



TEST REPORT

Application No.: GZCR2206000806LM
Applicant: Shenzhen Yuegang Optical Co., Ltd
Address of Applicant: No.77-79 Xinhe Road, Shangmugu Community, Pinghu Street, Longgang District, SHENZHEN Guangdong
Manufacturer: Shenzhen Yuegang Optical Co., Ltd
Address of Manufacturer: No.77-79 Xinhe Road, Shangmugu Community, Pinghu Street, Longgang District, SHENZHEN Guangdong
Factory: Shenzhen Yuegang Optical Co., Ltd
Address of Factory: No.77-79 Xinhe Road, Shangmugu Community, Pinghu Street, Longgang District, SHENZHEN Guangdong
Equipment Under Test (EUT):
EUT Name: laser light
Model No.: YG-LA-01, Li00013US, YG-JG006, Li00025US, YG-LA-02, Li00035US, Li00056US, Li00057US ♣
♣ Please refer to section 2 of this report which indicates which item was actually tested and which were electrically identical.
Standard(s) : 47 CFR Part 15, Subpart C 15.231
Date of Receipt: 2022-06-27
Date of Test: 2022-06-29 to 2022-06-30
Date of Issue: 2022-08-03

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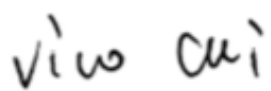
* In the configuration tested, the EUT complied with the standards specified above.

Kobe Jian
EMC Laboratory Manager



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Revision Record			
Version	Report No.	Date	Remark
01	GZCR220600080601	2022-08-03	Original

Authorized for issue by:			
			
		Lily Kuang/Project Engineer	
			
		Vico Cui/Reviewer	

2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.231	N/A	47 CFR Part 15, Subpart C 15.203	Pass

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
20dB Bandwidth	47 CFR Part 15, Subpart C 15.231	ANSI C63.10 (2013) Section 6.9	47 CFR Part 15, Subpart C 15.231(c)	Pass
Radiated Emissions below 1GHz		ANSI C63.10 (2013) Section 6.4&6.5	47 CFR Part 15C Section 15.231(b) and 15.209	Pass
Dwell Time (15.231(a))		ANSI C63.10 (2013) Section 7.5	47 CFR Part 15, Subpart C 15.231(a)	Pass
Field Strength of the Fundamental Signal (15.231(b))		ANSI C63.10 (2013) Section 6.5	47 CFR Part 15, Subpart C 15.231(b)	Pass
Radiated Emissions above 1GHz		ANSI C63.10 (2013) Section 6.6	47 CFR Part 15C Section 15.231(b) and 15.209	Pass

Note:

E.U.T./EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

♣Declaration of EUT Family Grouping:

Model No.: YG-LA-01, Li00013US, YG-JG006, Li00025US, YG-LA-02, Li00035US, Li00056US, Li00057US.

According to the declaration from the applicant, the electrical circuit design, layout, components used and internal wiring were identical for all models, with only difference on the color box and appearance. Therefore only one model Li00025US was tested in this report.



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 3V (1 x "CR2032")
Test voltage:	DC 3V
Cable(s):	N/A
Frequency	433.92MHz
Modulation Type:	ASK
Antenna Type:	Integrated Antenna
Antenna Gain:	0 dBi declared by applicant.

4.2 Description of Support Units

The EUT has been tested as an independent unit.

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
20dB Bandwidth	±3%
Radiated Emissions below 1GHz	±5.00dB (30MHz-1GHz; 3m); ±4.38dB (30MHz-1GHz; 10m)
Dwell Time (15.231(a))	±0.37%
Field Strength of the Fundamental Signal (15.231(b))	±5.00dB (30MHz-1GHz; 3m); ±4.38dB (30MHz-1GHz; 10m)
Radiated Emissions above 1GHz	±5.12 dB (1GHz-6 GHz); ±5.38 dB (6GHz-18GHz); ±5.61(18GHz-40GHz)

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,
198 Kezhu Road, Sciencetech Park, Guangzhou Economic & Technology Development District,
Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.



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4.5 Test Facility

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

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

- **ISED (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)**

The 10m Semi-anechoic chamber, 966 Anechoic Chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584, G-20107 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

20dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
6dB Attenuator	HP	8491A	EMC2062	2022-04-15	2024-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-02	2023-11-01
MXA Signal Analyzer (10Hz-8.4GHz)	Agilent Technologies	N9020A	SEM004-10	2022-03-05	2023-03-01

Radiated Emissions below 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2019-10-20	2022-10-19
Chamber cable	HangTianXing	N/A	EMC0542	2020-09-09	2022-09-08
Amplifier (9kHz-1.3GHz)	HP	8447F	EMC2065	2022-06-21	2023-06-20
High Pass Filter (915MHz)	FSY MICROWAVE	HM1465-9SS	EMC2079	2021-12-17	2022-12-16
EMI Test Receiver (1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2220	2022-05-20	2023-05-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Trilog Broadband Antenna (25MHz-1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	EMC2174	2022-06-19	2025-06-18

Dwell Time (15.231(a))					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
6dB Attenuator	HP	8491A	EMC2062	2022-04-15	2024-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-02	2023-11-01
MXA Signal Analyzer (10Hz-8.4GHz)	Agilent Technologies	N9020A	SEM004-10	2022-03-05	2023-03-01

Field Strength of the Fundamental Signal (15.231(b))					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2019-10-20	2022-10-19
Chamber cable	HangTianXing	N/A	EMC0542	2020-09-09	2022-09-08
Amplifier (9kHz-1.3GHz)	HP	8447F	EMC2065	2022-06-21	2023-06-20
EMI Test Receiver (1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2220	2022-05-20	2023-05-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Trilog Broadband Antenna (25MHz-1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	EMC2174	2022-06-19	2025-06-18



Radiated Emissions above 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-12-17	2022-12-16
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2021-12-17	2022-12-16
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2020-09-09	2022-09-08
Horn Antenna (1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DMM	Fluke	73	EMC0006	2022-06-24	2023-06-23
DMM	Fluke	73	EMC0007	2022-06-24	2023-06-23



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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 0dBi.

Antenna location: Refer to Internal photos

7 Radio Spectrum Matter Test Results

7.1 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.231(c)

Test Method: ANSI C63.10 (2013) Section 6.9

Limit:

Frequency range(MHz)	Limit
70-900	No wider than 0.25% of the center frequency
Above 900	No wider than 0.5% of the center frequency

