HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO: FCC 47 CFR part 15 section 15.258

FOR:

Neteera technologies Ltd.

Respiratory and cardiac rate monitor

Models: 130H/131H/130W/131W

FCC ID: 2AYVO-NETEERA1301

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1 Applicant information

Client name:	Neteera Technologies LTD
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Telephone:	+972 46288001
Fax:	+972 46288277
E-mail:	Hanna.Riezk@neteera.com
Contact name:	Mrs. Hanna Riezk

2 Equipment under test attributes

Product name:	Respiratory and cardiac rate monitor
Product type:	Monitor
Model(s):	130H/131H
Serial number:	131020450019
Hardware version:	1.0
Software release:	1.0
Receipt date	03-Jan-21

3 Manufacturer information

Manufacturer name:	Neteera Technologies LTD
Address:	High Tech Village, Building 1.1 The Hebrew University, Givat Ram, Jerusalem 9139002
Telephone:	+972 46288001
Fax:	+972 46288277
E-Mail:	Hanna.Riezk@neteera.com
Contact name:	Mrs. Hanna Riezk

4 Test details

Project ID:	41599
Location:	Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started:	03-Jan-21
Test completed:	03-Feb-21
Test specification(s):	FCC 47 CFR part 15 section 15.258

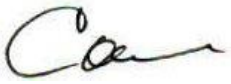
5 Tests summary

Test	Status
Transmitter characteristics	
FCC section 15.258(b), Transmiter power test	Pass
FCC section 15.215(c), Occupied bandwidth	Pass
FCC section 15.258(c)(2), Out of band radiated emissions below 40 GHz at model without Wi-Fi module	Pass
FCC section 15.258(c)(2), Out of band radiated emissions below 40 GHz at model with Wi-Fi module*	Pass
FCC section 15.258(c)(3), Out of band radiated emissions above 40 GHz up to 370 GHz	Pass
FCC Section 15.258(d), Frequency stability test	Pass
FCC Section 15.203, Antenna requirement	Pass

* The 130H is an additional model with WiFi module that was tested only to out of band radiated emmisions below 40GHz.

This test report supersedes the previously issued test report identified by Doc ID: NETRAD_FCC.41599_Rev1

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. A. Morozov, test engineer, EMC & Radio	03-Jan-21 – 03-Feb-21	
Reviewed by:	Mrs. S. Peysahov Sheynin, test engineer, EMC & Radio	07-Apr-21	
Approved by:	Mr. S. Samokha, technical manager, EMC & Radio	08-Apr-21	

6 EUT description

Note: The following data in this clause is provided by the customer and represents his sole responsibility

6.1 General information

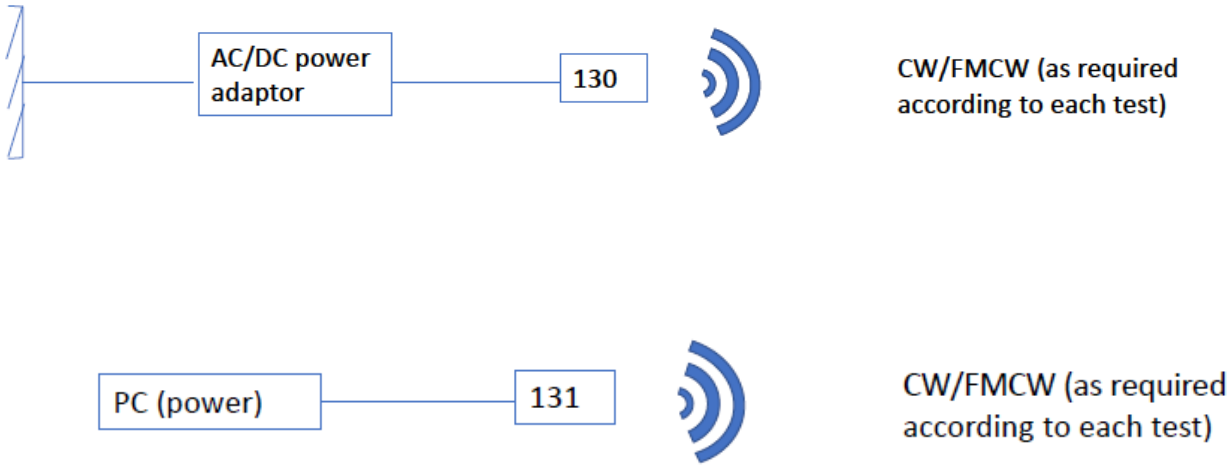
Neteera 130H/131H has designed and developed a contact-free vital-signs monitoring technology capable of detecting a variety of parameters, based on a high frequency (116GHz-123GHz) micro-radar on-chip and algorithm.

According to manufacturer's declaration provided in Appendix F of the test report, the models 130H, 131H, 130W and 131W, are identical in components, assembly, technical specifications and performance operation principles, except the following distinctions:

The 130H/130W models include a WiFi module, whereas the 131H/131W do not.

The 130W/131W models are intended for use for wellness purposes, and not intended for medical use.

6.2 Test configuration



6.3 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	116000 – 123000 MHz
Operating frequencies	119000 – 122980 MHz

Maximum rated output power	At transmitter 50 Ω RF output connector	dBm
	EIRP with maximum declared antenna gain	19.72 dBm

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

Antenna connection			
unique coupling	standard connector*	V integral	with temporary RF connector
			without temporary RF connector

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Integral	Neteera	the antenna is part of the chip packaging , the dielectric lens model number is L7	19 dBi (antenna +lens)

Type of modulation	FMCW
Modulating test signal (baseband)	119000 – 122980 MHz

Transmitter power source					
	Battery	**Nominal rated voltage**	VDC	Battery type	
X	DC	**Nominal rated voltage**	5 VDC		
	AC mains	**Nominal rated voltage**	VAC	Frequency	Hz

Common power source for transmitter and receiver	X yes	no

Test specification:	Section 15.258(b), Transmitter power		
Test procedure:	ANSI C63.10, Section 9.11		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C

7.1 Transmitter power test

7.1.1 General

This test was performed to measure the peak output power. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Output power limits

Assigned frequency range, MHz	Maximum output power	
	EIRP, dBm	
	Peak	Average
116000 – 123000	43	40

7.1.2 Test procedure

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

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

7.1.2.3 The average and peak voltage was measured at the low and high frequency channels with oscilloscope connected to RF detector and provided in the associated plots.

7.1.2.4 The unmodulated signal was applied to Zero-Biased Detector via variable attenuator as shown in Figure 7.1.2.

7.1.2.5 The variable attenuator was adjusted such that the oscilloscope indicated a voltage equal to the peak voltage recorded in the step 7.1.2.3.

7.1.2.6 The variable attenuator was disconnected from the Zero-Biased Detector.

7.1.2.7 Without changing any settings, the variable attenuator was connected to a power meter as shown in Figure 7.1.3.

7.1.2.8 The power was measured and result was recorded in Table 7.1.2 and Table 7.1.3.

7.1.2.9 The steps 7.1.2.4 through 7.1.2.8 were repeated for the average voltage recorded in the step 7.1.2.3 and 7.1.2.4.

