smartcare Ltd.
Address: 12 Abba Eban Avenue, Ackerstein Towers Bldg. D, Herzliya 4612001, Israel
Telephone: +972 73 244 77 77
Fax: +972 9 772 99 62
E-Mail: talco@essence-grp.com
Contact name: Mr. Tal Cohen

4 Test details

Project ID: 31197
Location: Primary: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 01-Jul-18
Test completed: 22-Jul-18
Test specification: FCC CFR 47 Part 15 subpart C, section 15.231(a) and subpart B, Class B;
RSS-210, Annex 1 and ICES-003, Class B

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions	Pass
FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth	Pass
FCC Part 15, Section 203 / RSS-Gen, Section 7.4, Antenna requirements	Pass
Unintentional emissions	
Section 15.109 / ICES-003, Section 6.2, Radiated emission, Class B	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.

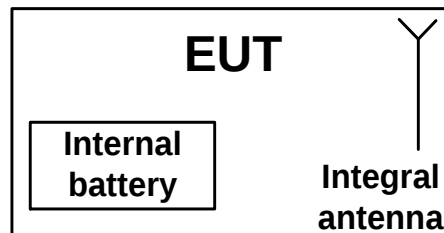
	Name and Title	Date	Signature
Tested by:	Mr. S. Samokha, test engineer	01-22 July, 2018	
Reviewed by:	Mrs. Y. Rapin, technical writer	02 August, 2018	
Approved by:	Mr. K. Zushchuk, projects and customer manager, EMC and radio group	14 October, 2018	

6 EUT description

6.1 General information

The EUT (model ES700VPD-MH) is battery powered Voice Panic Detector, operated at 433.92 MHz and provided for the testing in one configuration.

6.2 Test configuration



6.3 Changes made in EUT

No changes were implemented in the EUT during the testing.

6.4 Transmitter characteristics

Type of equipment					
X	Stand-alone (Equipment with or without its own control provisions)				
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
	Plug-in card (Equipment intended for a variety of host systems)				
Operating frequency		433.92 MHz			
Maximum rated output power		At transmitter 50 Ω RF output connector			
		Field strength at 3 m distance		84.75 dB(μ V/m) – peak 77.51 dB(μ V/m) -average	
Is transmitter output power variable?		X	No		
			Yes	continuous variable	
				stepped variable with stepsize	
				dB	
				dBm	
				dBm	
Antenna connection					
unique coupling		standard connector		X	integral
				X	without temporary RF connector
Antenna/s technical characteristics					
Type		Manufacturer		Model number	
Integral		Epsilon		FU-ES-700VPD	
				Gain	
				-5 dBi	
Transmitter aggregate data rate/s		1.2 kbps			
Type of modulation		OOK			
Transmitter power source					
X	Battery	Nominal rated voltage	3.0 VDC	Battery type	Alkaline
	DC	Nominal rated voltage	VDC		
	AC mains	Nominal rated voltage	VAC	Frequency	
Common power source for transmitter and receiver					
		X		yes	no

Test specification:	Field strength of emissions FCC CFR 47, Section 15.231(b); RSS-210, Section A1.1.2		
Test procedure:	ANSI C63.10, Section 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18 - 22-Jul-18		
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1009 hPa	Power: 3.0 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C requirements

7.1 Field strength of emissions

7.1.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.1.1 and Table 7.1.2.

Table 7.1.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)	
	Peak	Average
433.05 – 434.79	100.11	80.11

Table 7.1.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(μV/m)				
	Within restricted bands			Outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	80.11	60.11
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			
Above 1000	74.0	NA	54.0		

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

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

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

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

Note 1: The fundamental emission limit in dB(μV/m) was calculated as follows:

$$\text{Lim}_{AVR} = 20 \times \log(56.81818 \times F - 6136.3636) - \text{within } 130 - 174 \text{ MHz band};$$

$$\text{Lim}_{AVR} = 20 \times \log(41.6667 \times F - 7083.3333) - \text{within } 260 - 470 \text{ MHz band},$$

where F is the carrier frequency in MHz.

The limit for spurious emissions was 20 dB lower than fundamental emission limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

Note 2: The above 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.

Test specification:	Field strength of emissions FCC CFR 47, Section 15.231(b); RSS-210, Section A1.1.2		
Test procedure:	ANSI C63.10, Section 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18 - 22-Jul-18		
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1009 hPa	Power: 3.0 VDC
Remarks:			

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

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and the performance check was conducted.

7.1.2.2 The measurements were performed in two EUT typical positions.

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

7.1.2.4 The worst test results (the lowest margins) found in the EUT horizontal position were recorded in in Table 7.1.3, Table 7.1.5 and shown in the associated plots.

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

7.1.3.1 The EUT was set up as shown in Figure 7.1.2 / Figure 7.1.3, energized and the performance check was conducted.

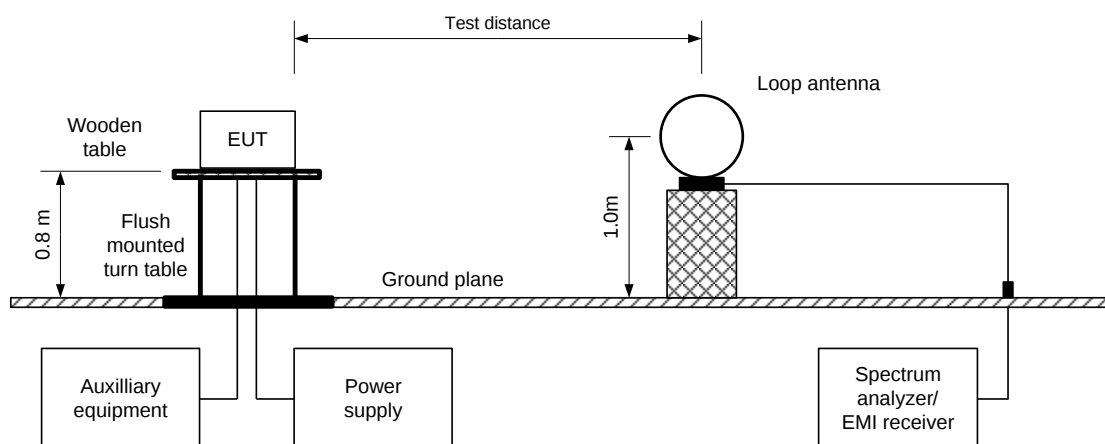
7.1.3.2 The measurements were performed in two EUT typical positions.

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

7.1.3.4 The worst test results (the lowest margins) found in the EUT vertical (X, Y, Z-axis) position were recorded in Table 7.1.3, Table 7.1.5 and shown in the associated plots.

7.1.3.5 Upon this the test was completed.

Figure 7.1.1 Setup for spurious emission field strength measurements below 30 MHz



Test specification:	Field strength of emissions FCC CFR 47, Section 15.231(b); RSS-210, Section A1.1.2		
Test procedure:	ANSI C63.10, Section 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18 - 22-Jul-18		
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1009 hPa	Power: 3.0 VDC
Remarks:			

Figure 7.1.2 Setup for spurious emission field strength measurements in 30 -1000 MHz

