

TEST REPORT

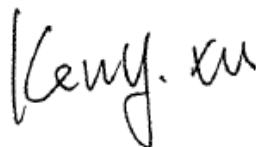
Application No.: SZCR2401000016AT
Applicant: Shenzhen huayi medical technologies Co., Ltd.
Address of Applicant: Room 2503, D2 Building, Nanshan Zhiyuan, Nanshan District, Shenzhen 518055 China
Manufacturer: Shenzhen huayi medical technologies Co., Ltd.
Address of Manufacturer: Room 2503, D2 Building, Nanshan Zhiyuan, Nanshan District, Shenzhen 518055 China

Equipment Under Test (EUT):

EUT Name: contactless sleep monitor
Model No.: HY-MHR202, HY-MHR202-2 ♣
♣ Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
FCC ID: 2BEENHY-MHR202
Standard(s) : FCC 47 CFR Part 15, Subpart C
Date of Receipt: 2024-01-03
Date of Test: 2024-01-10 to 2024-03-12
Date of Issue: 2024-03-12

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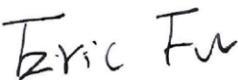
* In the configuration tested, the EUT complied with the standards specified above.



Keny Xu
EMC Laboratory Manager



Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2024-03-12		Original

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



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2 Test Summary

Test Item	FCC Rule No.	Test Method	Result
Antenna Requirement	15.203	--	PASS
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.207	ANSI C63.10 (2013) Section 6.2	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 (c)(2)	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.: HY-MHR202, HY-MHR202-2

Only the model HY-MHR202 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 HY-MHR202 has a light board, but HY-MHR202-2 has no light board.

1. HY-MHR202: Regular products, including motherboard, light board, remote control, charge, USB cable.
2. HY-MHR202-2: Cost-reduced products, including motherboard, charge, USB cable.



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 5V from AC/DC adapter Adapter model: GAT-0502000
Cable Loss (for RF conducted test):	3.0dB
Operation Frequency:	57GHz-64GHz
Modulation Type:	FMCW
Number of Channels:	1
Antenna Type:	Integrated Patch Antenna
Antenna Gain:	5.0dBi

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	20	5
LTHV	-20	5.75
LTLV	-20	4.25
HTHV	40	5.75
HTLV	40	4.25

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



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Radiated Spurious Emissions Above 1GHz	$\pm 4.6\text{dB (1-18GHz)}; \pm 4.8\text{dB (Above 18GHz)}$
<p>Remark:</p> <p>The U_{lab} (lab Uncertainty) is less than $U_{\text{CISPR/ETSI}}$ (CISPR/ETSI Uncertainty), so the test results</p> <ul style="list-style-type: none"> - 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



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5 Equipment List

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2022-05-14	2025-05-13
EMI Test Receiver	Rohde&Schwarz	ESCI	SEM004-02	2023-03-20	2024-03-19
Measurement Software	AUDIX	e3 V8.2014-6-27a	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2023-07-07	2024-07-06
LISN	Rohde&Schwarz	ENV216	SEM007-01	2023-09-19	2024-09-18
LISN	ETS-LINDGREN	3816/2	SEM007-02	2023-03-20	2024-03-19

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	REBES	STH-06SF-S1	06110-01	2023-02-19	2025-02-18



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Mixer(110-170GHz)					
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



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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 5.0dBi.

Antenna location: Refer to internal photos



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7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz

7.1.1 E.U.T. Operation

Operating Environment:

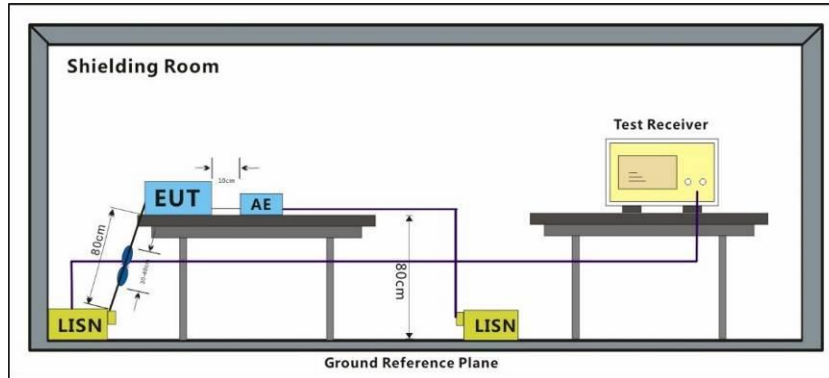
Temperature: 23.4 °C Humidity: 47.3 % RH Atmospheric Pressure: 1000 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode _ Keep the EUT in continuously transmitting mode



7.1.3 Test Setup Diagram



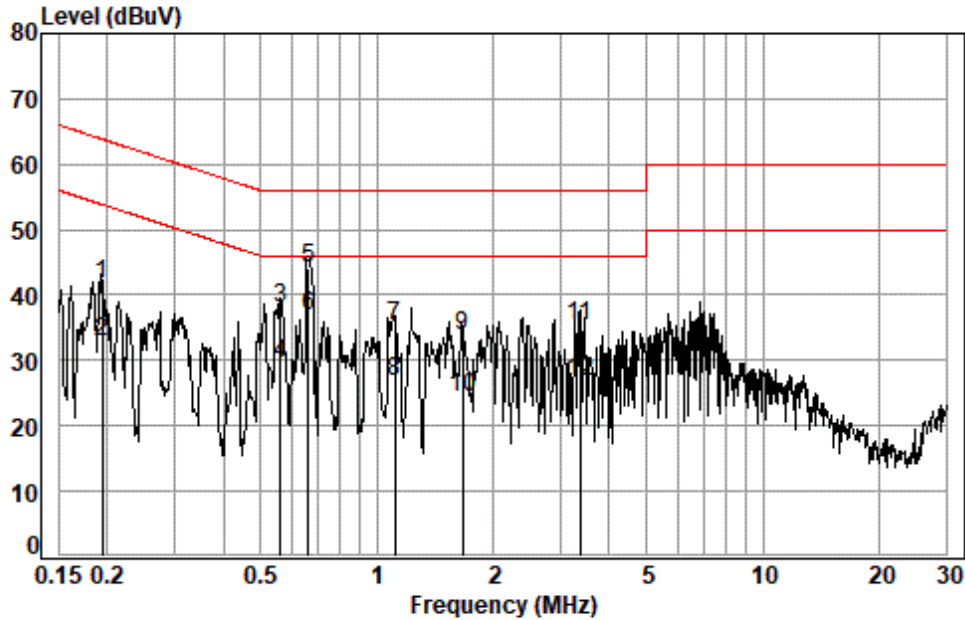
7.1.4 Measurement Procedure and Data

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: Level=Read Level+ Cable Loss+ LISN Factor



Test Mode: 03; Line: Live line



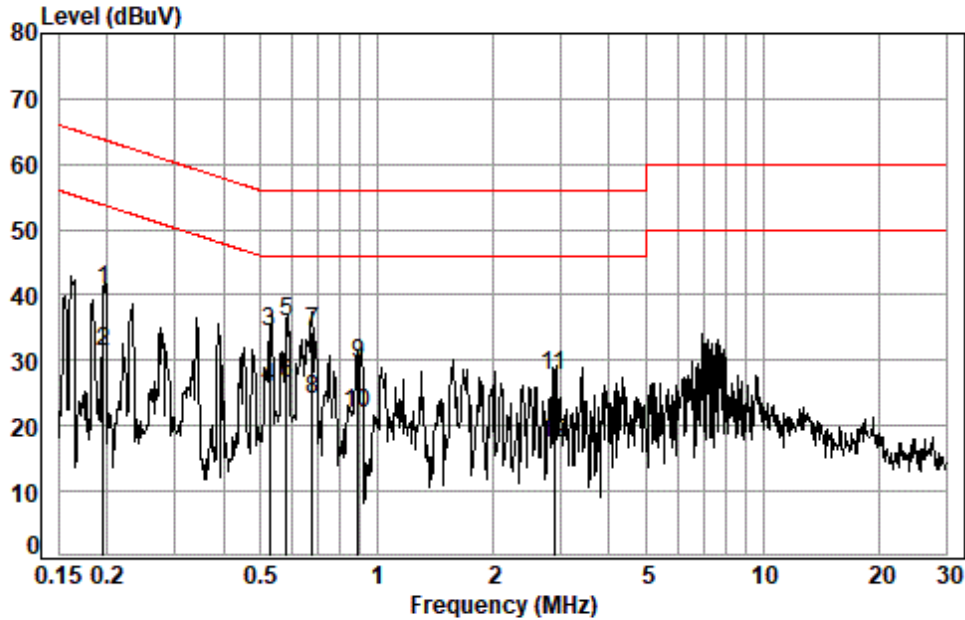
Site : Shielding Room
 Condition: Line
 Job No. : 00016AT
 Test mode: 03

