

TEST REPORT

Application No.: SZCR2503001186AT

Applicant: Zhejiang Lingzhu Technology Co., Ltd.

Address of Applicant: Room 302, No 1 Building Huace Center, Xihu District Hangzhou 310000 China

Manufacturer: Zhejiang Lingzhu Technology Co., Ltd.

Address of Manufacturer: Room 302, No 1 Building Huace Center, Xihu District Hangzhou 310000 China

Factory: EarDa Technologies Co., Ltd

Address of Factory: Block A, LianFeng Creative Industry Park, 2 JiSheng Road., HuangGe Town, NanSha District, Guangzhou, China

Equipment Under Test (EUT):

EUT Name: Human Presence Sensor

Model No.: HP222-Z, HP222-ZT ♣

♣ Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.

FCC ID: 2BEWX-HP222-Z

Standard(s) : 47 CFR Part 15, Subpart C 15.255

Date of Receipt: 2025-03-27

Date of Test: 2025-04-05 to 2025-05-15

Date of Issue: 2025-05-23

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu

Keny Xu
EMC Laboratory Manager



SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch EMC Laboratory

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SZEMC-TRF-01 Rev. A/1

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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2025-05-23		Original

Authorized for issue by:				
		Darren Yuan		
		Darren Yuan/Project Engineer		
		Eric Fu		
		Eric Fu/Reviewer		



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2 Test Summary

Test Item	FCC Rule No.	Test Method	Result
Antenna Requirement	15.203	--	PASS
Transmitter power and Transmitter off-times	15.255(b)(3)	ANSI C63.10-2020 Section 9.2.1/9.2.2	PASS
Occupied bandwidth	15.215 (c), 15.255 (b)(3)	ANSI C63.10-2020 Section 9.4	PASS
Radiated spurious emissions below 40 GHz	15.255 (d)(2)	ANSI C63.10-2020 Section 9.11	PASS
Radiated emissions outside assigned band and above 40 GHz up to 200 GHz	15.255 (d)(3)	ANSI C63.10-2020 Section 9.10	PASS
Frequency stability	15.255 (f)	ANSI C63.10-2020 Section 9.5	PASS

Declaration of EUT Family Grouping:

Model No.: HP222-Z, HP222-ZT

Only the model HP222-Z was tested, since according to the declaration from the applicant, the electrical circuit design, PCB layout, components used, internal wiring and functions were identical for all the above models, with only difference on Whether the button has a logo.



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4 General Information

4.1 Details of E.U.T.

Power supply:	3V DC which from button cell
Operation Frequency:	60GHz-64GHz
Modulation Type:	FMCW
Antenna Type:	AiP
Antenna Gain:	7.43dBi

Remark: The information in this section is provided by the applicant or manufacturer, SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
DC power supply	Chroma	62012P-80-60	REF. No.SEA27C00

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Transmitter power and power spectral density	$\pm 4.8\text{dB}$
Occupied bandwidth	$\pm 3\%$
Radiated Spurious Emissions Below 1GHz	$\pm 6.0\text{dB}$ for 3m; $\pm 5.0\text{dB}$ for 10m
Radiated Spurious Emissions Above 1GHz	$\pm 4.6\text{dB}$ (1-18GHz); $\pm 4.8\text{dB}$ (Above 18GHz)

Remark:

The U_{lab} (lab Uncertainty) is less than $U_{\text{CISPR/ETSI}}$ (CISPR/ETSI Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

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4.4 Test Location

All tests were performed at:

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No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI (Member No. 1937)

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen EMC laboratory have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1336

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1336. Test Firm Registration Number: 787754.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Loop Antenna	ETS-Lindgren	6502	SEM003-08	2023-11-20	2025-11-19
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2023-06-19	2026-06-18
MXE EMI Receiver	Agilent Technologies	N9038A	SEM004-15	2024-08-14	2025-08-13
BiConiLog Antenna	ETS-LINDGREN	3142C	SEM003-01	2023-09-16	2025-09-15
Pre-Amplifier	Agilent Technologies	8447D	SEM005-01	2025-03-13	2026-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2024-07-06	2025-07-05
3m Fully-Anechoic Chamber	AUDIX	N/A	SEM001-02	2024-05-11	2027-05-10
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	SEM004-20	2025-03-29	2026-03-28
Horn Antenna(800MHz-18GHz)	Rohde&Schwarz	HF907	SEM003-07	2023-07-23	2025-07-22
Microwave system amplifier (0.5GHz-26.5GHz)	Agilent	83017A	SEM005-25	2024-09-14	2025-09-13
Broad-Band Horn Antenna(15GHz-40GHz)	SCHWARZBECK	BBHA 9170	SEM003-15	2024-08-10	2025-08-09
Programmable Temperature Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2025-03-18	2026-03-17
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2025-03-14	2026-03-13
Coaxial Cable	SGS	N/A	SEM026-01	2024-07-06	2025-07-05
Waveguide(40-60GHz)	REBES	SWG-19025-FB	06303-01	2025-02-18	2028-02-17
Waveguide(50-75GHz)	REBES	SWG-15025-FB	01525-09	2025-02-18	2028-02-17
Waveguide(75-110GHz)	REBES	SWG-10025-FB	01509-01	2025-02-18	2028-02-17
Waveguide(110-170GHz)	REBES	SWG-06025-FB	06302-01	2025-02-18	2028-02-17
Waveguide(140-220GHz)	REBES	SWG-05025-FB	SEM020-12	2025-02-18	2028-02-17
Waveguide Harmonic Mixer(40-60GHz)	REBES	STH-19SF-S1	06937-01	2025-02-18	2028-02-17



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Waveguide Harmonic Mixer(50-75GHz)	KEYSIGHT	M1970V	MY51390966	2025-02-18	2028-02-17
Waveguide Harmonic Mixer(75-110GHz)	KEYSIGHT	M1970W	MY51430883	2025-02-18	2028-02-17
Waveguide Harmonic Mixer(110-170GHz)	REBES	STH-06SF-S1	06110-01	2025-02-18	2028-02-17
Waveguide Harmonic Mixer(140-220GHz)	Rohde&Schwarz	HM140-220	SEM020-18	2025-02-18	2028-02-17
Signal Analyzer	Rohde & Schwarz	FSV40	SEM008-04	2025-03-13	2026-03-12

General used equipment

Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	deli	8838	SEM002-32	2024-07-24	2025-07-23
Humidity/ Temperature Indicator	deli	8838	SEM002-33	2024-07-24	2025-07-23
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2025-03-17	2026-03-16



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6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203

6.1.2 Conclusion

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 7.43dBi.

Antenna location: Refer to internal photos



7 Radio Spectrum Matter Test Results

7.1 Transmitter power and Transmitter off-times

Test Requirement 47 CFR Part 15C Section 15.255 (b)(3)

Test Method: ANSI C63.10-2020 Section 9.2.1, 9.2.2

Limit:

The peak EIRP shall not exceed 20 dBm, and The sum of continuous transmitter off-times of at least two milliseconds shall equal at least 16.5 milliseconds within any contiguous interval of 33 milliseconds.

7.1.1 E.U.T. Operation

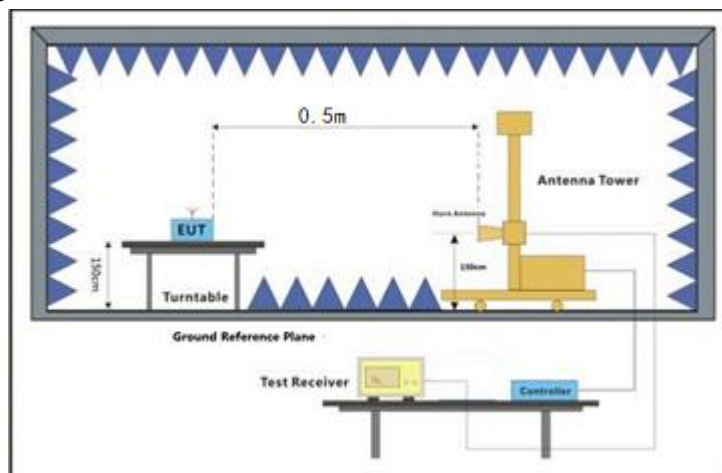
Operating Environment:

Temperature: 21.4 °C Humidity: 52.7 % RH Atmospheric Pressure: 1020 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in transmitting mode.

7.1.3 Test Setup Diagram



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7.1.4 Measurement Procedure and Data

- a. For transmitter power test, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 0.5 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation
- b. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- c. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the same height and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- d. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- e. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- g. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor
Spectrum analyser setting during test.

1. Place the EUT on the table and set it in the transmitting mode.
2. SA set RBW=1MHz, VBW=3*RBW, Detector=Peak Trace: Max Hold, Peak Search.
3. During test, the EUT will be rotate for 0 degrees to 360 degrees in X, Y, Z axis to find the maximum reading base on the previous test in different host-specific condition and the worst data was record in the report.