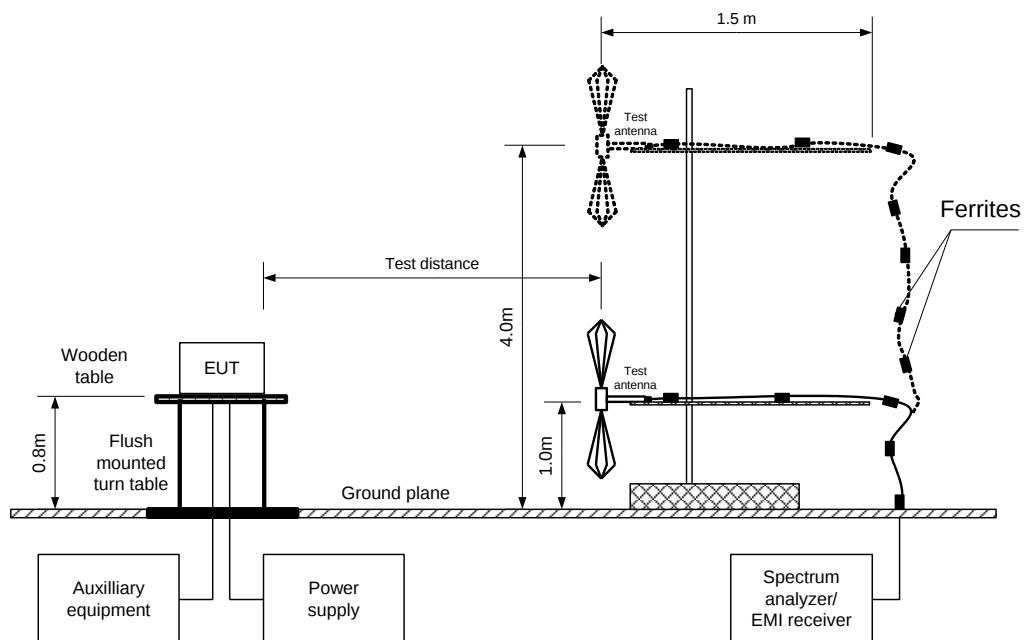
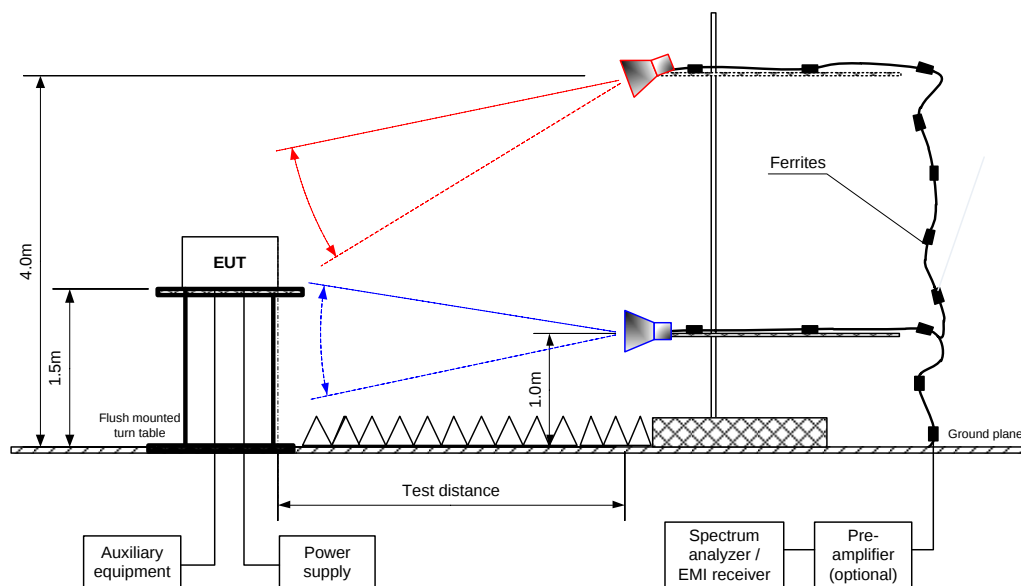


Figure 7.1.3 Setup for spurious emission field strength measurements above 1000 MHz



Test specification:	Field strength of emissions FCC CFR 47, Section 15.231(b); RSS-210, Section A1.1.2		
Test procedure:	ANSI C63.10, Section 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18 - 22-Jul-18		
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1009 hPa	Power: 3.0 VDC
Remarks:			

Table 7.1.3 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz

TEST DISTANCE:	3 m
EUT POSITION:	Typical with maximum emission (Horizontal)
MODULATION:	OOK
MODULATING SIGNAL:	ID code
BIT RATE:	1.2 kbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 4500 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	0.2 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz) 1.0 MHz (above 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Average field strength				Verdict
	Pol.	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**	
Fundamental emission***											
EUT Orientation Horizontal											
433.9330	H	1.92	32.0	84.75	100.11	-15.36	84.75	77.51	80.11	-2.60	Pass
EUT Orientation Vertical											
433.9330	H	1.92	32.0	82.33	100.11	-17.78	82.33	75.09	80.11	-5.02	Pass
Spurious emissions											
1301.700	H	1.00	70	58.99	74.0	-15.01	58.99	51.75	54.0	-2.25	Pass

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

**- Margin, dB = Measured (calculated) value, dB(μV/m) - Limit, dB(μV/m)

*** Max value was obtained in horizontal EUT position and at Unom (115%Unom, 85%Unom) input power voltage.

Table 7.1.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Number of bursts within 100 ms		
NA	NA	0.20	5	NA	-7.24
NA	NA	0.43	1	NA	
NA	NA	0.84	35	NA	
NA	NA	1.67	1	NA	
NA	NA	1.73	2	NA	
NA	NA	7.50	1	NA	

*- Average factor was calculated as follows

for pulse train shorter than 100 ms:

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

for pulse train longer than 100 ms:

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

Reference numbers of test equipment used

HL 0446	HL 3615	HL 4277	HL 4360	HL 4933	HL 5288		
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Full description is given in Appendix A.

Test specification:	Field strength of emissions FCC CFR 47, Section 15.231(b); RSS-210, Section A1.1.2			
Test procedure:	ANSI C63.10, Section 6.5, 6.6			
Test mode:	Compliance	Verdict:		PASS
Date(s):	01-Jul-18 - 22-Jul-18			
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1009 hPa	Power: 3.0 VDC	
Remarks:				

Table 7.1.5 Field strength of emissions below 1 GHz within restricted bands

TEST DISTANCE:	3 m
EUT POSITION:	Vertical and horizontal
MODULATION:	OOK
MODULATING SIGNAL:	ID code
BIT RATE:	1.2 kbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	0.2 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconical (30 MHz – 200 MHz) Log periodic (200 MHz – 1000 MHz) Biconilog (30 MHz – 1000 MHz)

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
867.816833	51.09	50.16	60.11	-9.95	H	1.00	127	Pass

*- Margin = Measured emission - specification limit.

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

Table 7.1.6 Restricted bands according to FCC 15, Section 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	12.290 - 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	16.420 - 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 7.1.7 Restricted bands according to RSS-Gen, Table 3

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 - 2.190	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	12.290 - 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 - 24.0
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

Reference numbers of test equipment used

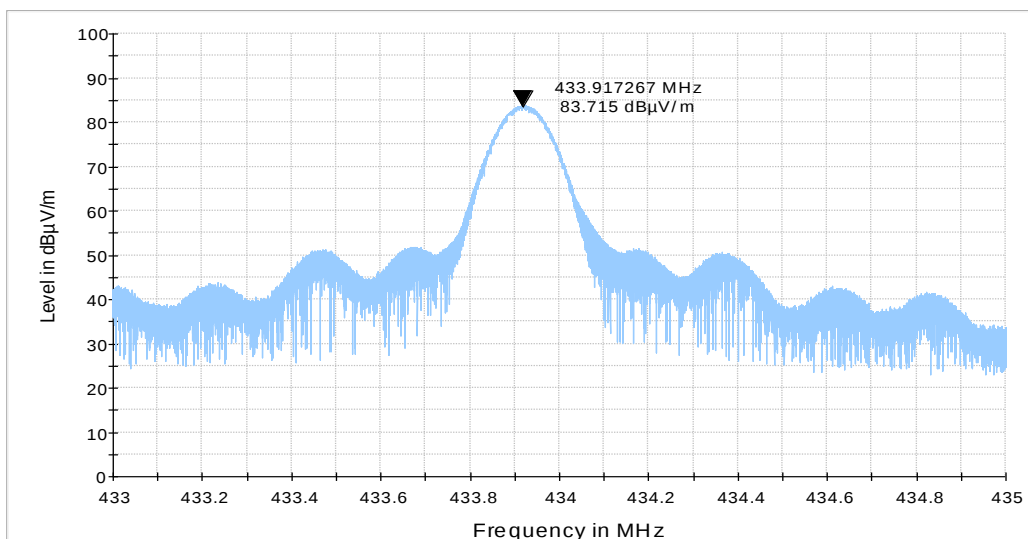
HL 0446	HL 3615	HL 4277	HL 4360	HL 4933	HL 5288		
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Full description is given in Appendix A.

Test specification:	Field strength of emissions FCC CFR 47, Section 15.231(b); RSS-210, Section A1.1.2		
Test procedure:	ANSI C63.10, Section 6.5, 6.6		
Test mode:	Compliance	Verdict: PASS	
Date(s):	01-Jul-18 - 22-Jul-18		
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1009 hPa	Power: 3.0 VDC
Remarks:			

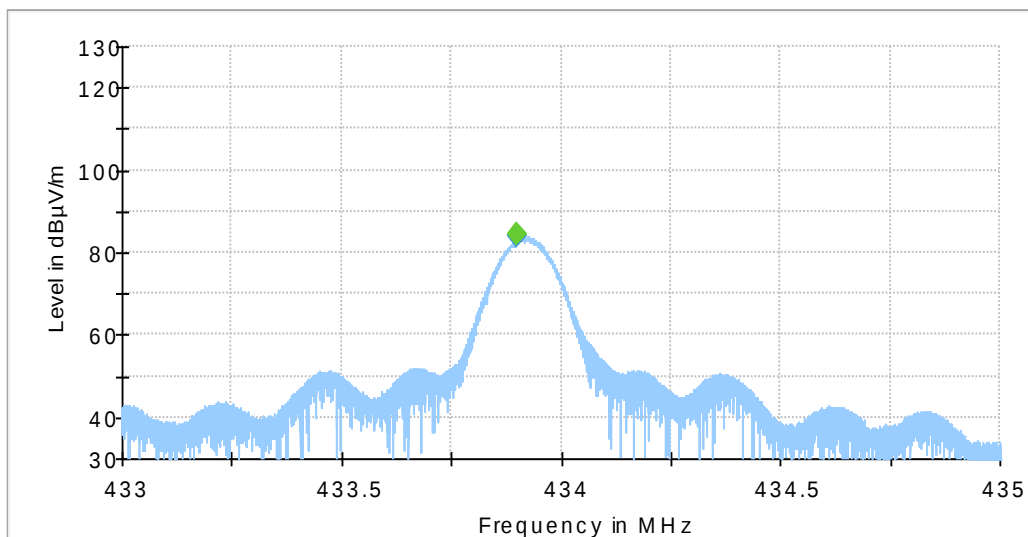
Plot 7.1.1 Radiated emission measurements at the fundamental frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Horizontal)