Test specification:	Section 15.258(b), Transmitter power		
Test procedure:	ANSI C63.10, Section 9.11		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

Figure 7.1.1 Peak output power test setup

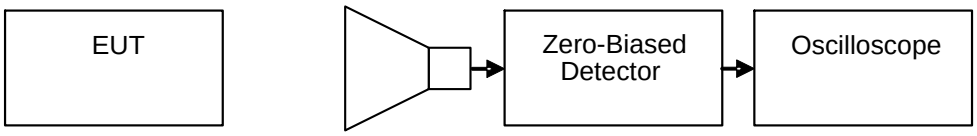


Figure 7.1.2 Peak output power test setup

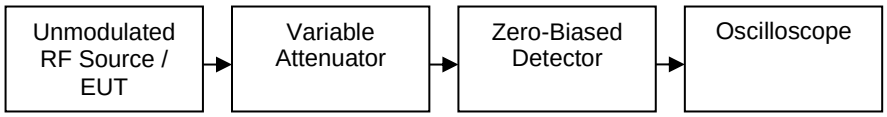
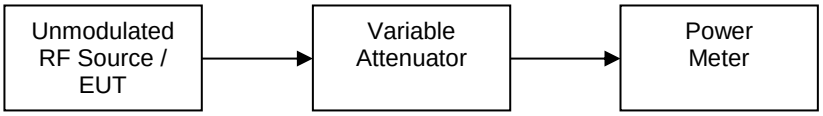


Figure 7.1.3 Peak output power test setup



Test specification:	Section 15.258(b), Transmitter power		
Test procedure:	ANSI C63.10, Section 9.11		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

Table 7.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 116.0 – 123.0 GHz
DETECTOR USED: Peak
MEASUREMENTS DISTANCE: 0.3 m
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
EUT ANTENNA GAIN: 19 dBi
MODULATION: CW

Frequency, MHz	λ*, m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}**, dBuV/m	EIRP***, dBm	Limit, dBm	Margin****, dB	Verdict
119000	0.002521	2.85	-22.58	24.0	132.19	19.53	43.0	-23.47	Pass
121000	0.002479	1.79	-22.53	24.0	132.38	19.72	43.0	-23.28	Pass
122980	0.002439	1.23	-25.39	24.0	129.66	17.01	43.0	-25.99	Pass

Note: Max peak conducted power is 19.72 dBm – 19 dBi = 0.72 dBm
* - λ = 300/Frequency(MHz)
** - E_{meas}= 126.8 – 20log(λ) + Power measured – Measurement Antenna Gain (24 dBi)
*** - EIRP= E_{meas} + 20log(Measurements distance) – 104.7
**** - Margin = EIRP – Limit

Table 7.1.3 Average output power test results

ASSIGNED FREQUENCY RANGE: 116.0 – 123.0 GHz
DETECTOR USED: Average
MEASUREMENTS DISTANCE: 0.3 m
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
EUT ANTENNA GAIN: 19 dBi
MODULATION: CW

Frequency, MHz	λ*, m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}**, dBuV/m	EIRP***, dBm	Limit, dBm	Margin****, dB	Verdict
119000	0.002521	2.20	-23.46	24.0	131.30	18.65	40.0	-21.35	Pass
121000	0.002479	1.00	-27.19	24.0	127.72	15.06	40.0	-24.94	Pass
122980	0.002439	0.63	-29.62	24.0	125.43	12.78	40.0	-27.22	Pass

* - λ = 300/Frequency(MHz)
** - E_{meas}= 126.8 – 20log(λ) + Power measured – Measurement Antenna Gain (24 dBi)
*** - EIRP= E_{meas} + 20log(Measurements distance) – 104.7
**** - Margin = EIRP – Limit

Reference numbers of test equipment used

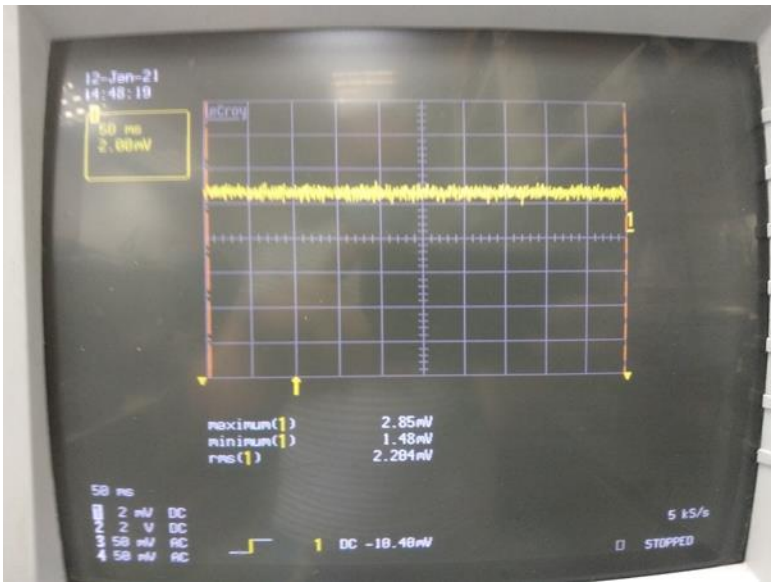
HL 3536	HL 3296	HL 1304	HL 5376	HL 5373	HL 5371	HL 5409	HL 3901

Full description is given in Appendix A.

Test specification:	**Section 15.258(b), Transmitter power**		
Test procedure:	ANSI C63.10, Section 9.11		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	**Relative Humidity:** 46 %	**Air Pressure:** 1010 hPa	**Power:** 5 VDC
Remarks:			

Plot 7.1.1 Output power test result at the 119.00 GHz frequency

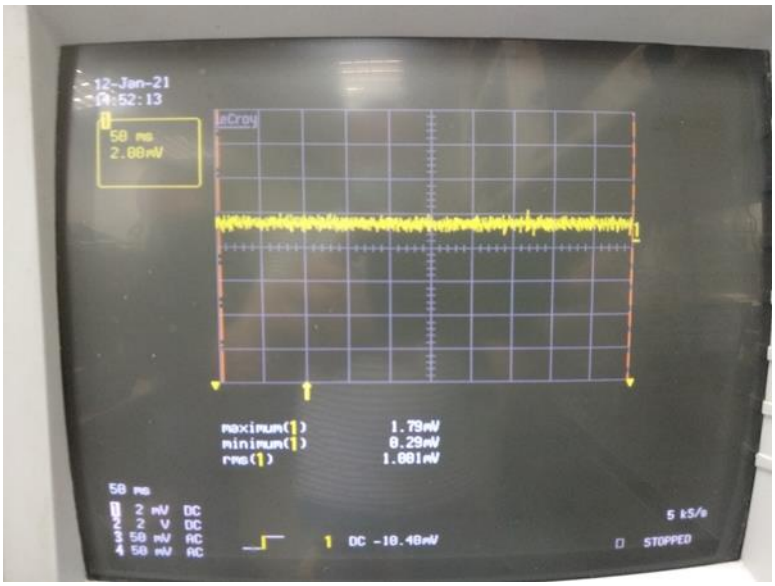
DETECTOR:	Peak/Average
MODULATION:	CW
EUT POLARIZATION:	Vertical
TEST ANTENNAPOLARIZATION:	Vertical



Test specification:	**Section 15.258(b), Transmitter power**		
Test procedure:	ANSI C63.10, Section 9.11		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	**Relative Humidity:** 46 %	**Air Pressure:** 1010 hPa	**Power:** 5 VDC
Remarks:			

Plot 7.1.2 Output power test result at the 121.00 GHz frequency

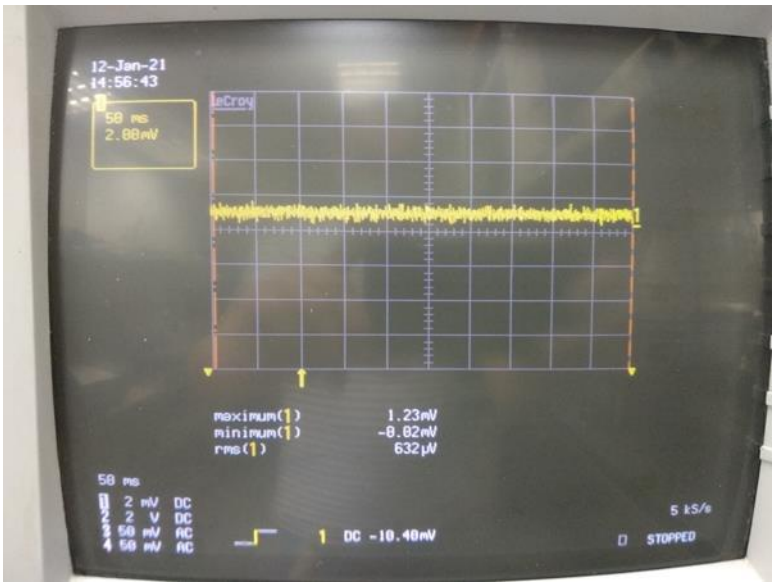
DETECTOR:	Peak/Average
MODULATION:	CW
EUT POLARIZATION:	Vertical
TEST ANTENNAPOLARIZATION:	Vertical



Test specification:	**Section 15.258(b), Transmitter power**		
Test procedure:	ANSI C63.10, Section 9.11		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	**Relative Humidity:** 46 %	**Air Pressure:** 1010 hPa	**Power:** 5 VDC
Remarks:			

Plot 7.1.3 Output power test result at the 122.98 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	CW
EUT POLARIZATION:	Vertical
TEST ANTENNAPOLARIZATION:	Vertical



Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	ANSI C63.10, Section 9.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 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

Table 7.2.1 Occupied bandwidth limits

Assigned frequency range, MHz	Modulation envelope reference points
116000 – 123000	6 dBc

NOTE: Modulation envelope reference points provided in terms of attenuation below unmodulated 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 as provided in Table 7.2.2.

