

**TEST REPORT**

<b>Application No.:</b>	GZCR2202000178LM
<b>Applicant:</b>	Vanguard USA Inc.
<b>Address of Applicant:</b>	9157 East M-36 Whitmore Lake, Michigan USA
<b>Manufacturer:</b>	FOSHAN NANHAI CHEVAN OPTICAL ELECTRONICS CO., LTD
<b>Address of Manufacturer:</b>	Carp Industry Area, Dawo Danzao Town, Nanhai Foshan City, Guangdong, P.R. China
<b>Factory:</b>	GOLD EMPIRE (MYANMAR) CO., LTD
<b>Address of Factory:</b>	PLOT NO.33/1 + 33KA/2 + 34KA/1 BLOCK NO. 560, LAKEPOOT TAW VILLAGE HMAWBI T/S, YANGON MYANMAR
<b>Equipment Under Test (EUT):</b>	
<b>EUT Name:</b>	Bluetooth remote control
<b>Model No.:</b>	BT-11, BT-10 ♣
♣	Please refer to section 2 of this report which indicates which item was actually tested and which were electrically identical.
<b>Standard(s) :</b>	47 CFR Part 15, Subpart C 15.247
<b>Date of Receipt:</b>	2022-02-21
<b>Date of Test:</b>	2022-02-23 to 2022-03-09
<b>Date of Issue:</b>	2022-03-15

<b>Test Result:</b>	<b>Pass*</b>
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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	GZCR220200017802	2022-03-15	Original

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

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## 2 Test Summary

<b>Radio Spectrum Technical Requirement</b>				
<b>Item</b>	<b>Standard</b>	<b>Method</b>	<b>Requirement</b>	<b>Result</b>
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

<b>Radio Spectrum Matter Part</b>				
<b>Item</b>	<b>Standard</b>	<b>Method</b>	<b>Requirement</b>	<b>Result</b>
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.9.1	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	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Above 1GHz		ANSI C63.10 (2013) Section 6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass**

**Note:**

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

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

\*\*: The EUT passed Radiated Spurious Emissions Above 1GHz test after modifications.

**¤ Declaration of EUT Family Grouping:**

Model No.: BT-11, BT-10

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 appearance.

Therefore only one model BT-11 was tested in this report.

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## 4 General Information

### 4.1 Details of E.U.T.

Power supply:	DC 3 V (1*CR2032 size battery)
Cable(s):	None
Test Voltage:	DC 3 V
Operation Frequency:	2402MHz to 2480MHz
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	PCB Antenna
Antenna Gain:	0.55 dBi

### 4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Note Book Computer	LENOVO	ThinkPad T490	PF1D1MVJ

### 4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Peak Output Power	± 0.75dB
Minimum 6dB Bandwidth	± 3%
Power Spectrum Density	± 2.84dB
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB
Radiated Emissions which fall in the restricted bands	±5.00dB (30MHz-1GHz; 3m); ±4.38dB (30MHz-1GHz; 10m); ± 4.52dB (1GHz-6GHz); ± 4.54dB (above 6GHz)
Radiated Spurious Emissions Below 1GHz	±5.00dB (3m); ±4.38dB (10m)
Radiated Spurious Emissions Above 1GHz	±4.52dB (1GHz-6GHz); ±4.54dB (above 6GHz)

### 4.4 Test Location

All tests were performed at:

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

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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, IEC60061 and Rules of procedure IEC60062, and the relevant IEC60065 CB-Scheme Operational documents.

## 4.6 Deviation from Standards

None

## 4.7 Abnormalities from Standard Conditions

None

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## 5 Equipment List

<b>Conducted Peak Output Power</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
MI CABLE	SGS-EMC	0.8M	EMC2137	2021-11-02	2023-11-01
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-20	2022-09-19
Test Software JS1120-3	JS Tonscend	V2.6	GZE100-69	N/A	N/A
Power Meter (U2021XA_Ch2)	Agilent Technologies	U2021XA_Ch2	SEM009-02	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch3)	Agilent Technologies	U2021XA_Ch3	SEM009-03	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch1)	Agilent Technologies	U2021XA_Ch1	SEM009-01	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch4)	Agilent Technologies	U2021XA_Ch4	SEM009-04	2021-05-19	2022-05-18

<b>Minimum 6dB Bandwidth</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
MI CABLE	SGS-EMC	0.8M	EMC2137	2021-11-02	2023-11-01
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-20	2022-09-19
Test Software JS1120-3	JS Tonscend	V2.6	GZE100-69	N/A	N/A
Power Meter (U2021XA_Ch2)	Agilent Technologies	U2021XA_Ch2	SEM009-02	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch3)	Agilent Technologies	U2021XA_Ch3	SEM009-03	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch1)	Agilent Technologies	U2021XA_Ch1	SEM009-01	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch4)	Agilent Technologies	U2021XA_Ch4	SEM009-04	2021-05-19	2022-05-18

<b>Power Spectrum Density</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
MI CABLE	SGS-EMC	0.8M	EMC2137	2021-11-02	2023-11-01
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-20	2022-09-19
Test Software JS1120-3	JS Tonscend	V2.6	GZE100-69	N/A	N/A
Power Meter (U2021XA_Ch2)	Agilent Technologies	U2021XA_Ch2	SEM009-02	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch3)	Agilent Technologies	U2021XA_Ch3	SEM009-03	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch1)	Agilent Technologies	U2021XA_Ch1	SEM009-01	2021-05-19	2022-05-18

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Power Meter (U2021XA_Ch4)	Agilent Technologies	U2021XA_Ch4	SEM009-04	2021-05-19	2022-05-18
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**Conducted Band Edges Measurement**

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
MI CABLE	SGS-EMC	0.8M	EMC2137	2021-11-02	2023-11-01
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-20	2022-09-19
Test Software JS1120-3	JS Tonscend	V2.6	GZE100-69	N/A	N/A
Power Meter (U2021XA_Ch2)	Agilent Technologies	U2021XA_Ch2	SEM009-02	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch3)	Agilent Technologies	U2021XA_Ch3	SEM009-03	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch1)	Agilent Technologies	U2021XA_Ch1	SEM009-01	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch4)	Agilent Technologies	U2021XA_Ch4	SEM009-04	2021-05-19	2022-05-18

**Conducted Spurious Emissions**

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
MI CABLE	SGS-EMC	0.8M	EMC2137	2021-11-02	2023-11-01
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-20	2022-09-19
Test Software JS1120-3	JS Tonscend	V2.6	GZE100-69	N/A	N/A
Power Meter (U2021XA_Ch2)	Agilent Technologies	U2021XA_Ch2	SEM009-02	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch3)	Agilent Technologies	U2021XA_Ch3	SEM009-03	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch1)	Agilent Technologies	U2021XA_Ch1	SEM009-01	2021-05-19	2022-05-18
Power Meter (U2021XA_Ch4)	Agilent Technologies	U2021XA_Ch4	SEM009-04	2021-05-19	2022-05-18

**Radiated Emissions which fall in the restricted bands**

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

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EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-20	2022-09-19
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2021-11-01	2022-10-31
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

**Radiated Spurious 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	2021-05-19	2022-05-18
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2020-04-16	2022-04-15
EMI Test Receiver (1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2220	2021-05-26	2022-05-25
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Trilog Broadband Antenna (25MHz-1GHz)-Lab	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	SEM003-18	2019-02-22	2022-02-22

**Radiated Spurious 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
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-20	2022-09-19
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2021-11-01	2022-10-31
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
Notch Filter (5150-5880)	Mico-Tronics	BRM50716	EMC2168	2021-07-29	2022-07-28
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

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**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

Standard 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.

