Test specification:	**Section 15.247(e) / RSS-247 section 5.2(2), Peak spectral power density**		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Jun-20		
Temperature: 25.3 ºC	**Relative Humidity:** 38 %	**Air Pressure:** 1024 hPa	**Power:** 28 VDC
Remarks:			

Table 7.5.2 Peak spectral power density test results

ASSIGNED FREQUENCY: 2400-2483.5 MHz
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 3 kHz
VIDEO BANDWIDTH: 10 kHz

CHANNEL BANDWIDTH: 5 MHz

Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	Cable loss, dB	Peak power density, dBm	Limit, dBm	Margin*, dB	Verdict
Modulation QPSK							
2410.3	5.74	Included	Included	5.74	8.0	-2.27	Pass
2420.3	6.46	Included	Included	6.46	8.0	-1.55	Pass
2435.3	5.65	Included	Included	5.65	8.0	-2.35	Pass
Modulation 16QAM							
2410.3	6.03	Included	Included	6.03	8.0	-1.97	Pass
2420.3	5.92	Included	Included	5.92	8.0	-2.08	Pass
2435.3	4.85	Included	Included	4.85	8.0	-3.15	Pass

RESOLUTION BANDWIDTH: 10 kHz
VIDEO BANDWIDTH: 30 kHz
CHANNEL BANDWIDTH: 10 MHz

Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	Cable loss, dB	Peak power density, dBm	Limit, dBm	Margin*, dB	Verdict
Modulation QPSK							
2412.8	6.90	Included	Included	6.90	8.0	-1.10	Pass
2422.8	6.99	Included	Included	6.99	8.0	-1.01	Pass
2432.8	6.50	Included	Included	6.50	8.0	-1.50	Pass
Modulation 16QAM							
2412.8	6.99	Included	Included	6.99	8.0	-1.01	Pass
2422.8	7.19	Included	Included	7.19	8.0	-0.81	Pass
2432.8	6.88	Included	Included	6.88	8.0	-1.12	Pass

* - Margin = Total PSD – specification limit.

Reference numbers of test equipment used

HL 1809	HL 2909	HL 3901	HL 4366				

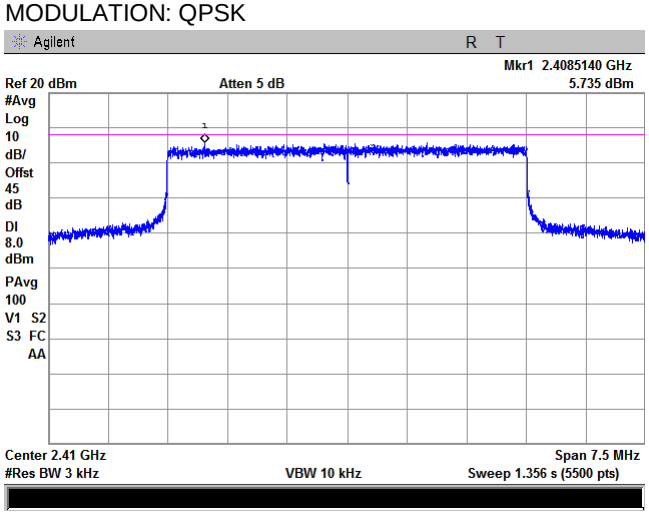
Full description is given in Appendix A.

Test specification:	**Section 15.247(e) / RSS-247 section 5.2(2), Peak spectral power density**		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Jun-20		
Temperature: 25.3 ºC	**Relative Humidity:** 38 %	**Air Pressure:** 1024 hPa	**Power:** 28 VDC
Remarks:			

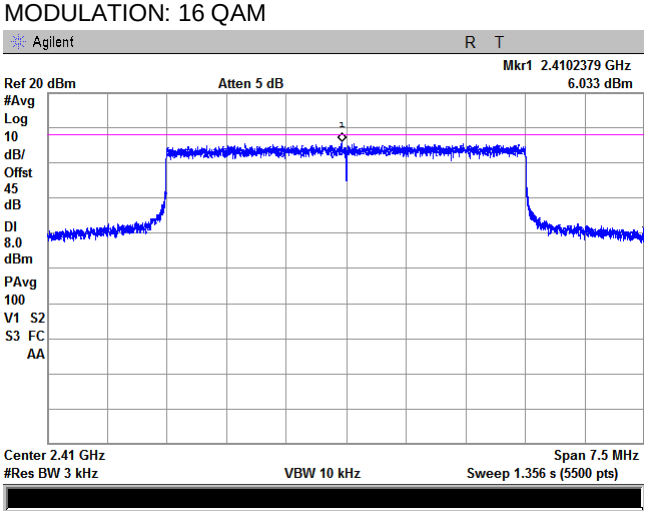
Plot 7.5.1 Peak spectral power density at low frequency within 6 dB band at 5 MHz BW

CHANNEL BANDWIDTH: 5 MHz

MODULATION: QPSK



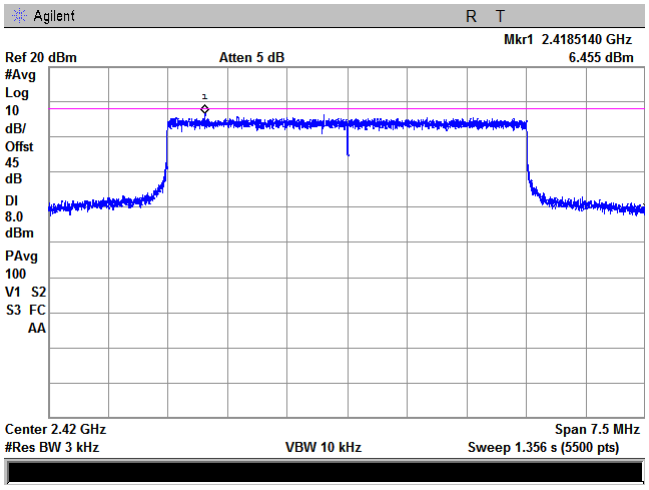
MODULATION: 16 QAM



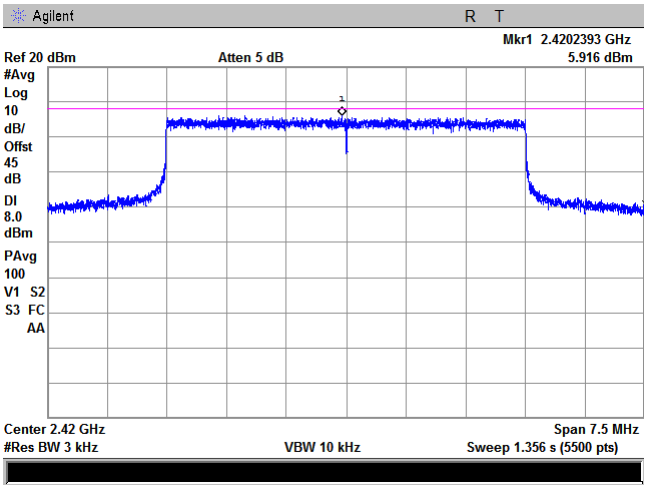
Plot 7.5.2 Peak spectral power density at mid frequency within 6 dB band at 5 MHz BW

