TEST REPORT

Application No.:	SZCR2412004581AT
Applicant:	LOCKIN (U.S.) INC.
Address of Applicant:	8605 SANTA MONICA BLVD #79525 WEST HOLLYWOOD, CA 90069-4109 CALIFORNIA 90069-4109 United States
Manufacturer:	LOCKIN (U.S.) INC.
Address of Manufacturer:	8605 SANTA MONICA BLVD #79525 WEST HOLLYWOOD, CA 90069-4109 CALIFORNIA 90069-4109 United States
Factory:	Chongqing Luxiangjia Technology Co., Ltd.
Address of Factory:	No.50 Industrial Avenue, Pulu Street, Tongliang District, Chongqing, P.R. China
Equipment Under Test (EUT):	
EUT Name:	Veno Pro Palm Vein Recognition Video Smart Lock
Model No.:	LKMSD411
Trade Mark:	LOCKIN
FCC ID:	2BMOG-LKMSD411
Standard(s) :	FCC 47 CFR Part 15, Subpart C
Date of Receipt:	2024-12-05
Date of Test:	2025-01-17 to 2025-02-18
Date of Issue:	2025-02-24
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		2025-02-24		Original

Authorized for issue by:				
		Bill Chen/Project Engineer		
		Eric Fu/Reviewer		

2 Test Summary

Test Item	FCC Rule No.	Test Method	Result
Antenna Requirement	15.203	--	PASS
Conducted Emissions at AC Power Line (150kHz-30MHz)	15.207 (c)	ANSI C63.10-2020 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 (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:	Rechargeable Li-ion Battery Pack Model:LKBAA554 Nominal Voltage:DC 7.4V Rated Capacity:5000mAh Nominal Energy:37Wh
Operation Frequency:	57GHz-64GHz
Modulation Type:	FMCW
Antenna Type:	AiP Antenna
Antenna Gain:	7.39dBi

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.
Adapter	HUAWEI	HW-050200E01	REF. No.SEA05E03F
Type-C Cable	SGS	N/A	REF. No.SEA07B00

4.3 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Value	Temperature(℃)	Voltage(V)
NTNV	25	8.14
LTHV	-20	7.4
LTLV	-20	6.66
HTHV	50	8.14
HTLV	50	6.66

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

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	ESR	SZ-WRG-M-047	2025-01-8	2026-01-7
Measurement Software	AUDIX	e3 V8.2014-6-27a	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2024-07-06	2025-07-05
LISN	Rohde&Schwarz	ENV216	SEM007-01	2024-08-15	2025-08-14
LISN	ETS-LINDGREN	3816/2	SEM007-02	2024-03-14	2025-03-13

Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2024-05-11	2027-05-10
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	SEM004-20	2024-03-30	2025-03-29
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	2024-03-19	2025-03-18
Pre-amplifier (26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2024-03-15	2025-03-14
Coaxial Cable	SGS	N/A	SEM026-01	2024-07-06	2025-07-05
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(140-220GHz)	REBES	SWG-05025-FB	SEM020-12	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
Waveguide Harmonic Mixer(140-220GHz)	Rohde&Schwarz	HM140-220	SEM020-18	2023-02-19	2025-02-18
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	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	2024-03-18	2025-03-17

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 7.39dBi.

Antenna location: Refer to internal photos

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 (2020) 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		

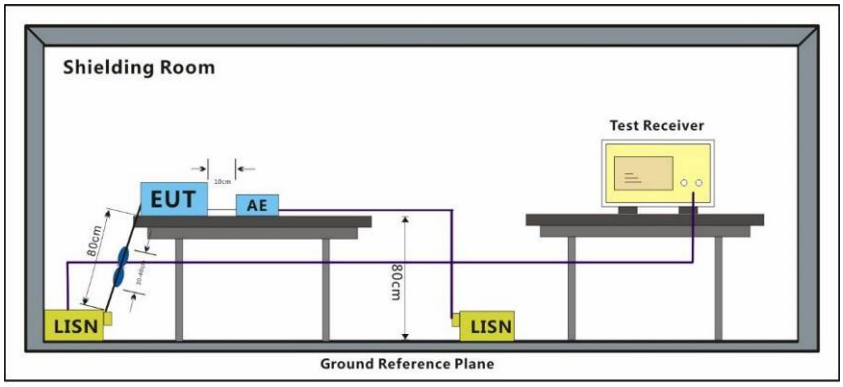
7.1.1 E.U.T. Operation

Operating Environment:
Temperature: 20.7 °C Humidity: 36.9 % RH Atmospheric Pressure: 1020 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	09	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.

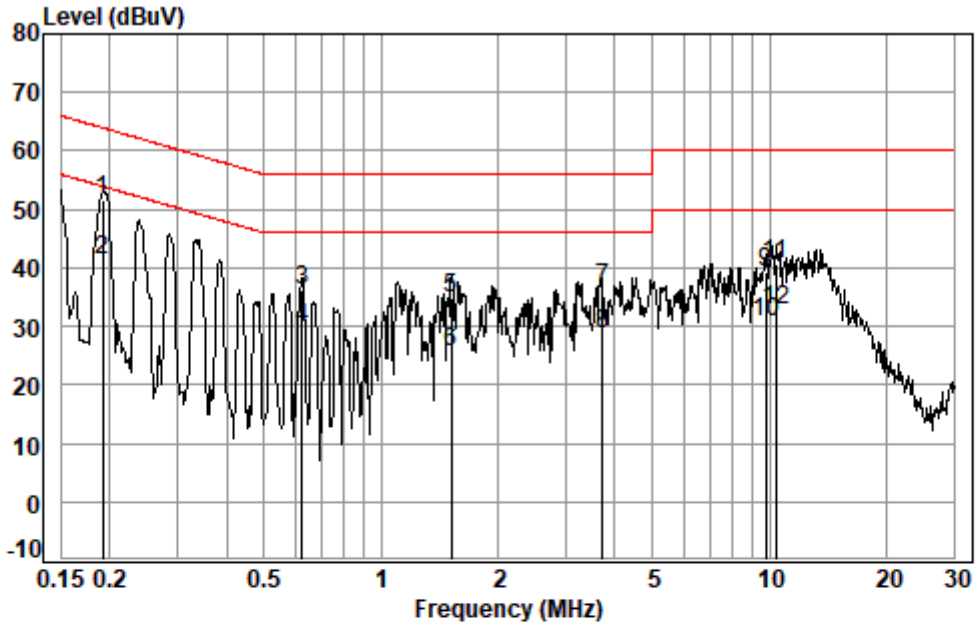
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.