7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 22.5 °C

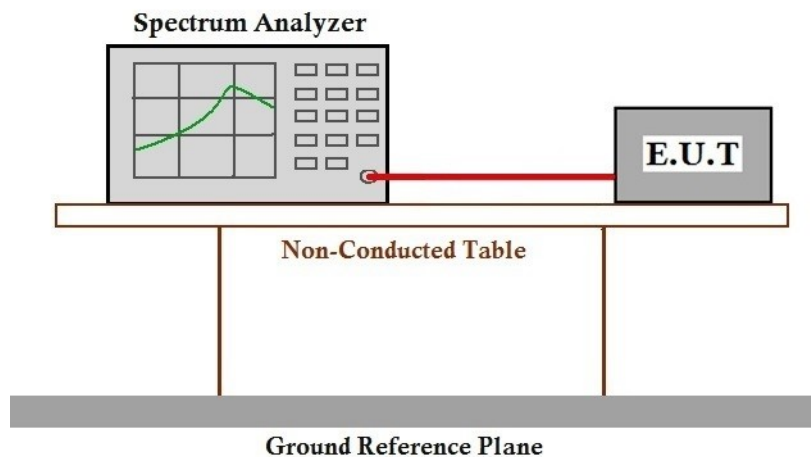
Humidity: 56.1 % RH

Atmospheric Pressure: 1018 mbar

7.1.1 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 00	Tx mode

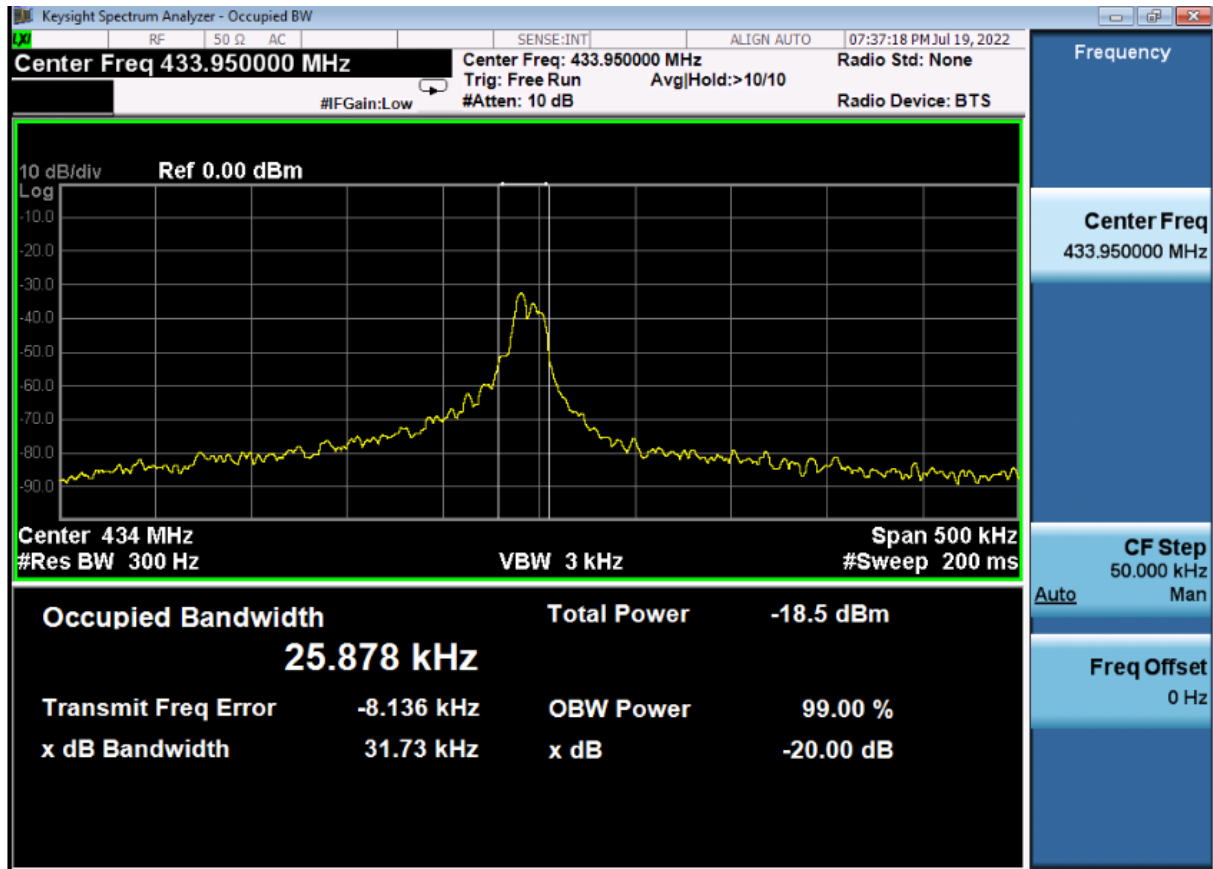
7.1.2 Test Setup Diagram



7.1.3 Measurement Procedure and Data

Test Result:

Test Channel	Bandwidth	Limit	Verdict
433.95MHz	31.73kHz	<1.08 MHz	PASS



7.2 Radiated Emissions below 1GHz

Test Requirement 47 CFR Part 15C Section 15.231(b) and 15.209

Test Method: ANSI C63.10 (2013) Section 6.4&6.5

Limit:

For Restricted bands

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

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.

For Other bands

Fundamental Frequency MHz	Field Strength of Fundamental (μV/m @ 3 m)	Field Strength of Harmonics and Spurious Emissions (μV/m @ 3 m)
40.66 to 40.70	2,250	225
70 to 130	1,250	125
130 to 174	**1,250 to 3,750	**125 to 375
174 to 260	3,750	375
260 to 470	**3,750 to 12,500	**375 to 1,250
Above 470	12,500	1,250
Detector:	Peak for pre-scan QP for 30MHz to 1000 MHz: 120 kHz resolution bandwidth Peak for Above 1 GHz: 1 MHz resolution bandwidth	

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F) - 6136.3636;

for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F) - 7083.3333.

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

The fundamental frequency of the EUT is 433.92 MHz

The limit for average or QP field strength dBuV/m for the fundamental emission= 80.83 dBuV/m



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No fundamental is allowed in the restricted bands.

The limit for average field strength dBuV/m for the spurious emission=60.83 dBuV/m. Spurious in the restricted bands must be less than 60.83 dBuV/m or 15.209, whichever limit permits a higher field strength.

7.2.1 E.U.T. Operation

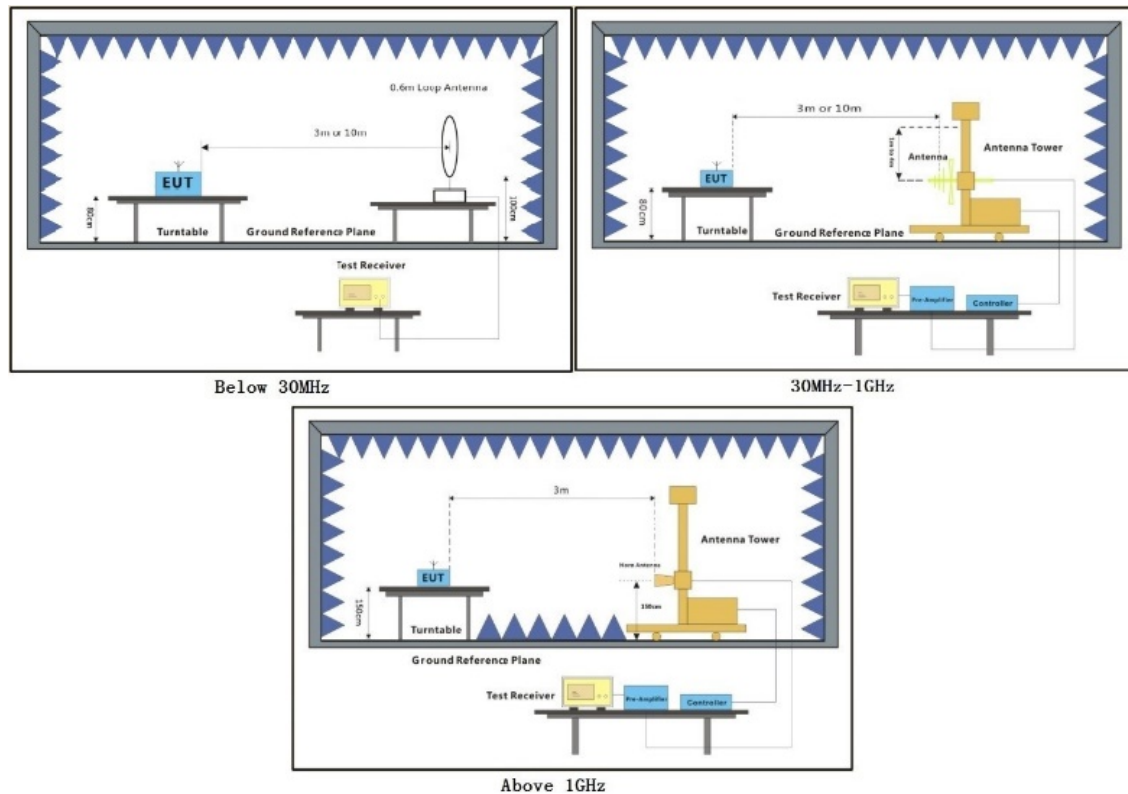
Operating Environment:

Temperature: 23 °C Humidity: 60 % RH Atmospheric Pressure: 1005 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Tx mode

7.2.3 Test Setup Diagram



7.2.4 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. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (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.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. 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.
- g. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows: Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor
- 2) Scan from 9kHz to 1GHz, 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.



