

# TEST REPORT

ACCORDING TO: FCC CFR 47 Part 15 subpart C, section 15.231 and subpart B,  
RSS-210 issue 10 Annex A, RSS-Gen issue 5, ICES-003 Issue 7:2020

FOR:

**Autonomous Pivot Ltd.**

**Autonomous Pivot Sense**

**Model: Autonomous Pivot rev 1.0**

**FCC ID: 2BLQN-AP2024**

**IC: 33159-AP2024**

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## 1 Applicant information

**Client name:** Autonomous Pivot Ltd.  
**Address:** 281 Nahal Timna, Eshtaol, 9977500, Israel  
**Telephone:** +972-54-2403-615  
**E-mail:** [yair@autonomouspivot.com](mailto:yair@autonomouspivot.com)  
**Contact name:** Mr. Yair Sharf

## 2 Equipment under test attributes

**Product name:** Autonomous Pivot Sense  
**Product type:** Transceiver  
**Model(s):** Autonomous Pivot rev 1.0  
**Serial number:** NA  
**Hardware version:** 1.0  
**Software release:** 1.152.0  
**Receipt date:** 18-Jan-24

## 3 Manufacturer information

**Manufacturer name:** Autonomous Pivot Ltd.  
**Address:** 281 Nahal Timna, Eshtaol, 9977500, Israel  
**Telephone:** +972-54-2403-615  
**E-Mail:** [yair@autonomouspivot.com](mailto:yair@autonomouspivot.com)  
**Contact name:** Mr. Yair Sharf

## 4 Test details




**Project ID:** 52937  
**Location:** Hermon Laboratories Ltd. 66 HaTachana str., P.O. Box 23, Binyamina 3055001, Israel  
**Test started:** 30-Jan-24  
**Test completed:** 15-Feb-24  
**Test specification(s):** FCC 47CFR part 15, subpart C, §15.231 and subpart B;  
RSS-210 issue 10 Annex A, RSS-Gen issue 5, ICES-003 Issue 7:2020

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
FCC Part 15, Section 231(a) / RSS-210, Section A1.1, Periodic operation requirements	
FCC Part 15, Section 231(a) / RSS-210, Section A1.2, Field strength of emissions	Pass
FCC Part 15, Section 231(c) / RSS-210, Section A1.3, Occupied bandwidth	Pass
FCC Part 15, Section 207 / RSS-Gen, Section 8.8, Conducted emission	Not required
FCC Part 15, Section 203 / RSS-Gen, Section 8.3, Antenna requirements	Pass
<b>Unintentional emissions</b>	
FCC Part 15, Section 107 / ICES-003, Section 6.1 class B, Conducted emission at AC power port	Not required
FCC Part 15, Section 109 / RSS-Gen, Section 7.1.2/ ICES-003, Section 6.2 class B, Radiated emission	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.

The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
<b>Tested by:</b>	Mr. S. Sugatov, test engineer, EMC & Radio	30-Jan-24 – 15-Feb-24	
<b>Reviewed by:</b>	Mrs. S. Peysahov Sheynin, certification specialist, EMC & Radio	30-Mar-24	
<b>Approved by:</b>	Mr. M. Nikishin, group leader, EMC & Radio	22-Oct-24	

## 6 EUT description

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

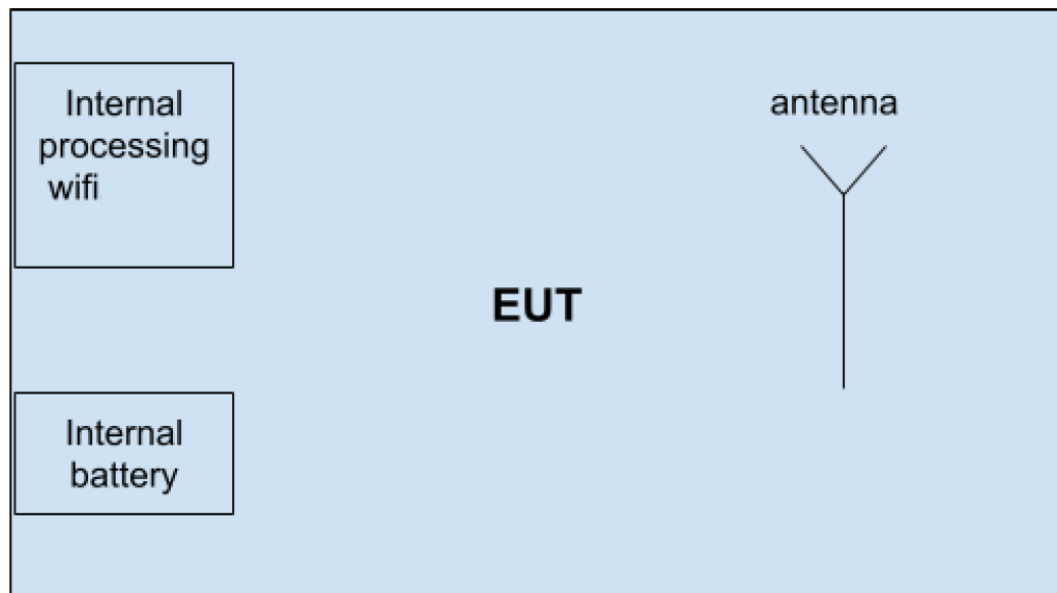
### 6.1 General information

The EUT is a Ground Penetrating Radar (GPR) used as a part of an agriculture technology system mounted on an irrigation pivot, operated by farmers at the farmers will. It is made out of a Ground Penetrating Radar (GPR), communication unit with cameras and GPS receiver, rain sensor and a pressure sensor. The communication unit collect the information from pressure sensor (wired connection), from temperature sensor over LoRa protocol, get and upload data from cloud over cellular modem and communicates with GPR over WiFi technology.

The system collects weather data and forecast from the cloud and operates GPR on demand based on pivot movement, events detected by the cameras, soil type, crop type and stage of growth, soil water estimation, weather events to identify if irrigation required. Images and local soil water content estimation trigger ad hoc GPR measurements based on what is currently seen in the field. Some data is generally determining measurement frequency such as soil type, crop type and stage of growth.

Once GPR is activated it performs RF scanning with stepped CW transmission over 325-1200MHz (except for the frequencies falling within restricted bands FCC 15.205) while all the transmissions are terminated within 5 seconds. GPR transmits from stackable array of 4 log periodic antennas encapsulated in a single radome (photograph is attached) mounted 75cm above the ground facing downward (Pointing the emission beam downward).

### 6.2 Test configuration



### 6.3 Changes made in EUT

No changes were implemented in the EUT during testing.

## 6.4 Transmitter characteristics

<b>Type of equipment</b>					
X	Stand-alone (Equipment with or without its own control provisions)				
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
	Plug-in card (Equipment intended for a variety of host systems)				
<b>Operational frequency bands</b>		325 MHz – 1200 MHz			
<b>Operating frequencies</b>		336 MHz, 646 MHz, 956 MHz			
<b>Maximum rated output power</b>		At transmitter 50 $\Omega$ RF output connector			
		Field strength at 3 m distance @ 336 MHz		79.10 dB( $\mu$ V/m) – peak 66.00 dB( $\mu$ V/m) -average	
		Field strength at 3 m distance @ 646 MHz		79.36 dB( $\mu$ V/m) – peak 66.26 dB( $\mu$ V/m) -average	
		Field strength at 3 m distance @ 956 MHz		75.62 dB( $\mu$ V/m) – peak 62.52 dB( $\mu$ V/m) -average	
<b>Is transmitter output power variable?</b>		X	No		
			Yes	continuous variable	
				stepped variable with stepsize	dB
		minimum RF power		dBm	
		maximum RF power		dBm	
<b>Antenna connection</b>					
unique coupling	standard connector	X	integral	<input checked="" type="checkbox"/> with temporary RF connector <input checked="" type="checkbox"/> without temporary RF connector	
<b>Antenna/s technical characteristics</b>					
Type	Manufacturer	Model number		Gain	
Integral	Autonomous Pivot LTD	V2.0		5.2 dBi	
<b>Transmitter aggregate data rate/s</b>		NA			
<b>Type of modulation</b>		CW			
<b>Modulating test signal (baseband)</b>		NA			
<b>Transmitter power source</b>					
	Battery	<b>Nominal rated voltage</b>		Battery type	
	DC	<b>Nominal rated voltage</b>	VDC		
X	AC mains	<b>Nominal rated voltage</b>	110 VAC	Frequency	50 Hz
<b>Common power source for transmitter and receiver</b>			X	yes	no



<b>Test specification:</b>		<b>FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements</b>	
<b>Test procedure:</b>		Supplier declaration	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b>		04-Feb-24	
<b>Temperature:</b> 25 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1019 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

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

### 7.1 Periodic operation requirements

#### 7.1.1 General

The EUT was verified for compliance with periodic operation requirements listed below:

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- A manually operated transmitter shall employ switch that will automatically deactivate the transmitter within not more than 5 seconds of being released;
- A transmitter activated automatically shall cease transmission within 5 seconds after activation;

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

#### 7.1.2 Test procedure for transmitter shut down test

7.1.2.1 The EUT was set up as shown in Figure 7.1.1.

7.1.2.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.2.3 The transmitter was activated either manually or automatically. Once manually operated transmitter was activated, the switch was immediately released.

7.1.2.4 The transmission time was captured and shown in Plot 7.1.2, Plot 7.1.3.

#### 7.1.3 Test procedure for measurements of transmission duration and burst period

7.1.3.1 The EUT was set up as shown in Figure 7.1.1.

7.1.3.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.3.3 The transmission time was captured and shown in, Plot 7.1.5, Plot 7.1.6 and Plot 7.1.7



<b>Test specification:</b>		<b>FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements</b>	
<b>Test procedure:</b>		Supplier declaration	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b>		04-Feb-24	
<b>Temperature:</b> 25 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1019 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

Figure 7.1.1 Setup for transmitter shut down test







Requirement	Rationale	Verdict
Continuous transmissions are not permitted	Supplier declaration*	Comply
A manually operated transmitter shall be deactivated within not more than 5 seconds of switch being released	NA	Comply
Transmitter activated automatically shall cease transmission within 5 seconds	Plot 7.1.1, Plot 7.1.2, Plot 7.1.3, Plot 7.1.4	Comply
Periodic transmissions at regular predetermined intervals are not permitted	Supplier declaration	Comply
Total duration of polling or supervision transmissions shall not exceed 2 seconds per hour	NA	Comply
Transmission of set-up information for security systems may exceed the transmission duration limits of 5 seconds, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.	NA	Comply

The screenshot shows the Keysight software interface. At the top, various settings are displayed: Input 2: 50 Ω, Atten: 10 dB, PNO: Fast, Cal: Off, Avg Type: Log Power, Trig: Video, Trig Delay: -5.100 ms. The spectrum plot shows a signal at 23.30 MHz with a peak level of -4.71 dBm. The reference level is set to -10.00 dBm. The plot shows a noisy baseline with a distinct peak at 23.30 MHz. The x-axis is labeled 'Center 336.000000 MHz' and the y-axis is labeled 'Scale/Div 10 dB'. The bottom status bar shows 'Span 0 Hz', 'Res BW 8 MHz', and 'Sweep 50.0 ms (1001 pts)'.



