TEST REPORT

Application No.:	SZCR2402000560AT
Applicant:	SHENZHEN MINEWSEMI CO., LTD
Address of Applicant:	3rd Floor,I Building, Gangzhilong Science Park, NO.6, Qinglong Road, Longhua District, Shenzhen, China
Manufacturer:	SHENZHEN MINEWSEMI CO., LTD
Address of Manufacturer:	3rd Floor,I Building, Gangzhilong Science Park, NO.6, Qinglong Road, Longhua District, Shenzhen, China
Equipment Under Test (EUT):	
EUT Name:	Radio Module(60GHZ Millimeter wave radar)
Model No.:	MS72SF11
Trade Mark:	MINEWSEMI
FCC ID:	2BDJ6-MS72SF11
Standard(s) :	FCC 47 CFR Part 15, Subpart C
Date of Receipt:	2024-02-22
Date of Test:	2024-03-14 to 2024-03-18
Date of Issue:	2024-04-24
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
EMC Laboratory Manager

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Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2024-04-24		Original

Authorized for issue by:				
		Leo Lai **Leo Lai/Project Engineer**		
		Eric Fu **Eric Fu/Reviewer**		

2 Test Summary

Test Item	FCC Rule No.	Test Method	Result
Antenna Requirement	15.203	--	PASS
Transmitter power	15.255(c)(2)(iii)(A)	ANSI C63.10-2020 Section 9.2.1/9.2.2	PASS
Occupied bandwidth	15.215 (c), 15.255 (c2)	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

3 Contents

4 General Information

4.1 Details of E.U.T.

Power supply:	DC 3.3V
Operation Frequency:	57GHz-64GHz
Modulation Type:	FMCW
Antenna Type:	Integrated Patch Antenna
Antenna Gain:	5dBi

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	ZHAOXIN	PS-3005D	REF. No.SEA27B01

4.3 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	25	3.3
LTHV	-40	3.6
LTLV	-40	3.0
HTHV	85	3.6
HTLV	85	3.0

Note:

NV:Normal Voltage	LV:Low Extreme Test Voltage	HV:High Extreme Test Voltage
NT:Normal Temperature	LT:Low Extreme Test Temperature	HT:High Extreme Test Temperature

4.4 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	± 3.1dB
Transmitter power and power spectral density	± 4.8dB
Occupied bandwidth	± 3%
Radiated Spurious Emissions Below 1GHz	± 6.0dB for 3m; ± 5.0dB for 10m
Radiated Spurious Emissions Above 1GHz	± 4.6dB (1-18GHz);± 4.8dB (Above 18GHz)

Remark:
The U_{lab} (lab Uncertainty) is less than $U_{cispr/ETSI}$ (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.

4.5 Test Location

All tests were performed at:

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

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.6 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.

4.7 Deviation from Standards

None

4.8 Abnormalities from Standard Conditions

None

5 Equipment List

Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2022-04-02	2025-04-01
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	SEM004-20	2023-03-31	2024-03-30
Horn Antenna(800MHz-18GHz)	Rohde&Schwarz	HF907	SEM003-07	2022-07-24	2024-07-23
Microwave system amplifier (0.5GHz-26.5GHz)	Agilent	83017A	SEM005-25	2023-09-19	2024-09-18
Broad-Band Horn Antenna(15GHz-40GHz)	SCHWARZBECK	BBHA 9170	SEM003-15	2022-11-13	2024-11-12
Programmable Temperature&Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2024-03-19	2025-03-18
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2023-03-31	2024-03-30
Coaxial Cable	SGS	N/A	SEM026-01	2023-07-07	2024-07-06
Waveguide(40-60GHz)	REBES	SWG-19025-FB	06303-01	2023-02-19	2025-02-18
Waveguide(50-75GHz)	REBES	SWG-15025-FB	01525-09	2023-02-19	2025-02-18
Waveguide(75-110GHz)	REBES	SWG-10025-FB	01509-01	2023-02-19	2025-02-18
Waveguide(110-170GHz)	REBES	SWG-06025-FB	06302-01	2023-02-19	2025-02-18
Waveguide Harmonic Mixer(40-60GHz)	REBES	STH-19SF-S1	06937-01	2023-02-19	2025-02-18
Waveguide Harmonic Mixer(50-75GHz)	KEYSIGHT	M1970V	MY51390966	2023-02-19	2025-02-18
Waveguide Harmonic Mixer(75-110GHz)	KEYSIGHT	M1970W	MY51430883	2023-02-19	2025-02-18
Waveguide Harmonic Mixer(110-170GHz)	REBES	STH-06SF-S1	06110-01	2023-02-19	2025-02-18
Spectrum Analyzer	Rohde&Schwarz	FSU43	SEM004-08	2023-03-30	2024-03-29
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A

General used equipment					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	deli	8838	SEM002-32	2023-07-28	2024-07-27
Humidity/ Temperature Indicator	deli	8838	SEM002-33	2023-07-28	2024-07-27

Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2023-03-23	2024-03-22

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 5dBi.

Antenna location: Refer to internal photos

7 Radio Spectrum Matter Test Results

7.1 Transmitter power

Test Requirement 47 CFR Part 15C Section 15.255 (c)(2)(iii)(A)

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

Limit:

The peak EIRP shall not exceed 14 dBm, and the sum of continuous transmitter off-times of at least two milliseconds shall equal at least 25.5 milliseconds within any contiguous interval of 33 milliseconds.

7.1.1 E.U.T. Operation

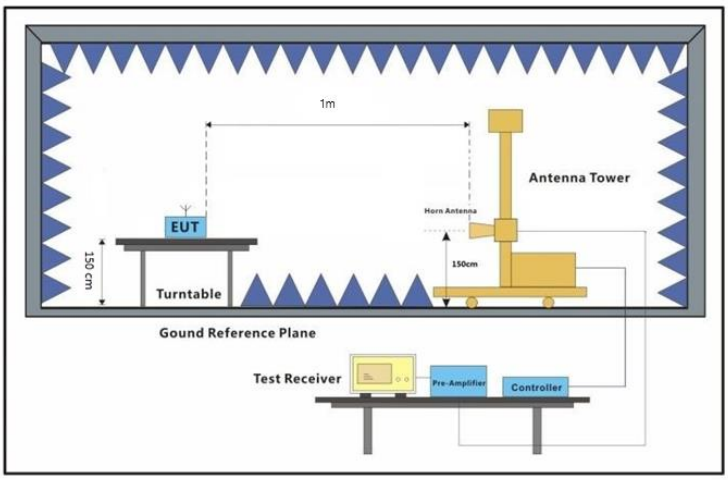
Operating Environment:

Temperature: 19.8 °C Humidity: 46.1 % RH Atmospheric Pressure: 1000 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode _ Keep the EUT in continuously transmitting mode

7.1.3 Test Setup Diagram



Above 40GHz

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 1 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 hight 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.

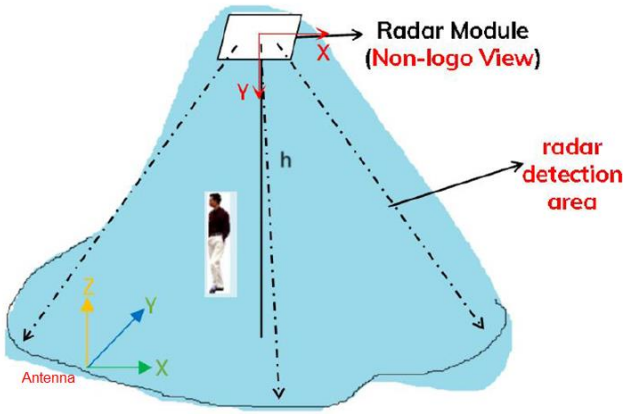
e. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

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 module 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 (c)(2)

Test Method: ANSI C63.10-2020 Section 9.4

Limit: 57-64GHz

7.2.1 E.U.T. Operation

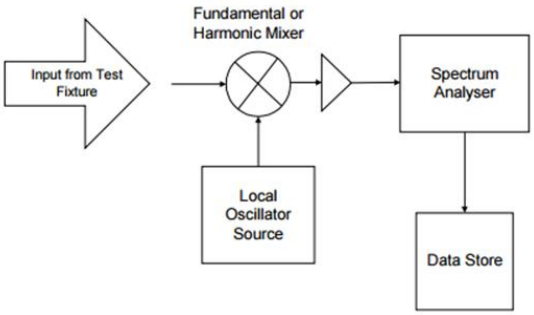
Operating Environment:

Temperature: 19.8 °C Humidity: 46.1 % RH Atmospheric Pressure: 1000 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode _ Keep the EUT in continuously 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(uV/m)* Within restricted bands		
	Peak	Quasi Peak	Average
0.009 - 0.090	148.5 - 128.5	NA	128.5 - 108.5**
0.090 - 0.110	NA	108.5 - 106.8**	NA
0.110 - 0.490	126.8 - 113.8	NA	106.8 - 93.8**
0.490 - 1.705	NA	73.8 - 63.0**	NA
1.705 - 30.0*		69.5	
30 - 88		40.0	
88 - 216		43.5	

216 - 960		46.0	
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:

LimS2 = 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

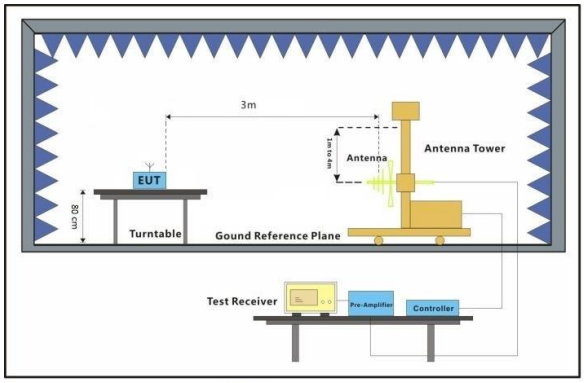
Operating Environment:

Temperature: 19.8 °C Humidity: 46.1 % RH Atmospheric Pressure: 1000 mbar

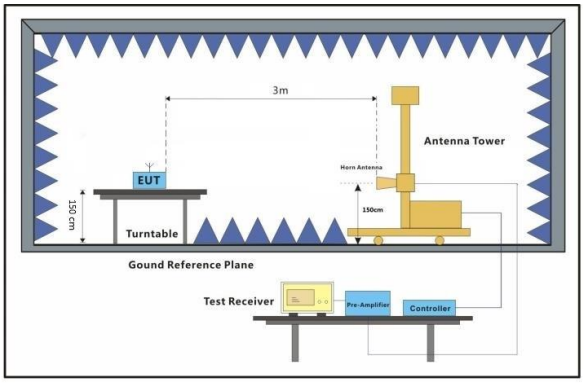
7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode _ Keep the EUT in continuously transmitting mode

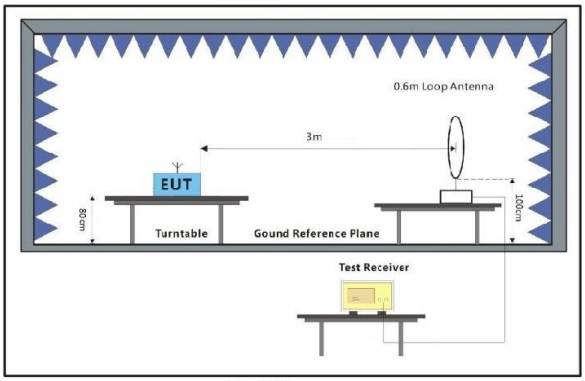
7.3.3 Test Setup Diagram



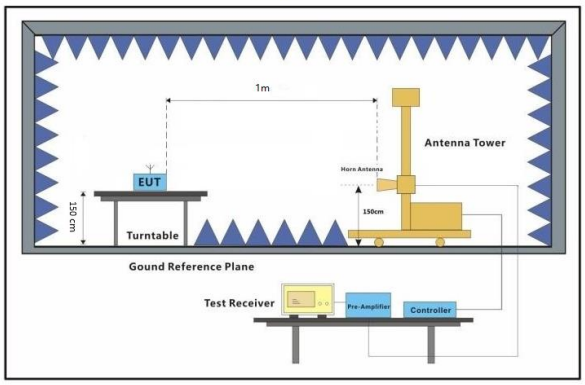
30MHz-1GHz



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 t tuned to the same hight (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.

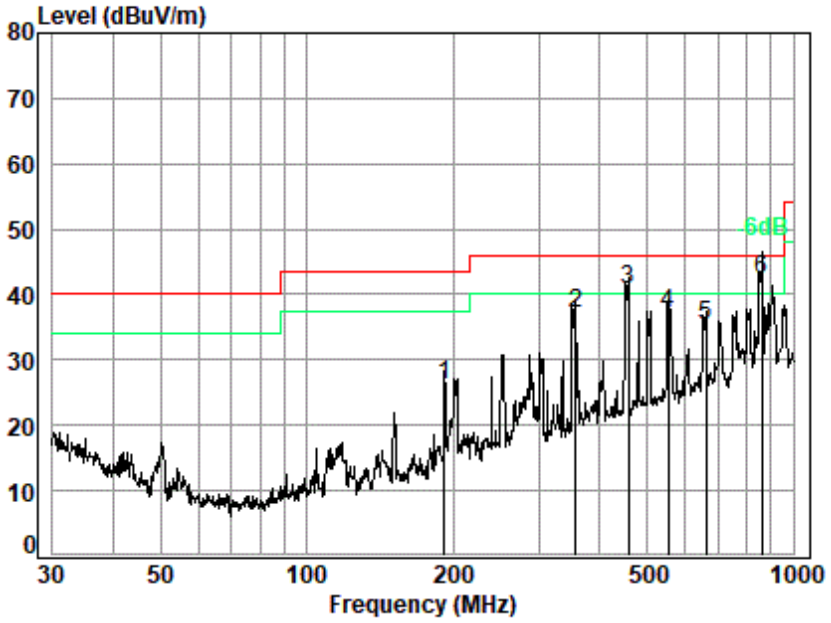
i. Repeat above procedures until all frequencies measured was complete.

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.

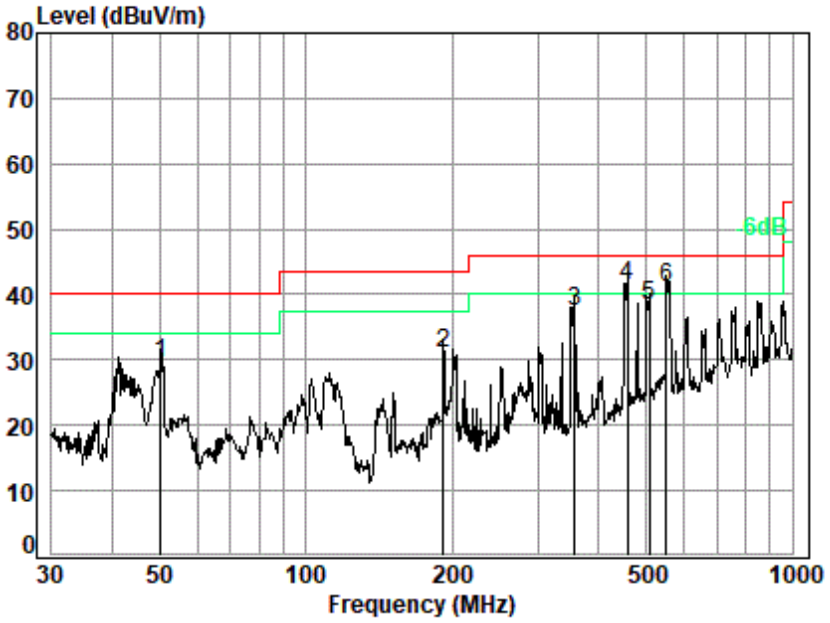
Test Mode: 01; Polarity: Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : 00016AT
Test Mode: 03

	Freq	Ant Factor	Cable Loss	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	191.75	14.26	1.69	27.28	37.55	26.22	43.50	-17.28	QP
2	356.68	20.13	2.39	27.14	41.69	37.07	46.00	-8.93	QP
3	457.51	21.28	2.75	27.59	44.28	40.72	46.00	-5.28	QP
4	552.88	23.71	3.06	28.02	38.49	37.24	46.00	-8.76	QP
5	661.15	25.22	3.39	28.04	34.81	35.38	46.00	-10.62	QP
6 q	863.06	27.52	3.99	27.31	38.18	42.38	46.00	-3.62	QP

