

TEST REPORT

Application No.: GZCR2205000568AT
Applicant: IPX Corporation
Address of Applicant: 5F, 98, Hannam-daero, Yongsan-gu, Seoul, South Korea
Manufacturer: Bath & Beauty Work, Ltd.
Address of Manufacturer: 277 Broadway Suite 1208 New York, NY 100072033, USA
Factory: Bath & Beauty Work, Ltd.
Address of Factory: 277 Broadway Suite 1208 New York, NY 100072033, USA
Equipment Under Test (EUT):
EUT Name: BT21_22_RETRO_KEYBOARD_SET
Model No.: 8809841687393, 8809841687409, 8809841687416 ♣
♣ 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 15.249
Date of Receipt: 2022-05-09
Date of Test: 2022-05-13 to 2022-05-26
Date of Issue: 2022-06-20

Test Result:	Pass*
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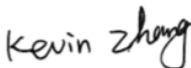

* In the configuration tested, the EUT complied with the standards specified above.

Kobe Jian
EMC Laboratory Manager



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Revision Record			
Version	Report No.	Date	Remark
01	GZCR220500056802	2022-06-20	Original

Authorized for issue by:			
		 <hr/> Kevin Zhang/Project Engineer	
		 <hr/> Ricky Liu/Reviewer	



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 Guangzhou Branch Testing Center EEC Laboratory 中国·广州·经济技术开发区科学城科珠路198号 邮编: 510663 t (86-20) 82155555 f (86-20) 82075058 sgs.china@sgs.com

2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.249	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 15.249	ANSI C63.10 (2013) Section 6.9	47 CFR Part 15, Subpart C 15.215	Pass
Field Strength of the Fundamental Signal (15.249(a))		ANSI C63.10 (2013) Section 6.5&6.6	47 CFR Part 15, Subpart C 15.249(a)	Pass
Restricted Band Around Fundamental Frequency		ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.249(d) & 15.209	Pass
Radiated Emissions Below 1GHz		ANSI C63.10 (2013) Section 6.4&6.5	47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d)	Pass
Radiated Emissions Above 1GHz		ANSI C63.10 (2013) Section 6.6	47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d)	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.: 8809841687393, 8809841687409, 8809841687416.

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 appearance color.

Therefore only one model 8809841687393 was tested in this report.



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 3 V (2*AA size battery)
Test Voltage:	DC 3 V
Operation Frequency:	2408 MHz to 2474 MHz
Modulation Type:	FSK
Number of Channels:	34 as below
Channel Spacing:	2MHz
Antenna Type:	PCB Antenna
Antenna Gain:	-0.61 dBi

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2408MHz	10	2426MHz	19	2444MHz	28	2462MHz
2	2410MHz	11	2428MHz	20	2446MHz	29	2464MHz
3	2412MHz	12	2430MHz	21	2448MHz	30	2466MHz
4	2414MHz	13	2432MHz	22	2450MHz	31	2468MHz
5	2416MHz	14	2434MHz	23	2452MHz	32	2470MHz
6	2418MHz	15	2436MHz	24	2454MHz	33	2472MHz
7	2420MHz	16	2438MHz	25	2456MHz	34	2474MHz
8	2422MHz	17	2440MHz	26	2458MHz		
9	2424MHz	18	2442MHz	27	2460MHz		

Using test software was control EUT work in continuous transmitter and receiver mode. and select test channel as below:

Channel	Frequency
The lowest channel (CH1)	2408MHz
The middle channel (CH17)	2440MHz
The highest channel (CH34)	2474MHz

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
--	--	--	--
The EUT has been tested as an independent unit.			



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4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
20dB Bandwidth	± 3%
Field Strength of the Fundamental Signal (15.249(a))	±5.00dB (30MHz-1GHz; 3m);±4.38dB (30MHz-1GHz; 10m);± 5.12dB (1GHz-6GHz);± 5.38dB (6GHz-18GHz);± 5.61dB (18GHz-40GHz)
Restricted Band Around Fundamental Frequency	±5.00dB (30MHz-1GHz; 3m);±4.38dB (30MHz-1GHz; 10m);± 5.12dB (1GHz-6GHz);± 5.38dB (6GHz-18GHz);± 5.61dB (18GHz-40GHz)
Radiated Emissions Below 1GHz	± 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 dB (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.



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4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

4.8 Duty cycle of the EUT

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percent.

Formula:

$$\text{Duty Cycle} = \text{Ton}/(\text{Ton}+\text{Toff})$$

Measurement Procedure:

1. Set span = Zero
2. RBW=8MHz
3. VBW=8MHz
4. Detector=Peak

Channel (MHz)	Mode	Duty Cycle (%)
2408MHz	FSK	11.9
2442MHz	FSK	11.9
2474MHz	FSK	11.9



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5 Equipment List

20dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
MI CABLE	SGS-EMC	0.8M	EMC2137	2021-11-02	2023-11-01
MXA Signal Analyzer (10Hz-8.4GHz)	Agilent Technologies	N9020A	SEM004-10	2022-03-03	2023-03-02

Field Strength of the Fundamental Signal (15.249(a))					
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
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
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

Restricted Band Around Fundamental Frequency					
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



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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	2022-05-16	2023-05-15
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	SEM003-18	2022-03-03	2025-03-02

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
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-12-17	2022-12-16
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	2021-07-05	2022-07-05



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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 -0.61dBi.

Antenna location: Refer to Internal photos



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7 Radio Spectrum Matter Test Results

7.1 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.215
 Test Method: ANSI C63.10 (2013) Section 6.9

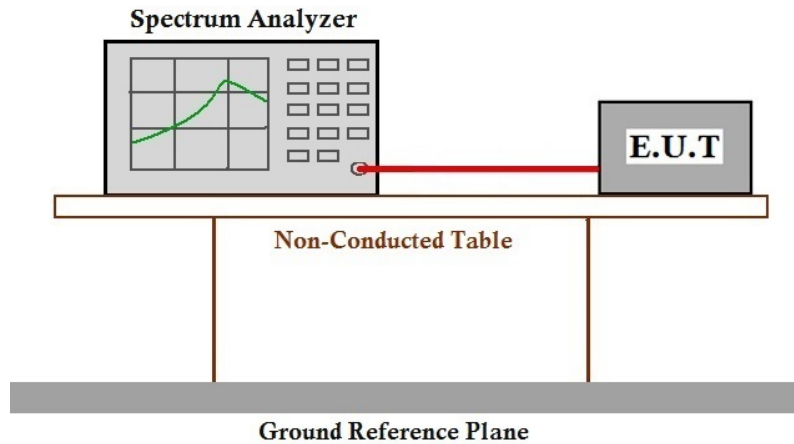
7.1.1 E.U.T. Operation

Operating Environment:
 Temperature: 24.3 °C Humidity: 47.9 % RH Atmospheric Pressure: 1005 mbar

7.1.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 00	TX mode_Keep the EUT in transmitting with modulation mode.

7.1.3 Test Setup Diagram



7.1.4 Measurement Procedure and Data

Test Mode: 00;
2474MHz

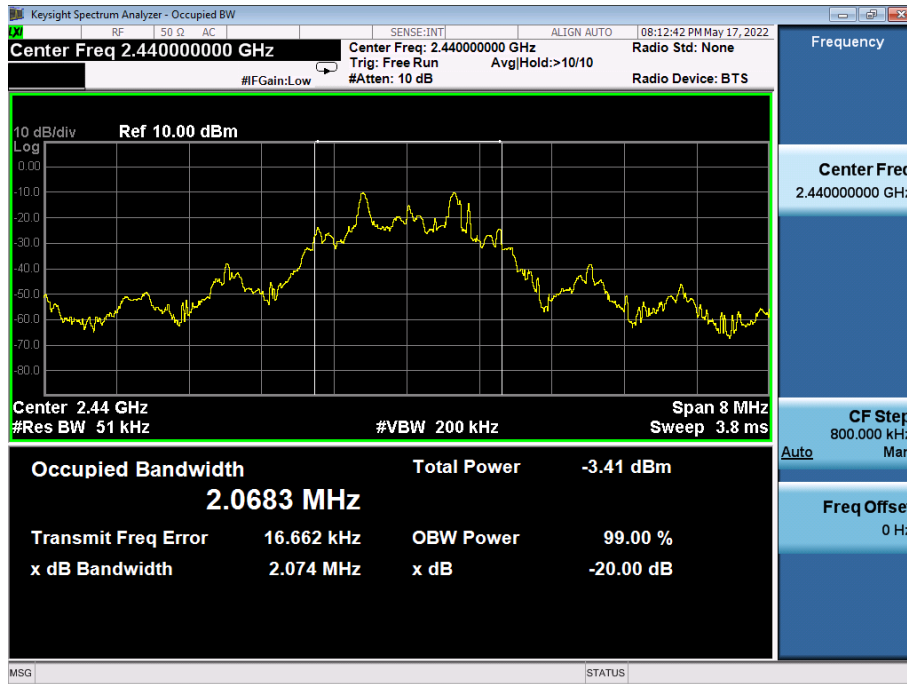


2408MHz



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2440MHz



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7.2 Field Strength of the Fundamental Signal (15.249(a))

Test Requirement 47 CFR Part 15, Subpart C 15.249(a)

Test Method: ANSI C63.10 (2013) Section 6.5&6.6

Limit:

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928	50	500
2400-2483.5	50	500
5725-5875	50	500
24000-24250	250	2500

Remark: The frequencies above 1000MHz 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 fundamental frequency in "902-928MHz", the field strength of fundamental is based on Quasi-Peak.

7.2.1 E.U.T. Operation

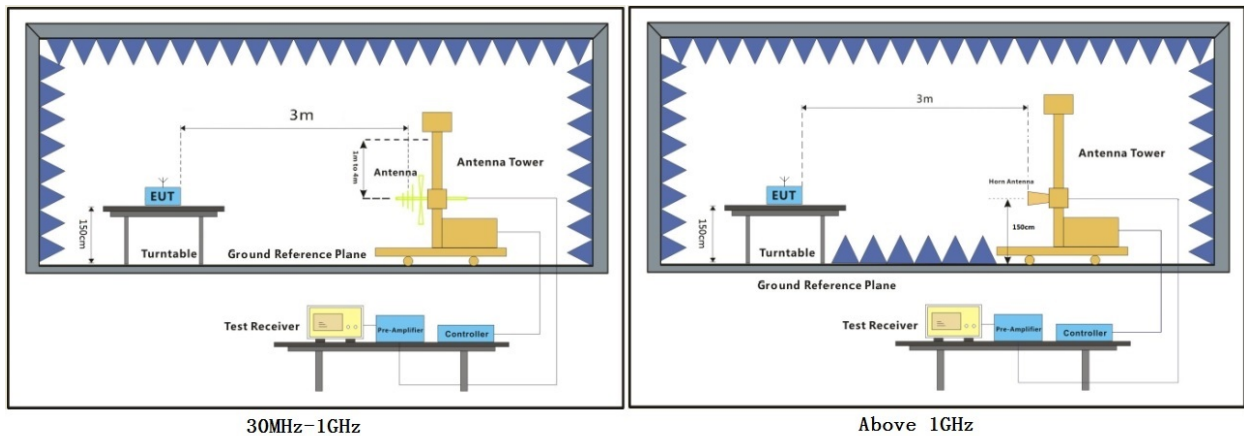
Operating Environment:

Temperature: 24.9 °C Humidity: 69.3 % RH Atmospheric Pressure: 1005 mbar

7.2.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 00	TX mode_Keep the EUT in transmitting with modulation mode.