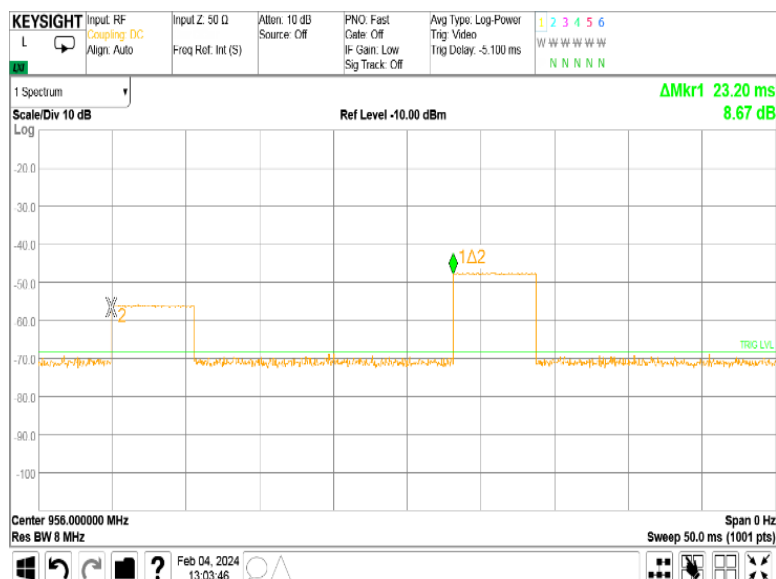
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Test specification:		FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements	
Test procedure:		Supplier declaration	
Test mode:		Verdict: PASS	
Date(s):			
04-Feb-24			
Temperature: 25 °C	Relative Humidity: 47 %	Air Pressure: 1019 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.1.2 Transmission period at 646 MHz



Plot 7.1.3 Transmission period at 956 MHz





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Date of Issue: 27-Oct-24

<b>Test specification:</b> FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements			
<b>Test procedure:</b> Supplier declaration			
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	04-Feb-24		
<b>Temperature:</b> 25 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1019 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

Plot 7.1.4 Transmission period over the burst

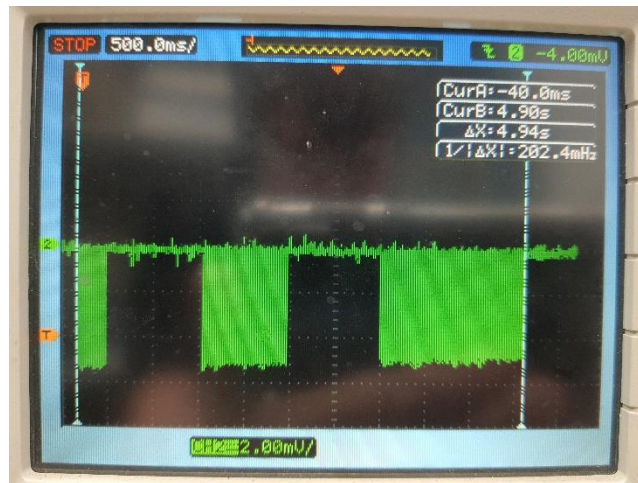


Table 7.1.2 Transmission period over the burst

Single Channel Transmission period, ms	Number of channels within the band*	Total Transmission Time over the burst, s**	Transmission period over the burst, s
23.3	122	2.84	4.94

\*Supplier Declaration provided in Appendix G

\*\* Total Transmission Time over the burst = Single Channel Transmission period x Number of channels

**Reference numbers of test equipment used**

HL 2227	HL 3901	HL 4645	HL 5376	HL 5588	HL 5933	HL 6105	
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Full description is given in Appendix A.



<b>Test specification:</b> FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
<b>Test procedure:</b> ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 14-Feb-24 - 15-Feb-24			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 56 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

## 7.2 Field strength of emissions

### 7.2.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

**Table 7.2.1 Radiated fundamental emission limits**

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)	
	Peak	Average
336	96.8	76.8
646	102.0	82.0
956	102.0	82.0

**Table 7.2.2 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**		
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		

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

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

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

**7.2.2.3** The worst test results (the lowest margins) recorded in Table 7.2.3, Table 7.2.4 Table 7.2.6 and shown in the associated plots.

### 7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz

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

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

**7.2.3.3** The worst test results (the lowest margins) recorded in Table 7.2.3 and Table 7.2.4 and shown in the associated plots.



<b>Test specification:</b> FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
<b>Test procedure:</b> ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 14-Feb-24 - 15-Feb-24			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 56 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz

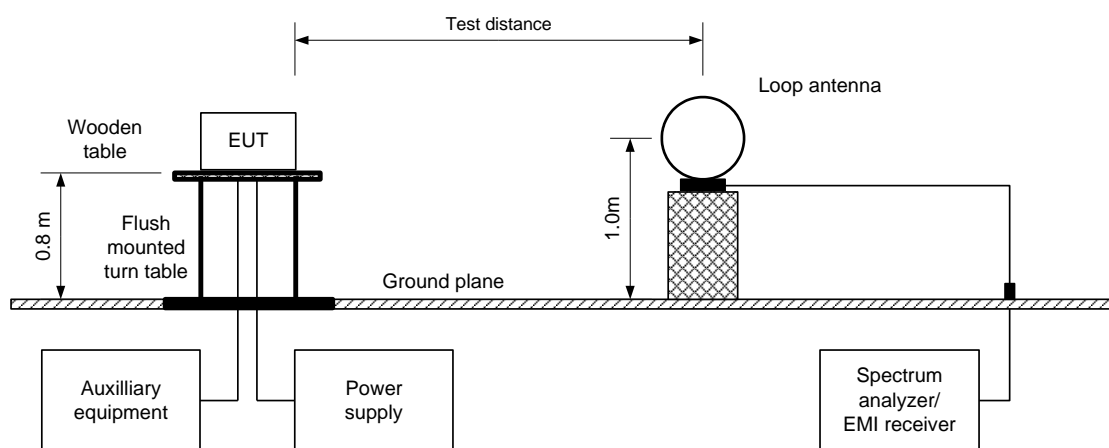
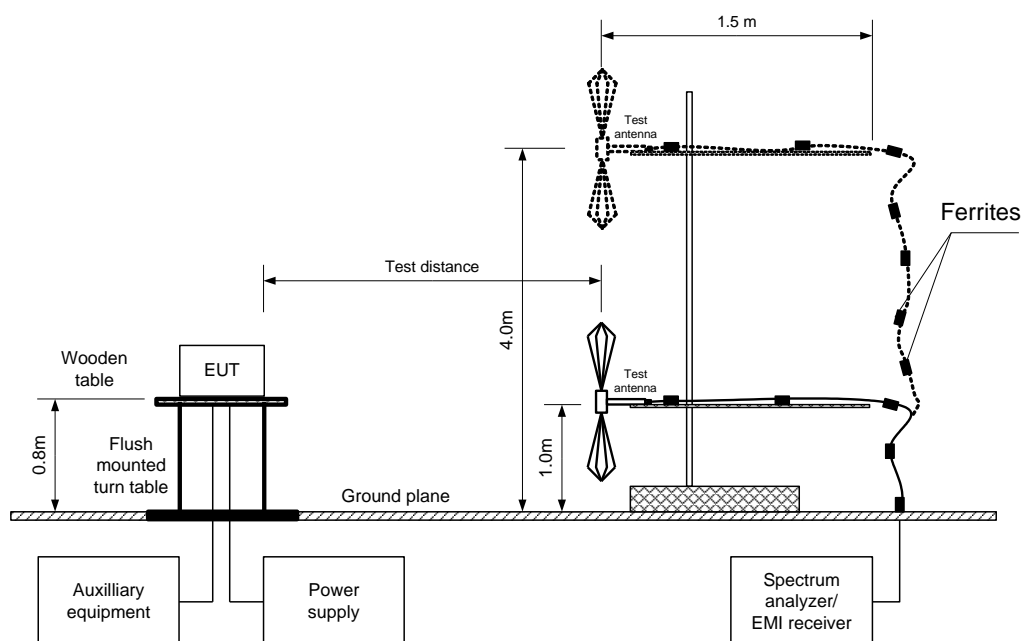
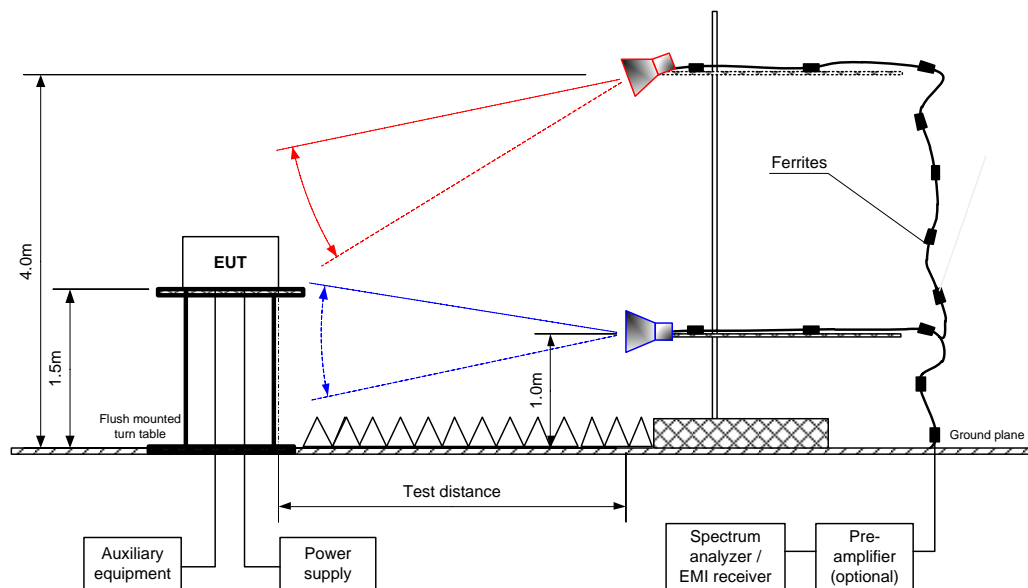


Figure 7.2.2 Setup for spurious emission field strength measurements in 30 -1000 MHz



<b>Test specification:</b>		<b>FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions</b>	
<b>Test procedure:</b>		ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>			
14-Feb-24 - 15-Feb-24			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 56 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

**Figure 7.2.3 Setup for spurious emission field strength measurements above 1000 MHz**





<b>Test specification:</b> FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
<b>Test procedure:</b> ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 14-Feb-24 - 15-Feb-24			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 56 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

**Table 7.2.3 Field strength of fundamental emission, spurious emissions outside restricted bands below 1 GHz and within restricted bands at frequencies above 1 GHz**