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 main PCB and no consideration of replacement. The best case gain of the antenna is 0.55 dBi.

Antenna location: Refer to internal photo.

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## 7 Radio Spectrum Matter Test Results

### 7.1 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

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for $\geq 50$ hopping channels
	0.25 for $25 \leq$ hopping channels $< 50$
	1 for digital modulation
2400-2483.5	1 for $\geq 75$ 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

#### 7.1.1 E.U.T. Operation

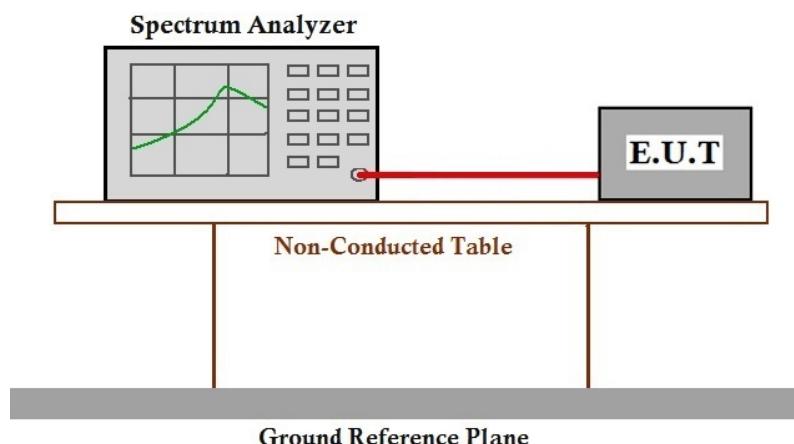
Operating Environment:

Temperature: 22.0 °C      Humidity: 51.0 % RH      Atmospheric Pressure: 1008 mbar

#### 7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

#### 7.1.3 Test Setup Diagram



#### 7.1.4 Measurement Procedure and Data

Please Refer to Appendix for Details

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## 7.2 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

### 7.2.1 E.U.T. Operation

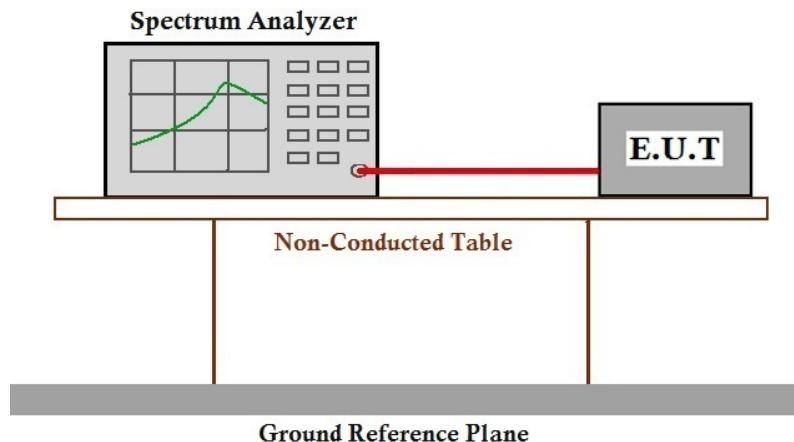
Operating Environment:

Temperature: 22.0 °C      Humidity: 51.0 % RH      Atmospheric Pressure: 1008 mbar

### 7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.2.3 Test Setup Diagram



### 7.2.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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### 7.3 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

#### 7.3.1 E.U.T. Operation

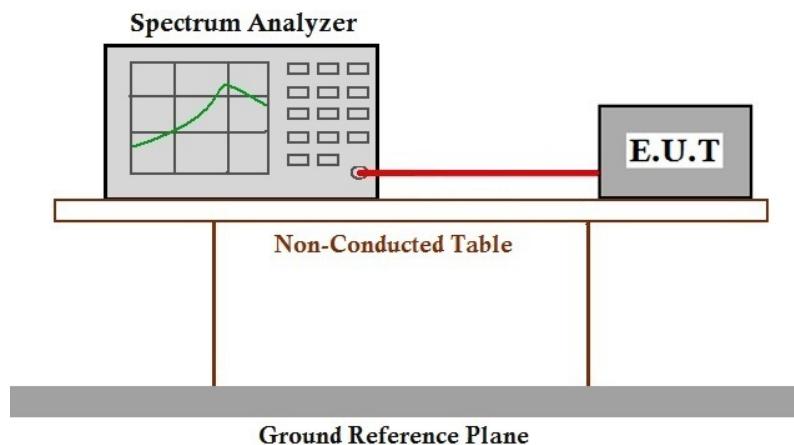
Operating Environment:

Temperature: 22.0 °C      Humidity: 51.0 % RH      Atmospheric Pressure: 1008 mbar

#### 7.3.2 Test Mode Description

Pre-scan / Mode Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

#### 7.3.3 Test Setup Diagram



#### 7.3.4 Measurement Procedure and Data

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## 7.4 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)).

### 7.4.1 E.U.T. Operation

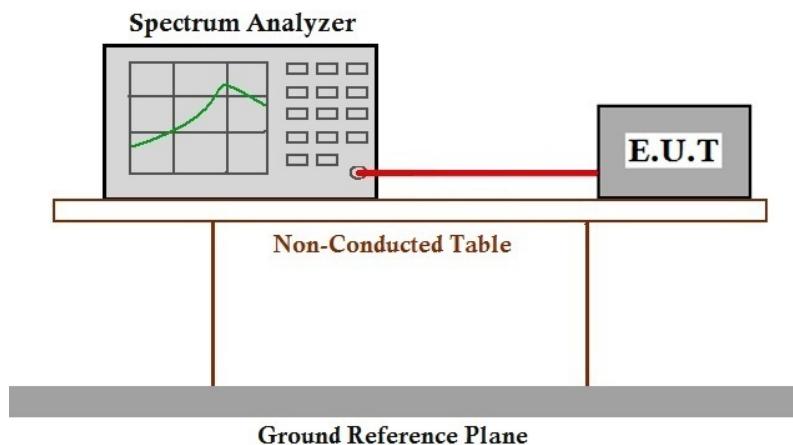
Operating Environment:

Temperature: 22.0 °C      Humidity: 51.0 % RH      Atmospheric Pressure: 1008 mbar

### 7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.4.3 Test Setup Diagram



### 7.4.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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## 7.5 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)).

### 7.5.1 E.U.T. Operation

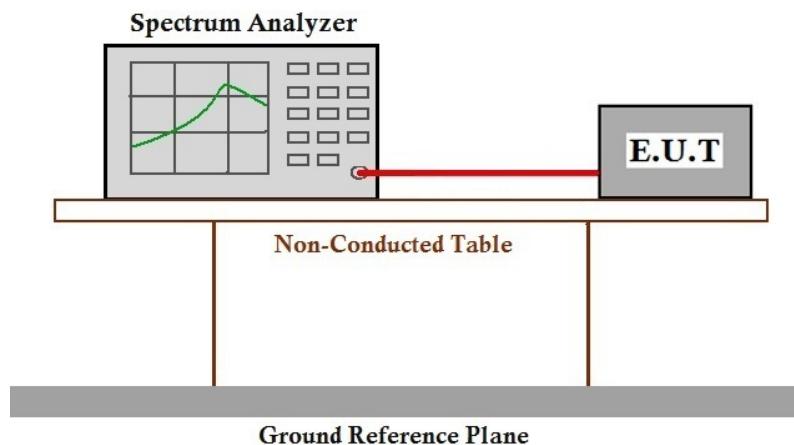
Operating Environment:

Temperature: 22.0 °C      Humidity: 51.0 % RH      Atmospheric Pressure: 1008 mbar

### 7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

### 7.5.3 Test Setup Diagram



### 7.5.4 Measurement Procedure and Data

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**7.6 Radiated Emissions which fall in the restricted bands**

Test Requirement 47 CFR Part 15, Subpart C 15.205 &amp; 15.209

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

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
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.