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

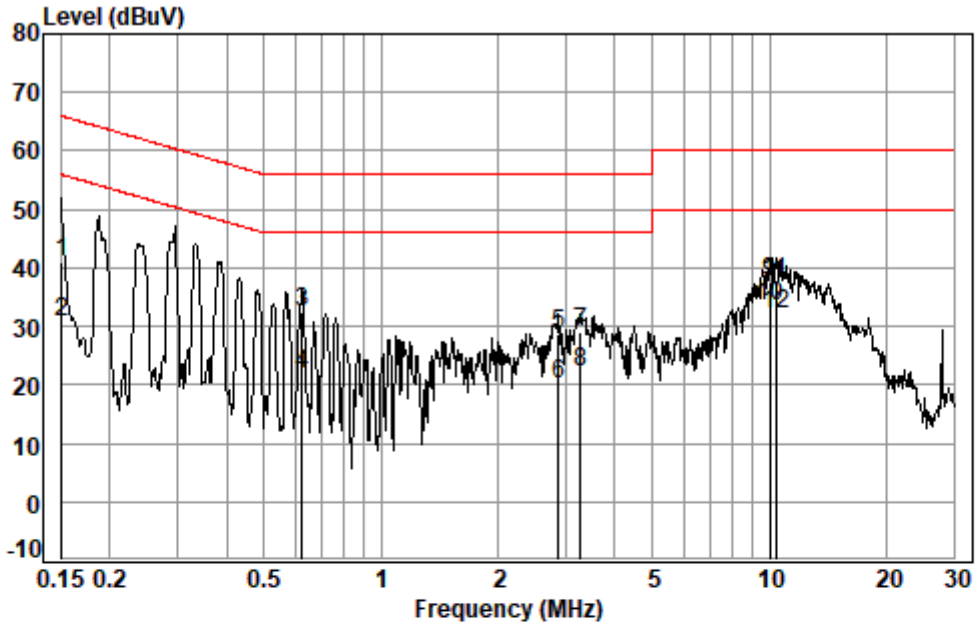
Test Mode: 09; Line: Live line



Site : Shielding Room
Condition: Line
Job No. : 04582AT/04581AT
Test mode: 09

		Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
		MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	*	0.1924	0.06	10.13	41.35	51.54	63.93	-12.39	QP
2	*	0.1924	0.06	10.13	31.21	41.40	53.93	-12.53	Average
3		0.6271	0.08	9.61	26.62	36.31	56.00	-19.69	QP
4		0.6271	0.08	9.61	20.14	29.83	46.00	-16.17	Average
5		1.5193	0.10	9.58	25.04	34.72	56.00	-21.28	QP
6		1.5193	0.10	9.58	15.85	25.53	46.00	-20.47	Average
7		3.7198	0.11	9.65	26.64	36.40	56.00	-19.60	QP
8		3.7198	0.11	9.65	19.02	28.78	46.00	-17.22	Average
9		9.8085	0.20	9.69	29.34	39.23	60.00	-20.77	QP
10		9.8085	0.20	9.69	20.93	30.82	50.00	-19.18	Average
11		10.3972	0.21	9.71	30.77	40.69	60.00	-19.31	QP
12		10.3972	0.21	9.71	22.94	32.86	50.00	-17.14	Average

Test Mode: 09; Line: Neutral Line



Site : Shielding Room
Condition: Neutral
Job No. : 04582AT/04581AT
Test mode: 09

		Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
		MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1		0.1508	0.06	10.15	30.85	41.06	65.96	-24.90	QP
2		0.1508	0.06	10.15	20.50	30.71	55.96	-25.25	Average
3		0.6271	0.08	9.67	22.83	32.58	56.00	-23.42	QP
4		0.6271	0.08	9.67	12.08	21.83	46.00	-24.17	Average
5		2.8692	0.11	9.54	18.88	28.53	56.00	-27.47	QP
6		2.8692	0.11	9.54	10.57	20.22	46.00	-25.78	Average
7		3.2583	0.11	9.54	19.51	29.16	56.00	-26.84	QP
8		3.2583	0.11	9.54	12.48	22.13	46.00	-23.87	Average
9	*	10.0186	0.20	9.58	27.89	37.67	60.00	-22.33	QP
10	*	10.0186	0.20	9.58	23.54	33.32	50.00	-16.68	Average
11		10.3972	0.21	9.61	27.66	37.48	60.00	-22.52	QP
12		10.3972	0.21	9.61	22.36	32.18	50.00	-17.82	Average

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

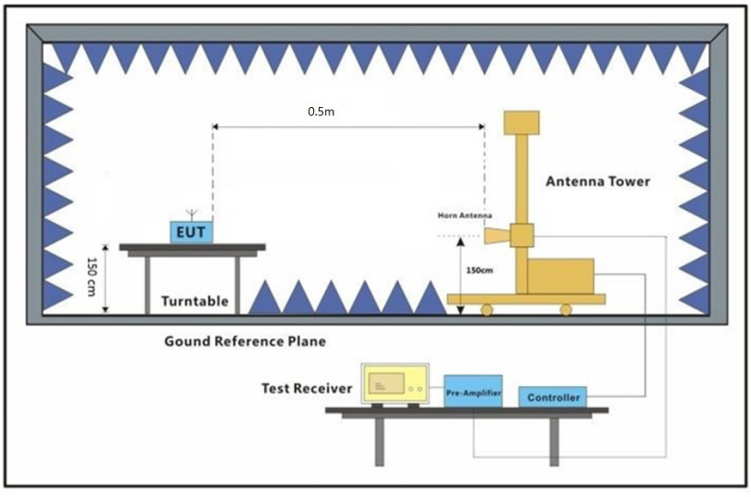
Operating Environment:

Temperature: 20.7 °C Humidity: 36.9 % RH Atmospheric Pressure: 1020 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	09	TX mode _ Keep the EUT in continuously transmitting mode

7.2.3 Test Setup Diagram



Above 40GHz

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 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 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.

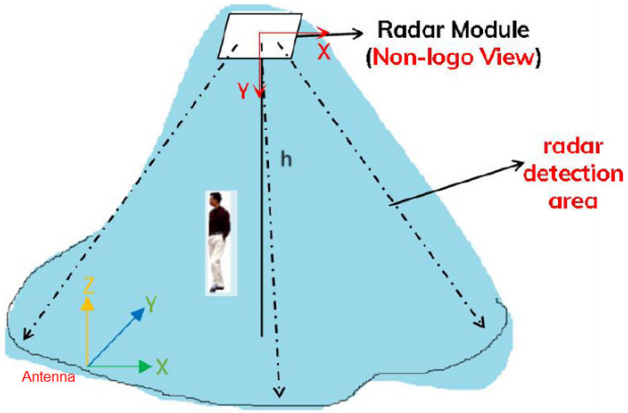
e. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

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

7.3 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

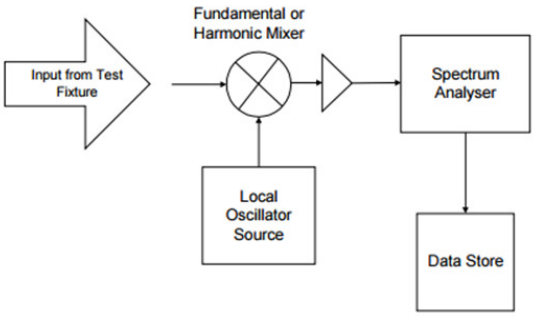
Operating Environment:

Temperature: 20.7 °C Humidity: 36.9 % RH Atmospheric Pressure: 1020 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	09	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	

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

7.4.1 E.U.T. Operation

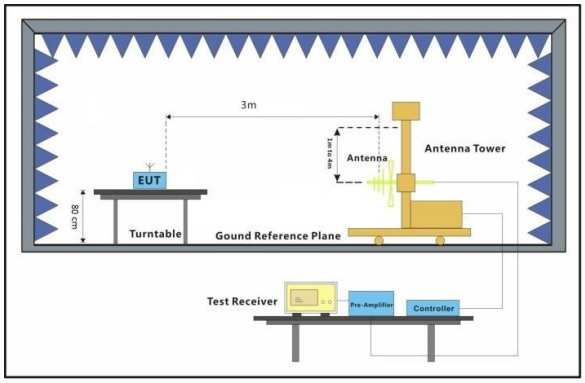
Operating Environment:

Temperature: 20.7 °C Humidity: 36.9 % RH Atmospheric Pressure: 1020 mbar

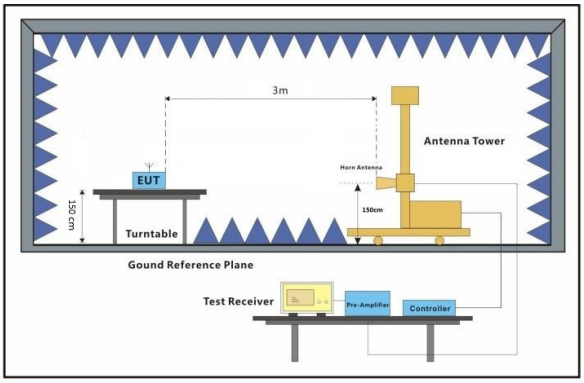
7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	09	TX mode _ Keep the EUT in continuously transmitting mode

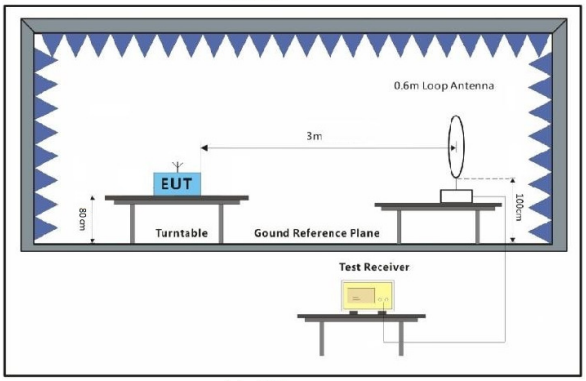
7.4.3 Test Setup Diagram



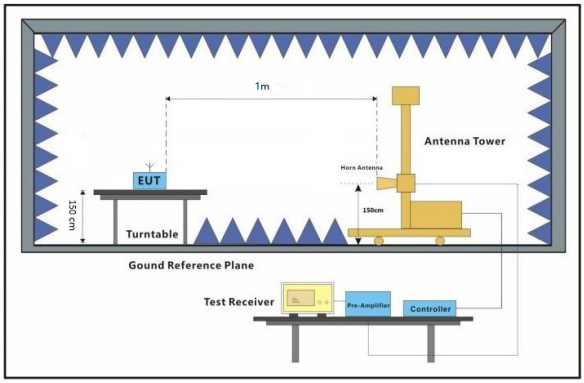
30MHz-1GHz



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 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.