	Freq	Cable Loss	LISN Factor	Read Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dB	
1	0.1945	0.02	10.28	31.26	41.56	63.84	-22.28 QP
2	0.1945	0.02	10.28	22.61	32.91	53.84	-20.93 Average
3	0.5641	0.04	10.34	27.72	38.10	56.00	-17.90 QP
4	0.5641	0.04	10.34	19.21	29.59	46.00	-16.41 Average
5 *	0.6648	0.05	10.33	33.85	44.23	56.00	-11.77 QP
6 *	0.6648	0.05	10.33	26.53	36.91	46.00	-9.09 Average
7	1.1114	0.06	10.37	24.78	35.21	56.00	-20.79 QP
8	1.1114	0.06	10.37	16.43	26.86	46.00	-19.14 Average
9	1.6713	0.07	10.38	23.21	33.66	56.00	-22.34 QP
10	1.6713	0.07	10.38	13.76	24.21	46.00	-21.79 Average
11	3.3635	0.08	10.66	24.65	35.39	56.00	-20.61 QP
12	3.3635	0.08	10.66	16.12	26.86	46.00	-19.14 Average



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Test Mode: 03; Line: Neutral Line



Site : Shielding Room
 Condition: Neutral
 Job No. : 00016AT
 Test mode: 03

	Freq	Cable Loss	LISN Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1955	0.02	10.25	30.63	40.90	63.80	-22.90	QP
2	0.1955	0.02	10.25	21.13	31.40	53.80	-22.40	Average
3	0.5265	0.04	10.30	23.95	34.29	56.00	-21.71	QP
4	0.5265	0.04	10.30	15.52	25.86	46.00	-20.14	Average
5 *	0.5823	0.04	10.31	25.44	35.79	56.00	-20.21	QP
6 *	0.5823	0.04	10.31	16.16	26.51	46.00	-19.49	Average
7	0.6790	0.05	10.34	23.87	34.26	56.00	-21.74	QP
8	0.6790	0.05	10.34	13.54	23.93	46.00	-22.07	Average
9	0.8944	0.06	10.33	19.17	29.56	56.00	-26.44	QP
10	0.8944	0.06	10.33	11.56	21.95	46.00	-24.05	Average
11	2.8845	0.07	10.61	16.89	27.57	56.00	-28.43	QP
12	2.8845	0.07	10.61	6.65	17.33	46.00	-28.67	Average



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7.2 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.

7.2.1 E.U.T. Operation

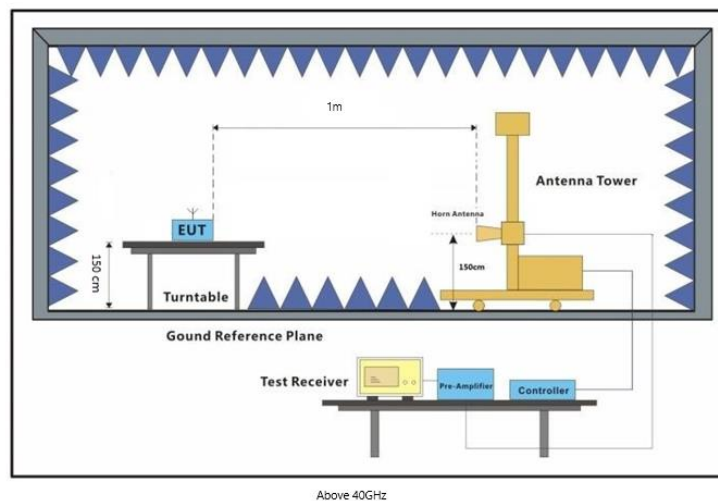
Operating Environment:

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

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode _ Keep the EUT in continuously transmitting mode

7.2.3 Test Setup Diagram



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7.2.4 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 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

Please Refer to Appendix for Details



7.3 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

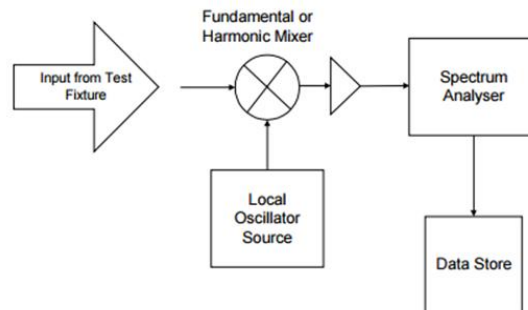
7.3.1 E.U.T. Operation

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

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode _ Keep the EUT in continuously transmitting mode

7.3.3 Test Setup Diagram



7.3.4 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



7.4 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	



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

SZEMC-TRF-01 Rev. A/1

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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

7.4.1 E.U.T. Operation

Operating Environment:

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

7.4.2 Test Mode Description

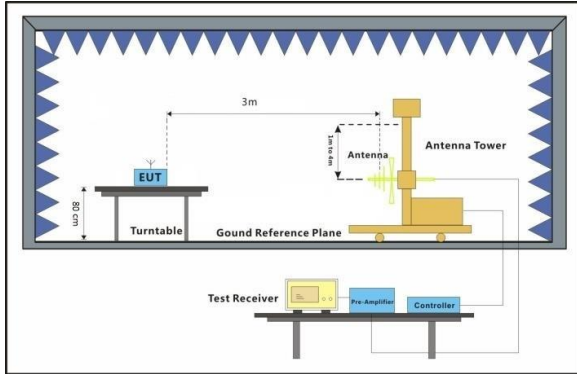
Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode _ Keep the EUT in continuously transmitting mode



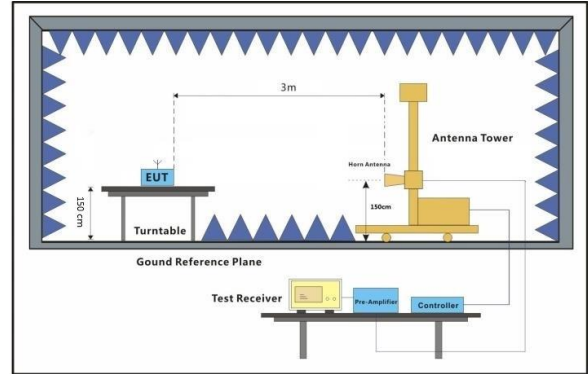
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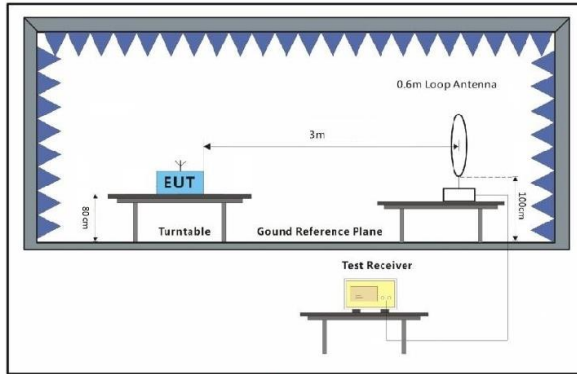
7.4.3 Test Setup Diagram



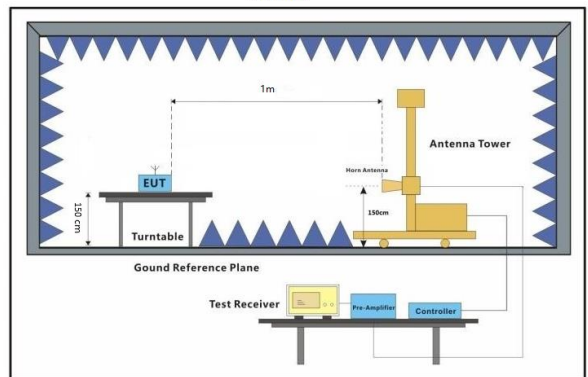
30MHz-1GHz



1GHz-18GHz



Below 30MHz



18GHz-40GHz



7.4.4 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.

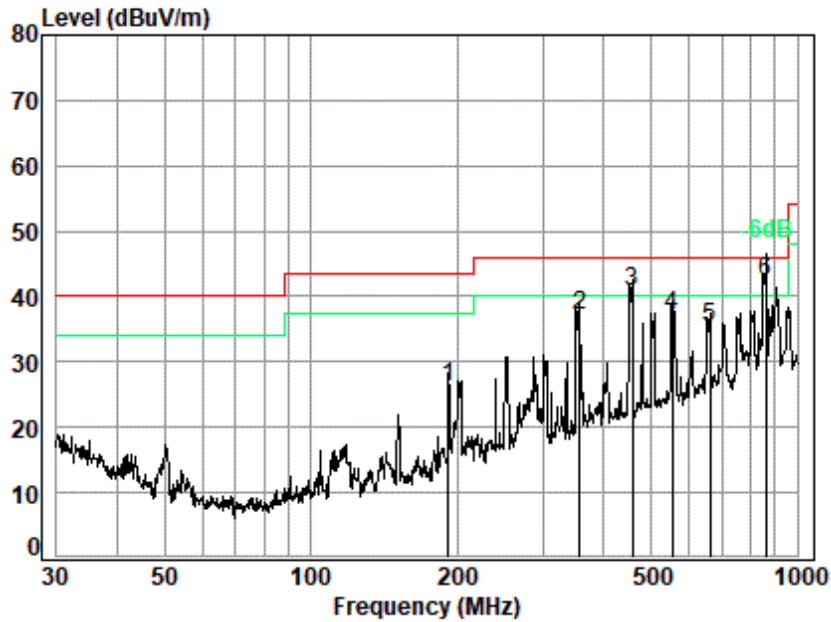
Remark 3: Scan from 9kHz to 40GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below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