Plot 7.1.2 Radiated emission measurements at the fundamental frequency

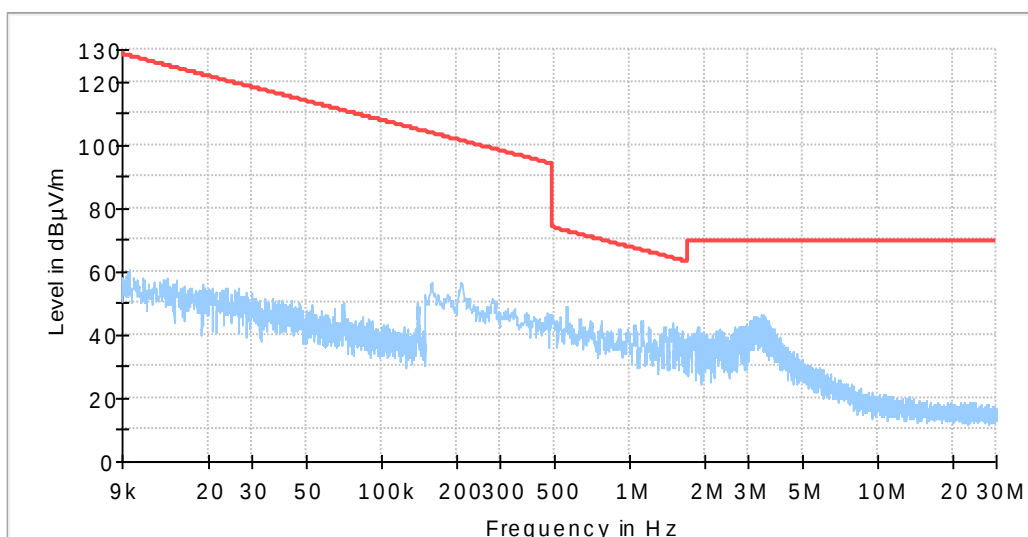
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Test specification:	Field strength of emissions FCC CFR 47, Section 15.231(b); RSS-210, Section A1.1.2		
Test procedure:	ANSI C63.10, Section 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18 - 22-Jul-18		
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1009 hPa	Power: 3.0 VDC
Remarks:			

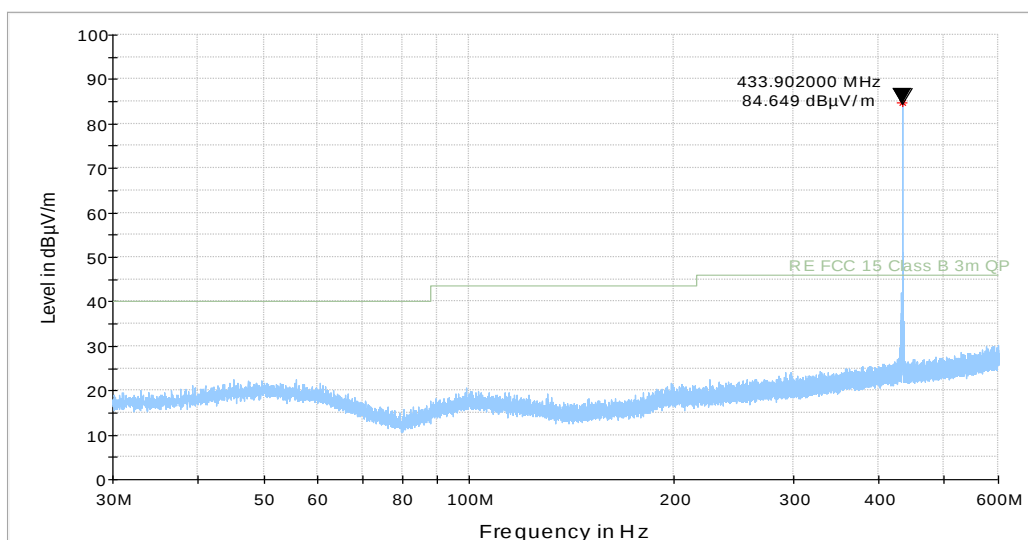
Plot 7.1.3 Radiated emission measurements from 0.009 to 30 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Horizontal)



Plot 7.1.4 Radiated emission measurements from 30 to 600 MHz

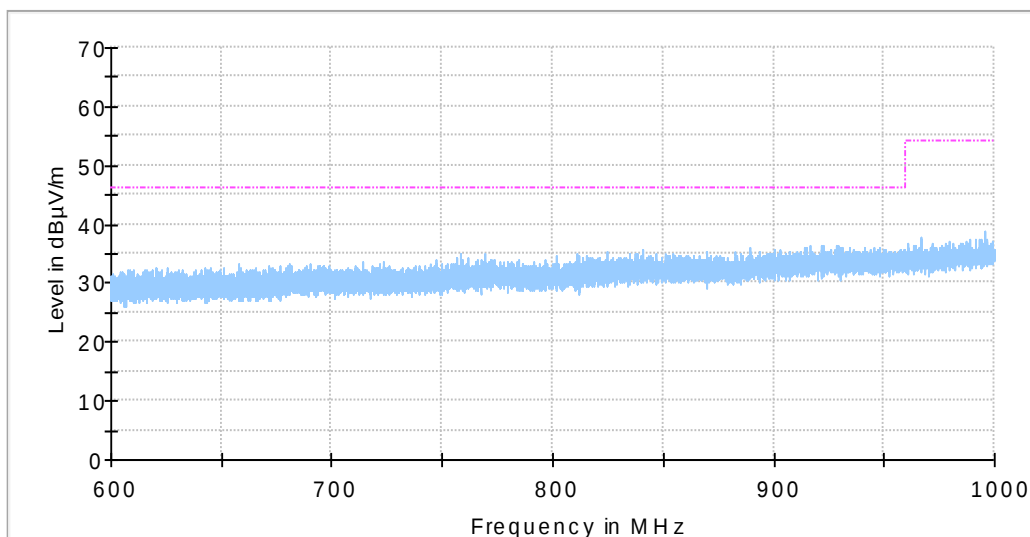
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Horizontal)



Test specification:	Field strength of emissions FCC CFR 47, Section 15.231(b); RSS-210, Section A1.1.2		
Test procedure:	ANSI C63.10, Section 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18 - 22-Jul-18		
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1009 hPa	Power: 3.0 VDC
Remarks:			

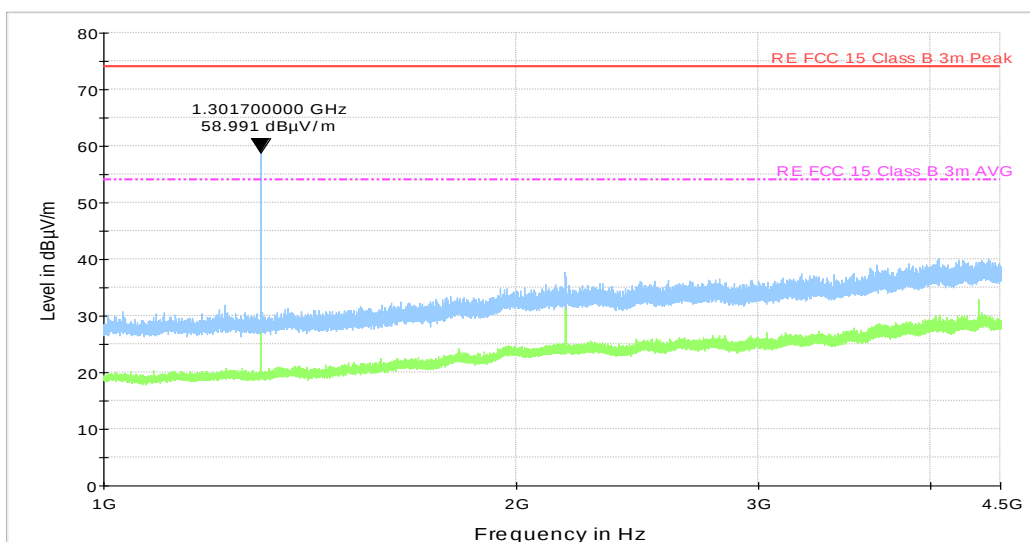
Plot 7.1.5 Radiated emission measurements from 600 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Horizontal)