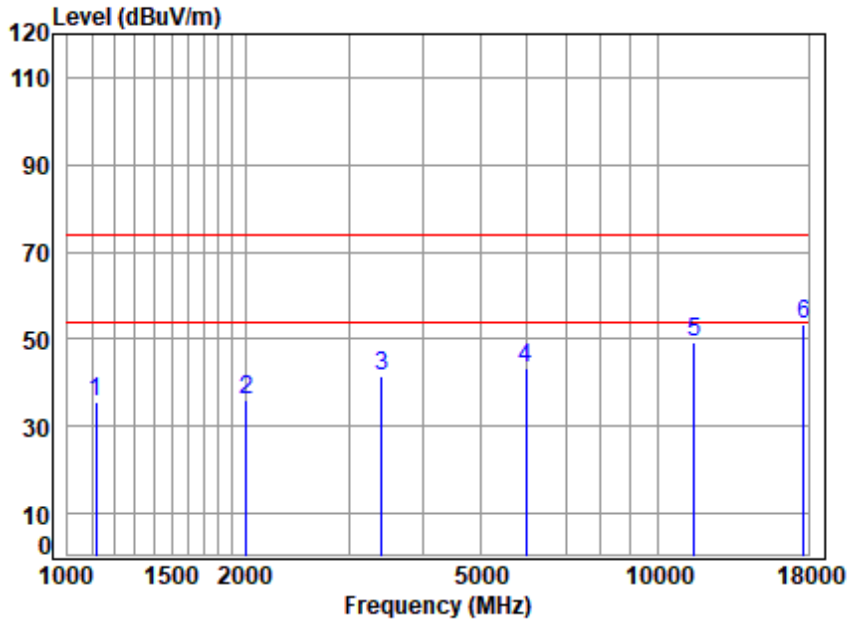
Test Mode: 01; Polarity: Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : 00016AT
Test Mode: 03

	Freq	Ant Factor	Cable Loss	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	50.23	12.73	0.83	27.75	43.72	29.53	40.00	-10.47	QP
2	191.75	14.26	1.69	27.28	42.48	31.15	43.50	-12.35	QP
3	356.68	20.13	2.39	27.14	42.07	37.45	46.00	-8.55	QP
4 q	457.51	21.28	2.75	27.59	45.01	41.45	46.00	-4.55	QP
5	508.26	23.13	2.92	27.82	39.98	38.21	46.00	-7.79	QP
6	550.95	23.78	3.05	28.01	42.09	40.91	46.00	-5.09	QP

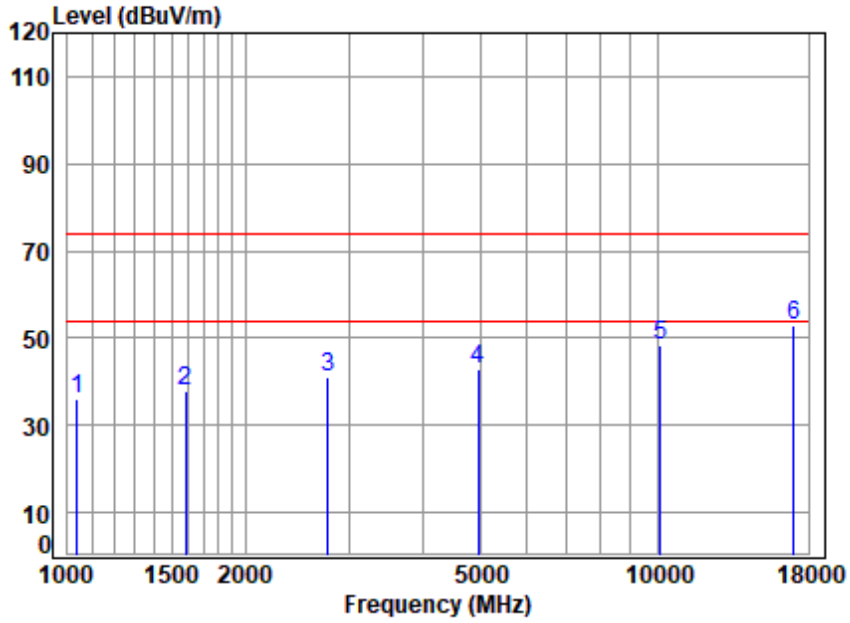
Test Mode: 01; Polarity: Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No : 00560AT
Mode : TX RSE

	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	1119.323	3.43	23.78	38.32	46.54	35.43	74.00	-38.57	Peak
2	2006.877	4.69	28.83	38.43	41.00	36.09	74.00	-37.91	Peak
3	3405.929	6.11	32.33	36.12	39.24	41.56	74.00	-32.44	Peak
4	5984.305	8.16	34.84	34.91	35.40	43.49	74.00	-30.51	Peak
5	11533.480	13.00	37.77	37.68	36.29	49.38	74.00	-24.62	Peak
6	p17690.530	14.97	43.78	37.61	32.12	53.26	74.00	-20.74	Peak

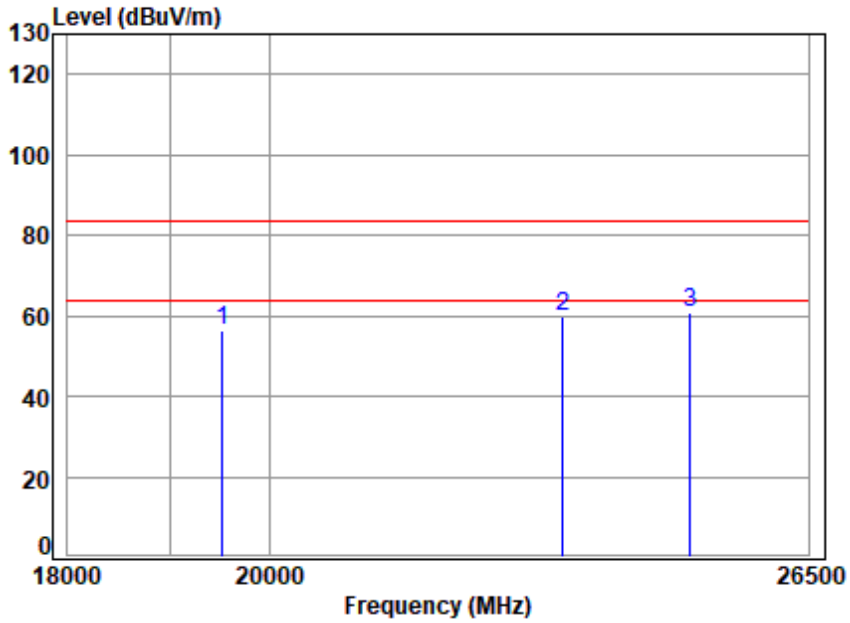
Test Mode: 01; Polarity: Vertical



Site : chamber
Condition: 3m VERTICAL
Job No : 00560AT
Mode : TX RSE

	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	1038.290	3.27	25.07	38.31	45.82	35.85	74.00	-38.15	Peak
2	1583.392	4.18	26.87	38.40	45.08	37.73	74.00	-36.27	Peak
3	2758.041	5.39	29.72	36.62	42.74	41.23	74.00	-32.77	Peak
4	4973.662	7.41	34.51	35.41	36.36	42.87	74.00	-31.13	Peak
5	10097.600	12.66	37.40	37.42	35.89	48.53	74.00	-25.47	Peak
6	p17038.150	14.58	43.10	37.52	32.69	52.85	74.00	-21.15	Peak

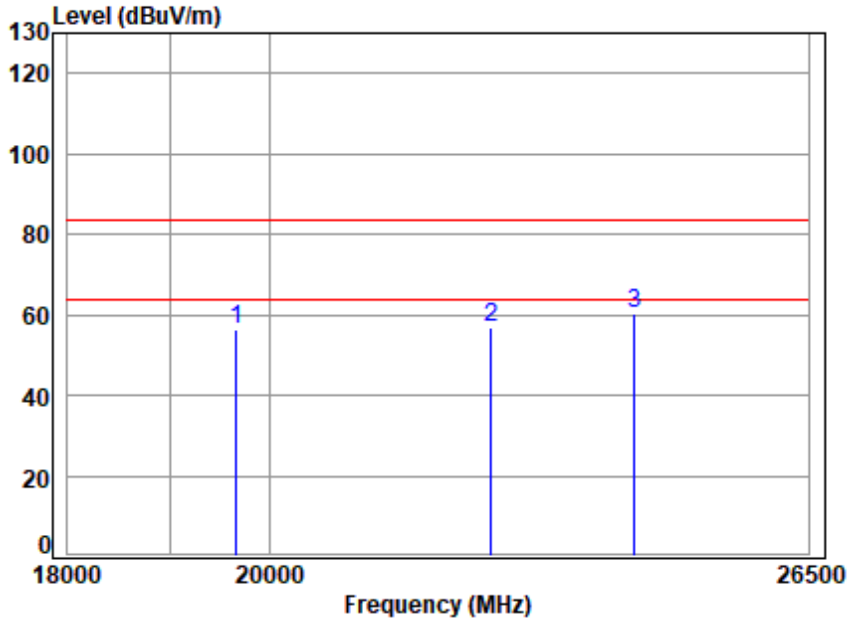
Test Mode: 01; Polarity: Horizontal



Site : chamber
Condition: 1m Horizontal
Job No : 00560AT
Mode : TX RSE

	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	19515.470	6.41	38.15	36.91	48.84	56.49	83.54	-27.05	Peak
2	23297.580	7.38	39.86	36.72	49.41	59.93	83.54	-23.61	Peak
3	p24900.160	7.63	39.46	36.21	50.09	60.97	83.54	-22.57	Peak