7.2.3 Test Setup Diagram



7.2.4 Measurement Procedure and Data

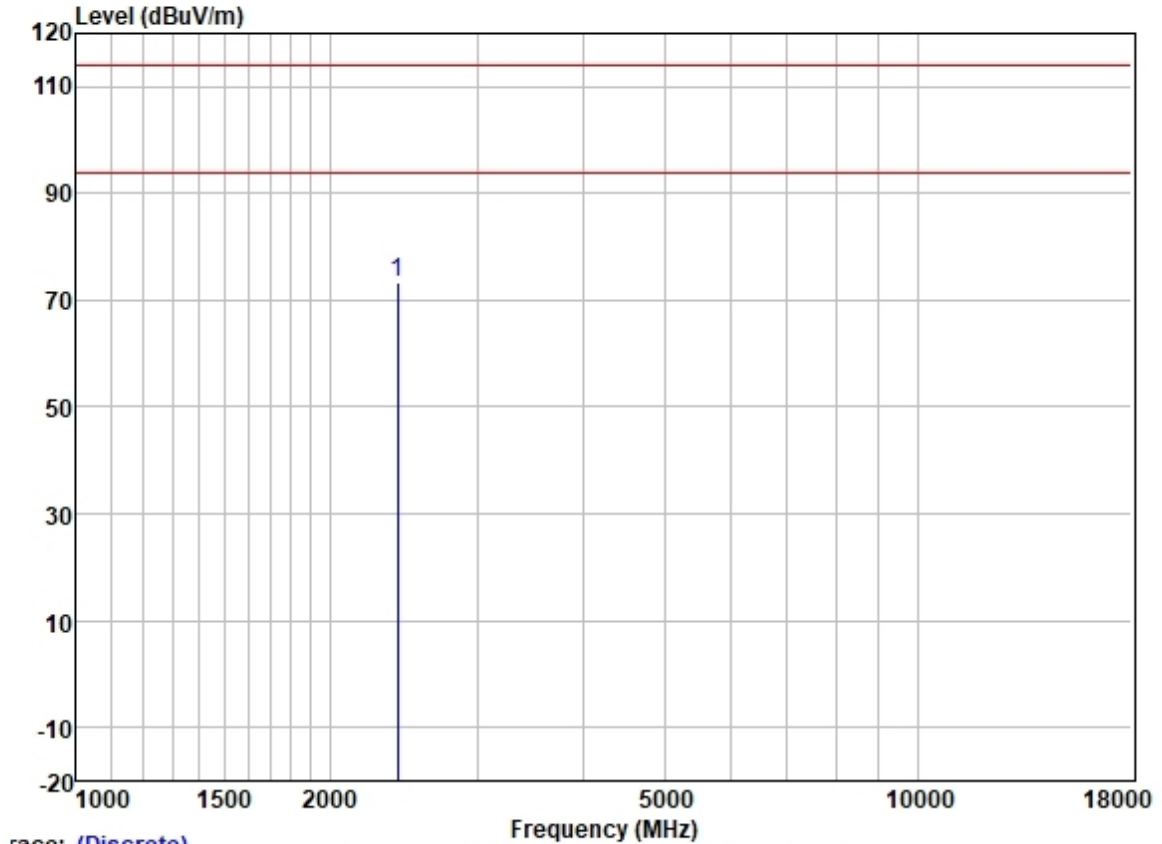
- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 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.
- c. 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.
- 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 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.
- 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. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. 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.
- j. Repeat above procedures until all frequencies measured was complete.

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



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Test Mode: 00; Polarity: Vertical; Modulation:FSK; Channel:Low



Trace: (Discrete)

Trace	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Limit Level	Over Limit	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dBuV/m	dB	
1	2408.753	78.90	27.36	4.07	37.14	73.19	114.00	-40.81	VERTICAL	Peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
2408.753	73.19	None	114.00	-40.81	PK
2408.753	54.70	-18.49	94.00	-39.30	AV

Remark: AV level=PK level+Factor (dB)

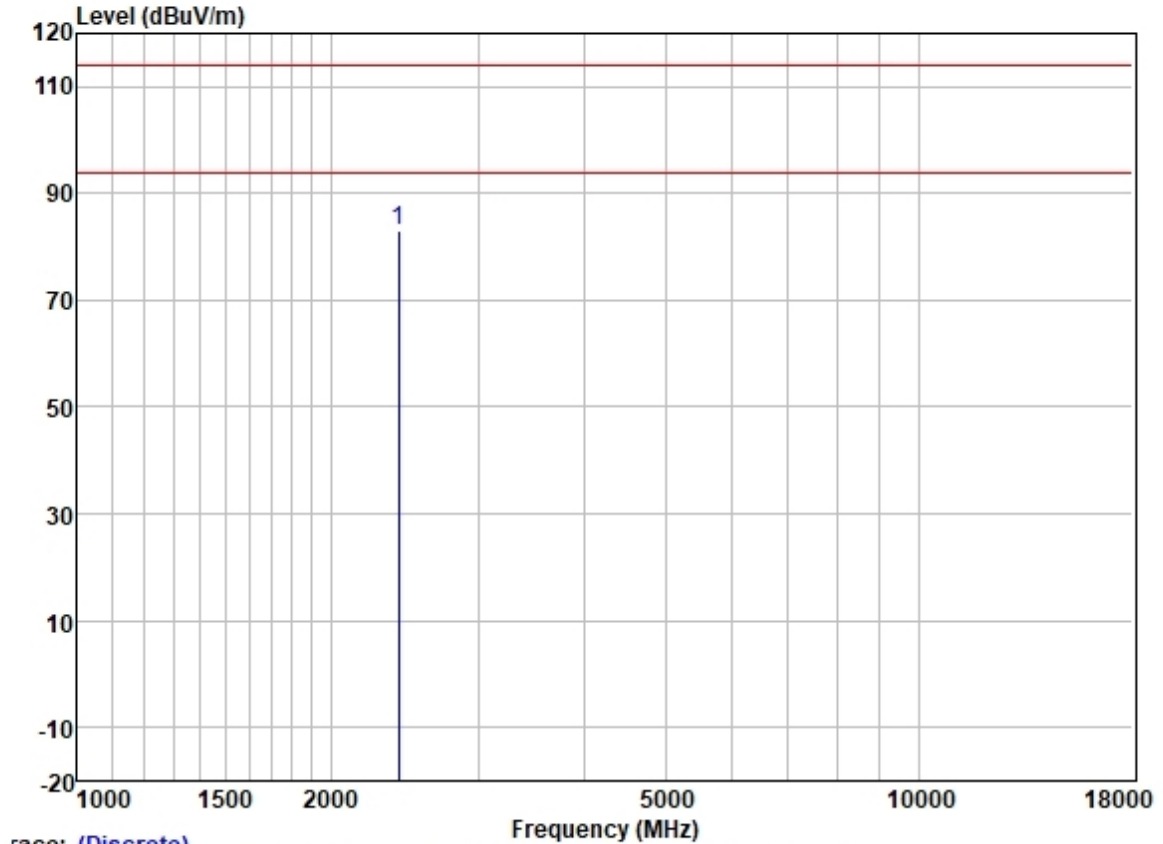
Factor (dB)=20*log(Duty cycle)

Duty cycle= 0.119



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Test Mode: 00; Polarity: Horizontal; Modulation:FSK; Channel:Low



Trace: (Discrete)

	Read	Antenna	Cable	Preamp		Limit	Over		
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2408.753	88.81	27.36	4.07	37.14	83.10	114.00	-30.90	HORIZONTAL Peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
2408.753	83.10	None	114.00	-30.90	PK
2408.753	64.61	-18.49	94.00	-29.39	AV

Remark: AV level=PK level+Factor (dB)

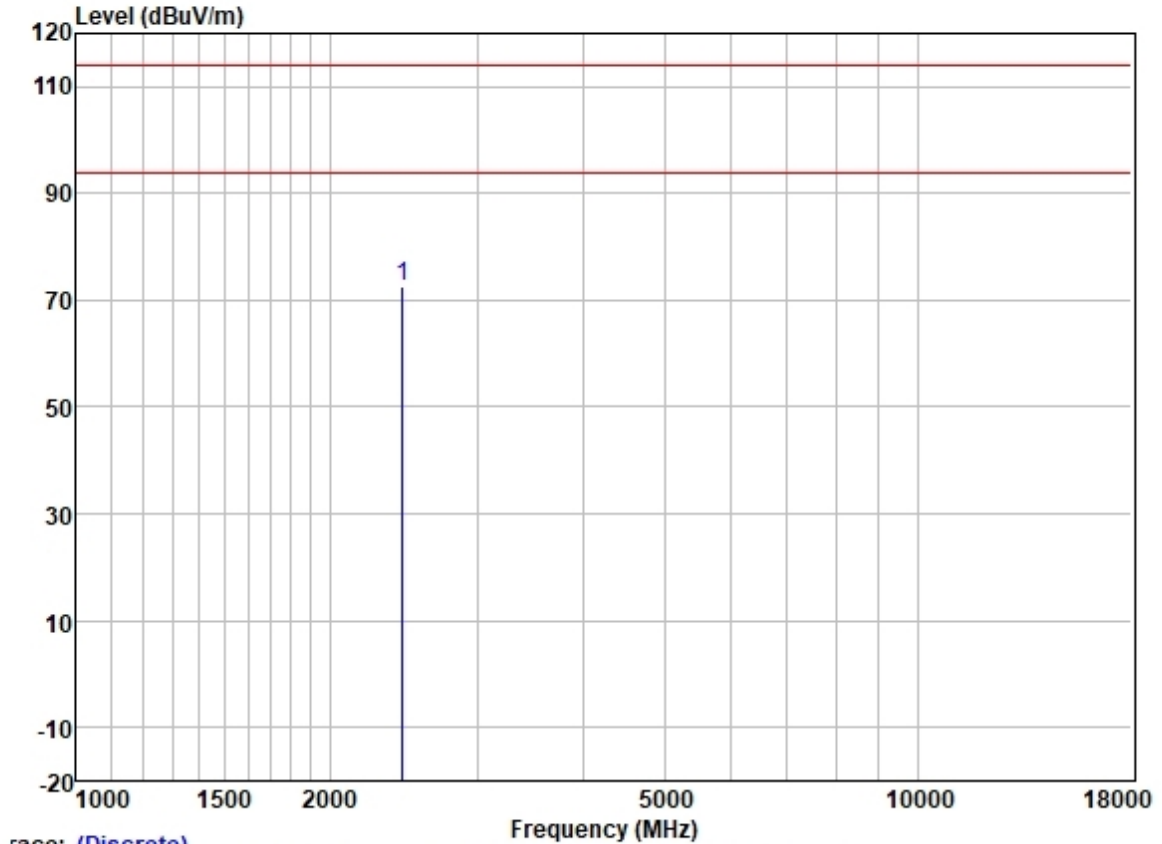
Factor (dB)=20*log(Duty cycle)

