



TEST REPORT

Application No.: GZCR2203000324AT
Applicant: Teenage Engineering AB
Address of Applicant: Textilgatan 31 Stockholm 12030 Sweden
Manufacturer: Teenage Engineering AB
Address of Manufacturer: Textilgatan 31 Stockholm 12030 Sweden
Factory: Eolane (China) Co., Ltd.
Address of Factory: 49 Plant, #9 Dongfu Road, Suzhou Industrial Park, 215123 Suzhou, China
Equipment Under Test (EUT):
EUT Name: OP-1 field
Model No.: TE002AS002
Trade Mark: 
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2021-12-09
Date of Test: 2021-12-29 to 2022-03-18
Date of Issue: 2022-04-25

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	Chapter	Date	Modifier	Remark
01		2022-04-25		Original

Authorized for issue by				
				
		Curry Wu/Project Engineer		
				
		Ricky Liu/Reviewer		

2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Conducted Peak Output Power		ANSI C63.10 (2013) Section 11.9.1.3	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Minimum 6dB Bandwidth		ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass
Power Spectrum Density		ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Band Edges Measurement		ANSI C63.10 (2013) Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions		ANSI C63.10 (2013) Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands		ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions (Below 1GHz)		ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions (Above 1GHz)		ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Duty Cycle		ANSI C63.10 (2013) Section 11.6	KDB 558074 D01 v05r02 section 6	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.



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3 Contents

	Page
1 Cover Page	1
2 Test Summary.....	3
3 Contents	4
4 General Information.....	6
4.1 Details of E.U.T.	6
4.2 Description of Support Units.....	6
4.3 Measurement Uncertainty	6
4.4 Test Location	7
4.5 Test Facility.....	7
4.6 Deviation from Standards.....	8
4.7 Abnormalities from Standard Conditions.....	8
5 Equipment List	9
6 Radio Spectrum Technical Requirement.....	12
6.1 Antenna Requirement	12
6.1.1 Test Requirement:	12
6.1.2 Conclusion	12
7 Radio Spectrum Matter Test Results.....	13
7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)	13
7.1.1 E.U.T. Operation	13
7.1.2 Test Mode Description	13
7.1.3 Test Setup Diagram	14
7.1.4 Measurement Procedure and Data.....	14
7.2 Conducted Peak Output Power	17
7.2.1 E.U.T. Operation	17
7.2.2 Test Mode Description	17
7.2.3 Test Setup Diagram	17
7.2.4 Measurement Procedure and Data.....	18
7.3 Minimum 6dB Bandwidth.....	19
7.3.1 E.U.T. Operation	19
7.3.2 Test Mode Description	19
7.3.3 Test Setup Diagram	19
7.3.4 Measurement Procedure and Data.....	19
7.4 Power Spectrum Density	20
7.4.1 E.U.T. Operation	20
7.4.2 Test Mode Description	20
7.4.3 Test Setup Diagram	20
7.4.4 Measurement Procedure and Data.....	20
7.5 Conducted Band Edges Measurement	21
7.5.1 E.U.T. Operation	21
7.5.2 Test Mode Description	21
7.5.3 Test Setup Diagram	21
7.5.4 Measurement Procedure and Data.....	21



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7.6	Conducted Spurious Emissions	23
7.6.1	E.U.T. Operation	23
7.6.2	Test Mode Description	23
7.6.3	Test Setup Diagram	23
7.6.4	Measurement Procedure and Data	23
7.7	Radiated Emissions which fall in the restricted bands	25
7.7.1	E.U.T. Operation	25
7.7.2	Test Mode Description	25
7.7.3	Test Setup Diagram	26
7.7.4	Measurement Procedure and Data	26
7.8	Radiated Spurious Emissions (Below 1GHz)	36
7.8.1	E.U.T. Operation	36
7.8.2	Test Mode Description	36
7.8.3	Test Setup Diagram	37
7.8.4	Measurement Procedure and Data	38
7.9	Radiated Spurious Emissions (Above 1GHz)	41
7.9.1	E.U.T. Operation	41
7.9.2	Test Mode Description	41
7.9.3	Test Setup Diagram	42
7.9.4	Measurement Procedure and Data	43
7.10	Duty Cycle	56
7.10.1	E.U.T. Operation	56
7.10.2	Test Mode Description	56
7.10.3	Test Setup Diagram	56
7.10.4	Measurement Procedure and Data	56
8	Test Setup Photo	57
9	EUT Constructional Details (EUT Photos)	58
10	Appendix	59



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4 General Information

4.1 Details of E.U.T.

Power supply:	Rechargeable battery: DC 3.7V(Charging by Type C cable)
Operation Frequency:	2402MHz to 2480MHz
Data Rate:	1Mbps & 2Mbps
Bluetooth Version:	V5.2 LE
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	ANT1: Dipole Antenna; ANT2: Clip Antenna
Antenna Gain:	Dipole: -10dBi; Clip: -3dBi

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Adapter	Sony	UCH 32	REF. No.SEA05A03A

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	$\pm 2.76\text{dB}$
Conducted Peak Output Power	$\pm 0.75\text{dB}$
Minimum 6dB Bandwidth	$\pm 3\%$
Power Spectrum Density	$\pm 2.84\text{dB}$
Conducted Band Edges Measurement	$\pm 0.75\text{dB}$
Conducted Spurious Emissions	$\pm 0.75\text{dB}$
Radiated Emissions which fall in the restricted bands	$\pm 5.08\text{dB}$ (1GHz-6GHz); $\pm 5.14\text{dB}$ (above 6GHz)
Radiated Spurious Emissions (Below 1GHz)	$\pm 5.06\text{dB}$ (3m); $\pm 4.46\text{dB}$ (10m)
Radiated Spurious Emissions (Above 1GHz)	$\pm 5.08\text{dB}$ (1GHz-6GHz); $\pm 5.14\text{dB}$ (above 6GHz)
Duty Cycle	$\pm 0.37\%$
Remark: The U_{lab} (lab Uncertainty) is less than U_{CISPR} (CISPR 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.	

4.4 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.

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



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5 Equipment List

Conducted Peak Output Power					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Power Meter (U2021XA_Ch2)	Agilent Technologies	U2021XA_Ch2	SEM009-02	2021-05-19	2022-05-18
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Minimum 6dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Power Spectrum Density					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Conducted Band Edges Measurement					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Conducted Spurious Emissions					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A



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Radiated Emissions which fall in the restricted bands					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver(20Hz-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
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-12-17	2022-12-16
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
MXE EMI Receiver(10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2021-11-01	2022-10-31
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-16	2022-09-15
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Horn Antenna(14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2021-08-30	2022-08-29

Radiated Spurious Emissions (Below 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver(10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2021-12-17	2022-12-16
Chamber cable	HangTianXing	N/A	EMC0542	2020-09-09	2022-09-08
Trilog Broadband Antenna(25MHz-1GHz)-Lab	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	SEM003-18	2022-02-22	2023-02-21
Amplifier(9kHz-1.3GHz)	HP	8447F	EMC2065	2021-05-19	2022-05-18
High Pass Filter (915MHz)	FSY MICROWAVE	HM1465-9SS	EMC2079	2021-12-17	2022-12-16
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2019-10-20	2022-10-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
EMI Test Receiver(1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2220	2021-05-26	2022-05-25



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Radiated Spurious Emissions (Above 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver(20Hz-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
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-12-17	2022-12-16
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
MXE EMI Receiver(10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2021-11-01	2022-10-31
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-16	2022-09-15
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Horn Antenna(14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2021-08-30	2022-08-29

Duty Cycle					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	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
DMM	Fluke	73	EMC0007	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 & 15.247(b)(4)

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 shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of 15.211, 15.213, 15.217, 15.219, 15.221, or 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna is integrated on the enclosure and no consideration of replacement. The best case gain of the antenna are -10dBi(Dipole) and -3dBi(Clip).

Antenna location: Refer to internal photo.



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7 Radio Spectrum Matter Test Results

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

Test Requirement 47 CFR Part 15, Subpart C 15.207

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

Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency.		
Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz		

7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 24.2 °C

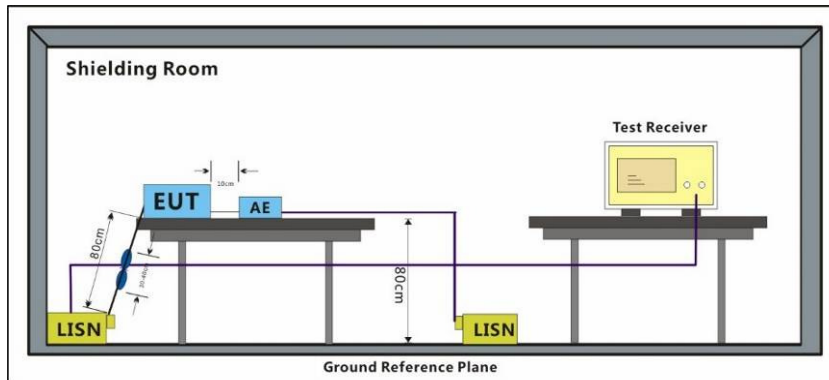
Humidity: 54.7 % RH

Atmospheric Pressure: 1003 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	02	Charge + TX mode(1Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.
Final test	03	Charge + TX mode(2Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

7.1.3 Test Setup Diagram

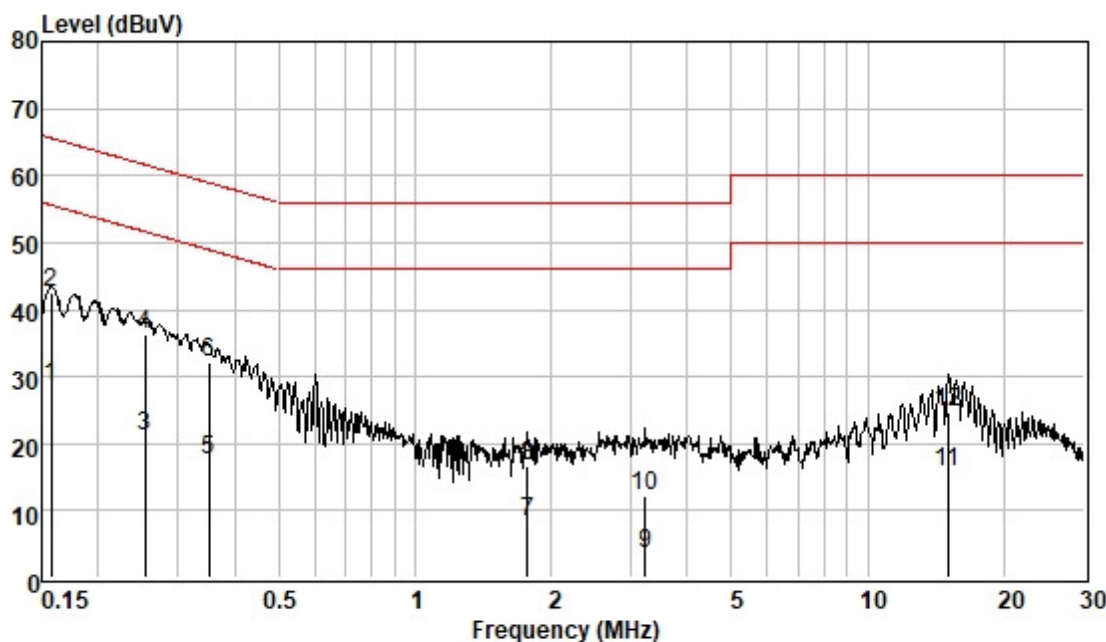


7.1.4 Measurement Procedure and Data

- 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.

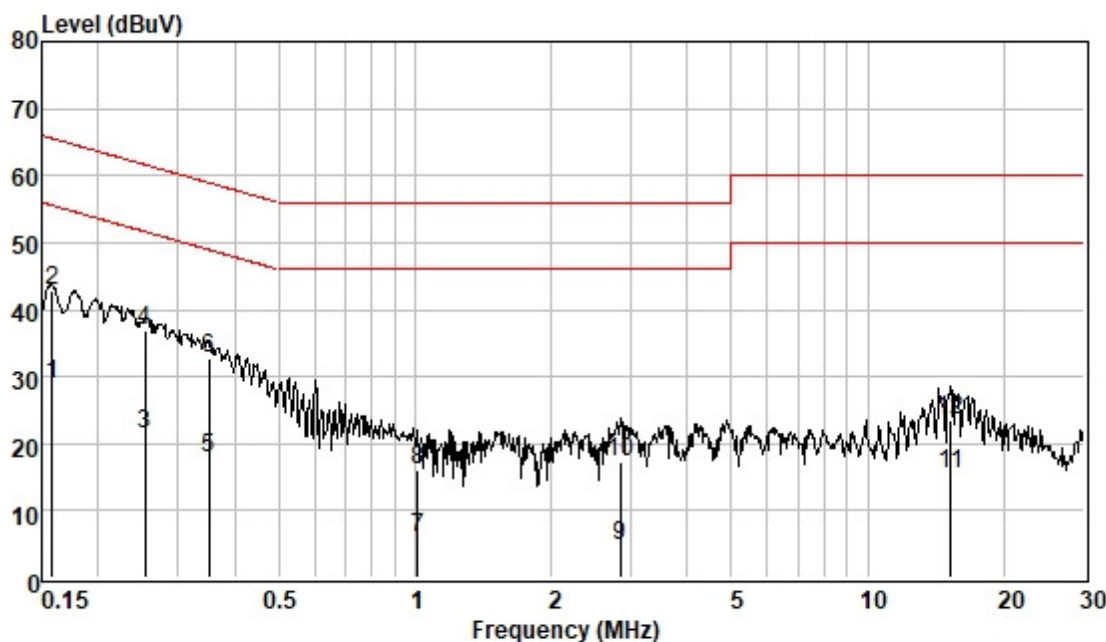
Remark: LISN=Read Level+ Cable Loss+ LISN Factor

- 6) Dipole antenna and Clip antenna can't work together. The measurements are performed for both antennas and show the worst one in the report. The Clip antenna is the worst one if no other remark in the test item.