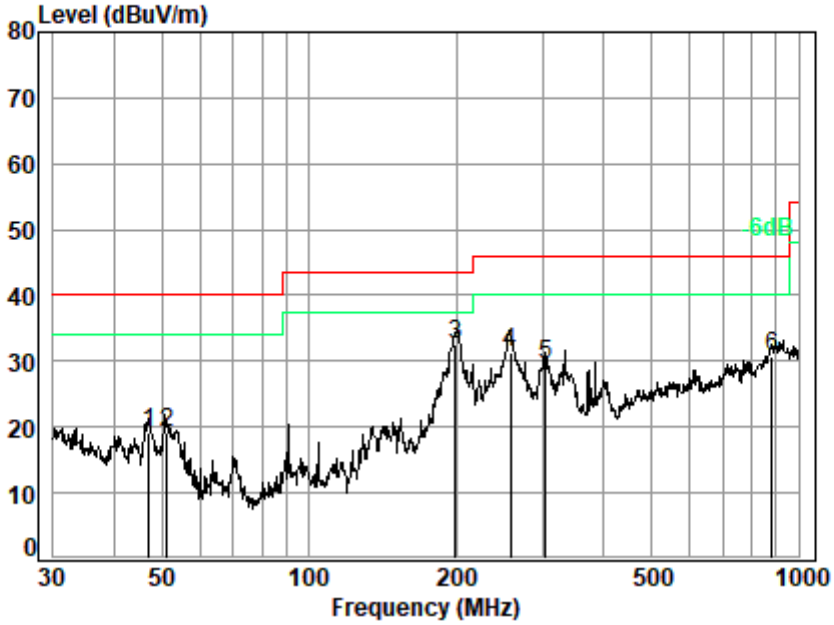
i. Repeat above procedures until all frequencies measured was complete.

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.

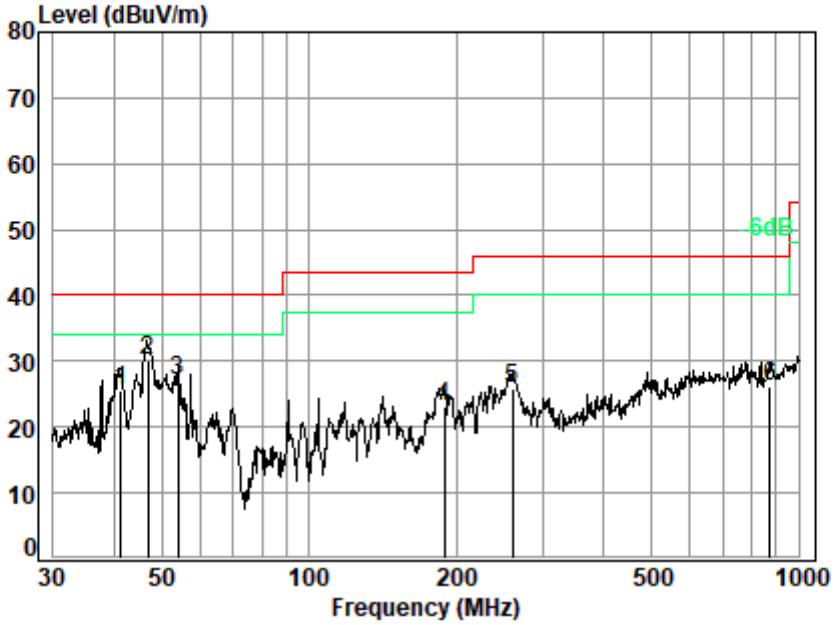
Test Mode: 09; Polarity: Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : 04581AT/04582AT
Test Mode: 09

	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	46.995	13.64	0.84	27.74	32.50	19.24	40.00	-20.76	QP
2	51.301	12.56	0.87	27.73	33.38	19.08	40.00	-20.92	QP
3 q	199.286	14.08	1.76	27.17	43.73	32.40	43.50	-11.10	QP
4	257.422	17.27	2.03	26.93	38.96	31.33	46.00	-14.67	QP
5	304.610	18.39	2.22	26.77	35.62	29.46	46.00	-16.54	QP
6	881.407	27.76	4.07	26.90	25.73	30.66	46.00	-15.34	QP

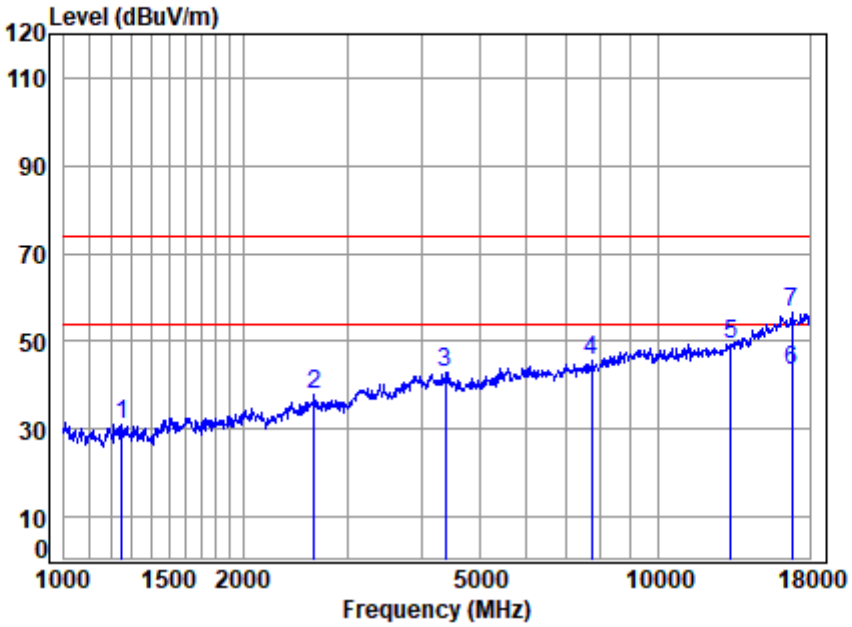
Test Mode: 09; Polarity: Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : 04581AT/04582AT
Test Mode: 09

	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	41.277	15.76	0.79	27.76	36.88	25.67	40.00	-14.33	QP
2 q	46.830	13.69	0.84	27.74	43.28	30.07	40.00	-9.93	QP
3	54.071	12.12	0.90	27.72	41.90	27.20	40.00	-12.80	QP
4	189.074	14.29	1.72	27.22	34.47	23.26	43.50	-20.24	QP
5	260.144	17.22	2.05	26.92	33.66	26.01	46.00	-19.99	QP
6	875.247	27.67	4.06	26.94	21.47	26.26	46.00	-19.74	QP