Duty cycle= 0.119



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Test Mode: 00; Polarity: Vertical; Modulation:FSK; Channel:middle



Trace: (Discrete)

	Read	Antenna	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	2440.751	78.33	27.42	3.82	37.13	72.44	114.00	-41.56	VERTICAL Peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
2440.751	72.44	None	114.00	-41.56	PK
2440.751	53.95	-18.49	94.00	-40.05	AV

Remark: AV level=PK level+Factor (dB)

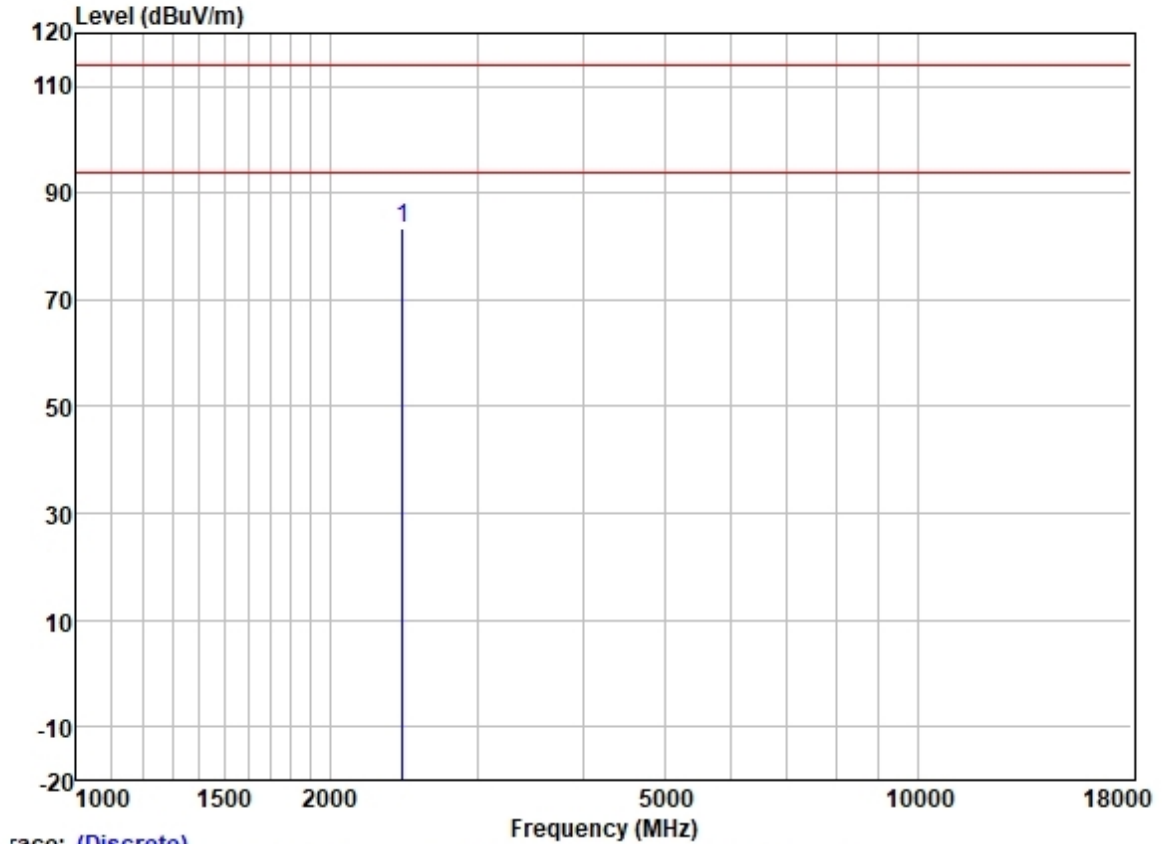
Factor (dB)=20*log(Duty cycle)

Duty cycle= 0.119



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Test Mode: 00; Polarity: Horizontal; Modulation:FSK; Channel:middle



Trace: (Discrete)

	Read Freq	Antenna Level	Cable Factor	Preamp Loss	Limit Level	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	2440.751	89.40	27.42	3.82	37.13	83.51	114.00	-30.49 HORIZONTAL Peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
2440.751	83.51	None	114.00	-30.49	PK
2440.751	65.02	-18.49	94.00	-28.98	AV

Remark: AV level=PK level+Factor (dB)

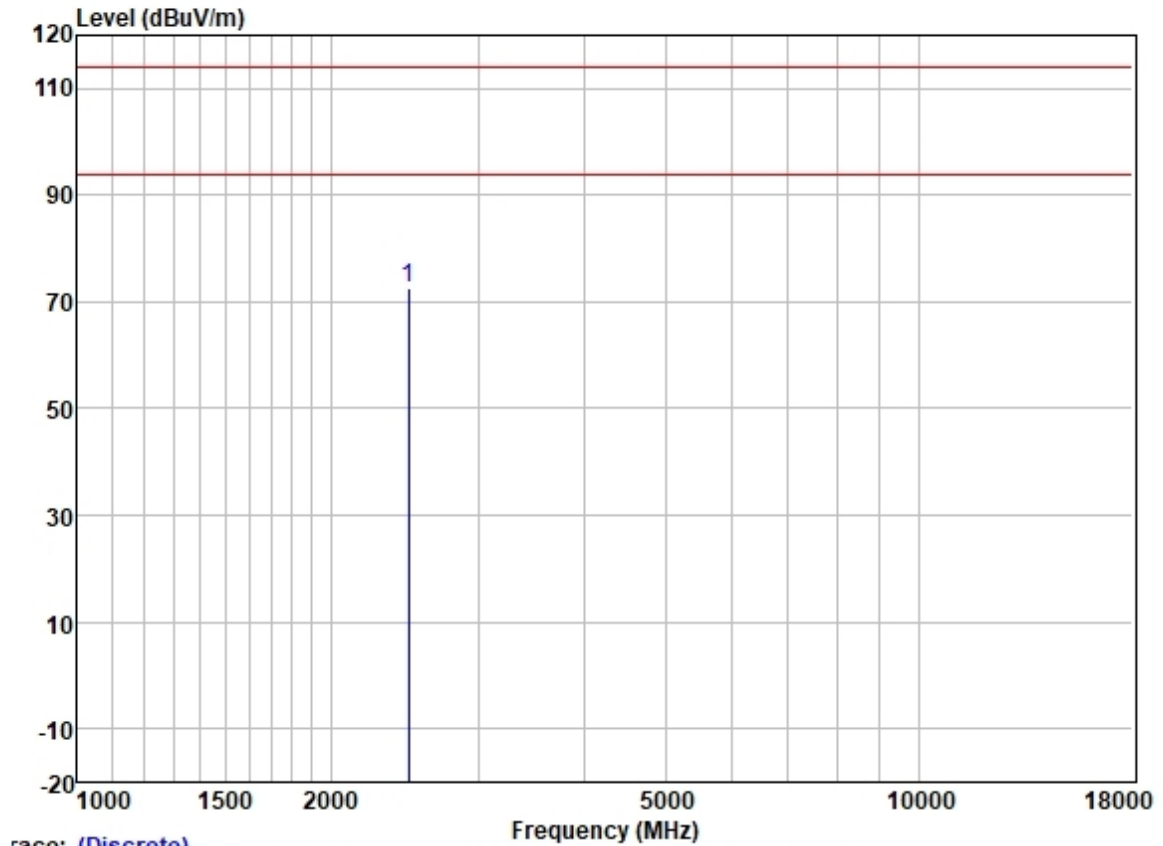
Factor (dB)=20*log(Duty cycle)

Duty cycle= 0.119



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Test Mode: 00; Polarity: Vertical; Modulation:FSK; Channel:High



Trace: (Discrete)

Trace	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Limit Level	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2474.157	78.62	27.46	3.57	37.13	72.52	114.00	-41.48	VERTICAL Peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
2474.157	72.52	None	114.00	-41.48	PK
2474.157	54.03	-18.49	94.00	-39.97	AV

Remark: AV level=PK level+Factor (dB)

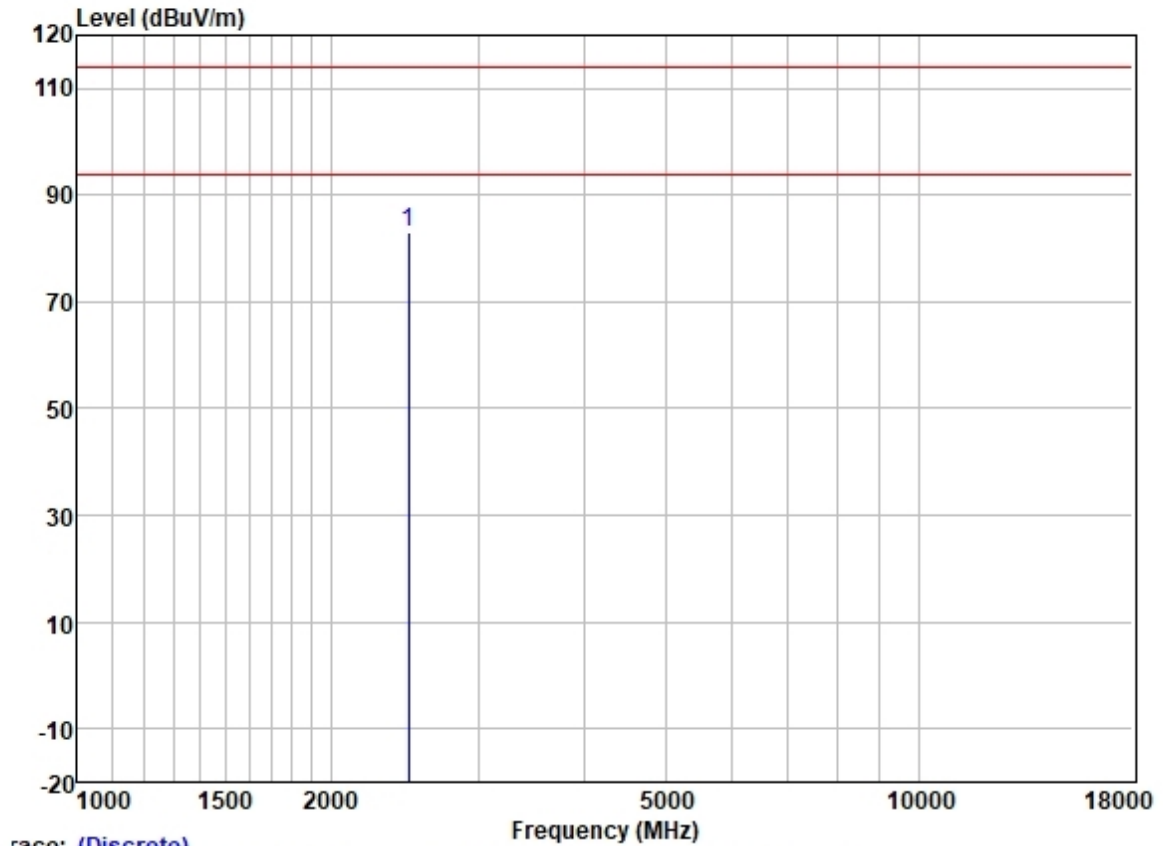
Factor (dB)=20*log(Duty cycle)