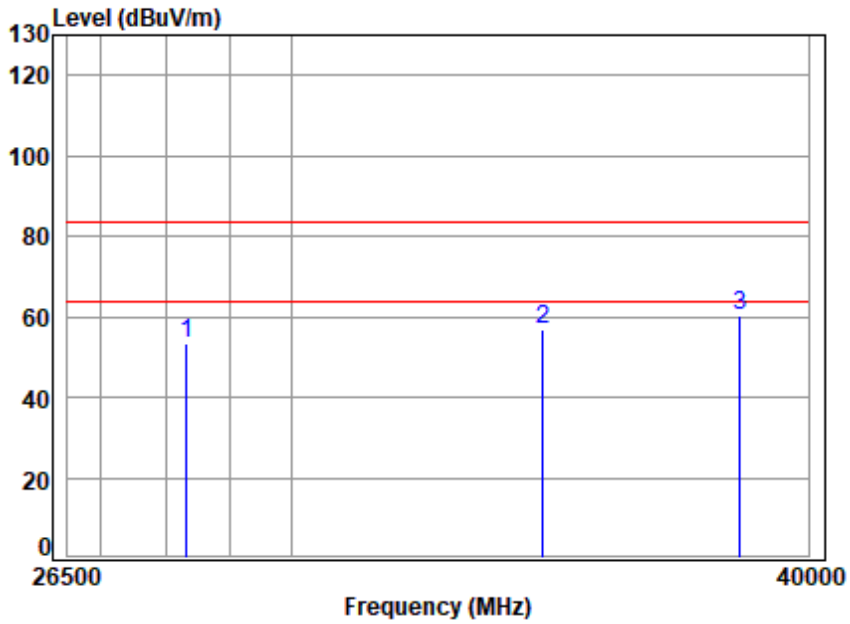
Test Mode: 01; Polarity: Vertical



Site : chamber
Condition: 1m Vertical
Job No : 00560AT
Mode : TX RSE

	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	19651.800	6.44	38.17	36.99	48.87	56.49	83.54	-27.05	Peak
2	22457.080	7.20	39.05	36.97	47.75	57.03	83.54	-26.51	Peak
3	p24206.950	7.48	39.87	36.65	49.80	60.50	83.54	-23.04	Peak

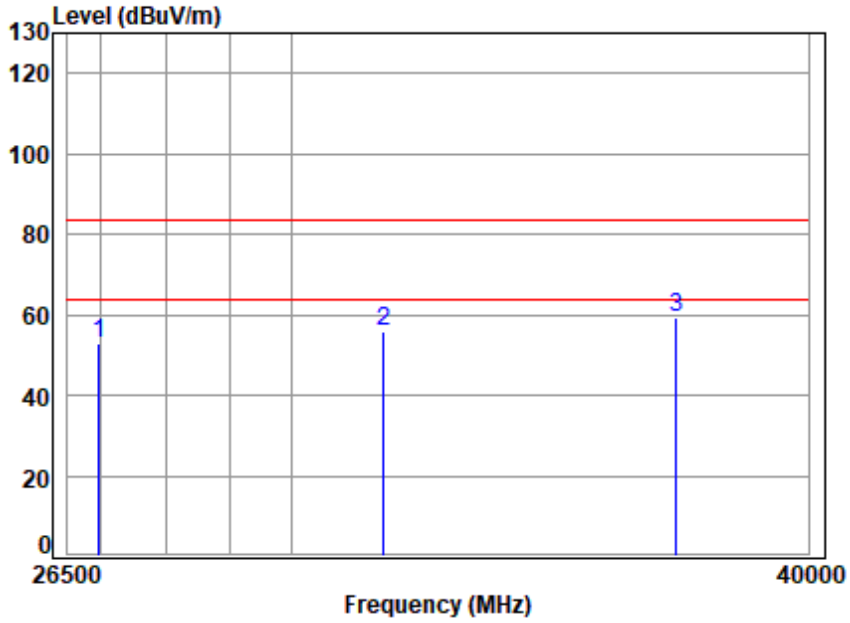
Test Mode: 01; Polarity: Horizontal



Site : chamber
Condition: 1m Horizontal
Job No : 00560AT
Mode : TX RSE

	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	28316.200	7.93	40.09	54.32	59.88	53.58	83.54	-29.96	Peak
2	34503.700	10.47	41.85	43.94	48.41	56.79	83.54	-26.75	Peak
3	p38497.300	10.88	43.85	38.60	44.09	60.22	83.54	-23.32	Peak

Test Mode: 01; Polarity: Vertical



Site : chamber
Condition: 1m Vertical
Job No : 00560AT
Mode : TX RSE

	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	26962.250	7.73	40.28	53.52	58.18	52.67	83.54	-30.87	Peak
2	31567.620	8.67	41.61	49.58	55.00	55.70	83.54	-27.84	Peak
3	p37158.000	11.36	43.65	39.62	43.96	59.35	83.54	-24.19	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/cm2)	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 C63.10-2013 section 9 as follows: E=sqrt(PD×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

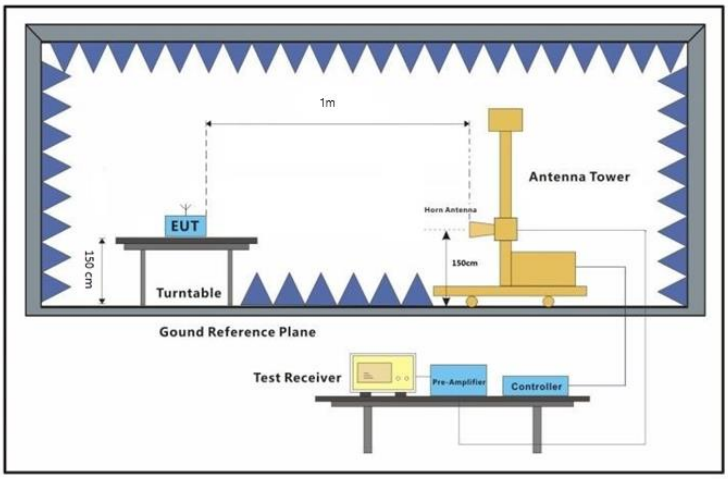
Operating Environment:

Temperature: 23.2 °C Humidity: 45.8 % RH Atmospheric Pressure: 1000 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode _ Keep the EUT in continuously transmitting mode

7.4.3 Test Setup Diagram



Above 40GHz

7.4.4 Measurement Procedure and Data

a. 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

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 hight (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.

d. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

e. 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.

f. 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.

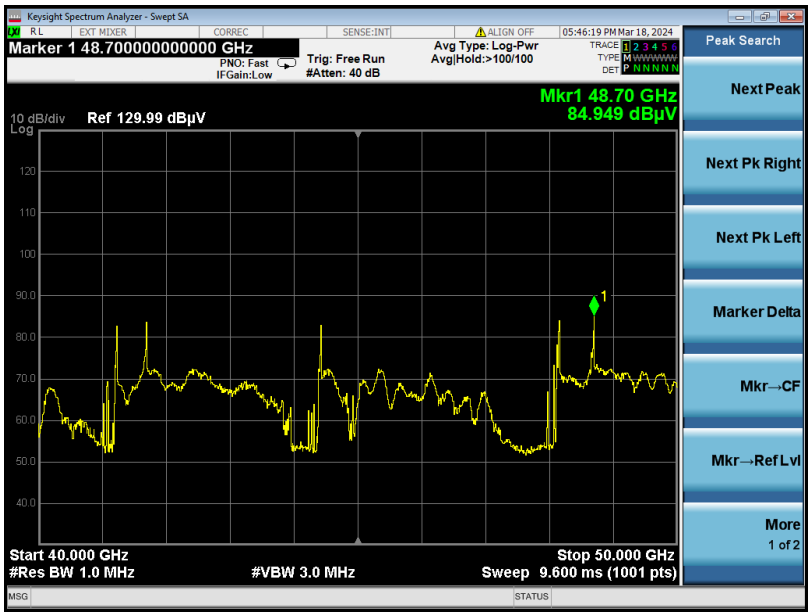
g. Repeat above procedures until all frequencies measured was complete.