Pol : LINE
Mode :
Model :

	Frequency MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
1	0.157	19.09	0.06	9.54	28.69	55.60	-26.91	Average
2	0.157	32.83	0.06	9.54	42.43	65.60	-23.17	QP
3	0.253	11.44	0.06	9.57	21.07	51.64	-30.57	Average
4	0.253	26.66	0.06	9.57	36.29	61.64	-25.35	QP
5	0.350	7.96	0.06	9.58	17.60	48.96	-31.36	Average
6	0.350	22.42	0.06	9.58	32.06	58.96	-26.90	QP
7	1.772	-1.46	0.11	9.60	8.25	46.00	-37.75	Average
8	1.772	6.91	0.11	9.60	16.62	56.00	-39.38	QP
9	3.224	-6.32	0.15	9.62	3.45	46.00	-42.55	Average
10	3.224	2.57	0.15	9.62	12.34	56.00	-43.66	QP
11	14.986	5.77	0.31	9.83	15.91	50.00	-34.09	Average
12	14.986	14.60	0.31	9.83	24.74	60.00	-35.26	QP



Pol : NEUTRAL
Mode :
Model :

	Frequency MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
1	0.158	19.39	0.06	9.53	28.98	55.56	-26.58	Average
2	0.158	33.16	0.06	9.53	42.75	65.56	-22.81	QP
3	0.253	11.94	0.06	9.56	21.56	51.64	-30.08	Average
4	0.253	27.35	0.06	9.56	36.97	61.64	-24.67	QP
5	0.350	8.20	0.06	9.57	17.83	48.96	-31.13	Average
6	0.350	23.07	0.06	9.57	32.70	58.96	-26.26	QP
7	1.016	-3.76	0.07	9.59	5.90	46.00	-40.10	Average
8	1.016	6.51	0.07	9.59	16.17	56.00	-39.83	QP
9	2.839	-4.91	0.14	9.61	4.84	46.00	-41.16	Average
10	2.839	7.53	0.14	9.61	17.28	56.00	-38.72	QP
11	15.226	5.18	0.31	9.86	15.35	50.00	-34.65	Average
12	15.226	13.19	0.31	9.86	23.36	60.00	-36.64	QP

7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)

Test Method: ANSI C63.10 (2013) Section 11.9.1.3

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥ 50 hopping channels
	0.25 for $25 \leq$ hopping channels < 50
	1 for digital modulation
2400-2483.5	1 for ≥ 75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 24.2 °C

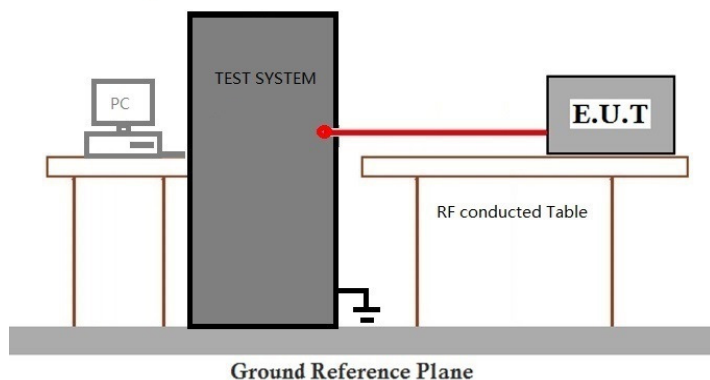
Humidity: 54.7 % RH

Atmospheric Pressure: 1003 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.2.3 Test Setup Diagram



7.2.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



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7.3 Minimum 6dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247a(2)

Test Method: ANSI C63.10 (2013) Section 11.8.1

Limit:

≥500 kHz

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 24.2 °C

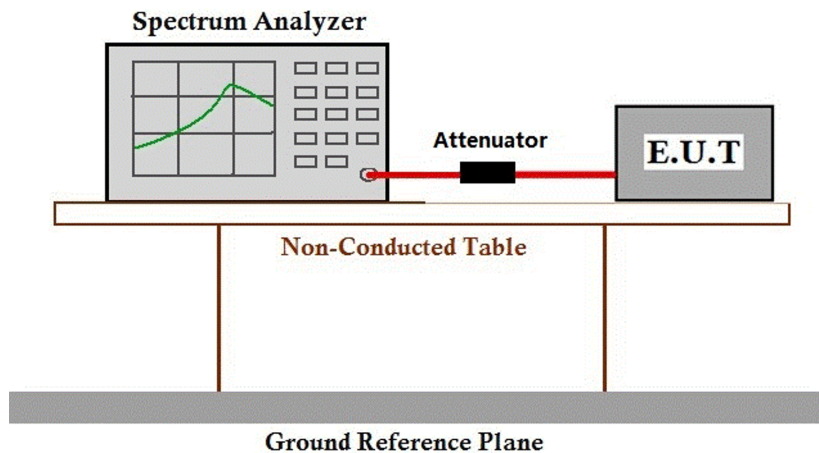
Humidity: 54.7 % RH

Atmospheric Pressure: 1003 mbar

7.3.2 Test Mode Description

Pre-scan /	Mode	Description
Final test	Code	
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.3.3 Test Setup Diagram



7.3.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details

7.4 Power Spectrum Density

Test Requirement 47 CFR Part 15, Subpart C 15.247(e)

Test Method: ANSI C63.10 (2013) Section 11.10.2

Limit:

≤8dBm in any 3 kHz band during any time interval of continuous transmission

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 24.2 °C

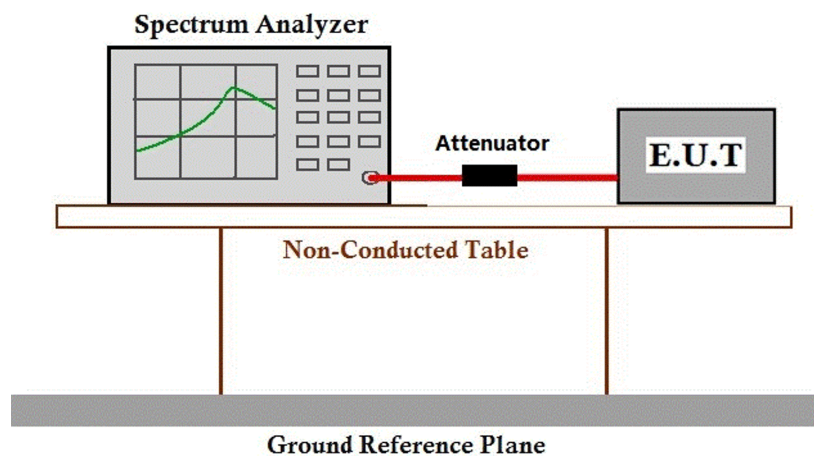
Humidity: 57.7 % RH

Atmospheric Pressure: 1003 mbar

7.4.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test 01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.4.3 Test Setup Diagram



7.4.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details

7.5 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)
 Test Method: ANSI C63.10 (2013) Section 11.13.3.2
 Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

7.5.1 E.U.T. Operation

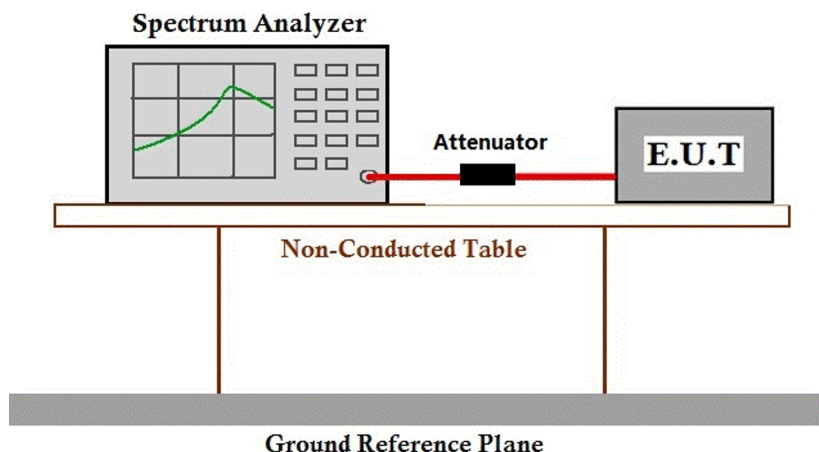
Operating Environment:

Temperature: 24.2 °C Humidity: 54.7 % RH Atmospheric Pressure: 1003 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

cable loss=0.9dB



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7.6 Conducted Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 11.11

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 24.2 °C

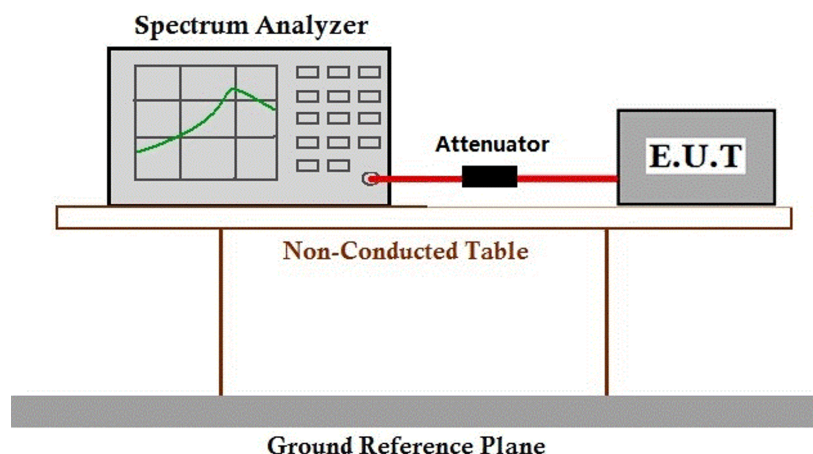
Humidity: 54.7 % RH

Atmospheric Pressure: 1003 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

cable loss=0.9dB



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7.7 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
 Test Method: ANSI C63.10 (2013) Section 6.10.5
 Test Distance: 3m
 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
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.

7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 24.7 °C Humidity: 54.3 % RH Atmospheric Pressure: 1003 mbar

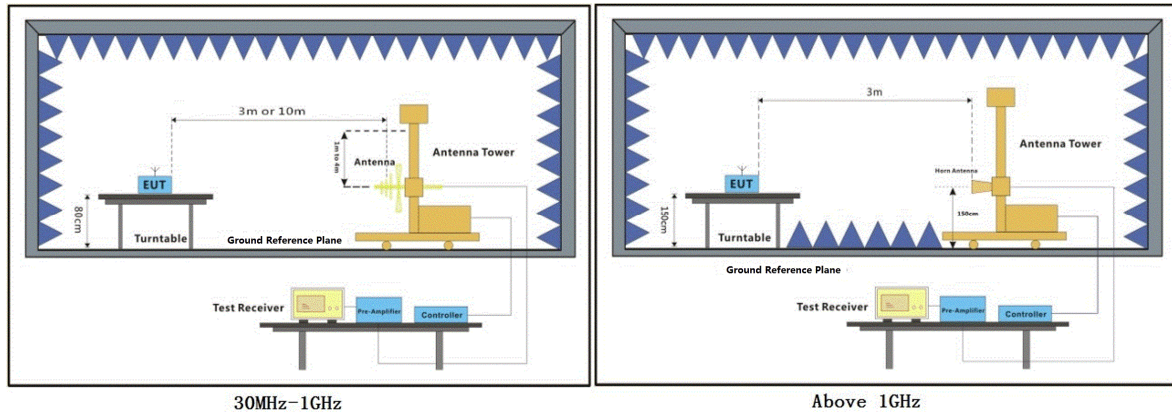
7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	02	Charge + TX mode(1Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.
Final test	03	Charge + TX mode(2Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.



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7.7.3 Test Setup Diagram



7.7.4 Measurement Procedure and Data

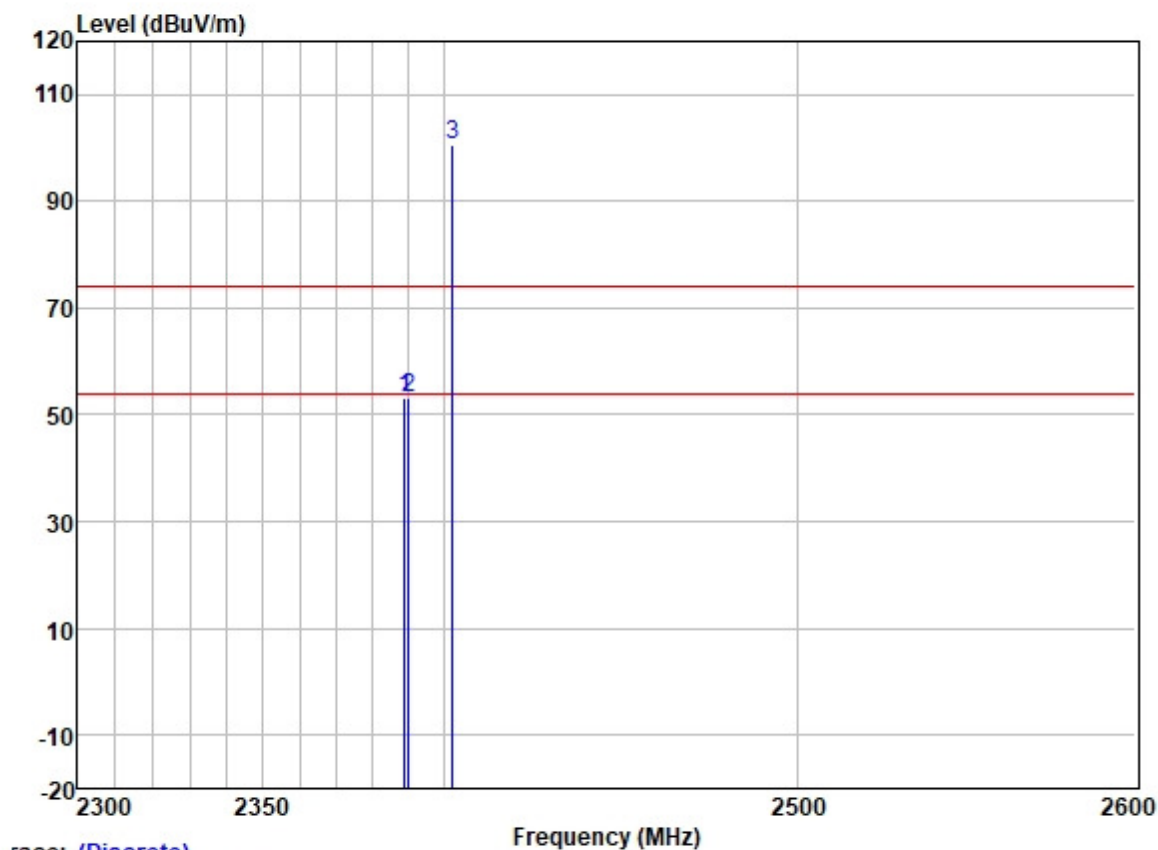
- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters 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.
- Test the EUT in the lowest channel, the Highest channel.
- The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- Repeat above procedures until all frequencies measured was complete.

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

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

Remark 3: Dipole antenna and Clip antenna can't work together. The radiation measurements are performed for both antennas and show the worst one in the report. The Clip antenna is the worst one if no other remark in the test item.