Please Refer to Appendix for Details



7.2 Occupied Bandwidth

Test Requirement 47 CFR Part 15C Section 15.215(c), 15.255 (b)(3)

Test Method: ANSI C63.10-2020 Section 9.4

Limit: 57-64GHz

7.2.1 E.U.T. Operation

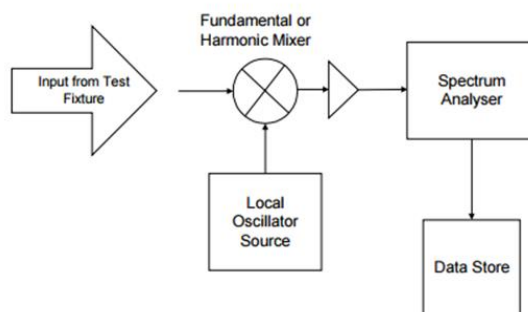
Operating Environment:

Temperature: 21.4 °C Humidity: 52.7 % RH Atmospheric Pressure: 1020 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in transmitting mode.

7.2.3 Test Setup Diagram



7.2.4 Measurement Procedure and Data

1. Place the EUT on the table and set it in the transmitting mode.
2. SA set RBW=1%~5% OBW, or a minimum of 1 MHz if this is not possible due to a large OBW, VBW=3*RBW and Detector=Peak.
3. Measure and record the result of 20dB and 99% bandwidth.

Please Refer to Appendix for Details



7.3 Radiated spurious emissions below 40 GHz

Test Requirement 47 CFR Part 15C Section 15.255 (d)(2)

Test Method: ANSI C63.10-2020 Section 9.11

Limit:

Below 30MHz:

Frequency	Field Strength (μV/m)	Measurement Distance (metres)
9 - 490 kHz	2,400/F (kHz)	300
490 - 1,705 kHz	24,000/F (kHz)	30
1.705-30 MHz	30	30

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Above 30MHz:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (metres)
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

Frequency (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	



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216 - 960		46.0	
Above 960		54.0	
1000 - 200000	74.0	N/A	54.0

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

$$\text{LimS2} = \text{LimS1} + 20 \log (S1/S2),$$

where S1 and S2 - 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 tenth harmonic of the highest fundamental frequency but not exceeding 40 GHz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 200 GHz for intentional radiators operated above 30 GHz.

Frequency (MHz)	Field strength at 1 m, dB(uV/m)*		
	Within restricted bands		
	Peak	Quasi Peak	Average
1000 - 200000	83.5	N/A	63.5

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 21.4 °C Humidity: 52.7 % RH Atmospheric Pressure: 1000 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in transmitting mode.



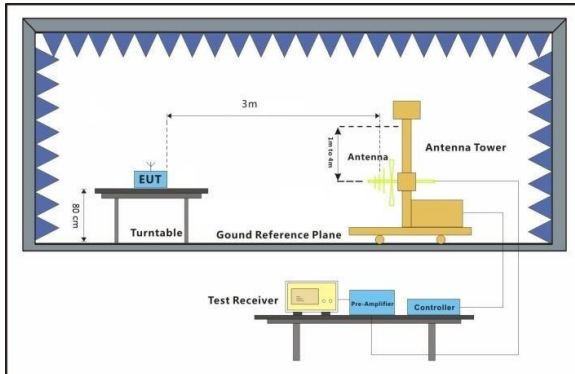
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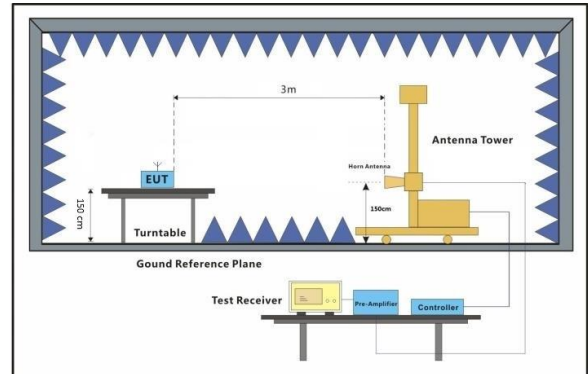
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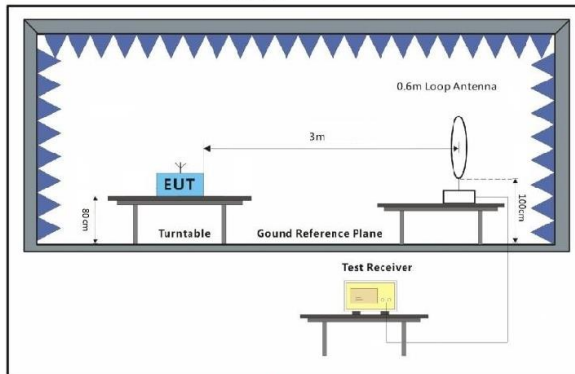
7.3.3 Test Setup Diagram



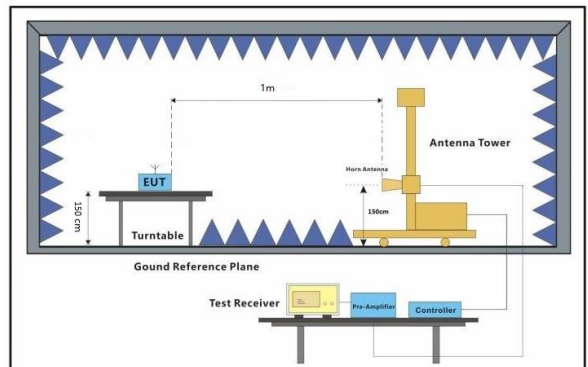
30MHz-1GHz



1GHz-18GHz



Below 30MHz



18GHz-40GHz



7.3.4 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For 1-18GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. For 18-40GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 1 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the same height (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- i. Repeat above procedures until all frequencies measured was complete.

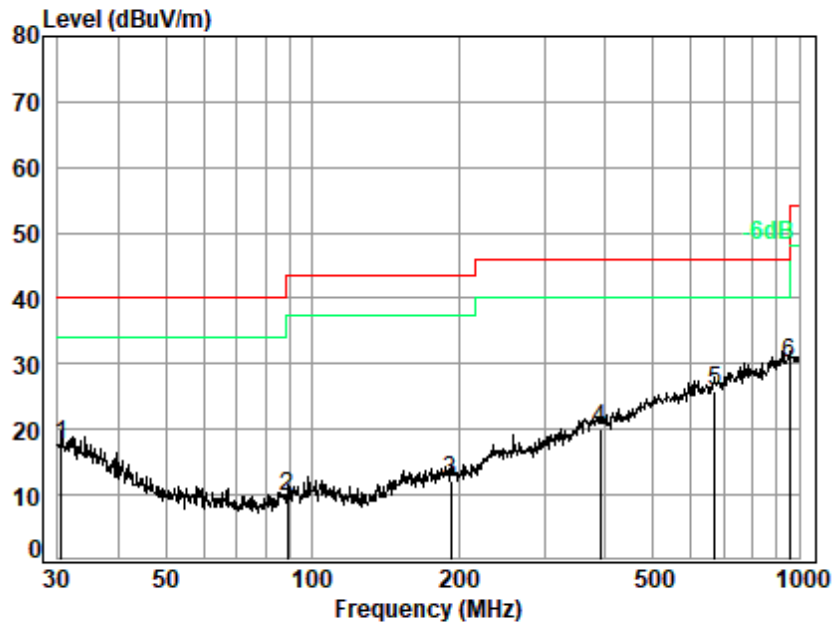
Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Remark 3: Scan from 9kHz to 40GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



Test Mode: 01; Polarity: Horizontal

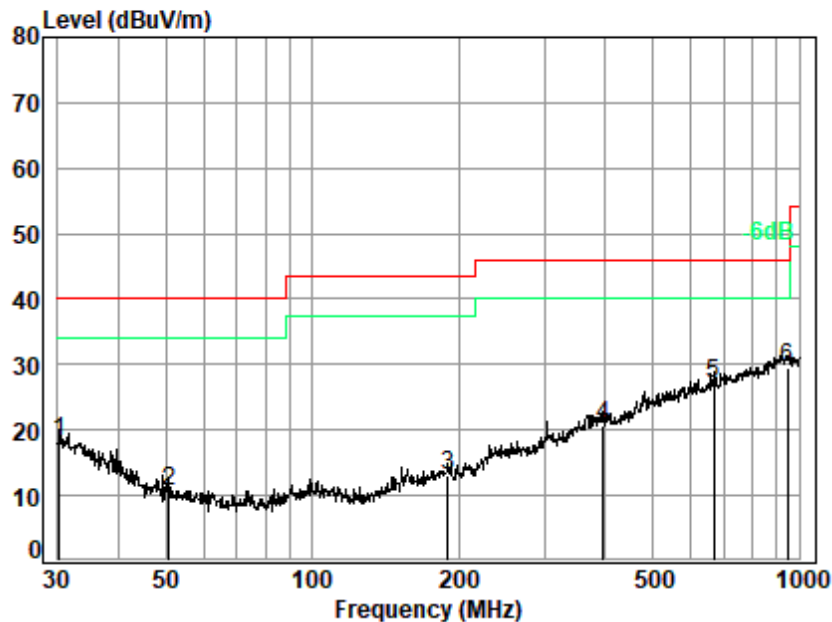


Site : chamber
Condition: 3m HORIZONTAL
Job No. : 01186AT
Test Mode: 01

		Ant	Cable	Preamp	Read	Limit	Over	
	Freq	Factor	Loss	Factor	Level	Line	Limit	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB
1	30.531	20.95	0.68	27.79	23.84	17.68	40.00	-22.32 QP
2	88.964	11.61	1.15	27.62	24.57	9.71	43.50	-33.79 QP
3	192.419	14.23	1.73	27.20	23.54	12.30	43.50	-31.20 QP
4	390.723	20.75	2.55	27.12	23.83	20.01	46.00	-25.99 QP
5	670.489	25.57	3.46	27.80	24.77	26.00	46.00	-20.00 QP
6 q	955.438	28.10	4.27	26.37	24.00	30.00	46.00	-16.00 QP