TEST DISTANCE: 3 m  
EUT POSITION: Typical  
INVESTIGATED FREQUENCY RANGE: 0.009 – 10000 MHz  
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 at low frequency 336 MHz											
336.00	V	1.00	-60	79.10	96.80	-17.70	79.10	54.03	76.80	-22.77	Pass
336.00	H	1.80	180	80.16	96.80	-16.64	80.16	55.09	76.80	-21.71	
Spurious emissions at 336 MHz											
36.990	V	1.62	41	40.77	76.80	-36.03	36.96	11.89	56.80	-44.91	Pass
180.301	H	1.02	156	37.16	76.80	-39.64	32.84	7.77	56.80	-49.03	
381.865	V	1.02	-137	39.12	76.80	-37.68	28.21	3.14	56.80	-53.66	
450.016	V	1.02	-120	36.36	76.80	-40.44	31.08	6.01	56.80	-50.79	
550.004	H	1.04	57	37.82	76.80	-38.98	32.94	7.87	56.80	-48.93	
1008.000	H	2.81	-144	37.06	74.0	-36.94	37.06	11.99	54.0	-42.01	
1680.000	V	3.53	52	49.40	74.0	-34.74	49.40	24.33	54.0	-29.67	
2352.000	H	1.91	-180	48.50	74.0	-35.88	48.50	23.43	54.0	-30.57	
Fundamental emission at mid frequency 646 MHz											
646.00	V	1.10	-110	73.69	102.00	-28.31	73.69	48.62	82.00	-33.38	Pass
646.00	H	1.70	-120	79.36	102.00	-22.64	79.36	54.29	82.00	-27.71	
Spurious emissions at 646 MHz											
38.728	V	1.00	-22	41.57	82.00	-40.43	36.96	11.89	62.00	-50.11	Pass
179.720	H	1.00	157	36.35	82.00	-45.65	31.99	6.92	62.00	-55.08	
350.012	H	1.81	-22	35.57	82.00	-46.43	30.68	5.61	62.00	-56.39	
382.844	V	1.00	-137	37.90	82.00	-44.10	28.29	3.22	62.00	-58.78	
450.004	V	1.00	-120	36.12	82.00	-45.88	31.49	6.42	62.00	-55.58	
1938.000	H	4.00	-180	58.10	82.00	-23.90	58.10	33.03	62.00	-28.97	



<b>Test specification:</b> FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
<b>Test procedure:</b> ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 14-Feb-24 - 15-Feb-24			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 56 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

**Table 7.2.4 Field strength of fundamental emission, spurious emissions outside restricted bands below 1 GHz and within restricted bands at frequencies above 1 GHz (continuation)**

TEST DISTANCE: 3 m  
EUT POSITION: Typical  
INVESTIGATED FREQUENCY RANGE: 0.009 – 10000 MHz  
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 at high frequency 956 MHz											
956.00	V	1.00	80	70.23	102.00	-31.77	70.23	45.16	82.00	-36.84	Pass
956.00	H	1.70	-115	75.62	102.00	-26.38	75.62	50.55	82.00	-31.45	
Spurious emissions at 956 MHz											
39.309	V	1.43	-21	40.40	82.00	-41.60	36.61	11.54	62.00	-50.46	Pass
182.641	H	1.02	156	37.32	82.00	-44.68	32.98	7.91	62.00	-54.09	
350.003	V	1.02	-100	36.36	82.00	-45.64	31.09	6.02	62.00	-55.98	
381.886	V	1.02	142	35.24	82.00	-46.76	26.00	0.93	62.00	-61.07	
450.024	V	1.02	29	35.63	82.00	-46.37	30.59	5.52	62.00	-56.48	
550.006	H	1.02	57	37.59	82.00	-44.41	32.73	7.66	62.00	-54.34	
1912.000	H	2.45	-61	51.70	82.00	-30.30	51.70	26.63	62.00	-35.37	
2868.000	H	1.55	-51	60.50	74.00	-13.50	60.50	35.43	54.00	-18.57	

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

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

\*\*\* In the frequency range 30-960 MHz test results including the ground reflection factor of 4.7 dB according to ANSI C63.10 sections 6.11 and 10.2.2.

**Table 7.2.5 Average factor calculation**

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Number pulse during 100 msec	Duration, ms	Period, ms		
5.58	1	NA	NA	NA	-25.07

\*- 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 3903	HL 4015	HL 4933	HL 5288	HL 5902	HL 7585	HL 3440
HL 5112	HL 4956						

Full description is given in Appendix A.





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<b>Test specification:</b> FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
<b>Test procedure:</b> ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 14-Feb-24 - 15-Feb-24			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 56 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

Table 7.2.6 Field strength of emissions below 1 GHz within restricted bands

TEST DISTANCE: 3 m  
EUT POSITION: Typical  
INVESTIGATED FREQUENCY RANGE: 0.009 – 10000 MHz  
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)

Double ridged guide (above 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*					
Spurious emissions at 336 MHz									
130.08	41.73	38.52	43.5	-4.98	Vertical	1.00	41	Pass	
169.37	32.36	27.86	43.5	-15.64	Vertical	2.00	155		
Spurious emissions at 646 MHz									
127.15	38.52	36.03	43.5	-7.47	Vertical	1.00	108		
Spurious emissions at 956 MHz									
128.84	38.01	34.92	43.5	-8.58	Vertical	1.00	73		

\*- Margin = Measured emission - specification limit.

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

\*\*\* In the frequency range 30-960 MHz test results including the ground reflection factor of 4.7 dB according to ANSI C63.10 sections 6.11 and 10.2.2.



<b>Test specification:</b> FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
<b>Test procedure:</b> ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 14-Feb-24 - 15-Feb-24			
<b>Temperature:</b> 23 °C	<b>Relative Humidity:</b> 56 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

Table 7.2.7 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 7.2.8 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



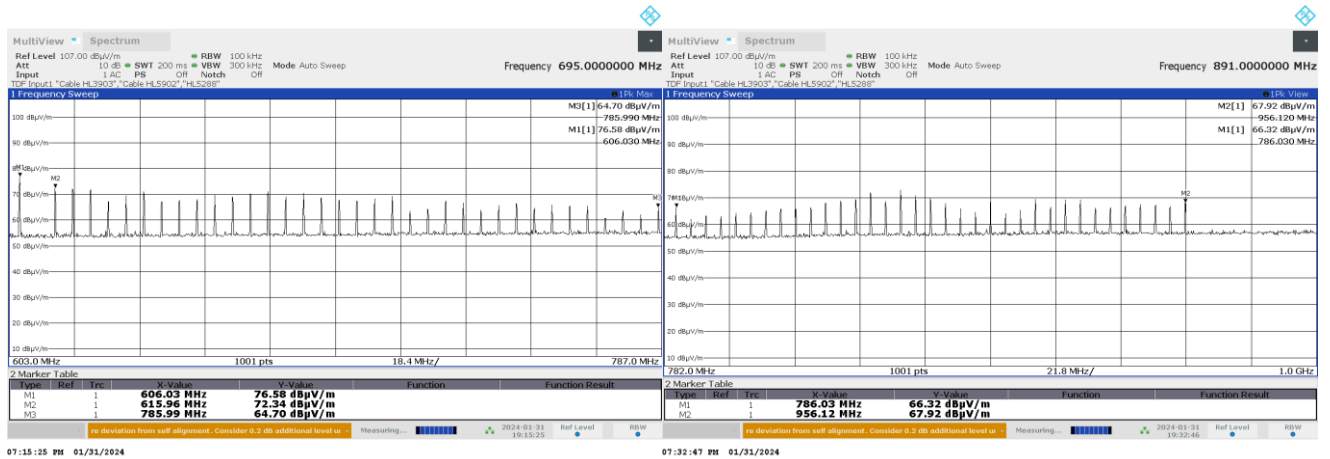
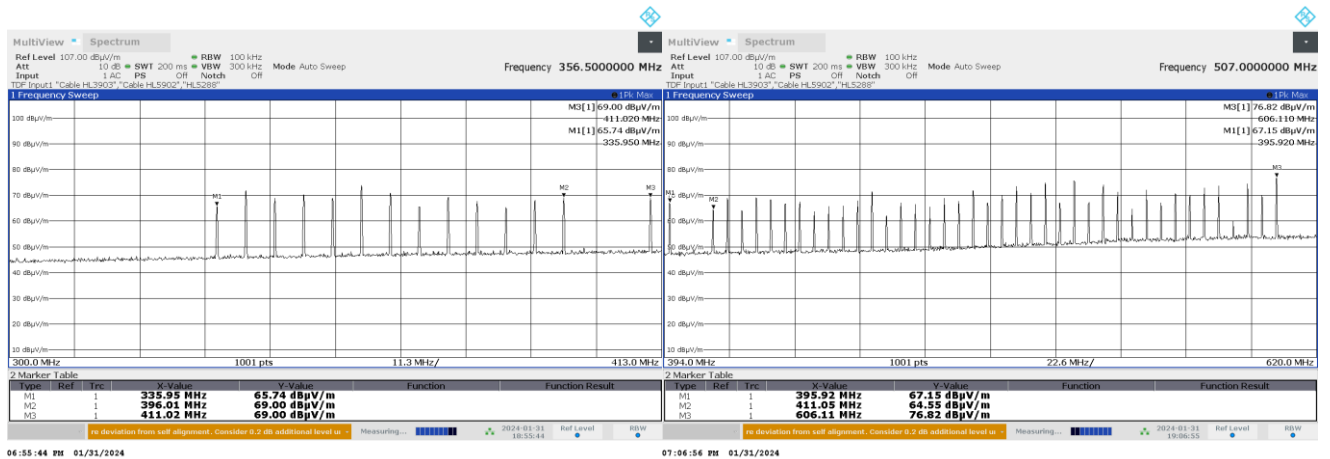
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Report ID: AUTRAD\_FCC.52937.docx

Date of Issue: 27-Oct-24

Test specification:		FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
Test procedure:		ANSI C63.4, Section 13.1.4			
Test mode:		Compliance		Verdict: PASS	
Date(s):		14-Feb-24 - 15-Feb-24			
Temperature: 23 °C		Relative Humidity: 56 %		Air Pressure: 1012 hPa	
Power: 110 VAC, 50 Hz		Remarks:			

Plot 7.2.1 RF scanning of fundamental frequencies (except for the frequencies falling within restricted bands FCC 15.205)



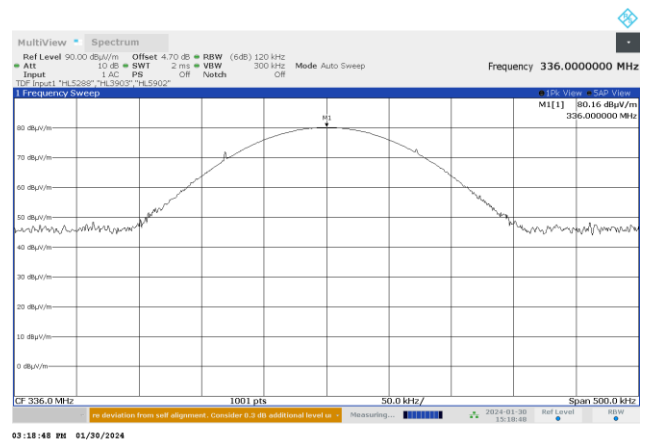
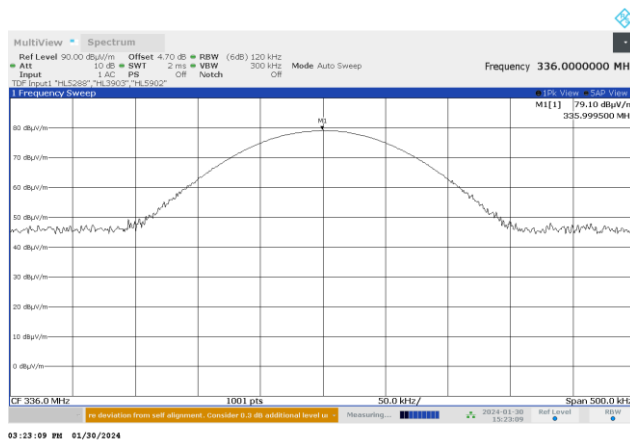