Duty cycle= 0.119



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Test Mode: 00; Polarity: Horizontal; Modulation:FSK; Channel:High



Trace: (Discrete)

	Read	Antenna	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	2474.157	89.01	27.46	3.57	37.13	82.91	114.00	-31.09	HORIZONTAL Peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
2474.157	82.91	None	114.00	-31.09	PK
2474.157	64.42	-18.49	94.00	-29.58	AV

Remark: AV level=PK level+Factor (dB)

Factor (dB)=20*log(Duty cycle)

Duty cycle= 0.119



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7.3 Restricted Band Around Fundamental Frequency

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.249(d) & 15.209

Test Method: ANSI C63.10 (2013) Section 6.10.5

Limit:

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
Above 1GHz	74.0	Peak Value

Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

7.3.1 E.U.T. Operation

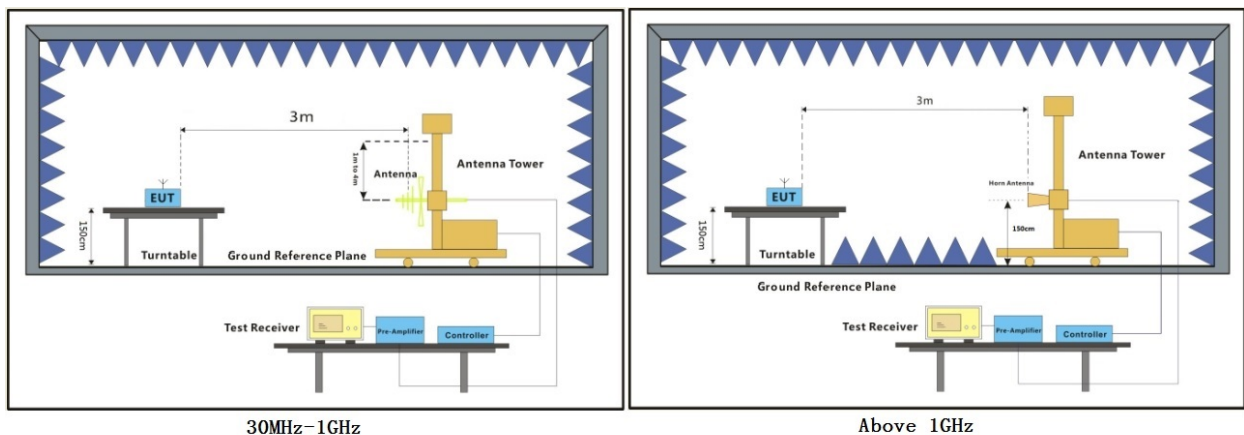
Operating Environment:

Temperature: 24.9 °C Humidity: 69.2 % RH Atmospheric Pressure: 1005 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in transmitting with modulation mode.

7.3.3 Test Setup Diagram



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7.3.4 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For 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.
- c. 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.
- 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 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.
- 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. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. 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.
- j. Repeat above procedures until all frequencies measured was complete.

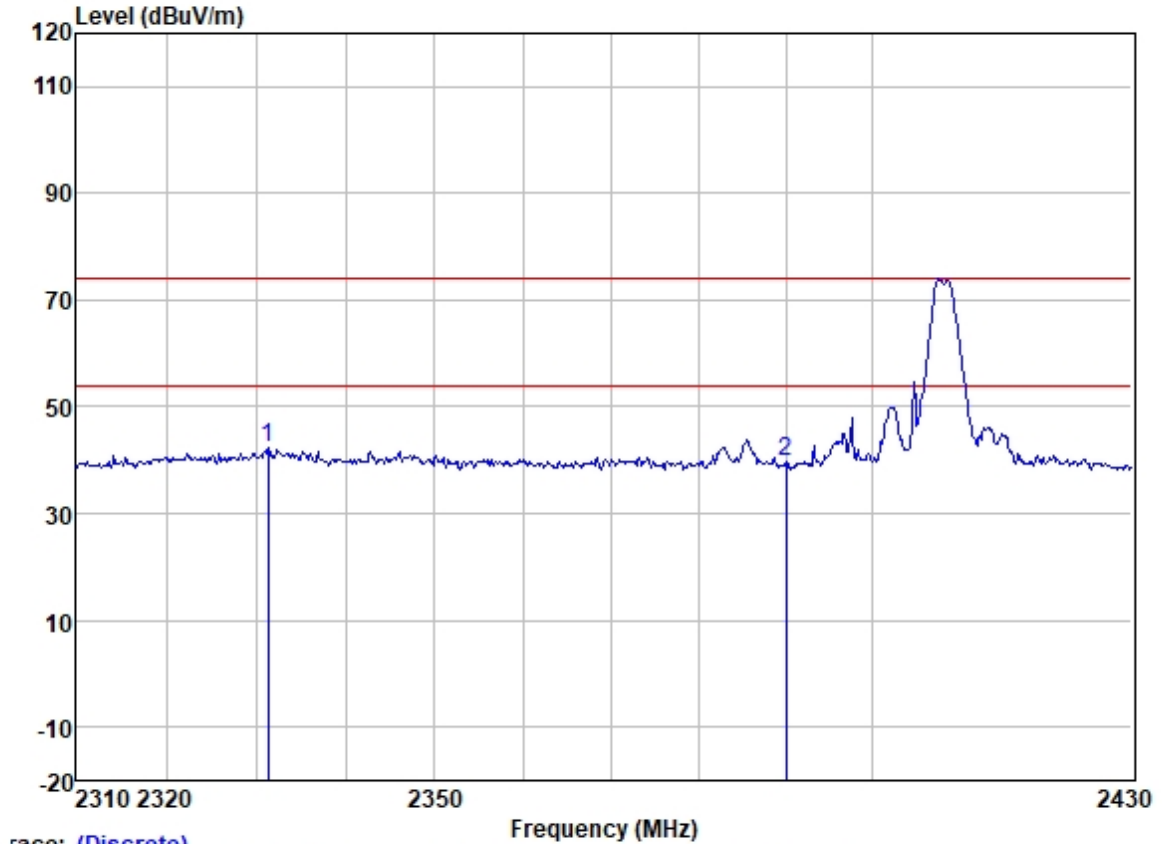
Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor



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Test Mode: 00; Polarity: Vertical; Modulation:FSK; Channel:Low



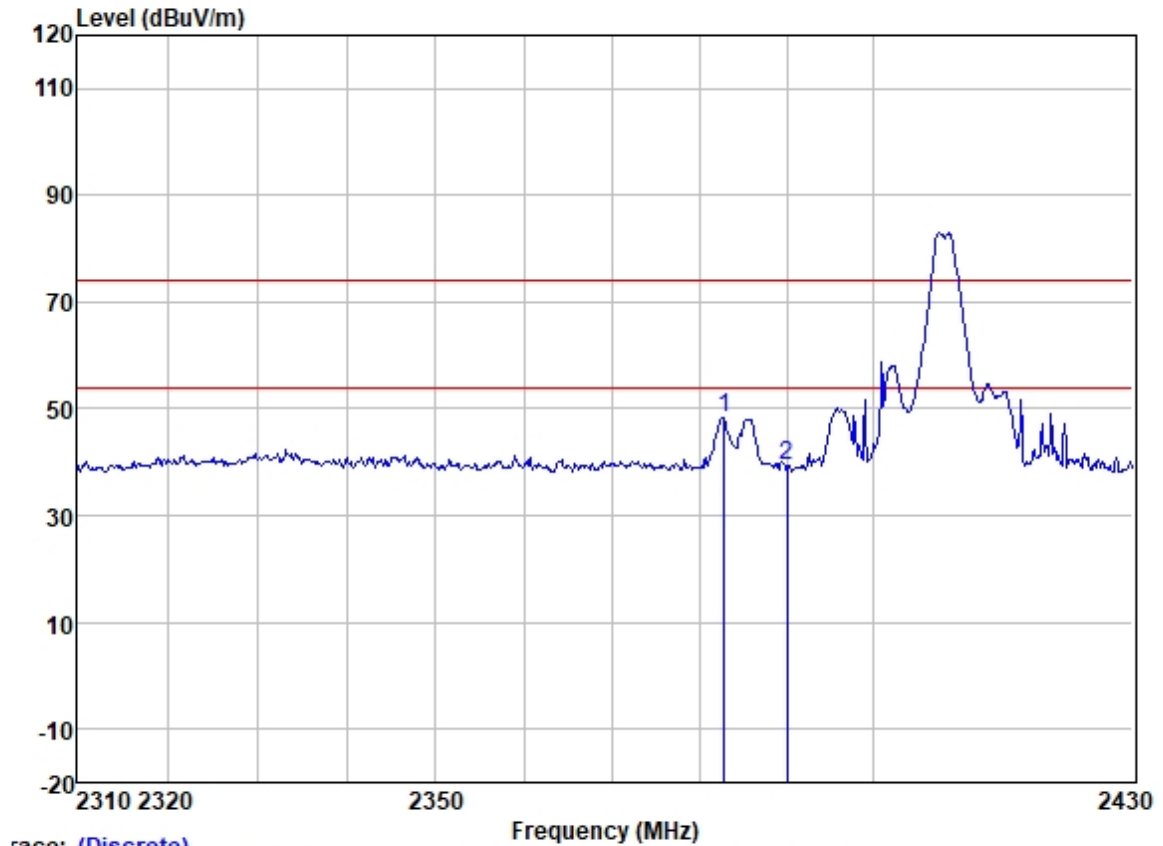
Trace: (Discrete)

	Read	Antenna	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	2331.390	47.42	27.20	4.76	37.15	42.23	74.00	-31.77	VERTICAL	Peak
2	2390.000	45.40	27.33	4.22	37.14	39.81	74.00	-34.19	VERTICAL	Peak



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Test Mode: 00; Polarity: Horizontal; Modulation:FSK; Channel:Low