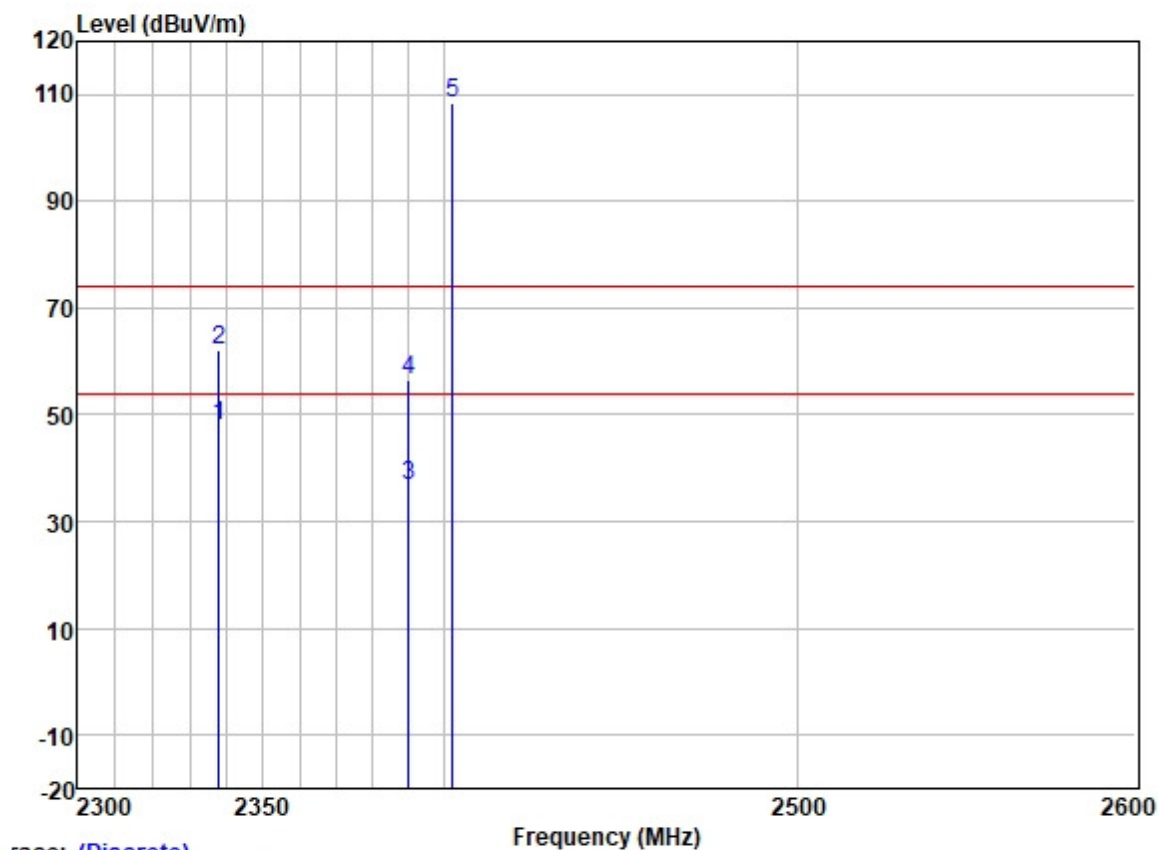
Test Mode: 02; Polarity: Horizontal; Modulation: GFSK; Channel: Low



Trace: (Discrete)

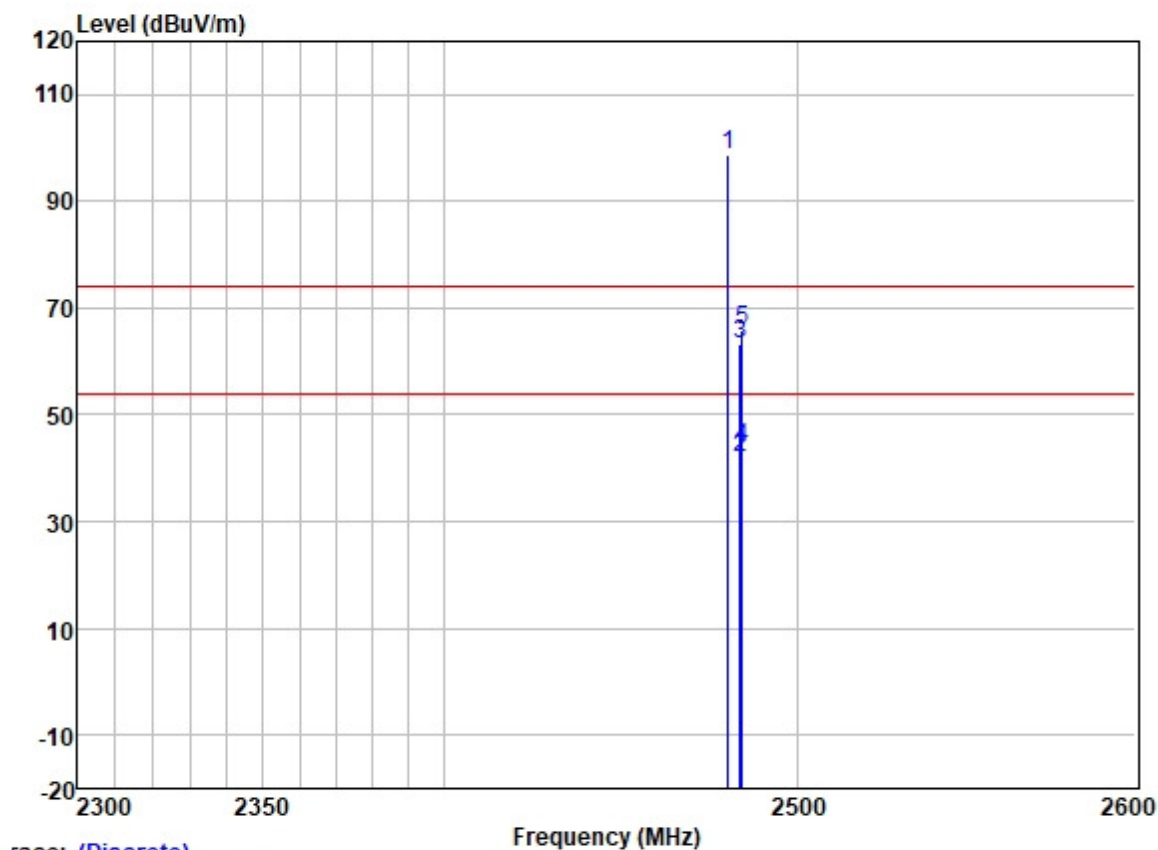
	Freq	ReadAntenna	Cable	Preamp	Limit	Over		
		Level	Factor	Loss	Factor	Level	Line	Limit
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	2388.850	60.03	27.33	3.48	37.59	53.25	74.00	-20.75
2	2390.000	60.05	27.33	3.48	37.59	53.27	74.00	-20.73
3 *	2402.000	107.28	27.35	3.50	37.59	100.54	74.00	26.54
								HORIZONTAL Peak
								HORIZONTAL Peak
								HORIZONTAL Peak

Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:Low



	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2338.070	55.05	27.22	3.37	37.61	48.03	54.00	-5.97	VERTICAL	Average
2	2338.070	69.00	27.22	3.37	37.61	61.98	74.00	-12.02	VERTICAL	Peak
3	2390.000	43.49	27.33	3.48	37.59	36.71	54.00	-17.29	VERTICAL	Average
4	2390.000	63.32	27.33	3.48	37.59	56.54	74.00	-17.46	VERTICAL	Peak
5 *	2402.000	115.27	27.35	3.50	37.59	108.53	74.00	34.53	VERTICAL	Peak

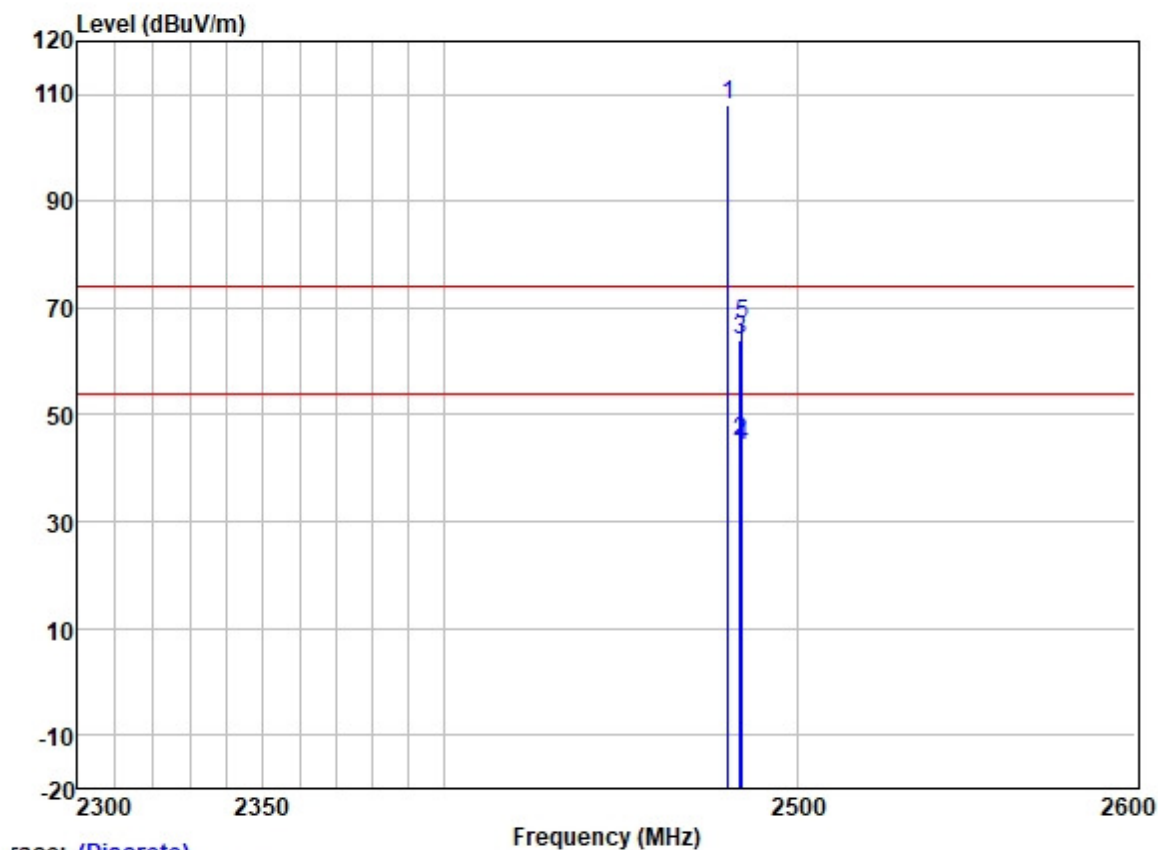
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:High



race: (Discrete)

	Freq	ReadAntenna 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 *	2480.000	105.09	27.47	3.60	37.57	98.59	74.00	24.59	HORIZONTAL Peak
2	2483.500	48.58	27.48	3.53	37.57	42.02	54.00	-11.98	HORIZONTAL Average
3	2483.500	69.69	27.48	3.53	37.57	63.13	74.00	-10.87	HORIZONTAL Peak
4	2484.121	50.24	27.48	3.53	37.57	43.68	54.00	-10.32	HORIZONTAL Average
5	2484.121	72.36	27.48	3.53	37.57	65.80	74.00	-8.20	HORIZONTAL Peak

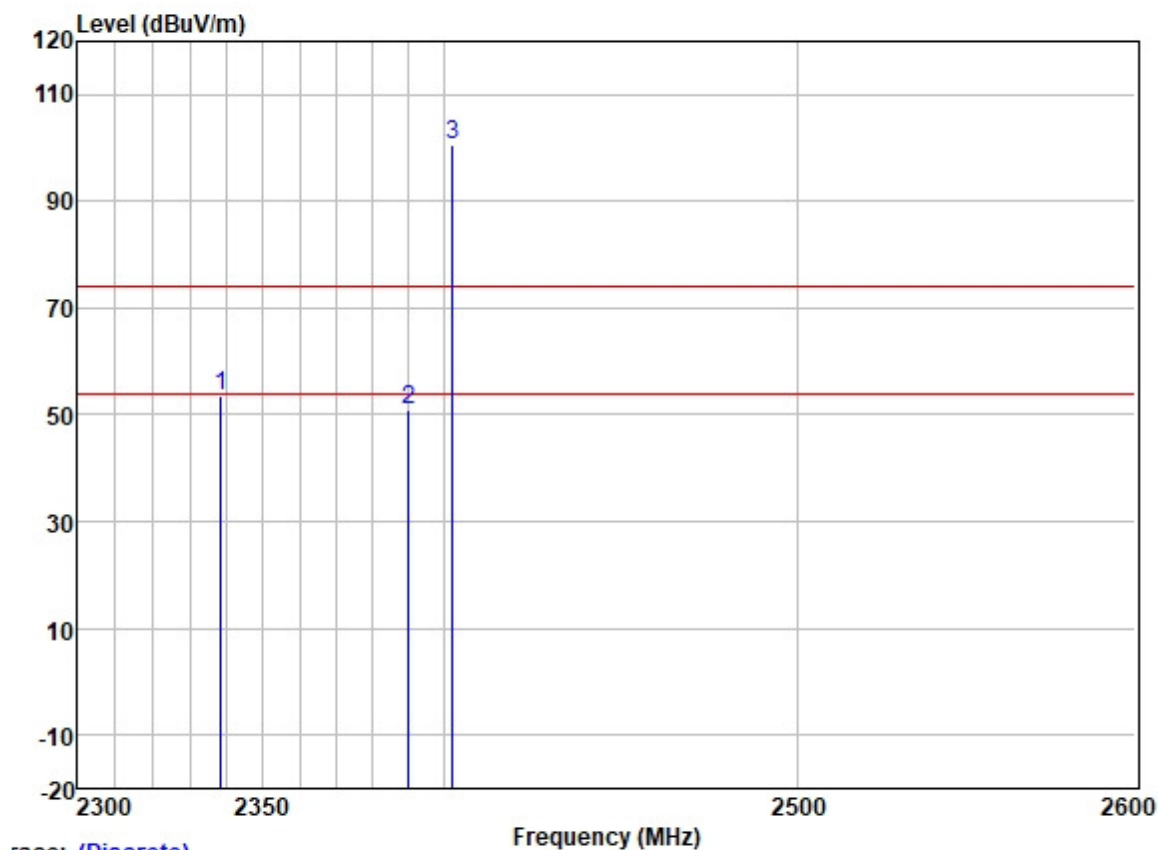
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High



race: (Discrete)

	Freq	ReadAntenna 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 *	2480.000	114.74	27.47	3.60	37.57	108.24	74.00	34.24	VERTICAL	Peak
2	2483.500	51.48	27.48	3.53	37.57	44.92	54.00	-9.08	VERTICAL	Average
3	2483.500	70.58	27.48	3.53	37.57	64.02	74.00	-9.98	VERTICAL	Peak
4	2484.171	50.59	27.48	3.53	37.57	44.03	54.00	-9.97	VERTICAL	Average
5	2484.171	73.65	27.48	3.53	37.57	67.09	74.00	-6.91	VERTICAL	Peak

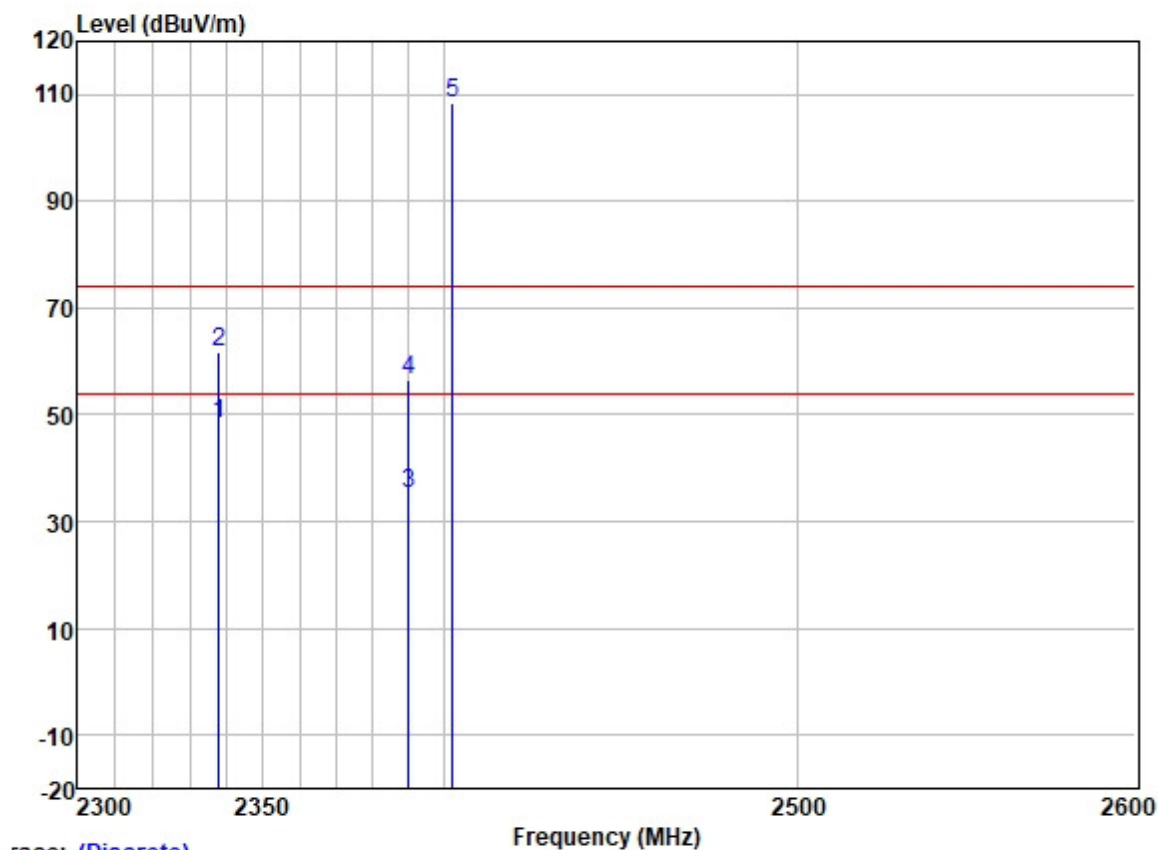
Test Mode: 03; Polarity: Horizontal; Modulation: GFSK; Channel: Low