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

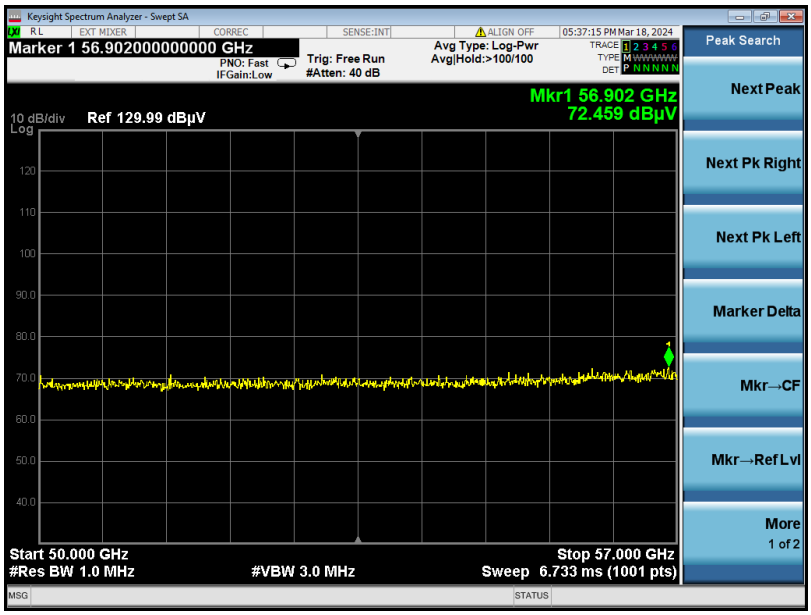
Test Mode: 01; Polarity: Horizontal

Test Mode: 01; Polarity: Vertical

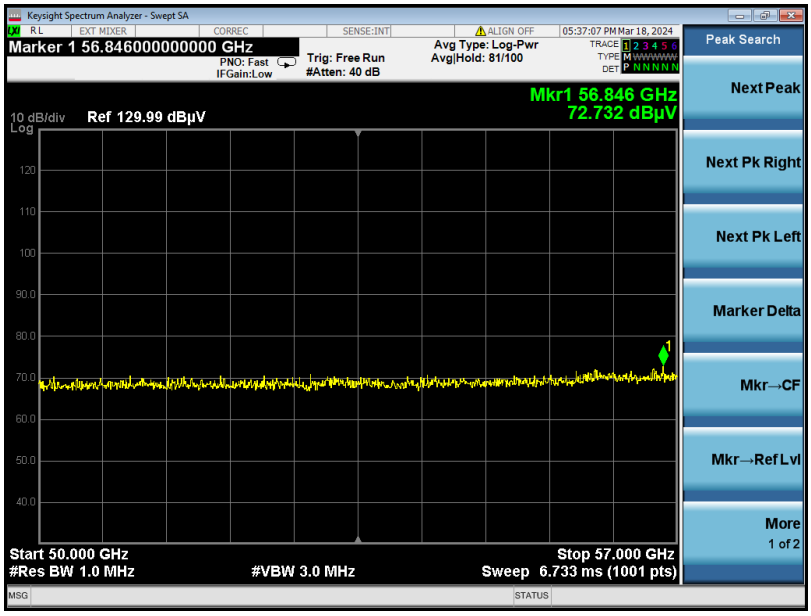


Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
48.16	1	74.243	114.85	94.85	H	PASS
48.80	1	84.949	114.85	94.85	V	PASS

Test Mode: 01; Polarity: Horizontal

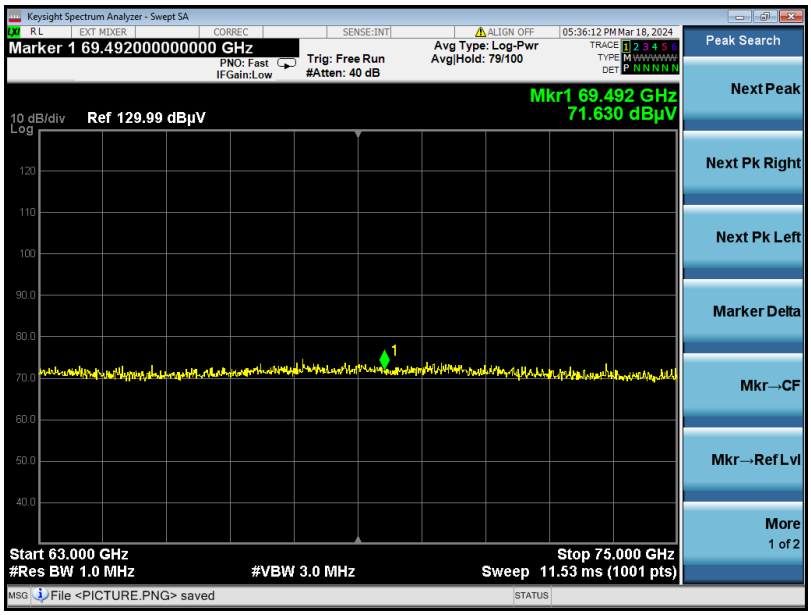


Test Mode: 01; Polarity: Vertical

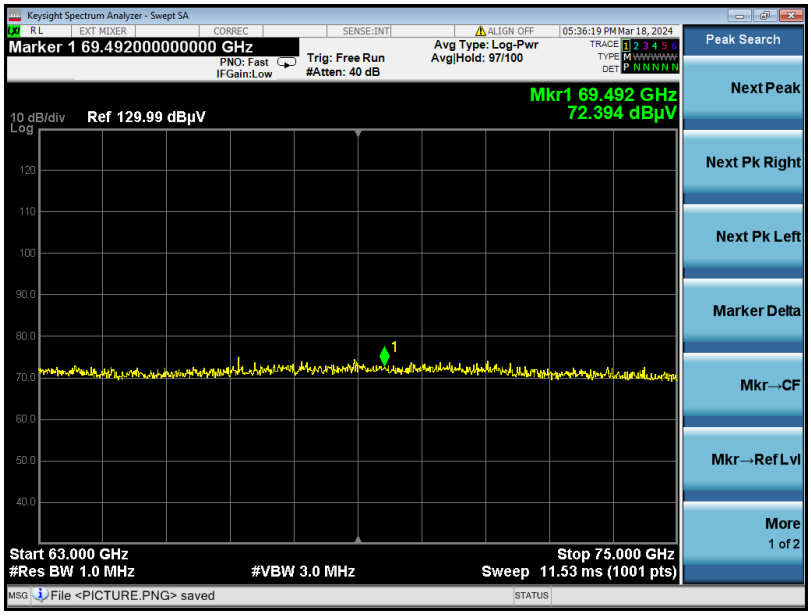


Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
56.902	1	72.459	114.85	94.85	H	PASS
56.846	1	72.732	114.85	94.85	V	PASS

Test Mode: 01; Polarity: Horizontal

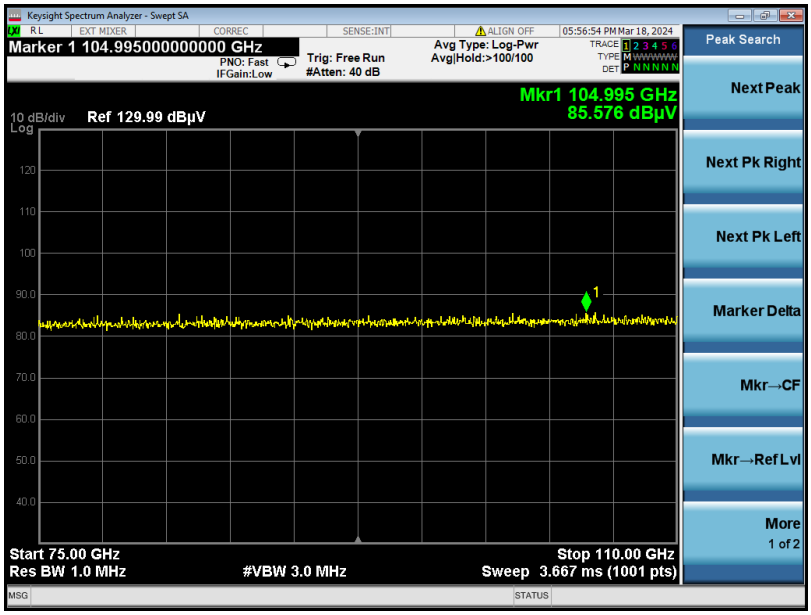


Test Mode: 01; Polarity: Vertical

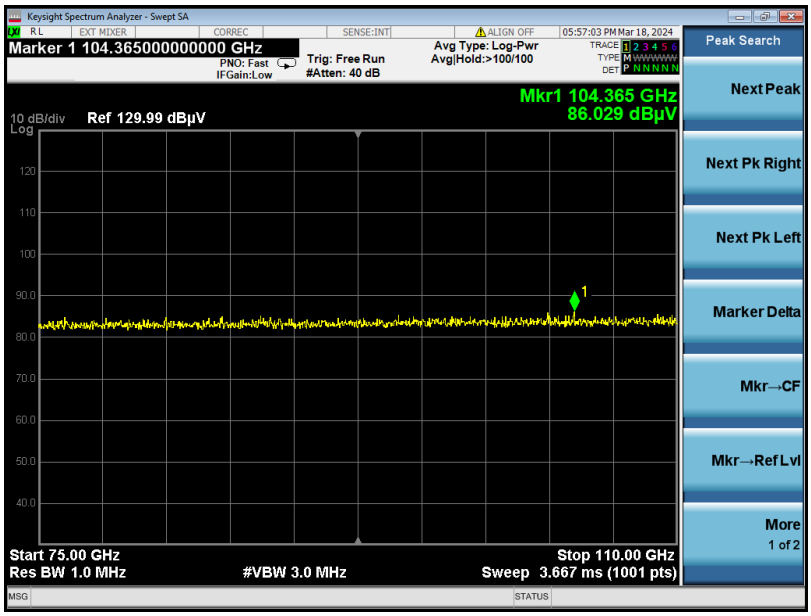


Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
69.492	1	71.630	114.85	94.85	H	PASS
69.492	1	72.394	114.85	94.85	V	PASS