Test Mode: 01; Polarity: Vertical

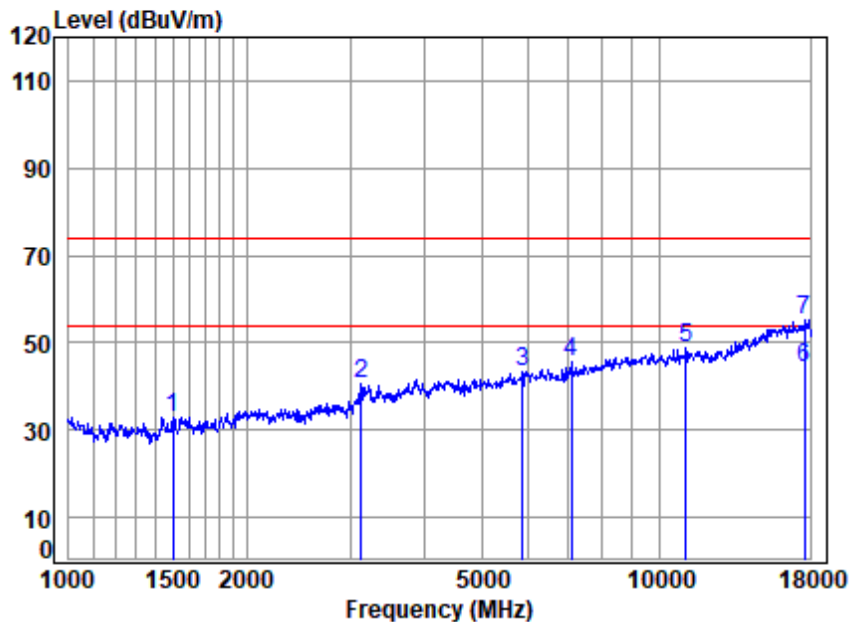


Site : chamber
Condition: 3m VERTICAL
Job No. : 01186AT
Test Mode: 01

	Ant	Cable	Preamp	Read		Limit	Over	
Freq	Factor	Loss	Factor	Level	Level	Line	Limit	Remark
MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	30.211	21.10	0.67	27.79	24.24	18.22	40.00	-21.78 QP
2	50.764	12.64	0.87	27.73	24.94	10.72	40.00	-29.28 QP
3	189.739	14.30	1.72	27.21	24.12	12.93	43.50	-30.57 QP
4	396.242	20.68	2.57	27.14	24.68	20.79	46.00	-25.21 QP
5	668.142	25.49	3.45	27.80	25.79	26.93	46.00	-19.07 QP
6 q	948.761	28.23	4.25	26.42	23.33	29.39	46.00	-16.61 QP



Test Mode: 01; Polarity: Horizontal

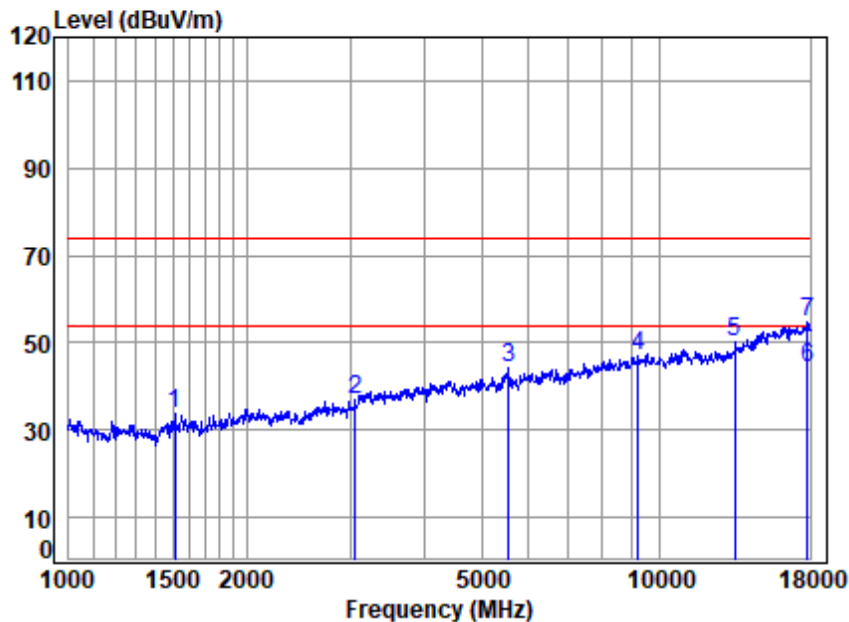


Site : chamber
Condition: 3m HORIZONTAL
Job No : 01186AT
Mode : RSE TX

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1498.781	4.89	26.77	54.78	56.02	32.90	74.00	-41.10	Peak
2	3132.079	6.04	32.18	54.90	57.09	40.41	74.00	-33.59	Peak
3	5864.443	8.65	34.46	53.24	53.31	43.18	74.00	-30.82	Peak
4	7096.999	8.58	35.79	53.19	54.38	45.56	74.00	-28.44	Peak
5	11108.160	11.70	37.52	53.02	52.74	48.94	74.00	-25.06	Peak
6	q17588.560	14.68	43.58	52.60	38.56	44.22	54.00	-9.78	Average
7	p17588.560	14.68	43.58	52.60	49.41	55.07	74.00	-18.93	Peak



Test Mode: 01; Polarity: Vertical



Site : chamber
Condition: 3m VERTICAL
Job No : 01186AT
Mode : RSE TX

		Cable	Ant	Preamp	Read		Limit	Over	
Freq		Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz		dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1511.833	4.89	26.85	54.78	56.88	33.84	74.00	-40.16	Peak
2	3051.653	5.99	30.25	54.96	55.51	36.79	74.00	-37.21	Peak
3	5567.137	8.37	34.70	53.55	54.95	44.47	74.00	-29.53	Peak
4	9205.540	10.60	37.11	53.51	52.67	46.87	74.00	-27.13	Peak
5	13442.810	13.16	38.80	53.06	51.49	50.39	74.00	-23.61	Peak
6	q17844.590	14.75	43.90	52.48	38.09	44.26	54.00	-9.74	Average
7	p17844.590	14.75	43.90	52.48	48.63	54.80	74.00	-19.20	Peak



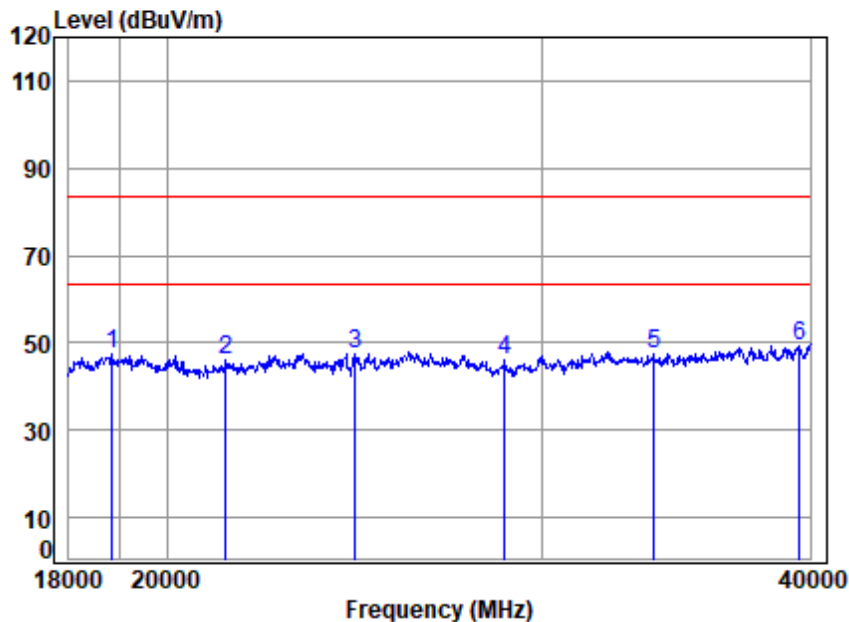
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Test Mode: 01; Polarity: Horizontal



Site : chamber
Condition: 1m HORIZONTAL
Job No : 01186AT
Mode : RSE TX
Note :

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	18853.250	5.89	36.82	54.74	59.59	47.56	83.54	-35.98	Peak
2	21320.210	6.00	36.96	55.15	58.06	45.87	83.54	-37.67	Peak
3	24517.670	6.74	38.12	53.84	56.46	47.48	83.54	-36.06	Peak
4	28763.170	7.08	38.24	53.29	53.96	45.99	83.54	-37.55	Peak
5	33824.750	7.77	40.39	51.99	51.22	47.39	83.54	-36.15	Peak
6	39523.750	7.53	42.72	52.13	51.17	49.29	83.54	-34.25	Peak