7.2.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope. The test results are provided in Table 7.2.2 and the associated plots.

Figure 7.2.1 Occupied bandwidth test setup

Test specification:	Section 15.215(c), Occupied bandwidth		
Test procedure:	ANSI C63.10, Section 9.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

OPERATING FREQUENCY RANGE:	116000 – 123000 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	300 kHz

Frequency, GHz	Occupied bandwidth 6 dBc, MHz	Verdict
121.000	3685.0	Pass

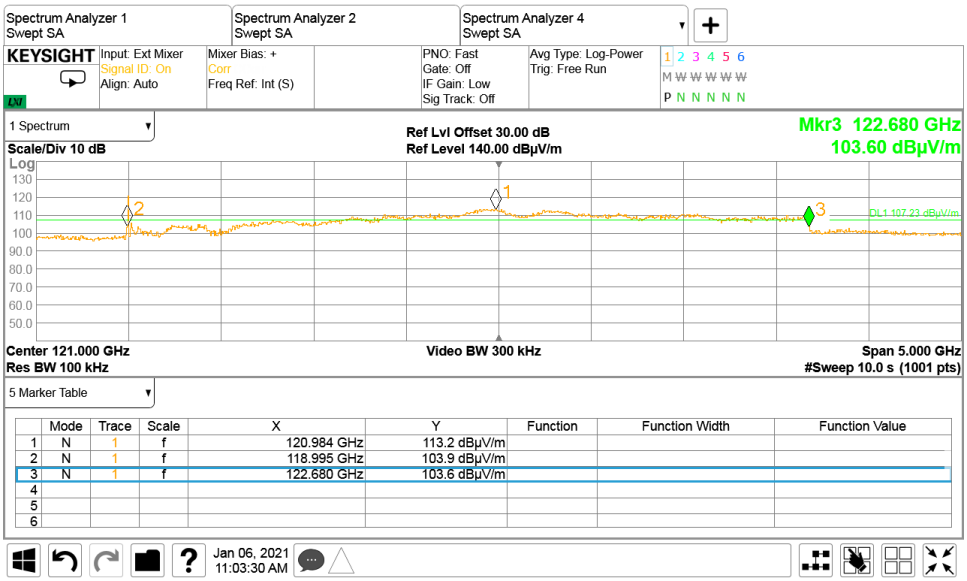
Reference numbers of test equipment used

HL 747	HL 3433	HL 3536	HL 5376				

Full description is given in Appendix A.

Plot 7.2.1 The 6dBc occupied bandwidth

CENTER FREQUENCY:	121000 MHz
MODULATION:	FMCW
ENVELOPE POINT:	6 dBc



Test specification:	**Section 15.258(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	**Relative Humidity:** 46 %	**Air Pressure:** 1010 hPa	**Power:** 5 VDC
Remarks:			

7.3 Out of band radiated emmisions below 40GHz at model without Wi-Fi module

7.3.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Radiated spurious emissions limits

Frequency range, MHz	**Field strength at 3 m, dB(μV/m)***		
	Within restricted bands		
	Peak	**Quasi Peak**	**Average**
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**
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 – 40000	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.

Note: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the third harmonic of the highest fundamental frequency or to 750 GHz, whichever is lower if the intentional radiator operates at or above 95 GHz.

Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

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

7.3.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

7.3.2.2 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.

7.3.2.3 The worst test results (the lowest margins) were recorded in Table 7.3.3 and shown in the associated plots.

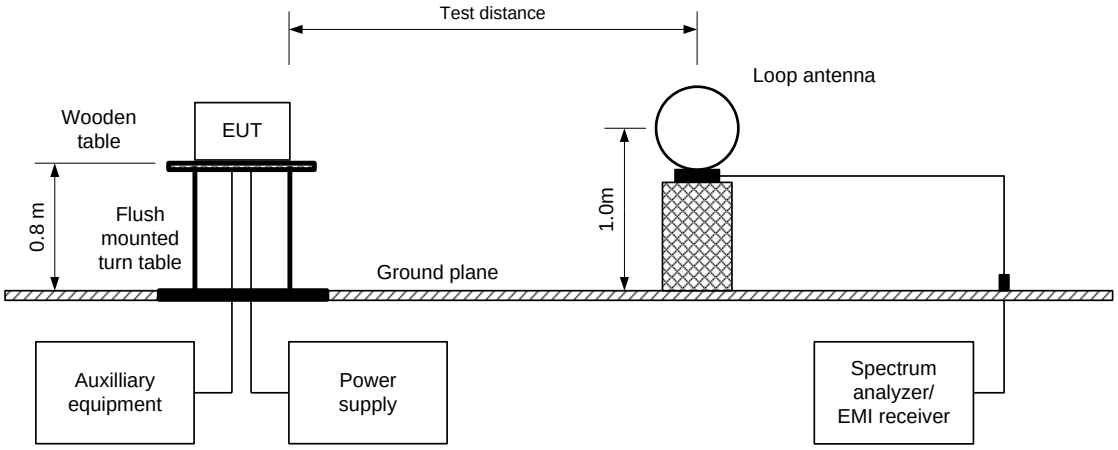
7.3.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.3.3.1 The EUT was set up as shown in Figure 7.2.2, Figure 7.2.3, energized and the performance check was conducted.

7.3.3.2 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.

7.3.3.3 The worst test results (the lowest margins) were recorded in Table 7.3.2 and Table 7.3.3 and shown in the associated plots.

Figure 7.3.1 Setup for spurious emission field strength measurements below 30 MHz



Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

Figure 7.3.2 Setup for spurious emission field strength measurements in 30 – 1000 MHz