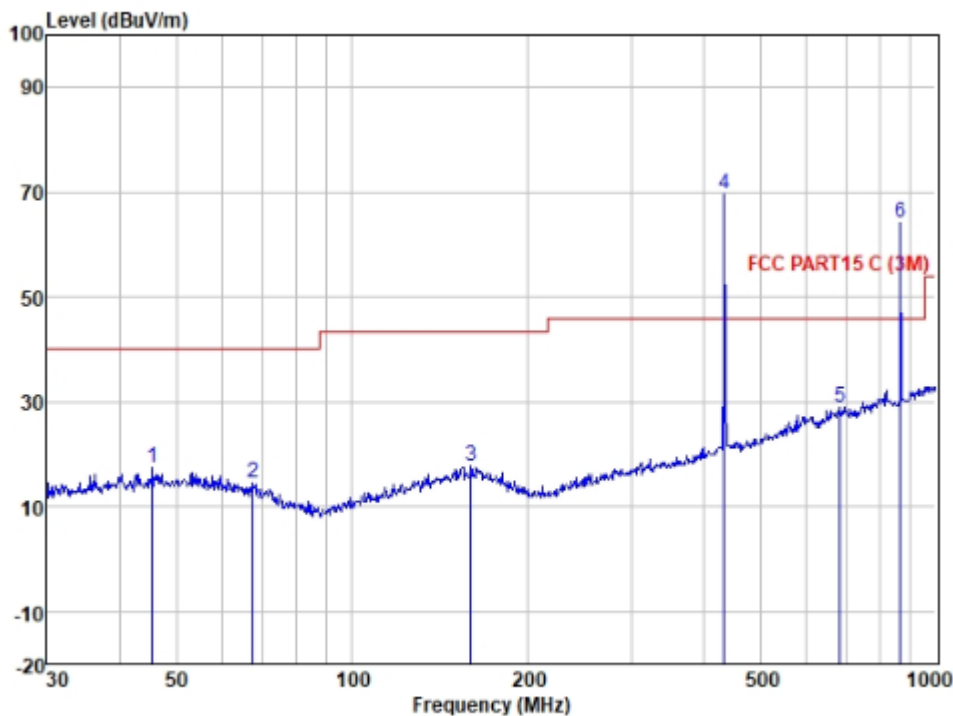
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Test Mode: 00; Polarity: Horizontal

Horizontal.

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
45.375	29.93	13.93	1.12	27.60	17.38	60.00	-42.62	Peak
45.375	N/A	N/A	N/A	N/A	7.78	40.00	-32.22	Average
67.675	28.65	12.06	1.38	27.60	14.49	60.00	-45.51	Peak
67.675	N/A	N/A	N/A	N/A	4.89	40.00	-35.11	Average
159.784	29.07	13.69	2.33	28.18	17.73	63.50	-45.77	Peak
159.784	N/A	N/A	N/A	N/A	8.13	43.50	-35.37	Average
684.745	30.85	21.24	5.70	28.71	29.08	66.00	-36.92	Peak
684.745	N/A	N/A	N/A	N/A	19.48	46.00	-26.52	Average
869.130	63.36	22.26	6.71	28.30	64.03	80.83	-16.8	Peak
869.130	N/A	N/A	N/A	N/A	54.43	60.83	-6.4	Average



Site : SGS



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Test Mode :

	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Measured Level	Pol/Phase
	MHz	dBuV	dB/m	dB	dB	dBuV/m	
1	45.375	29.93	13.93	1.12	27.60	17.38	HORIZONTAL
2	67.675	28.65	12.06	1.38	27.60	14.49	HORIZONTAL
3	159.784	29.07	13.69	2.33	27.36	17.73	HORIZONTAL
4	434.065	77.02	16.60	4.09	28.18	69.53	HORIZONTAL
5	684.745	30.85	21.24	5.70	28.71	29.08	HORIZONTAL
6	869.130	63.36	22.26	6.71	28.30	64.03	HORIZONTAL

*Remark: Point 4 in the table is the fundamental frequency and please refer to section 7.4.



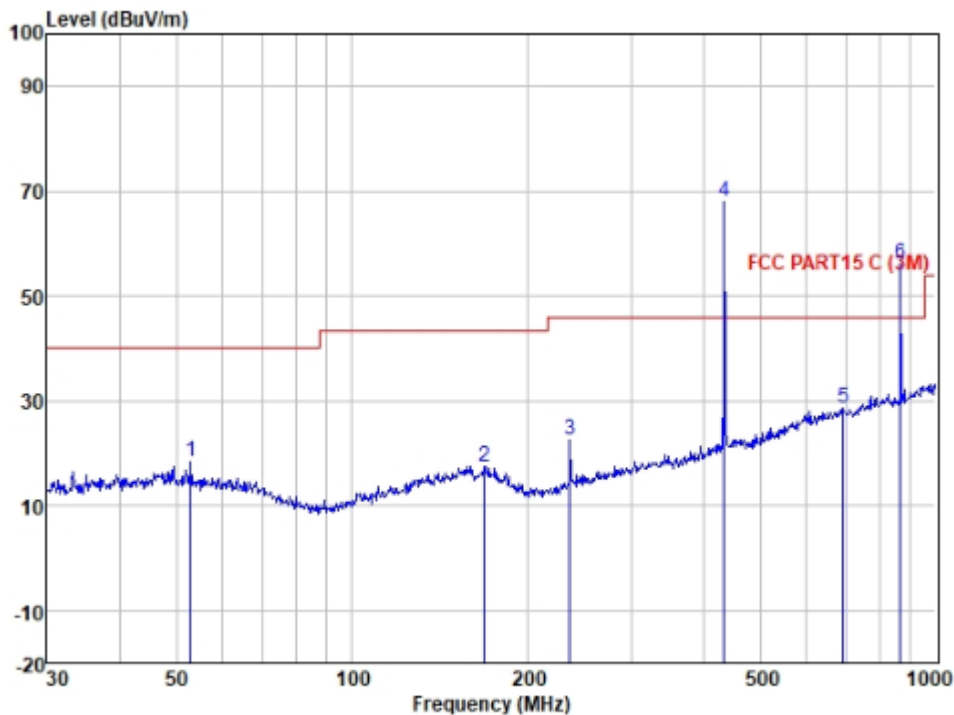
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Vertical

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
52.945	30.83	13.90	1.17	27.60	18.30	60.00	-41.7	Peak
52.945	N/A	N/A	N/A	N/A	8.7	40.00	-31.3	Average
168.414	29.17	13.30	2.39	27.34	17.52	63.50	-45.98	Peak
168.414	N/A	N/A	N/A	N/A	7.92	43.50	-35.58	Average
235.816	35.80	11.35	2.78	27.27	22.66	66.00	-43.34	Peak
235.816	N/A	N/A	N/A	N/A	13.06	46.00	-32.94	Average
694.417	30.31	21.33	5.77	28.70	28.71	46.00	-17.29	Peak
694.417	N/A	N/A	N/A	N/A	19.11	66.00	-46.89	Average
869.130	55.34	22.26	6.71	28.30	56.01	80.83	-24.82	Peak
869.130	N/A	N/A	N/A	N/A	46.41	60.83	-14.42	Average

Test Mode: 00; Polarity: Vertical



Site : SGS

Test Mode :

	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Measured Level	Pol/Phase
	MHz	dBuV	dB/m	dB	dB	dBuV/m	
1	52.945	30.83	13.90	1.17	27.60	18.30	VERTICAL
2	168.414	29.17	13.30	2.39	27.34	17.52	VERTICAL
3	235.816	35.80	11.35	2.78	27.27	22.66	VERTICAL
4	434.065	75.56	16.60	4.09	28.18	68.07	VERTICAL
5	694.417	30.31	21.33	5.77	28.70	28.71	VERTICAL
6	869.130	55.34	22.26	6.71	28.30	56.01	VERTICAL

*Remark: Point 4 in the table is the fundamental frequency and please refer to section 7.4.