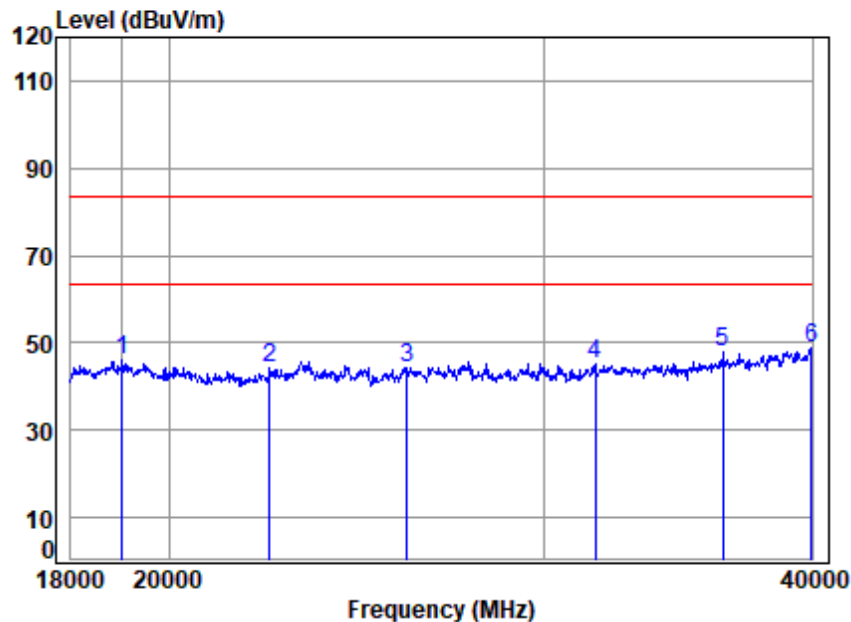


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Test Mode: 01; Polarity: Vertical



Site : chamber
Condition: 1m VERTICAL
Job No : 01186AT
Mode : RSE TX
Note :

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	19034.770	6.10	36.76	54.82	58.12	46.16	83.54	-37.38	Peak
2	22295.210	6.18	36.70	53.24	54.49	44.13	83.54	-39.41	Peak
3	25823.820	7.37	38.89	52.19	50.25	44.32	83.54	-39.22	Peak
4	31655.650	7.86	39.62	52.17	49.82	45.13	83.54	-38.41	Peak
5	36316.060	8.09	41.31	50.26	48.63	47.77	83.54	-35.77	Peak
6	p39968.070	7.73	43.16	51.82	49.68	48.75	83.54	-34.79	Peak



7.4 Radiated emissions outside assigned band and above 40 GHz up to 200 GHz

Test Requirement 47 CFR Part 15C Section 15.255 (d)(3)

Test Method: ANSI C63.10-2020 Section 9.10

Limit:

Above 40GHz:

Frequency (GHz)	Power density at 3 m distance (pW/cm ²)	Distance (m)	Field strength (dBuV/m)*, peak	Field strength (dBuV/m)*, average
40 - 200	90	3.0	105.31	85.31
40 - 200	90	1.0	114.85**	94.85**

* - Field strength was calculated per equation (26) of ANSI C63.10-2020 section 9 as follows:
 $E = \sqrt{PD \times 377}$, where PD is the power density at the distance specified by the limit in W/m², E- field strength in V/m.

** - The limit for other test distance was calculated using the inverse distance extrapolation factor as follows:
 $LimS2 = LimS1 + 20 \log (S1/S2)$, where S1 and S2 - standard defined and test distance respectively in meters.

7.4.1 E.U.T. Operation

Operating Environment:

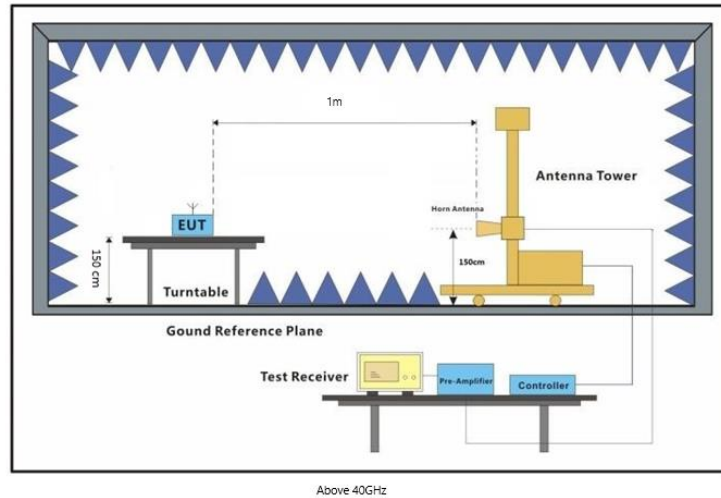
Temperature: 23.2 °C Humidity: 45.8 % RH Atmospheric Pressure: 1020 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in transmitting mode.



7.4.3 Test Setup Diagram



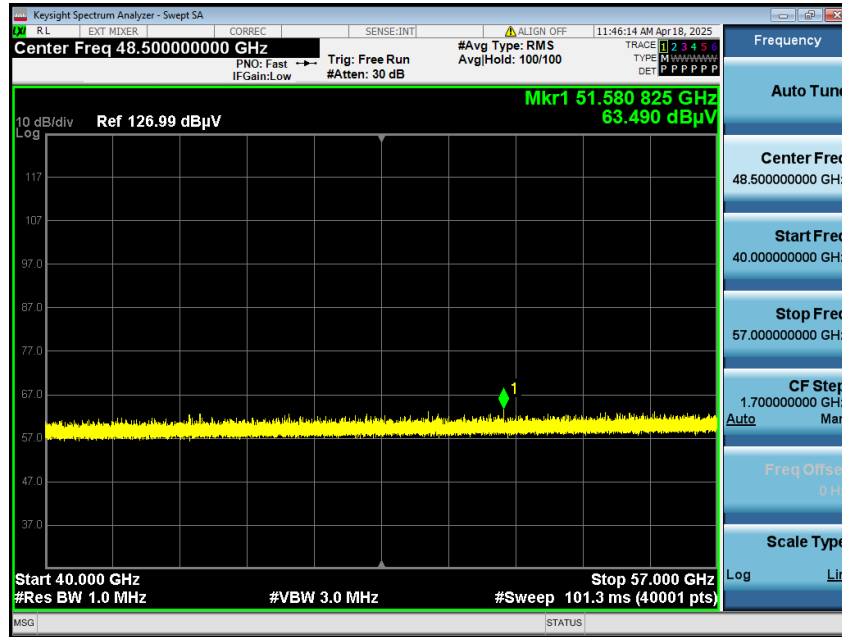
7.4.4 Measurement Procedure and Data

- For above 40GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 1 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the same height (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- Repeat above procedures until all frequencies measured was complete.

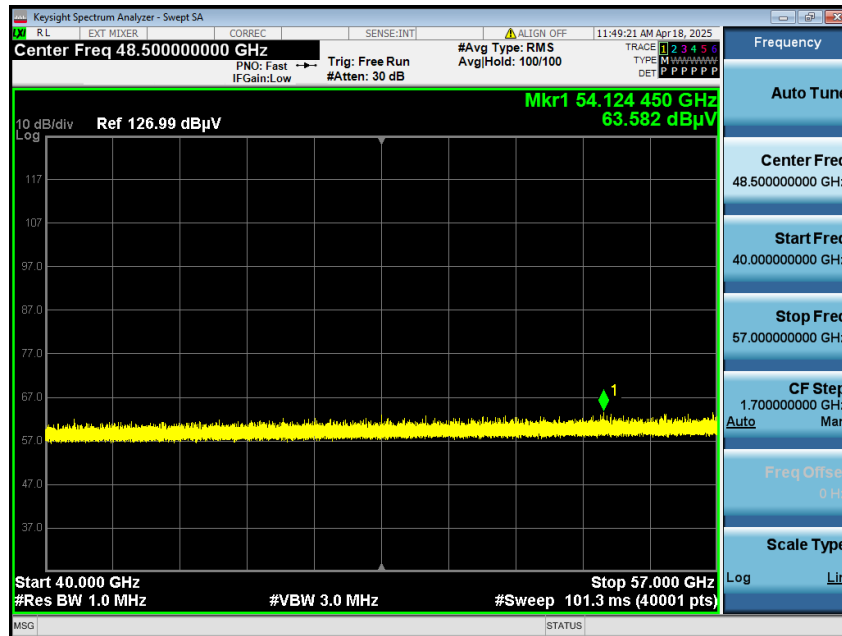
Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Test Mode: 01; Polarity: Horizontal



Test Mode: 01; Polarity: Vertical



Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
51.580	1	63.490	114.85	94.85	H	PASS
54.124	1	63.582	114.85	94.85	V	PASS