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Test Mode: 03; Polarity: Horizontal



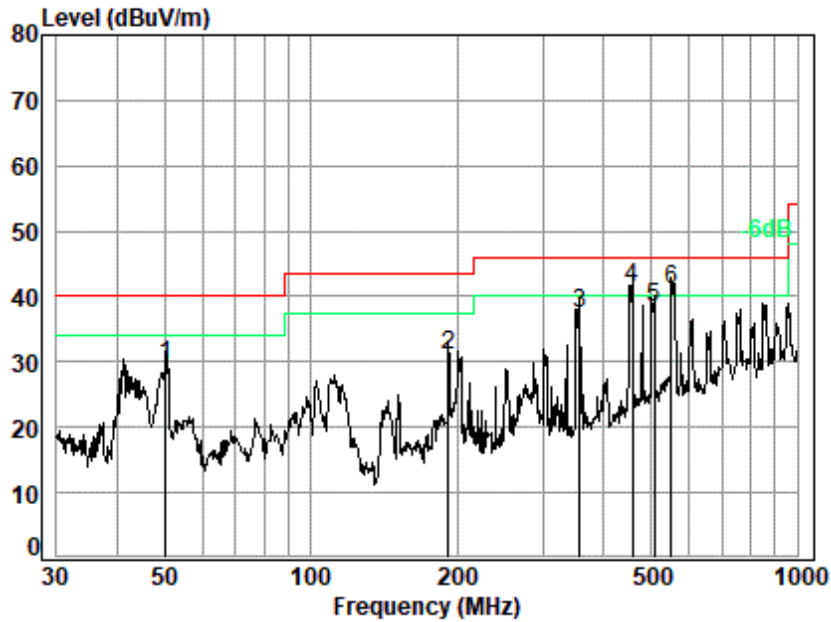
Site : chamber
 Condition: 3m HORIZONTAL
 Job No. : 00016AT
 Test Mode: 03

	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	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



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Test Mode: 03; Polarity: Vertical



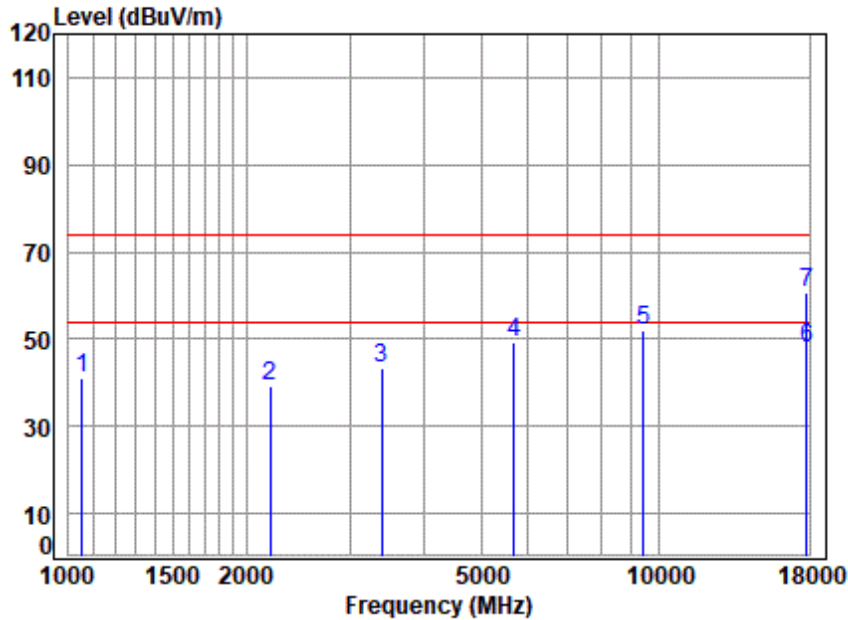
Site : chamber
 Condition: 3m VERTICAL
 Job No. : 00016AT
 Test Mode: 03

	Ant Freq	Cable Factor	Preamp Loss	Read Level	Limit Level	Over Limit	Remark	
	MHz	dB/m	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



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Test Mode: 03; Polarity: Horizontal



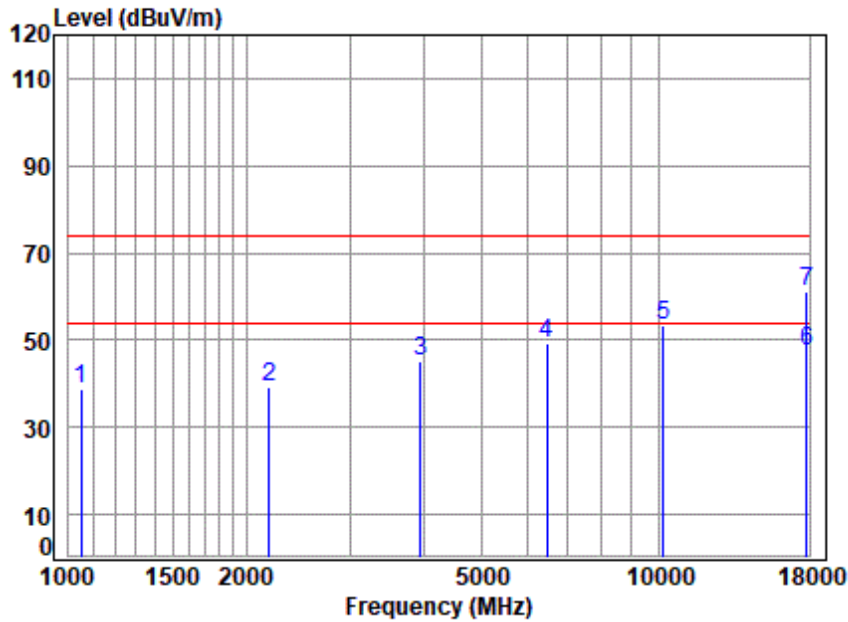
Site : chamber
 Condition: 3m HORIZONTAL
 Job No : 00016AT
 Mode : TX RSE

	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	1053.404	3.30	24.63	38.31	51.31	40.93	74.00	-33.07	Peak
2	2194.998	4.89	27.84	37.92	44.65	39.46	74.00	-34.54	Peak
3	3396.098	6.10	32.38	36.12	41.20	43.56	74.00	-30.44	Peak
4	5680.921	7.95	34.34	35.05	41.86	49.10	74.00	-24.90	Peak
5	9420.880	12.23	37.34	37.51	40.02	52.08	74.00	-21.92	Peak
6	q17844.590	15.06	43.90	37.64	26.36	47.68	54.00	-6.32	Average
7	p17844.590	15.06	43.90	37.64	39.46	60.78	74.00	-13.22	Peak



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Test Mode: 03; Polarity: Vertical



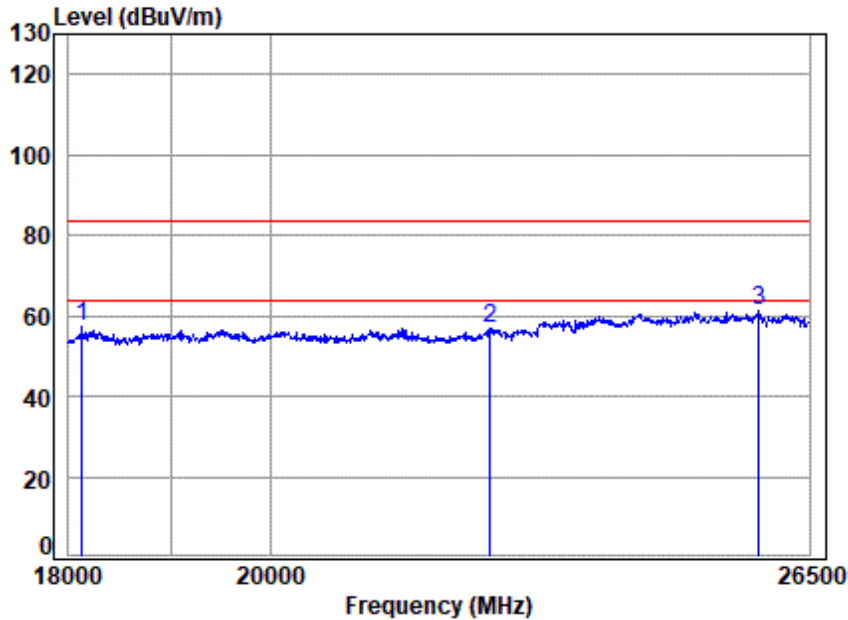
Site : chamber
 Condition: 3m VERTICAL
 Job No : 00016AT
 Mode : TX RSE