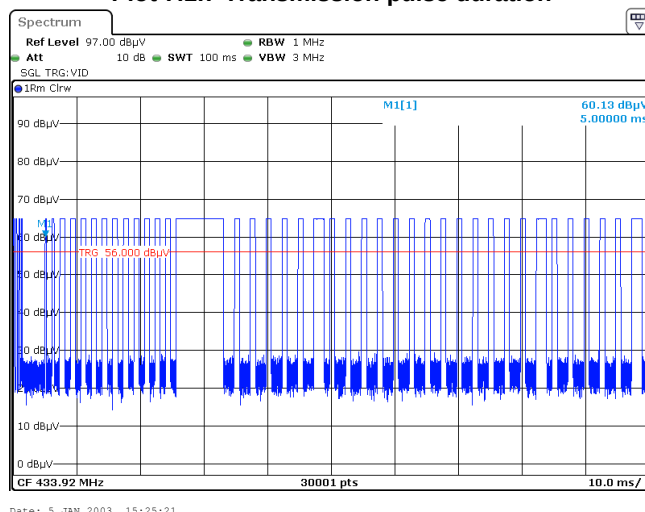
Plot 7.1.6 Radiated emission measurements from 1000 to 4500 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
EUT POSITION: Typical (Horizontal)

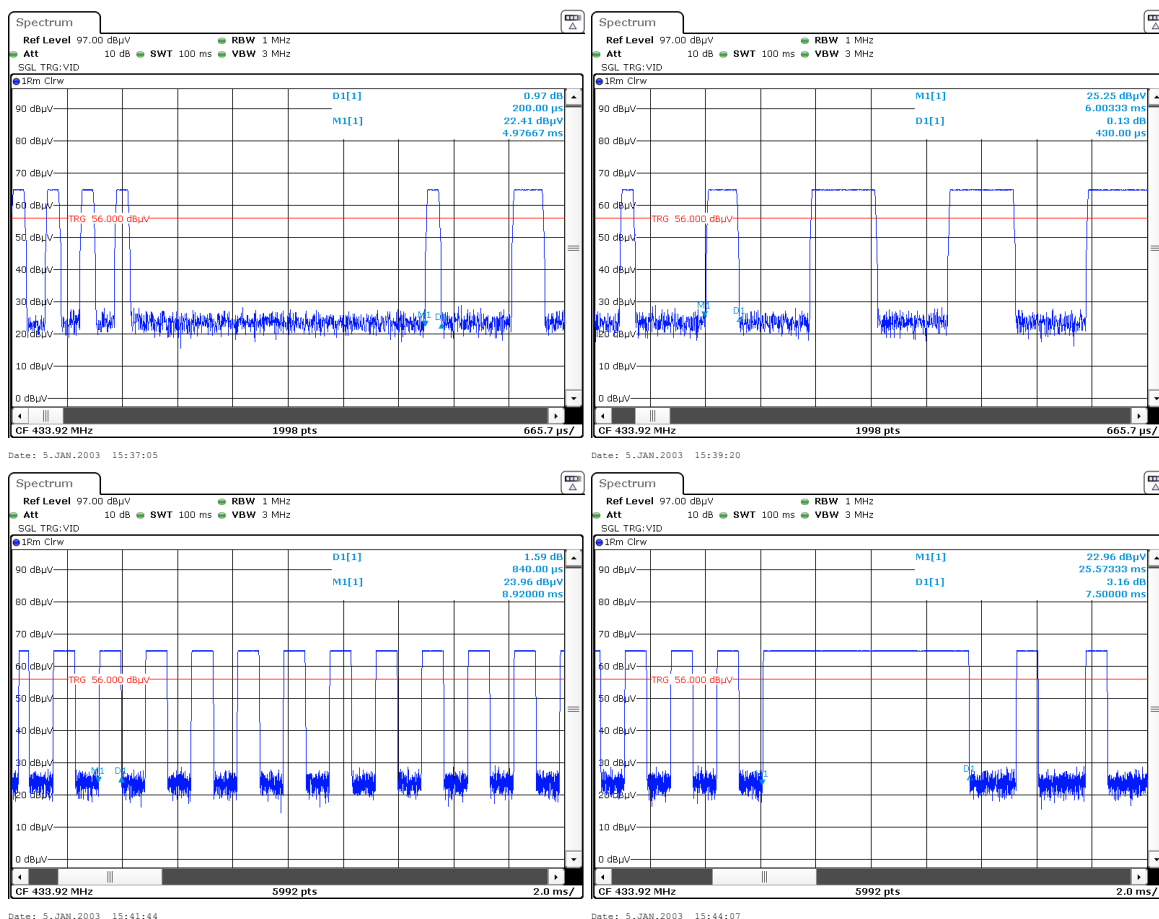


Test specification:	Field strength of emissions FCC CFR 47, Section 15.231(b); RSS-210, Section A1.1.2		
Test procedure:	ANSI C63.10, Section 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18 - 22-Jul-18		
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1009 hPa	Power: 3.0 VDC
Remarks:			