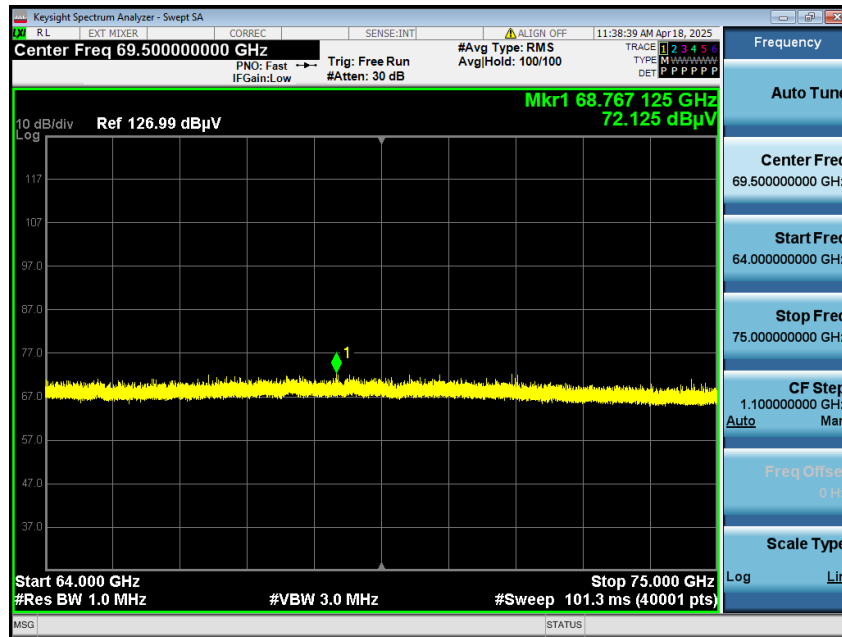


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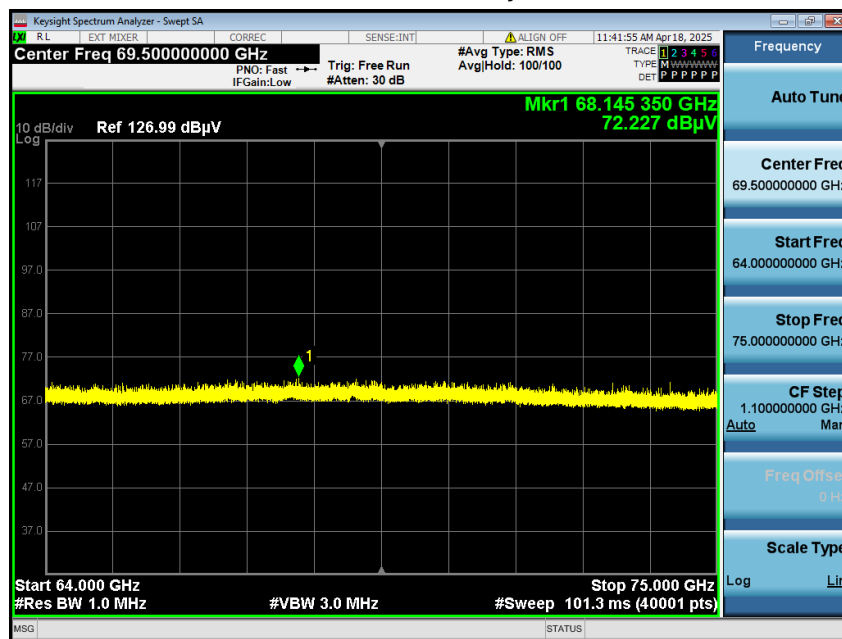
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Test Mode: 01; Polarity: Horizontal

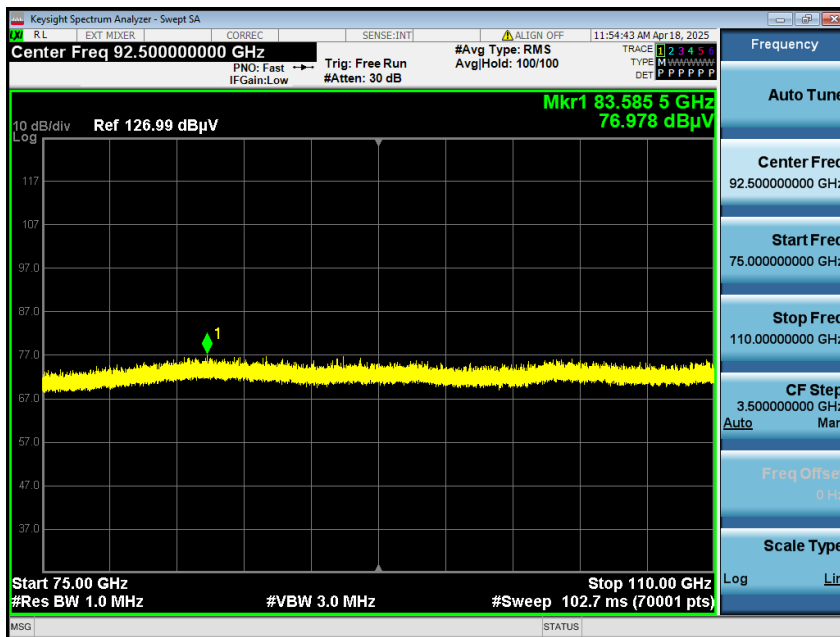


Test Mode: 01; Polarity: Vertical

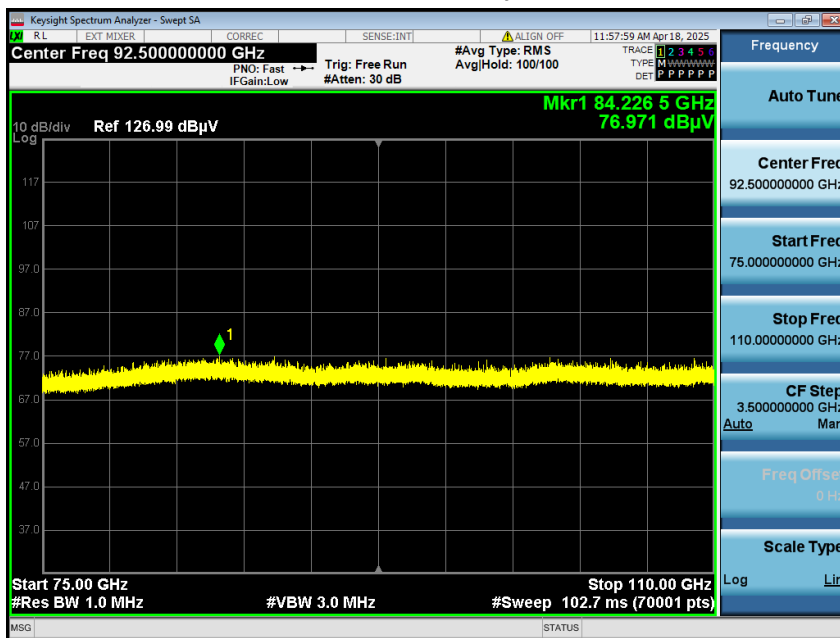


Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
68.767	1	72.125	114.85	94.85	H	PASS
68.145	1	72.227	114.85	94.85	V	PASS

Test Mode: 01; Polarity: Horizontal



Test Mode: 01; Polarity: Vertical

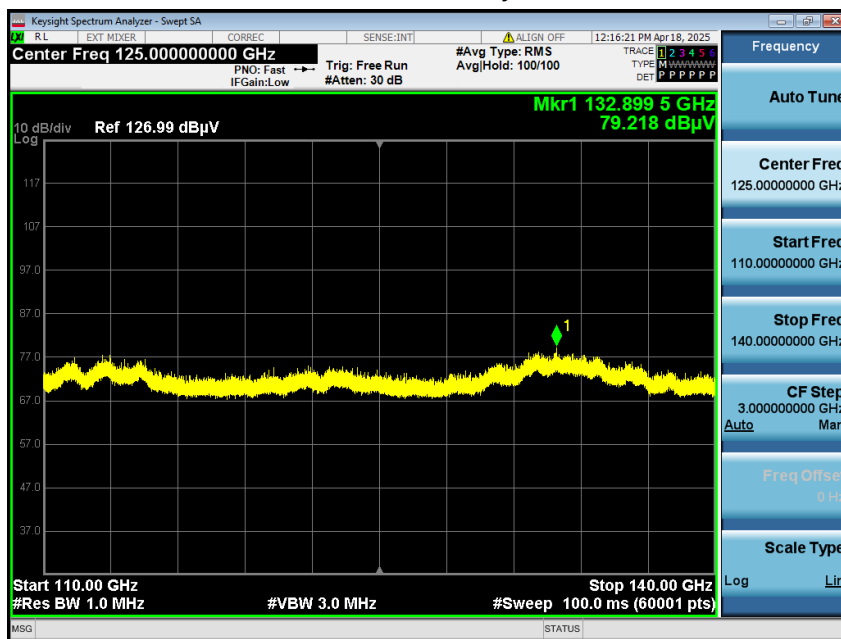


Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
83.585	1	76.978	114.85	94.85	H	PASS
84.226	1	76.971	114.85	94.85	V	PASS

Test Mode: 01; Polarity: Horizontal



Test Mode: 01; Polarity: Vertical



Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
131.767	1	78.416	114.85	94.85	H	PASS
132.899	1	79.218	114.85	94.85	V	PASS