	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	1050.364	3.30	24.69	38.31	49.00	38.68	74.00	-35.32	Peak
2	2188.663	4.88	27.89	37.94	44.63	39.46	74.00	-34.54	Peak
3	3946.885	6.72	33.52	36.10	40.97	45.11	74.00	-28.89	Peak
4	6470.026	8.54	35.54	35.23	40.52	49.37	74.00	-24.63	Peak
5	10185.530	12.68	37.31	37.46	40.76	53.29	74.00	-20.71	Peak
6	q17793.090	15.03	43.89	37.63	26.33	47.62	54.00	-6.38	Average
7	p17793.090	15.03	43.89	37.63	39.82	61.11	74.00	-12.89	Peak



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Test Mode: 03; Polarity: Horizontal



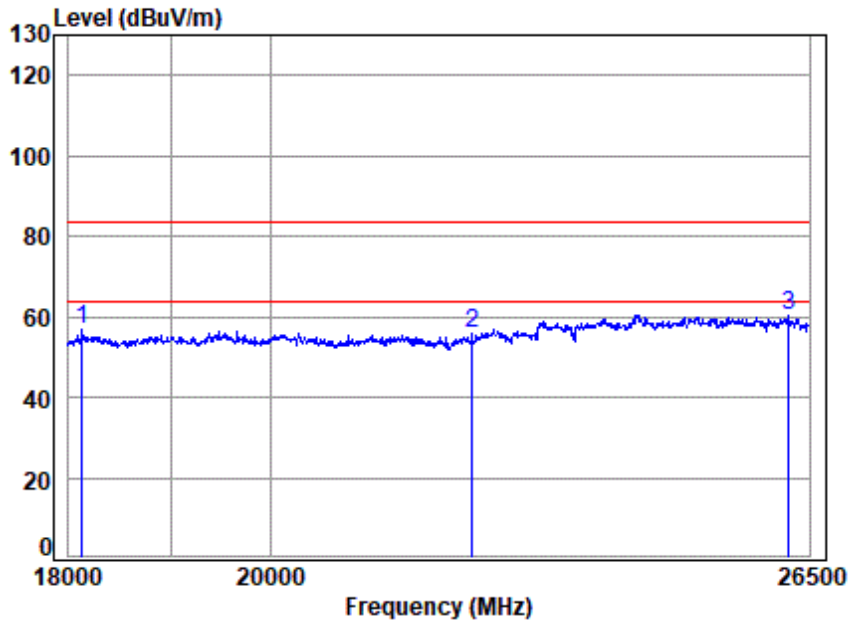
Site : chamber
 Condition: 1m Horizontal
 Job No : 00016AT
 Mode : TX RSE

	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	6.17	38.19	36.36	49.51	57.51	83.54	-26.03	Peak
2	7.19	39.01	36.98	47.56	56.78	83.54	-26.76	Peak
3	7.55	39.64	37.25	51.13	61.07	83.54	-22.47	Peak



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Test Mode: 03; Polarity: Vertical



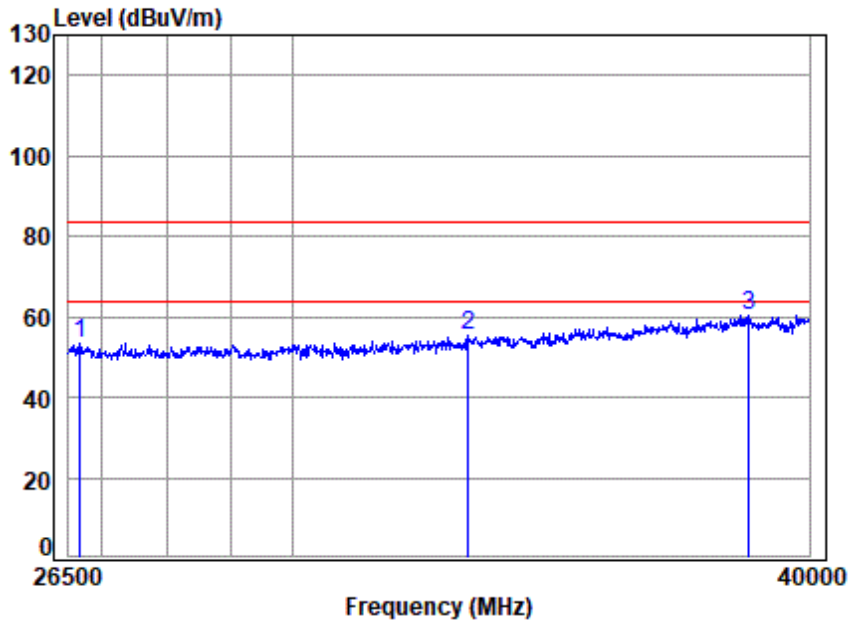
Site : chamber
 Condition: 1m Vertical
 Job No : 00016AT
 Mode : TX RSE

	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	18125.750	6.17	38.19	36.36	48.94	56.94	83.54	-26.60	Peak
2	22215.190	7.13	38.71	37.09	47.35	56.10	83.54	-27.44	Peak
3	p26204.430	7.57	39.82	37.79	50.83	60.43	83.54	-23.11	Peak



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Test Mode: 03; Polarity: Horizontal



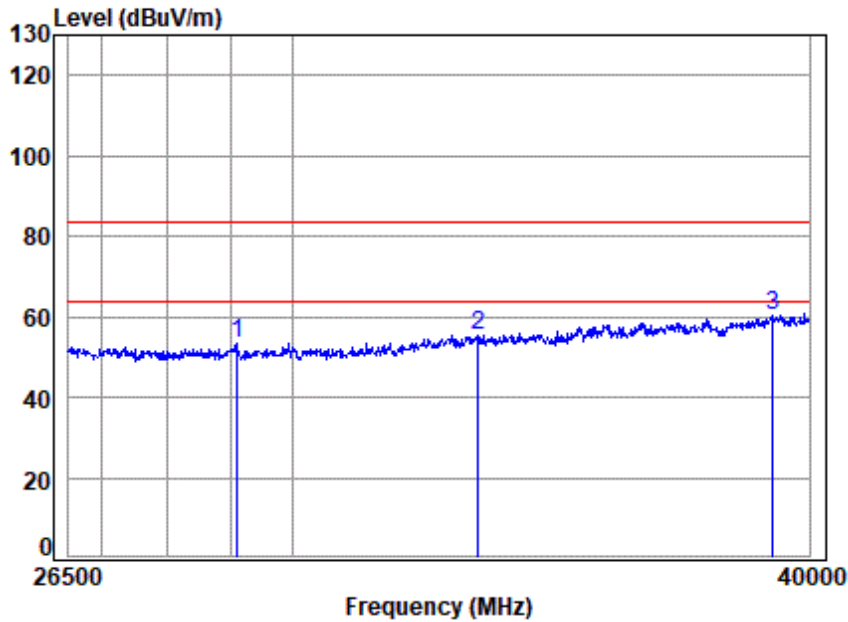
Site : chamber
 Condition: 1m Horizontal
 Job No : 00016AT
 Mode : TX RSE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	26653.200	7.67	40.09	53.71	59.41	53.46	83.54	-30.08 Peak
2	33098.290	9.93	41.96	46.77	50.27	55.39	83.54	-28.15 Peak
3	p38656.130	10.90	43.83	38.41	43.90	60.22	83.54	-23.32 Peak



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Test Mode: 03; Polarity: Vertical



Site : chamber
 Condition: 1m Vertical
 Job No : 00016AT
 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	29096.230	7.74	40.66	53.43	58.29	53.26	83.54	-30.28	Peak
2	33275.920	9.90	41.89	46.37	50.08	55.50	83.54	-28.04	Peak
3	p39184.950	10.75	43.73	37.69	43.50	60.29	83.54	-23.25	Peak



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7.5 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 C63.10-2013 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.

7.5.1 E.U.T. Operation

Operating Environment:

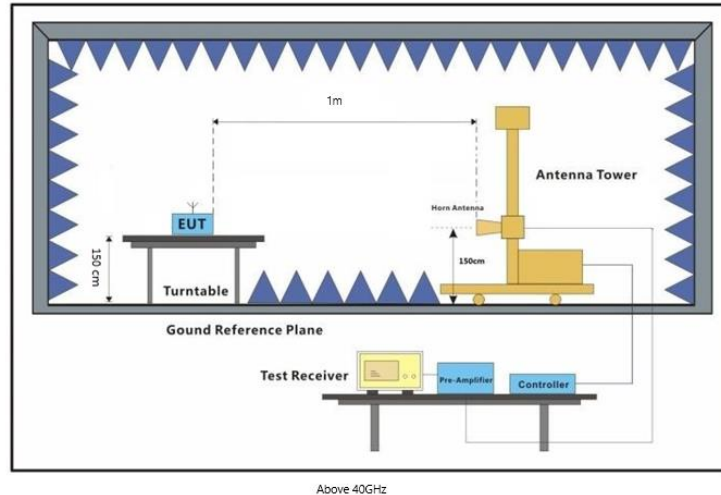
Temperature: 23.2 °C Humidity: 45.8 % RH Atmospheric Pressure: 1000 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode _ Keep the EUT in continuously transmitting mode