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	2338.466	60.46	27.22	3.37	37.61	53.44	74.00	-20.56	HORIZONTAL Peak
2	2390.000	57.66	27.33	3.48	37.59	50.88	74.00	-23.12	HORIZONTAL Peak
3 *	2402.000	107.21	27.35	3.50	37.59	100.47	74.00	26.47	HORIZONTAL Peak

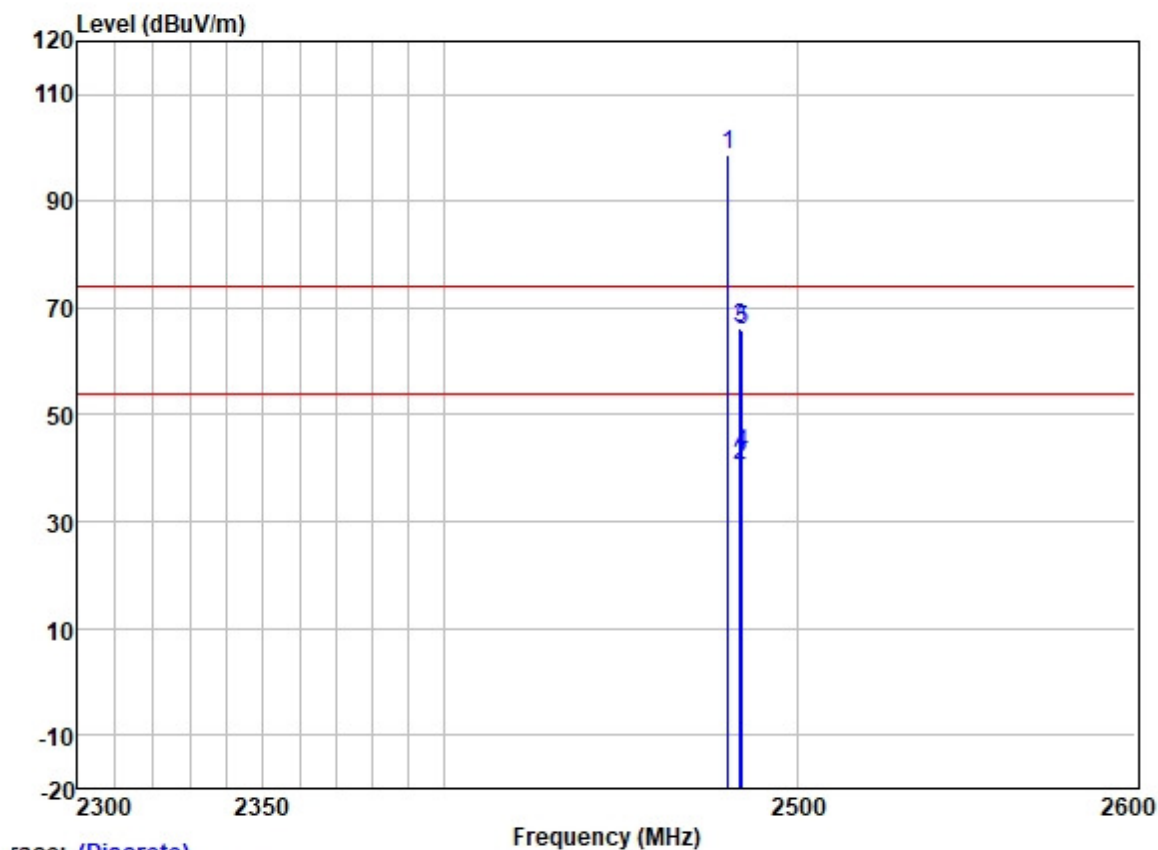
Test Mode: 03; Polarity: Vertical; Modulation:GFSK; Channel:Low



race: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2338.070	55.45	27.22	3.37	37.61	48.43	54.00	-5.57	VERTICAL	Average
2	2338.070	68.68	27.22	3.37	37.61	61.66	74.00	-12.34	VERTICAL	Peak
3	2390.000	42.16	27.33	3.48	37.59	35.38	54.00	-18.62	VERTICAL	Average
4	2390.000	63.47	27.33	3.48	37.59	56.69	74.00	-17.31	VERTICAL	Peak
5 *	2402.000	115.26	27.35	3.50	37.59	108.52	74.00	34.52	VERTICAL	Peak

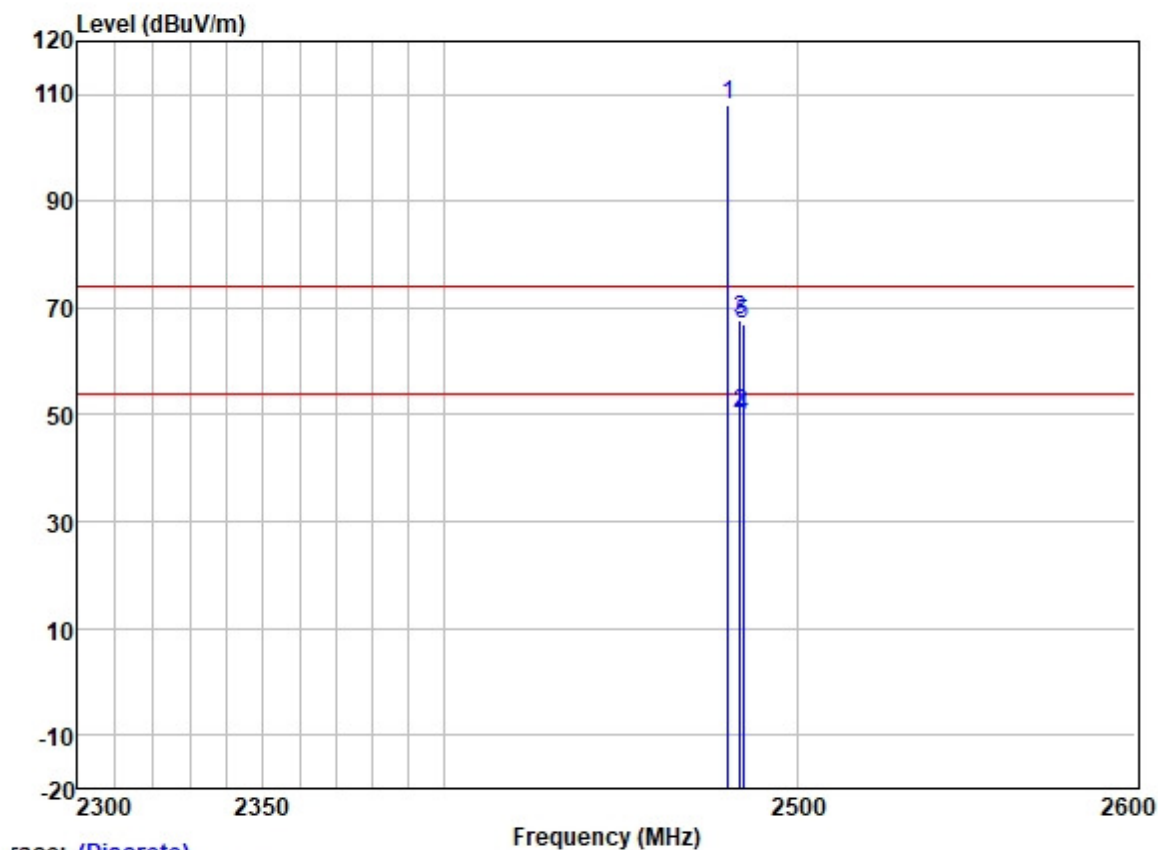
Test Mode: 03; Polarity: Horizontal; Modulation:GFSK; Channel:High



Trace: (Discrete)

	Freq	ReadAntenna 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 *	2480.000	105.07	27.47	3.60	37.57	98.57	74.00	24.57	HORIZONTAL	Peak
2	2483.500	47.15	27.48	3.53	37.57	40.59	54.00	-13.41	HORIZONTAL	Average
3	2483.500	72.80	27.48	3.53	37.57	66.24	74.00	-7.76	HORIZONTAL	Peak
4	2484.096	49.28	27.48	3.53	37.57	42.72	54.00	-11.28	HORIZONTAL	Average
5	2484.096	72.41	27.48	3.53	37.57	65.85	74.00	-8.15	HORIZONTAL	Peak

Test Mode: 03; Polarity: Vertical; Modulation:GFSK; Channel:High



race: (Discrete)

	Freq	ReadAntenna 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 *	2480.000	114.73	27.47	3.60	37.57	108.23	74.00	34.23	VERTICAL Peak
2	2483.500	56.62	27.48	3.53	37.57	50.06	54.00	-3.94	VERTICAL Average
3	2483.500	74.23	27.48	3.53	37.57	67.67	74.00	-6.33	VERTICAL Peak
4	2484.371	56.41	27.48	3.53	37.57	49.85	54.00	-4.15	VERTICAL Average
5	2484.371	73.70	27.48	3.53	37.57	67.14	74.00	-6.86	VERTICAL Peak



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7.8 Radiated Spurious Emissions (Below 1GHz)

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
 Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6
 Test Distance: 3m
 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
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.

7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 24.7 °C Humidity: 54.3 % RH Atmospheric Pressure: 1003 mbar

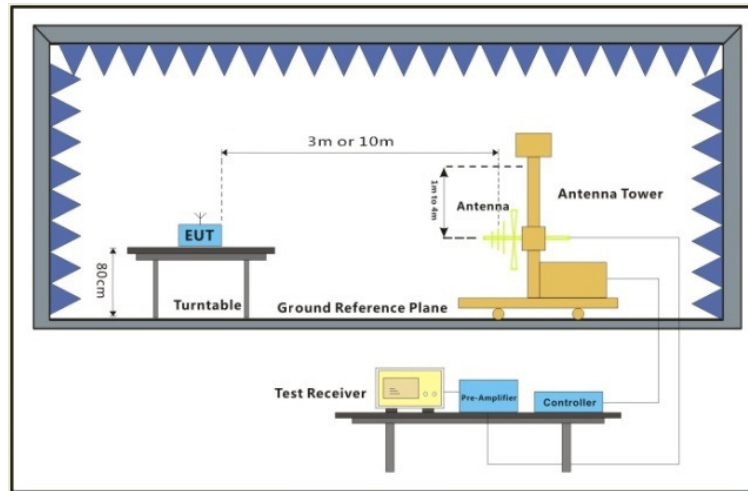
7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	02	Charge + TX mode(1Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.
Final test	03	Charge + TX mode(2Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.



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7.8.3 Test Setup Diagram



30MHz-1GHz

7.8.4 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. 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.

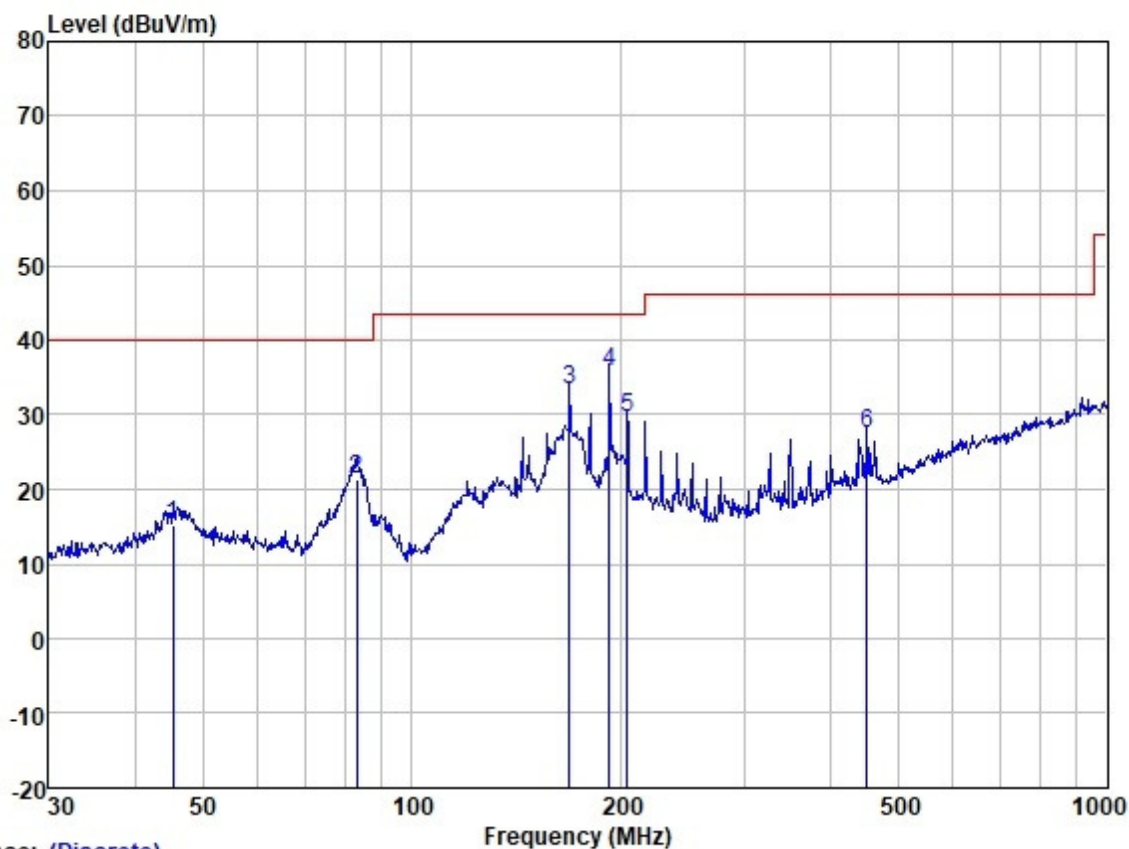
Remark:

- 1) Through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) 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
- 3) Scan from 9kHz to 1 GHz, 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.
- 4) Dipole antenna and Clip antenna can't work together. The radiation measurements are performed for both antennas and show the worst one in the report. The Clip antenna is the worst one if no other remark in the test item.