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Test specification:		FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions	
Test procedure:		ANSI C63.4, Section 13.1.4	
Test mode:		Verdict: PASS	
Date(s):			
14-Feb-24 - 15-Feb-24			
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

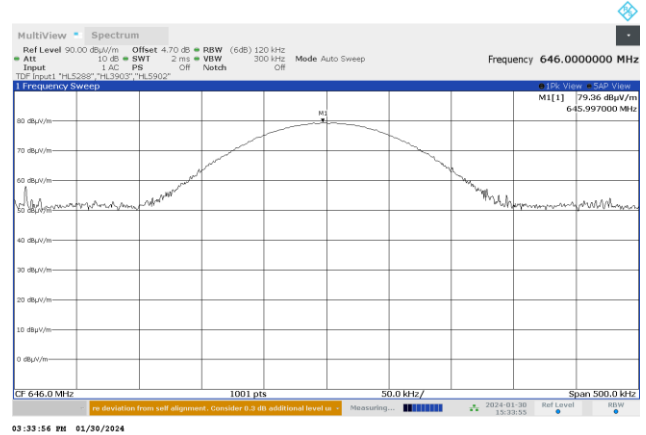
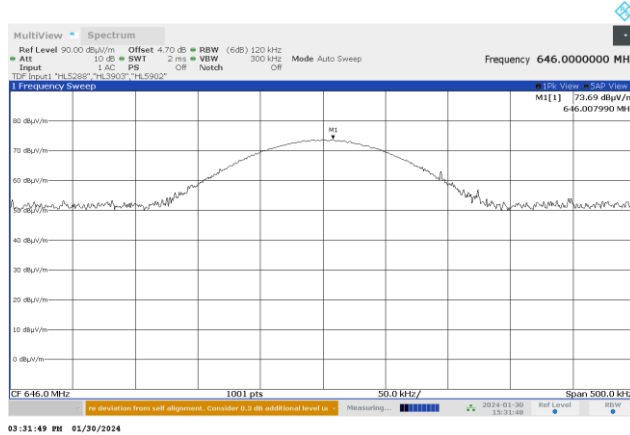
Plot 7.2.2 Radiated emission measurements at the fundamental frequency 336 MHz

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



Plot 7.2.3 Radiated emission measurements at the fundamental frequency 646 MHz

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



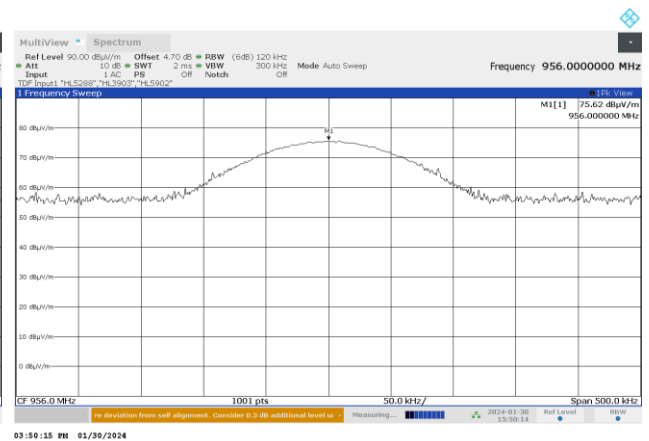
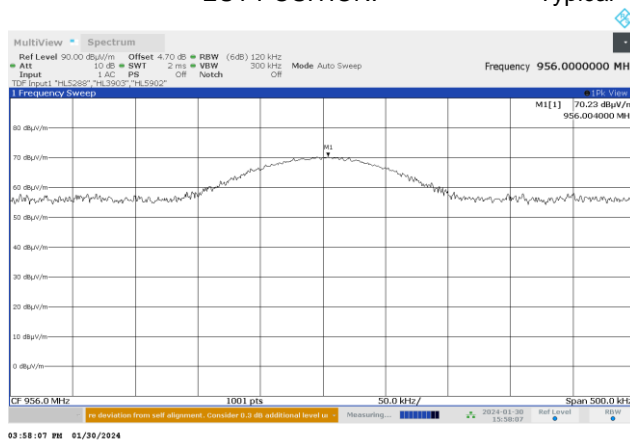


HERMON LABORATORIES

Test specification: FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
Test procedure: ANSI C63.4, Section 13.1.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 14-Feb-24 - 15-Feb-24			
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

#### Plot 7.2.4 Radiated emission measurements at the fundamental frequency 956 MHz

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

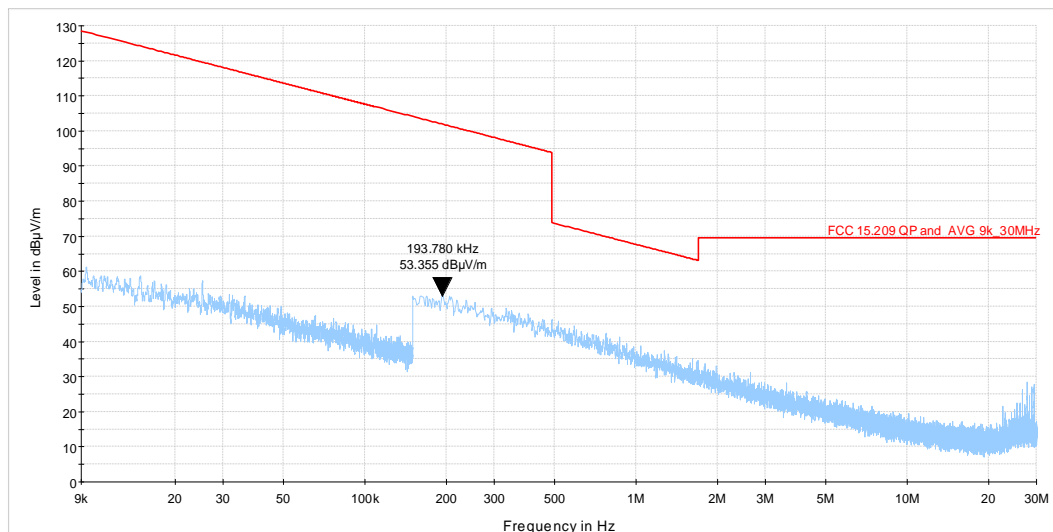




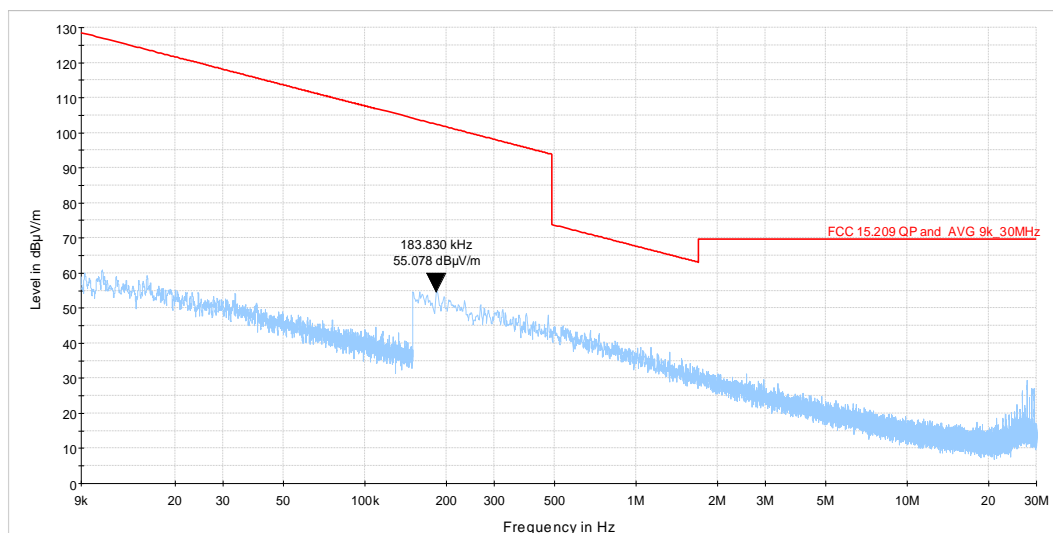
Test specification:		FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions	
Test procedure:		ANSI C63.4, Section 13.1.4	
Test mode:		Verdict: PASS	
Date(s):			
14-Feb-24 - 15-Feb-24			
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.2.5 Radiated emission measurements from 0.09 to 30 MHz at the fundamental frequency 336 MHz

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



Plot 7.2.6 Radiated emission measurements from 0.09 to 30 MHz at the fundamental frequency 646 MHz

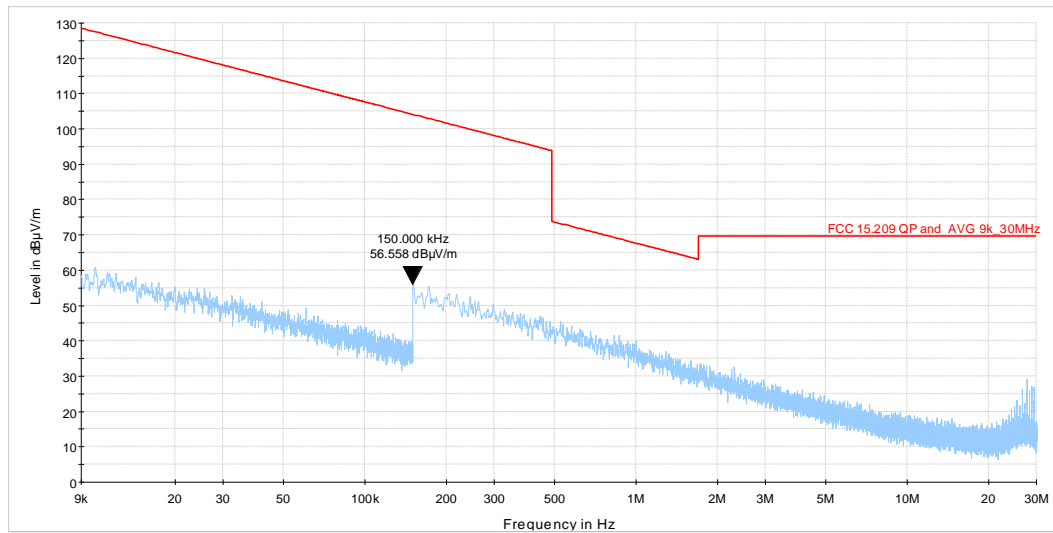




HERMON LABORATORIES

Test specification:		FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions	
Test procedure:		ANSI C63.4, Section 13.1.4	
Test mode:		Verdict: PASS	
Date(s):			
14-Feb-24 - 15-Feb-24			
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.2.7 Radiated emission measurements from 0.09 to 30 MHz at the fundamental frequency 956 MHz