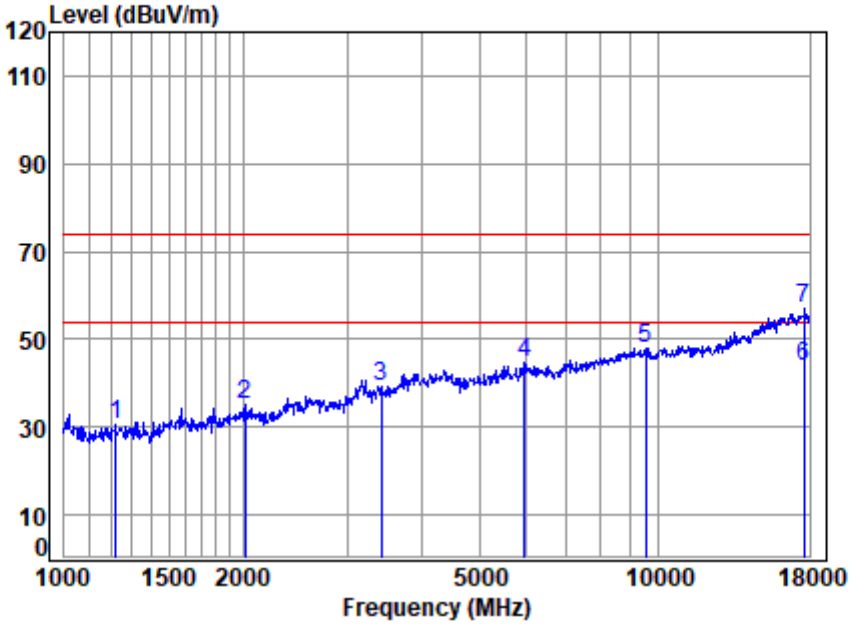
Test Mode: 09; Polarity: Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04581AT\04582AT
Mode : RSE TX

	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	1252.885	4.56	25.08	54.70	56.10	31.04	74.00	-42.96	Peak
2	2633.397	6.56	30.23	54.97	55.93	37.75	74.00	-36.25	Peak
3	4392.376	8.00	34.74	54.26	54.36	42.84	74.00	-31.16	Peak
4	7739.857	9.28	36.18	53.12	53.18	45.52	74.00	-28.48	Peak
5	13288.280	13.86	38.60	53.11	49.99	49.34	74.00	-24.66	Peak
6	q16793.680	15.78	42.89	52.68	37.33	43.32	54.00	-10.68	Average
7	p16793.680	15.78	42.89	52.68	50.42	56.41	74.00	-17.59	Peak

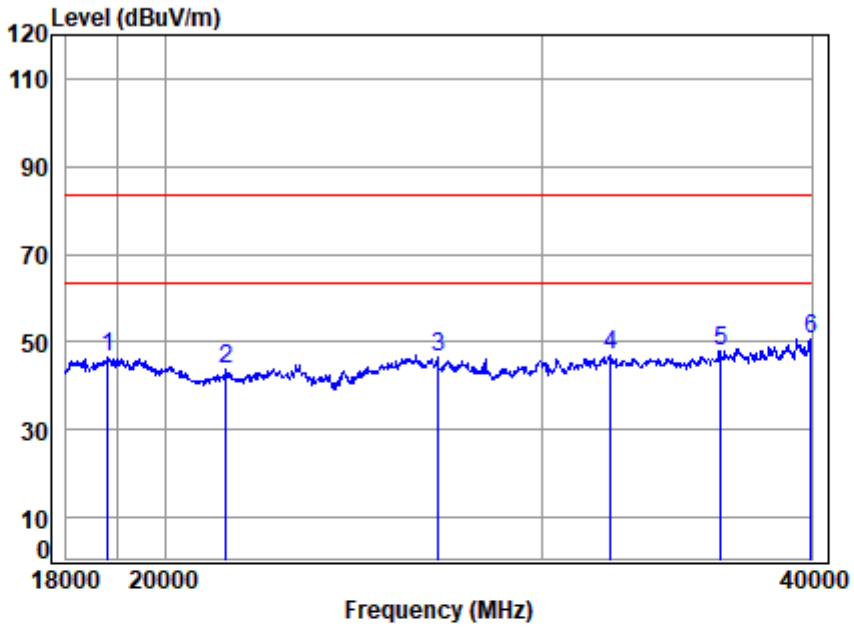
Test Mode: 09; Polarity: Vertical



Site : chamber
Condition: 3m VERTICAL
Job No : 04581AT\04582AT
Mode : RSE TX

	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	1220.714	4.56	24.69	54.69	55.92	30.48	74.00	-43.52	Peak
2	2018.511	5.58	28.87	54.90	55.62	35.17	74.00	-38.83	Peak
3	3415.787	6.86	32.21	54.68	55.06	39.45	74.00	-34.55	Peak
4	5949.811	9.50	34.70	53.15	53.73	44.78	74.00	-29.22	Peak
5	9530.432	11.45	37.50	53.38	52.34	47.91	74.00	-26.09	Peak
6	q17639.470	16.29	43.68	52.58	36.55	43.94	54.00	-10.06	Average
7	p17639.470	16.29	43.68	52.58	49.43	56.82	74.00	-17.18	Peak

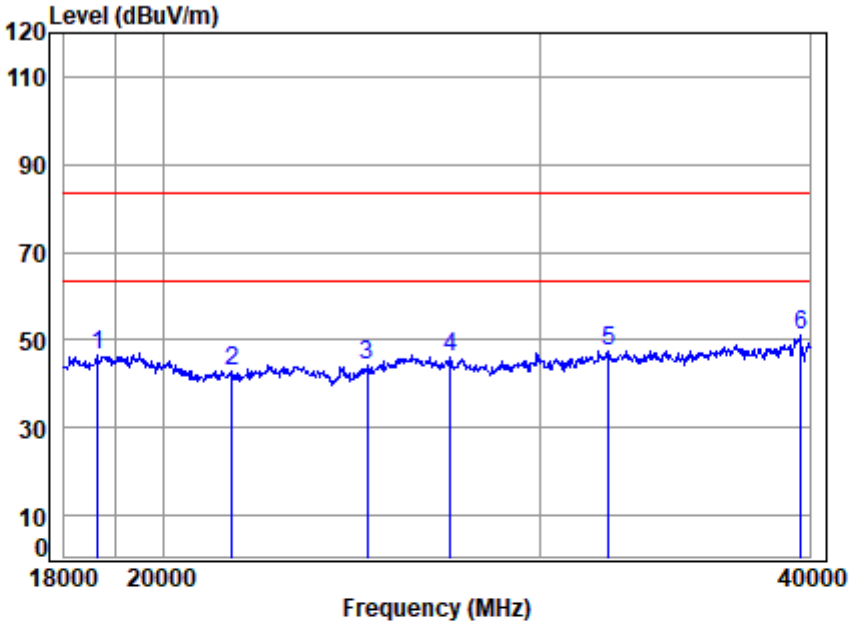
Test Mode: 09; Polarity: Horizontal



Site : chamber
Condition: 1m HORIZONTAL
Job No : 04581AT\04582AT
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	18808.140	5.83	36.85	54.72	58.38	46.34	83.54	-37.20	Peak
2	21371.340	6.00	37.00	55.03	55.70	43.67	83.54	-39.87	Peak
3	26790.000	7.42	38.54	52.26	52.73	46.43	83.54	-37.11	Peak
4	32216.670	8.03	40.17	52.17	50.83	46.86	83.54	-36.68	Peak
5	36287.070	8.12	41.26	50.26	48.74	47.86	83.54	-35.68	Peak
6	p39936.170	7.71	43.12	51.84	51.63	50.62	83.54	-32.92	Peak

Test Mode: 09; Polarity: Vertical



Site : chamber
Condition: 1m VERTICAL
Job No : 04581AT\04582AT
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	18643.660	5.60	36.73	54.66	58.73	46.40	83.54	-37.14	Peak
2	21542.680	6.00	37.07	54.64	54.62	43.05	83.54	-40.49	Peak
3	24892.480	6.81	38.51	52.87	51.62	44.07	83.54	-39.47	Peak
4	27221.270	7.30	38.20	52.37	53.13	46.26	83.54	-37.28	Peak
5	32268.160	8.04	40.18	52.18	51.64	47.68	83.54	-35.86	Peak
6	p39650.200	7.59	42.82	52.04	52.62	50.99	83.54	-32.55	Peak

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/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 C63.10-2020 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.