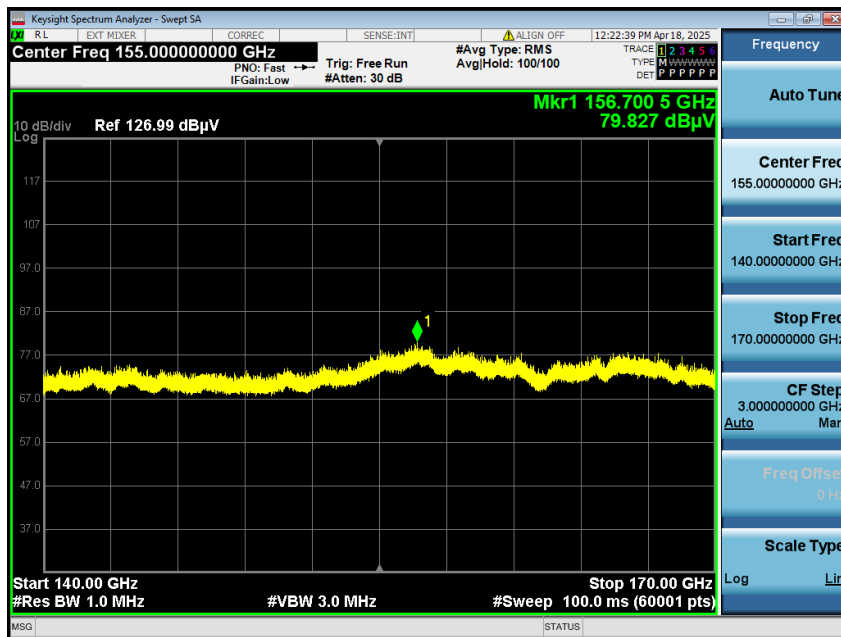
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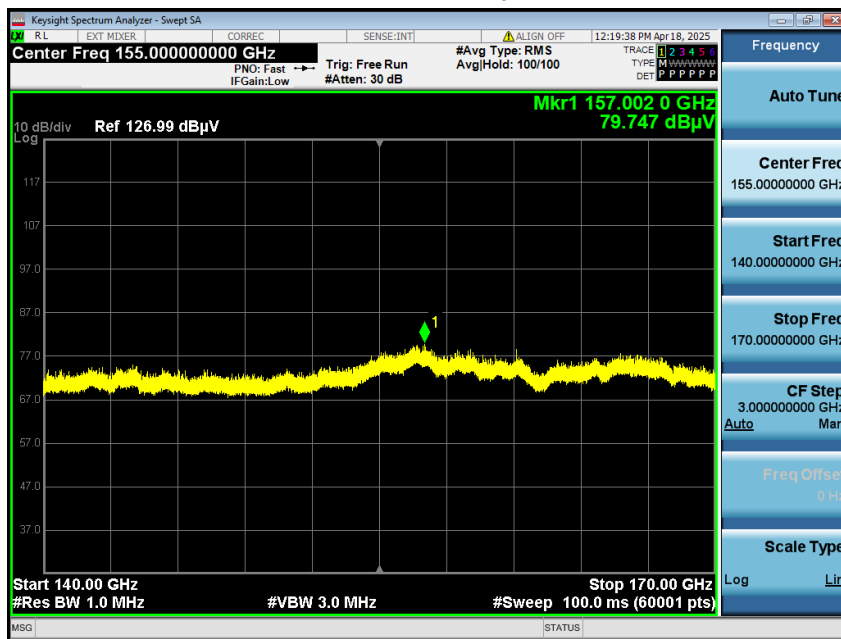
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Test Mode: 01; Polarity: Horizontal

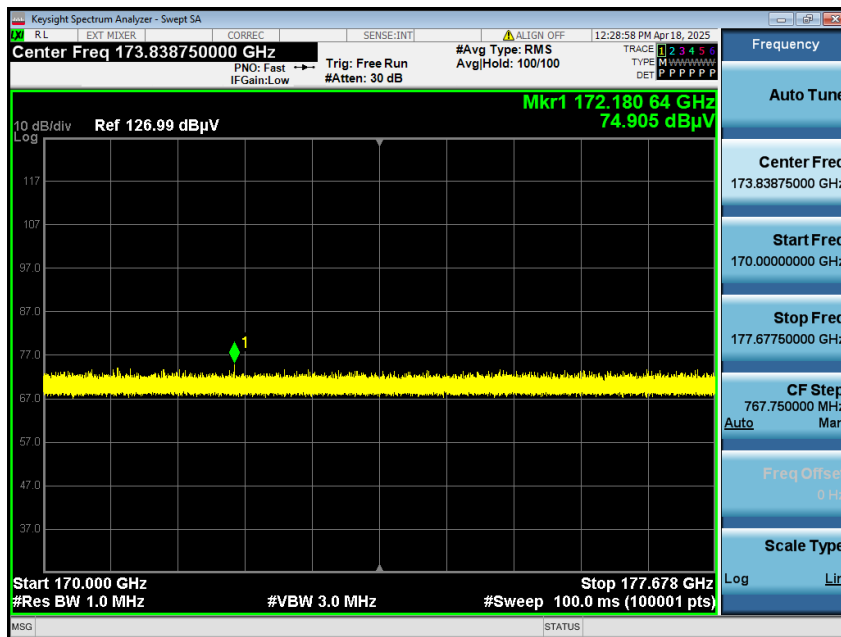


Test Mode: 01; Polarity: Vertical

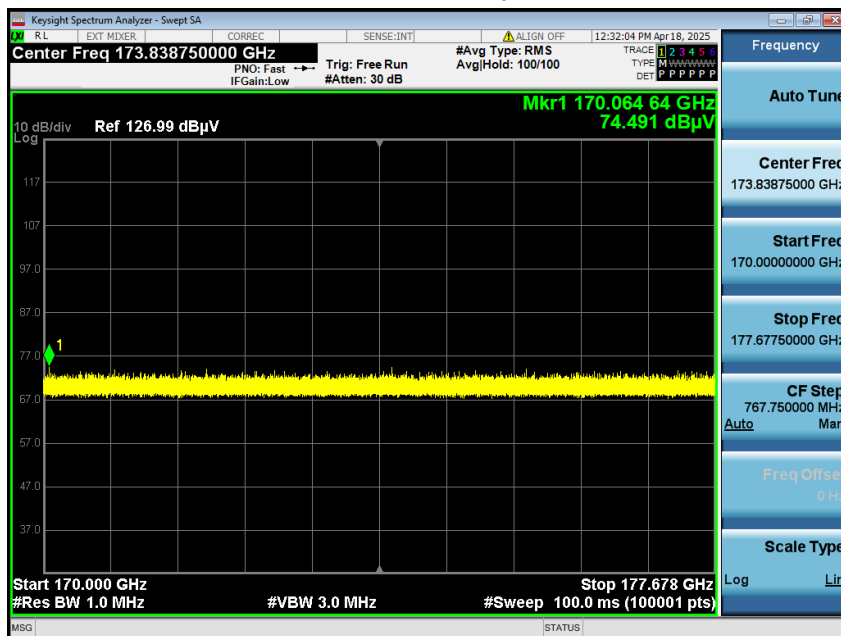


Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
156.700	1	79.827	114.85	94.85	H	PASS
157.002	1	79.747	114.85	94.85	V	PASS

Test Mode: 01; Polarity: Horizontal



Test Mode: 01; Polarity: Vertical



Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
172.180	1	74.905	114.85	94.85	H	PASS
170.064	1	74.491	114.85	94.85	V	PASS

7.5 Frequency Stability

Test Requirement 47 CFR Part 15C Section 15.255 (f)

Test Method: ANSI C63.10-2020 Section 9.5

Limit:

Frequency (GHz)	Limit
57 - 64	The signal must be contained within assigned frequency band.

7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 21.4 °C

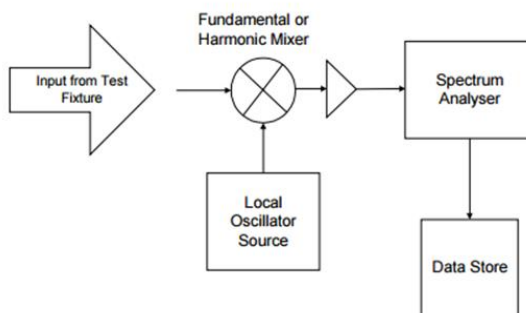
Humidity: 47.4 % RH

Atmospheric Pressure: 1020 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in transmitting mode.

7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

1. Temperature conditions:

- a) The RF output port of the EUT was connected to Frequency Meter;
- b) Set the working Frequency in the middle channel;
- c) record the 20°C and nominal voltage frequency value as reference point;
- d) vary the temperature from 0°C to 40°C with step 10°C
- e) when reach a temperature point, keep the temperature balance at least 1 hour to make the product working in this status;
- f) read the frequency at the relative temperature.

2. Voltage conditions:

- a) record the 20°C and nominal voltage frequency value as reference point;
 - b) vary the voltage from -15% nominal voltage to +15% voltage;
- read the frequency at the relative voltage.

Remark: Manufacturer declared that the minimum temperature for normal operation of this product is 0°C.