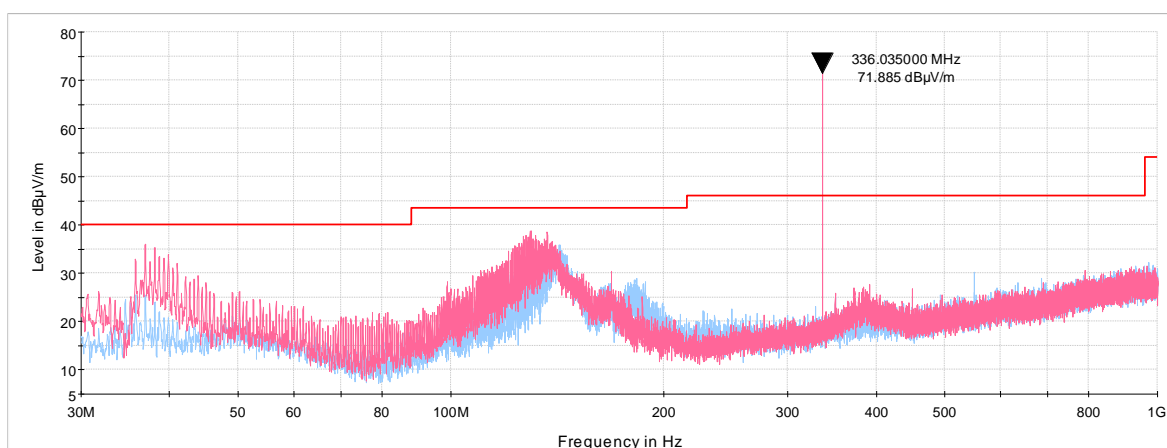


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Test specification: FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
Test procedure: ANSI C63.4, Section 13.1.4		Verdict: PASS	
Test mode: Compliance			
Date(s): 14-Feb-24 - 15-Feb-24			
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

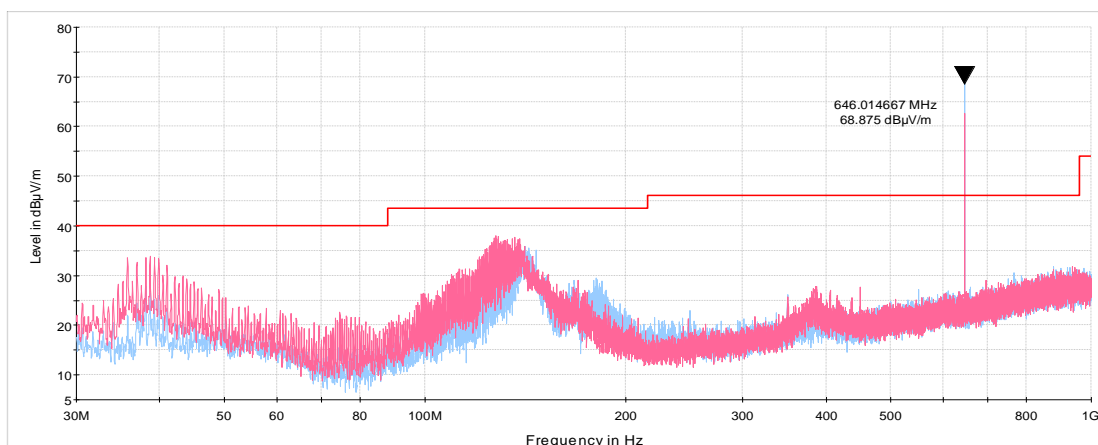
Plot 7.2.8 Radiated emission measurements from 30 to 1000 MHz at the fundamental frequency 336 MHz

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



Plot 7.2.9 Radiated emission measurements from 30 to 1000 MHz at the fundamental frequency 646 MHz

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







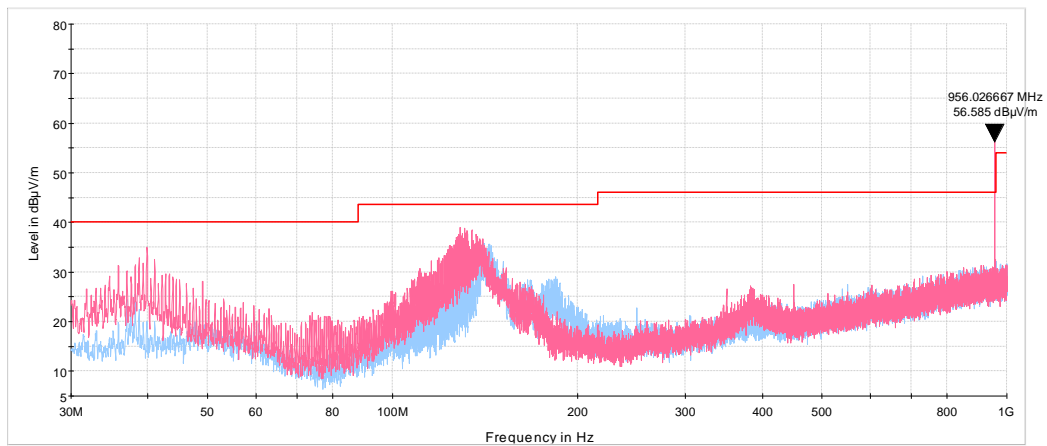
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Report ID: AUTRAD\_FCC.52937.docx  
Date of Issue: 27-Oct-24

Test specification:		FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions	
Test procedure:		ANSI C63.4, Section 13.1.4	
Test mode:		Verdict: PASS	
Date(s):			
14-Feb-24 - 15-Feb-24			
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

**Plot 7.2.10 Radiated emission measurements from 30 to 1000 MHz at the fundamental frequency 956 MHz**

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



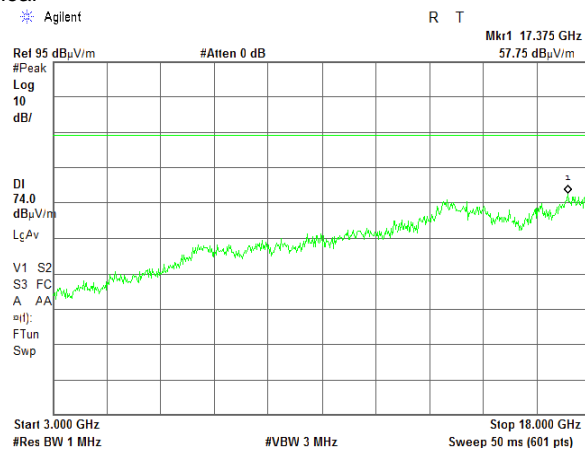
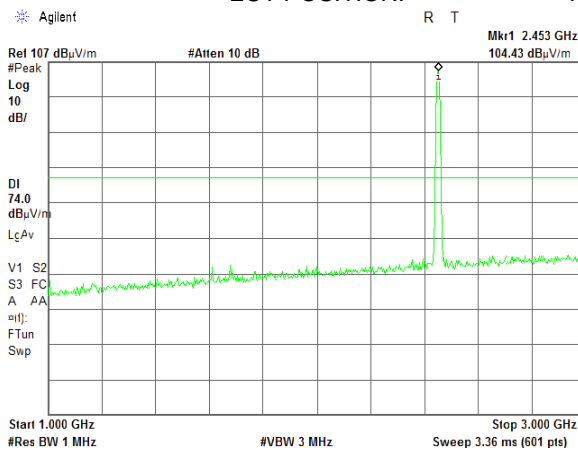


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Test specification:		FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions	
Test procedure:		ANSI C63.4, Section 13.1.4	
Test mode:		Verdict: PASS	
Date(s):			
14-Feb-24 - 15-Feb-24			
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.2.11 Radiated emission measurements from 1000 to 18000 MHz at the fundamental frequency 336 MHz

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



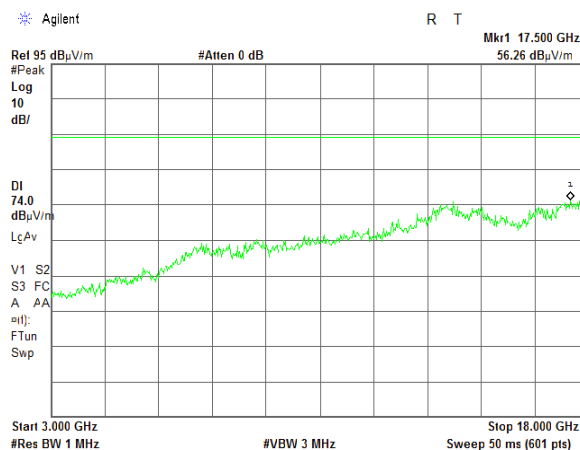
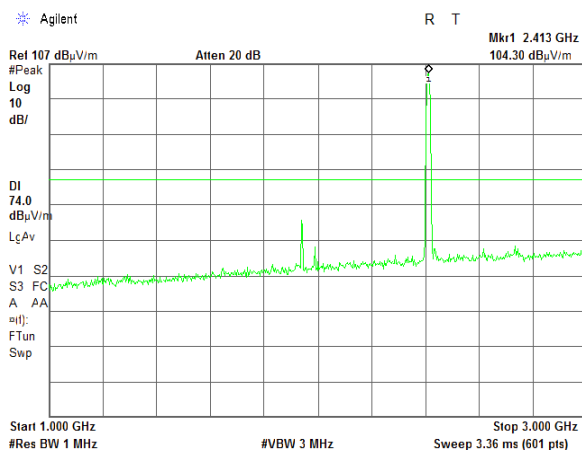
Note: Frequency 2453 MHz belong to WiFi communication



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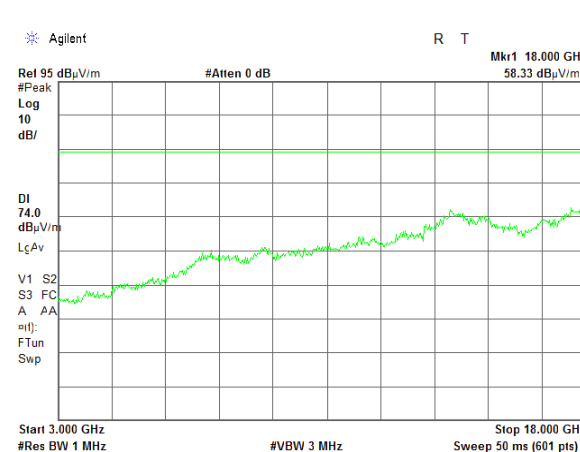
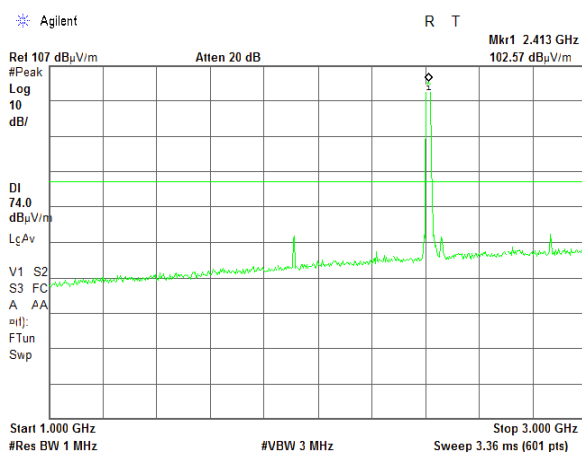
Test specification:		FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions	
Test procedure:		ANSI C63.4, Section 13.1.4	
Test mode:		Verdict: PASS	
Date(s):			
14-Feb-24 - 15-Feb-24			
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.2.12 Radiated emission measurements from 1000 to 18000 MHz at the fundamental frequency 646 MHz