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Test Mode: 03; Polarity: Horizontal



Trace: (Discrete)

Site : SGS

Condition:

Job :

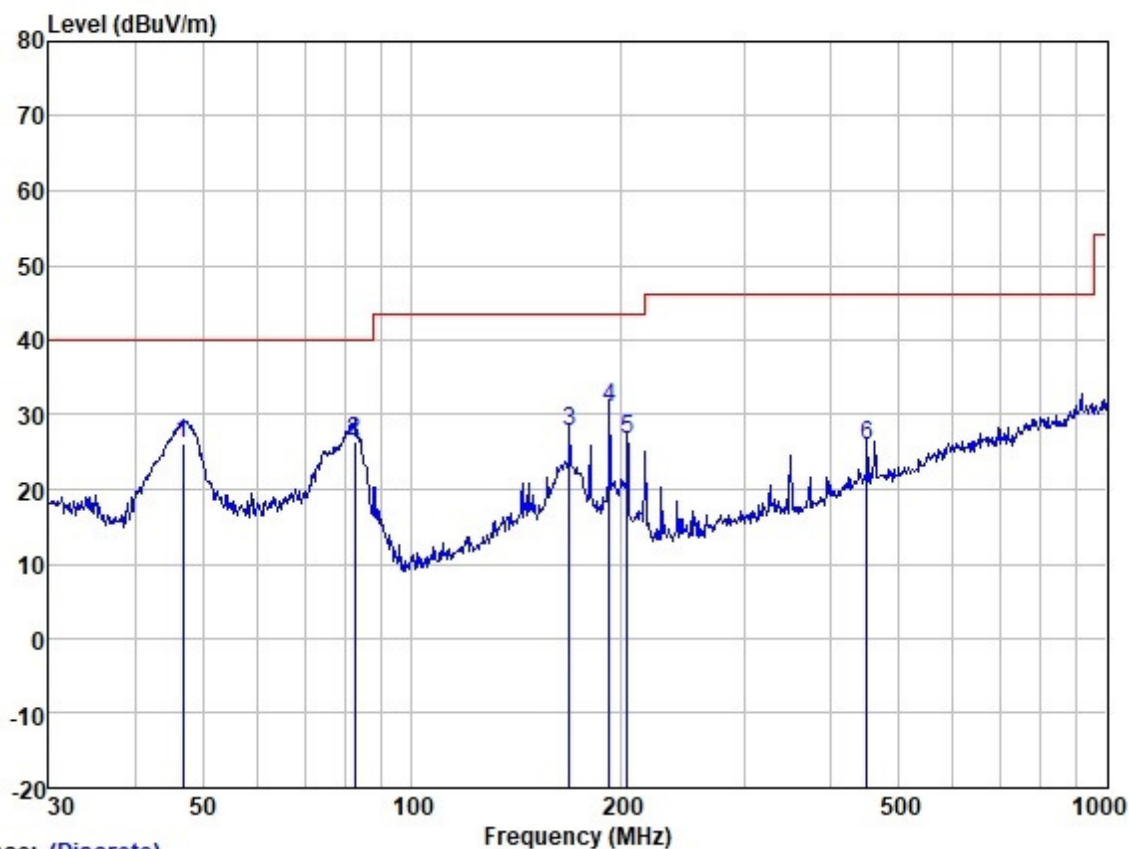
Model :

Power :

Test Mode: BLE

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	45.217	27.82	13.44	1.12	27.17	15.21	40.00	-24.79	HORIZONTAL	QP
2	83.230	38.76	8.17	1.51	27.09	21.35	40.00	-18.65	HORIZONTAL	QP
3	168.414	44.86	12.83	2.39	26.77	33.31	43.50	-10.19	HORIZONTAL	QP
4	192.419	49.79	10.12	2.50	26.74	35.67	43.50	-7.83	HORIZONTAL	QP
5	204.238	44.17	9.49	2.54	26.73	29.47	43.50	-14.03	HORIZONTAL	QP
6	451.135	34.11	16.85	4.19	27.72	27.43	46.00	-18.57	HORIZONTAL	QP

Test Mode: 03; Polarity: Vertical



Trace: (Discrete)

Site : SGS

Condition:

Job :

Model :

Power :

Test Mode: BLE

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	46.830	38.55	13.52	1.13	27.17	26.03	40.00	-13.97	VERTICAL	QP
2	82.648	43.65	8.28	1.50	27.09	26.34	40.00	-13.66	VERTICAL	QP
3	168.414	39.39	12.83	2.39	26.77	27.84	43.50	-15.66	VERTICAL	QP
4	192.419	45.14	10.12	2.50	26.74	31.02	43.50	-12.48	VERTICAL	QP
5	204.238	41.45	9.49	2.54	26.73	26.75	43.50	-16.75	VERTICAL	QP
6	451.135	32.47	16.85	4.19	27.72	25.79	46.00	-20.21	VERTICAL	QP

7.9 Radiated Spurious Emissions (Above 1GHz)

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6
Test Distance: 3m
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
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.

7.9.1 E.U.T. Operation

Operating Environment:

Temperature: 24.2 °C Humidity: 54.7 % RH Atmospheric Pressure: 1003 mbar

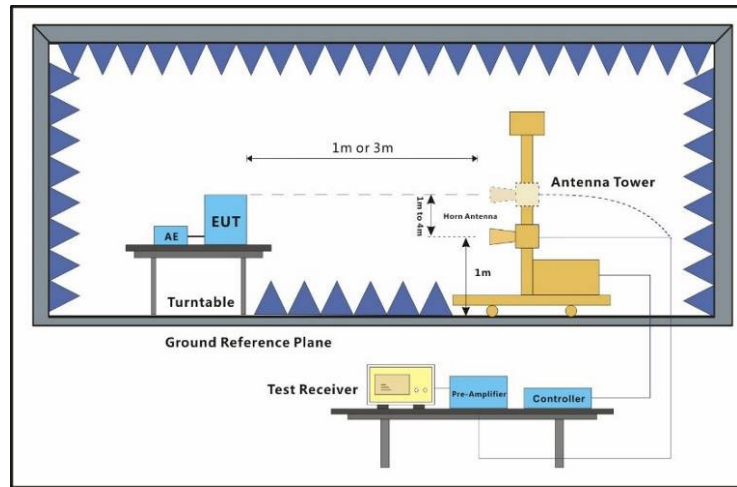
7.9.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Pre-scan	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	02	Charge + TX mode(1Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.
Final test	03	Charge + TX mode(2Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.



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7.9.3 Test Setup Diagram



7.9.4 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. 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) 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 1GHz to 25GHz, 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.

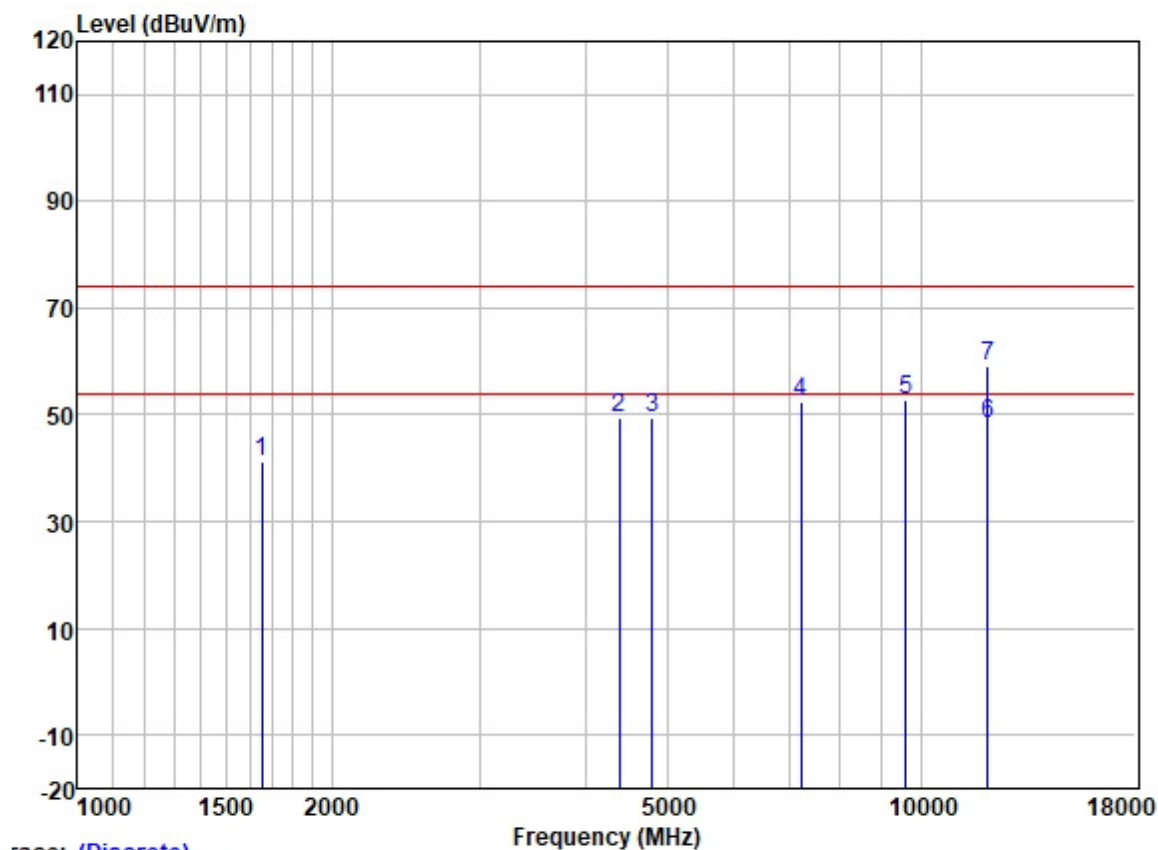
3) The field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only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

4) Dipole antenna and Clip antenna can't work together. The radiation measurements are performed for both antennas and show the worst one in the report. The Clip antenna is the worst one if no other remark in the test item.



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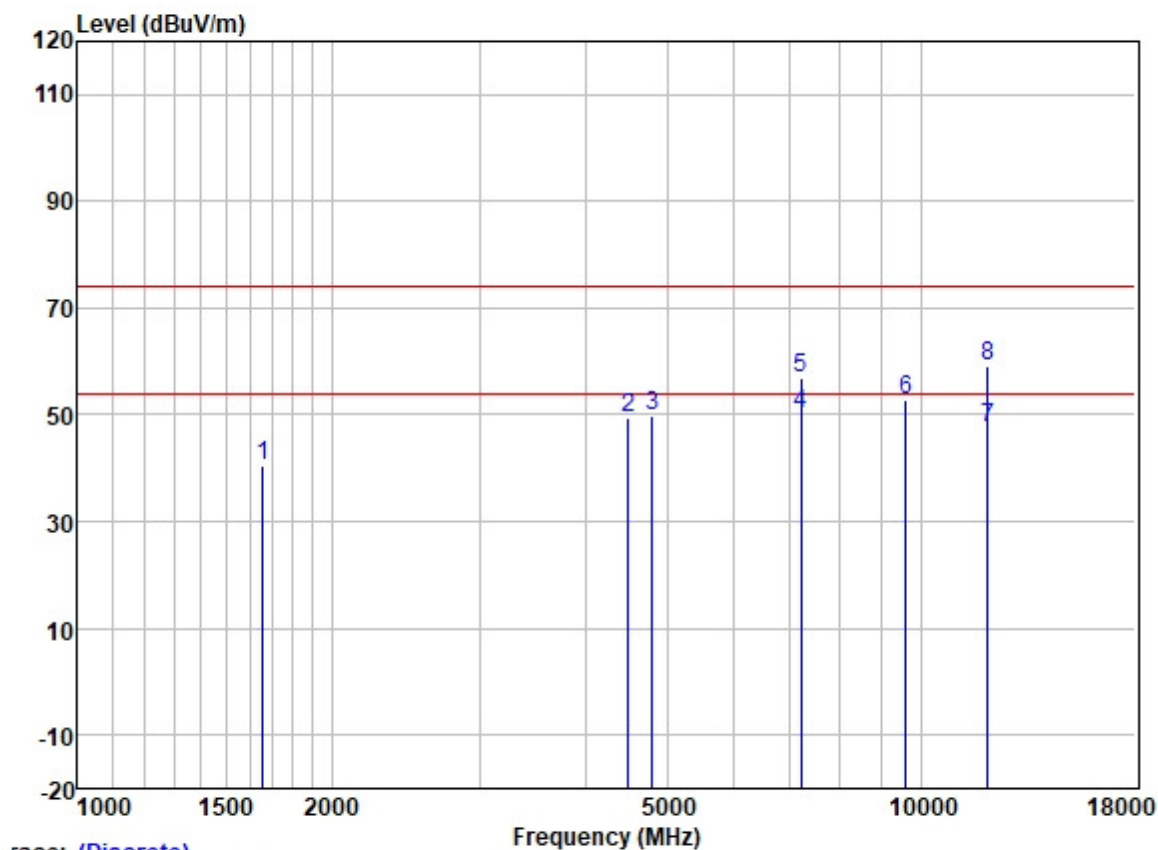
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:Low



race: (Discrete)

	Freq	ReadAntenna 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	1653.550	50.66	25.64	2.80	37.93	41.17	74.00	-32.83	HORIZONTAL	Peak
2	4392.376	50.79	30.66	4.70	36.81	49.34	74.00	-24.66	HORIZONTAL	Peak
3	4804.000	49.61	31.42	5.40	36.83	49.60	74.00	-24.40	HORIZONTAL	Peak
4	7206.000	48.42	35.54	5.98	37.38	52.56	74.00	-21.44	HORIZONTAL	Peak
5	9608.000	44.73	38.37	7.07	37.42	52.75	74.00	-21.25	HORIZONTAL	Peak
6	12010.000	38.20	38.90	8.19	37.10	48.19	54.00	-5.81	HORIZONTAL	Average
7	12010.000	49.31	38.90	8.19	37.10	59.30	74.00	-14.70	HORIZONTAL	Peak