**7.6.1 E.U.T. Operation**

Operating Environment:

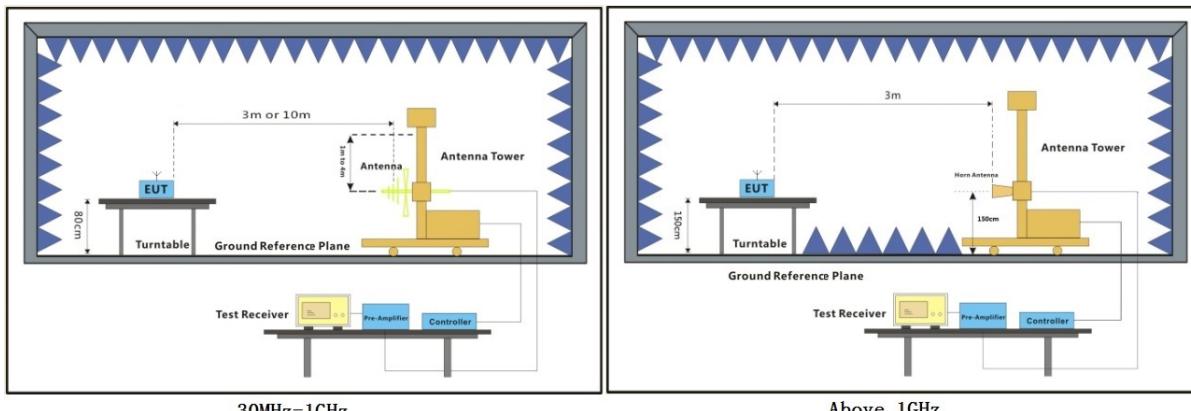
Temperature: 21.6 °C

Humidity: 68.0 % RH

Atmospheric Pressure: 1014 mbar

**7.6.2 Test Mode Description**

Pre-scan / Mode Final test	Mode Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

**7.6.3 Test Setup Diagram**

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**7.6.4 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 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 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.

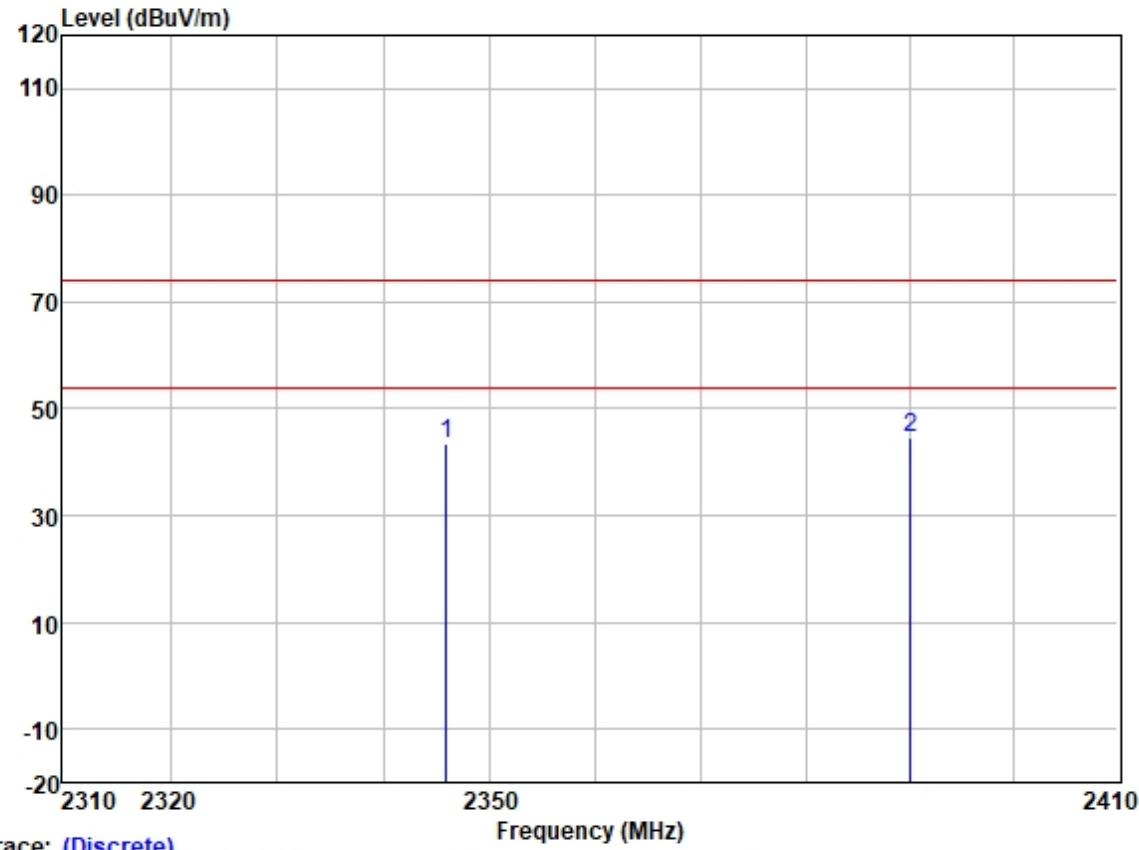
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Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:Low



Race: (Discrete)

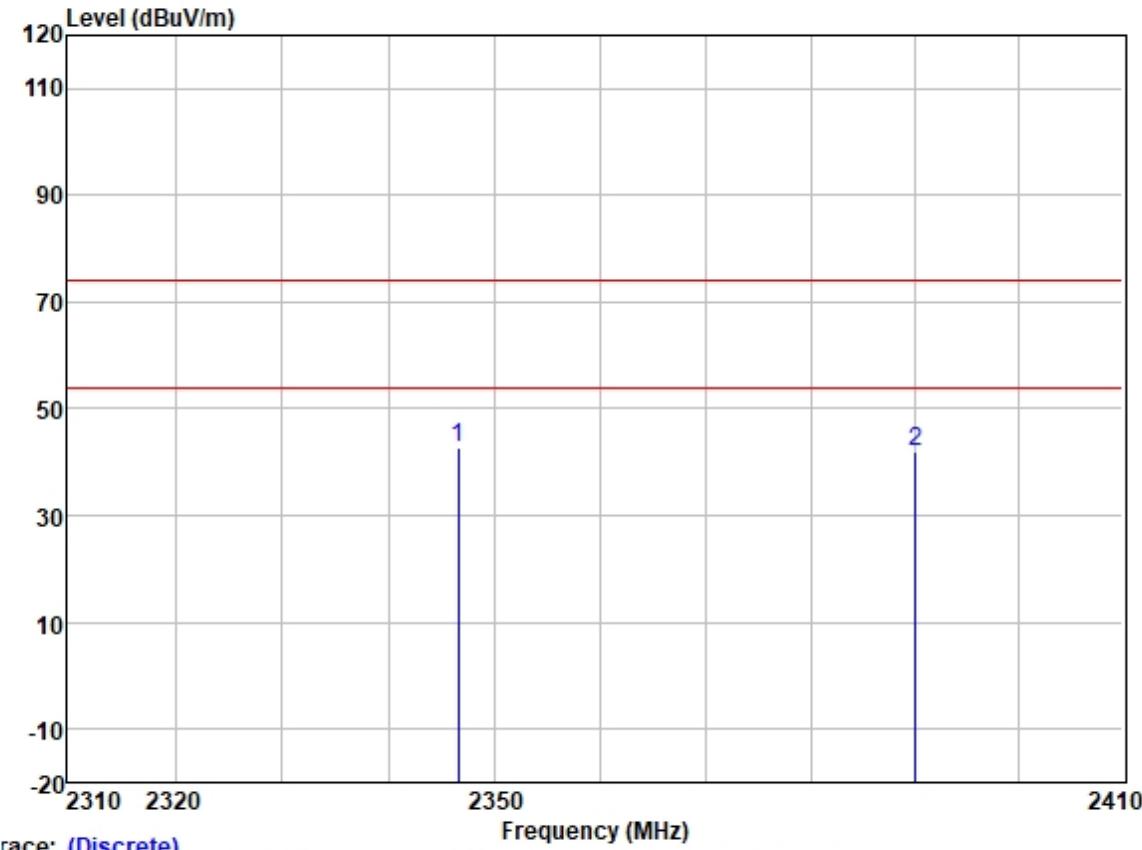
Freq	ReadAntenna		Cable		Preamp		Limit	Over	Line	Limit	Pol/Phase	Remark
	MHz	Level	Factor	Loss	Factor	Level	dBuV/m	dBuV/m	dB			
1	2345.910	49.78	27.24	3.48	37.14	43.36	74.00	-30.64	VERTICAL		Peak	
2	2390.000	50.93	27.33	3.50	37.13	44.63	74.00	-29.37	VERTICAL		Peak	