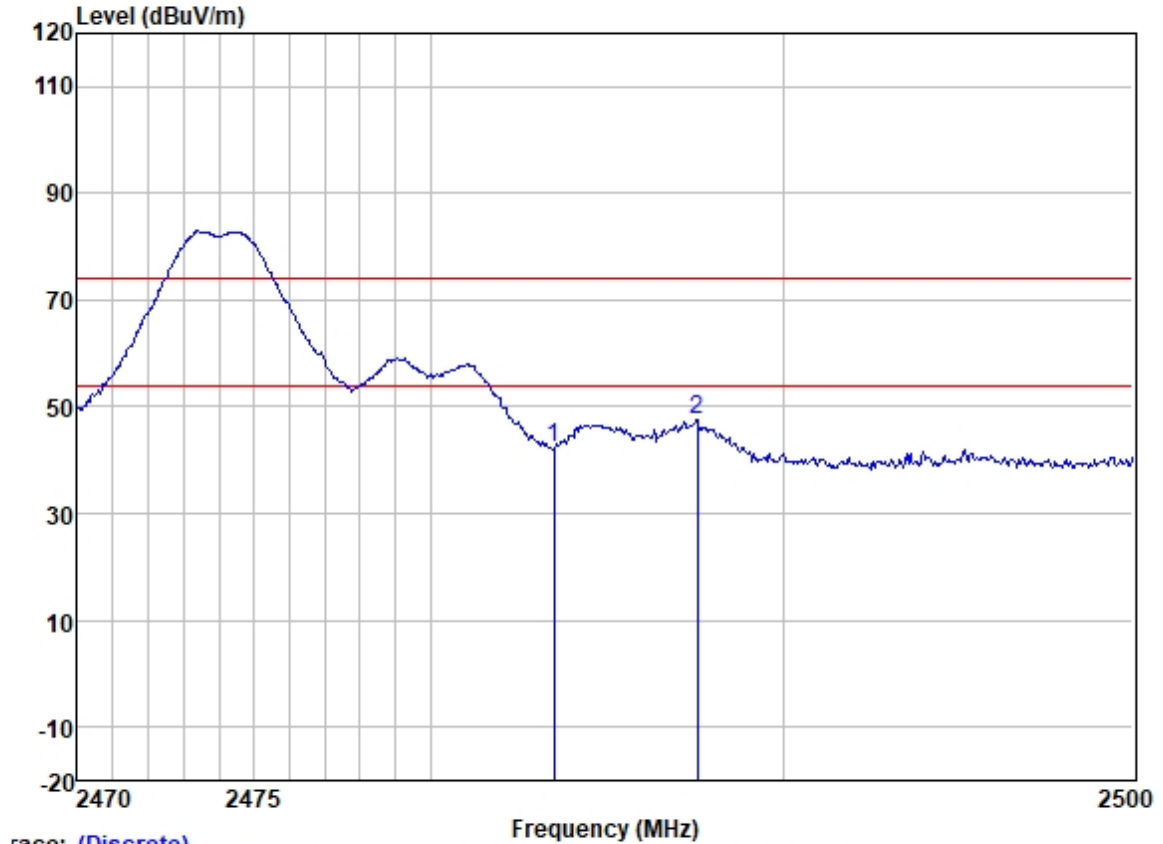
Trace: (Discrete)

	Read	Antenna	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	2382.838	54.03	27.31	4.27	37.14	48.47	74.00	-25.53	HORIZONTAL Peak
2	2390.000	45.06	27.33	4.22	37.14	39.47	74.00	-34.53	HORIZONTAL Peak



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Test Mode: 00; Polarity: Vertical; Modulation:FSK; Channel:High



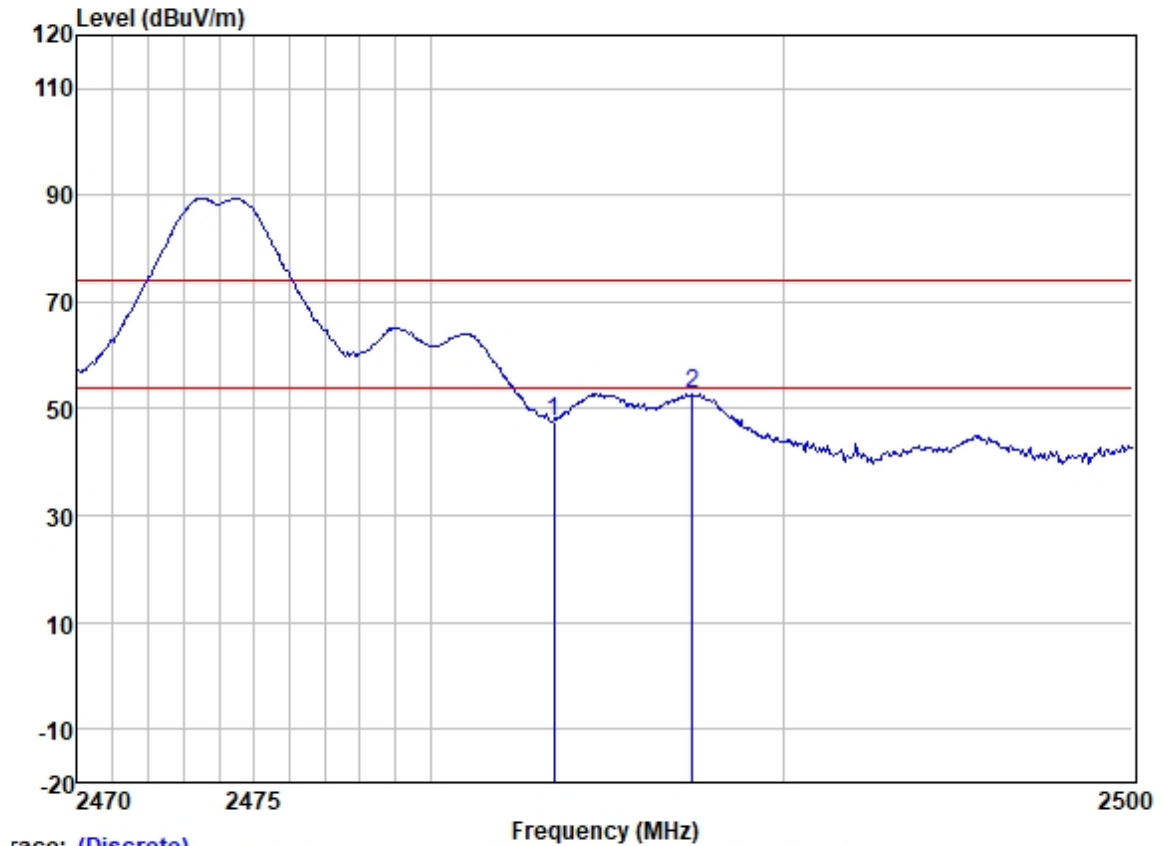
Trace: (Discrete)

	Read Freq	Antenna Level	Cable Loss	Preamp Factor	Limit Level	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	2483.500	48.50	27.48	3.42	37.13	42.27	74.00	-31.73 VERTICAL Peak
2	2487.566	53.95	27.48	3.42	37.12	47.73	74.00	-26.27 VERTICAL Peak



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Test Mode: 00; Polarity: Horizontal; Modulation:FSK; Channel:High



Trace: (Discrete)

	Read	Antenna	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	2483.500	53.83	27.48	3.42	37.13	47.60	74.00	-26.40	HORIZONTAL Peak
2	2487.446	59.00	27.48	3.42	37.13	52.77	74.00	-21.23	HORIZONTAL Peak



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7.4 Radiated Emissions Below 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d)

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

Limit:

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
960-1000	500	3

7.4.1 E.U.T. Operation

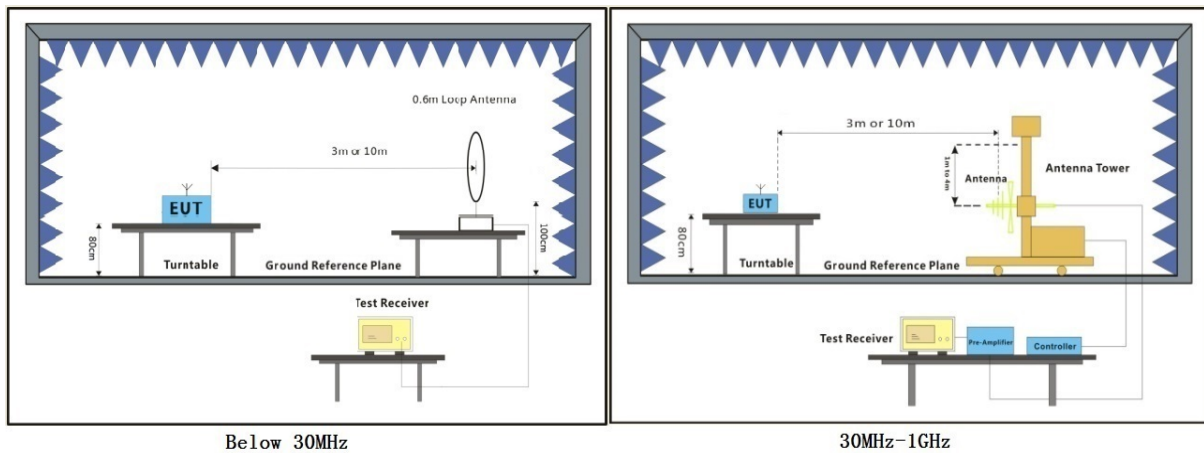
Operating Environment:

Temperature: 20.7 °C Humidity: 50.7 % RH Atmospheric Pressure: 1005 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode_Keep the EUT in transmitting with modulation mode.

7.4.3 Test Setup Diagram



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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. 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 quasi-peak method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- 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
- 2. Scan from 9kHz to 30MHz, 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.
- 3. The disturbance below 1GHz was very low and the harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.

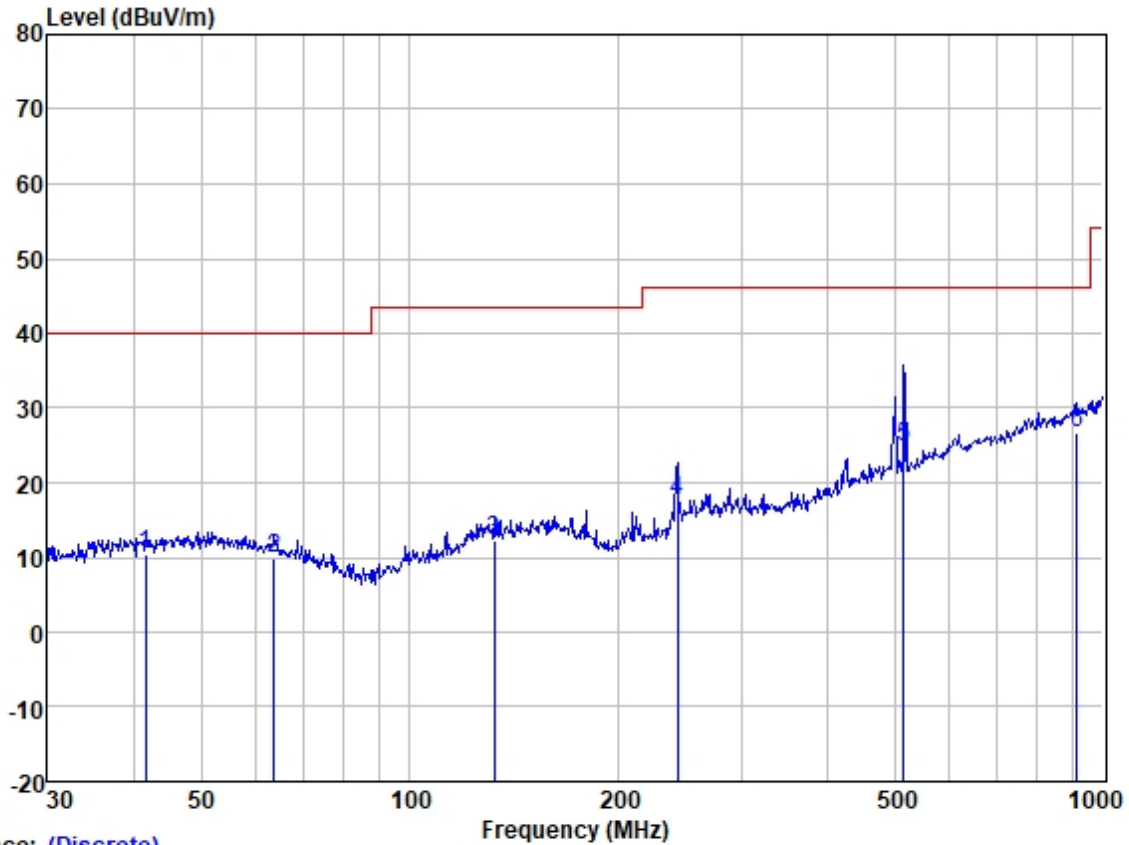


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Test Mode: 00; Polarity: Horizontal; Modulation:FSK; Channel:Low