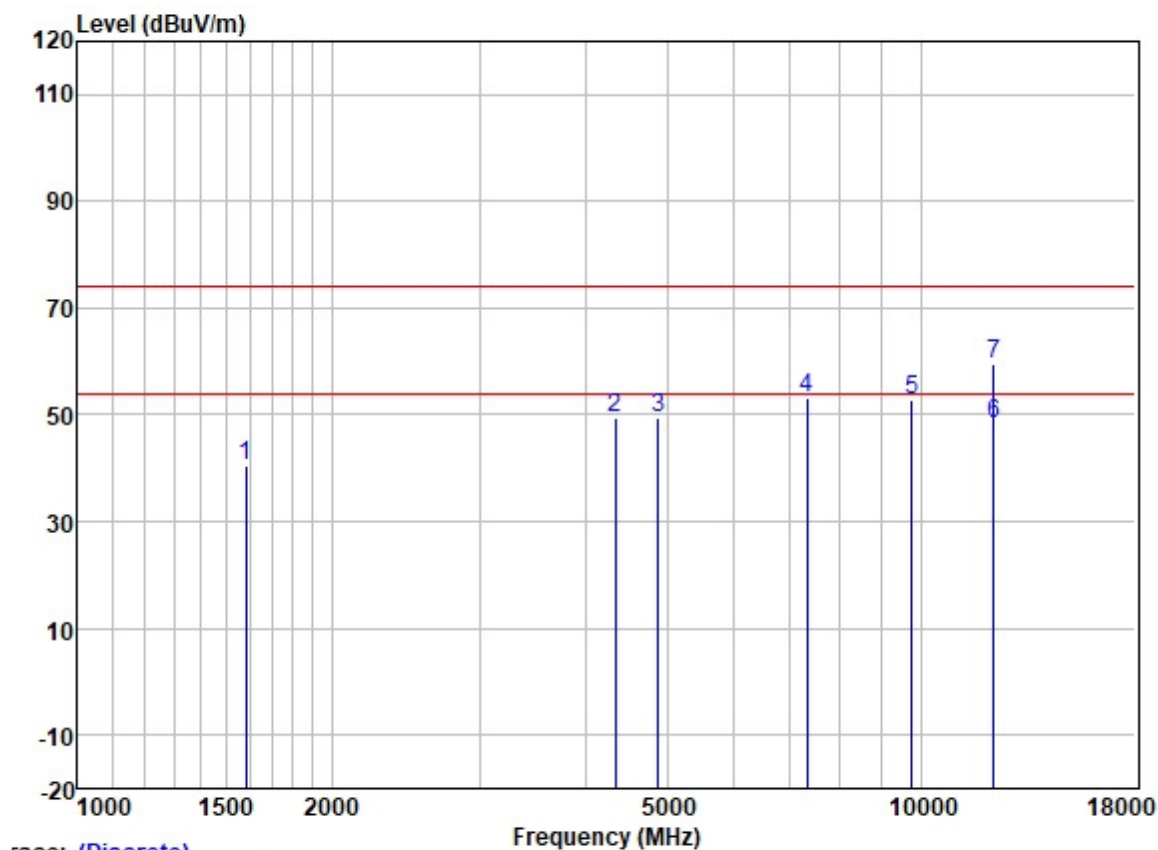
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:Low



race: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over		
		Level	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1658.337	50.03	25.65	2.80	37.93	40.55	74.00	-33.45	VERTICAL Peak
2	4495.125	50.44	30.80	5.05	36.82	49.47	74.00	-24.53	VERTICAL Peak
3	4804.000	49.89	31.42	5.40	36.83	49.88	74.00	-24.12	VERTICAL Peak
4	7206.000	45.91	35.54	5.98	37.38	50.05	54.00	-3.95	VERTICAL Average
5	7206.000	52.89	35.54	5.98	37.38	57.03	74.00	-16.97	VERTICAL Peak
6	9608.000	44.72	38.37	7.07	37.42	52.74	74.00	-21.26	VERTICAL Peak
7	12010.000	37.73	38.90	8.19	37.10	47.72	54.00	-6.28	VERTICAL Average
8	12010.000	49.17	38.90	8.19	37.10	59.16	74.00	-14.84	VERTICAL Peak

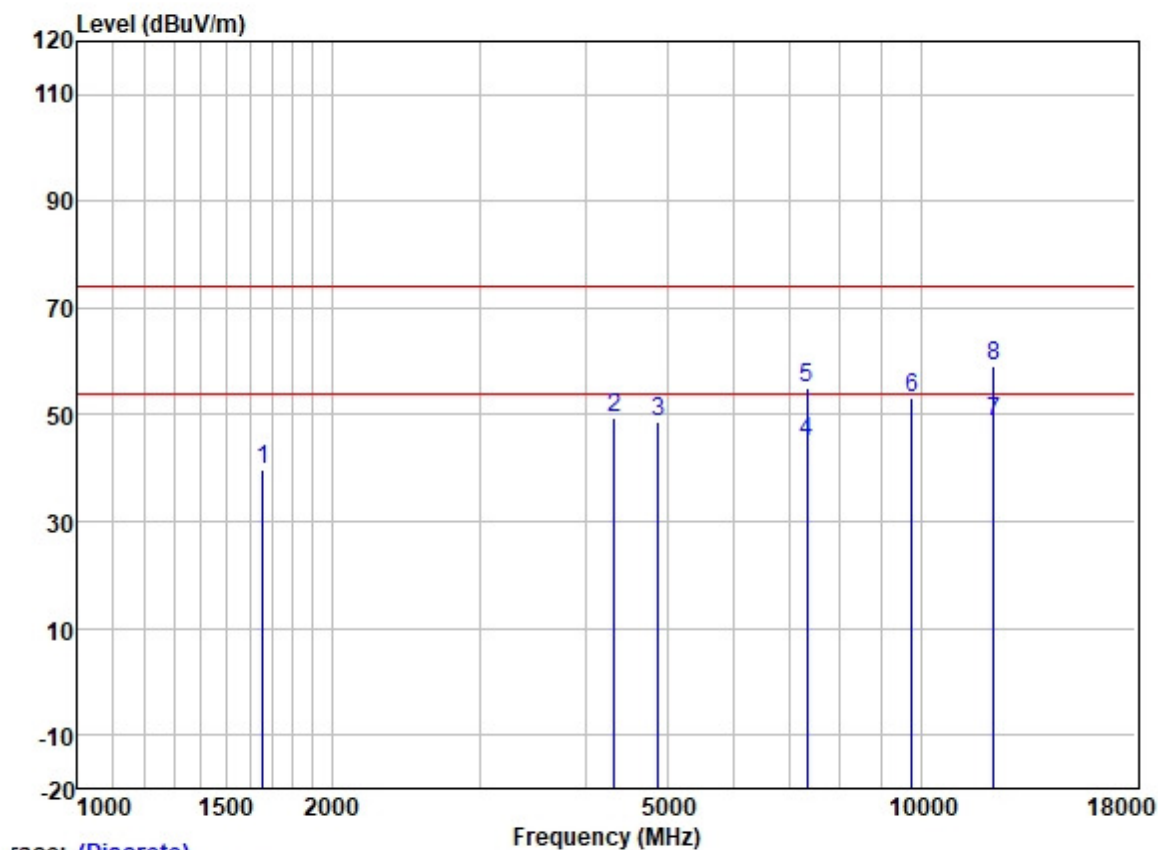
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:middle



race: (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	1583.392	50.21	25.56	2.80	38.00	40.57	74.00	-33.43	HORIZONTAL	Peak
2	4341.886	50.91	30.57	4.67	36.81	49.34	74.00	-24.66	HORIZONTAL	Peak
3	4880.000	49.18	31.54	5.50	36.84	49.38	74.00	-24.62	HORIZONTAL	Peak
4	7320.000	48.53	36.00	6.13	37.43	53.23	74.00	-20.77	HORIZONTAL	Peak
5	9760.000	44.51	38.50	7.02	37.41	52.62	74.00	-21.38	HORIZONTAL	Peak
6	12200.000	38.27	38.77	8.10	37.00	48.14	54.00	-5.86	HORIZONTAL	Average
7	12200.000	49.75	38.77	8.10	37.00	59.62	74.00	-14.38	HORIZONTAL	Peak

Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:middle



race: (Discrete)

	Freq	ReadAntenna 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	1658.337	49.34	25.65	2.80	37.93	39.86	74.00	-34.14	VERTICAL	Peak
2	4329.354	50.96	30.54	4.67	36.81	49.36	74.00	-24.64	VERTICAL	Peak
3	4880.000	48.48	31.54	5.50	36.84	48.68	74.00	-25.32	VERTICAL	Peak
4	7320.000	40.13	36.00	6.13	37.43	44.83	54.00	-9.17	VERTICAL	Average
5	7320.000	50.41	36.00	6.13	37.43	55.11	74.00	-18.89	VERTICAL	Peak
6	9760.000	45.08	38.50	7.02	37.41	53.19	74.00	-20.81	VERTICAL	Peak
7	12200.000	38.87	38.77	8.10	37.00	48.74	54.00	-5.26	VERTICAL	Average
8	12200.000	49.45	38.77	8.10	37.00	59.32	74.00	-14.68	VERTICAL	Peak

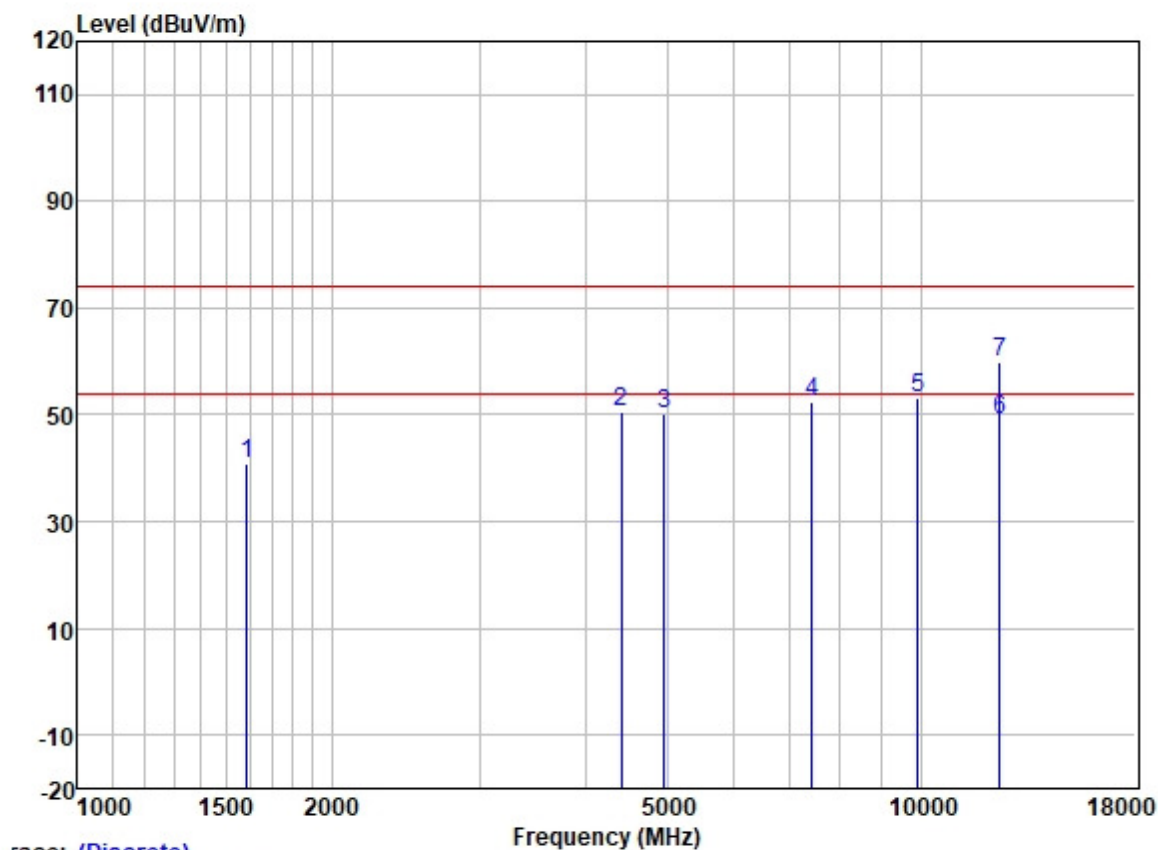


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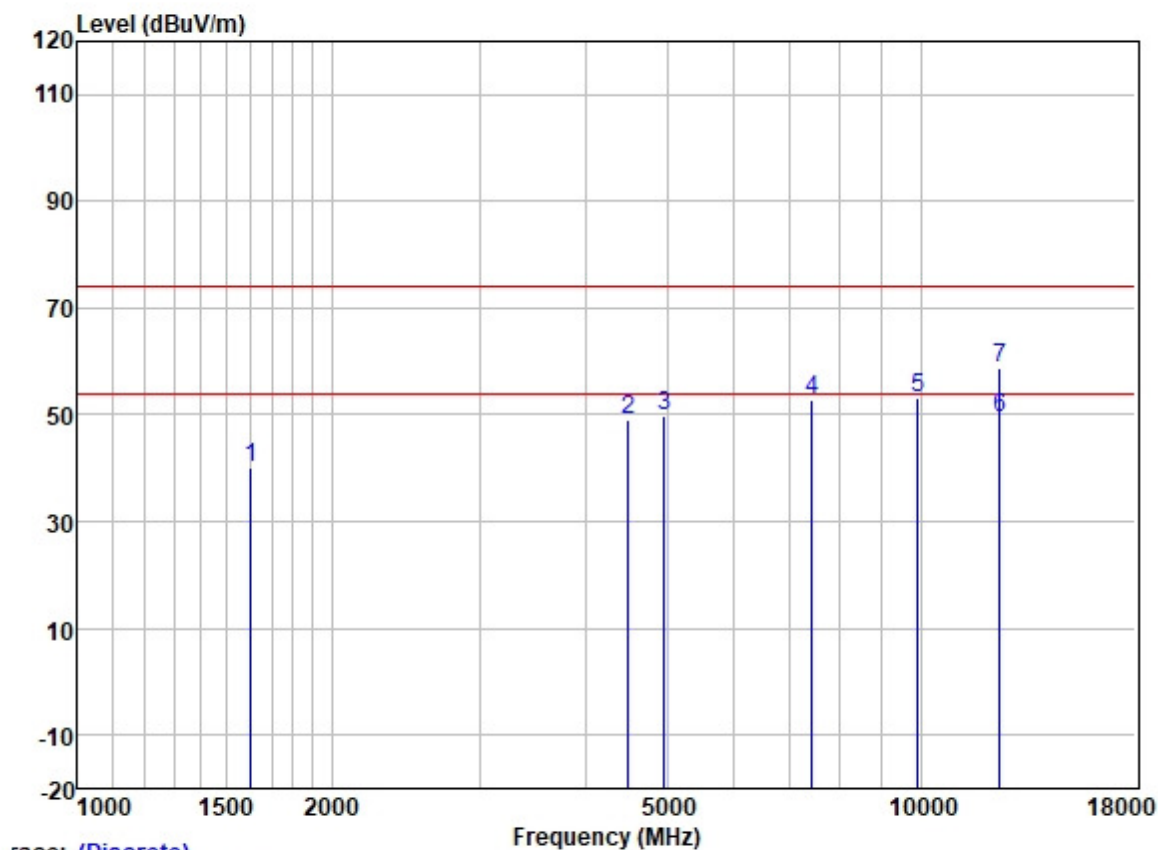
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:High



race: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1587.975	50.30	25.57	2.80	37.98	40.69	74.00	-33.31	HORIZONTAL	Peak
2	4417.841	51.83	30.70	4.74	36.81	50.46	74.00	-23.54	HORIZONTAL	Peak
3	4960.000	49.72	31.65	5.65	36.84	50.18	74.00	-23.82	HORIZONTAL	Peak
4	7440.000	47.55	36.27	6.22	37.47	52.57	74.00	-21.43	HORIZONTAL	Peak
5	9920.000	44.82	38.65	6.96	37.40	53.03	74.00	-20.97	HORIZONTAL	Peak
6	12400.000	39.37	38.57	7.97	36.88	49.03	54.00	-4.97	HORIZONTAL	Average
7	12400.000	50.40	38.57	7.97	36.88	60.06	74.00	-13.94	HORIZONTAL	Peak

Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High



race: (Discrete)

	Freq	ReadAntenna 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	1606.441	49.66	25.59	2.80	37.98	40.07	74.00	-33.93	VERTICAL	Peak
2	4495.125	50.20	30.80	5.05	36.82	49.23	74.00	-24.77	VERTICAL	Peak
3	4960.000	49.27	31.65	5.65	36.84	49.73	74.00	-24.27	VERTICAL	Peak
4	7440.000	47.65	36.27	6.22	37.47	52.67	74.00	-21.33	VERTICAL	Peak
5	9920.000	44.88	38.65	6.96	37.40	53.09	74.00	-20.91	VERTICAL	Peak
6	12400.000	39.63	38.57	7.97	36.88	49.29	54.00	-4.71	VERTICAL	Average
7	12400.000	49.21	38.57	7.97	36.88	58.87	74.00	-15.13	VERTICAL	Peak