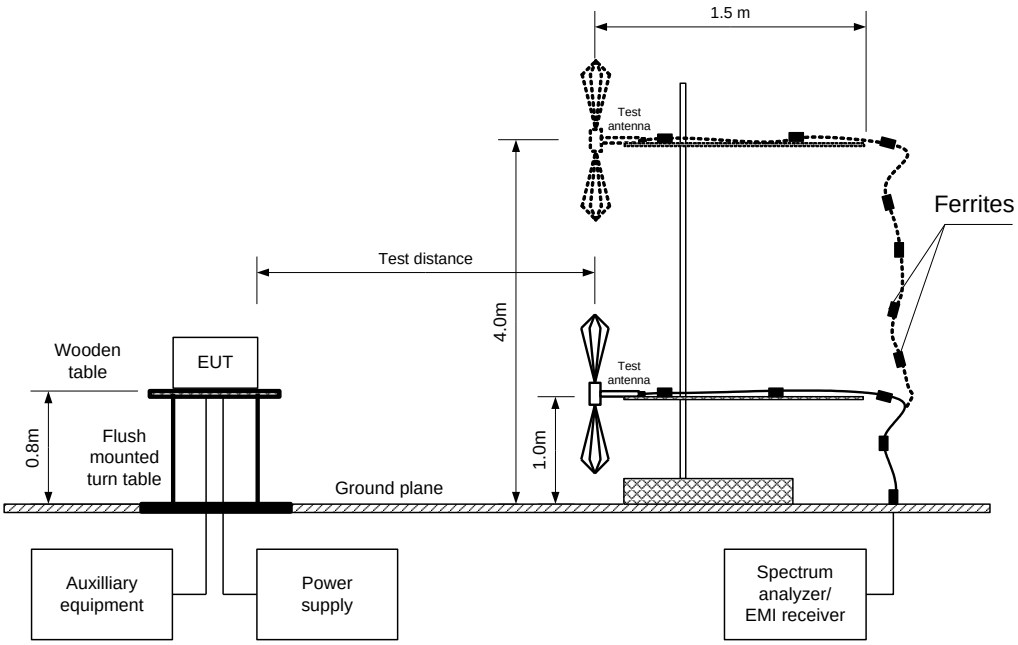
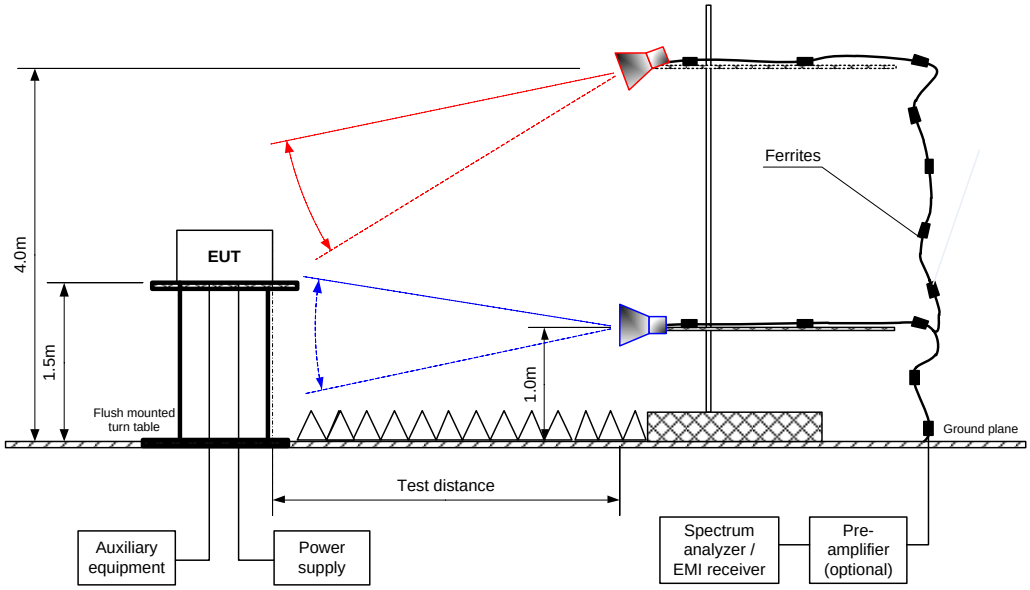


Figure 7.3.3 Setup for spurious emission field strength measurements above1000 MHz



Test specification:	**Section 15.258(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	**Relative Humidity:** 46 %	**Air Pressure:** 1010 hPa	**Power:** 5 VDC
Remarks:			

Table 7.3.2 Field strength of spurious emissions at frequencies above 1 GHz

TEST DISTANCE:	3 m
EUT POSITION:	Typical (Vertical)
MODULATION:	CW
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 - 40000 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1.0 MHz
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	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)	Limit, dB(μV/m)	Margin, dB**	
Low frequency 119.000 GHz										
5578.147	V	1.81	214	45.35	74.0	-28.65	40.32	54.0	-13.68	Pass
9296.652	H	1.00	149	49.39	74.0	-24.61	44.42	54.0	-9.58	
Mid frequency 121.000 GHz										
5671.810	V	1.80	210	45.29	74.0	-28.71	40.16	54.0	-13.84	Pass
9453.142	H	1.00	140	50.59	74.0	-23.41	45.98	54.0	-8.02	
High frequency 122.980 GHz										
5764.419	V	1.53	198	46.08	74.0	-27.92	40.09	54.0	-13.91	Pass
9607.475	H	1.02	149	49.20	74.0	-24.80	44.43	54.0	-9.57	

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = dB below (negative if above) specification limit.

Reference numbers of test equipment used

HL 5372	HL 3903	HL 4933	HL 5288	HL 5085	HL 4956	HL 5111	HL 5670
HL 5669							

Full description is given in Appendix A.

Test specification:	**Section 15.258(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	**Relative Humidity:** 46 %	**Air Pressure:** 1010 hPa	**Power:** 5 VDC
Remarks:			

Table 7.3.3 Field strength of emissions below 1 GHz

TEST DISTANCE:	3 m
EUT POSITION:	Typical (Vertical)
MODULATION:	CW
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) 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***				
Low frequency 119.000 GHz								Pass
375.004329	34.47	30.64	46.0	-15.36	Vertical	1.04	196	
Mid frequency 121.000 GHz								Pass
No emissions for measurements were found								
High frequency 122.980 GHz								Pass
No emissions for measurements were found								

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

Reference numbers of test equipment used

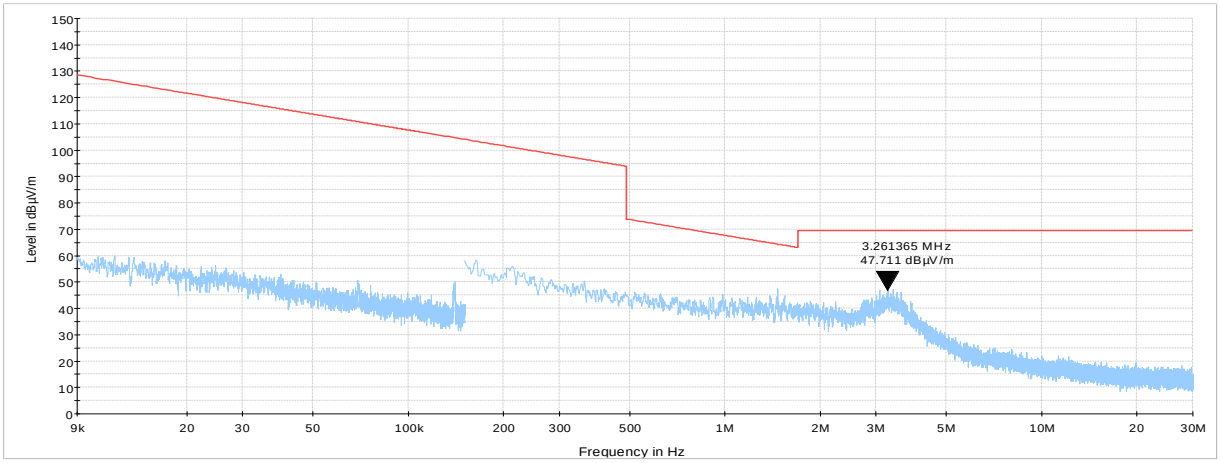
HL 5372	HL 3903	HL 446	HL 5670	HL 5669			

Full description is given in Appendix A.

Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

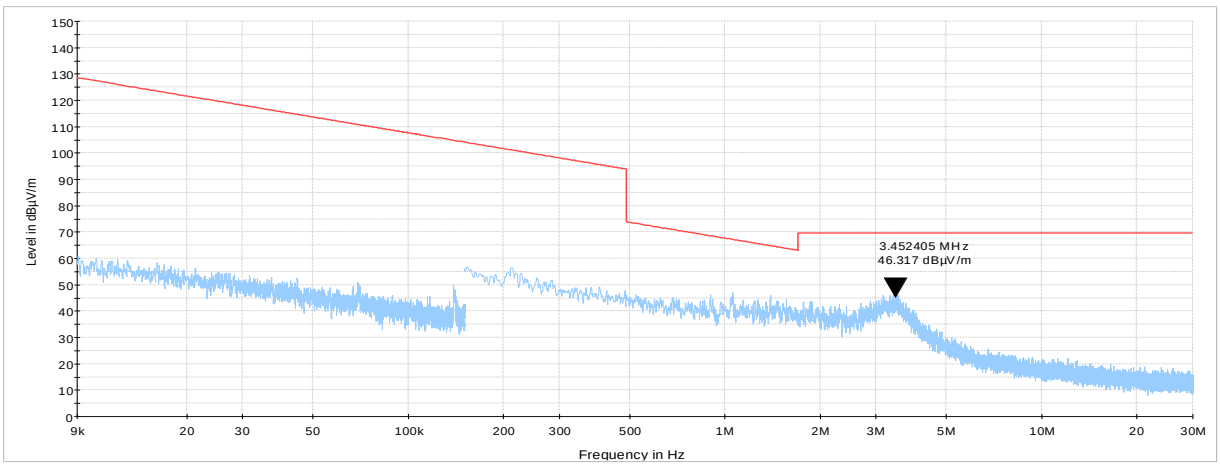
Plot 7.3.1 Radiated emission measurements from 9 KHz to 30 MHz at low frequency