CHANNEL BANDWIDTH: 5 MHz

MODULATION: QPSK



MODULATION: 16 QAM

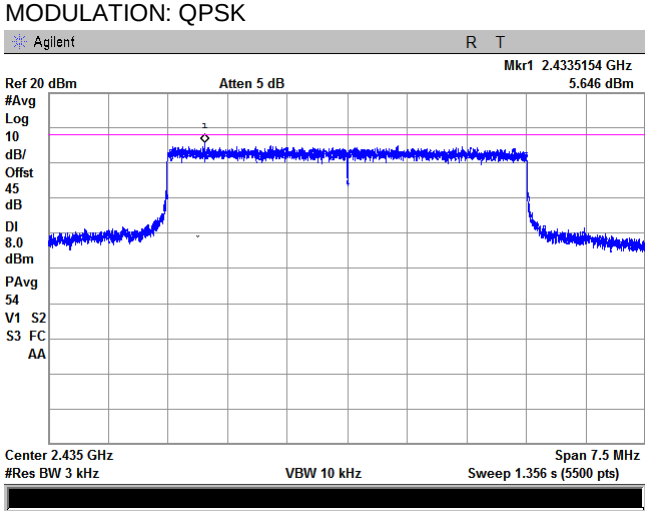


Test specification:	**Section 15.247(e) / RSS-247 section 5.2(2), Peak spectral power density**		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Jun-20		
Temperature: 25.3 ºC	**Relative Humidity:** 38 %	**Air Pressure:** 1024 hPa	**Power:** 28 VDC
Remarks:			

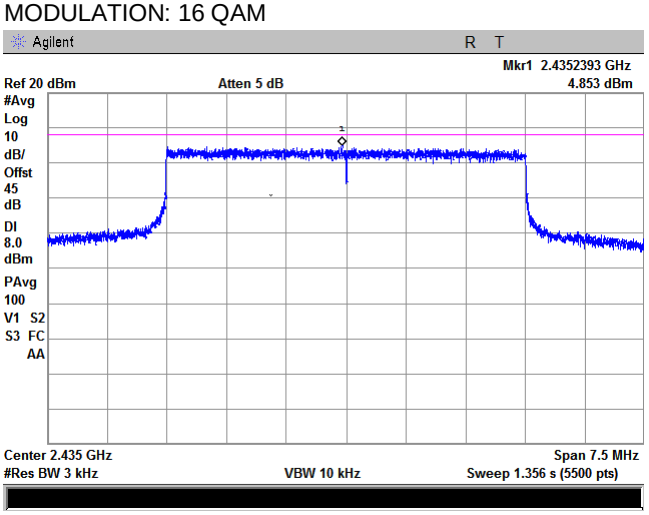
Plot 7.5.3 Peak spectral power density at high frequency within 6 dB band at 5 MHz BW

CHANNEL BANDWIDTH: 5 MHz

MODULATION: QPSK



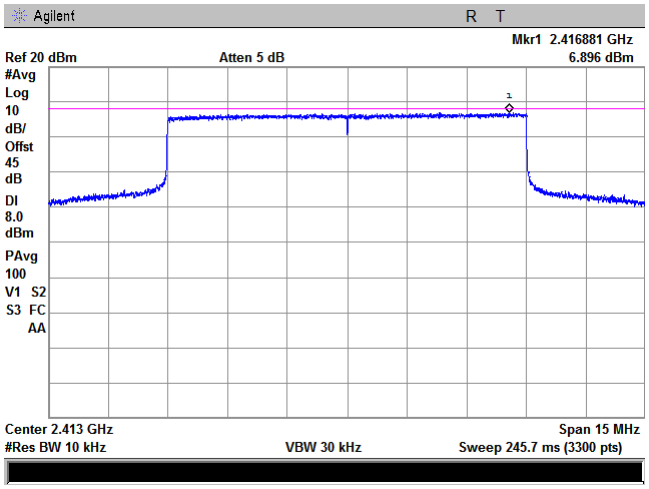
MODULATION: 16 QAM



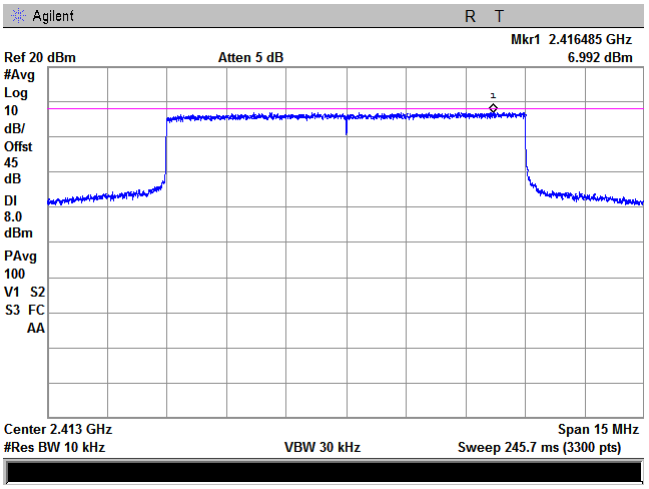
Plot 7.5.4 Peak spectral power density at low frequency within 6 dB band at 10 MHz BW