7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

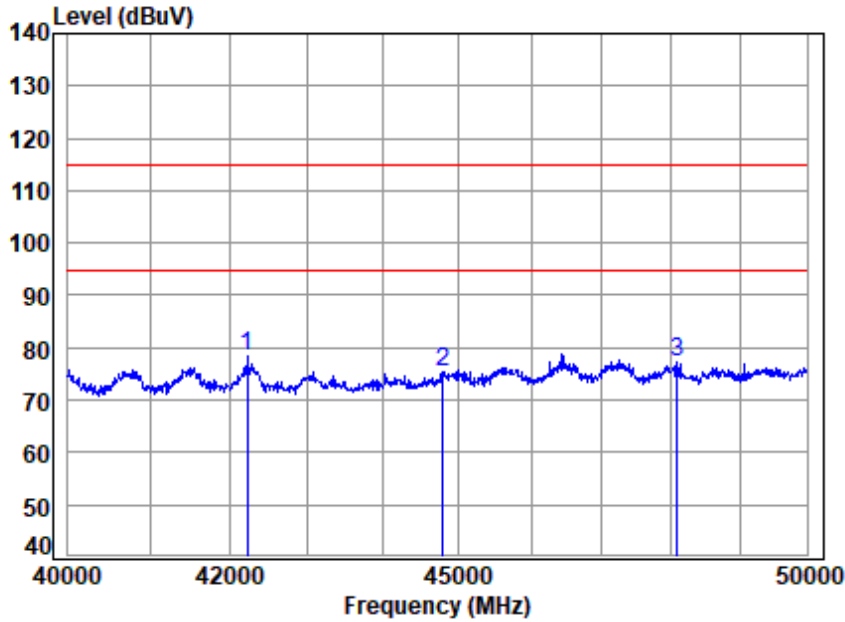
- For above 40GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 1 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation
- The antenna height is varied from one meter to four meters above the ground to determine 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

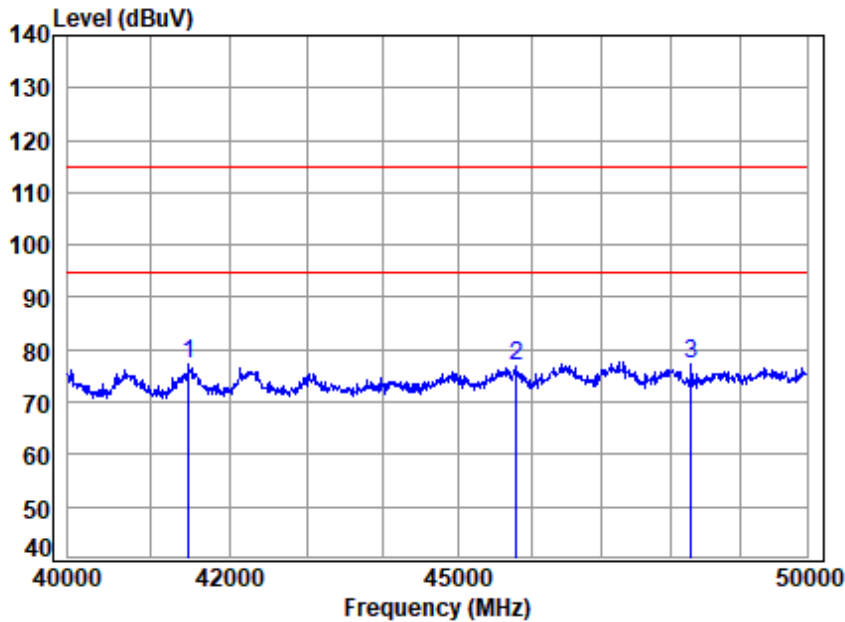
Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level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



Test Mode: 03; Polarity: Horizontal



Test Mode: 03; Polarity: Vertical



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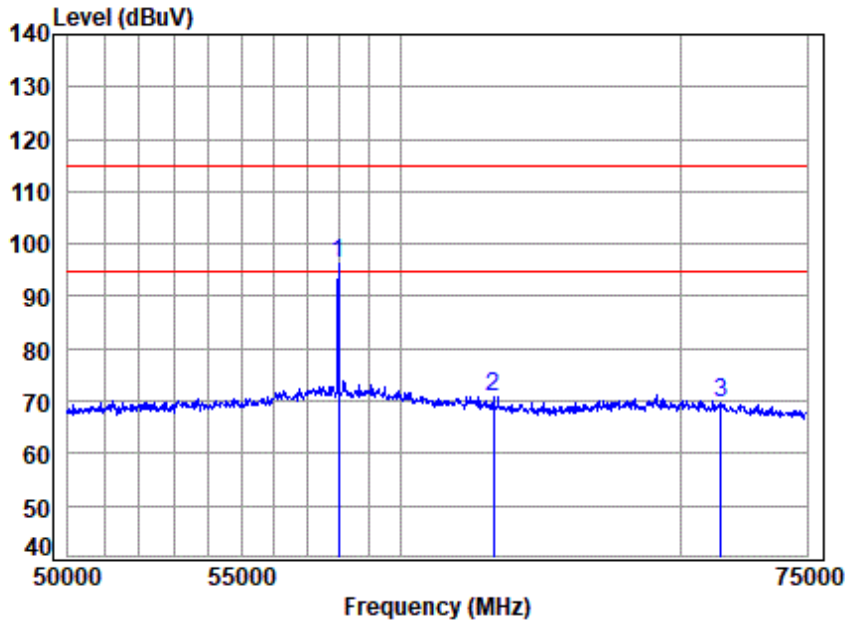
Frequency (MHz)	PK Value (dBuV/m)	Distance (M)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
42228.84	78.32	1	114.85	94.85	H	PASS
44801.27	75.51	1	114.85	94.85	H	PASS
48085.13	77.11	1	114.85	94.85	H	PASS
41490.94	77.12	1	114.85	94.85	V	PASS
45801.99	76.77	1	114.85	94.85	V	PASS
48278.65	77.28	1	114.85	94.85	V	PASS



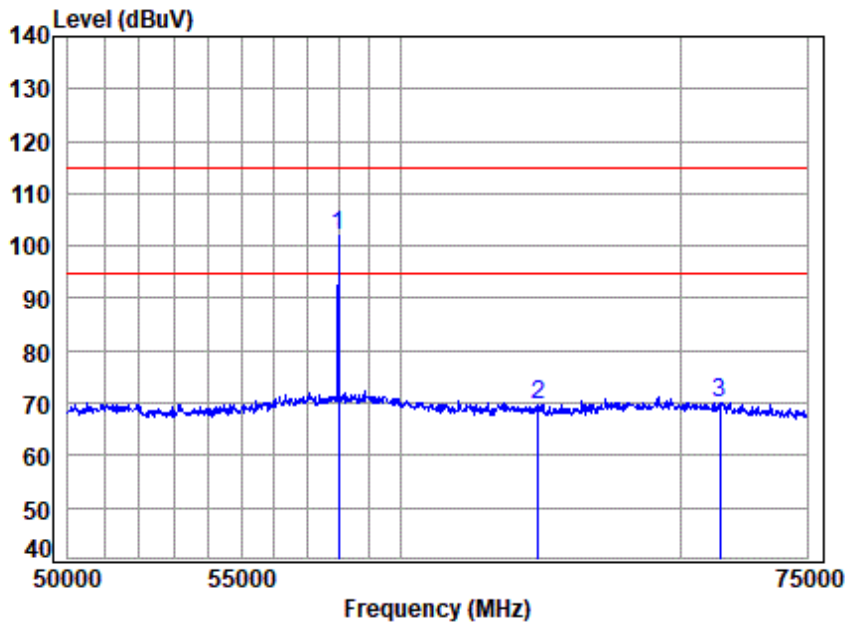
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Test Mode: 03; Polarity: Horizontal



Test Mode: 03; Polarity: Vertical



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Frequency (MHz)	PK Value (dBuV/m)	Distance (M)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
*57998.85	96.35	1	114.85	94.85	H	PASS
63153.67	70.78	1	114.85	94.85	H	PASS
71554.13	69.66	1	114.85	94.85	H	PASS
*57998.85	102.14	1	114.85	94.85	V	PASS
64735.15	69.75	1	114.85	94.85	V	PASS
71496.13	70.07	1	114.85	94.85	V	PASS

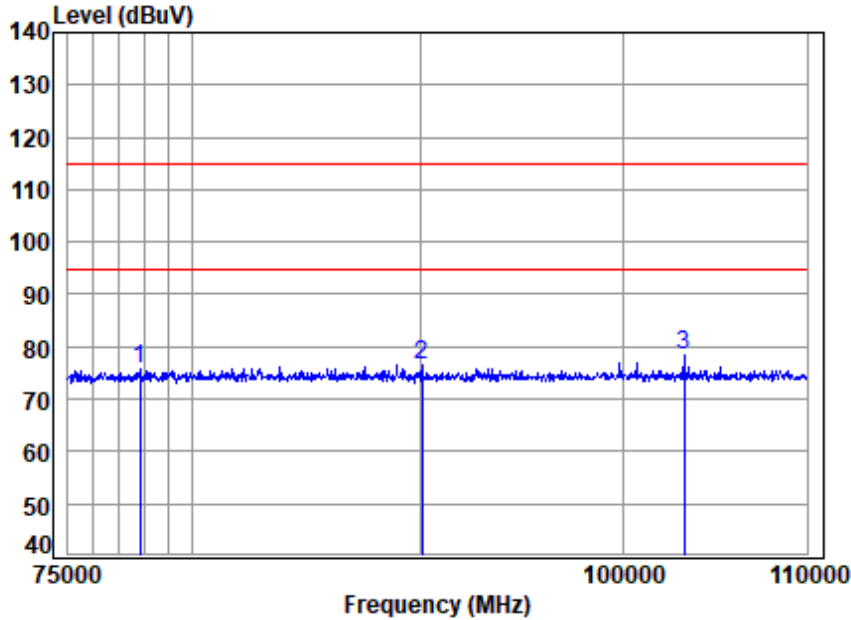
Note: * means the frequency is the fundamental signal of the EUT.