Test Mode: 01; Polarity: Horizontal



Test Mode: 01; Polarity: Vertical



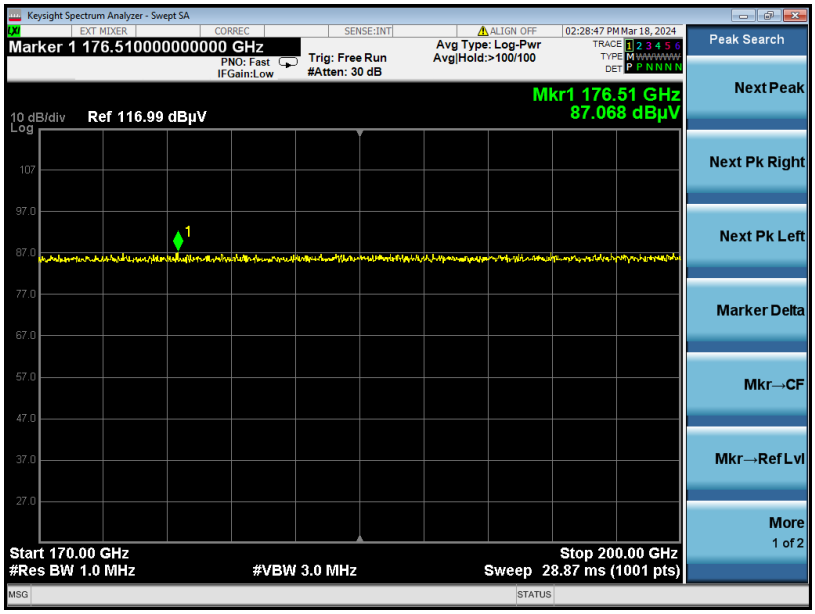
Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
104.995	1	85.576	114.85	94.85	H	PASS
104.365	1	86.029	114.85	94.85	V	PASS

Test Mode: 01; Polarity: Horizontal

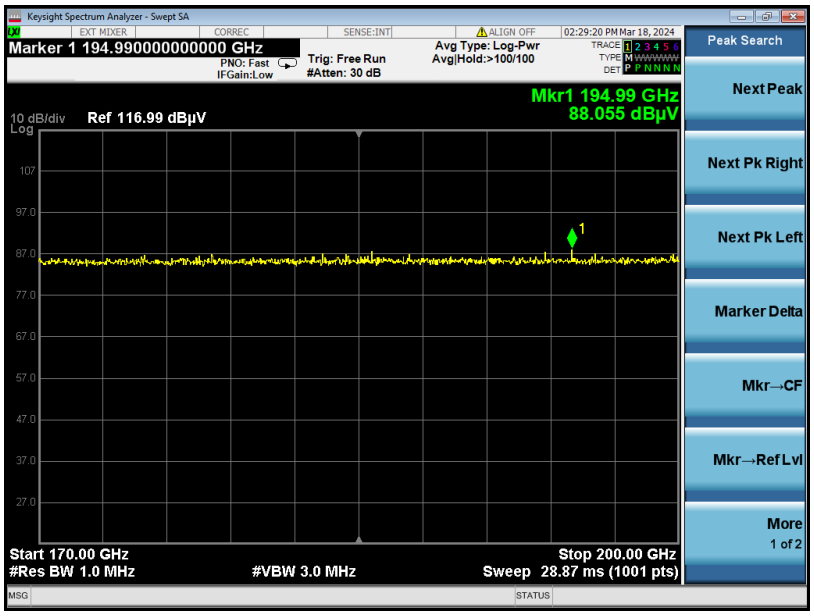
Test Mode: 01; Polarity: Vertical

Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
160.760	1	88.159	114.85	94.85	H	PASS
156.740	1	88.225	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
176.510	1	87.068	114.85	94.85	H	PASS
194.990	1	88.055	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

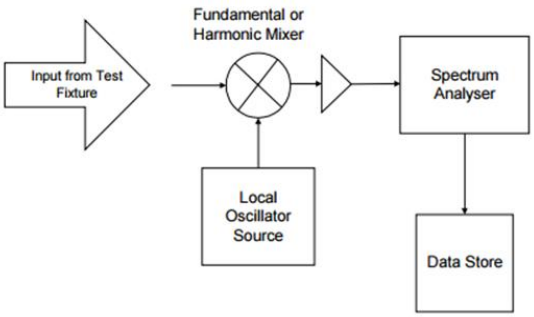
Operating Environment:

Temperature: 19.8 °C Humidity: 47.4 % RH Atmospheric Pressure: 1000 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode _ Keep the EUT in continuously 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 norminal 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 banlance 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 norminal voltage frequency value as reference point;

b) vary the voltage from -15% norminal 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℃.

Please Refer to Appendix for Details

8 Test Setup Photo

Refer to Appendix - Test Setup Photo for SZCR2402000560AT

9 EUT Constructional Details (EUT Photos)

Refer to Appendix – External and Internal Photos for SZCR2402000560AT.