7.5.1 E.U.T. Operation

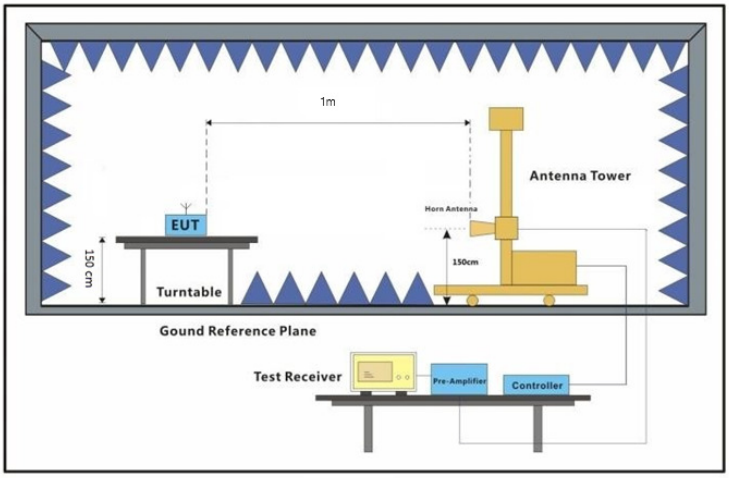
Operating Environment:

Temperature: 20.7 °C Humidity: 36.9 % RH Atmospheric Pressure: 1020 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	09	TX mode _ Keep the EUT in continuously transmitting mode

7.5.3 Test Setup Diagram



Above 40GHz

7.5.4 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.

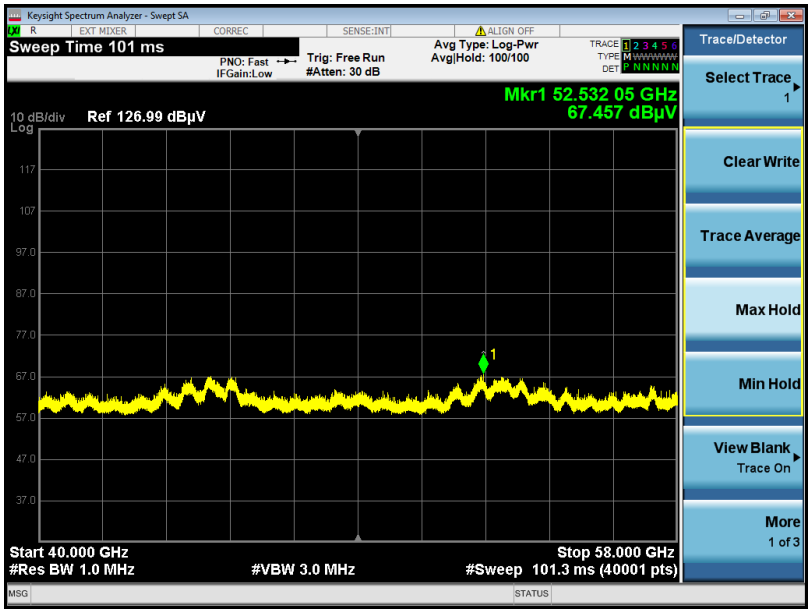
f. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

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

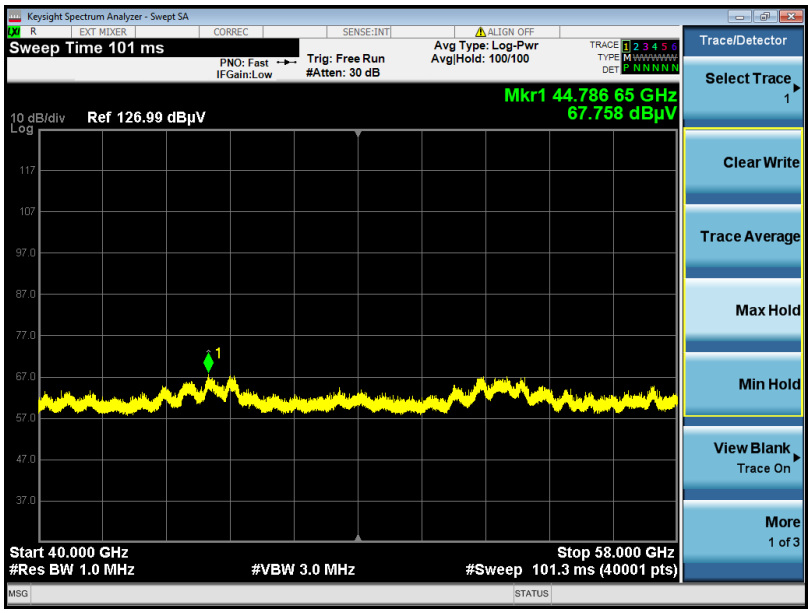
Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

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: 09; Polarity: Horizontal

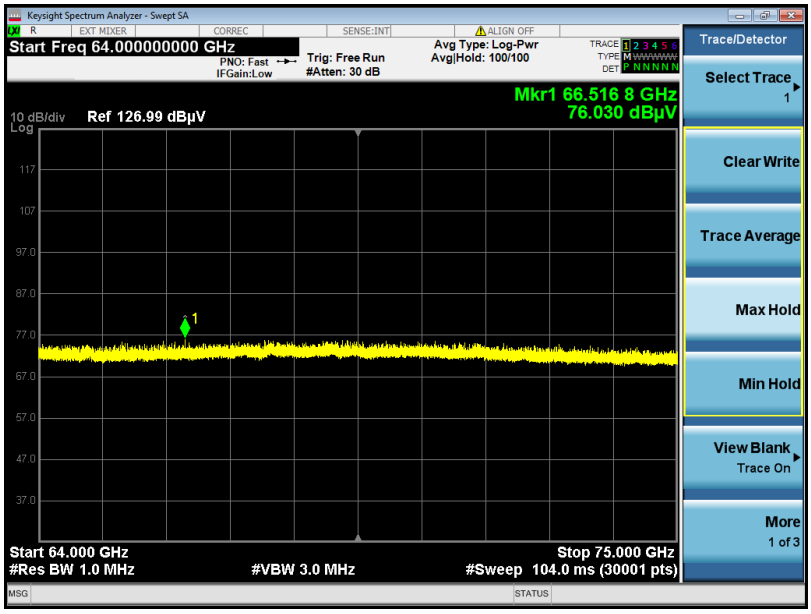


Test Mode: 09; Polarity: Vertical

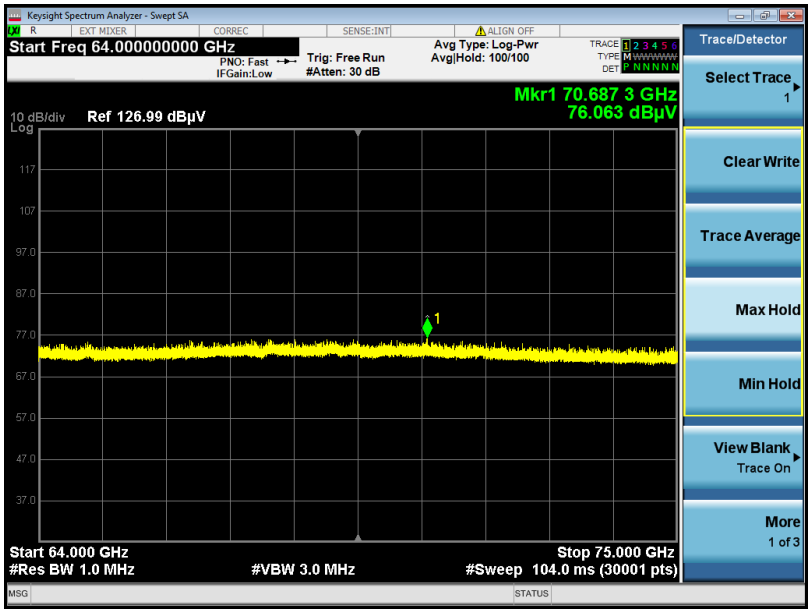


Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
52.532	1	67.46	114.85	94.85	H	PASS
44.787	1	67.758	114.85	94.85	V	PASS