7.3 Dwell Time (15.231(a))

Test Requirement 47 CFR Part 15, Subpart C 15.231(a)

Test Method: ANSI C63.10 (2013) Section 7.5

Limit:

Device type	Limit
Manually operated transmitter	The switch automatically deactivate the transmitter within not more than 5 seconds of being released
Automatically activated transmitter	Cease transmission within 5 seconds after activation
Periodic transmissions to determine system integrity of transmitters used in security or safety applications	The total transmission time does not exceed 2 seconds per hour

7.3.1 E.U.T. Operation

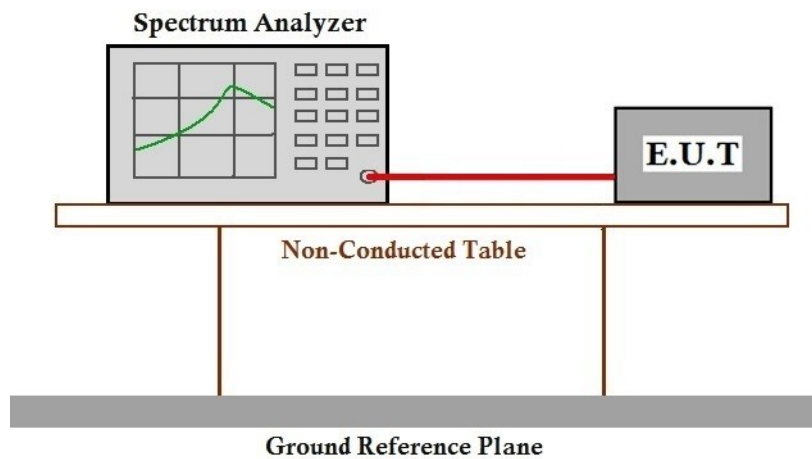
Operating Environment:

Temperature: 22.5 °C

Humidity: 56.1 % RH

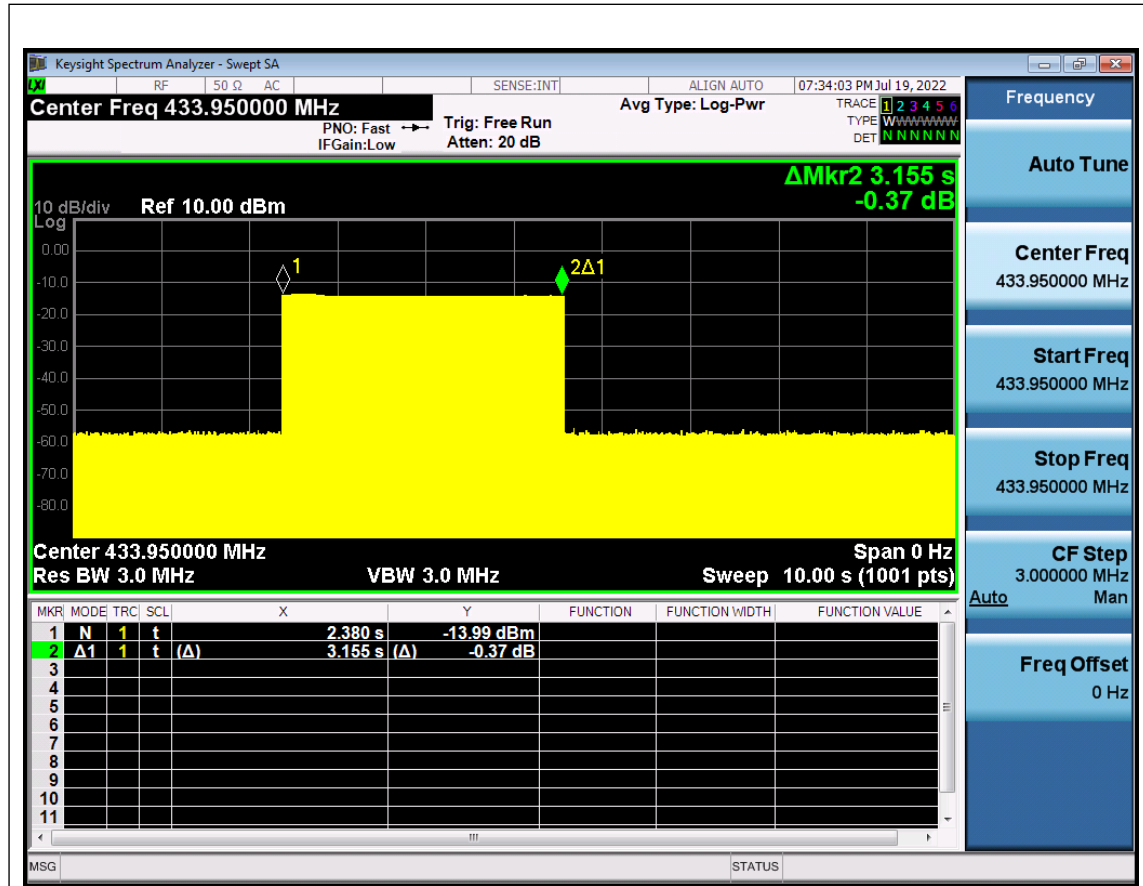
Atmospheric Pressure: 1018 mbar

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

Carrier Frequency	Shutdown Time	Limit
433.95MHz	3.155s	≤5s



7.4 Field Strength of the Fundamental Signal (15.231(b))

Test Requirement 47 CFR Part 15, Subpart C 15.231(b)

Test Method: ANSI C63.10 (2013) Section 6.5

Limit:

Fundamental Frequency MHz	Field Strength of Fundamental ($\mu\text{V/m}$ @ 3 m)	Field Strength of Harmonics and Spurious Emissions ($\mu\text{V/m}$ @ 3 m)
40.66 to 40.70	2,250	225
70 to 130	1,250	125
130 to 174	**1,250 to 3,750	**125 to 375
174 to 260	3,750	375
260 to 470	**3,750 to 12,500	**375 to 1,250
Above 470	12,500	1,250
Detector:	Peak for pre-scan	
	QP for 30MHz to1000 MHz:120 kHz resolution bandwidth	
	Peak for Above 1 GHz: 1 MHz resolution bandwidth	

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$;for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$.]

The fundamental frequency of the EUT is 433.92 MHz

The limit for average or QP field strength dB $\mu\text{V/m}$ for the fundamental emission= 80.83 dB $\mu\text{V/m}$

No fundamental is allowed in the restricted bands.

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C

Humidity: 60 % RH

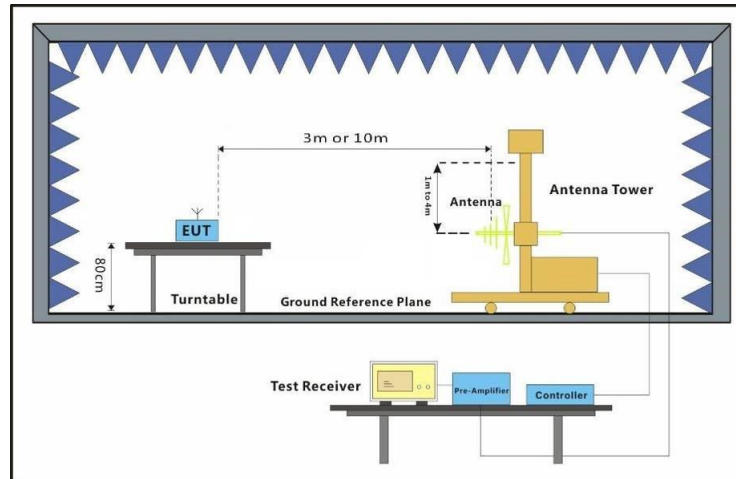
Atmospheric Pressure: 1005 mbar

7.4.2 Test Mode Description

Pre-scan / Mode		Description
Final test Code		
Final test 00		Tx mode



7.4.3 Test Setup Diagram



7.4.4 Measurement Procedure and Data

- 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.
- For above 1GHz, 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.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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 heights from 1 meter to 4 meters (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. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.