CHANNEL BANDWIDTH: 10 MHz

MODULATION: QPSK



MODULATION: 16 QAM

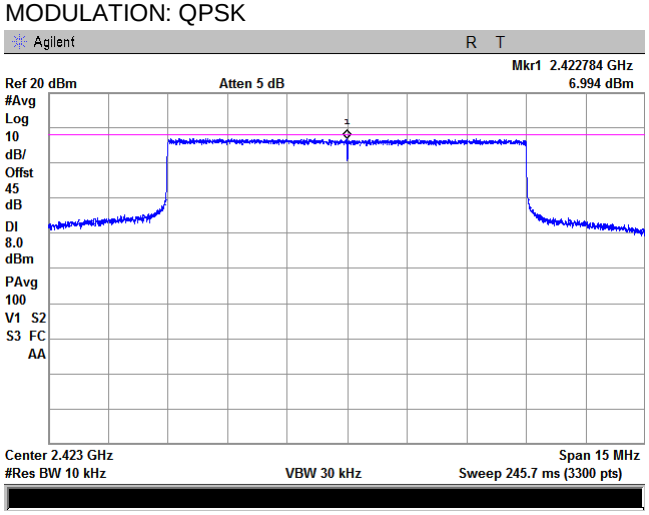


Test specification:	**Section 15.247(e) / RSS-247 section 5.2(2), Peak spectral power density**		
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	22-Jun-20		
Temperature: 25.3 ºC	**Relative Humidity:** 38 %	**Air Pressure:** 1024 hPa	**Power:** 28 VDC
Remarks:			

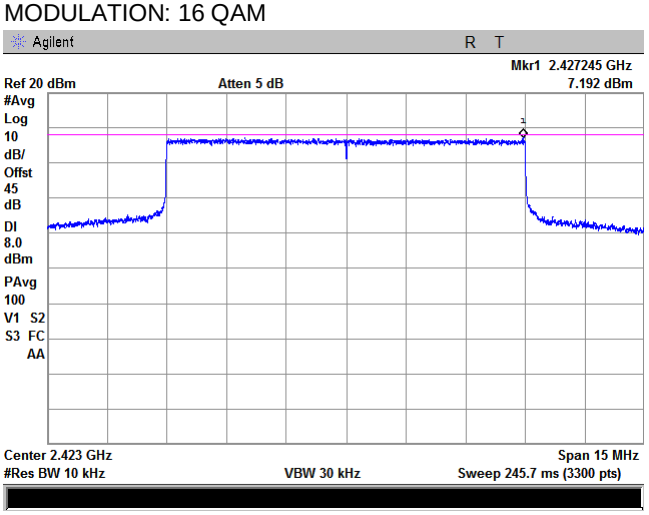
Plot 7.5.5 Peak spectral power density at mid frequency within 6 dB band at 10 MHz BW

CHANNEL BANDWIDTH: 10 MHz

MODULATION: QPSK



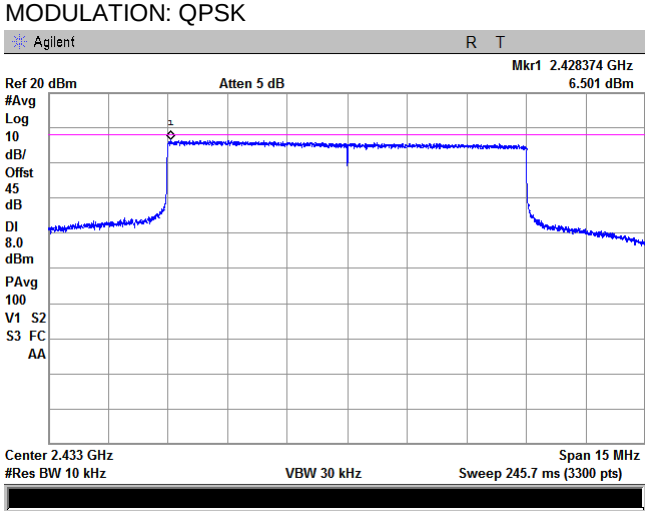
MODULATION: 16 QAM



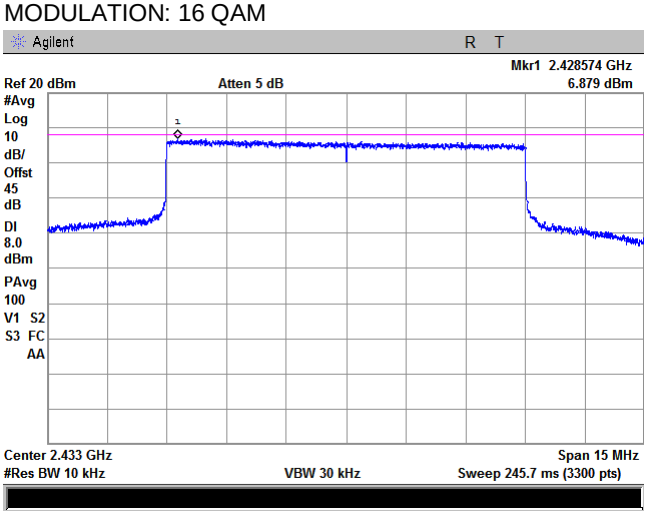
Plot 7.5.6 Peak spectral power density at high frequency within 6 dB band at 10 MHz BW

CHANNEL BANDWIDTH: 10 MHz

MODULATION: QPSK



MODULATION: 16 QAM



Test specification:	**FCC 47 CFR, Section 15.207 / ICES-003, Section 6.1, Class B, Conducted emissions**		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	27-Jul-20		
Temperature: 23 ºC	**Relative Humidity:** 34 %	**Air Pressure:** 1021 hPa	**Power:** 115 VAC, 60 Hz
Remarks:			

7.6 Conducted emissions

7.6.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.6.1. The worst test results (the lowest margins) were recorded in Table 7.6.2 and shown in the associated plots.

Table 7.6.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

* The limit decreases linearly with the logarithm of frequency.