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



Plot 7.3.2 Radiated emission measurements from 9 KHz to 30 MHz at mid frequency

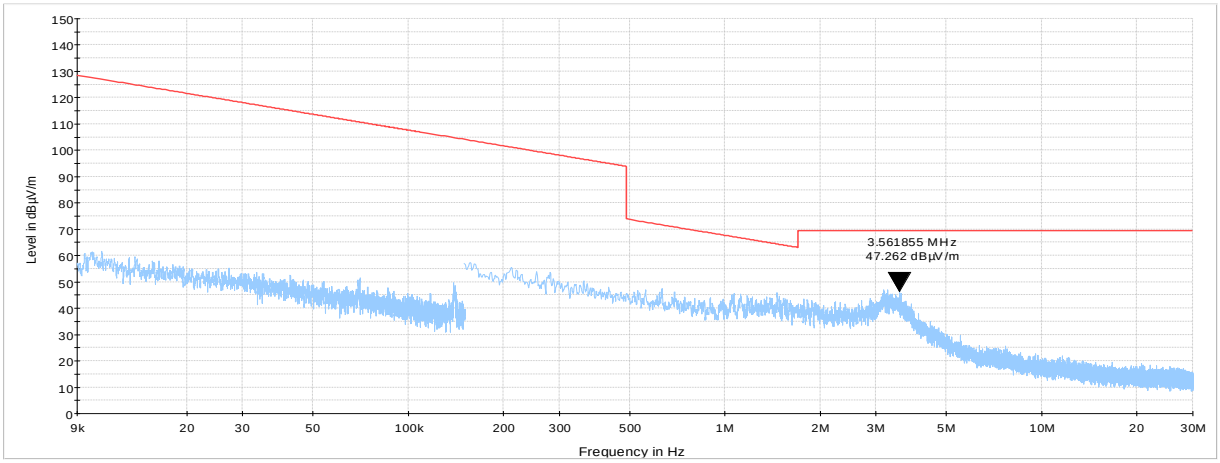
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Typical (Vertical)



Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

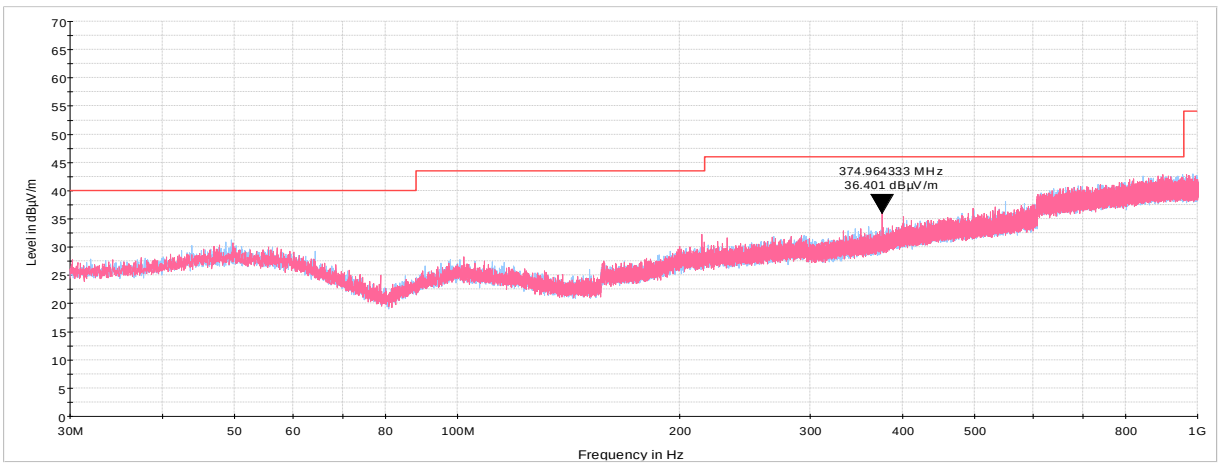
Plot 7.3.3 Radiated emission measurements from 9 KHz to 30 MHz at high frequency

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



Plot 7.3.4 Radiated emission measurements from 30 to 1000 MHz at low frequency

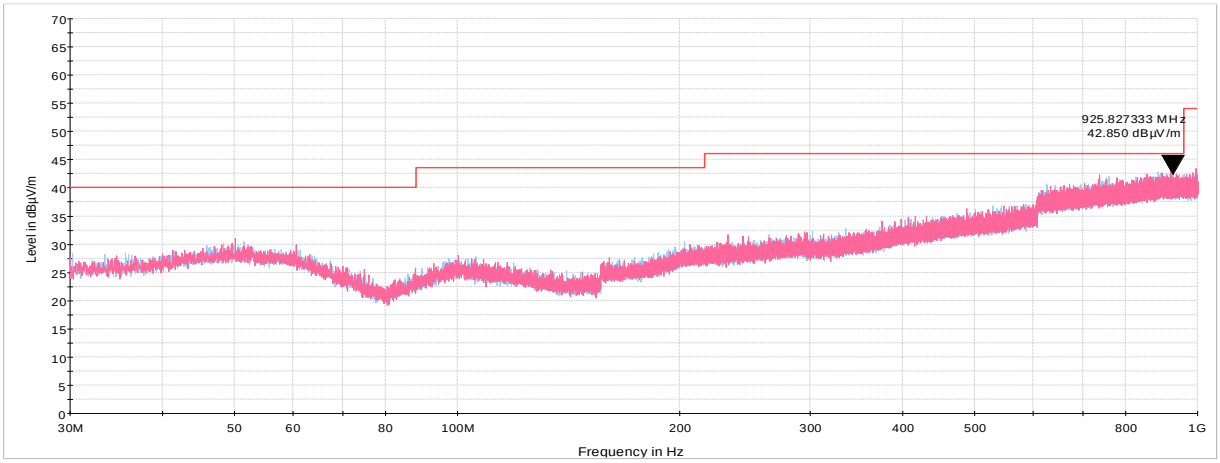
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	Typical (Vertical)



Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

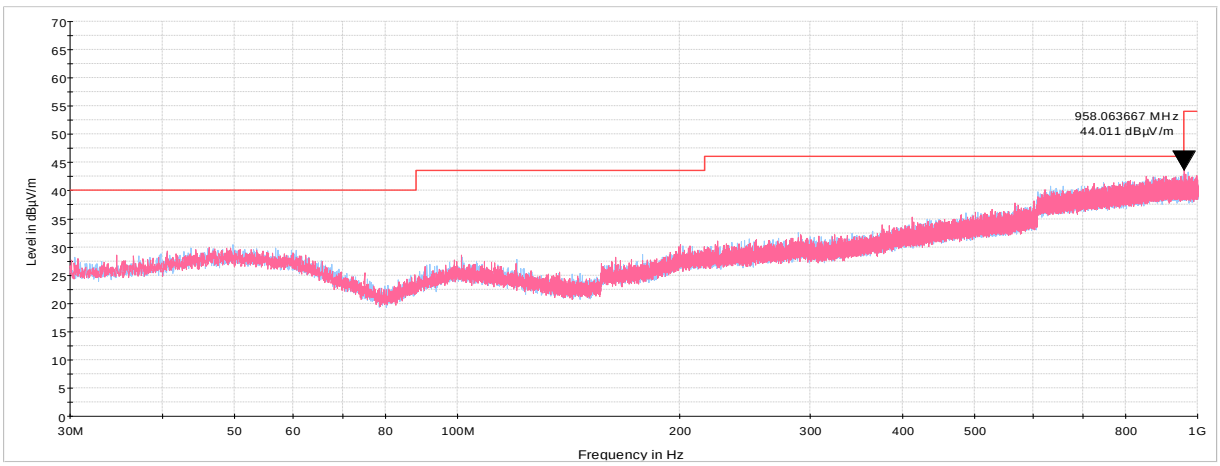
Plot 7.3.5 Radiated emission measurements from 30 to 1000 MHz at mid frequency