Note: Frequency 2413 MHz belong to WiFi communication

Plot 7.2.13 Radiated emission measurements from 1000 to 18000 MHz at the fundamental frequency 956 MHz



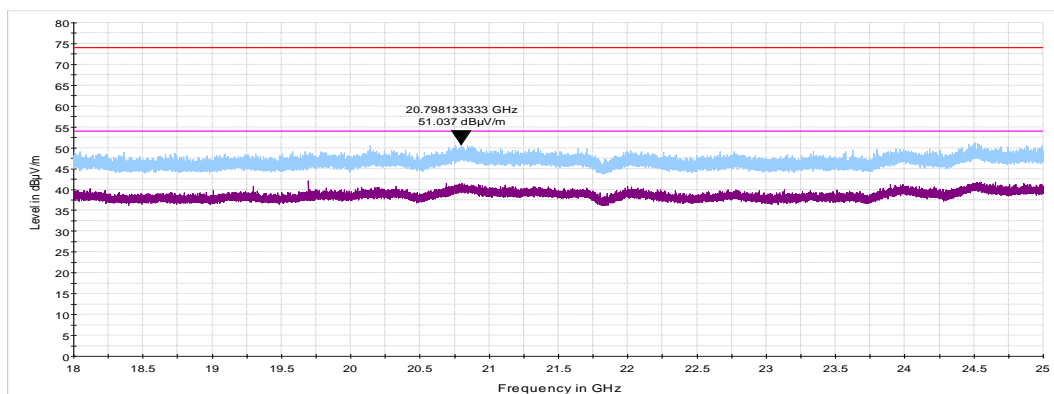
Note: Frequency 2413 MHz belong to WiFi communication



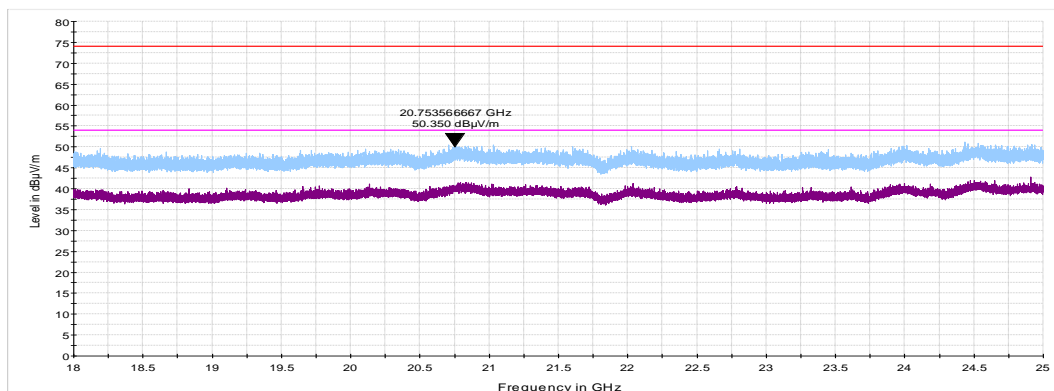
Test specification:		FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions	
Test procedure:		ANSI C63.4, Section 13.1.4	
Test mode:		Verdict: PASS	
Date(s):			
14-Feb-24 - 15-Feb-24			
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.2.14 Radiated emission measurements from 18000 to 25000 MHz at the fundamental frequency 336 MHz

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



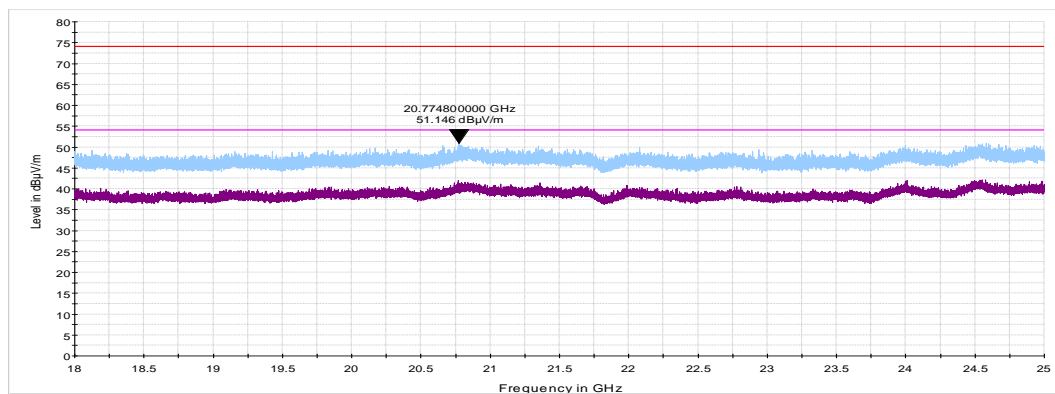
Plot 7.2.15 Radiated emission measurements from 18000 to 25000 MHz at the fundamental frequency 646 MHz





Test specification: FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
Test procedure: ANSI C63.4, Section 13.1.4			
Test mode: Compliance		Verdict: PASS	
Date(s): 14-Feb-24 - 15-Feb-24			
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.2.16 Radiated emission measurements from 18000 to 25000 MHz at the fundamental frequency 956 MHz





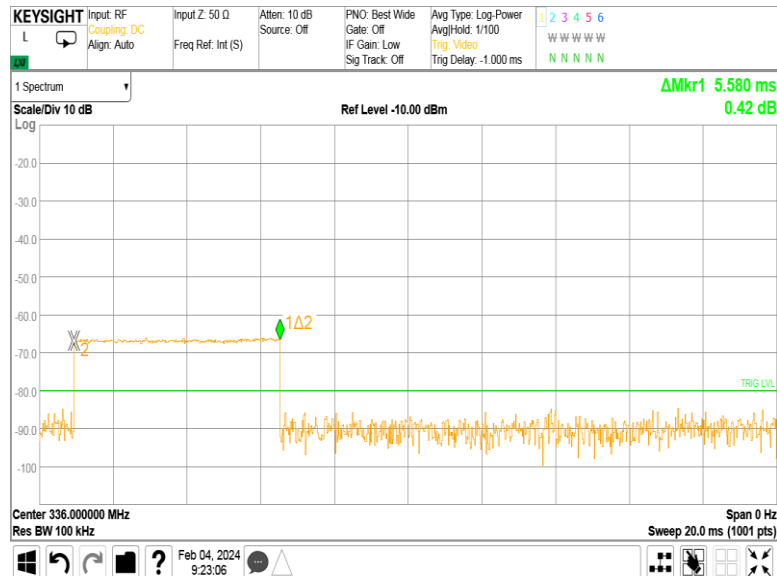
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Report ID: AUTRAD\_FCC.52937.docx

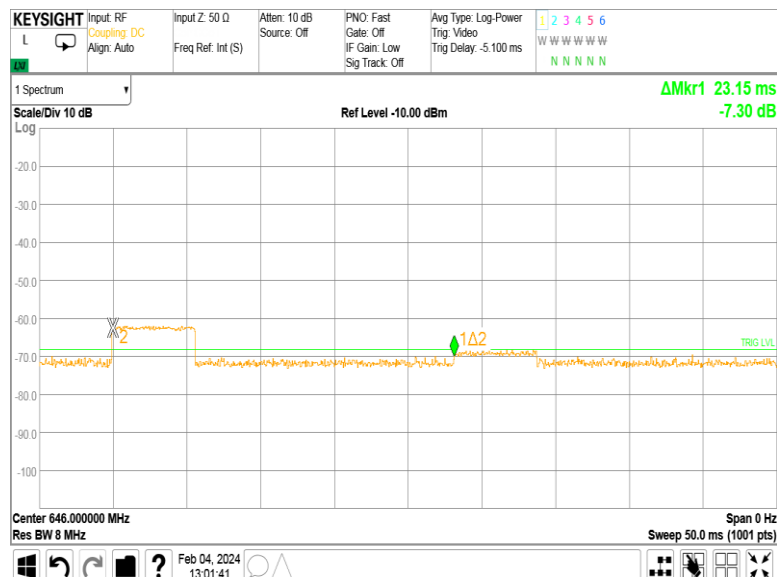
Date of Issue: 27-Oct-24

Test specification:		FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions			
Test procedure:		ANSI C63.4, Section 13.1.4			
Test mode:		Compliance		Verdict: PASS	
Date(s):		14-Feb-24 - 15-Feb-24			
Temperature: 23 °C		Relative Humidity: 56 %		Air Pressure: 1012 hPa	
Power: 110 VAC, 50 Hz		Remarks:			

Plot 7.2.17 Transmission pulse duration



Plot 7.2.18 Transmission pulse period





<b>Test specification:</b> FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth			
<b>Test procedure:</b> ANSI C63.4, Section 13.1.7			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 30-Jan-24			
<b>Temperature:</b> 20 °C	<b>Relative Humidity:</b> 54 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

## 7.3 Occupied bandwidth test

### 7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1. The test results are provided in Table 7.3.2 and associated plots.

**Table 7.3.1 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.

### 7.3.2 Test procedure

**7.3.2.1** The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

**7.3.2.2** The EUT was set to transmit modulated carrier.

**7.3.2.3** The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.3.2 and associated plot.

**Figure 7.3.1 Occupied bandwidth test setup**





<b>Test specification:</b> FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth			
<b>Test procedure:</b> ANSI C63.4, Section 13.1.7			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 30-Jan-24			
<b>Temperature:</b> 20 °C	<b>Relative Humidity:</b> 54 %	<b>Air Pressure:</b> 1012 hPa	<b>Power:</b> 110 VAC, 50 Hz
<b>Remarks:</b>			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Peak hold  
 RESOLUTION BANDWIDTH: 10 Hz  
 VIDEO BANDWIDTH: 100 Hz  
 MODULATION ENVELOPE REFERENCE POINTS: 20 dBc  
 MODULATION: CW

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
336.00	0.2148	0.25	840	839.7	Pass
646.00	0.2148	0.25	1615	1614.7	Pass
956.00	0.2227	0.50	4780	4779.8	Pass
Operating frequency MHz*	Total bandwidth MHz**	Worst Case Limit		Margin, kHz	Verdict
336 - 956	27.6148	840		812.4	Pass

\* - RF scanning with step CW transmission over 336 - 956 MHz (except for the frequencies falling within restricted bands FCC 15.205)

\*\* - The total BW was calculated as a maximum individual occupied bandwidth multiplied by 124 channels (supplier declaration)

**Reference numbers of test equipment used**

HL 7585	HL 5288	HL 5902	HL 3903					
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Full description is given in Appendix A.