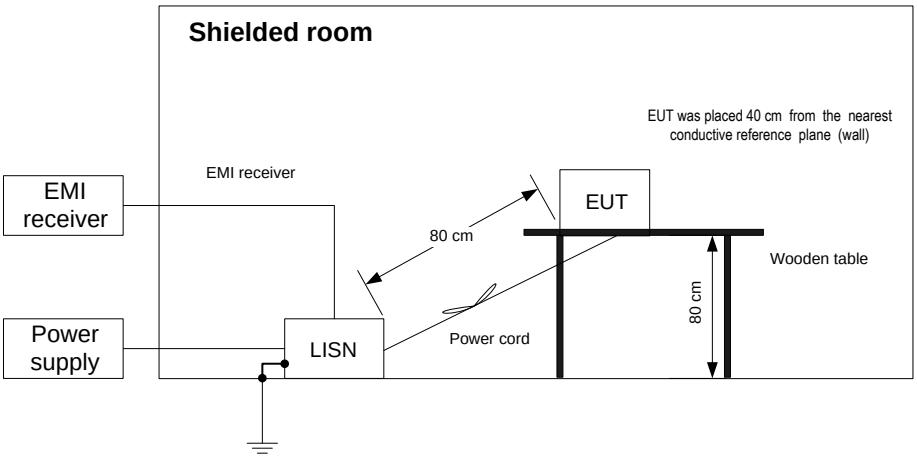
7.6.2 Test procedure

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

7.6.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to inTable 7.6.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

7.6.2.3 The position of the device cables was varied to determine maximum emission level.

Figure 7.6.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**FCC 47 CFR, Section 15.207 / ICES-003, Section 6.1, Class B, Conducted emissions**		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	27-Jul-20		
Temperature: 23 ºC	**Relative Humidity:** 34 %	**Air Pressure:** 1021 hPa	**Power:** 115 VAC, 60 Hz
Remarks:			

Table 7.6.2 Conducted emission test results

LINE:	AC mains
EUT OPERATING MODE:	Transmit
EUT SET UP:	TABLE-TOP
TEST SITE:	SHIELDED ROOM
DETECTORS USED:	PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE:	150 kHz - 30 MHz
RESOLUTION BANDWIDTH:	9 kHz

31957_CE_FCC_AC_L1_000 31/12/2019 13:35:27
Rel. SW 2.37 (June 2019)
Rel. FW 1.93 01/10/19
Margin: 20 dB

	Frequency [MHz]	QPeak [dBµV]	Limit 55022bqp [dBµV]	Delta [dB]	Avg [dBµV]	Limit 55022bav [dBµV]	Delta [dB]	Factor DC Limite.. [dB]	Factor LISN HL 2.. [dB]	Factor Cable HL .. [dB]
1	0.152045	51.39	65.89	-14.50	21.59	55.89	---	10.00	0.08	0.05
2	0.15818	51.70	65.56	-13.86	21.82	55.56	---	10.00	0.08	0.05
3	0.201125	44.07	63.56	-19.49	17.96	53.56	---	10.00	0.08	0.05
4	0.57127	44.77	56.00	-11.23	28.96	46.00	-17.04	10.00	0.10	0.05
5	0.724645	47.23	56.00	-8.77	23.19	46.00	---	10.00	0.09	0.06
6	0.8044	49.80	56.00	-6.20	25.33	46.00	---	10.00	0.11	0.06
7	1.14387	39.94	56.00	-16.06	24.82	46.00	---	10.00	0.12	0.06
8	1.42608	37.70	56.00	-18.30	19.92	46.00	---	10.00	0.13	0.06
9	2.85349	37.36	56.00	-18.64	19.67	46.00	---	10.00	0.16	0.07

31957_CE_FCC_AC_L2_001_000 31/12/2019 13:48:56
Rel. SW 2.37 (June 2019)
Rel. FW 1.93 01/10/19
Margin: 20 dB

	Frequency [MHz]	QPeak [dBµV]	Limit 55022bqp [dBµV]	Delta [dB]	Avg [dBµV]	Limit 55022bav [dBµV]	Delta [dB]	Factor DC Limite.. [dB]	Factor LISN HL 2.. [dB]	Factor Cable HL .. [dB]
1	0.152045	49.42	65.89	-16.47	20.39	55.89	---	10.00	0.08	0.05
2	0.16227	50.03	65.35	-15.32	20.74	55.35	---	10.00	0.08	0.05
3	0.201125	43.84	63.56	-19.72	17.28	53.56	---	10.00	0.08	0.05
4	0.732825	41.81	56.00	-14.19	22.45	46.00	---	10.00	0.10	0.06
5	0.80849	51.61	56.00	-4.39	25.21	46.00	---	10.00	0.11	0.06
6	1.14387	42.19	56.00	-13.81	26.87	46.00	-19.13	10.00	0.12	0.06
7	1.42608	36.12	56.00	-19.88	18.32	46.00	---	10.00	0.13	0.06
8	24.004925	37.85	60.00	---	33.48	50.00	-16.52	10.00	1.13	0.22
9	25.002885	32.80	60.00	---	30.13	50.00	-19.87	10.00	1.18	0.23

Reference numbers of test equipment used

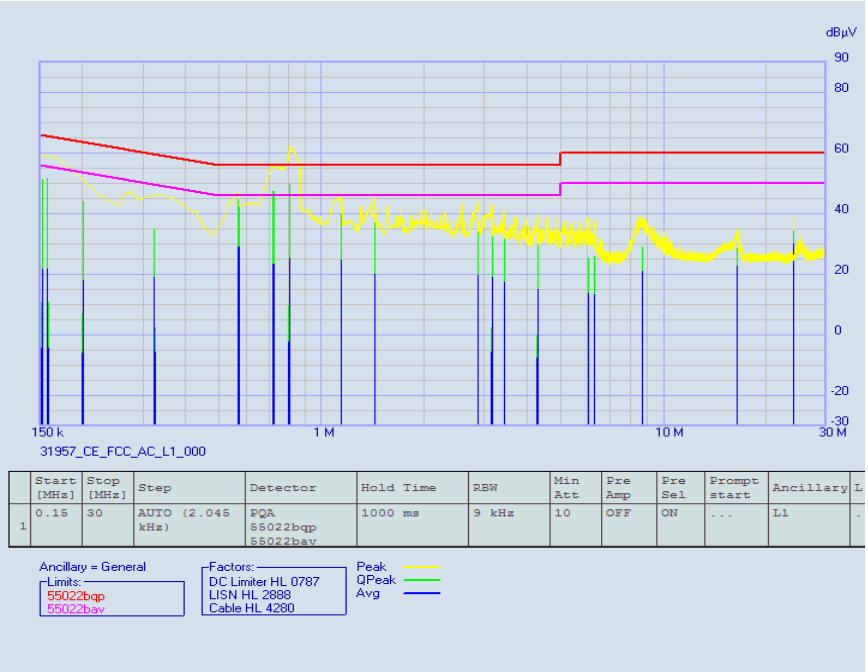
HL 2358	HL 2888	HL 4280	HL 787	HL 5707			

Full description is given in Appendix A.