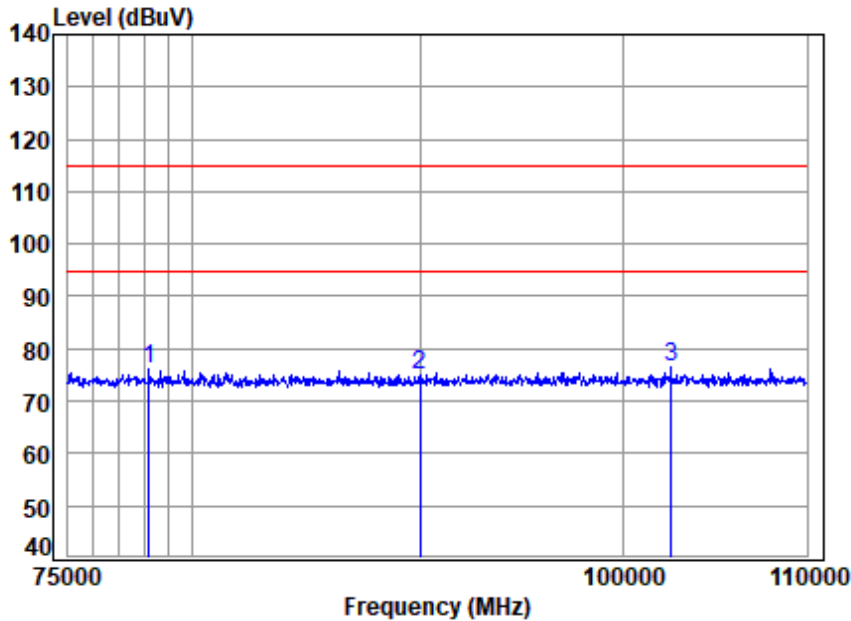
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Test Mode: 03; Polarity: Vertical



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 中国·广东·深圳市南山区科技园中区M-10栋1号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

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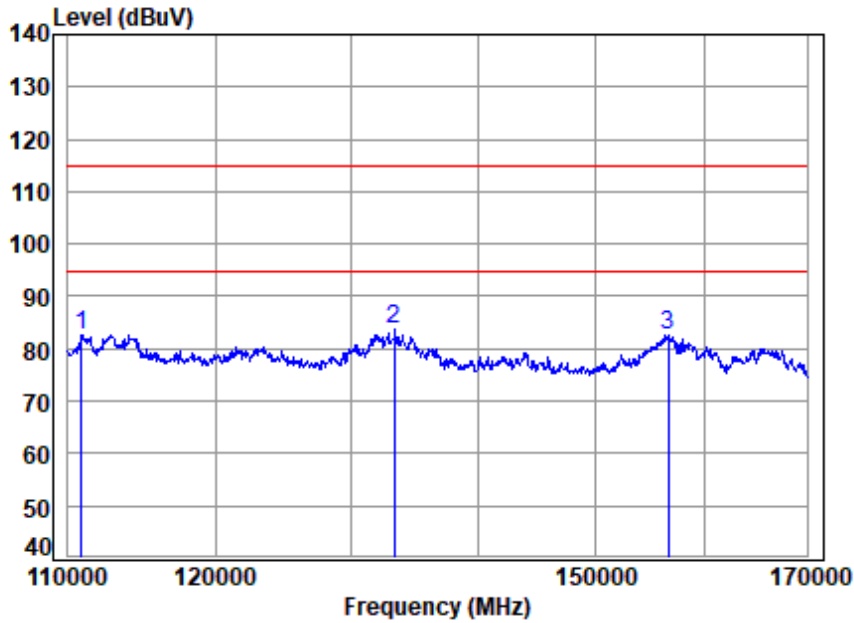
Frequency (MHz)	PK Value (dBuV/m)	Distance (M)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
77838.67	75.79	1	114.85	94.85	H	PASS
90101.91	76.65	1	114.85	94.85	H	PASS
103224.2	78.41	1	114.85	94.85	H	PASS
78197.23	76.09	1	114.85	94.85	V	PASS
89998.45	75.11	1	114.85	94.85	V	PASS
102515.1	76.44	1	114.85	94.85	V	PASS



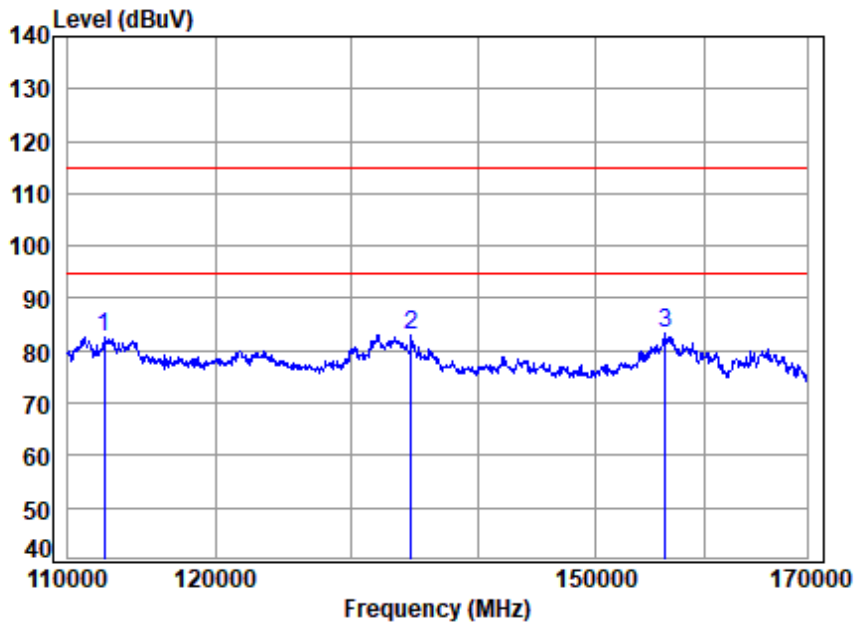
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Test Mode: 03; Polarity: Vertical



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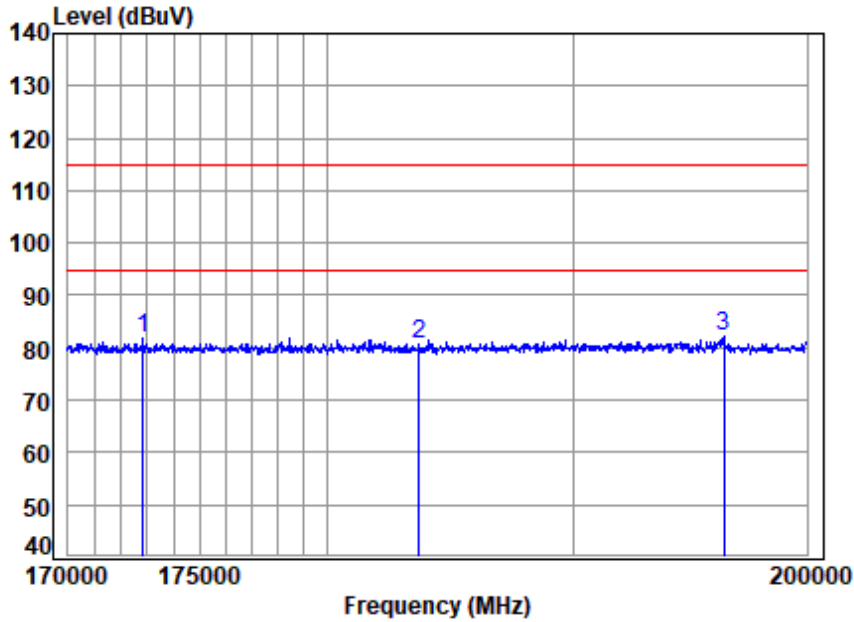
Frequency (MHz)	PK Value (dBuV/m)	Distance (M)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
110865.3	82.73	1	114.85	94.85	H	PASS
133338.5	83.9	1	114.85	94.85	H	PASS
156641.3	82.68	1	114.85	94.85	H	PASS
112371.6	82.77	1	114.85	94.85	V	PASS
134680.2	82.81	1	114.85	94.85	V	PASS
156436.9	83.32	1	114.85	94.85	V	PASS