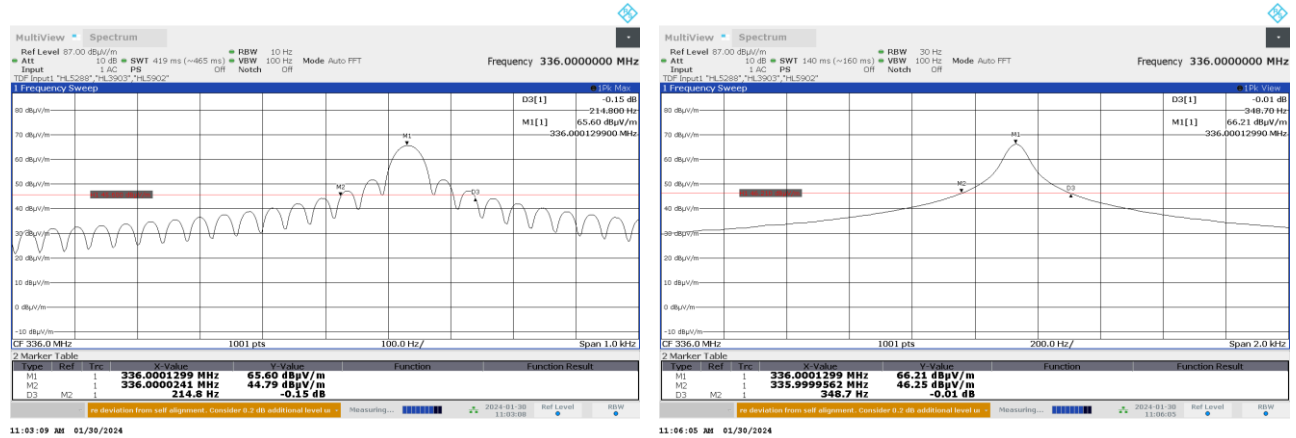
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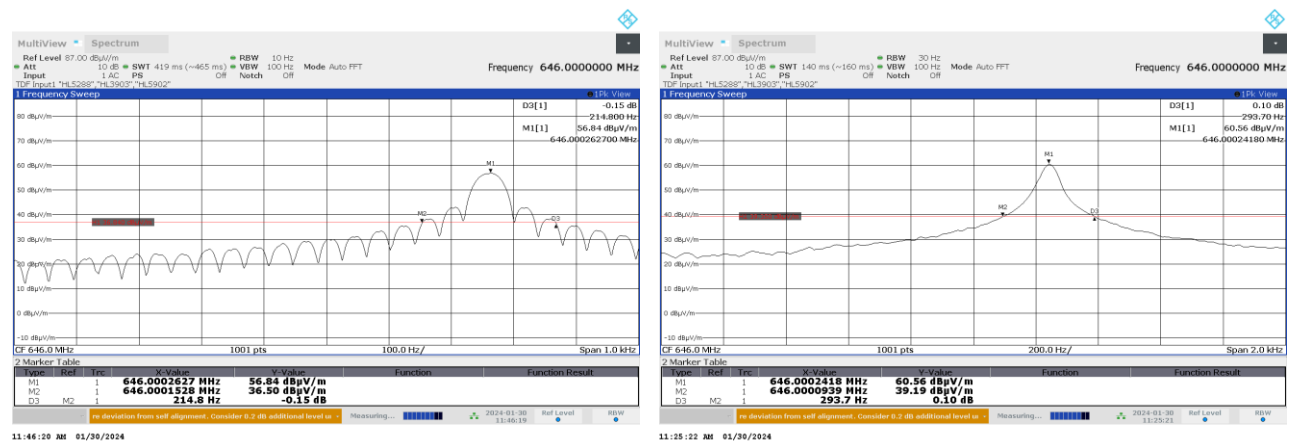
Date of Issue: 27-Oct-24

Test specification: FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth			
Test procedure: ANSI C63.4, Section 13.1.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 30-Jan-24			
Temperature: 20 °C	Relative Humidity: 54 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.3.1 Occupied bandwidth test result at the fundamental frequency 336 MHz



Plot 7.3.2 Occupied bandwidth test result at the fundamental frequency 646 MHz





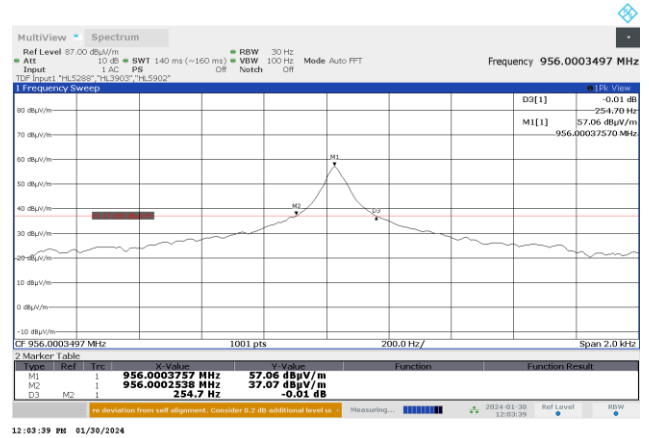
HERMON LABORATORIES

Report ID: AUTRAD\_FCC.52937.docx

Date of Issue: 27-Oct-24

Test specification: FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth			
Test procedure: ANSI C63.4, Section 13.1.7			
Test mode: Compliance		Verdict: PASS	
Date(s): 30-Jan-24			
Temperature: 20 °C	Relative Humidity: 54 %	Air Pressure: 1012 hPa	Power: 110 VAC, 50 Hz
Remarks:			

Plot 7.3.3 Occupied bandwidth test result at the fundamental frequency 956 MHz





<b>Test specification:</b> FCC Part 15, Section 203 / RSS-Gen, Section 6.8, Antenna requirements			
<b>Test procedure:</b> Visual inspection / supplier declaration			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 04-Feb-24			
<b>Temperature:</b> 25 °C	<b>Relative Humidity:</b> 47 %	<b>Air Pressure:</b> 1019 hPa	<b>Power:</b> 230 VAC, 50 Hz
<b>Remarks:</b>			

## 7.4 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 7.4.1.

**Table 7.4.1 Antenna requirements**

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



Test specification:		FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22	
Test mode:		Verdict: PASS	
Date(s):			
08-Feb-24			
Temperature: 20 °C	Relative Humidity: 42 %	Air Pressure: 1003 hPa	Power: 12 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

#### FCC part 15

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:  $\text{Lim}_{S2} = \text{Lim}_{S1} + 20 \log(S1/S2)$ , where  $S1$  and  $S2$  – standard defined and test distance respectively in meters.

#### ICES-003

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	30.0	40.0	40.0	50.0
88 - 216	33.1	43.5	43.5	54.0
216 - 230	35.6	46.0	46.4	56.9
230 - 960	37.0	47.0	47.0	57.0
960 - 1000	43.5	54.0	49.5	60.0
Above 1000	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	Peak	Average	Peak	Average
	74.0	54.0	80.0	60.0

\*The more stringent limit applies at transition frequencies



<b>Test specification:</b>		FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission	
<b>Test procedure:</b>		ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>			
08-Feb-24			
<b>Temperature:</b> 20 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1003 hPa	<b>Power:</b> 12 VDC
<b>Remarks:</b>			

### 8.1.2 Test procedure

**8.1.2.1 30 – 1000 MHz range.** The EUT was set up as shown in Figure 8.2.1 and the associated photographs, energized and the EUT performance was checked.

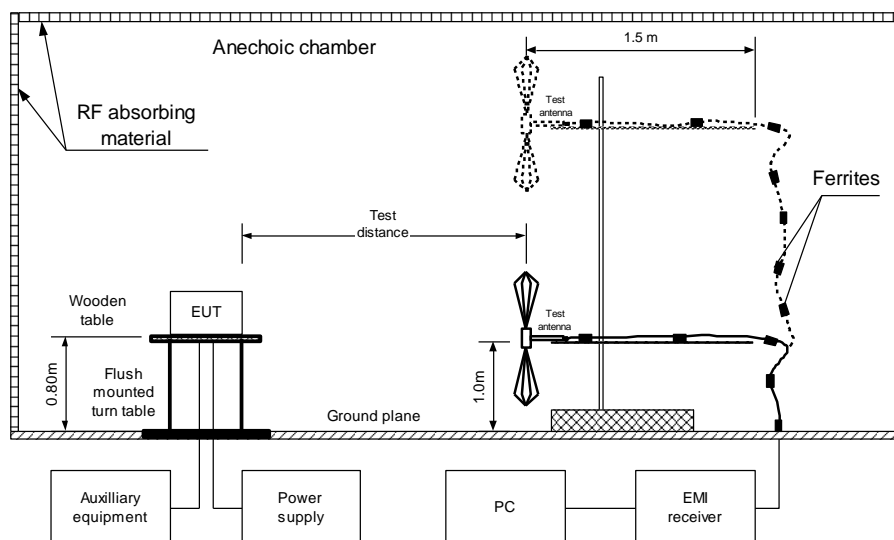
**8.1.2.2** The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.

**8.1.2.3 1000 – 40000 MHz range.** The EUT was set up as shown in Figure 8.2.2 and the associated photographs, energized and the EUT performance was checked.

**8.1.2.4** The measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. In order to stay within the 3 dB beamwidth while keeping the antenna height scanned from 1 to 4 m, a few sweeps with different antenna angles over the entire height were performed.

**8.1.2.5** The worst test results with respect to the limits were recorded in Table 8.2.2 and shown in the associated plots.

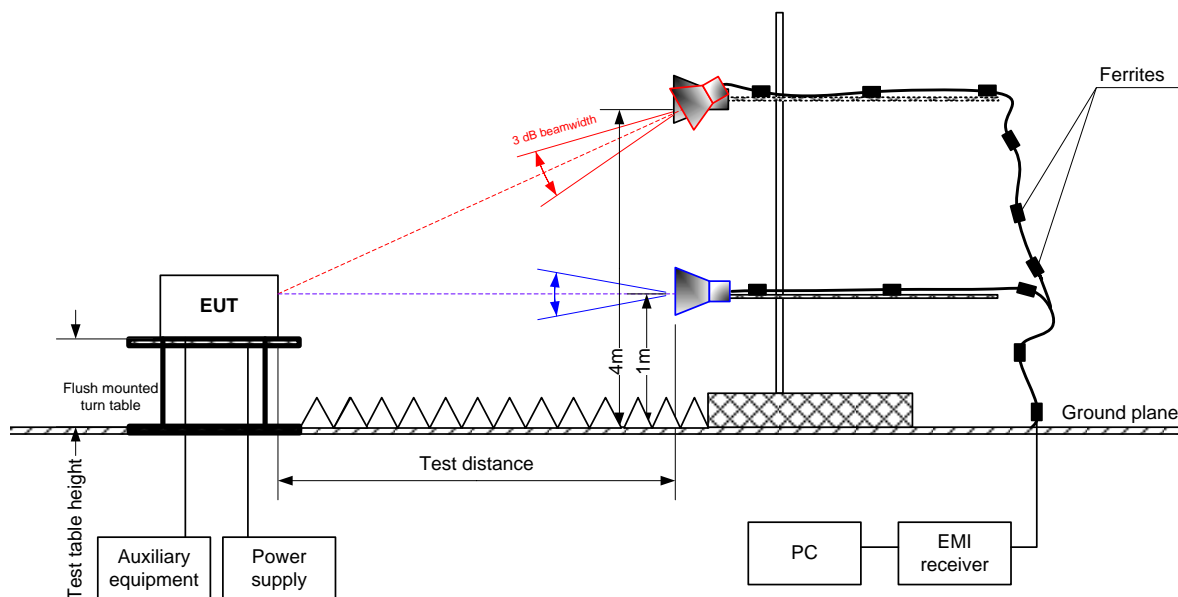
**Figure 8.1.1 Setup for radiated emission measurements in 30 – 1000 MHz range, table-top EUT**





<b>Test specification:</b> FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 08-Feb-24			
<b>Temperature:</b> 20 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1003 hPa	<b>Power:</b> 12 VDC
<b>Remarks:</b>			

Figure 8.1.2 Setup for radiated emission measurements in 1000 – 6000 MHz range, table-top EUT





HERMON LABORATORIES

Test specification:		FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22	
Test mode:		Verdict: PASS	
Date(s):			
08-Feb-24			
Temperature: 20 °C	Relative Humidity: 42 %	Air Pressure: 1003 hPa	Power: 12 VDC
Remarks:			

Table 8.1.2 Radiated emission test results

EUT SET UP: TABLE-TOP  
LIMIT: Class A  
EUT OPERATING MODE: Receive  
TEST SITE: SEMI ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
FREQUENCY RANGE: 30 MHz – 1000 MHz  
RESOLUTION BANDWIDTH: 120 kHz

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

TEST SITE: SEMI ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
DETECTORS USED: PEAK / AVERAGE  
FREQUENCY RANGE: 1000 MHz – 18000 MHz  
RESOLUTION BANDWIDTH: 1000 kHz

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

\*- Margin = Measured emission - specification limit.