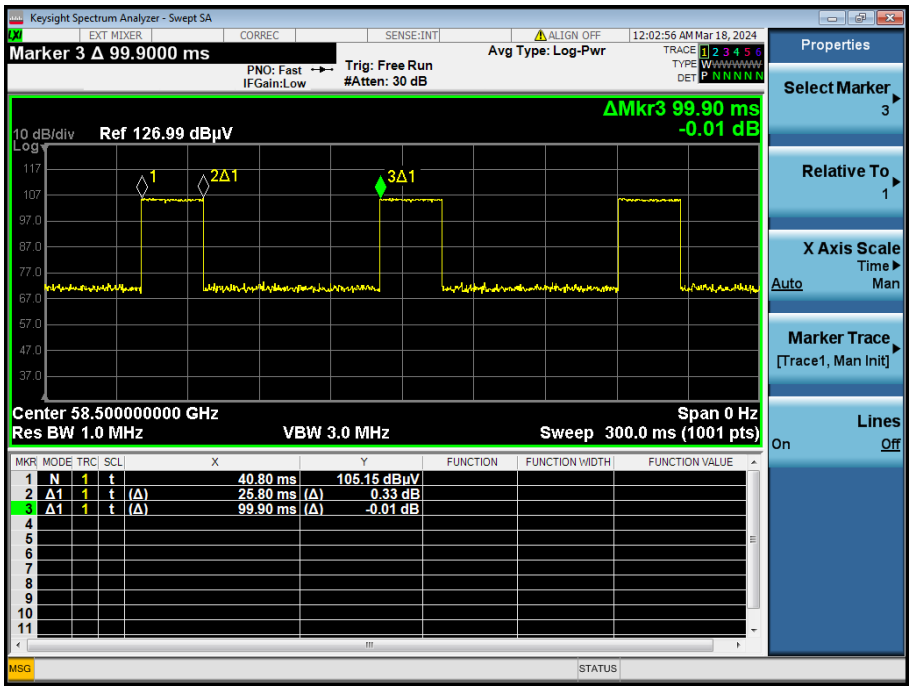
10 Appendix

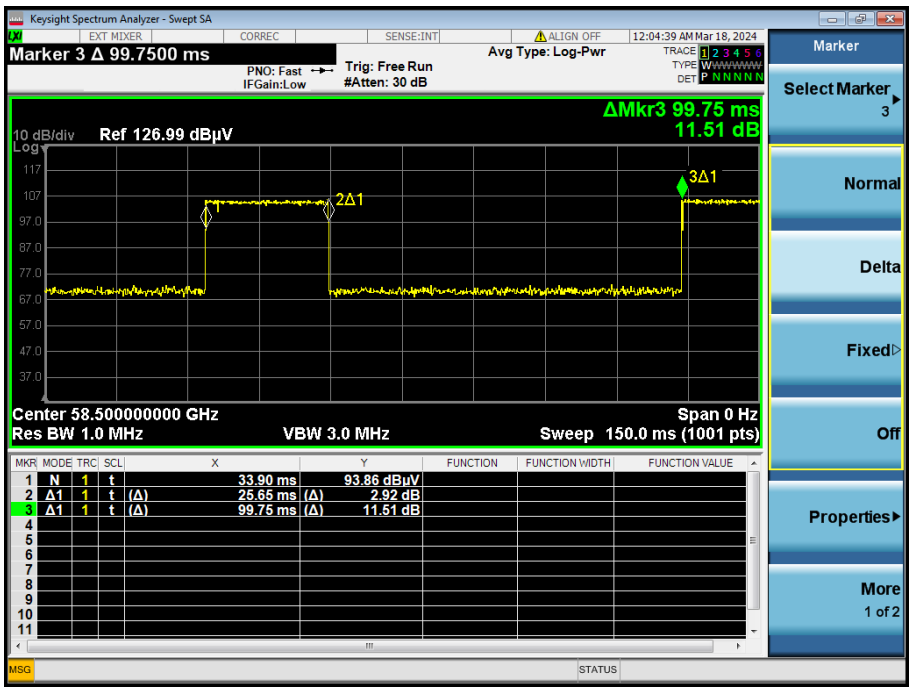
1. Transmitter power

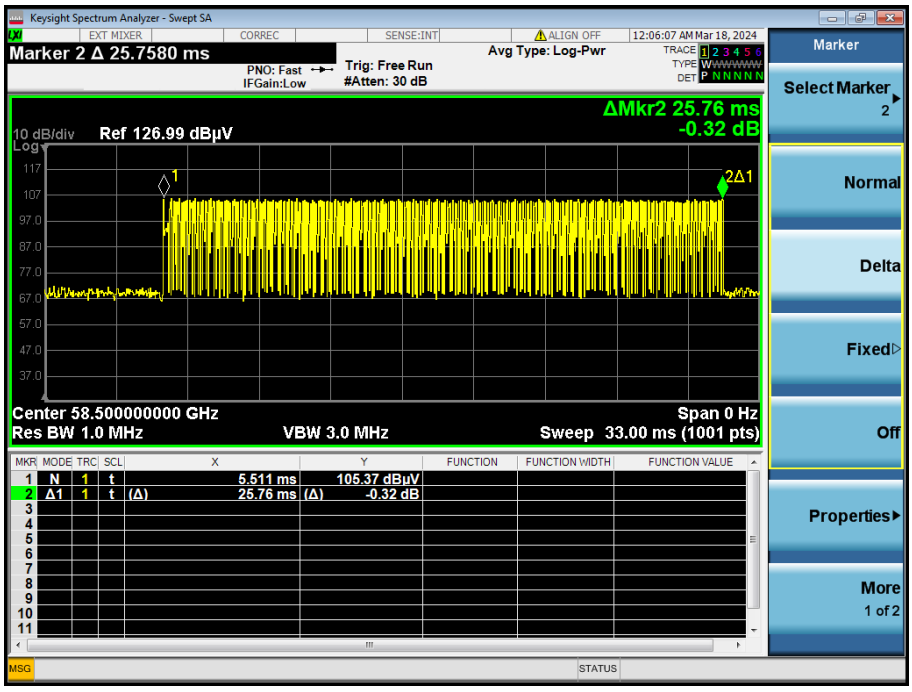
1.1 Ant1

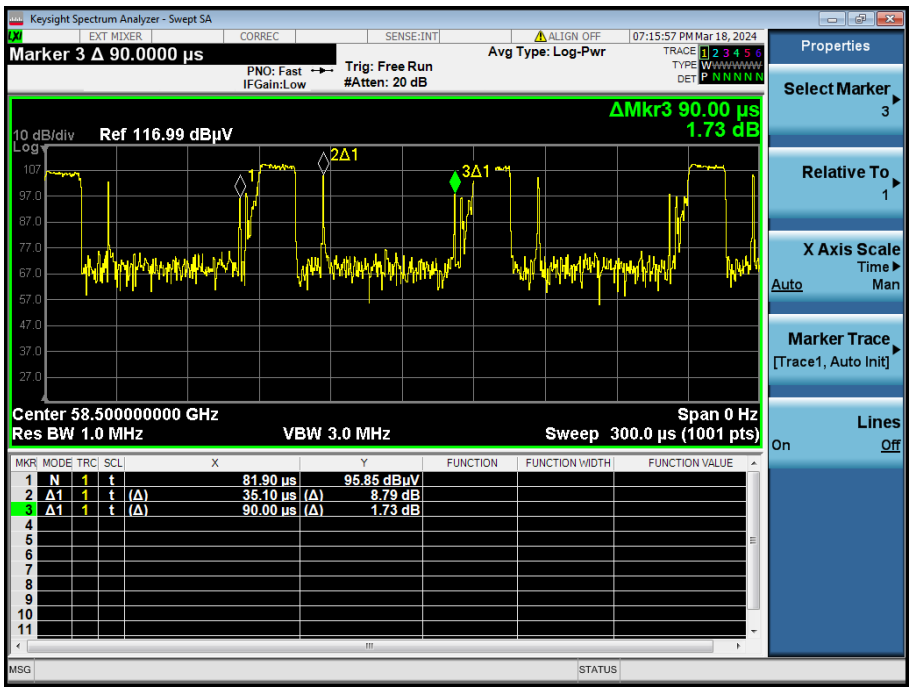
1.1.1 Test Result of duty cycle &

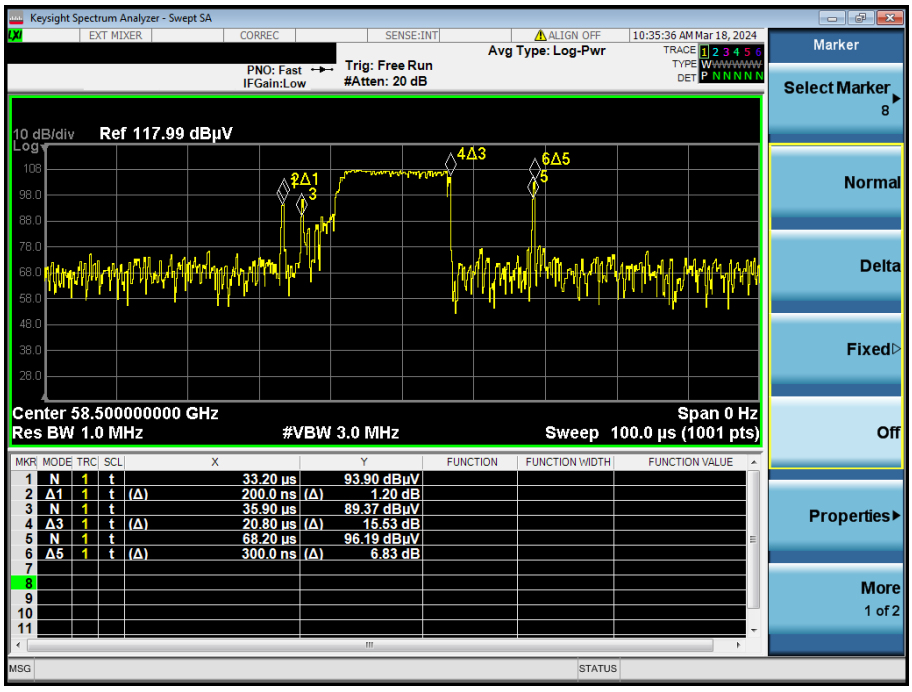
Duty Cycle











Duty Cycle

Chirp Witdh(us)	Chirp Period(us)	Chirp Number (us)	Burst Period (ms)	Tx ON(ms)	Tx OFF(ms)	Tx OFF Rate(%)	Tx OFF Limit (%)	Verdict
21.3	90	287	25.76	6.11	26.89	81.47	77.27	Pass

Chirp numberin Burst Period = 25.76ms/90us

Transmission Time = Chirp number in Burst Period * Chirp Width = 200ns+20.8us+300ns = 21.3us

OFFTime(ms) = Burst Period(ms)-ON Time (ms)

TX OFF Time Ratio = TX OFF Time(ms) /Burst Period(ms)

TX OFF Time Ratio Limit(%) =(25.50ms /33ms)"100% = 77.27%

The FMCW Desensitization factor

Star Freq(GHz)	Stop Freq(GHz)	FMCW Witdh(MHz)	Ramp Time(us)	RBW(MHz)	Desensitization Factor(lin)	Desensitization Factor(dB)
57	64	7000	90	1	0.17	15.36