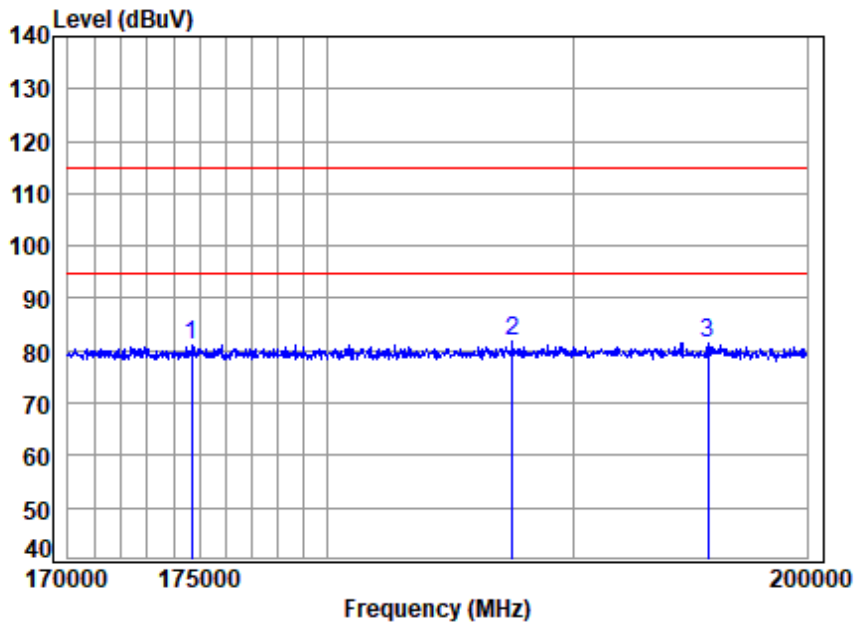
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Test Mode: 03; Polarity: Vertical



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Frequency (MHz)	PK Value (dBuV/m)	Distance (M)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
172841.6	81.85	1	114.85	94.85	H	PASS
183643.2	80.8	1	114.85	94.85	H	PASS
196360.6	82.07	1	114.85	94.85	H	PASS
174677.1	81.16	1	114.85	94.85	V	PASS
187473	81.76	1	114.85	94.85	V	PASS
195691.6	81.35	1	114.85	94.85	V	PASS



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7.6 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.

7.6.1 E.U.T. Operation

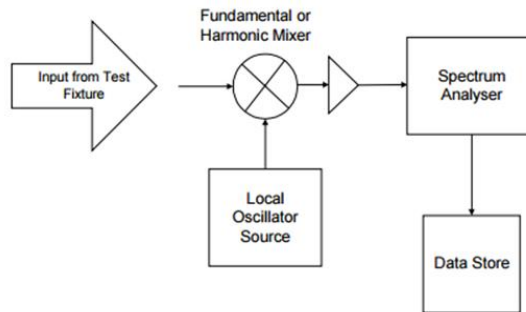
Operating Environment:

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

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode _ Keep the EUT in continuously transmitting mode

7.6.3 Test Setup Diagram



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7.6.4 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 -20°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 -20°C.

Please Refer to Appendix for Details



8 Test Setup Photo

Refer to Appendix - Test Setup Photo for SZCR2401000016AT

9 EUT Constructional Details (EUT Photos)

Refer to Appendix – External and Internal Photos for SZCR2401000016AT.



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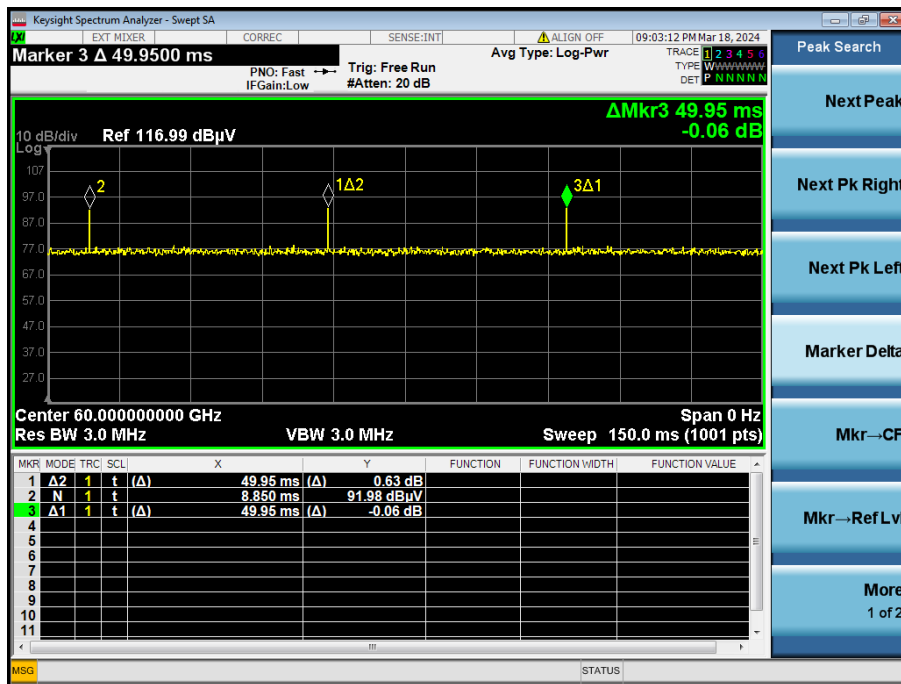
10 Appendix

1. Transmitter power

1.1 Ant1

1.1.1 Test Result of duty cycle & FMCW Desensitization factor

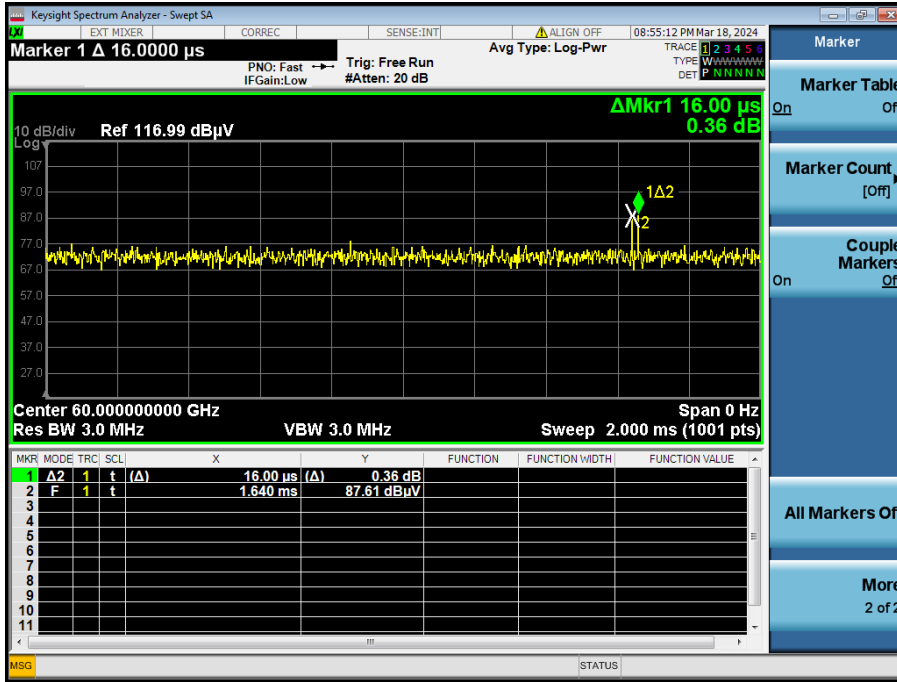
Duty Cycle



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Duty Cycle

Chirp Width(us)	Chirp Period(ms)	Chirp Number	Burst Period (us)	Tx ON Result (us)	Tx OFF Result (ms)	Tx OFF Limit (ms)	Verdict
16	33	1	16	16	32.984	25.50	Pass

Chirp number in Burst Period = 16us/16us = 1

Transmission Time = Chirp number in Burst Period * Chirp Width = 16us

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

TX OFF Time Limit =25.50ms

The FMCW Desensitization factor

Star Freq(GHz)	Stop Freq(GHz)	FMCW Width(MHz)	Ramp Time(ms)	RBW(MHz)	Desensitization Factor(lin)	Desensitization Factor(dB)
57	64	7000	33	1	0.9978	0.02