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

## Reference numbers of test equipment used

HL 3903	HL 4360	HL 4933	HL 5085	HL 5288	HL 5311		
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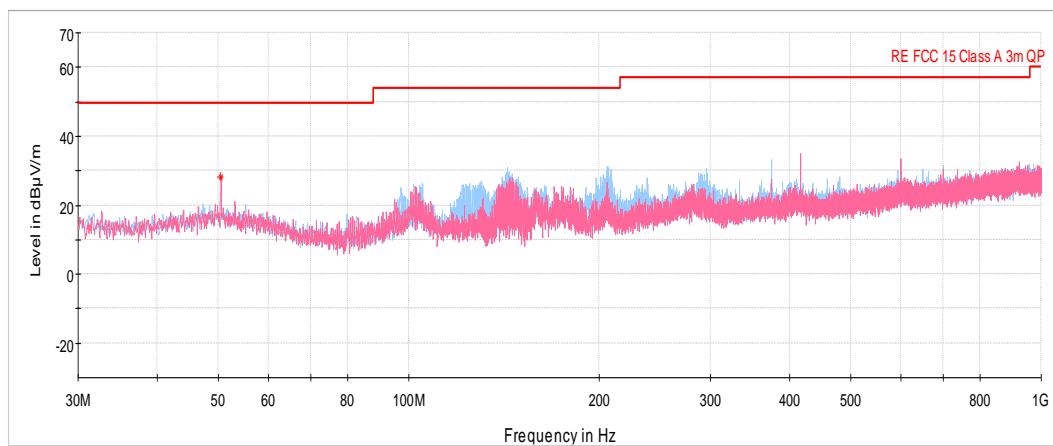
Full description is given in Appendix A.



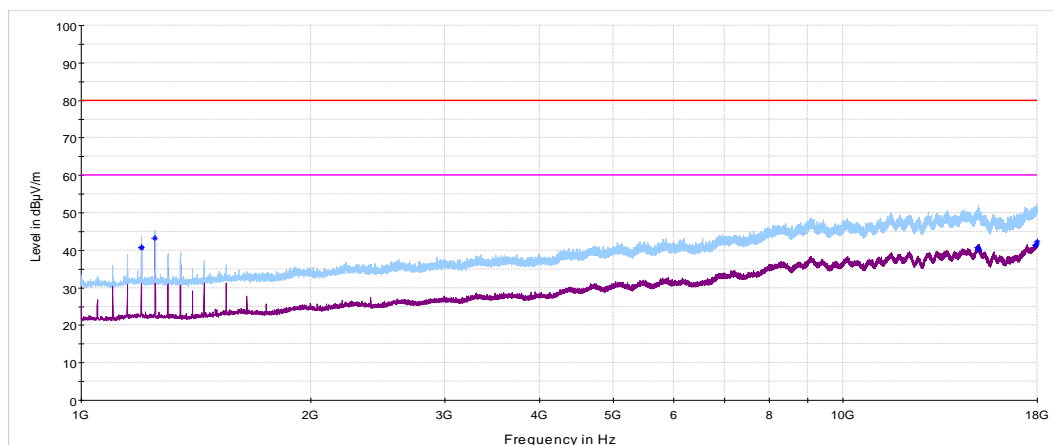
<b>Test specification:</b> FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 08-Feb-24			
<b>Temperature:</b> 20 °C	<b>Relative Humidity:</b> 42 %	<b>Air Pressure:</b> 1003 hPa	<b>Power:</b> 12 VDC
<b>Remarks:</b>			

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

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

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

TEST SITE: Semi anechoic chamber  
LIMIT: Class A  
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	07-Mar-23	07-Mar-24
2227	Crystal Detector 0.01-18 GHz, 100 mW	Hewlett Packard Co	8472A	NA	08-Jan-24	08-Jan-26
3440	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	10-Aug-23	10-Aug-24
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFL EX 102A	1225/2A	16-Apr-23	16-Apr-24
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFL EX 102A	1226/2A	16-Apr-23	16-Apr-24
4015	Temp. & Humidity Meter, (-50 - +70) deg, (20 - 99 )% RH	Mad Electronics	HTC-1	NA	01-May-23	01-May-24
4360	EMI Test Receiver, 20 Hz to 40 GHz	Rohde & Schwarz	ESU40	100322	24-Jan-24	24-Jan-25
4645	Oscilloscope, 60 MHz, two channels	Agilent Technologies	DSO 1002A	CN492315 18	12-Jun-23	12-Jun-24
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	19-Jan-23	19-Jan-24
4956	Active horn antenna, 18 to 40 GHz	COM-POWER CORPORATION	AHA-840	105004	08-Mar-23	08-Mar-24
5085	Attenuator, 4 dB, DC - 6 GHz, 1 W	Mini-Circuits	UNAT-4+	NA	24-Mar-22	24-Mar-25
5112	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/11SK/11SK/5500MM	502494/2EA	16-Apr-23	16-Apr-24
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	24-Mar-22	24-Mar-25
5311	Controller	Dolev Ltd	FC-06	FC06.1-2016-024	01-May-23	01-May-24
5376	EXA Signal Analyzer, 10 Hz - 32 GHz	Keysight Technologies	N9010B	MY57470404	08-Jan-24	08-Jan-25
5588	Cable, 50 Ohm, DC to 18 GHz, 1.8 m, SMA/N-type	Mini Circuits	CBL-6FT-SMNM+	NA	13-Jul-23	13-Jul-24
5902	RF cable, 18 GHz, 6.0m, N-type	Huber-Suhner	SF126EA/11N/11N/6000	NA	19-Nov-23	19-Nov-24
5933	Thermometer Hygrometer , (0 to +50) deg., (20-95) % RH	Kkmoon	Dyimore	NA	01-May-23	01-May-24
6105	Field Probe Set, 5 un	NA	NA	NA	05-Sep-23	05-Sep-24
7585	EMI Test Receiver, 1 Hz to 44 GHz	Rohde & Schwarz	ESW44	103130	21-Sep-23	21-Sep-24

## 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 $\mu$ V to obtain field strength in dB $\mu$ 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 $\mu$ V to obtain field strength in dB $\mu$ V/m.

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

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 $\mu$ V to obtain field strength in dB $\mu$ V/m.

above 1000 MHz

Frequency, MHz	Antenna factor, dB/m
1000	26.9
1100	28.1
1200	28.4
1300	29.6
1400	29.1
1500	30.4
1600	30.7
1700	31.5
1800	32.3
1900	32.6
2000	32.5
2100	32.9
2200	33.5
2300	33.2
2400	33.7
2500	34.6
2600	34.7
2700	34.6
2800	35.0
2900	35.5
3000	36.2
3100	36.8
3200	36.8
3300	37.0
3400	37.5
3500	38.2

Frequency, MHz	Antenna factor, dB/m
3600	38.9
3700	39.4
3800	39.4
3900	39.6
4000	39.7
4100	39.8
4200	40.5
4300	40.9
4400	41.1
4500	41.4
4600	41.3
4700	41.6
4800	41.9
4900	42.3
5000	42.7
5100	43.0
5200	42.9
5300	43.5
5400	43.6
5500	44.3
5600	44.7
5700	45.0
5800	45.0
5900	45.3
6000	45.9

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

## 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: $\pm 3.9$ dB 150 kHz to 30 MHz: $\pm 3.8$ dB
Radiated emissions at 10 m measuring distance Horizontal polarization  Vertical polarization	Biconilog antenna: $\pm 5.0$ dB Biconical antenna: $\pm 5.0$ dB Log periodic antenna: $\pm 5.1$ dB Double ridged horn antenna: $\pm 5.3$ dB Biconilog antenna: $\pm 5.5$ dB Biconical antenna: $\pm 5.5$ dB Log periodic antenna: $\pm 5.6$ dB Double ridged horn antenna: $\pm 5.8$ dB
Radiated emissions at 3 m measuring distance Horizontal polarization  Vertical polarization	Biconilog antenna: $\pm 5.3$ dB Biconical antenna: $\pm 5.0$ dB Log periodic antenna: $\pm 5.3$ dB Double ridged horn antenna: $\pm 5.3$ dB Biconilog antenna: $\pm 6.0$ dB Biconical antenna: $\pm 5.7$ dB Log periodic antenna: $\pm 6.0$ dB Double ridged horn antenna: $\pm 6.0$ dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: $\pm 2.6$ dB 2.9 GHz to 6.46 GHz: $\pm 3.5$ dB 6.46 GHz to 13.2 GHz: $\pm 4.3$ dB 13.2 GHz to 22.0 GHz: $\pm 5.0$ dB 22.0 GHz to 26.8 GHz: $\pm 5.5$ dB 26.8 GHz to 40.0 GHz: $\pm 4.8$ dB
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0$ %
Occupied bandwidth	$\pm 8.0$ %

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

47CFR part 15: 2022

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-210 Issue 10: 2019

Licence-Exempt Radio Apparatus: Category I Equipment

RSS-Gen Issue 5: 2018

General Requirements and Information for the certification of Radiocommunication Equipment

ICES-003 Issue 7: 2020

Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement

## 13 APPENDIX E Abbreviations and acronyms

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


14 APPENDIX F Manufacturer's declaration about periodic operation



## Declaration that Continuous and Periodic transmissions are not permitted

I declare that Autonomous Pivot is aware that continuous and periodic transmissions are not permitted.

Yair Sharf Co-founder and VP R&D



**Autonomous Pivot Ltd.**  
**515789527**

15 APPENDIX G Manufacturer's declaration about number of channels in use



## Declaration about 122 channels in use

Transmission period over burst

single channel transmission period ms	number of channels within the band	total transmission time over the burst	transmission period over the burst	frequencies
23.3ms	13	303ms	1300ms	336-396 in 5MHz steps
23.3ms	40	932ms	1930ms	411-606 in 5MHz steps
23.3ms	69	1608ms	1710ms	616-956 in 5MHz steps
	<b>total</b>	2843ms	4940ms	



**Autonomous Pivot Ltd.**  
**515789527**

END OF DOCUMENT