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

$$20\log(\text{Duty cycle})=20\log(0.33)=-9.6\text{dB}$$

Here:

$$\text{Duty cycle} = \text{Ton_cum} / \text{Ton+off}$$

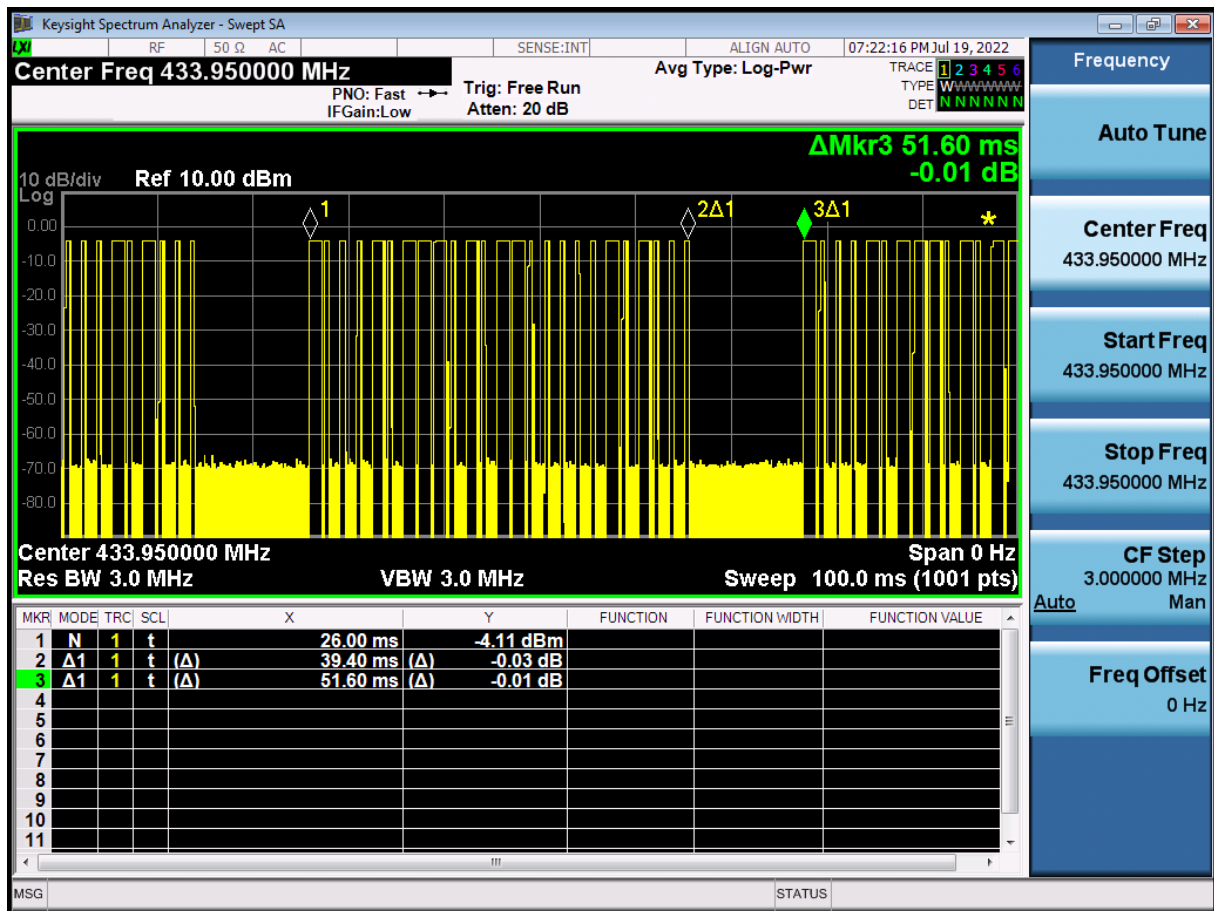
$$\text{Ton_cum} = 1.1 \times 10 + 0.4 \times 15 = 17(\text{ms})$$