Plot 7.1.7 Transmission pulse duration

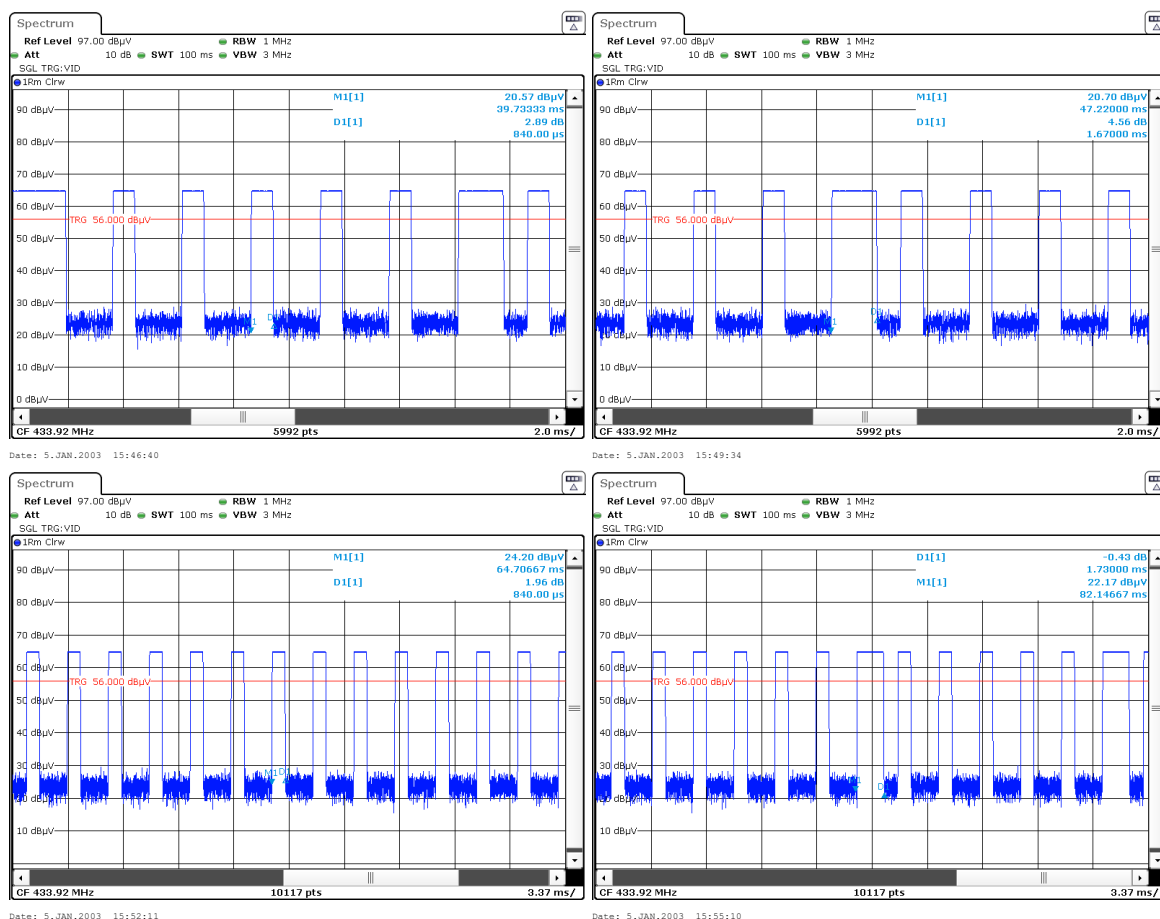


Plot 7.1.8 Transmission pulse period

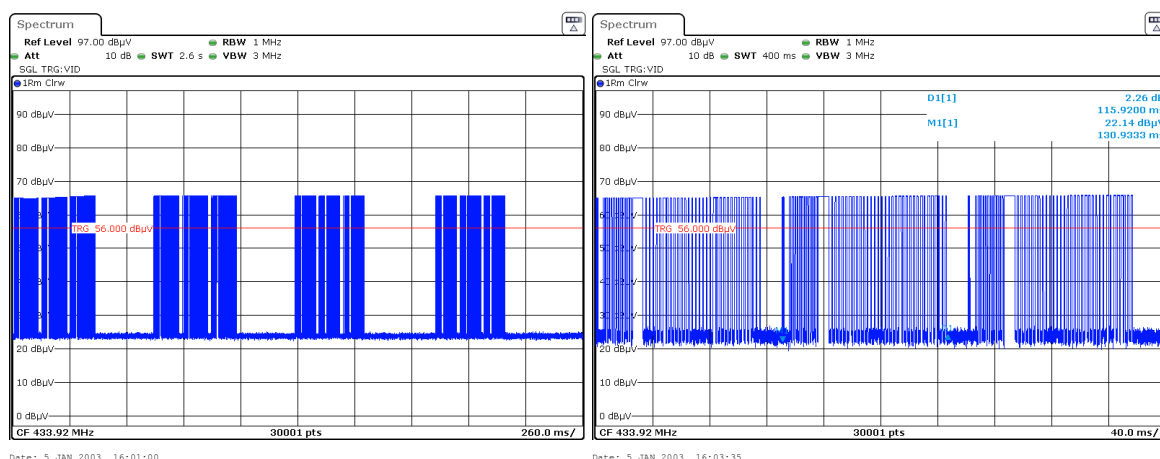


Test specification:	Field strength of emissions FCC CFR 47, Section 15.231(b); RSS-210, Section A1.1.2		
Test procedure:	ANSI C63.10, Section 6.5, 6.6		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18 - 22-Jul-18		
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1009 hPa	Power: 3.0 VDC
Remarks:			

Plot 7.1.9 Transmission pulse period



Plot 7.1.10 Transmission burst duration



Test specification:	Occupied bandwidth FCC CFR 47, Section 15.231(c); RSS-210, Section A1.1.3		
Test procedure:	ANSI C63.10, Section 6.9.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Jul-18		
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1012 hPa	Power: 3.0 VDC
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1. The test results are provided in Table 7.2.2 and associated plots.

Table 7.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, % of the carrier frequency
70 - 900	20.0	0.25
Above 900		0.50

*- Modulation envelope reference points provided in terms of attenuation below 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.

7.2.2.3 The transmitter occupied 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.

Figure 7.2.1 Occupied bandwidth test setup



Test specification:	Occupied bandwidth FCC CFR 47, Section 15.231(c); RSS-210, Section A1.1.3		
Test procedure:	ANSI C63.10, Section 6.9.2		
Test mode:	Compliance	Verdict: PASS	
Date(s):	02-Jul-18		
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1012 hPa	Power: 3.0 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 1 kHz
VIDEO BANDWIDTH: 10 kHz
MODULATION ENVELOPE REFERENCE POINTS: 20 dBc
MODULATION: OOK
MODULATING SIGNAL: PRBS
BIT RATE: 1.2 kbps

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
433.92	5.794	0.25	1084.800	1079.006	Pass

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 1 kHz
VIDEO BANDWIDTH: 10 kHz
MODULATION ENVELOPE REFERENCE POINTS: 99%
MODULATION: OOK
MODULATING SIGNAL: PRBS
BIT RATE: 1.2 kbps

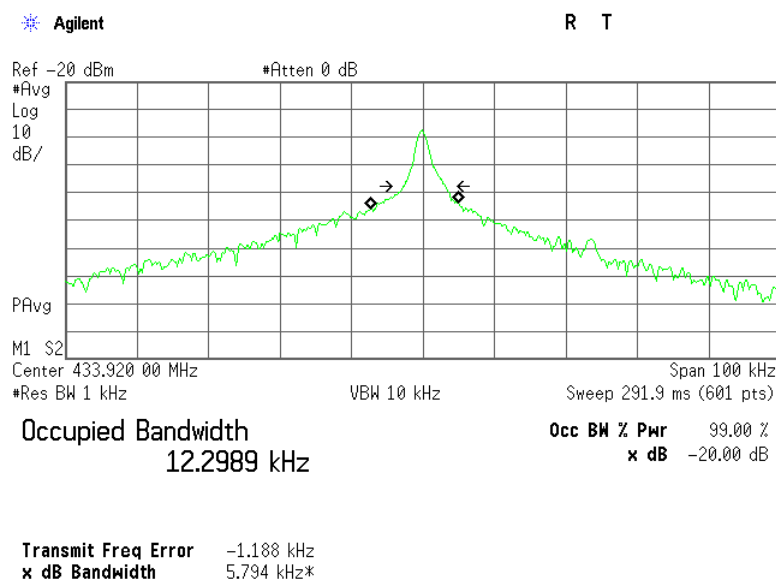
Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
433.92	12.290	0.25	1084.800	1072.510	Pass

Reference numbers of test equipment used

HL 3818	HL 3434							
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Full description is given in Appendix A.

Plot 7.3.1 Occupied bandwidth test results



Test specification:	Antenna requirement FCC CFR 47, Section 15.203; RSS-Gen, Section 7.4		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date(s):	02-Jun-18		
Temperature: 25 °C	Relative Humidity: 44 %	Air Pressure: 1012 hPa	Power: 3.0 VDC
Remarks:			

7.3 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 7.3.1.

Table 7.3.1 Antenna requirements

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

Photograph 7.3.1 Antenna assembly



Test specification:	Radiated emission, Class B FCC CFR 47, Section 15.109; ICES-003, Section 6.2		
Test procedure:	ANSI C63.4, Sections 8.3 and 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18		
Temperature: 24 °C	Relative Humidity: 49 %	Air Pressure: 1012 hPa	Power: 3.0 VDC
Remarks:			

8 Unintentional emissions according to 47CFR part 15 subpart B and ICES-003 requirements

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 8.1.1 Radiated emission test limits

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

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

8.1.2 Test procedure for measurements in semi-anechoic chamber

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

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

8.1.2.3 The EUT was tested with power supply options 1, 2, 3 and 4 as provided in Section 6.1 of this report.

8.1.2.4 The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

Test specification:	Radiated emission, Class B FCC CFR 47, Section 15.109; ICES-003, Section 6.2		
Test procedure:	ANSI C63.4, Sections 8.3 and 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18		
Temperature: 24 °C	Relative Humidity: 49 %	Air Pressure: 1012 hPa	Power: 3.0 VDC
Remarks:			