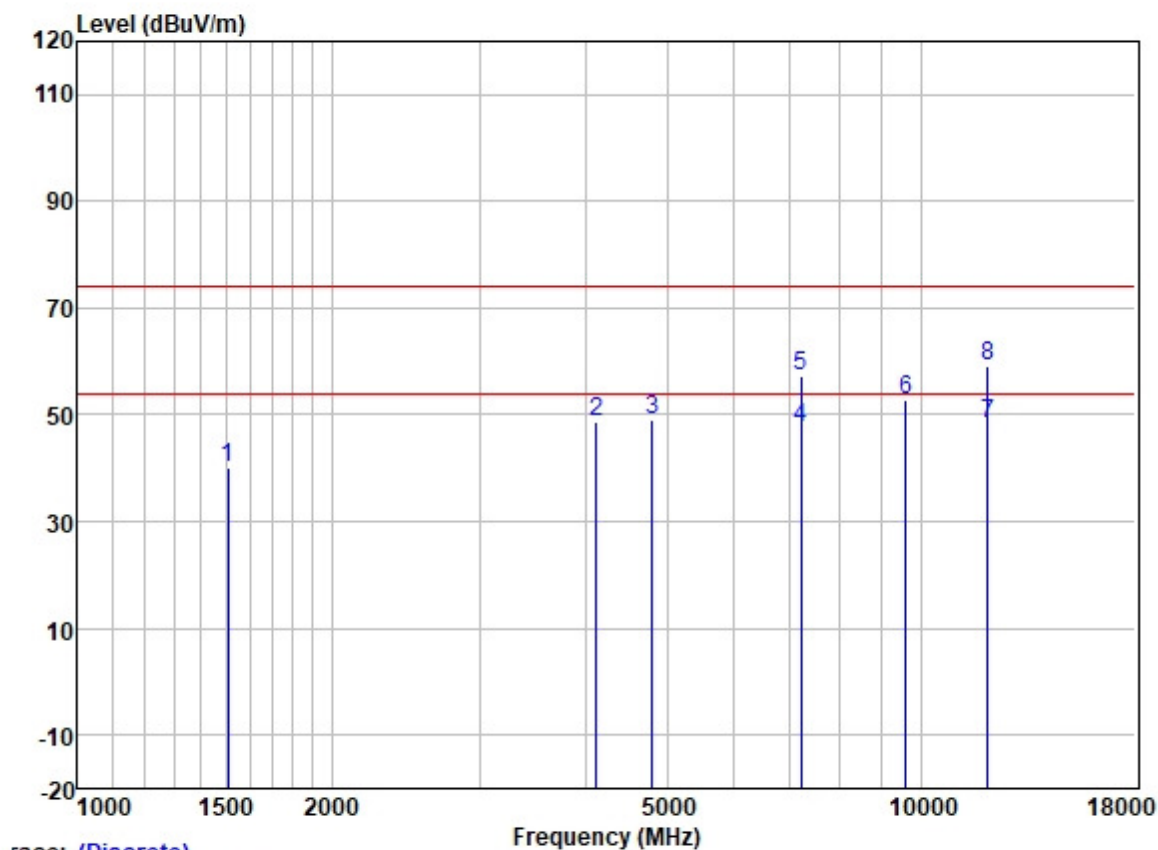


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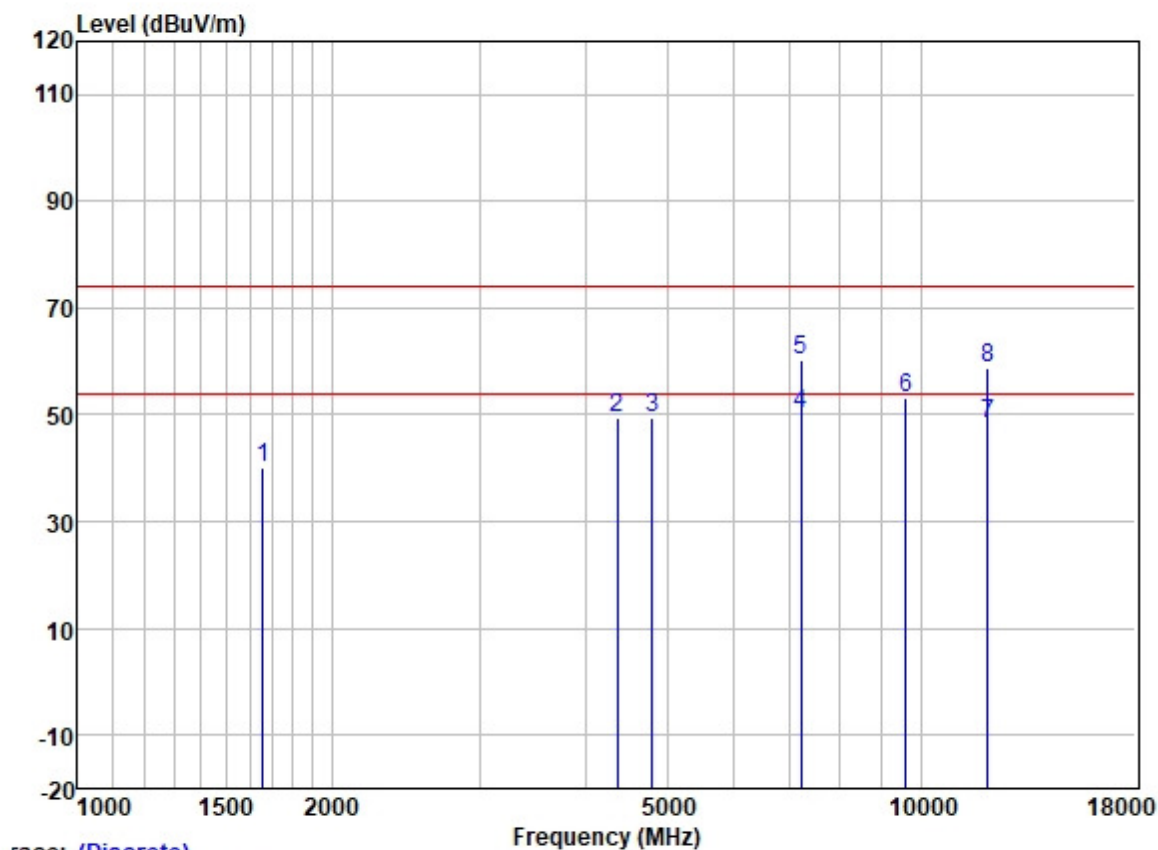
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Test Mode: 03; Polarity: Horizontal; Modulation: GFSK; Channel: Low



	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1507.470	49.97	25.51	2.80	38.10	40.18	74.00	-33.82	HORIZONTAL	Peak
2	4121.768	50.93	29.98	4.60	36.80	48.71	74.00	-25.29	HORIZONTAL	Peak
3	4804.000	49.13	31.42	5.40	36.83	49.12	74.00	-24.88	HORIZONTAL	Peak
4	7206.000	43.42	35.54	5.98	37.38	47.56	54.00	-6.44	HORIZONTAL	Average
5	7206.000	53.05	35.54	5.98	37.38	57.19	74.00	-16.81	HORIZONTAL	Peak
6	9608.000	44.82	38.37	7.07	37.42	52.84	74.00	-21.16	HORIZONTAL	Peak
7	12010.000	38.41	38.90	8.19	37.10	48.40	54.00	-5.60	HORIZONTAL	Average
8	12010.000	49.15	38.90	8.19	37.10	59.14	74.00	-14.86	HORIZONTAL	Peak

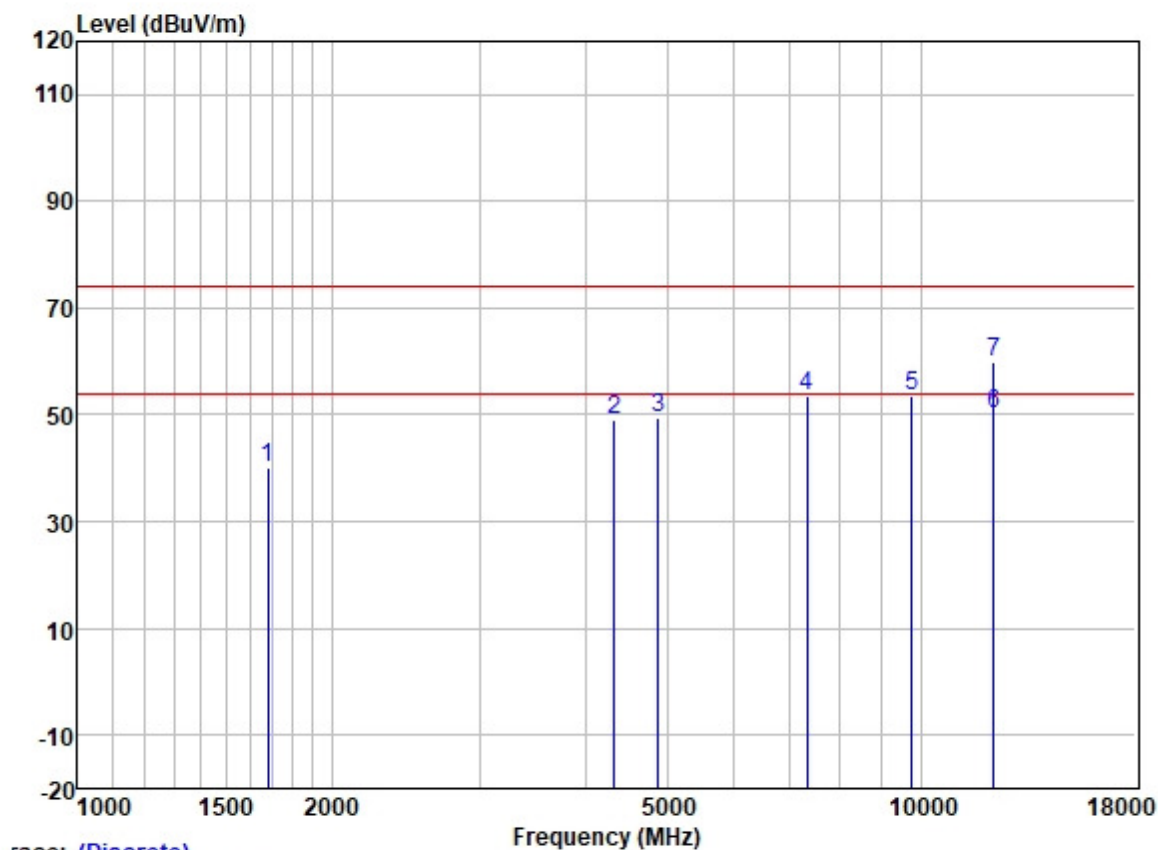
Test Mode: 03; Polarity: Vertical; Modulation:GFSK; Channel:Low



race: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1658.337	49.63	25.65	2.80	37.93	40.15	74.00	-33.85	VERTICAL	Peak
2	4367.058	51.10	30.62	4.68	36.81	49.59	74.00	-24.41	VERTICAL	Peak
3	4804.000	49.53	31.42	5.40	36.83	49.52	74.00	-24.48	VERTICAL	Peak
4	7206.000	46.08	35.54	5.98	37.38	50.22	54.00	-3.78	VERTICAL	Average
5	7206.000	56.14	35.54	5.98	37.38	60.28	74.00	-13.72	VERTICAL	Peak
6	9608.000	45.18	38.37	7.07	37.42	53.20	74.00	-20.80	VERTICAL	Peak
7	12010.000	38.21	38.90	8.19	37.10	48.20	54.00	-5.80	VERTICAL	Average
8	12010.000	48.84	38.90	8.19	37.10	58.83	74.00	-15.17	VERTICAL	Peak

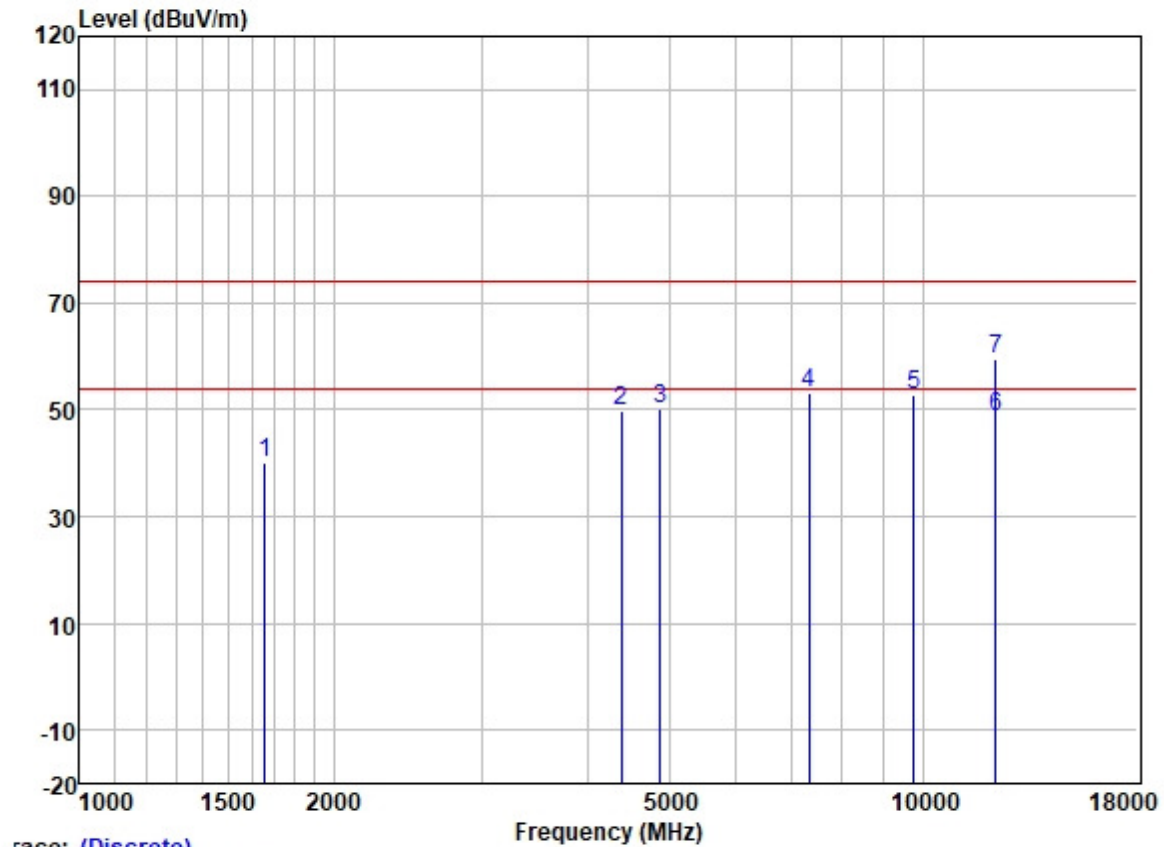
Test Mode: 03; Polarity: Horizontal; Modulation:GFSK; Channel:middle



race: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over		
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	Remark
1	1682.477	49.52	25.68	2.80	37.91	40.09	74.00	-33.91	HORIZONTAL Peak
2	4329.354	50.58	30.54	4.67	36.81	48.98	74.00	-25.02	HORIZONTAL Peak
3	4880.000	49.39	31.54	5.50	36.84	49.59	74.00	-24.41	HORIZONTAL Peak
4	7320.000	48.83	36.00	6.13	37.43	53.53	74.00	-20.47	HORIZONTAL Peak
5	9760.000	45.29	38.50	7.02	37.41	53.40	74.00	-20.60	HORIZONTAL Peak
6	12200.000	40.28	38.77	8.10	37.00	50.15	54.00	-3.85	HORIZONTAL Average
7	12200.000	49.89	38.77	8.10	37.00	59.76	74.00	-14.24	HORIZONTAL Peak