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



Plot 7.3.6 Radiated emission measurements from 30 to 1000 MHz at high frequency

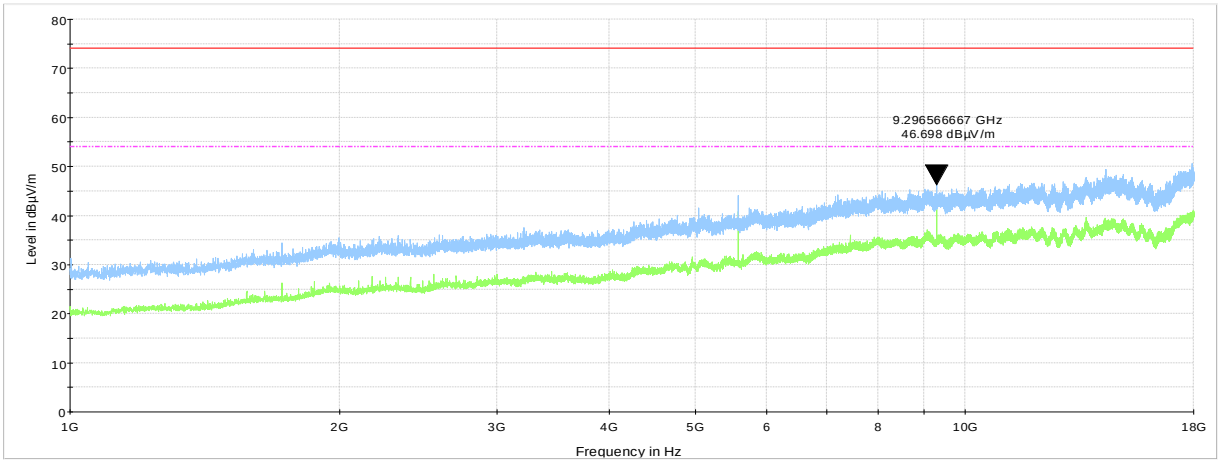
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	Typical (Vertical)



Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

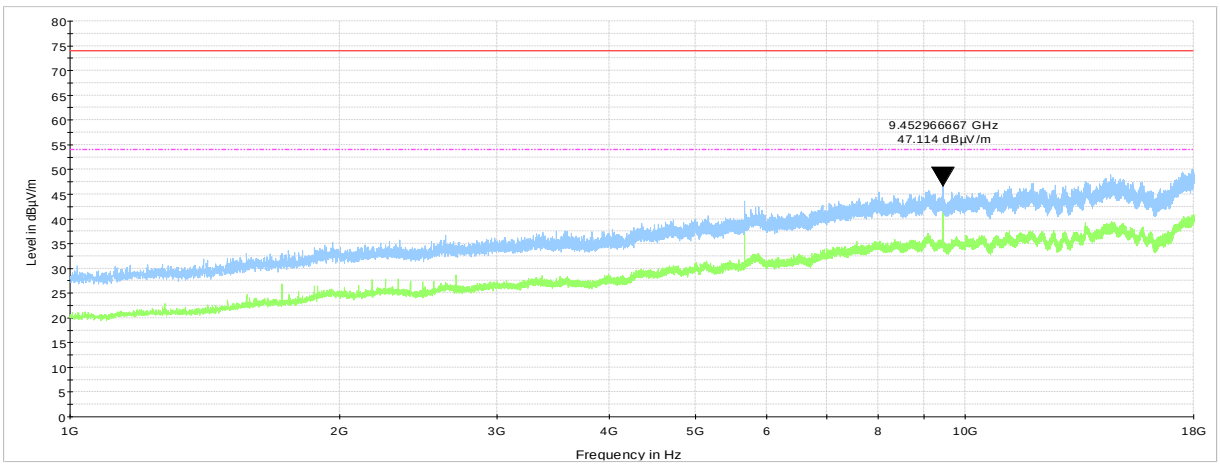
Plot 7.3.7 Radiated emission measurements from 1 to 18 MHz at low frequency

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



Plot 7.3.8 Radiated emission measurements from 1 to 18 MHz at mid frequency

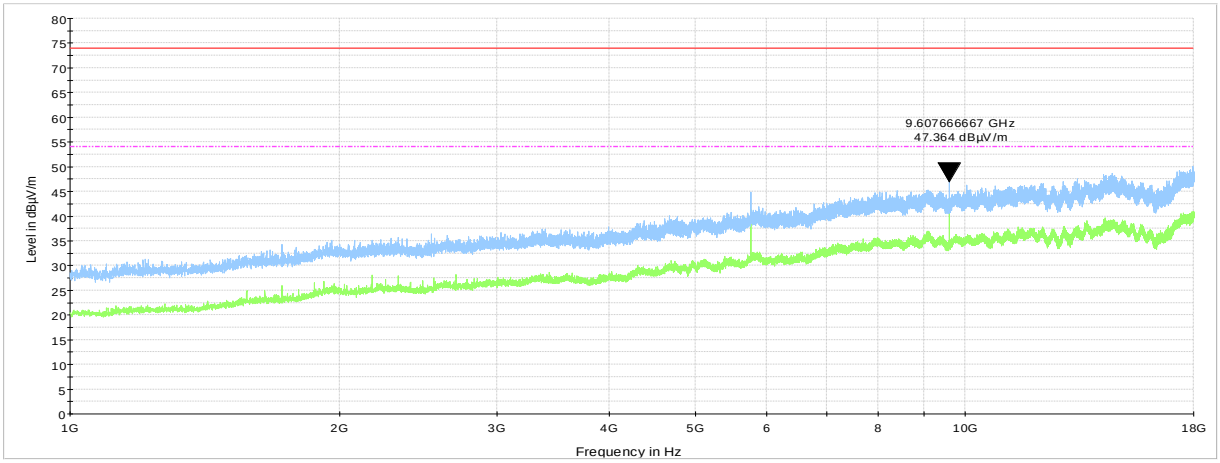
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	Typical (Vertical)



Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

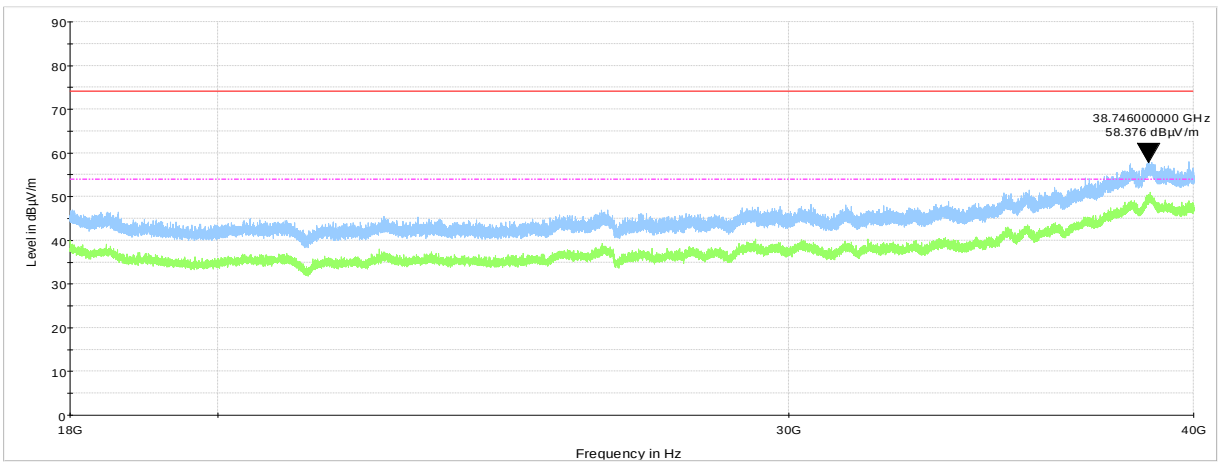
Plot 7.3.9 Radiated emission measurements from 1 to 18 MHz at high frequency