Trace: (Discrete)

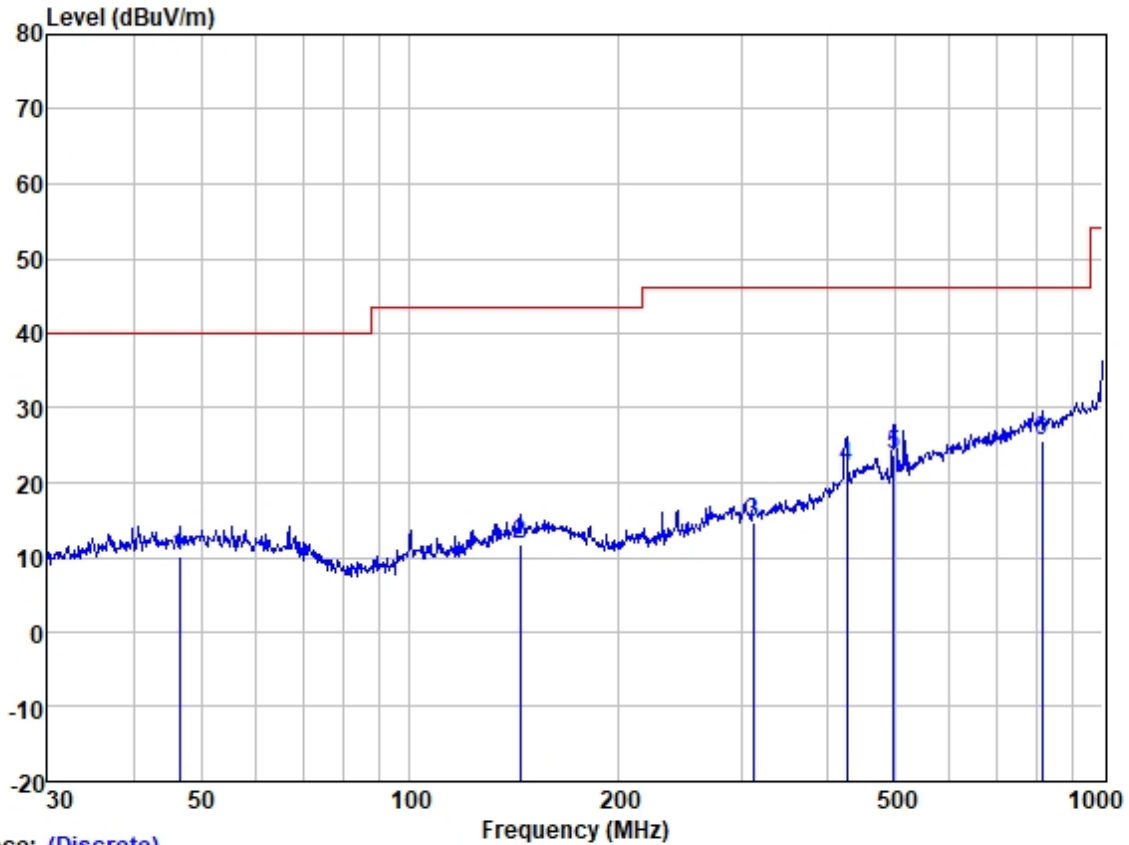
Site : SGS
Job :
Model :
Power :
Test Mode :

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	41.567	23.25	13.21	1.11	27.17	10.40	40.00	-29.60	HORIZONTAL	QP
2	63.759	23.39	12.33	1.32	27.15	9.89	40.00	-30.11	HORIZONTAL	QP
3	132.221	25.17	12.08	1.99	26.98	12.26	43.50	-31.24	HORIZONTAL	QP
4	243.377	30.16	11.33	2.84	26.64	17.69	46.00	-28.31	HORIZONTAL	QP
5	515.437	30.19	18.07	4.51	28.01	24.76	46.00	-21.24	HORIZONTAL	QP
6	916.069	23.73	23.73	6.96	27.82	26.60	46.00	-19.40	HORIZONTAL	QP



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Test Mode: 00; Polarity: Vertical; Modulation:FSK; Channel:Low



Trace: (Discrete)

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

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	46.503	22.77	13.50	1.13	27.17	10.23	40.00	-29.77	VERTICAL	QP
2	144.335	23.31	13.13	2.15	26.87	11.72	43.50	-31.78	VERTICAL	QP
3	312.179	24.40	13.50	3.26	26.61	14.55	46.00	-31.45	VERTICAL	QP
4	426.521	29.26	16.15	4.07	27.46	22.02	46.00	-23.98	VERTICAL	QP
5	497.677	29.70	17.64	4.39	27.97	23.76	46.00	-22.24	VERTICAL	QP
6	815.968	24.93	22.53	6.23	28.01	25.68	46.00	-20.32	VERTICAL	QP



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7.5 Radiated Emissions Above 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d)

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

Limit:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
Above 1000	500	3

7.5.1 E.U.T. Operation

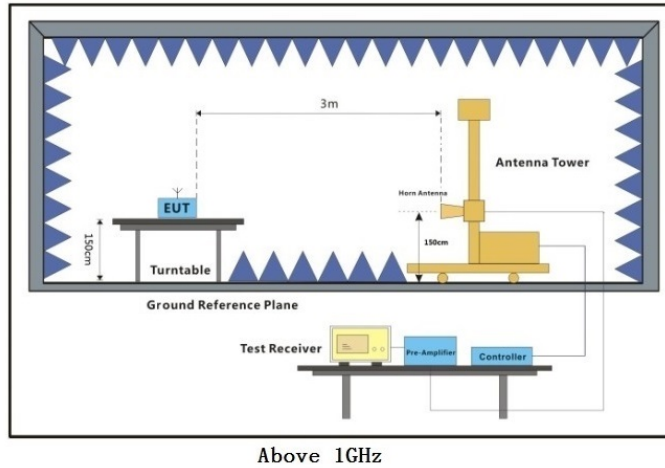
Operating Environment:

Temperature: 21.4 °C Humidity: 56.2 % RH Atmospheric Pressure: 1005 mbar

7.5.2 Test Mode Description

Pre-scan / Mode	Code	Description
Final test	00	TX mode_Keep the EUT in transmitting with modulation mode.

7.5.3 Test Setup Diagram



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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 (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 or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- 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
- 2. Scan from 18GHz to 40GHz, the disturbance above 18GHz 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.
- 3. As shown in this section, 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.
- 4. The disturbance above 18GHz were very low and the harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.

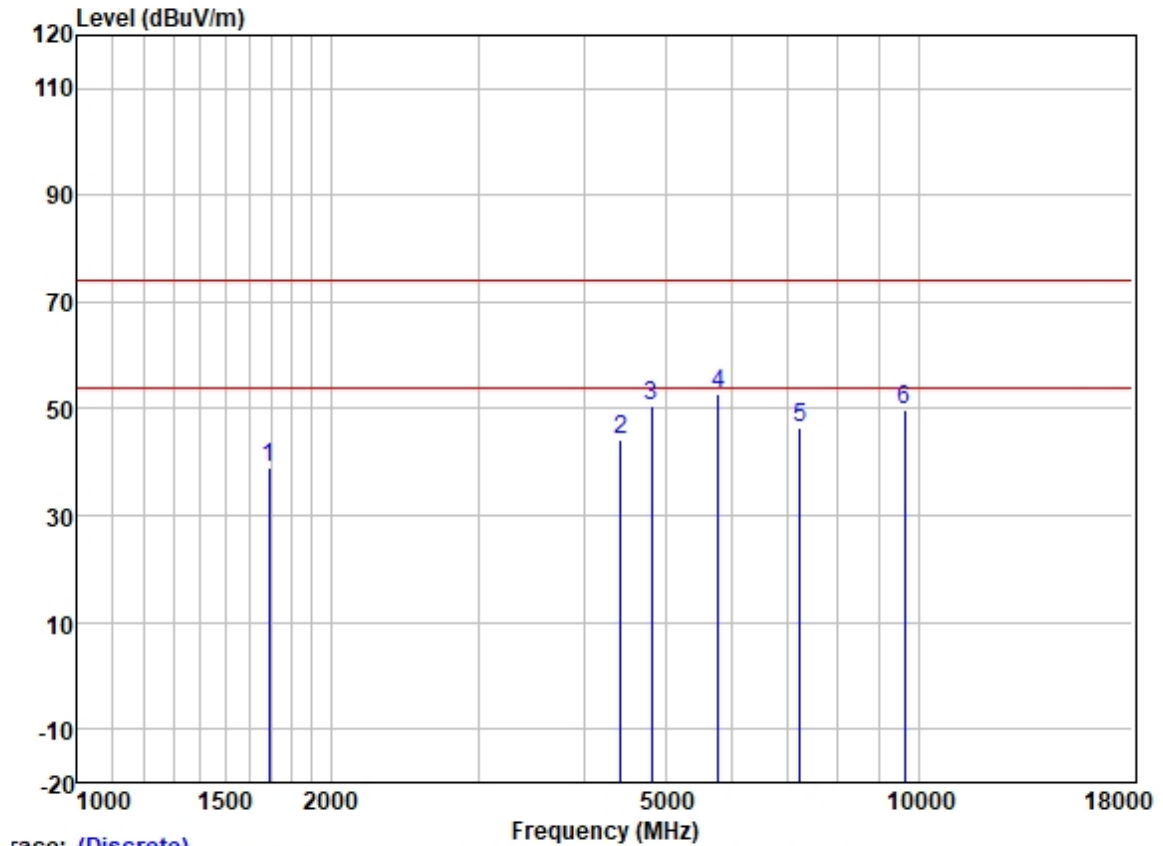


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Test Mode: 00; Polarity: Vertical; Modulation:FSK; Channel:Low