Test Mode: 09; Polarity: Horizontal

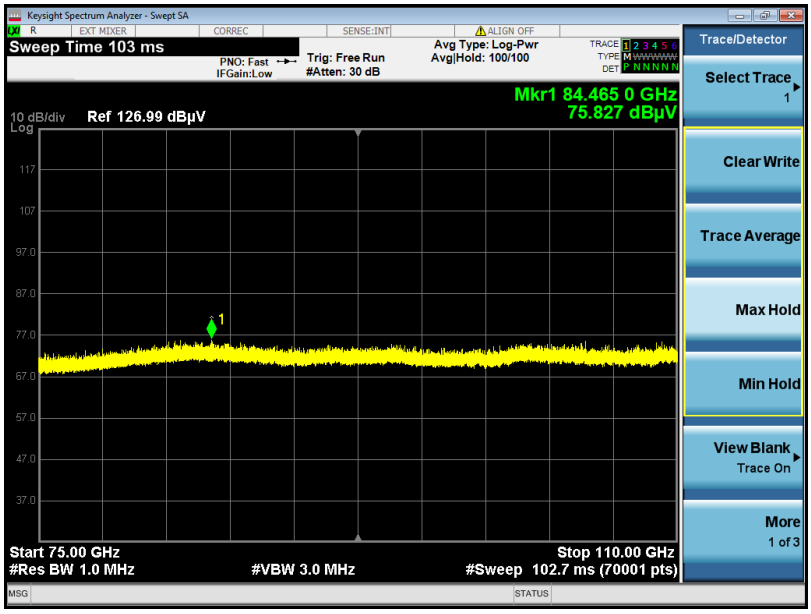


Test Mode: 09; Polarity: Vertical

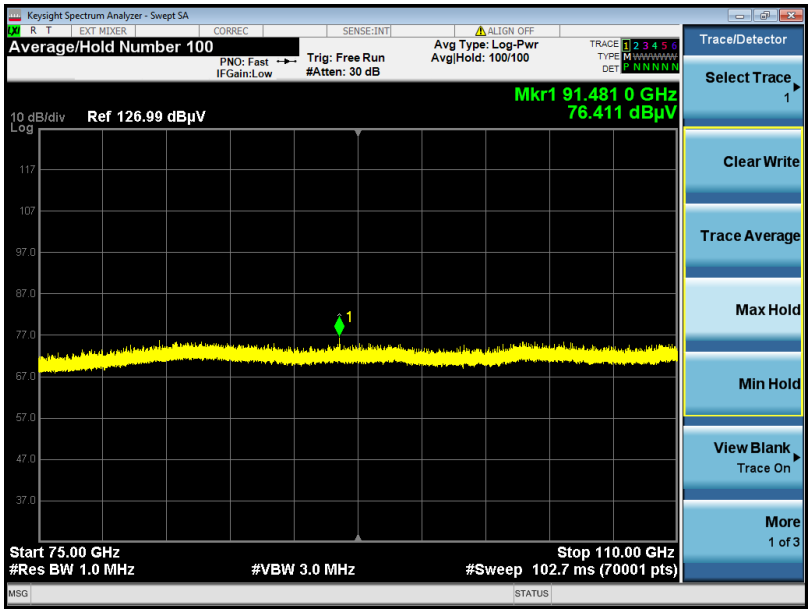


Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
66.517	1	76.03	114.85	94.85	H	PASS
70.687	1	76.063	114.85	94.85	V	PASS

Test Mode: 09; Polarity: Horizontal

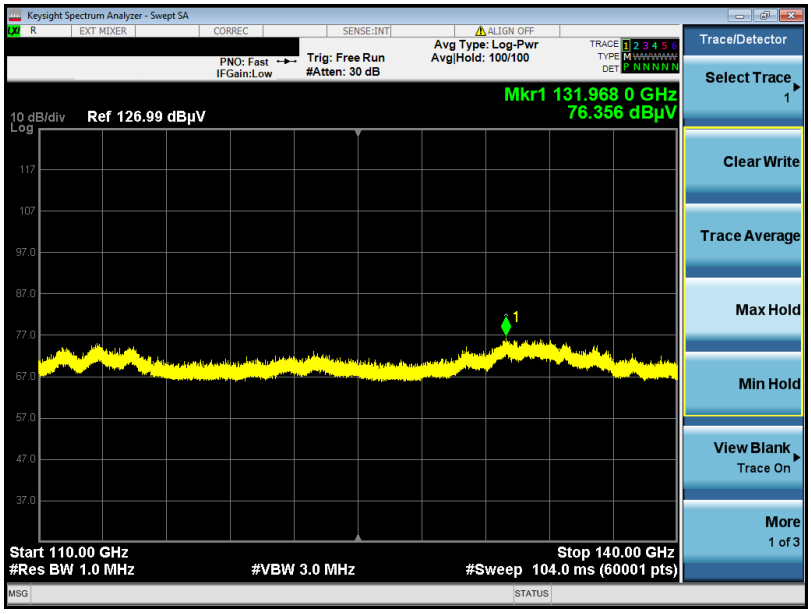


Test Mode: 09; Polarity: Vertical



Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
84.465	1	75.827	114.85	94.85	H	PASS
91.481	1	76.411	114.85	94.85	V	PASS

Test Mode: 09; Polarity: Horizontal



Test Mode: 09; Polarity: Vertical

Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
131.968	1	76.356	114.85	94.85	H	PASS
131.924	1	76.701	114.85	94.85	V	PASS

Test Mode: 09; Polarity: Horizontal

Test Mode: 09; Polarity: Vertical

Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
156.617	1	78.366	114.85	94.85	H	PASS
156.442	1	77.669	114.85	94.85	V	PASS

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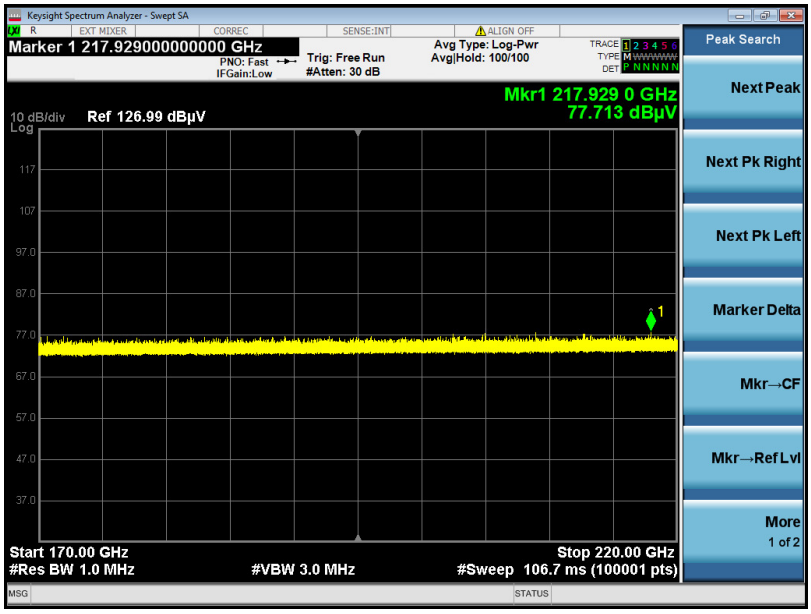
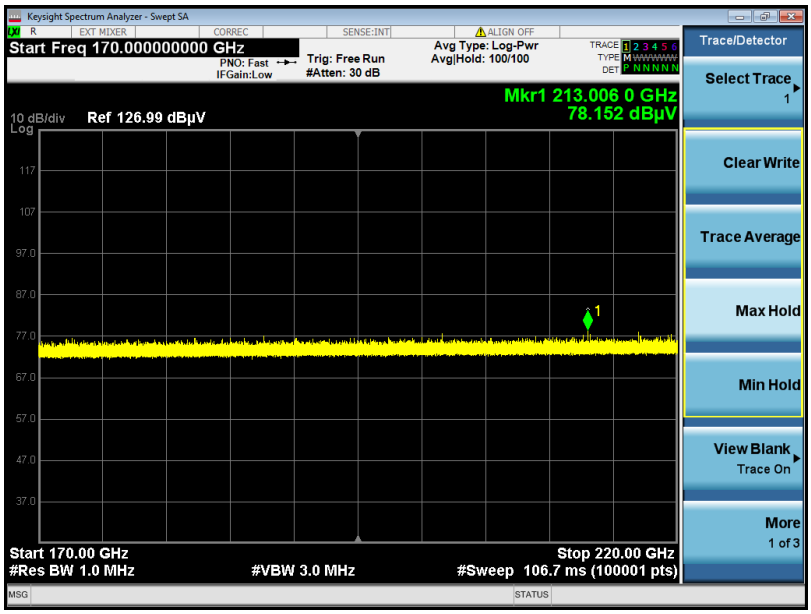
Test Mode: 09; Polarity: Horizontal



Test Mode: 09; Polarity: Vertical



Frequency (GHz)	Distance (M)	PK Value (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Polarization	Result
217.929	1	77.713	114.85	94.85	H	PASS
213.006	1	78.152	114.85	94.85	V	PASS

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.