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



Plot 7.3.10 Radiated emission measurements from 18 to 40 GHz at low frequency

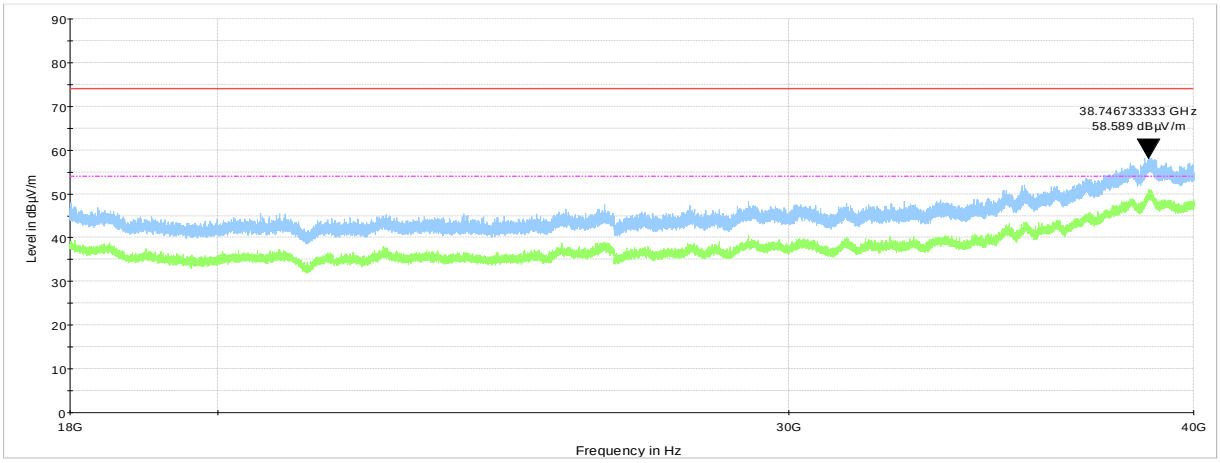
TEST SITE:	Semi anechoic chamber
TEST DISTANCE:	3 m
ANTENNA POLARIZATION:	Vertical and Horizontal
EUT POSITION:	Typical (Vertical)



Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	13-Jan-21		
Temperature: 25 ºC	Relative Humidity: 46 %	Air Pressure: 1010 hPa	Power: 5 VDC
Remarks:			

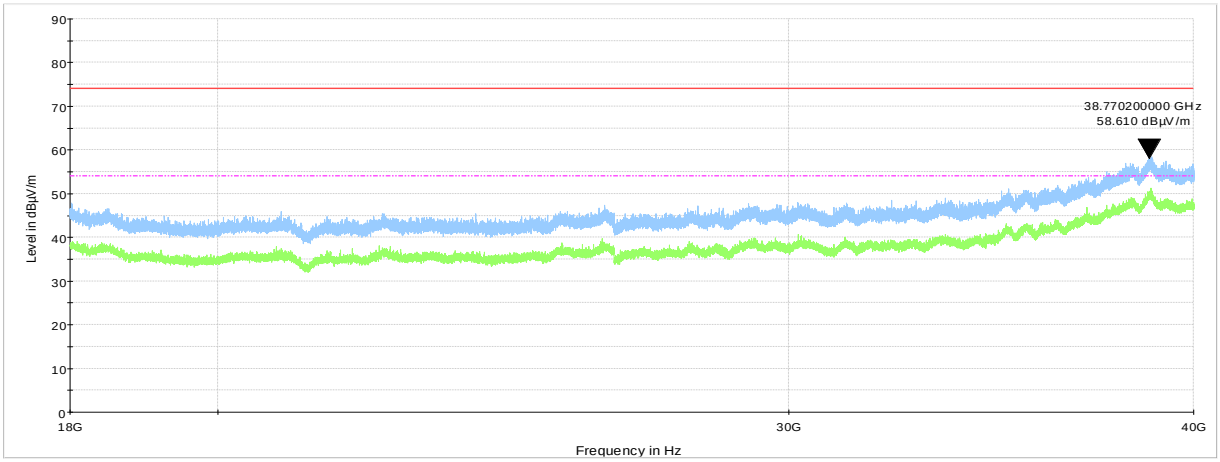
Plot 7.3.11 Radiated emission measurements from 18 to 40 GHz at mid frequency

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



Plot 7.3.12 Radiated emission measurements from 18 to 40 GHz at high frequency

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



Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	18-Jan-21		
Temperature: 24 ºC	Relative Humidity: 48 %	Air Pressure: 1015 hPa	Power: 5 VDC
Remarks:			

7.4 Out of band radiated emmisions below 40GHz at model with Wi-Fi module

7.4.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Radiated spurious emissions limits

Frequency range, MHz	Field strength at 3 m, dB(μV/m)*		
	Within restricted bands		
	Peak	Quasi Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**
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 – 40000	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.

Note: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the third harmonic of the highest fundamental
frequency or to 750 GHz, whichever is lower if the intentional radiator operates at or above 95 GHz.

Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	18-Jan-21		
Temperature: 24 ºC	Relative Humidity: 48 %	Air Pressure: 1015 hPa	Power: 5 VDC
Remarks:			

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

7.4.1.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

7.4.1.2 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.

7.4.1.3 The worst test results (the lowest margins) were recorded in Table 7.3.3 and shown in the associated plots.

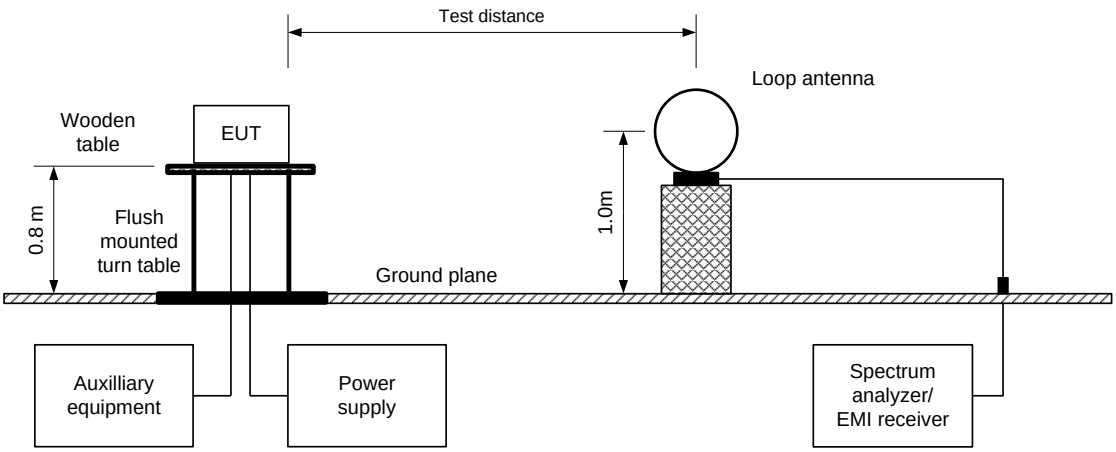
7.4.2 Test procedure for spurious emission field strength measurements above 30 MHz

7.4.2.1 The EUT was set up as shown in Figure 7.2.2, Figure 7.2.3, energized and the performance check was conducted.

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

7.4.2.3 The worst test results (the lowest margins) were recorded in Table 7.3.2 and Table 7.3.3 and shown in the associated plots.

Figure 7.4.1 Setup for spurious emission field strength measurements below 30 MHz



Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	18-Jan-21		
Temperature: 24 ºC	Relative Humidity: 48 %	Air Pressure: 1015 hPa	Power: 5 VDC
Remarks:			

Figure 7.4.2 Setup for spurious emission field strength measurements in 30 – 1000 MHz