Test specification:	**FCC 47 CFR, Section 15.207 / ICES-003, Section 6.1, Class B, Conducted emissions**		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	27-Jul-20		
Temperature: 23 ºC	**Relative Humidity:** 34 %	**Air Pressure:** 1021 hPa	**Power:** 115 VAC, 60 Hz
Remarks:			

Plot 7.6.1 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK

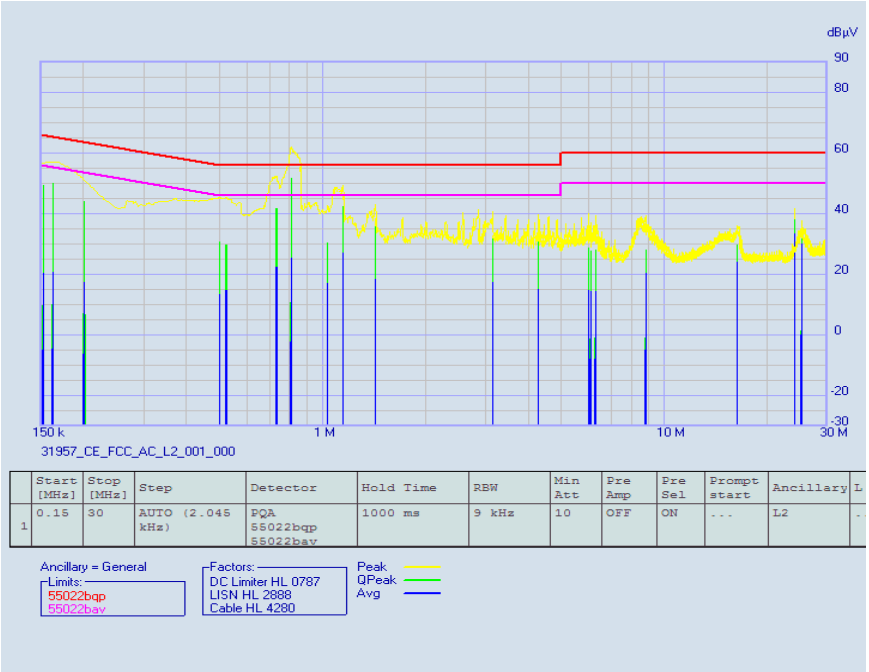


	Start [MHz]	Stop [MHz]	Step	Detector	Hold Time	RBW	Min Att	Pre Amp	Pre Sel	Prompt start	Ancillary	L
1	0.15	30	AUTO (2.045 kHz)	PQA 55022bqp 55022bav	1000 ms	9 kHz	10	OFF	ON	...	L1	-

Test specification:	**FCC 47 CFR, Section 15.207 / ICES-003, Section 6.1, Class B, Conducted emissions**		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	27-Jul-20		
Temperature: 23 ºC	**Relative Humidity:** 34 %	**Air Pressure:** 1021 hPa	**Power:** 115 VAC, 60 Hz
Remarks:			

Plot 7.6.2 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



	Start [MHz]	Stop [MHz]	Step	Detector	Hold Time	RBW	Min Att	Pre Amp	Pre Sel	Prompt start	Ancillary	L
1	0.15	30	AUTO (2.045 kHz)	PQA 55022bqp 55022bav	1000 ms	9 kHz	10	OFF	ON	...	L2	.

Test specification:	**Section 15.203, Antenna requirement**		
Test procedure:	Visual inspection		
Test mode:	Compliance	**Verdict:**	
Date(s):			
Temperature: 24.2 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1009 hPa	**Power:** 28 VDC
Remarks:			

7.7 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 7.7.1.

Table 7.7.1 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	

Test specification:	**FCC 47 CFR, Section 15.107 / ICES-003, Section 6.1, Class B, Conducted emissions**		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	27-Jul-20		
Temperature: 23 ºC	**Relative Humidity:** 45 %	**Air Pressure:** 1005 hPa	**Power:** 115 VAC, 60 Hz
Remarks:			

8 Emission tests according to 47CFR part 15 subpart B requirements

8.1 Conducted emissions

8.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port.
Specification test limits are given in Table 8.1.1. The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

Table 8.1.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(µV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

* The limit decreases linearly with the logarithm of frequency.

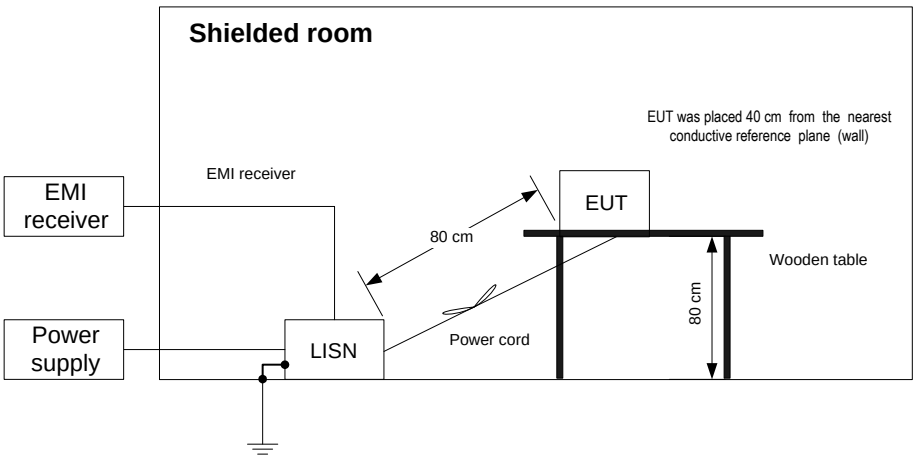
8.1.2 Test procedure

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

8.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 8.1.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

8.1.2.3 The position of the device cables was varied to determine maximum emission level.

Figure 8.1.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**FCC 47 CFR, Section 15.107 / ICES-003, Section 6.1, Class B, Conducted emissions**		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	27-Jul-20		
Temperature: 23 ºC	**Relative Humidity:** 45 %	**Air Pressure:** 1005 hPa	**Power:** 115 VAC, 60 Hz
Remarks:			