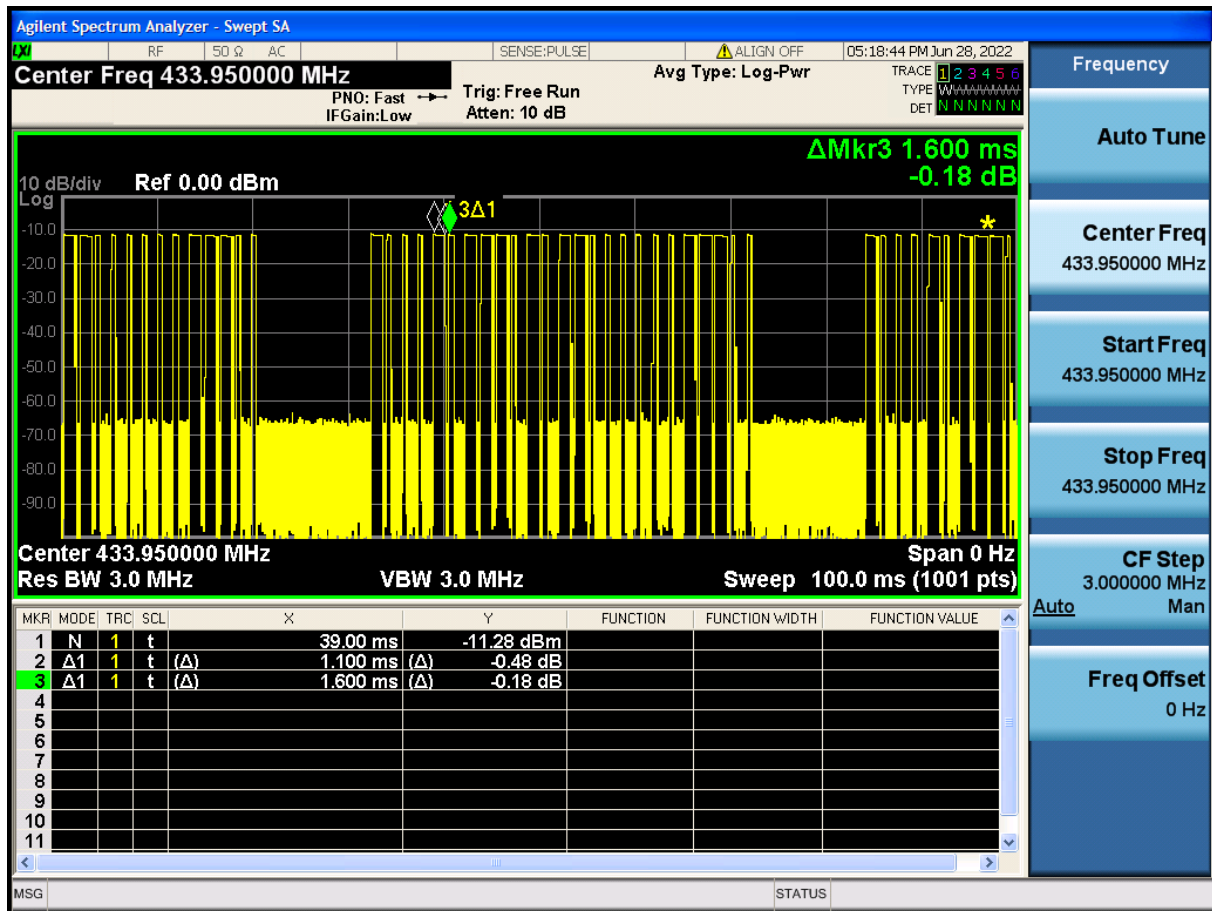
$$\text{Ton+off} = 51.6 (\text{ms})$$

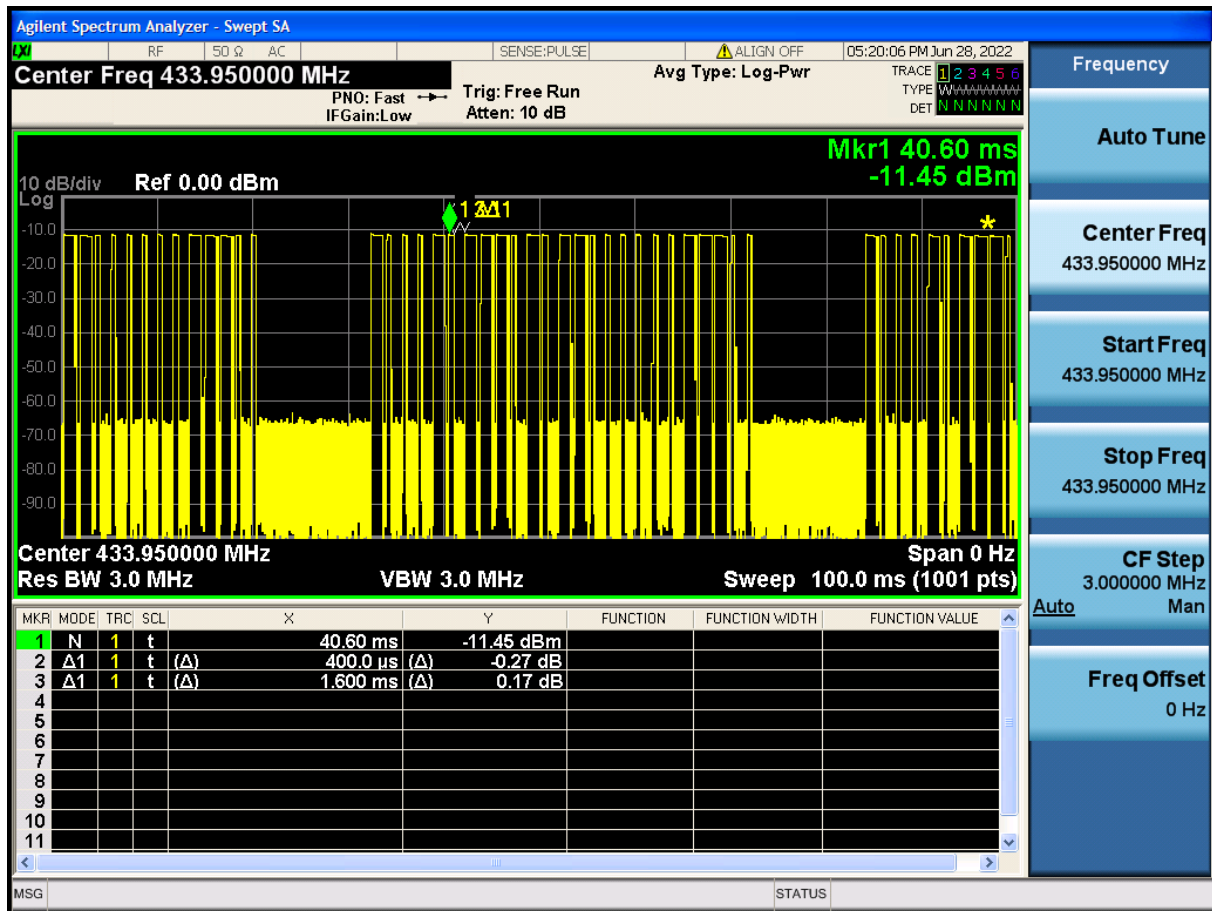
$$\text{Duty cycle} = 17/51.6 = 0.33$$

Please refer to below plots for more details.

Test plot

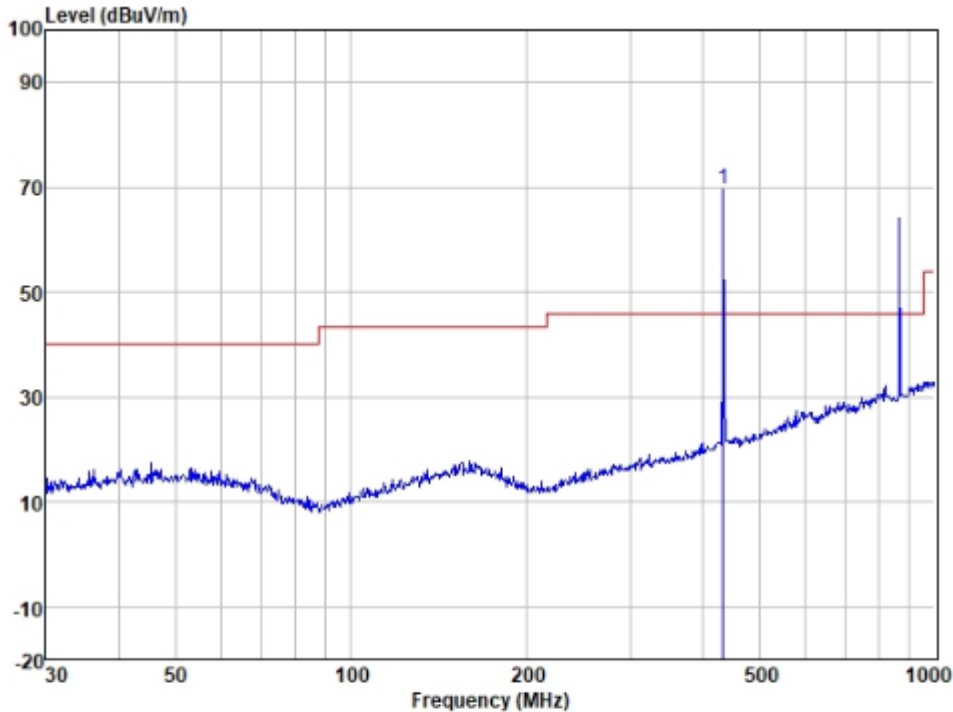






Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
433.92	77.02	16.60	4.09	28.18	69.53	80.83	-11.3	QP

Test Mode: 00; Polarity: Horizontal



Site : SGS
Job :
Model :
Power :
Test Mode :

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Pol/Phase
	MHz	dBuV	dB/m	dB	dB	dBuV/m	
1	434.065	77.02	16.60	4.09	28.18	69.53	HORIZONTAL

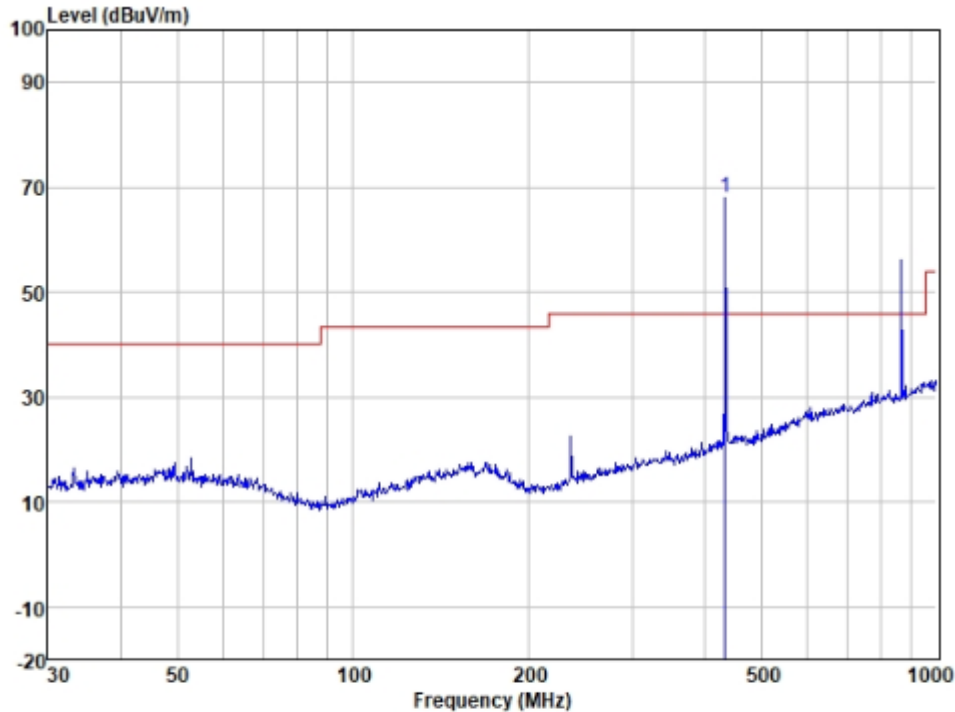


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Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
433.92	75.56	16.60	4.09	28.18	68.07	80.83	-12.76	QP

Test Mode: 00; Polarity: Vertical



Site : SGS
Job :
Model :
Power :
Test Mode :

Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Measured Level	Pol/Phase
MHz	dBuV	dB/m	dB	dB	dBuV/m	
1 434.065	75.56	16.60	4.09	28.18	68.07	VERTICAL

7.5 Radiated Emissions above 1GHz

Test Requirement 47 CFR Part 15C Section 15.231(b) and 15.209

Test Method: ANSI C63.10 (2013) Section 6.6

Limit:

For Restricted bands

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
Above 960	500	3
Remark: Radiated emission limits in this band is 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.		