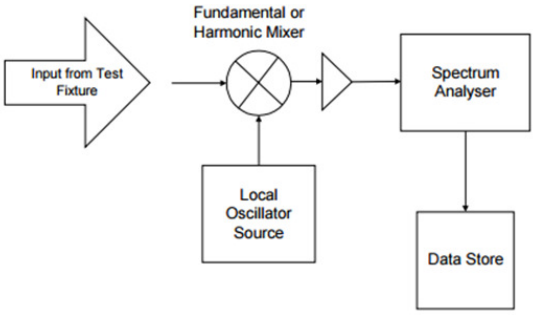
7.6.1 E.U.T. Operation

Operating Environment:
Temperature: 20.7 °C Humidity: 36.9 % RH Atmospheric Pressure: 1020 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	09	TX mode _ Keep the EUT in continuously transmitting mode

7.6.3 Test Setup Diagram



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 EUT in continuously transmitting mode;

c) record the 20℃ and nominal voltage frequency value as reference point;

d) vary the temperature from -20℃ to 40℃ with step 10℃

e) when reach a temperature point, keep the temperature maintain 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℃ and nominal voltage frequency value as reference point;

b) vary the voltage from -10% nominal voltage to +10% 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 SZCR2412004581AT

9 EUT Constructional Details (EUT Photos)

Refer to Appendix – External and Internal Photos for SZCR2412004581AT.

10 Appendix

1. Transmitter power and Transmitter off-times

Frequency (GHz)	dBuV/m @ 1m	Mesured EIRP (dBm)	Desensitization Factor(dB)	Final EIRP (dBm)	EIRP Limit (dBm)	Result	Remark
59.896	120.422	9.67	3.56	13.23	14	Pass	peak
	97.751	-13.019	3.56	-9.459	14	Pass	Average

Remark:

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

EIRP[dBm] = E[dBμV/m] + 20 log(d[meters]) - 104.77, Desensitization Factor has added in the final EIRP value.

EIRP[dBm] = E[dBμV/m] + 20 log(0.5m]) - 104.77

Final EIRP[dBm]=Mesured EIRP[dBm]+ Desensitization Factor[dB]

The FMCW Desensitization factor

FMCW Witdh(MHz)	T_{chirp}(us)	RBW(MHz)	Desensitization Factor(lin)	Desensitization Factor(dB)
2769.1	600	1	0.44058	3.56