Please Refer to Appendix for Details



8 Test Setup Photo

Refer to Appendix - Test Setup Photo for SZCR2503001186AT

9 EUT Constructional Details (EUT Photos)

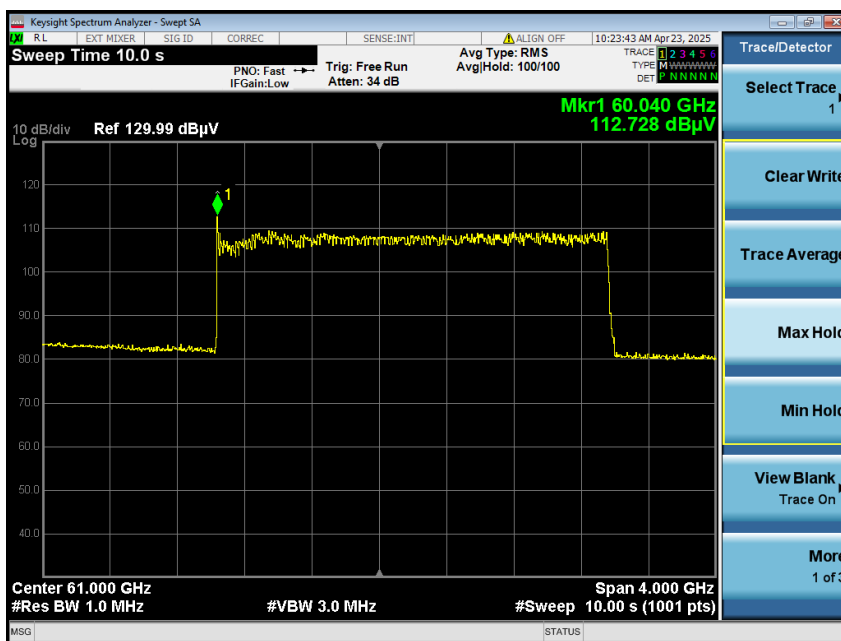
Refer to Appendix – External and Internal Photos for SZCR2503001186AT



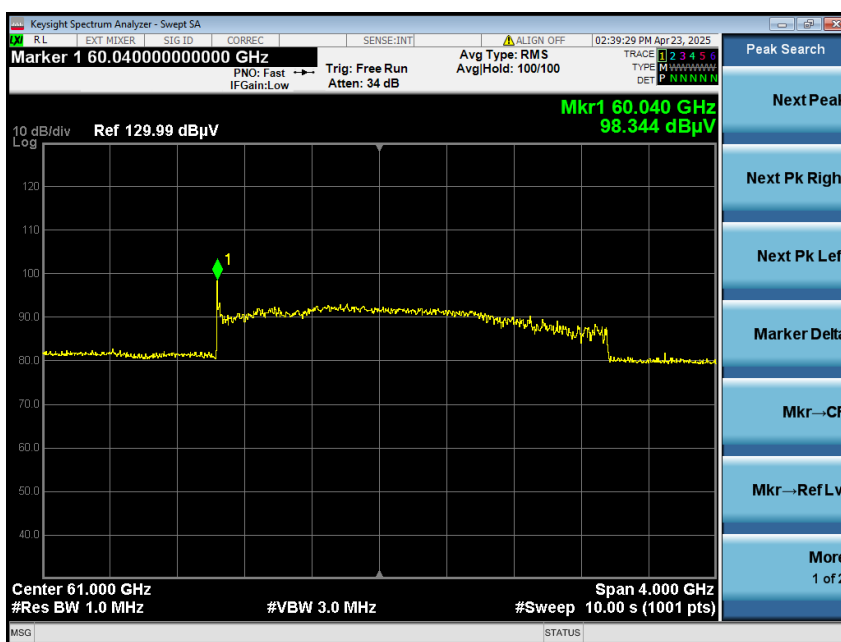
10 Appendix

1. Transmitter power and Transmitter off-times

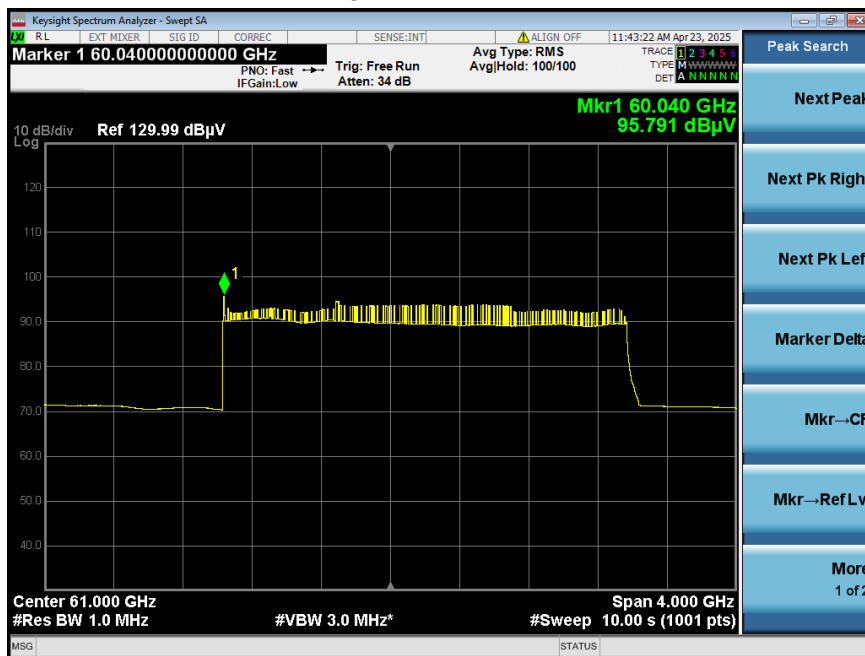
Peak Power- Horizontal



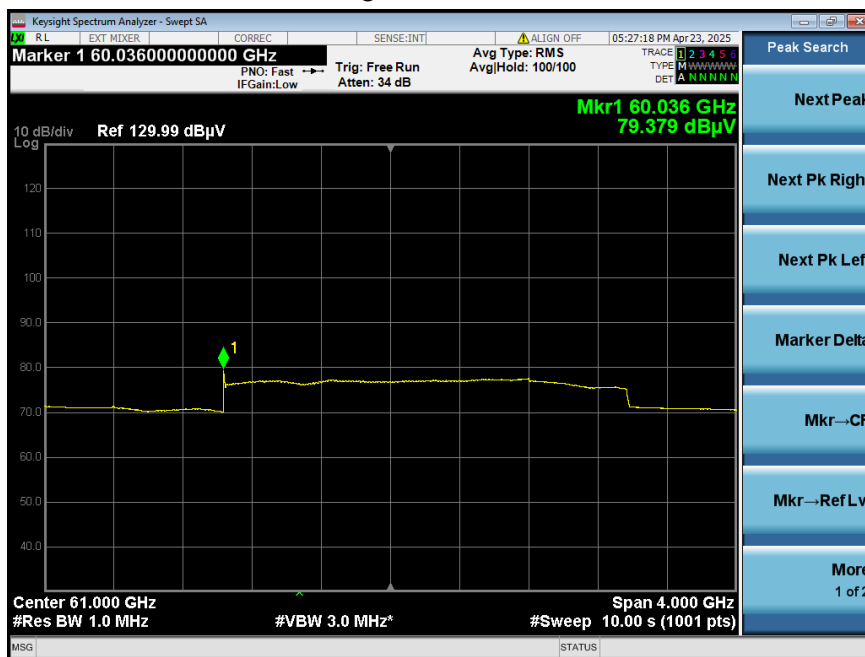
Peak Power- Vertical



Average Power- Horizontal



Average Power - Vertical



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Frequency (GHz)	Polarity	dBuV/m @ 0.5m	Mesured EIRP (dBm)	Desensitization Factor(dB)	Final EIRP (dBm)	EIRP Limit (dBm)	Result	Remark
60.040	Horizontal	112.728	1.94	10.11	12.05	20	Pass	peak
	Horizontal	95.791	-15.00	10.11	-4.89	20	Pass	Average
	Vertical	98.344	-12.45	10.11	-2.34	20	Pass	peak
	Vertical	79.379	-31.41	10.11	-21.3	20	Pass	Average

Remark:

$E[\text{dB}\mu\text{V/m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$, where E = field strength and d = distance at which field strength limit is specified in the rules

$\text{EIRP}[\text{dBm}] = E[\text{dB}\mu\text{V/m}] + 20 \log(d[\text{meters}]) - 104.77$

$\text{Final EIRP}[\text{dBm}] = \text{Mesured EIRP}[\text{dBm}] + \text{Desensitization Factor}[\text{dB}]$

The FMCW Desensitization factor

FMCW Width(MHz)	$T_{\text{chirp}}(\mu\text{s})$	RBW(MHz)	Desensitization Factor(lin)	Desensitization Factor(dB)
2311.9	100	1	0.097	10.11

FMCW desensitization factor $= -10 \cdot \log(\alpha) = -10 \cdot \log(0.097) = 10.11\text{dB}$

$$\alpha = \frac{1}{\sqrt{1 + \left(\frac{2 \ln(2)}{\pi} \right)^2 \left(\frac{BW_{\text{Chirp}}}{T_{\text{Chirp}} B^2} \right)^2}}$$

where

- α is the reduction in amplitude
- BW_{Chirp} is the FMCW Chirp Bandwidth
- T_{Chirp} is the FMCW Chirp Time
- B is the 3 dB IF Bandwidth = RBW