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



Race: (Discrete)

Freq	ReadAntenna		Cable		Preamp		Limit	Over	Line	Limit	Pol/Phase	Remark
	Level	Factor	Loss	Factor	Level	dBuV/m						
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB					
1 2346.507	49.27	27.24	3.48	37.14	42.85	74.00	-31.15	HORIZONTAL	Peak			
2 2390.000	48.12	27.33	3.50	37.13	41.82	74.00	-32.18	HORIZONTAL	Peak			

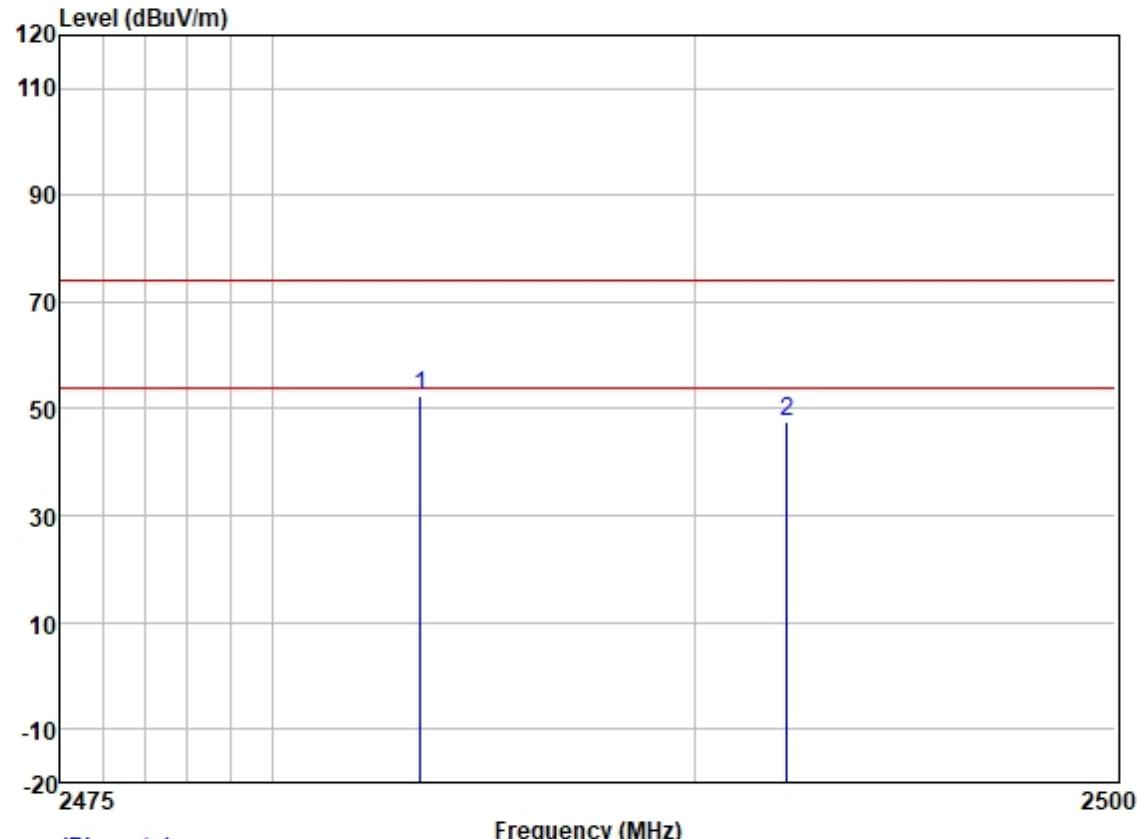
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Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High



Race: (Discrete)

Freq	ReadAntenna	Cable	Preamp	Limit	Over	Limit	Over	Pol/Phase	Remark
	Freq	Level	Factor						
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	dB	
1 2483.500	58.46	27.48	3.54	37.11	52.37	74.00	-21.63	VERTICAL	Peak
2 2492.173	53.82	27.49	3.54	37.10	47.75	74.00	-26.25	VERTICAL	Peak

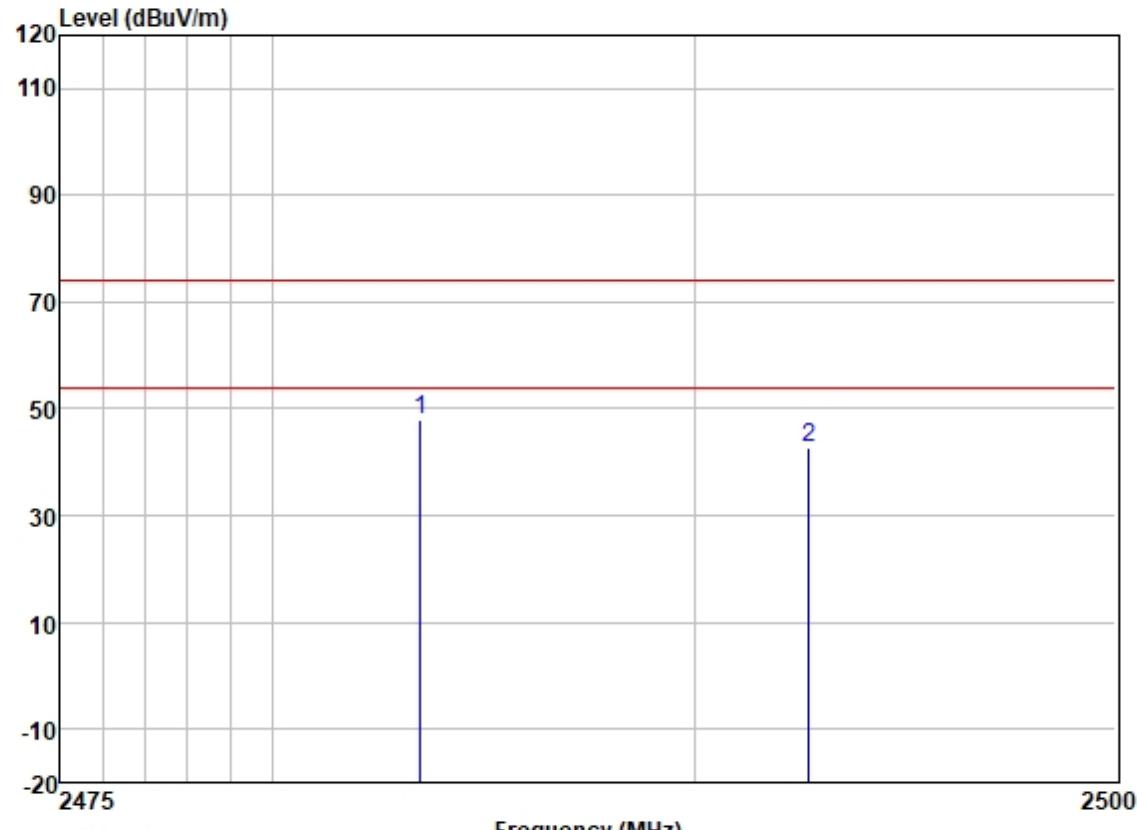
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Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:High