FMCW desensitization factor = -20*Log(α) = -20*log(0.9978) = 0.02dB

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

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

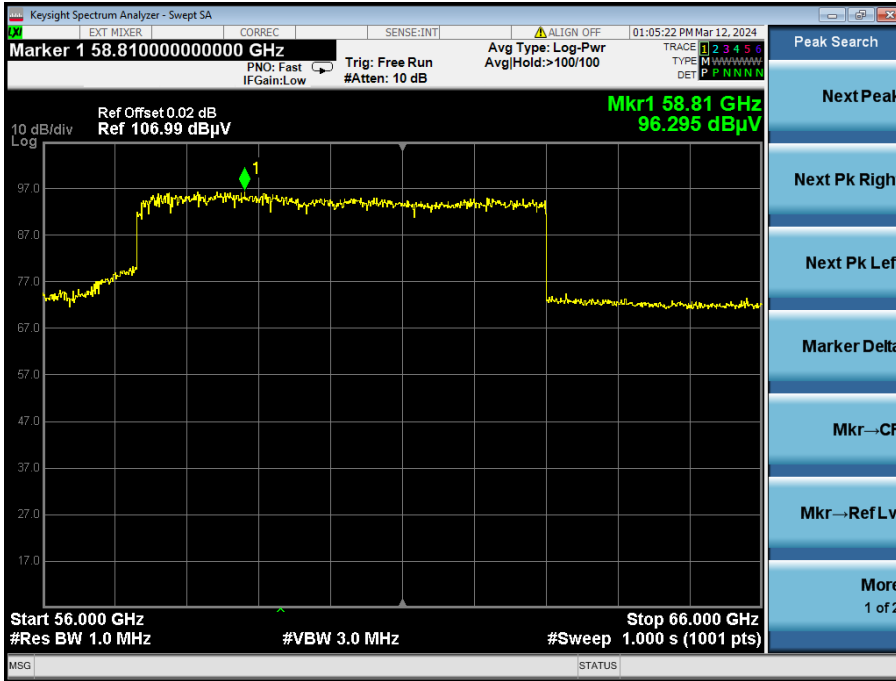


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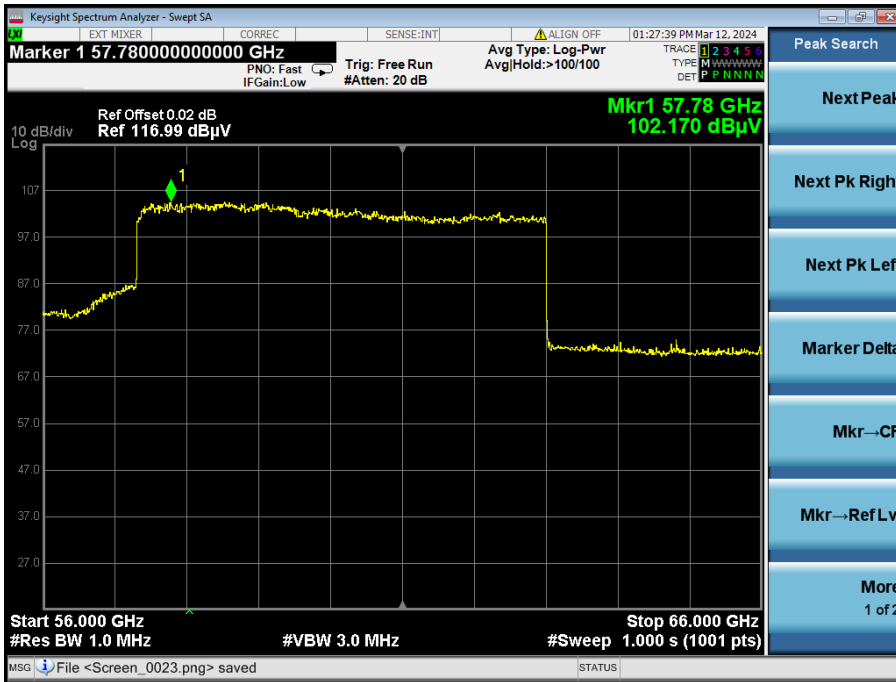
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1.1.2 Test Result of EIRP

Peak Power- Horizontal



Peak Power- Vertical



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Frequency (GHz)	Distance (m)	Polarity	dBuV/m@ 3m	E.I.R.P. Power (dBm)	E.I.R.P. Limit (dBm)	Remark	Tx OFF Result (ms)	Tx OFF Limit (ms)	Result
58.81	1	Horizontal	96.295	-8.475	14	peak	32.984	25.50	Pass
57.78	1	Vertical	102.170	-2.6	14	peak			Pass

Remark:

- $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$, where E = field strength and d = distance at which field strength limit is specified in the rules
- FMCW desensitization factor(0.02dB) was added in the test result.



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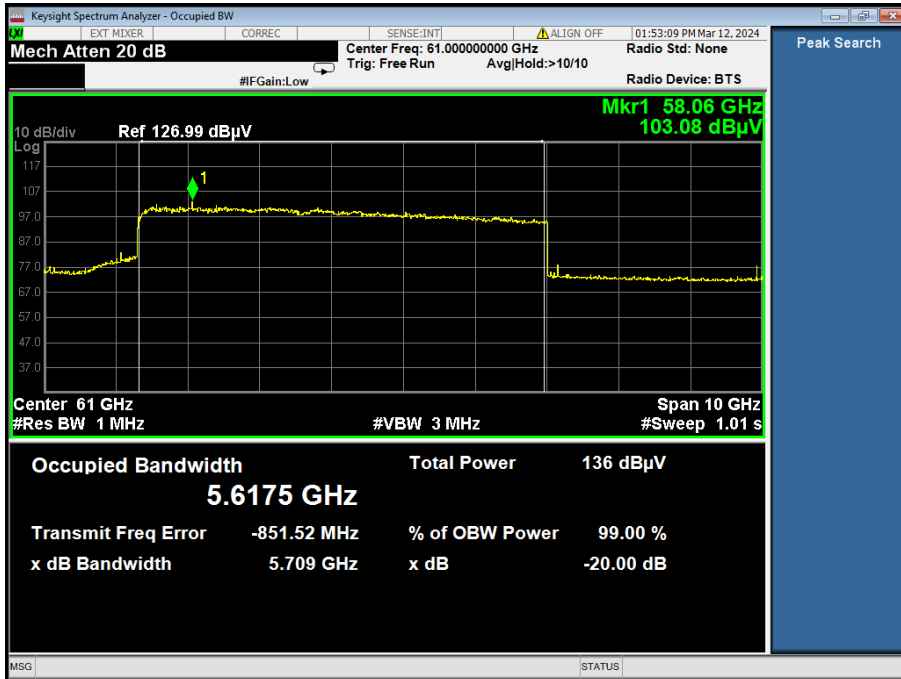
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2. Occupied bandwidth

2.1 OBW

2.1.1 Test Result

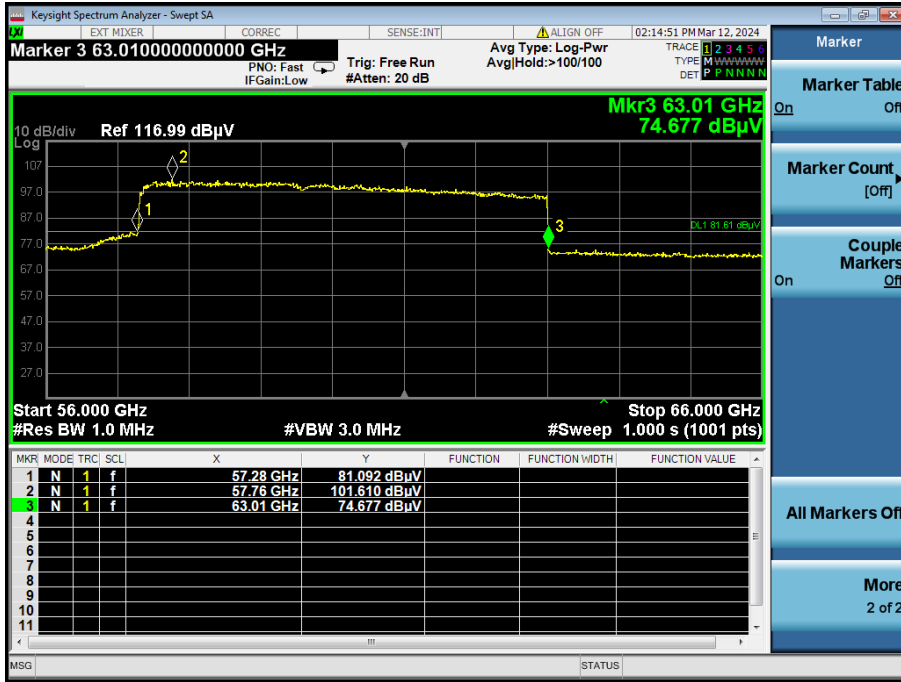
99% & -20dB Occupied Channel Bandwidth



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Centre Frequency (GHz)	-20dB OCW (GHz)	99% OCW (GHz)	FL (GHz)	Limit (GHz)	F _H (GHz)	Limit (GHz)	Result
58.060	5.709	5.6175	57.28	57	63.01	64	Pass

Remark:

FL: 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	5	57.2874	57	63.0123	64	Pass
	30	5	57.2863	57	63.0121	64	Pass
	20	5	57.2877	57	63.0128	64	Pass
	10	5	57.2872	57	63.0132	64	Pass
	0	5	57.2872	57	63.0138	64	Pass
	-10	5	57.2823	57	63.0117	64	Pass
	-20	5	57.2803	57	63.0196	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	4.25	20	57.2873	57	63.0133	64	Pass
	5	20	57.2878	57	63.0126	64	Pass
	5.75	20	57.2880	57	63.0143	64	Pass

Remark:

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

- End of the Report -



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