Figure 8.1.1 Setup for radiated emission measurements

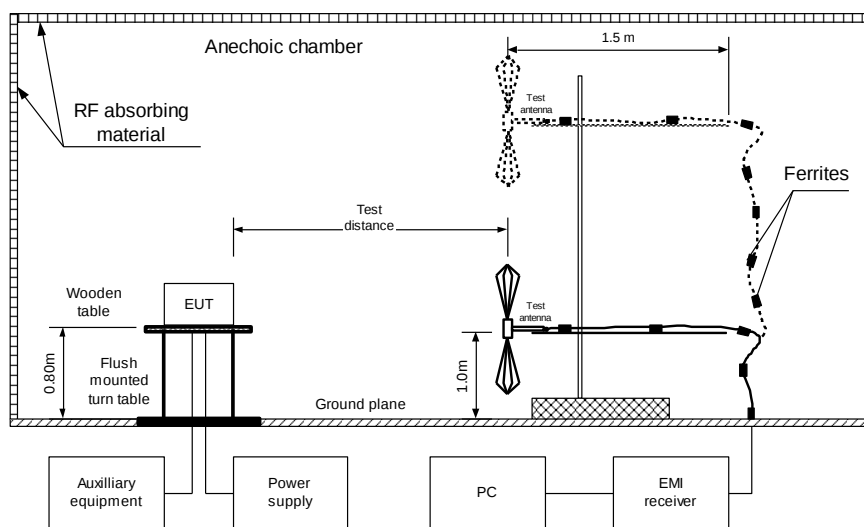
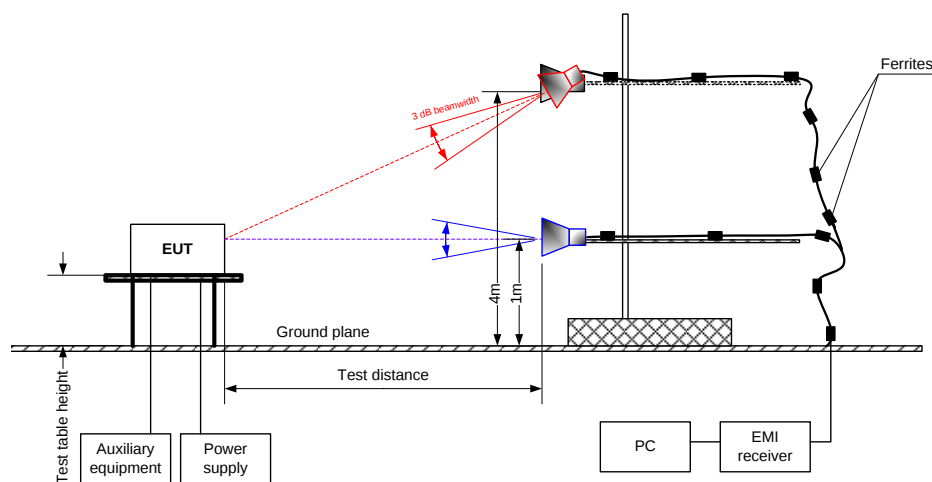
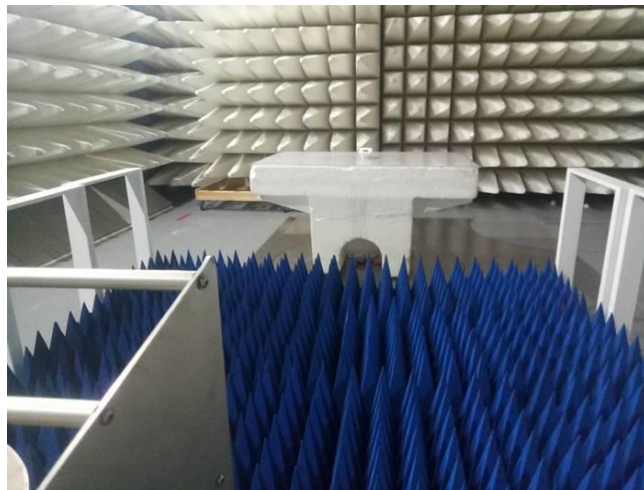
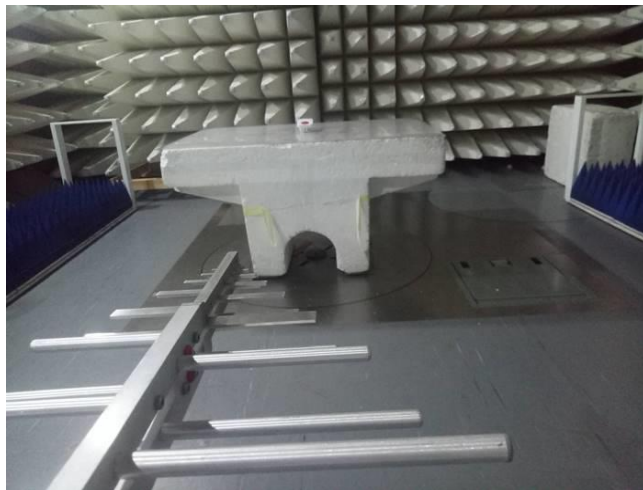


Figure 8.1.2 Setup for radiated emission measurements in 1000 – 2300 MHz range



Test specification:	Radiated emission, Class B FCC CFR 47, Section 15.109; ICES-003, Section 6.2		
Test procedure:	ANSI C63.4, Sections 8.3 and 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18		
Temperature: 24 °C	Relative Humidity: 49 %	Air Pressure: 1012 hPa	Power: 3.0 VDC
Remarks:			

Photograph 8.1.1 Setup for radiated emission measurements, general view



Photograph 8.1.2 Setup for radiated emission measurements, EUT cabling





Test specification:	Radiated emission, Class B FCC CFR 47, Section 15.109; ICES-003, Section 6.2		
Test procedure:	ANSI C63.4, Sections 8.3 and 12.2.5		
Test mode:	Compliance	Verdict: PASS	
Date(s):	01-Jul-18		
Temperature: 24 °C	Relative Humidity: 49 %	Air Pressure: 1012 hPa	Power: 3.0 VDC
Remarks:			

Table 8.1.2 Radiated emission test results

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

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

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 2300 MHz
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna tilt, degrees	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 emission peaks were found											Pass

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

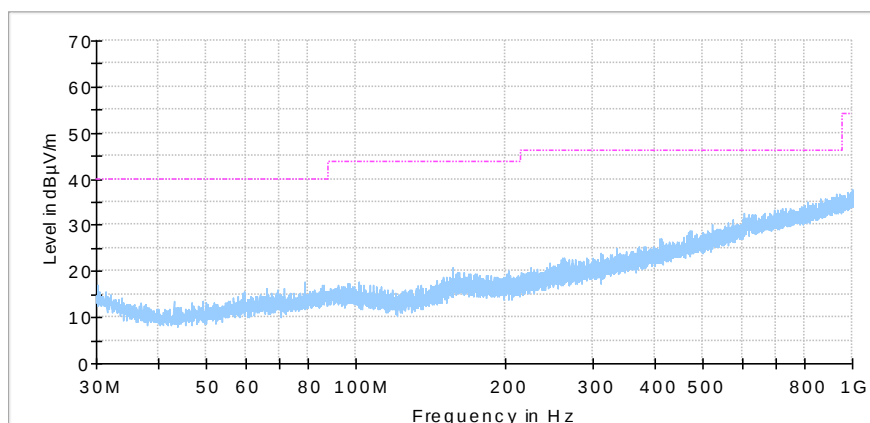
HL 3615	HL 4360	HL 4933	HL 4956	HL 5111	HL 5288		
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Full description is given in Appendix A.

Test specification:	Radiated emission, Class B FCC CFR 47, Section 15.109; ICES-003, Section 6.2		
Test procedure:	ANSI C63.4, Sections 8.3 and 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Jul-18		
Temperature: 24 °C	Relative Humidity: 49 %	Air Pressure: 1012 hPa	Power: 3.0 VDC
Remarks:			

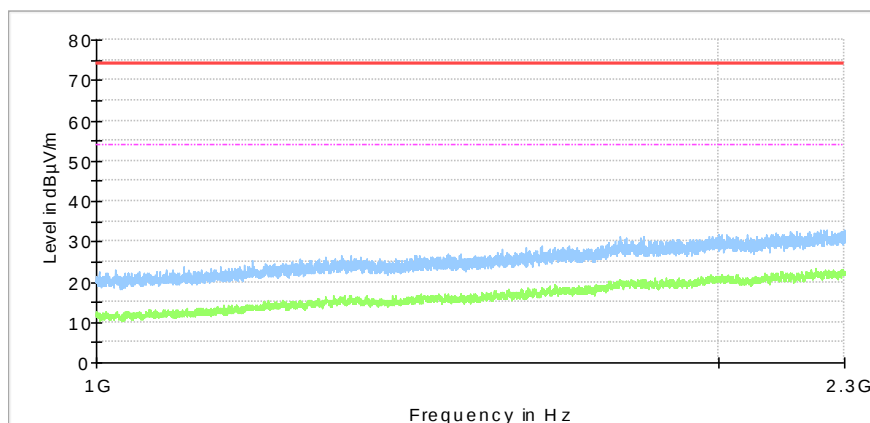
**Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range,
vertical and horizontal antenna polarization**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



**Plot 8.1.2 Radiated emission measurements above 1000 MHz,
vertical antenna polarization**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



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	11-Feb-18	11-Feb-19
3434	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25683	28-Mar-18	28-Mar-19
3615	Cable RF, 6.5 m, N type-N type, DC-6 GHz	Suhner Switzerland	RG 214/U	NA	10-Jun-18	10-Jun-19
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	28-May-18	28-May-19
4277	Test Cable , DC-18 GHz, 3.05 m, N/M - N/M	Mini-Circuits	APC-10FT-NMNM+	0748A	01-Aug-18	01-Aug-19
4360	EMI Test Receiver, 20 Hz to 40 GHz.	Rohde & Schwarz	ESU40	100322	26-Dec-17	26-Dec-18
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	04-Jan-18	04-Jan-19
4956	Active horn antenna, 18 to 40 GHz	COM-POWER CORPORATION	AHA-840	105004	11-Jan-18	11-Jan-19
5111	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/11SK/11SK/5500MM	502493/2EA	09-Apr-18	09-Apr-19
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	809	21-Jan-18	21-Jan-19

10 APPENDIX B Test equipment correction factors

HL 0446: Active Loop Antenna
EMCO, model: 6502, s/n 2857

Frequency,	Measured antenna factor, dBS/m	Measurement uncertainty, dB
10	-33.4	±1.0
20	-37.8	±1.0
50	-40.5	±1.0
75	-41.0	±1.0
100	-41.2	±1.0
150	-41.2	±1.0
250	-41.1	±1.0
500	-41.2	±1.0
750	-41.3	±1.0
1000	-41.3	±1.0