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**7.7 Radiated Spurious Emissions Below 1GHz**

Test Requirement 47 CFR Part 15, Subpart C 15.205 &amp; 15.209

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

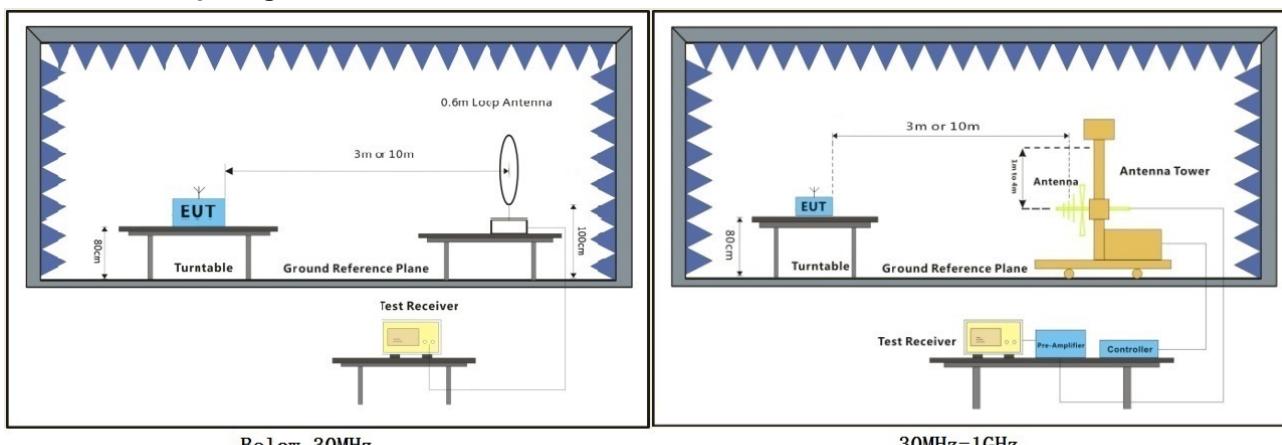
**7.7.1 E.U.T. Operation**

Operating Environment:

Temperature: 23 °C      Humidity: 52 % RH      Atmospheric Pressure: 1014 mbar

**7.7.2 Test Mode Description**

Pre-scan / Final test	Mode / Code	Description
Final test	02	TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation.

**7.7.3 Test Setup Diagram**

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**7.7.4 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 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.

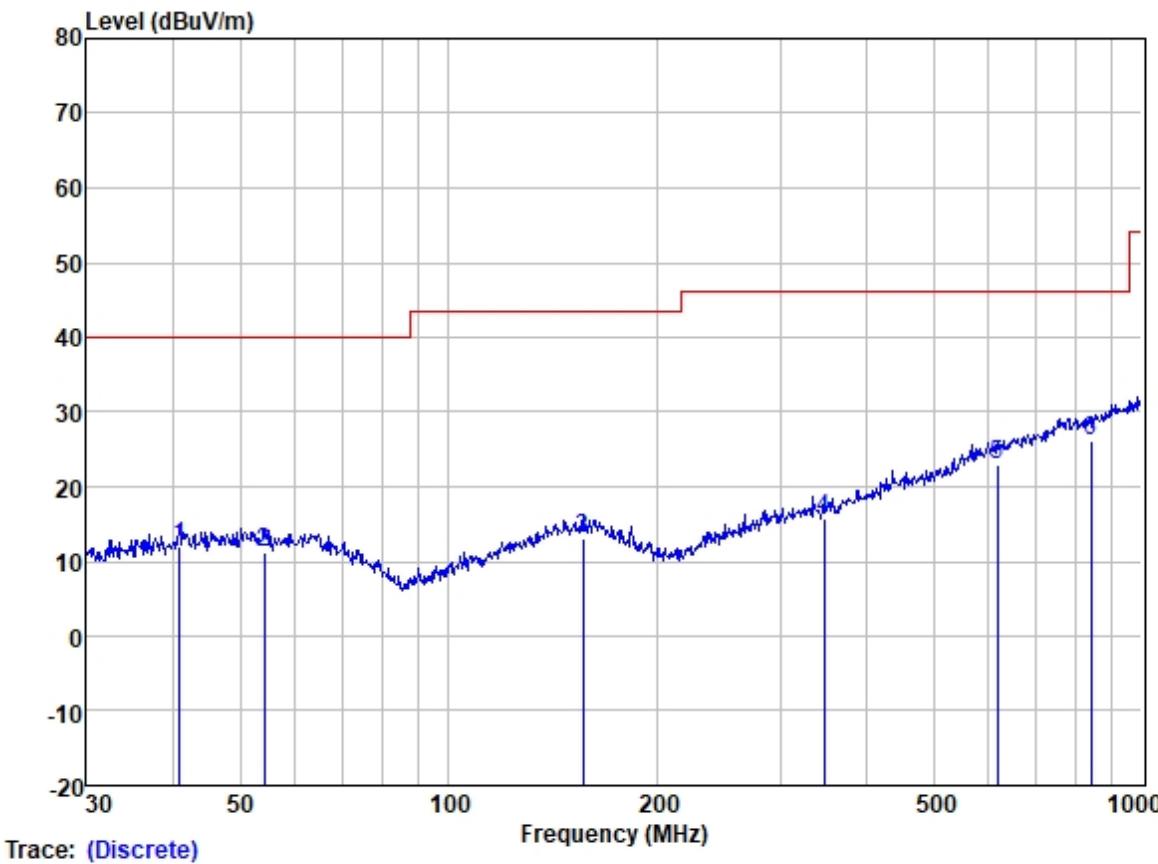
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Test Mode: 02; Polarity: Horizontal



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

Freq	Read	Antenna	Cable	Preamp	Measured	Limit	Over	Pol/	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	Phase	
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 40.845	24.74	13.32	1.10	27.18	11.98	40.00	-28.02	HORIZONTAL	QP
2 54.071	23.60	13.70	1.18	27.17	11.31	40.00	-28.69	HORIZONTAL	QP
3 155.910	24.15	13.44	2.30	26.81	13.08	43.50	-30.42	HORIZONTAL	QP
4 348.027	24.84	14.18	3.59	26.96	15.65	46.00	-30.35	HORIZONTAL	QP
5 618.537	25.98	19.85	5.28	28.20	22.91	46.00	-23.09	HORIZONTAL	QP
6 842.130	25.33	22.42	6.46	27.96	26.25	46.00	-19.75	HORIZONTAL	QP