Table 8.1.2 Conducted emission test results

LINE: AC mains
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(μV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*	Measured emission, dB(μV)	Limit, dB(μV)	Margin, dB*		
0.150	NA	59.34	66.00	-6.66	27.90	56.00	-28.10	L1	Pass
0.154	NA	58.85	65.78	-6.93	27.44	55.78	-28.34		
0.201	NA	54.44	63.56	-9.12	23.73	53.56	-29.83		
0.301	NA	32.83	60.21	-27.38	12.60	50.21	-37.61		
1.318	NA	27.47	56.00	-28.53	18.58	46.00	-27.42		
2.144	NA	26.03	56.00	-29.97	16.94	46.00	-29.06		
4.612	NA	30.22	56.00	-25.78	20.82	46.00	-25.18		
0.150	NA	58.94	66.00	-7.06	27.49	56.00	-28.51	L2	Pass
0.154	NA	58.39	65.78	-7.39	27.06	55.78	-28.72		
0.201	NA	53.48	63.56	-10.08	22.98	53.56	-30.58		
0.301	NA	31.28	60.21	-28.93	12.28	50.21	-37.93		
1.320	NA	26.09	56.00	-29.91	17.41	46.00	-28.59		
2.567	NA	26.18	56.00	-29.82	20.10	46.00	-25.90		
4.618	NA	31.98	56.00	-24.02	22.31	46.00	-23.69		

*****- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

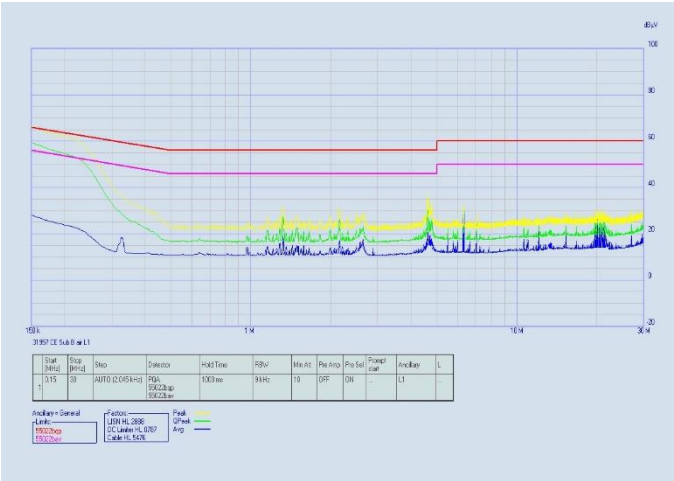
HL 0787	HL 2888	HL 4778	HL 5476				

Full description is given in Appendix A.

Test specification:	**FCC 47 CFR, Section 15.107 / ICES-003, Section 6.1, Class B, Conducted emissions**		
Test procedure:	ANSI C63.4, Section 7.3		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	27-Jul-20		
Temperature: 23 ºC	**Relative Humidity:** 45 %	**Air Pressure:** 1005 hPa	**Power:** 115 VAC, 60 Hz
Remarks:			

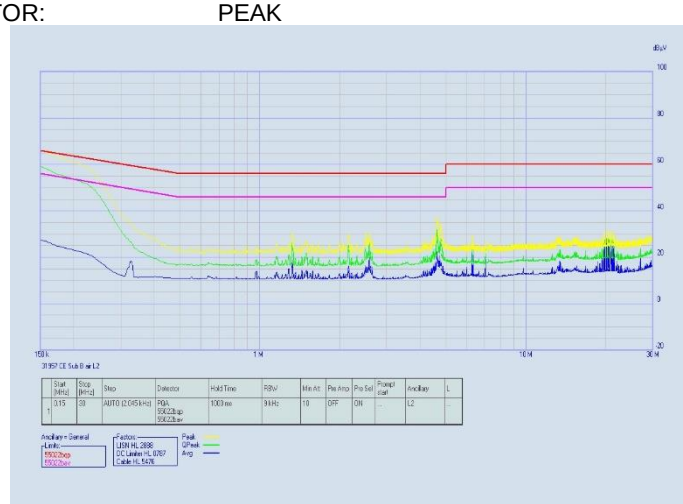
Plot 8.1.1 Conducted emission measurements

LINE: L1
LIMIT: Class B
EUT OPERATING MODE: Receive
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 8.1.2 Conducted emission measurements

LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Receive
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	**FCC 47 CFR, Section 15.109 / ICES-003, Section 6.2, Class B, Radiated emissions**		
Test procedure:	ANSI C63.4, Section 8.3		
Test mode:	Compliance	**Verdict:**	
Date(s):	27-Jul-20		
Temperature: 24.2 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1009 hPa	**Power:** 28 VDC
Remarks:			

8.2 Radiated emission

8.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.2.1.

Table 8.2.1 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.

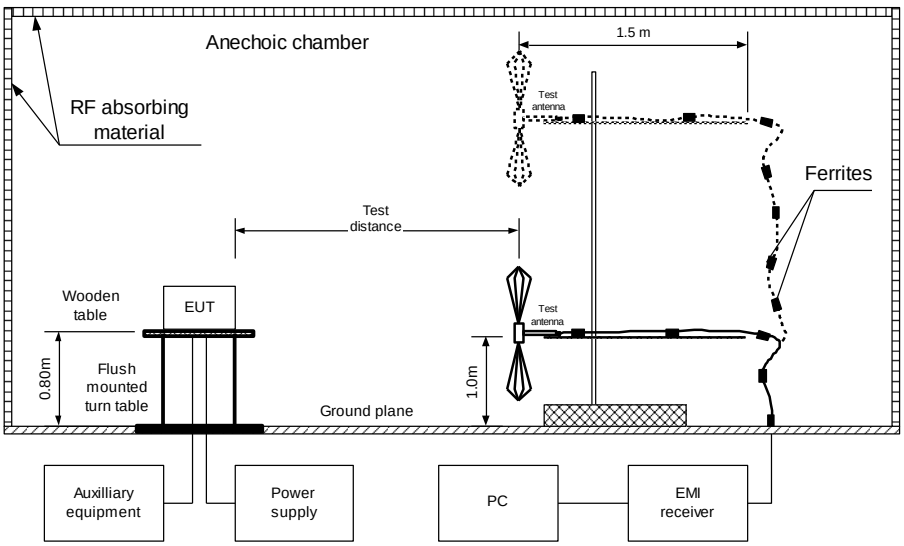
8.2.2 Test procedure for measurements in semi-anechoic chamber

8.2.2.1 The EUT was set up as shown in Figure 8.2.1 and associated photograph/s, energized and the performance check was conducted.