Frequency,	Measured antenna factor, dBS/m	Measurement uncertainty, dB
2000	-41.4	±1.0
3000	-41.4	±1.0
4000	-41.5	±1.0
5000	-41.5	±1.0
10000	-41.7	±1.0
15000	-42.1	±1.0
20000	-42.7	±1.0
25000	-44.2	±1.0
30000	-45.8	±1.0

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

HL 4933: Active Horn Antenna
COM-POWER CORPORATION, model: AHA-118, s/n 701046

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
1000	-16.1
1500	-15.1
2000	-10.9
2500	-11.9
3000	-11.1
3500	-10.6
4000	-8.6
4500	-8.3
5000	-5.9
5500	-5.7
6000	-3.3
6500	-4.0
7000	-2.2
7500	-1.7
8000	1.1
8500	-0.8
9000	-1.5
9500	-0.2

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
10000	1.8
10500	1.0
11000	0.3
11500	-0.5
12000	3.1
12500	1.4
13000	-0.3
13500	-0.4
14000	2.5
14500	2.2
15000	1.9
15500	0.5
16000	2.1
16500	1.2
17000	0.6
17500	3.1
18000	4.2

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

HL 4956: Active horn antenna
COM-POWER Corp., model: AHA-840, s/n 105004

Frequency, MHz	Measured antenna factor, dB/m
18000	5.1
18500	3.6
19000	2.2
19500	0.7
20000	0.7
20500	0.8
21000	0.5
21500	-1.3
22000	-2.1
22500	-2.0
23000	-1.6
23500	-2.9
24000	-2.3
24500	-2.6
25000	-1.8
25500	-1.2
26000	-0.5
26500	-1.2
27000	-0.1
27500	-1.0
28000	-0.7
28500	0.5

Frequency, MHz	Measured antenna factor, dB/m
29500	1.4
30000	2.9
30500	2.9
31000	2.9
31500	1.2
32000	0.7
32500	0.2
33000	-1.7
33500	-2.2
34000	2.3
34500	-1.1
35000	0.7
35500	-1.1
36000	0.1
36500	1.4
37000	3.7
37500	5.8
38000	6.6
38500	7.3
39000	6.5
39500	7.3
40000	7.1

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

HL 5288: Trilog Antenna
Frankonia, model: ALX-8000E, s/n: 00809

Frequency, MHz	Antenna factor, dB/m
30	14.96
35	15.33
40	16.37
45	17.56
50	17.95
60	16.87
70	13.22
80	10.56
90	13.61
100	15.46
120	14.03
140	12.23

Frequency, MHz	Antenna factor, dB/m
160	12.67
180	13.34
200	15.40
250	16.42
300	17.28
400	19.98
500	21.11
600	22.90
700	24.13
800	25.25
900	26.35
1000	27.18

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

HL 3615: Cable RF

Suhner Switzerland, model: RG 214/U, s/n: NA, HL 3615

Set / Applied, MHz	Measured, dB	Uncertainty, dB
50	0.31	+0.08 / -0.08
100	0.45	+0.08 / -0.08
200	0.66	+0.08 / -0.08
300	0.83	+0.09 / -0.09
400	0.98	+0.09 / -0.09
500	1.12	+0.09 / -0.09
600	1.26	+0.09 / -0.09
700	1.38	+0.09 / -0.09
800	1.50	+0.09 / -0.09
900	1.63	+0.09 / -0.09
1000	1.74	+0.09 / -0.09
1100	1.85	+0.09 / -0.09
1200	1.97	+0.09 / -0.09
1300	2.08	+0.09 / -0.09
1400	2.19	+0.09 / -0.09
1500	2.30	+0.09 / -0.09
1600	2.41	+0.09 / -0.09
1700	2.53	+0.09 / -0.09
1800	2.63	+0.09 / -0.09
1900	2.74	+0.09 / -0.09
2000	2.83	+0.09 / -0.09
2100	2.93	+0.11 / -0.11
2200	3.00	+0.11 / -0.11
2300	3.07	+0.11 / -0.11
2400	3.13	+0.11 / -0.11
2500	3.19	+0.15 / -0.15
2600	3.25	+0.15 / -0.15
2700	3.33	+0.15 / -0.15
2800	3.40	+0.15 / -0.15
2900	3.48	+0.15 / -0.15
3000	3.57	+0.15 / -0.15
3100	3.63	+0.17 / -0.17
3200	3.71	+0.17 / -0.17

Set / Applied, MHz	Measured, dB	Uncertainty, dB
3300	3.78	+0.17 / -0.17
3400	3.88	+0.17 / -0.17
3500	3.96	+0.17 / -0.17
3600	4.06	+0.17 / -0.17
3700	4.15	+0.17 / -0.17
3800	4.26	+0.17 / -0.17
3900	4.36	+0.17 / -0.17
4000	4.48	+0.17 / -0.17
4100	4.58	+0.22 / -0.23
4200	4.72	+0.22 / -0.23
4300	4.80	+0.22 / -0.23
4400	4.93	+0.22 / -0.23
4500	5.00	+0.22 / -0.23
4600	5.10	+0.22 / -0.23
4700	5.20	+0.22 / -0.23
4800	5.30	+0.22 / -0.23
4900	5.43	+0.22 / -0.23
5000	5.54	+0.22 / -0.23
5100	5.65	+0.22 / -0.23
5200	5.73	+0.22 / -0.23
5300	5.86	+0.22 / -0.23
5400	5.95	+0.22 / -0.23
5500	6.05	+0.22 / -0.23
5600	6.16	+0.22 / -0.23
5700	6.28	+0.22 / -0.23
5800	6.38	+0.22 / -0.23
5900	6.53	+0.22 / -0.23
6000	6.63	+0.22 / -0.23
6100	6.75	+0.22 / -0.23
6200	6.82	+0.22 / -0.23
6300	6.93	+0.22 / -0.23
6400	7.00	+0.22 / -0.23
6500	7.05	+0.22 / -0.23

HL 4277: Test Cable

Mini-Circuits, model: APC-10FT-NMNM+, s/n 0748A

Set / Applied, MHz	Measured, dB	Uncertainty, dB
0.1	0.26	+0.07 / -0.07
50	0.27	+0.07 / -0.07
100	0.38	+0.07 / -0.07
200	0.55	+0.07 / -0.07
300	0.69	+0.08 / -0.09
400	0.80	+0.08 / -0.09
500	0.91	+0.08 / -0.09
600	1.00	+0.08 / -0.09
700	1.08	+0.08 / -0.09
800	1.17	+0.08 / -0.09
900	1.24	+0.08 / -0.09
1000	1.32	+0.08 / -0.09
1100	1.39	+0.12 / -0.13
1200	1.45	+0.12 / -0.13
1300	1.52	+0.12 / -0.13
1400	1.58	+0.12 / -0.13
1500	1.65	+0.12 / -0.13
1600	1.71	+0.12 / -0.13
1700	1.77	+0.12 / -0.13
1800	1.82	+0.12 / -0.13
1900	1.88	+0.12 / -0.13
2000	1.93	+0.12 / -0.13
2100	1.99	+0.12 / -0.13
2200	2.05	+0.12 / -0.13
2300	2.10	+0.12 / -0.13
2400	2.15	+0.12 / -0.13
2500	2.20	+0.17 / -0.18
2600	2.25	+0.17 / -0.18
2700	2.30	+0.17 / -0.18
2800	2.35	+0.17 / -0.18
2900	2.40	+0.17 / -0.18
3000	2.44	+0.17 / -0.18
3100	2.49	+0.19 / -0.2
3200	2.54	+0.19 / -0.2
3300	2.58	+0.19 / -0.2
3400	2.62	+0.19 / -0.2
3500	2.66	+0.19 / -0.2
3600	2.71	+0.19 / -0.2
3700	2.75	+0.19 / -0.2
3800	2.79	+0.19 / -0.2
3900	2.84	+0.19 / -0.2
4000	2.88	+0.19 / -0.2

Set / Applied, MHz	Measured, dB	Uncertainty, dB
4100	2.84	+0.19 / -0.2
4200	2.88	+0.19 / -0.2
4300	2.92	+0.3 / -0.33
4400	2.96	+0.3 / -0.33
4500	3.01	+0.3 / -0.33
4600	3.05	+0.3 / -0.33
4700	3.09	+0.3 / -0.33
4800	3.13	+0.3 / -0.33
4900	3.18	+0.3 / -0.33
5000	3.21	+0.3 / -0.33
5100	3.25	+0.3 / -0.33
5200	3.30	+0.3 / -0.33
5300	3.34	+0.3 / -0.33
5400	3.39	+0.3 / -0.33
5500	3.44	+0.3 / -0.33
5600	3.48	+0.3 / -0.33
5700	3.53	+0.3 / -0.33
5800	3.57	+0.3 / -0.33
5900	3.60	+0.3 / -0.33
6000	3.65	+0.3 / -0.33
6100	3.68	+0.3 / -0.33
6200	3.72	+0.3 / -0.33
6300	3.77	+0.3 / -0.33
6400	3.83	+0.3 / -0.33
6500	3.86	+0.3 / -0.33
6600	3.92	+0.3 / -0.33
6700	3.96	+0.3 / -0.33
6800	4.00	+0.3 / -0.33
6900	4.04	+0.3 / -0.33
7000	4.08	+0.3 / -0.33
7100	4.11	+0.3 / -0.33
7200	4.16	+0.3 / -0.33
7300	4.20	+0.3 / -0.33
7400	4.24	+0.3 / -0.33
7500	4.29	+0.3 / -0.33
7600	4.33	+0.3 / -0.33
7700	4.38	+0.3 / -0.33
7800	4.42	+0.3 / -0.33
7900	4.51	+0.3 / -0.33
8000	4.52	+0.3 / -0.33
8100	4.55	+0.34 / -0.36
8200	4.55	+0.34 / -0.36