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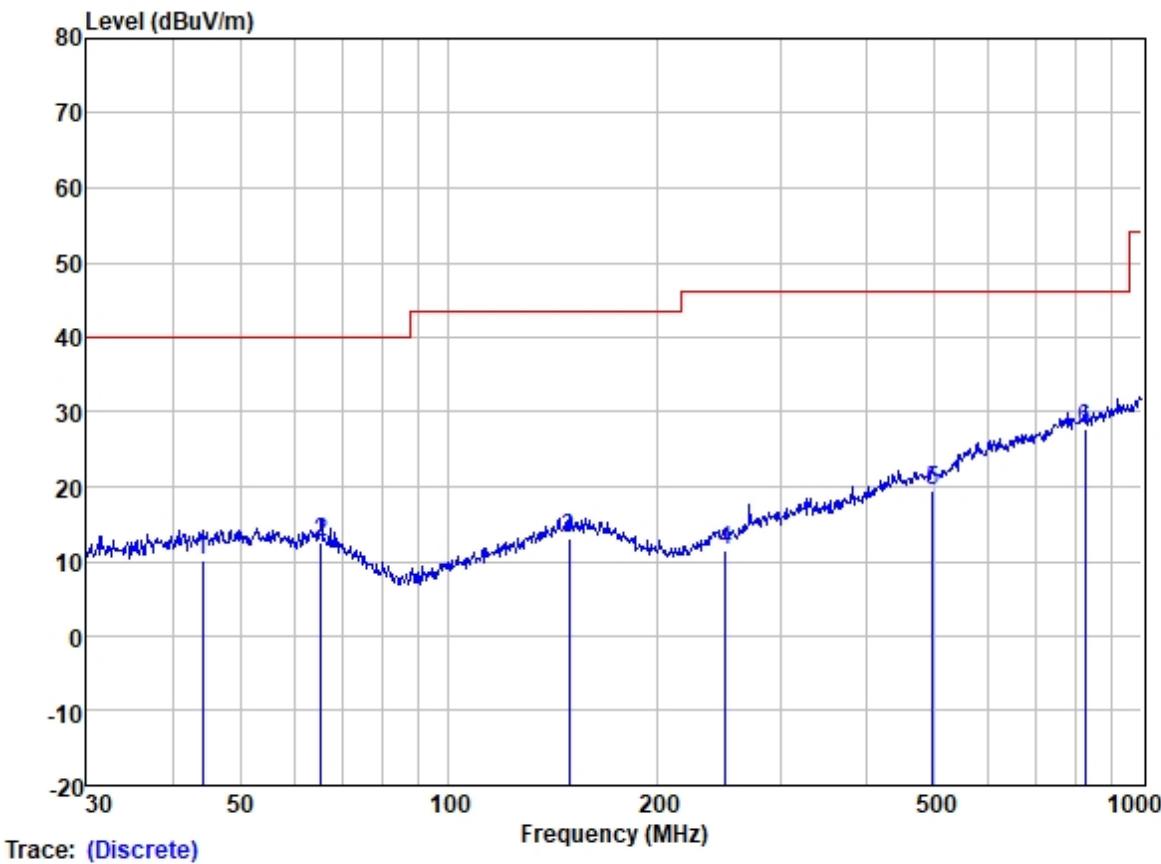
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Test Mode: 02; Polarity: Vertical



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

Freq	Read	Antenna	Cable	Preamp	Measured	Limit	Over	Pol/	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	Phase	
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 44.120	22.68	13.61	1.12	27.17	10.24	40.00	-29.76	VERTICAL	QP
2 65.343	25.49	12.80	1.35	27.15	12.49	40.00	-27.51	VERTICAL	QP
3 148.963	24.14	13.47	2.22	26.84	12.99	43.50	-30.51	VERTICAL	QP
4 250.301	23.53	11.70	2.92	26.62	11.53	46.00	-34.47	VERTICAL	QP
5 497.677	25.40	17.58	4.39	27.97	19.40	46.00	-26.60	VERTICAL	QP
6 827.493	26.99	22.40	6.38	27.99	27.78	46.00	-18.22	VERTICAL	QP

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**7.8 Radiated Spurious Emissions Above 1GHz**

Test Requirement 47 CFR Part 15, Subpart C 15.205 &amp; 15.209

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

Limit:

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

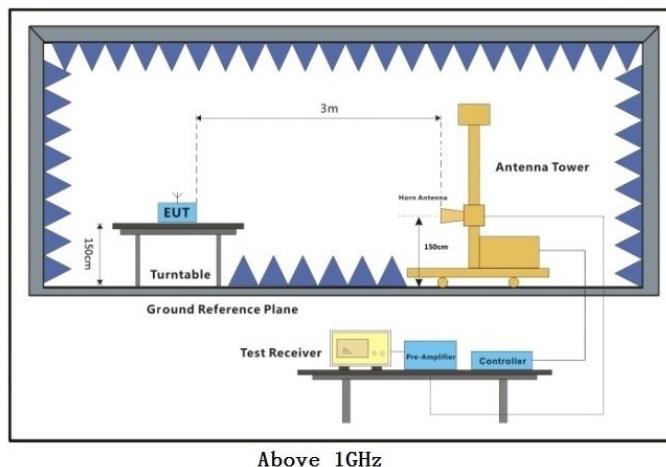
**7.8.1 E.U.T. Operation**

Operating Environment:

Temperature: 21.6 °C      Humidity: 68.0 % RH      Atmospheric Pressure: 1014 mbar

**7.8.2 Test Mode Description**

Pre-scan / Final test	Mode Code	Description
Final test	02	TX mode _Keep the EUT in continuously transmitting mode with GFSK modulation.

**7.8.3 Test Setup Diagram**

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**7.8.4 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 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. 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.