8.2.2.2 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.

8.2.2.3 The worst test results (the lowest margins) were recorded in Table 8.2.2 and shown in the associated plots.

Figure 8.2.1 Setup for radiated emission measurements in Semi anechoic chamber, table-top equipment



Test specification:	**FCC 47 CFR, Section 15.109 / ICES-003, Section 6.2, Class B, Radiated emissions**		
Test procedure:	ANSI C63.4, Section 8.3		
Test mode:	Compliance	**Verdict:**	
Date(s):	27-Jul-20		
Temperature: 24.2 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1009 hPa	**Power:** 28 VDC
Remarks:			

Table 8.2.2 Radiated emission test results

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

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
33.595	31.40	26.08	40.0	-13.92	Vertical	1.02	-15.00	Pass
90.500	34.27	31.24	43.5	-12.26	Vertical	1.02	131.00	
96.293	28.11	21.81	43.5	-21.69	Vertical	1.25	-102.0	
112.485	28.02	21.67	43.5	-21.83	Vertical	1.04	13.00	

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 14000MHz
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*				
2425.850	45.47	76.0	-30.53	32.60	56.0	-23.40	Horizontal	2.05	199	Pass

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

Reference numbers of test equipment used

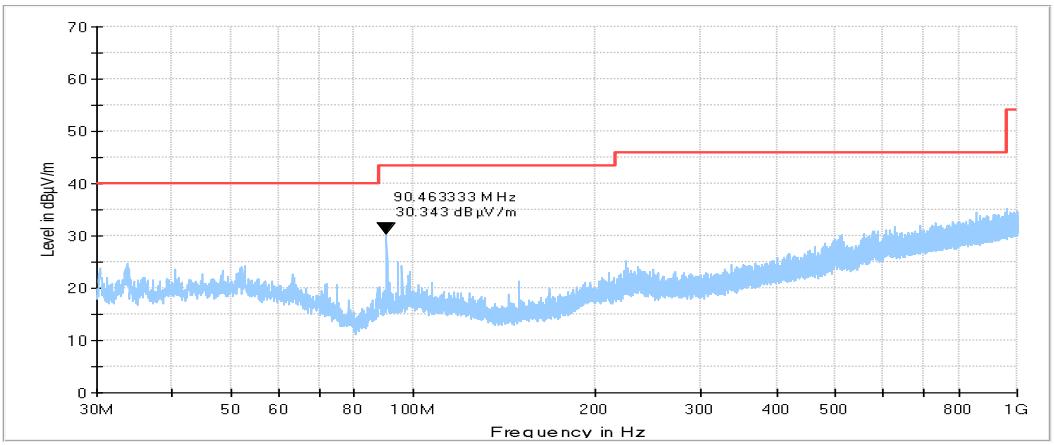
HL 4360	HL 3903	HL 4011	HL 3047	HL 5311	HL 5309	HL 5288	HL 5085
HL 5405							

Full description is given in Appendix A.

Test specification:	**FCC 47 CFR, Section 15.109 / ICES-003, Section 6.2, Class B, Radiated emissions**		
Test procedure:	ANSI C63.4, Section 8.3		
Test mode:	Compliance	**Verdict:**	
Date(s):	27-Jul-20		
Temperature: 24.2 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1009 hPa	**Power:** 28 VDC
Remarks:			

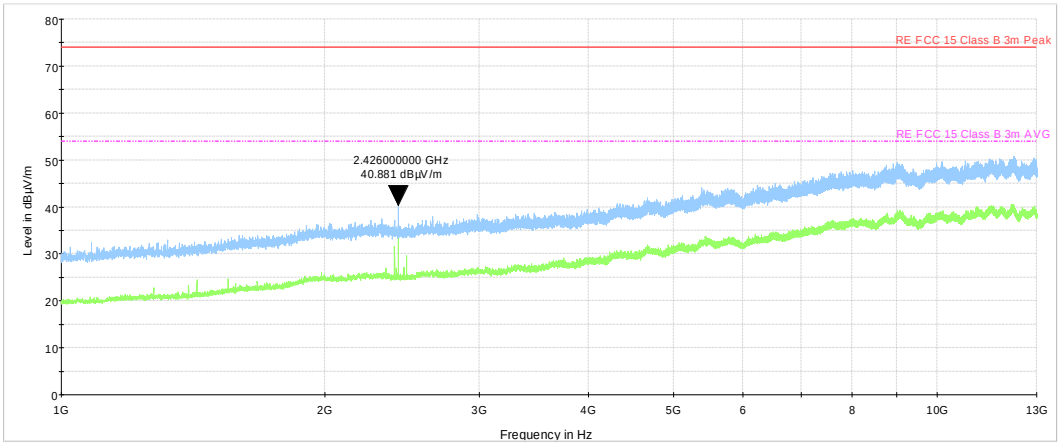
Plot 8.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

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



Plot 8.2.2 Radiated emission measurements above 1000 MHz, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
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 (9) kHz - 30 MHz	EMCO	6502	2857	24-Feb-20	24-Feb-21
1809	HygroThermometer, Min/Max Memory	Delta TRAK	13301	NA	11-Aug-19	11-Aug-20
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	05-Apr-20	05-Apr-21
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY45101057	16-Apr-20	16-Apr-21
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY45240586	16-Apr-20	16-Apr-21
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	27-Apr-20	27-Apr-21
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	06-Apr-20	06-Apr-21
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1226/2A	06-Apr-20	06-Apr-21
4011	Temp. & Humidity Meter, (-50 - +70) deg, (20 - 99)% RH	Mad Electronics	HTC-1	NA	11-Aug-19	11-Aug-20
4338	Reject Band Filter, 50 Ohm, 0 to 2170 and 3000 to 18000 MHz,SMA-FM / SMA-M	Micro-Tronics	BRM 50702-02	023	05-Jun-19	05-Jun-21
4360	EMI Test Receiver, 20 Hz to 40 GHz.	Rohde & Schwarz	ESU40	100322	20-Jan-20	20-Jan-21
4366	Directional coupler, 1 GHz to 18 GHz, 10 dB, SMA Female	Tiger Micro-Electronics Institute	TGD-A1101-10	01e-JSDE805-007	03-Jun-20	03-Jun-22
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	06-Jan-20	06-Jan-21
4956	Active horn antenna, 18 to 40 GHz	COM-POWER CORPORATION	AHA-840	105004	29-Jan-20	29-Jan-21
5174	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 10 dB, 5 W	API Weinschel, Inc	75A-10-12	TD854	07-Apr-20	07-Apr-21
5175	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 20 dB, 5 W	API Weinschel, Inc	75A-20-12	TE289	07-Apr-20	07-Apr-21
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	08-Feb-19	08-Feb-22
5309	Antenna Mast, 1-4 meter, Pneumatic polarization	Dolev Ltd	FMB 1-4	NA	23-Apr-20	23-Apr-21
5311	Controller	Dolev Ltd	FC-06	FC06.1-2016-024	23-Apr-20	23-Apr-21
5665	Cable SF118/11N(x2)/6M, 18 GHz, 11N/11N	Huber-Suhner	SF118	501644/118	19-Apr-20	19-Apr-21
2358	Power Supply, 2 X 0-36VDC / 5A, 5VDC / 5A	Horizon Electronics	DHR3655D	767469	25-Jun-20	25-Jun-21