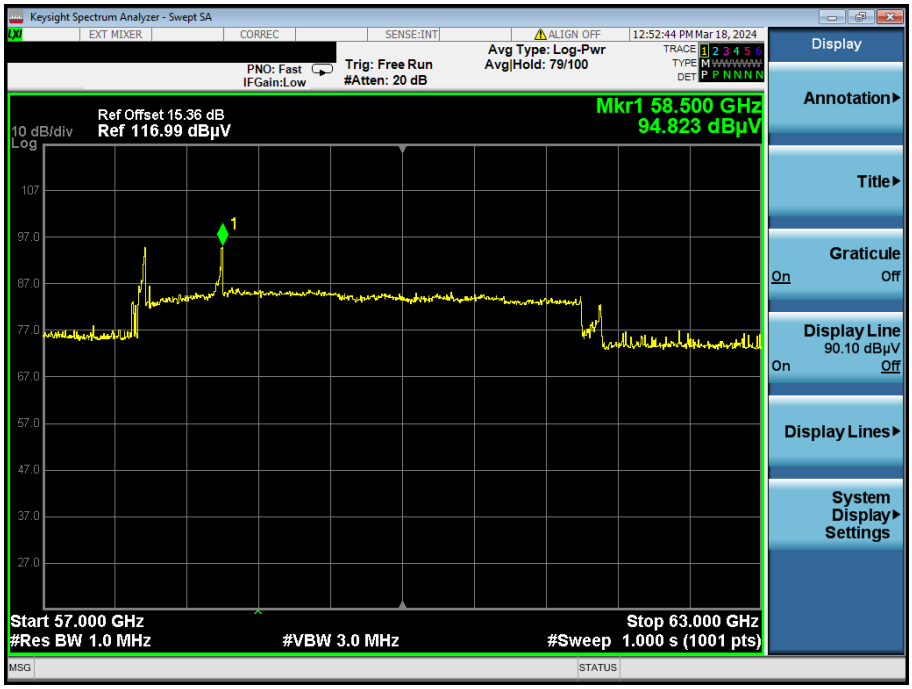
FMCW desensitization factor =-20*Log(α)=-20*log(0.17)= 15.36dB

$$\alpha = \frac{1}{\sqrt[4]{1+\left(\frac{2\ln(2)}{\pi}\right)^2\left(\frac{F_s}{T_s B^2}\right)^2}}$$

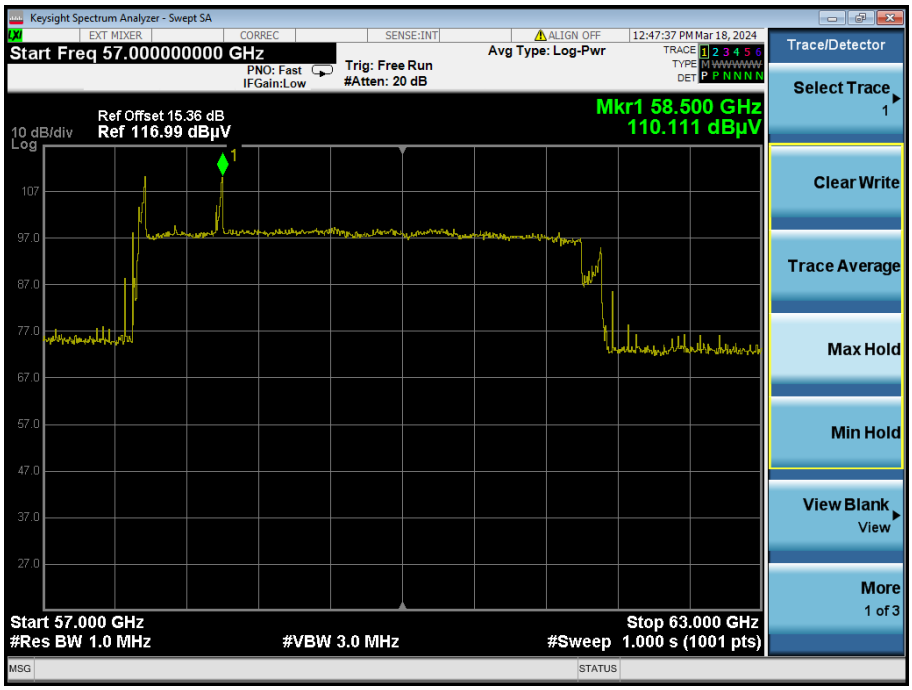
where
α is the reduction in amplitude
F_S is the FMCW Chirp Bandwidth
T_S is the FMCW Chirp Time
B is the 3 dB IF Bandwidth = RBW

1.1.2 Test Result of EIRP

Peak Power- Horizontal



Peak Power- Vertical



Frequency (GHz)	Distance (m)	Polarity	dBuV/m@ 3m	E.I.R.P.Power (dBm)	E.I.R.P Limit (dBm)	Remark	Duty Cycle	Duty Cycle Limit	Result
58.500	1	Horizontal	94.823	-9.947	14	peak	9.0%	≤22.7%	Pass
	1	Vertical	110.111	5.341	14	peak			Pass

Remark:

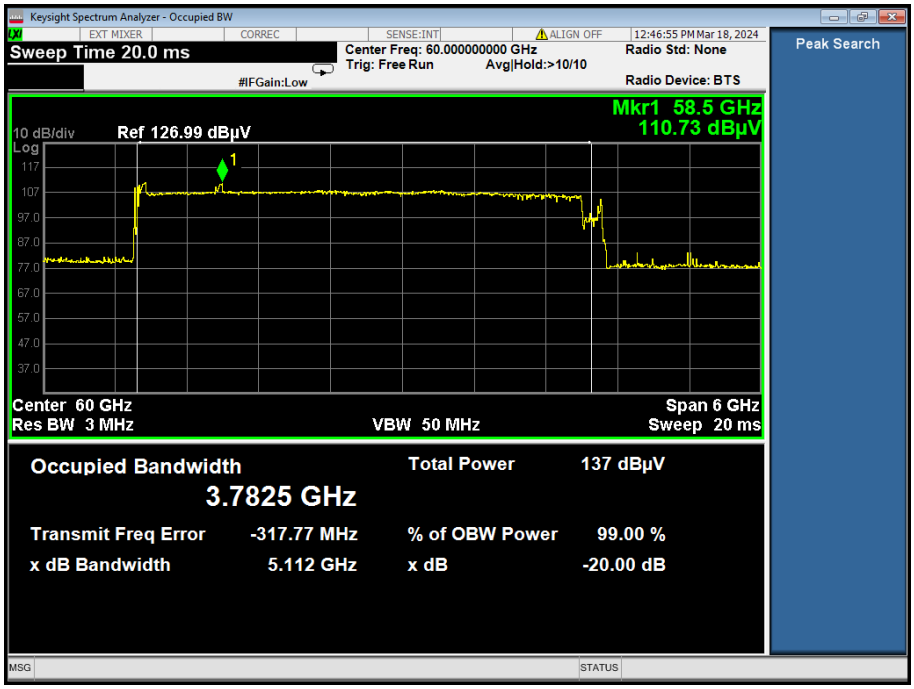
1. E[dBµV/m] = EIRP[dBm]-20 log(d[meters])+104.77, where E = field strength and d = distance at which field strength limit is specified in the rules
2. FMCW desensitization factor(15.36dB) was added in the test result.

2. Occupied bandwidth

2.1 OBW

2.1.1 Test Result

99% & -20dB Occupied Channel Bandwidth



Centre Frequency (GHz)	-20dB OCW (GHz)	99% OCW (GHz)	F_L (GHz)	Limit (GHz)	F_H (GHz)	Limit (GHz)	Result
58.500	5.112	3.7825	57.744	57	61.748	64	Pass

Remark:

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

3. Frequency stability

3.1 Frequency stability

3.1.1 Test Result

Frequency Stability vs temperature:

1. Test for 57GHz to 64GHz

Frequency (GHz)	Temperature (°C)	Voltage (V DC)	F_L (GHz)	Limit (GHz)	F_H (GHz)	Limit (GHz)	Result
57-64	40	3.3	57.7472	57	61.6622	64	Pass
	30	3.3	57.7468	57	61.6626	64	Pass
	20	3.3	57.7476	57	61.6629	64	Pass
	10	3.3	57.7472	57	61.6632	64	Pass
	0	3.3	57.7466	57	61.6629	64	Pass
	-10	3.3	57.7462	57	61.6622	64	Pass
	-20	3.3	57.7452	57	61.6618	64	Pass

Frequency Stability vs voltage:

1. Test for 57GHz to 64GHz

Frequency (GHz)	Voltage (V DC)	Temperature (°C)	F_L (GHz)	Limit (GHz)	F_H (GHz)	Limit (GHz)	Result
57-64	3.0	20	57.7473	57	61.6631	64	Pass
	3.3	20	57.7479	57	61.6628	64	Pass
	3.6	20	57.7481	57	61.6643	64	Pass

Remark:

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

- End of the Report -