For Other bands

Fundamental Frequency MHz	Field Strength of Fundamental (μV/m @ 3 m)	Field Strength of Harmonics and Spurious Emissions (μV/m @ 3 m)
40.66 to 40.70	2,250	225
70 to 130	1,250	125
130 to 174	**1,250 to 3,750	**125 to 375
174 to 260	3,750	375
260 to 470	**3,750 to 12,500	**375 to 1,250
Above 470	12,500	1,250
Detector:	Peak for pre-scan QP for 30MHz to1000 MHz:120 kHz resolution bandwidth Peak for Above 1 GHz: 1 MHz resolution bandwidth	

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F) - 6136.3636;

for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F) - 7083.3333.

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

The fundamental frequency of the EUT is 433.92 MHz

The limit for average or QP field strength dBuV/m for the fundamental emission= 80.83 dBuV/m

No fundamental is allowed in the restricted bands.

The limit for average field strength dBuV/m for the spurious emission=60.83 dBuV/m. Spurious in the restricted bands must be less than 60.83 dBuV/m or 15.209, whichever limit permits a higher field strength.

7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 23.3 °C Humidity: 58.8 % RH Atmospheric Pressure: 1005 mbar

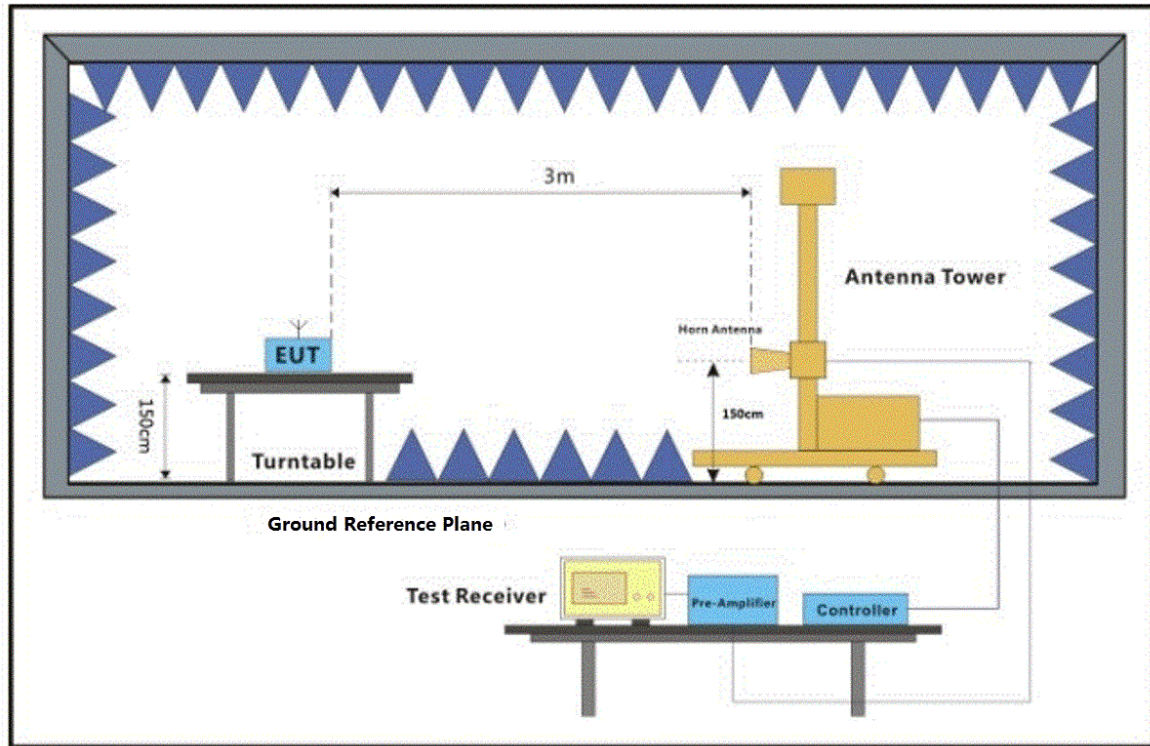


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7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	Tx mode

7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

- a. For above 1GHz, 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.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. 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.
- g. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows: Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor
- 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.

$$20\log(\text{Duty cycle}) = 20\log(0.33) = -9.6\text{dB}$$

Here:

$$\text{Duty cycle} = \text{Ton}_{\text{cum}} / \text{Ton} + \text{off}$$

$$\text{Ton}_{\text{cum}} = 1.1 \times 10 + 0.4 \times 15 = 17(\text{ms})$$

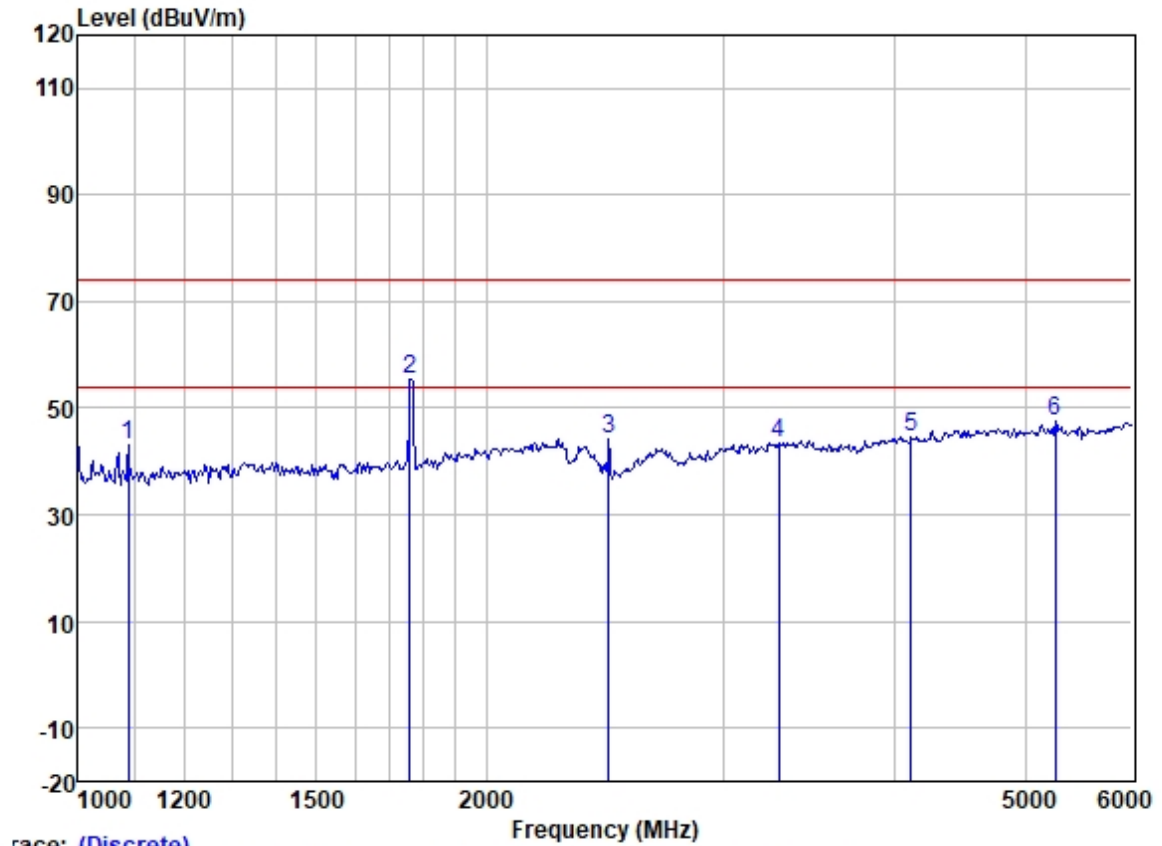
$$\text{Ton} + \text{off} = 51.6(\text{ms})$$

$$\text{Duty cycle} = 17 / 51.6 = 0.33$$

Please refer to below plots for more details.