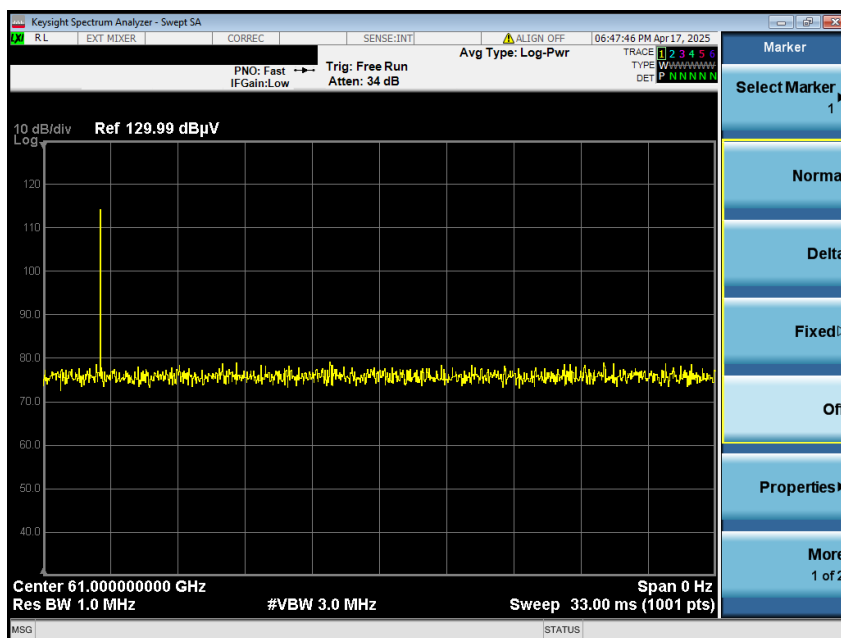
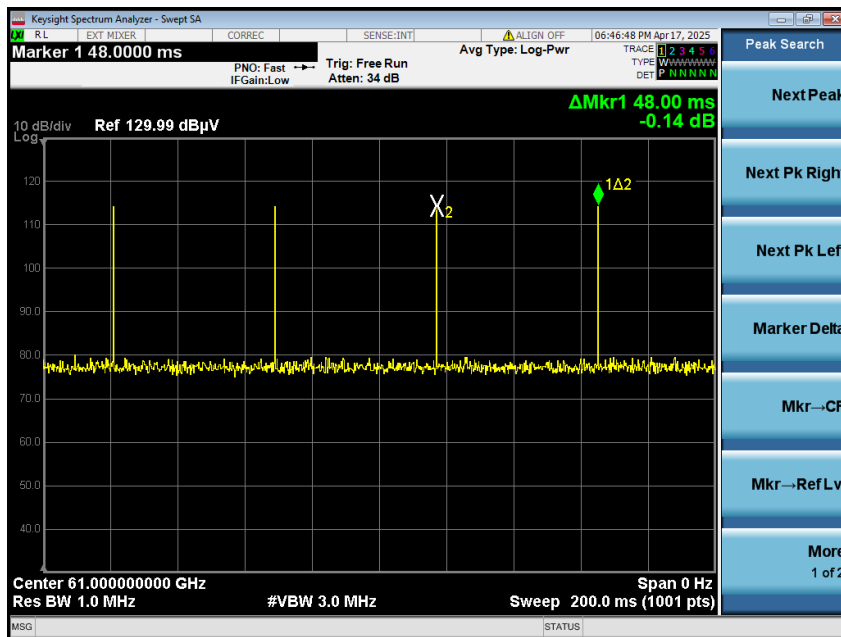
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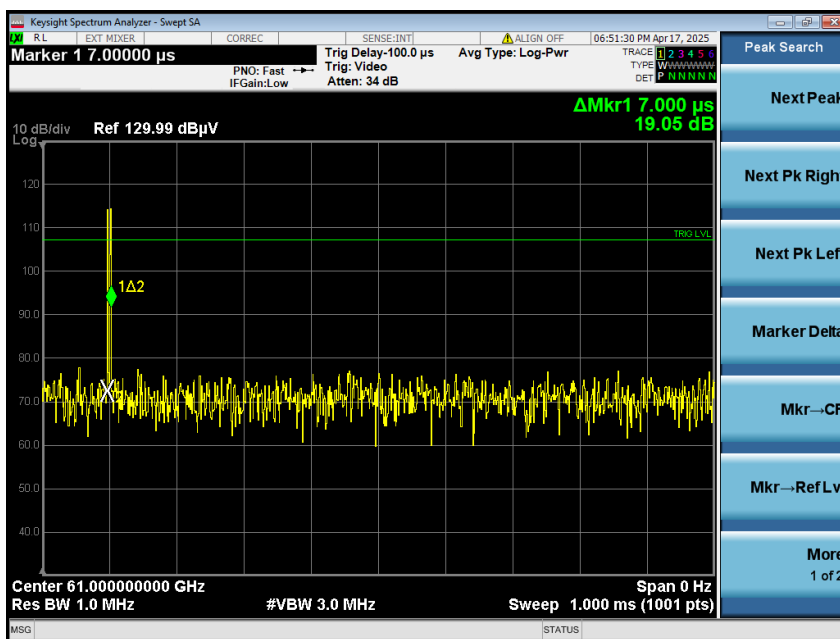
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Transmitter off-times (ms)

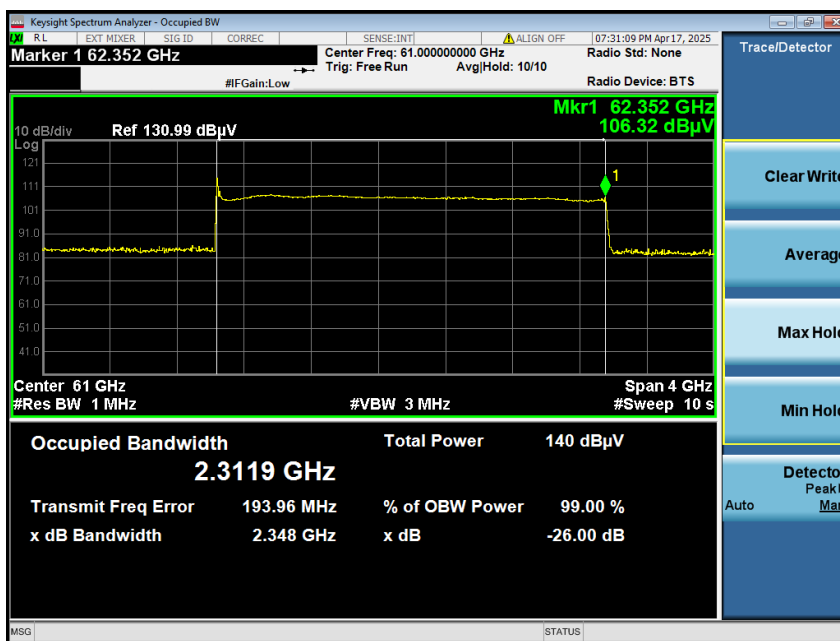
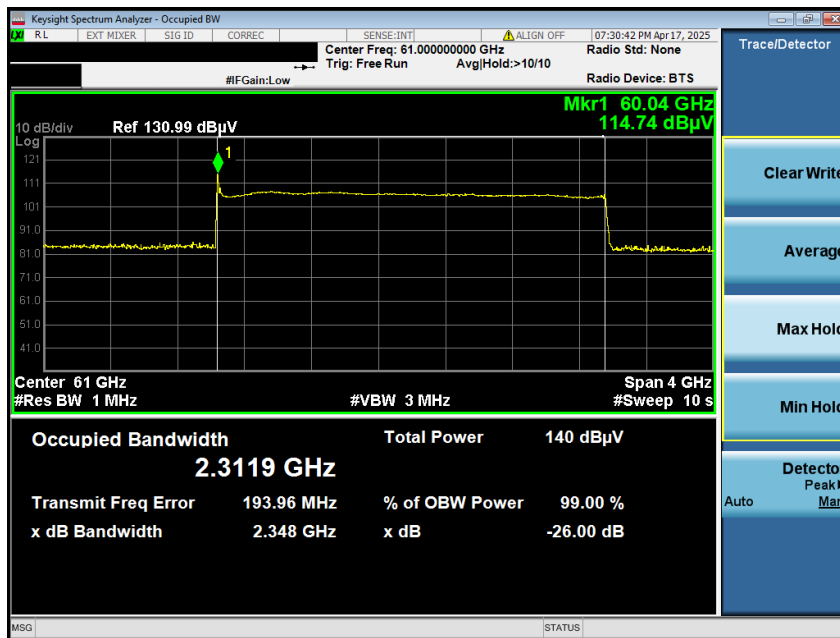




Frequency (GHz)	Transmitter off-times (ms)	Limit (ms)	Result
61	47.993	≥ 16.5	Pass

2. Occupied bandwidth

99% Occupied Channel Bandwidth



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Frequency Range (GHz)	99% OCW (GHz)	F _L (GHz)	Limit (GHz)	F _H (GHz)	Limit (GHz)	Result
60-64	2.3119	60.04	≥60	62.352	≤64	Pass

Remark: F_L: Frequency Low Band Edge, F_H: Frequency High Band Edge



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3. Frequency stability

Frequency Stability vs temperature:

1. Test for 60GHz to 64GHz

Frequency (GHz)	Temperature (°C)	Voltage (V DC)	F _L (GHz)	Limit (GHz)	F _H (GHz)	Limit (GHz)	Result
60-64	50	3.0	60.040	≥ 60	62.352	≤ 64	Pass
	40	3.0	60.040	≥ 60	62.352	≤ 64	Pass
	30	3.0	60.040	≥ 60	62.352	≤ 64	Pass
	20	3.0	60.040	≥ 60	62.352	≤ 64	Pass
	10	3.0	60.040	≥ 60	62.352	≤ 64	Pass
	0	3.0	60.040	≥ 60	62.352	≤ 64	Pass
	-10	3.0	60.040	≥ 60	62.352	≤ 64	Pass

Frequency Stability vs voltage:

1. Test for 60GHz to 64GHz

Frequency (GHz)	Voltage (V DC)	Temperature (°C)	F _L (GHz)	Limit (GHz)	F _H (GHz)	Limit (GHz)	Result
60-64	2.7	25	60.040	≥ 60	62.352	≤ 64	Pass
	3.0	25	60.040	≥ 60	62.352	≤ 64	Pass
	3.3	25	60.040	≥ 60	62.352	≤ 64	Pass

Remark:

F_L: Frequency Low Band Edge, F_H: Frequency High Band Edge

- End of the Report -