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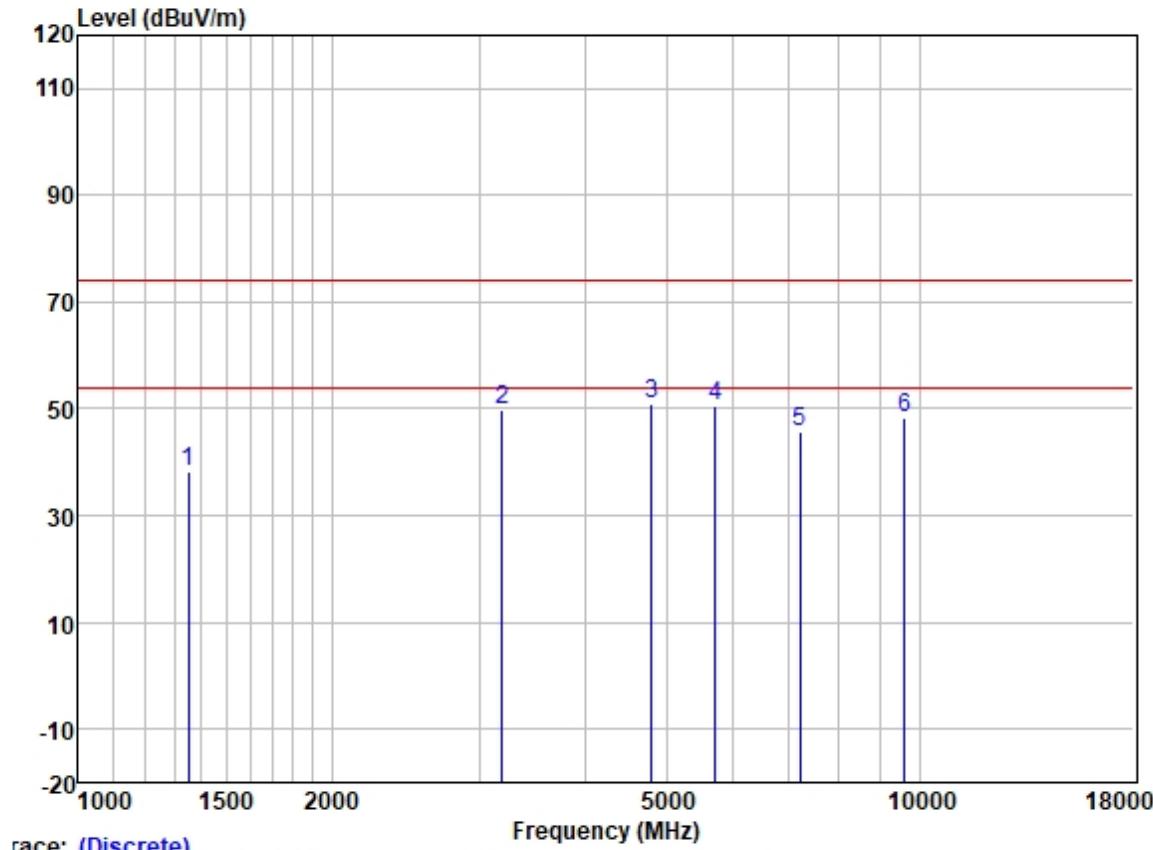
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Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:Low



Race: (Discrete)

	ReadAntenna		Cable		Preamp	Limit	Over	Line	Limit	Pol/Phase	Remark
	Freq	Level	Factor	Loss							
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	dB		
1	1350.667	47.74	25.31	2.70	37.56	38.19	74.00	-35.81	VERTICAL	peak	
2	3186.869	54.02	28.57	4.12	36.79	49.92	74.00	-24.08	VERTICAL	peak	
3	4804.000	51.12	31.42	5.20	36.63	51.11	74.00	-22.89	VERTICAL	peak	
4	5713.856	49.32	32.04	5.76	36.69	50.43	74.00	-23.57	VERTICAL	peak	
5	7206.000	40.40	35.54	6.68	36.77	45.85	74.00	-28.15	VERTICAL	peak	
6	9608.000	39.78	38.37	7.50	37.15	48.50	74.00	-25.50	VERTICAL	peak	

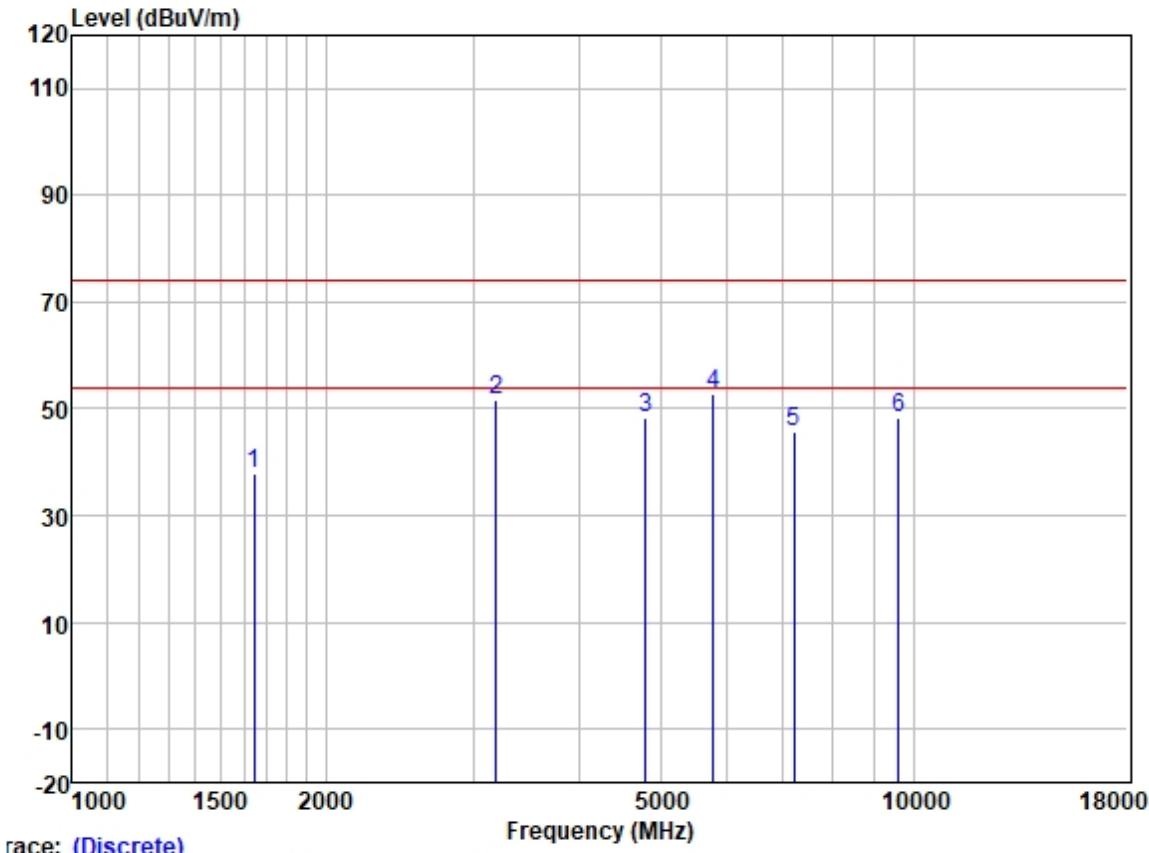
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Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Race: (Discrete)

	ReadAntenna		Cable		Preamp	Limit	Over	Line	Limit	Pol/Phase	Remark
	Freq	Level	Factor	Loss							
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	dB		
1	1644.019	46.64	25.63	2.87	37.35	37.79	74.00	-36.21	HORIZONTAL	peak	
2	3186.869	55.73	28.57	4.12	36.79	51.63	74.00	-22.37	HORIZONTAL	peak	
3	4804.000	48.43	31.42	5.20	36.63	48.42	74.00	-25.58	HORIZONTAL	peak	
4	5780.300	51.35	32.16	5.84	36.69	52.66	74.00	-21.34	HORIZONTAL	peak	
5	7206.000	40.26	35.54	6.68	36.77	45.71	74.00	-28.29	HORIZONTAL	peak	
6	9608.000	39.66	38.37	7.50	37.15	48.38	74.00	-25.62	HORIZONTAL	peak	