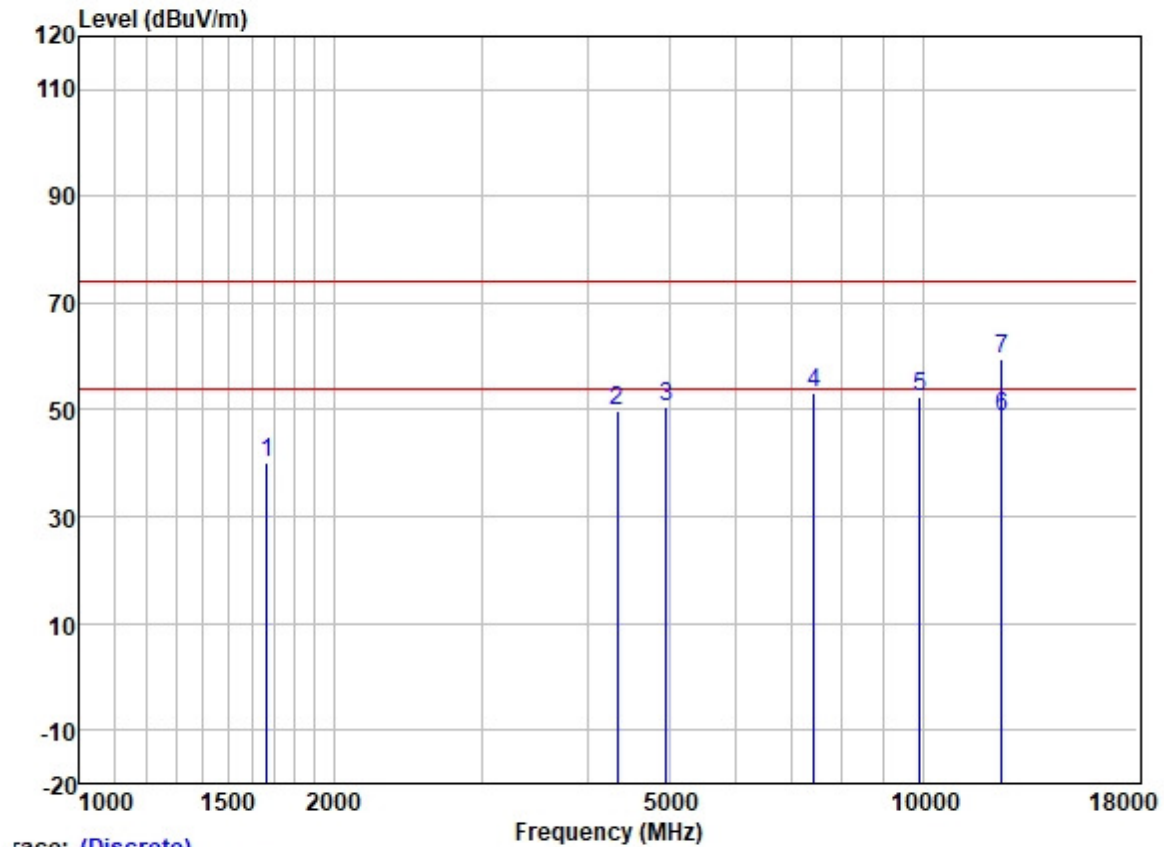
Test Mode: 03; Polarity: Vertical; Modulation:GFSK; Channel:middle



race: (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	1658.337	49.56	25.65	2.80	37.93	40.08	74.00	-33.92	VERTICAL	Peak
2	4392.376	51.28	30.66	4.70	36.81	49.83	74.00	-24.17	VERTICAL	Peak
3	4880.000	49.87	31.54	5.50	36.84	50.07	74.00	-23.93	VERTICAL	Peak
4	7320.000	48.32	36.00	6.13	37.43	53.02	74.00	-20.98	VERTICAL	Peak
5	9760.000	44.70	38.50	7.02	37.41	52.81	74.00	-21.19	VERTICAL	Peak
6	12200.000	38.74	38.77	8.10	37.00	48.61	54.00	-5.39	VERTICAL	Average
7	12200.000	49.51	38.77	8.10	37.00	59.38	74.00	-14.62	VERTICAL	Peak

Test Mode: 03; Polarity: Horizontal; Modulation:GFSK; Channel:High



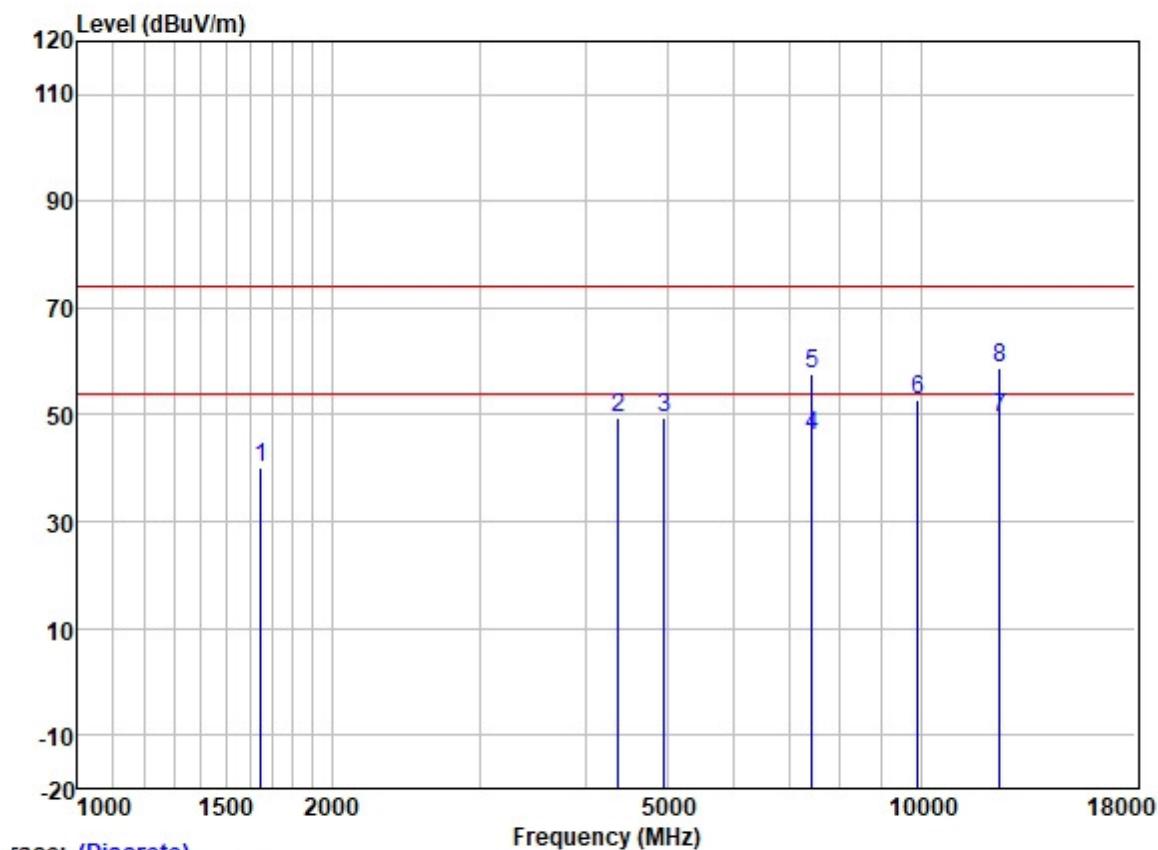
race: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over		
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1667.951	49.61	25.66	2.80	37.91	40.16	74.00	-33.84	HORIZONTAL Peak
2	4341.886	51.35	30.57	4.67	36.81	49.78	74.00	-24.22	HORIZONTAL Peak
3	4960.000	50.03	31.65	5.65	36.84	50.49	74.00	-23.51	HORIZONTAL Peak
4	7440.000	48.24	36.27	6.22	37.47	53.26	74.00	-20.74	HORIZONTAL Peak
5	9920.000	44.40	38.65	6.96	37.40	52.61	74.00	-21.39	HORIZONTAL Peak
6	12400.000	38.87	38.57	7.97	36.88	48.53	54.00	-5.47	HORIZONTAL Average
7	12400.000	49.95	38.57	7.97	36.88	59.61	74.00	-14.39	HORIZONTAL Peak



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Test Mode: 03; Polarity: Vertical; Modulation:GFSK; Channel:High



	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1648.778	49.70	25.63	2.80	37.93	40.20	74.00	-33.80	VERTICAL	Peak
2	4379.699	50.91	30.64	4.69	36.81	49.43	74.00	-24.57	VERTICAL	Peak
3	4960.000	48.89	31.65	5.65	36.84	49.35	74.00	-24.65	VERTICAL	Peak
4	7440.000	41.21	36.27	6.22	37.47	46.23	54.00	-7.77	VERTICAL	Average
5	7440.000	52.78	36.27	6.22	37.47	57.80	74.00	-16.20	VERTICAL	Peak
6	9920.000	44.69	38.65	6.96	37.40	52.90	74.00	-21.10	VERTICAL	Peak
7	12397.740	39.80	38.57	7.97	36.88	49.46	54.00	-4.54	VERTICAL	Average
8	12397.740	49.20	38.57	7.97	36.88	58.86	74.00	-15.14	VERTICAL	Peak

7.10 Duty Cycle

Test Requirement KDB 558074 D01 v05r02 section 6
Test Method: ANSI C63.10 (2013) Section 11.6

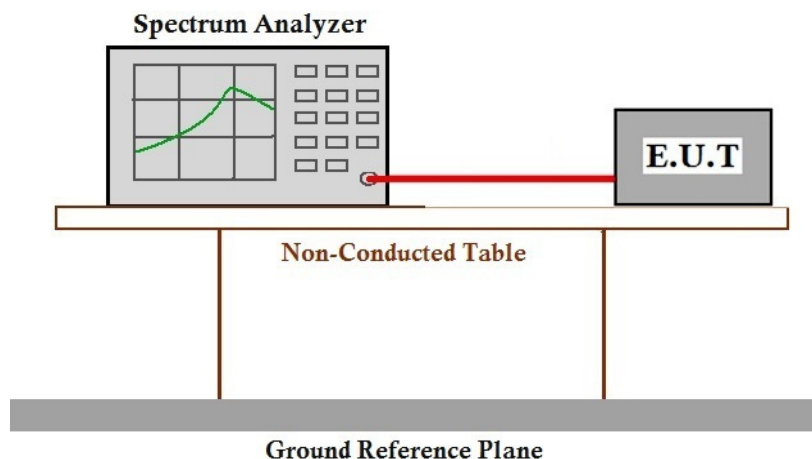
7.10.1 E.U.T. Operation

Operating Environment:
Temperature: 24.2 °C Humidity: 54.7 % RH Atmospheric Pressure: 1003 mbar

7.10.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	01	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.10.3 Test Setup Diagram



7.10.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details

8 Test Setup Photo

Refer to Appendix – Setup Photos for GZCR2203000324AT



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9 EUT Constructional Details (EUT Photos)

Refer to Appendix – External and Internal Photos for GZCR2203000324AT

10 Appendix

Clip Antenna

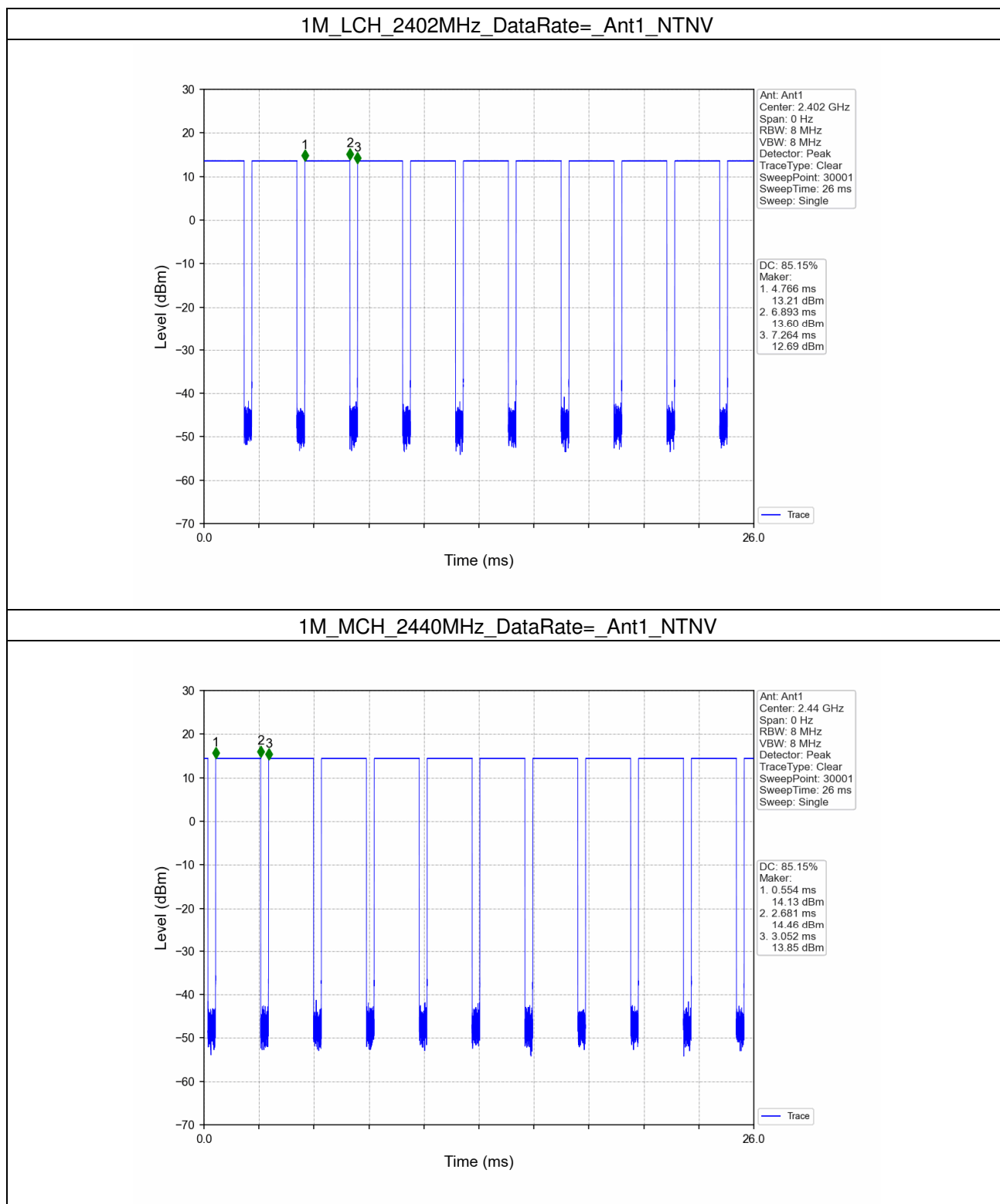
1. Duty Cycle

1.1 Ant1

1.1.1 Test Result

Ant1							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
1M	SISO	2402	2.127	2.498	85.15	0.70	0.01
		2440	2.127	2.498	85.15	0.70	0.01
		2480	2.127	2.498	85.15	0.70	0.03
2M	SISO	2402	1.071	1.875	57.12	2.43	0.03
		2440	1.071	1.876	57.09	2.43	0.03
		2480	1.071	1.875	57.12	2.43	0.03

1.1.2 Test Graph



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