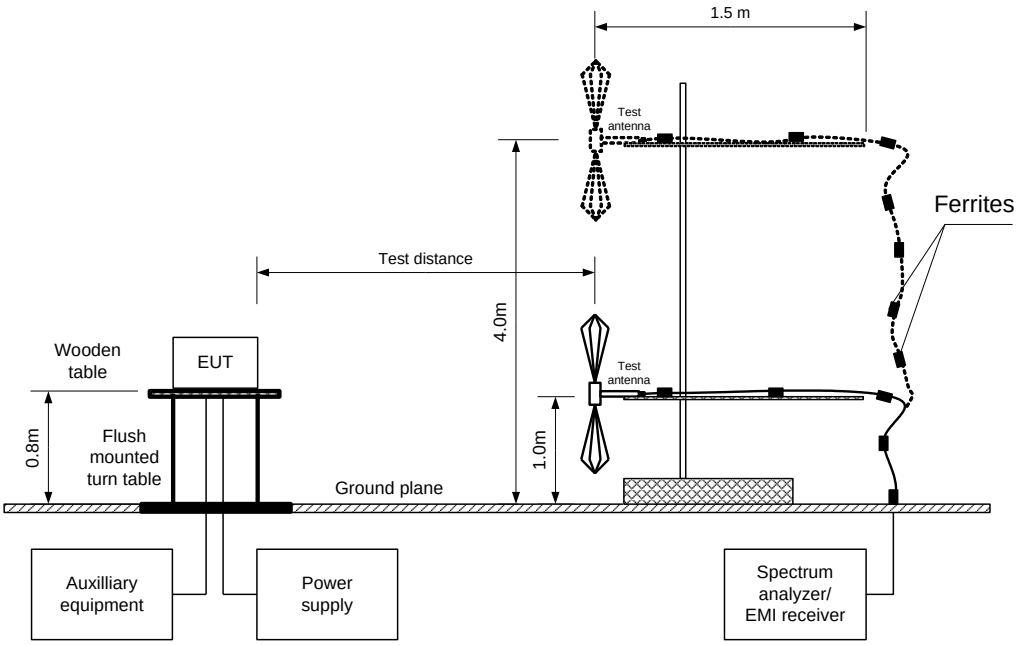
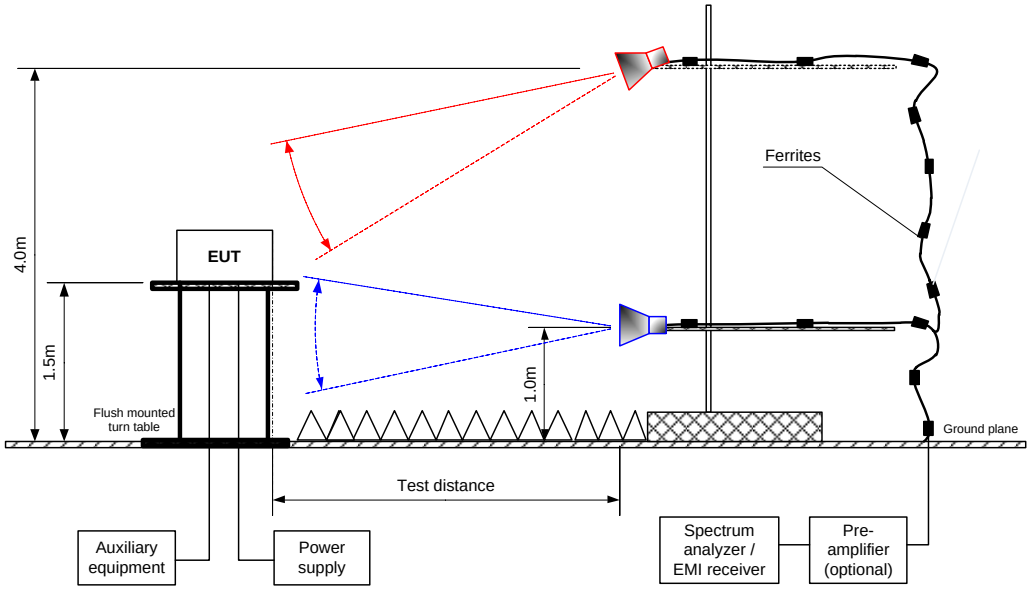


Figure 7.4.3 Setup for spurious emission field strength measurements above1000 MHz



Test specification:	**Section 15.258(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	18-Jan-21		
Temperature: 24 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1015 hPa	**Power:** 5 VDC
Remarks:			

Table 7.4.2 Field strength of spurious emissions at frequencies above 1 GHz

TEST DISTANCE:	3 m
EUT POSITION:	Typical (Vertical)
MODULATION:	CW
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
INVESTIGATED FREQUENCY RANGE:	0.009 - 40000 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1.0 MHz
VIDEO BANDWIDTH:	≥ Resolution bandwidth
TEST ANTENNA TYPE:	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)	Limit, dB(μV/m)	Margin, dB**	
Low frequency 119.000 GHz										
All emission were found 20dB below the limit										Pass
Mid frequency 121.000 GHz										
All emission were found 20dB below the limit										Pass
High frequency 122.980 GHz										
All emission were found 20dB below the limit										Pass

*****- EUT front panel refers to 0 degrees position of turntable.
******- Margin = dB below (negative if above) specification limit.

Reference numbers of test equipment used

HL 5372	HL 3903	HL 4933	HL 5288	HL 5085	HL 4956	HL 5111	HL 5670
HL 5669	HL 4338						

Full description is given in Appendix A.

Test specification:	**Section 15.258(c)(2), Out of band radiated emissions below 40 GHz**		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	18-Jan-21		
Temperature: 24 ºC	**Relative Humidity:** 48 %	**Air Pressure:** 1015 hPa	**Power:** 5 VDC
Remarks:			

Table 7.4.3 Field strength of emissions below 1 GHz

TEST DISTANCE:	3 m
EUT POSITION:	Typical (Vertical)
MODULATION:	CW
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) 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***				
Low frequency 119.000 GHz								
74.997125	31.95	30.08	40.0	-9.92	Vertical	1.72	201	Pass
200.040334	29.82	25.55	43.5	-17.95	Vertical	1.02	355	
266.649332	34.40	31.53	46.0	-14.47	Vertical	2.14	353	
Mid frequency 121.000 GHz								
75.001285	31.84	29.94	40.0	-10.06	Vertical	1.72	212	Pass
200.024334	30.74	27.49	43.5	-16.01	Vertical	1.00	337	
333.355665	37.75	33.23	46.0	-12.77	Vertical	1.32	360	
High frequency 122.980 GHz								
71.983059	26.06	22.86	40.0	-17.14	Vertical	1.72	201	Pass
74.993787	32.51	30.78	40.0	-9.22	Vertical	1.02	212	
199.986332	29.56	26.12	43.5	-17.38	Vertical	1.04	345	
333.351777	38.00	33.44	46.0	-12.56	Vertical	1.41	360	

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

Reference numbers of test equipment used

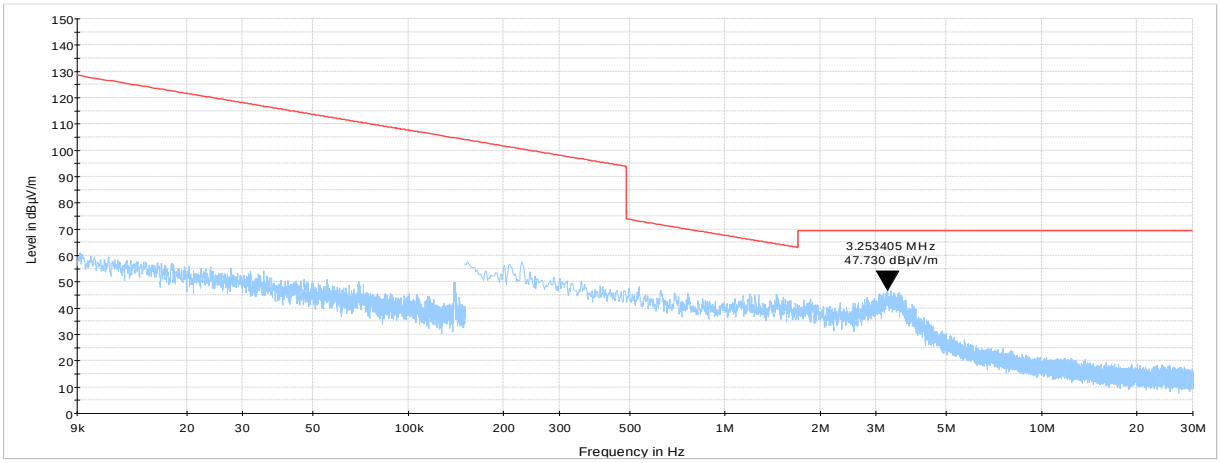
HL 5372	HL 3903	HL 0446	HL 5670	HL 5669			

Full description is given in Appendix A.

Test specification:	Section 15.258(c)(2), Out of band radiated emissions below 40 GHz		
Test procedure:	ANSI C63.10, Section 9.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	18-Jan-21		
Temperature: 24 ºC	Relative Humidity: 48 %	Air Pressure: 1015 hPa	Power: 5 VDC
Remarks:			

Plot 7.4.1 Radiated emission measurements from 9 KHz to 30 MHz at low frequency

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



Plot 7.4.2 Radiated emission measurements from 9 KHz to 30 MHz at mid frequency

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