Test Mode: 00; Polarity: Horizontal



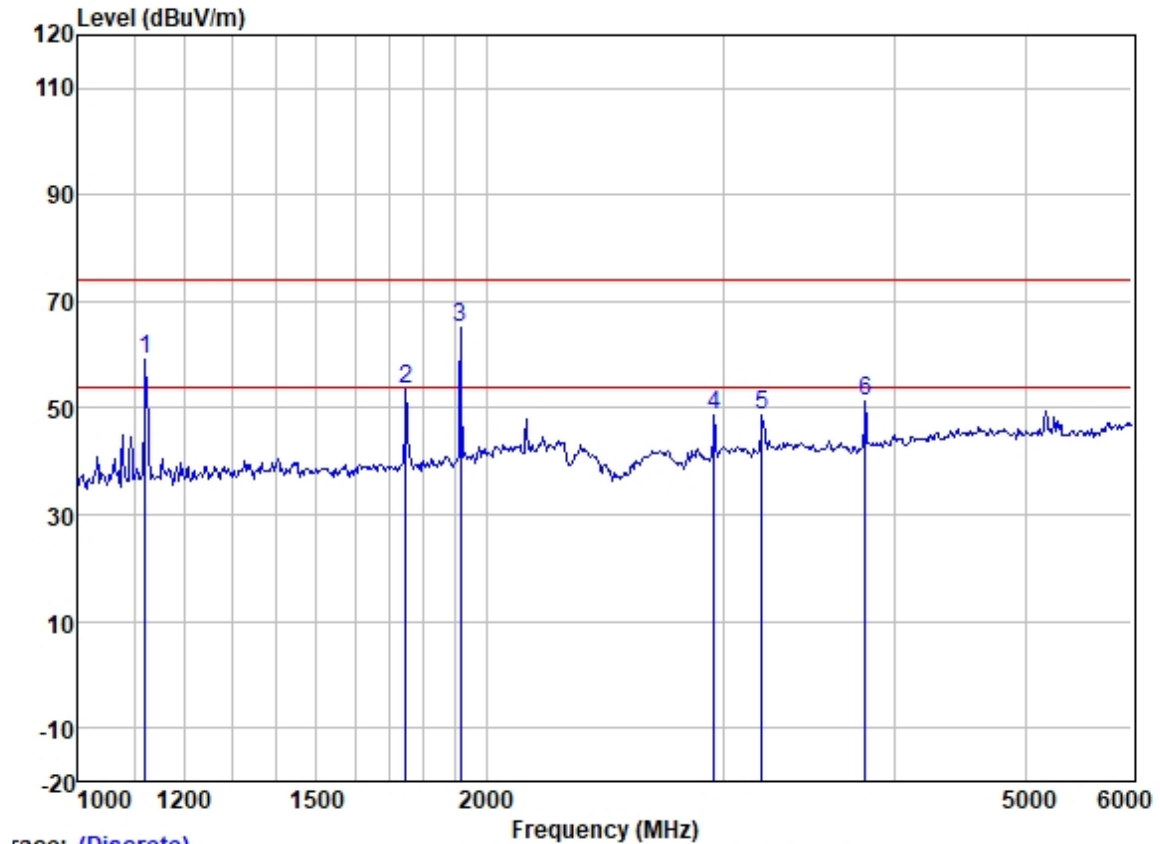
Trace: (Discrete)

		ReadAntenna		Cable	Preamp		Limit	Over		
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1089.811	53.76	24.35	2.47	37.67	42.91	74.00	-31.09	HORIZONTAL	Peak
2	1758.400	63.37	25.87	3.56	37.29	55.51	74.00	-18.49	HORIZONTAL	Peak
3	2462.692	50.31	27.45	3.64	37.11	44.29	74.00	-29.71	HORIZONTAL	Peak
4	3292.082	47.20	28.74	4.28	36.75	43.47	74.00	-30.53	HORIZONTAL	Peak
5	4118.504	45.85	29.98	5.24	36.60	44.47	74.00	-29.53	HORIZONTAL	Peak
6	5264.368	46.89	31.75	5.42	36.67	47.39	74.00	-26.61	HORIZONTAL	Peak

1GHz~5 GHz Field Strength of Unwanted Emissions.Quasi-Peak Measurement
Horizontal.

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
1089.811	53.76	24.35	2.47	37.67	42.91	74.00	-31.09	Peak
1089.811	N/A	N/A	N/A	N/A	33.31	54.00	-20.69	Average
1758.400	63.37	25.87	3.56	37.29	55.51	80.83	-25.32	Peak
1758.400	N/A	N/A	N/A	N/A	45.91	60.83	-14.92	Average
2462.692	50.31	27.45	3.64	37.11	44.29	80.83	-36.54	Peak
2462.692	N/A	N/A	N/A	N/A	34.69	60.83	-26.14	Average
3292.082	47.20	28.74	4.28	36.75	43.47	80.83	-37.36	Peak
3292.082	N/A	N/A	N/A	N/A	33.87	60.83	-26.96	Average
4118.504	45.85	29.98	5.24	36.60	44.47	74.00	-29.53	Peak
4118.504	N/A	N/A	N/A	N/A	34.87	54.00	-19.13	Average
5264.368	46.89	31.75	5.24	36.67	47.39	80.83	-33.44	Peak
5264.368	N/A	N/A	N/A	N/A	37.79	60.83	-23.04	Average

Test Mode: 00; Polarity: Vertical



		ReadAntenna		Cable	Preamp		Limit	Over		
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1121.506	69.84	24.42	2.52	37.66	59.12	74.00	-14.88	VERTICAL	Peak
2	1745.842	61.64	25.84	3.53	37.30	53.71	74.00	-20.29	VERTICAL	Peak
3	1916.324	71.30	26.05	4.89	37.23	65.01	74.00	-8.99	VERTICAL	Peak
4	2945.949	53.35	28.35	3.81	36.93	48.58	74.00	-25.42	VERTICAL	Peak
5	3199.044	52.53	28.58	4.35	36.79	48.67	74.00	-25.33	VERTICAL	Peak
6	3813.107	53.93	29.55	4.59	36.63	51.44	74.00	-22.56	VERTICAL	Peak

Vertical.

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
1121.506	69.84	24.42	2.52	37.66	59.12	74.00	-14.88	Peak
1121.506	N/A	N/A	N/A	N/A	49.52	54.00	-4.48	Average
1745.842	61.64	25.84	3.53	37.30	53.71	80.83	-27.12	Peak
1745.842	N/A	N/A	N/A	N/A	44.11	60.83	-16.72	Average
1916.324	71.30	26.05	4.89	37.23	65.01	80.83	-15.82	Peak
1916.324	N/A	N/A	N/A	N/A	55.41	60.83	-5.42	Average
2945.949	53.35	28.35	3.81	36.93	48.58	80.83	-32.25	Peak
2945.949	N/A	N/A	N/A	N/A	38.98	60.83	-21.85	Average
3199.044	52.53	28.58	4.35	36.79	48.67	80.83	-32.16	Peak
3199.044	N/A	N/A	N/A	N/A	39.07	60.83	-21.76	Average
3813.107	53.93	29.55	4.59	36.63	51.44	74.00	-22.56	Peak
3813.107	N/A	N/A	N/A	N/A	41.84	54.00	-12.16	Average



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8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR2206000806LM

9 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2206000806LM

- End of the Report -