FMCW desensitization factor =-10*Log(α)=-10*Log(0.43985)= 3.56dB

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

where

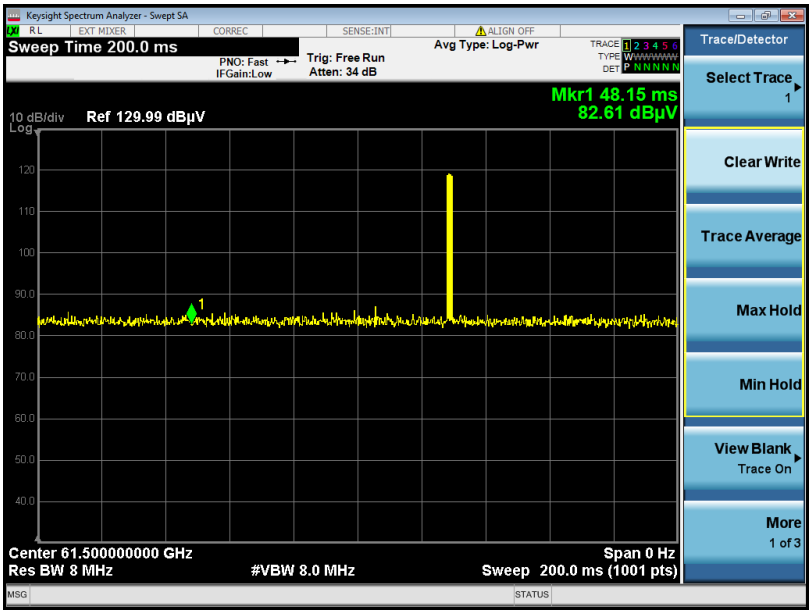
α is the reduction in amplitude

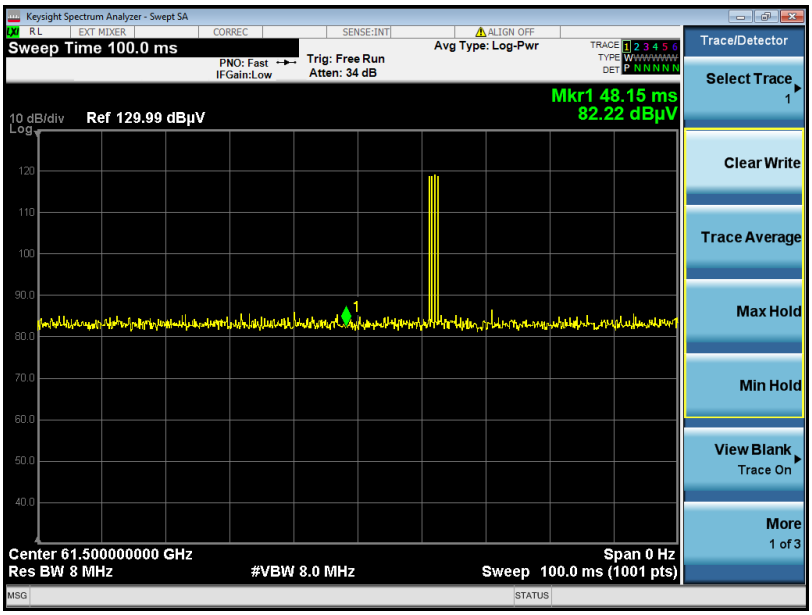
F_S is the FMCW Chirp Bandwidth

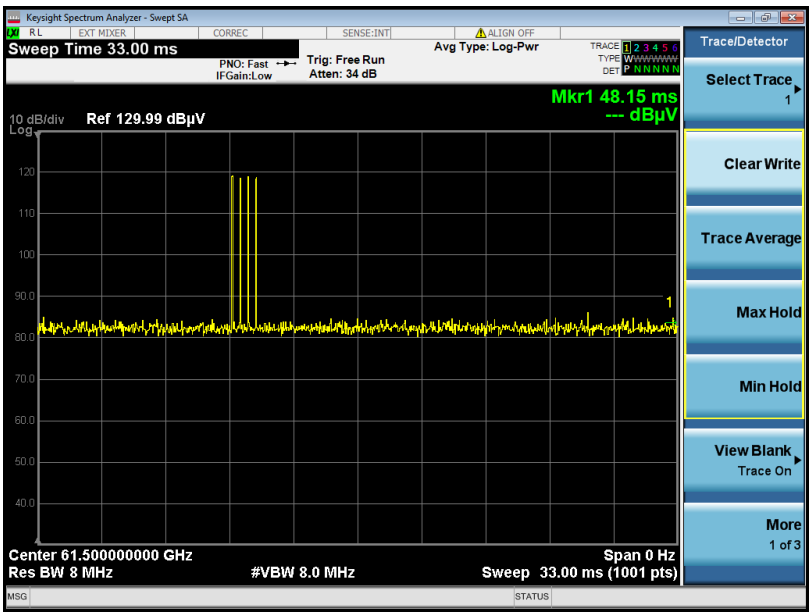
T_S is the FMCW Chirp Time

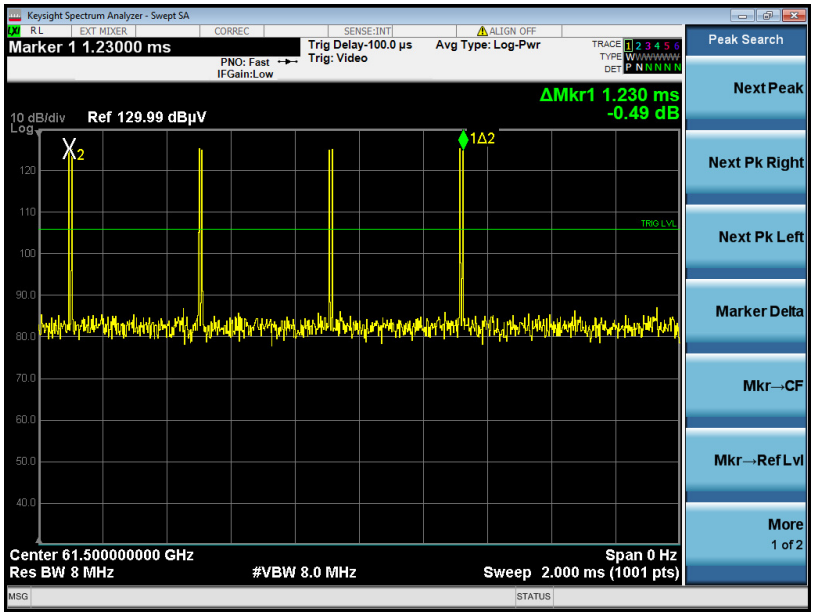
B is the 3 dB IF Bandwidth = RBW

Transmitter off-times (ms)









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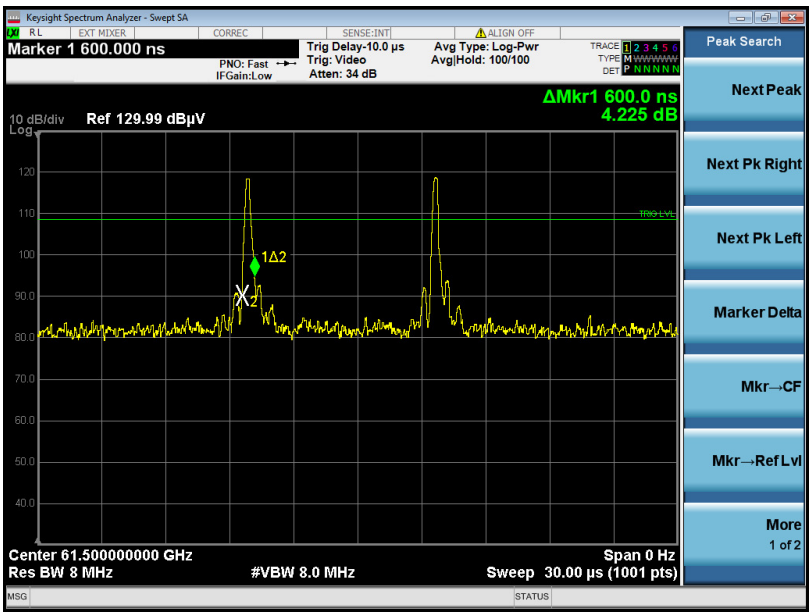

Frequency (GHz)	Transmitter off-times (ms)	Limit (ms)	Result
61.5	32.9952	⩾25.5	Pass

Note: burst number within 33ms is 8, Dwell time for one burst is 0.6us, total dwell time is 4.8us.

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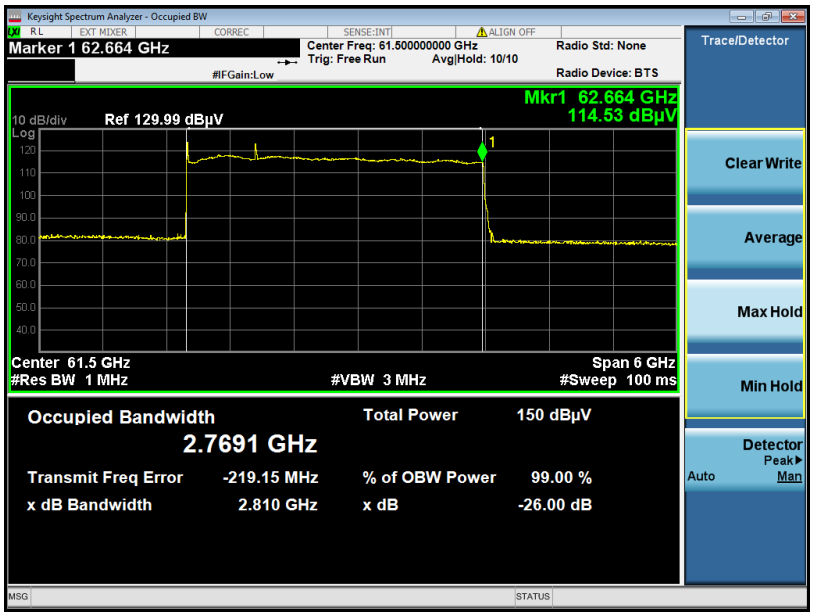
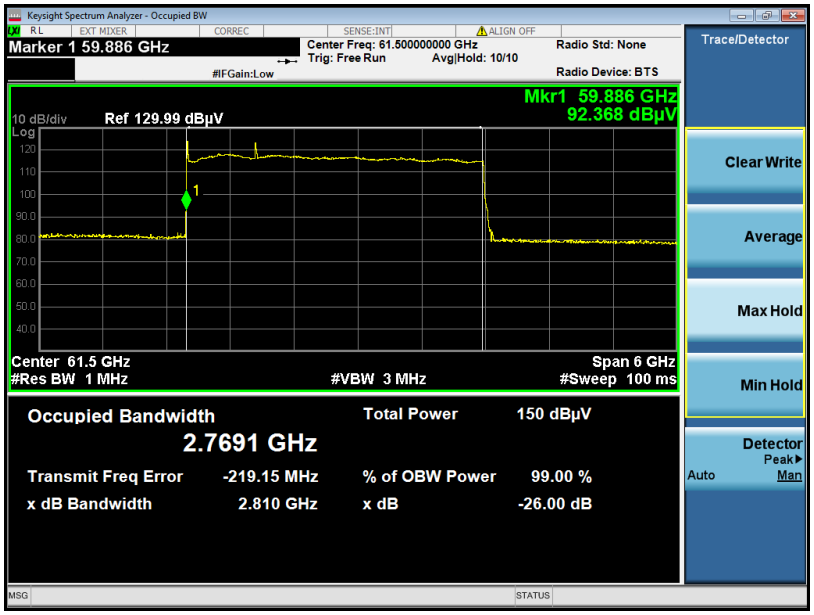
2. Occupied bandwidth

2.1 OBW

2.1.1 Test Result

99% & -20dB Occupied Channel Bandwidth





Centre Frequency (GHz)	99% OCW (GHz)	F_L (GHz)	Limit (GHz)	F_H (GHz)	Limit (GHz)	Result
61	2.7691	59.886	57	62.664	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 (℃)	Voltage (V DC)	F_L (GHz)	Limit (GHz)	F_H (GHz)	Limit (GHz)	Result
57-64	40	7.4	59.8972	57	62.6742	64	Pass
	30	7.4	59.8968	57	62.6746	64	Pass
	20	7.4	59.8976	57	62.6749	64	Pass
	10	7.4	59.8972	57	62.6752	64	Pass
	0	7.4	59.8966	57	62.6749	64	Pass
	-10	7.4	59.8962	57	62.6732	64	Pass
	-20	7.4	59.8952	57	62.6728	64	Pass

Frequency Stability vs voltage:

1. Test for 57GHz to 64GHz

Frequency (GHz)	Voltage (V DC)	Temperature (℃)	F_L (GHz)	Limit (GHz)	F_H (GHz)	Limit (GHz)	Result
57-64	6.66	20	59.8973	57	62.6741	64	Pass
	7.4	20	59.8979	57	62.6748	64	Pass
	8.14	20	59.8981	57	62.6743	64	Pass

Remark:

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

- End of the Report -