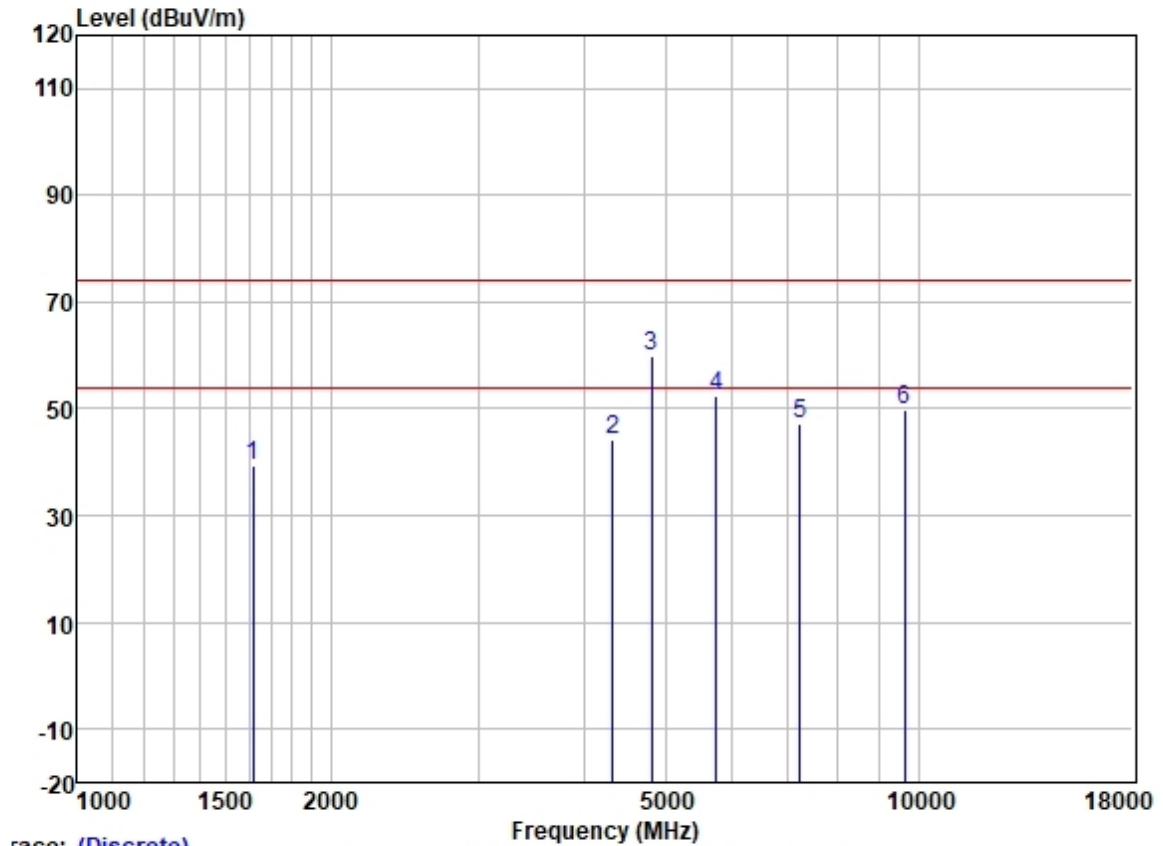
Trace: (Discrete)

	Read	Antenna	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	1692.231	47.42	25.70	3.30	37.46	38.96	74.00	-35.04	VERTICAL peak
2	4430.628	44.90	30.72	5.36	36.62	44.36	74.00	-29.64	VERTICAL peak
3	4816.000	50.30	31.45	5.46	36.50	50.71	74.00	-23.29	VERTICAL peak
4	5780.300	50.96	32.16	5.68	36.14	52.66	74.00	-21.34	VERTICAL peak
5	7224.000	41.37	35.62	6.35	36.94	46.40	74.00	-27.60	VERTICAL peak
6	9632.000	40.55	38.40	7.89	36.86	49.98	74.00	-24.02	VERTICAL peak



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Test Mode: 00; Polarity: Horizontal; Modulation:FSK; Channel:Low



Trace: (Discrete)

	Read Freq	Antenna Level	Cable Factor	Preamp Loss	Preamp Factor	Limit Level	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dB		
1	1615.754	48.14	25.60	3.04	37.55	39.23	74.00	-34.77	HORIZONTAL peak
2	4329.354	44.85	30.54	5.31	36.64	44.06	74.00	-29.94	HORIZONTAL peak
3	4816.000	59.44	31.45	5.46	36.50	59.85	74.00	-14.15	HORIZONTAL peak
4	5746.982	50.89	32.10	5.70	36.14	52.55	74.00	-21.45	HORIZONTAL peak
5	7224.000	42.02	35.62	6.35	36.94	47.05	74.00	-26.95	HORIZONTAL peak
6	9632.000	40.40	38.40	7.89	36.86	49.83	74.00	-24.17	HORIZONTAL peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
4816.000	59.85	None	74.00	-14.15	PK
4816.000	41.36	-18.49	54.00	-12.64	AV

Remark: AV level=PK level+Factor (dB)

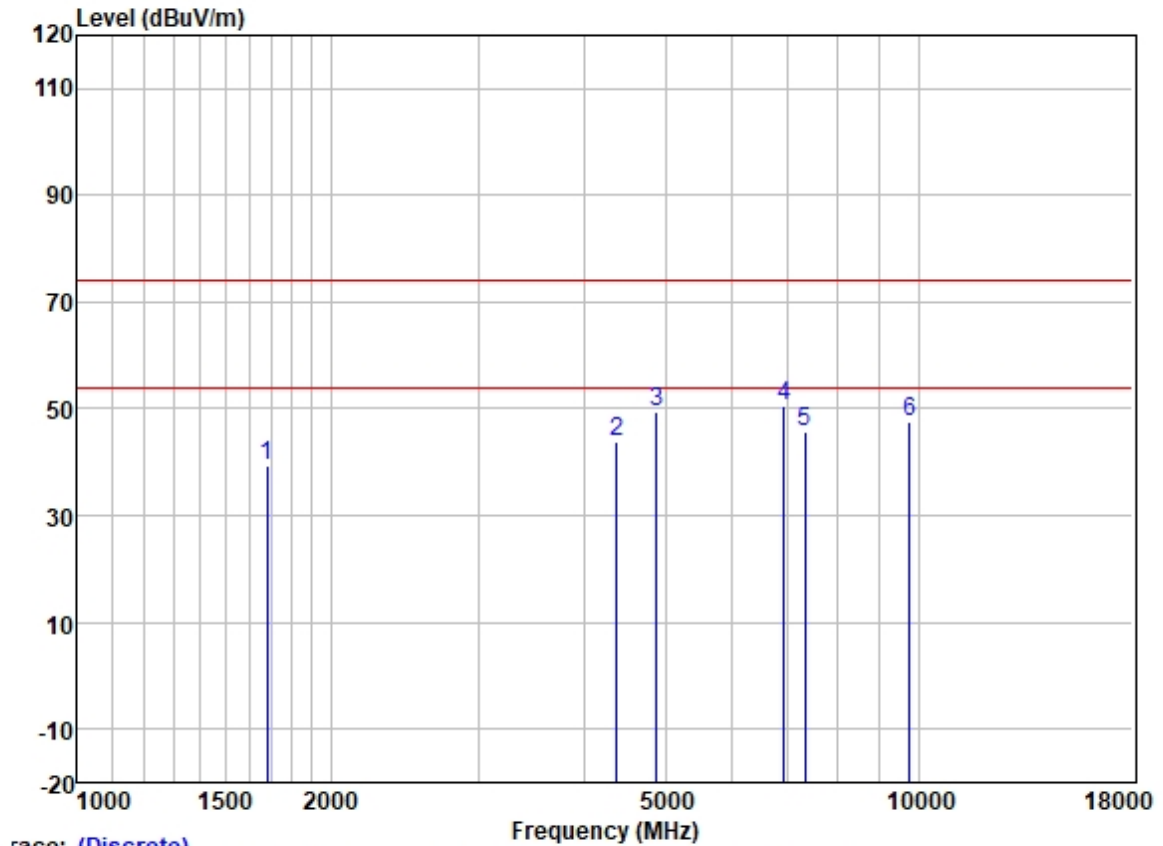
Factor (dB)=20*log(Duty cycle)

Duty cycle= 0.119



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Test Mode: 00; Polarity: Vertical; Modulation:FSK; Channel:middle



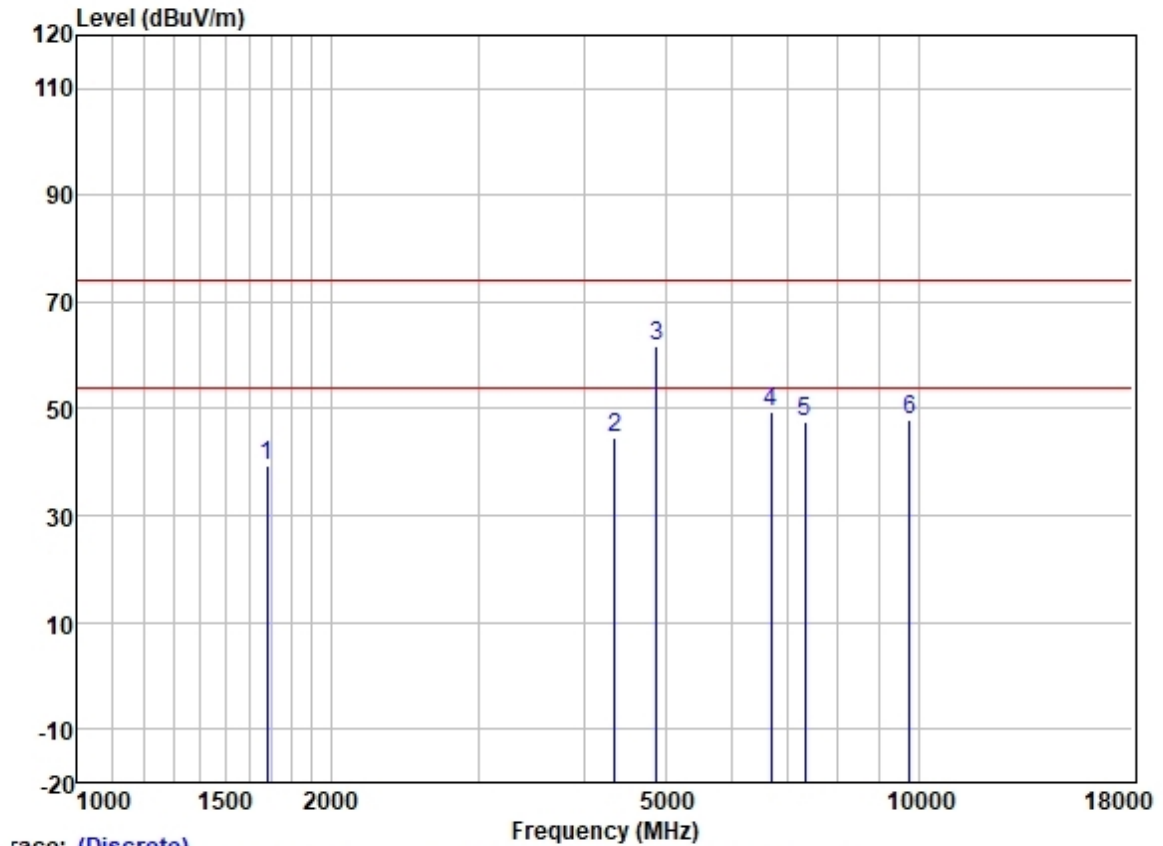
Trace: (Discrete)