HL 4277: Test Cable

Set / Applied, MHz	Measured, dB	Uncertainty, dB
8300	4.57	+0.34 / -0.36
8400	4.60	+0.34 / -0.36
8500	4.60	+0.34 / -0.36
8600	4.63	+0.34 / -0.36
8700	4.63	+0.34 / -0.36
8800	4.64	+0.34 / -0.36
8900	4.65	+0.34 / -0.36
9000	4.67	+0.34 / -0.36
9100	4.69	+0.34 / -0.36
9200	4.71	+0.34 / -0.36
9300	4.73	+0.34 / -0.36
9400	4.76	+0.34 / -0.36
9500	4.78	+0.34 / -0.36
9600	4.81	+0.34 / -0.36
9700	4.85	+0.34 / -0.36
9800	4.87	+0.34 / -0.36
9900	4.89	+0.34 / -0.36
10000	4.93	+0.34 / -0.36
10100	4.96	+0.4 / -0.44
10200	4.99	+0.4 / -0.44
10300	5.02	+0.4 / -0.44
10400	5.05	+0.4 / -0.44
10500	5.08	+0.4 / -0.44
10600	5.11	+0.4 / -0.44
10700	5.14	+0.4 / -0.44
10800	5.17	+0.4 / -0.44
10900	5.19	+0.4 / -0.44
11000	5.22	+0.4 / -0.44
11100	5.25	+0.4 / -0.44
11200	5.28	+0.4 / -0.44
11300	5.31	+0.4 / -0.44
11400	5.34	+0.4 / -0.44
11500	5.38	+0.4 / -0.44
11600	5.41	+0.4 / -0.44
11700	5.45	+0.4 / -0.44
11800	5.49	+0.4 / -0.44
11900	5.53	+0.4 / -0.44
12000	5.56	+0.4 / -0.44
12100	5.60	+0.4 / -0.44
12200	5.63	+0.4 / -0.44
12300	5.68	+0.4 / -0.44
12400	5.72	+0.4 / -0.44
12500	5.75	+0.47 / -0.52
12600	5.80	+0.47 / -0.52
12700	5.84	+0.47 / -0.52
12800	5.93	+0.47 / -0.52
12900	5.94	+0.47 / -0.52
13000	5.98	+0.47 / -0.52
13100	6.03	+0.47 / -0.52

Set / Applied, MHz	Measured, dB	Uncertainty, dB
13200	6.09	+0.47 / -0.52
13300	6.17	+0.47 / -0.52
13400	6.27	+0.47 / -0.52
13500	6.37	+0.47 / -0.52
13600	6.49	+0.47 / -0.52
13700	6.57	+0.47 / -0.52
13800	6.60	+0.47 / -0.52
13900	6.61	+0.47 / -0.52
14000	6.59	+0.47 / -0.52
14100	6.57	+0.47 / -0.52
14200	6.54	+0.47 / -0.52
14300	6.53	+0.47 / -0.52
14400	6.49	+0.47 / -0.52
14500	6.48	+0.47 / -0.52
14600	6.46	+0.47 / -0.52
14700	6.46	+0.47 / -0.52
14800	6.49	+0.47 / -0.52
14900	6.51	+0.47 / -0.52
15000	6.54	+0.47 / -0.52
15100	6.57	+0.47 / -0.52
15200	6.62	+0.47 / -0.52
15300	6.64	+0.47 / -0.52
15400	6.68	+0.47 / -0.52
15500	6.71	+0.47 / -0.52
15600	6.78	+0.47 / -0.52
15700	6.79	+0.47 / -0.52
15800	6.82	+0.47 / -0.52
15900	6.88	+0.47 / -0.52
16000	6.89	+0.47 / -0.52
16100	6.96	+0.47 / -0.52
16200	6.97	+0.47 / -0.52
16300	7.02	+0.47 / -0.52
16400	7.07	+0.47 / -0.52
16500	7.12	+0.47 / -0.52
16600	7.17	+0.47 / -0.52
16700	7.20	+0.47 / -0.52
16800	7.22	+0.47 / -0.52
16900	7.23	+0.47 / -0.52
17000	7.24	+0.47 / -0.52
17100	7.27	+0.47 / -0.52
17200	7.28	+0.47 / -0.52
17300	7.28	+0.47 / -0.52
17400	7.30	+0.47 / -0.52
17500	7.34	+0.47 / -0.52
17600	7.35	+0.47 / -0.52
17700	7.39	+0.47 / -0.52
17800	7.41	+0.47 / -0.52
17900	7.41	+0.47 / -0.52
18000	7.44	+0.47 / -0.52

HL 5111: RF cable

Huber-Suhner, SF102EA/11SK/11SK/5500MM, s/n 502493/2EA

Set / Applied, MHz	Measured, dB	Uncertainty, dB
100	0.70	±0.07
200	0.99	±0.08
300	1.21	±0.08
500	1.56	±0.08
1000	2.20	±0.08
1500	2.69	±0.08
2000	3.11	±0.08
2500	3.50	±0.10
3000	3.85	±0.10
3500	4.16	±0.10
4000	4.47	±0.10
4500	4.74	±0.10
5000	5.03	±0.10
5500	5.30	±0.10
6000	5.57	±0.10
6500	5.76	±0.10
7000	6.00	±0.10
7500	6.20	±0.10
8000	6.44	±0.10
8500	6.67	±0.10
9000	6.82	±0.10
9500	7.04	±0.10
10000	7.18	±0.10
10500	7.36	±0.10
11000	7.55	±0.10
11500	7.75	±0.10
12000	7.90	±0.10
12500	8.08	±0.13
13000	8.19	±0.13
13500	8.39	±0.13
14000	8.58	±0.13
14500	8.76	±0.18
15000	8.92	±0.18
15500	9.03	±0.18
16000	9.18	±0.18
16500	9.34	±0.18
17000	9.51	±0.18
17500	9.66	±0.18
18000	9.80	±0.18
18500	9.94	±0.23
19000	10.05	±0.23
19500	10.22	±0.23

Set / Applied, MHz	Measured, dB	Uncertainty, dB
20000	10.32	±0.23
20500	10.48	±0.23
21000	10.60	±0.23
21500	10.73	±0.23
22000	10.87	±0.23
22500	10.97	±0.29
23000	11.09	±0.29
23500	11.26	±0.29
24000	11.37	±0.29
24500	11.50	±0.29
25000	11.61	±0.23
25500	11.72	±0.23
26000	11.87	±0.23
26500	11.99	±0.23
27000	12.09	±0.33
27500	12.24	±0.33
28000	12.34	±0.40
28500	12.47	±0.40
29000	12.61	±0.40
29500	12.70	±0.40
30000	12.86	±0.40
30500	12.92	±0.33
31000	13.09	±0.33
31500	13.16	±0.33
32000	13.33	±0.33
32500	13.40	±0.33
33000	13.62	±0.33
33500	13.70	±0.33
34000	13.88	±0.33
34500	13.97	±0.40
35000	14.05	±0.40
35500	14.23	±0.40
36000	14.25	±0.40
36500	14.46	±0.40
37000	14.49	±0.33
37500	14.72	±0.33
38000	14.77	±0.33
38500	14.97	±0.33
39000	15.04	±0.33
39500	15.22	±0.33
40000	15.63	±0.47

11 APPENDIX C Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 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
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
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Occupied bandwidth	± 8.0 %

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.

12 APPENDIX D Specification references

FCC 47CFR part 15: 2017	Radio Frequency Devices.
RSS-Gen Issue 5, April 2018	General Requirements and Information for the certification of Radiocommunication Equipment
RSS-210 Issue 9, August 2016	Licence-Exempt Radio Apparatus: Category I Equipment
ANSI C63.2: 2016	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.
ANSI C63.10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
CAN/CSA-CEI/IEC CISPR 22: 2002	Information Technology Equipment- Radio Disturbance Characteristics- Limits and Methods of measurement

13 APPENDIX E Abbreviations and acronyms

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

END OF DOCUMENT