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
2888	LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1	Rolf Heine	NNB-2/16Z	02/10018	17-Mar-20	17-Mar-21
4280	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0763A	01-Aug-19	01-Aug-20
5598	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18000 MHz	Mini Circuits	BW-N10W5+	NA	24-Sep-19	24-Sep-20
5623	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini Circuits	BW-N20W5+	NA	06-Oct-19	06-Oct-20
5707	EMI receiver	PMM / Narda	PMM 9010F	060WW91101	22-Nov-19	22-Nov-21

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 dBμV to obtain field strength in dBμA/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 dBμV to obtain field strength in dBμV/m.

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

Frequency, MHz	Measured antenna factor, dB/m	Frequency, MHz	Measured antenna factor, dB/m
18000	5.1	29500	1.4
18500	3.6	30000	2.9
19000	2.2	30500	2.9
19500	0.7	31000	2.9
20000	0.7	31500	1.2
20500	0.8	32000	0.7
21000	0.5	32500	0.2
21500	-1.3	33000	-1.7
22000	-2.1	33500	-2.2
22500	-2.0	34000	2.3
23000	-1.6	34500	-1.1
23500	-2.9	35000	0.7
24000	-2.3	35500	-1.1
24500	-2.6	36000	0.1
25000	-1.8	36500	1.4
25500	-1.2	37000	3.7
26000	-0.5	37500	5.8
26500	-1.2	38000	6.6
27000	-0.1	38500	7.3
27500	-1.0	39000	6.5
28000	-0.7	39500	7.3
28500	0.5	40000	7.1

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

HL 5288: Trilog Antenna
Frankonia, model: ALX-8000E, s/n: 00809
30-1000 MHz

Frequency, MHz	Antenna factor, dB/m	Frequency, MHz	Antenna factor, dB/m
30	14.96	160	12.67
35	15.33	180	13.34
40	16.37	200	15.40
45	17.56	250	16.42
50	17.95	300	17.28
60	16.87	400	19.98
70	13.22	500	21.11
80	10.56	600	22.90
90	13.61	700	24.13
100	15.46	800	25.25
120	14.03	900	26.35
140	12.23	1000	27.18

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

above 1000 MHz

Frequency, MHz	Antenna factor, dB/m	Frequency, MHz	Antenna factor, dB/m
1000	26.9	3600	38.9
1100	28.1	3700	39.4
1200	28.4	3800	39.4
1300	29.6	3900	39.6
1400	29.1	4000	39.7
1500	30.4	4100	39.8
1600	30.7	4200	40.5
1700	31.5	4300	40.9
1800	32.3	4400	41.1
1900	32.6	4500	41.4
2000	32.5	4600	41.3
2100	32.9	4700	41.6
2200	33.5	4800	41.9
2300	33.2	4900	42.3
2400	33.7	5000	42.7
2500	34.6	5100	43.0
2600	34.7	5200	42.9
2700	34.6	5300	43.5
2800	35.0	5400	43.6
2900	35.5	5500	44.3
3000	36.2	5600	44.7
3100	36.8	5700	45.0
3200	36.8	5800	45.0
3300	37.0	5900	45.3
3400	37.5	6000	45.9
3500	38.2		

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

HL 2888 LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A
Rolf Heine, model: NNB-2/16Z, s/n 02/10018, HL 2888

Voltage division factor (insertion loss)

Frequency,	L1, dB	L2, dB	Uncertainty, dB
150	0.09	0.07	±0.09
170	0.08	0.07	±0.09
200	0.08	0.06	±0.09
250	0.09	0.06	±0.09
300	0.09	0.06	±0.09
350	0.09	0.07	±0.09
400	0.09	0.07	±0.09
500	0.09	0.07	±0.09
600	0.09	0.07	±0.09
700	0.10	0.08	±0.09
800	0.10	0.08	±0.09
900	0.11	0.08	±0.09
1000	0.11	0.08	±0.09
1200	0.11	0.09	±0.16
1500	0.12	0.10	±0.16
2000	0.14	0.12	±0.16
2500	0.15	0.12	±0.16
3000	0.16	0.14	±0.16
4000	0.19	0.16	±0.16
5000	0.23	0.19	±0.16
7000	0.30	0.25	±0.16
10000	0.46	0.40	±0.16
15000	0.71	0.62	±0.16
20000	0.94	0.85	±0.16
30000	1.41	1.33	±0.32

11 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.
Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for relevant parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; Recognized by Innovation, Science and Economic Development Canada for wireless and terminal testing (ISED), ISED #2186A, CAB identifier is IL1001; Certified by VCCI, Japan (the registration numbers are R-10808 for OATS, R-1082 for anechoic chamber, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 for conducted emissions at telecommunication ports).
The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

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

12 APPENDIX D 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.

13 APPENDIX E Specification references

FCC 47CFR part 15: 2019	Radio Frequency Devices
ANSI C63.10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.4: 2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
RSS-247 Issue 2: 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence- Exempt Local Area Network (LE-LAN) Devices
RSS-Gen Issue 5: 2019	General Requirements for Compliance of Radio Apparatus
ICES-003: 2016, Issue 6	Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement

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

END OF DOCUMENT