	Read	Antenna	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	1682.477	47.91	25.68	3.25	37.48	39.36	74.00	-34.64	VERTICAL peak
2	4379.699	44.56	30.64	5.35	36.63	43.92	74.00	-30.08	VERTICAL peak
3	4880.000	48.91	31.54	5.49	36.48	49.46	74.00	-24.54	VERTICAL peak
4	6914.763	45.76	34.89	6.39	36.60	50.44	74.00	-23.56	VERTICAL peak
5	7320.000	40.35	36.00	6.32	37.01	45.66	74.00	-28.34	VERTICAL peak
6	9760.000	38.49	38.50	7.43	36.83	47.59	74.00	-26.41	VERTICAL peak



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Test Mode: 00; Polarity: Horizontal; Modulation:FSK; Channel:middle



Trace: (Discrete)

	Read Freq	Antenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1682.477	47.79	25.68	3.25	37.48	39.24	74.00	-34.76	HORIZONTAL	peak
2	4354.454	45.34	30.59	5.34	36.64	44.63	74.00	-29.37	HORIZONTAL	peak
3	4880.000	61.03	31.54	5.49	36.48	61.58	74.00	-12.42	HORIZONTAL	peak
4	6679.040	45.36	34.33	6.27	36.39	49.57	74.00	-24.43	HORIZONTAL	peak
5	7320.000	42.14	36.00	6.32	37.01	47.45	74.00	-26.55	HORIZONTAL	peak
6	9760.000	38.88	38.50	7.43	36.83	47.98	74.00	-26.02	HORIZONTAL	peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
4880	61.58	None	74.00	-12.42	PK
4880	43.09	-18.49	54.00	-10.91	AV

Remark: AV level=PK level+Factor (dB)

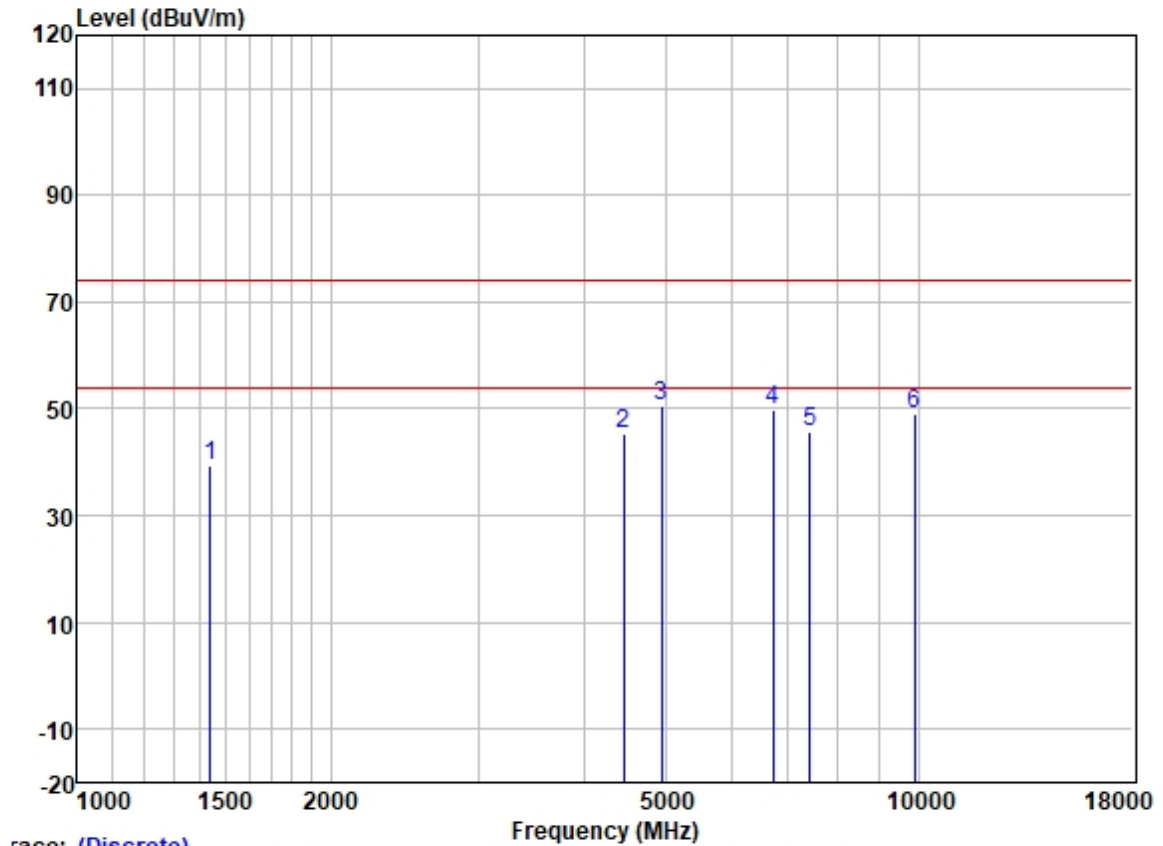
Factor (dB)=20*log(Duty cycle)

Duty cycle= 0.119



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Test Mode: 00; Polarity: Vertical; Modulation:FSK; Channel:High



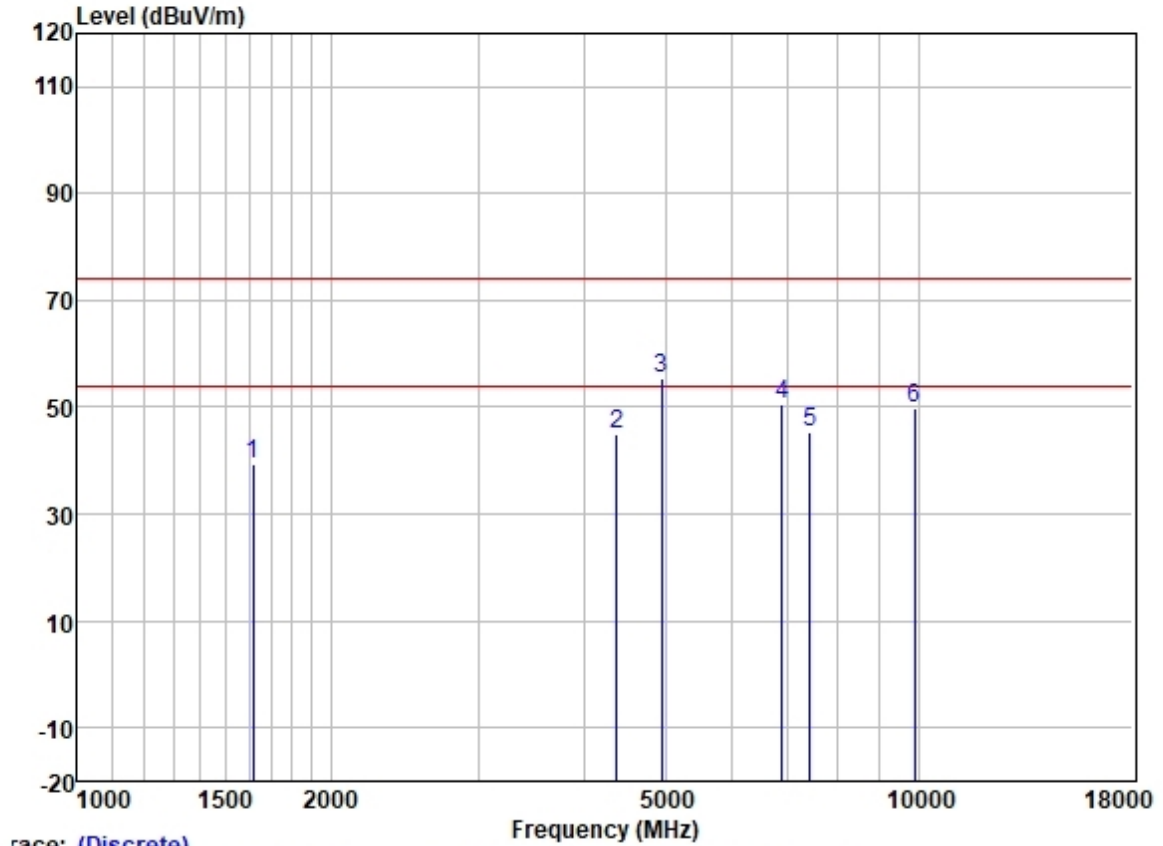
Trace: (Discrete)

	Read	Antenna	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	1439.343	48.95	25.44	2.80	37.84	39.35	74.00	-34.65	VERTICAL peak
2	4456.315	45.79	30.75	5.35	36.62	45.27	74.00	-28.73	VERTICAL peak
3	4948.000	50.02	31.64	5.52	36.43	50.75	74.00	-23.25	VERTICAL peak
4	6717.762	45.44	34.44	6.29	36.42	49.75	74.00	-24.25	VERTICAL peak
5	7422.000	40.38	36.22	6.30	37.07	45.83	74.00	-28.17	VERTICAL peak
6	9896.000	40.31	38.63	6.86	36.81	48.99	74.00	-25.01	VERTICAL peak



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Test Mode: 00; Polarity: Horizontal; Modulation:FSK; Channel:High



Trace: (Discrete)

	Read Freq	Antenna Level	Cable Factor	Preamp Loss	Preamp Factor	Limit Level	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dB		
1	1615.754	48.33	25.60	3.04	37.55	39.42	74.00	-34.58	HORIZONTAL peak
2	4379.699	45.46	30.64	5.35	36.63	44.82	74.00	-29.18	HORIZONTAL peak
3	4948.000	54.57	31.64	5.52	36.43	55.30	74.00	-18.70	HORIZONTAL peak
4	6874.906	46.07	34.82	6.37	36.55	50.71	74.00	-23.29	HORIZONTAL peak
5	7422.000	39.89	36.22	6.30	37.07	45.34	74.00	-28.66	HORIZONTAL peak
6	9896.000	41.13	38.63	6.86	36.81	49.81	74.00	-24.19	HORIZONTAL peak

Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Over limit (dB)	Remark
4948	55.30	None	74.00	-18.70	PK
4948	36.81	-18.49	54.00	-17.19	AV

Remark: AV level=PK level+Factor (dB)

Factor (dB)=20*log(Duty cycle)

Duty cycle= 0.119



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8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR220500056802



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9 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2205000568AT

- End of the Report -



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