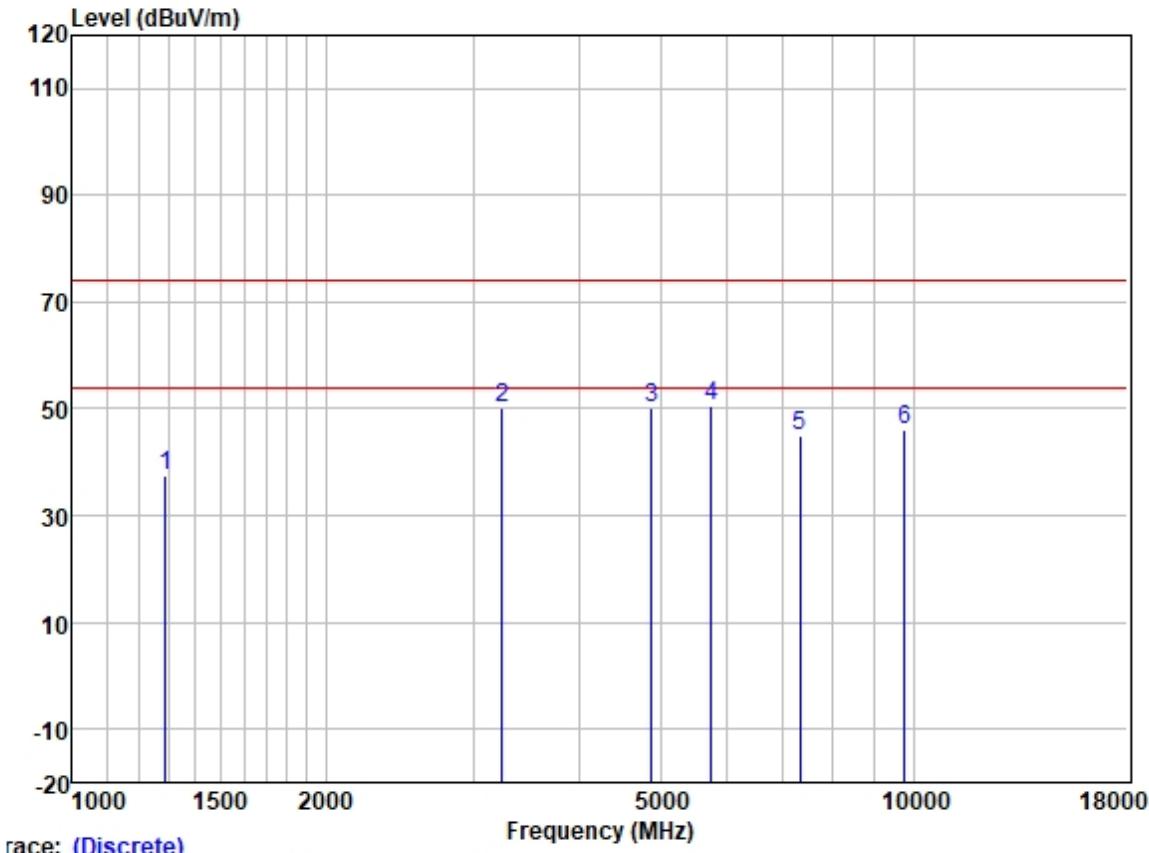
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Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:middle



Mode: (Discrete)

	ReadAntenna		Cable Preamp		Limit	Over	Line	Limit	Pol/Phase	Remark
	Freq	Level	Factor	Loss	Factor					
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1289.627	47.43	25.17	2.64	37.60	37.64	74.00	-36.36	VERTICAL	peak
2	3242.619	53.95	28.67	4.18	36.77	50.03	74.00	-23.97	VERTICAL	peak
3	4880.000	49.86	31.54	5.27	36.64	50.03	74.00	-23.97	VERTICAL	peak
4	5746.982	49.46	32.10	5.80	36.69	50.67	74.00	-23.33	VERTICAL	peak
5	7320.000	38.99	36.00	6.61	36.77	44.83	74.00	-29.17	VERTICAL	peak
6	9760.000	37.10	38.50	7.62	37.17	46.05	74.00	-27.95	VERTICAL	peak

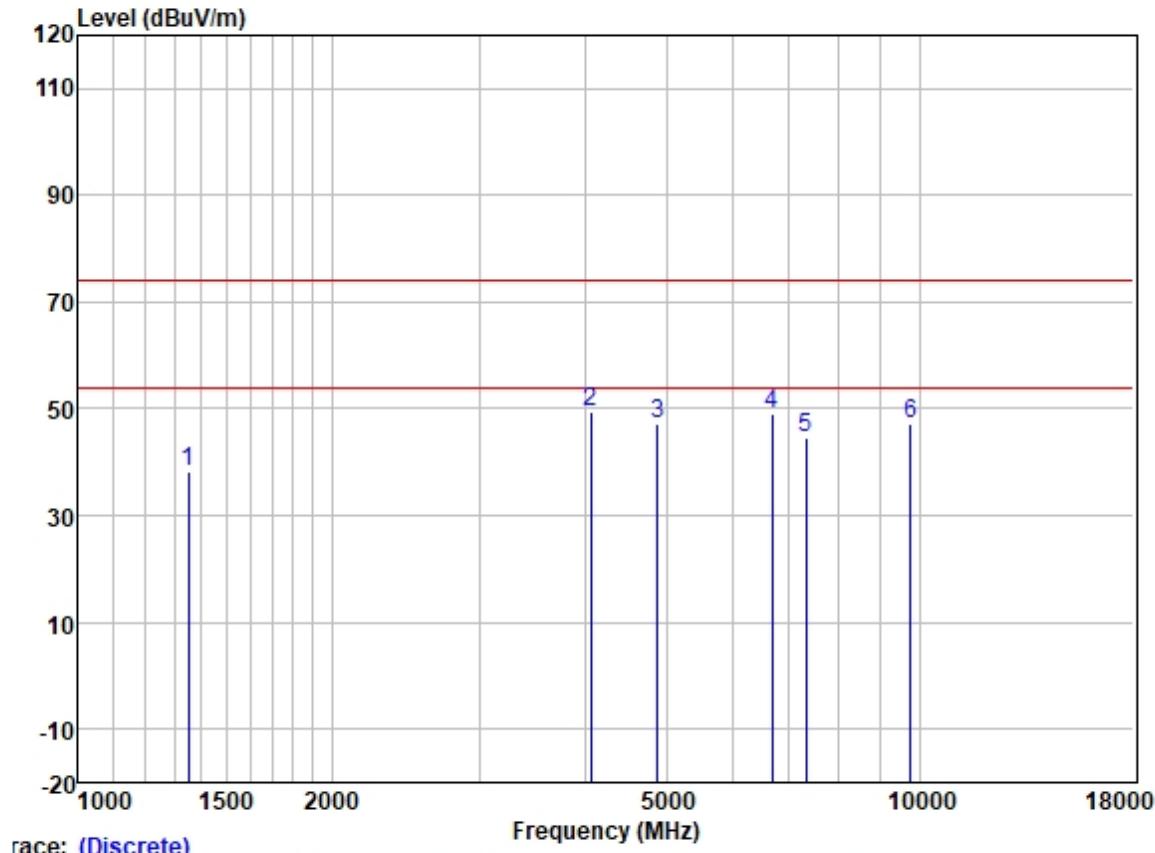
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Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; Channel:middle



	Freq	ReadAntenna		Cable		Preamp	Limit	Over	Line	Limit	Pol/Phase	Remark
		Level	Factor	Loss	Factor							
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB				
1	1350.667	47.96	25.31	2.70	37.56	38.41	74.00	-35.59	HORIZONTAL	peak		
2	4062.629	51.15	29.88	5.00	36.60	49.43	74.00	-24.57	HORIZONTAL	peak		
3	4880.000	47.10	31.54	5.27	36.64	47.27	74.00	-26.73	HORIZONTAL	peak		
4	6679.040	44.80	34.33	6.61	36.72	49.02	74.00	-24.98	HORIZONTAL	peak		
5	7320.000	38.64	36.00	6.61	36.77	44.48	74.00	-29.52	HORIZONTAL	peak		
6	9760.000	38.18	38.50	7.62	37.17	47.13	74.00	-26.87	HORIZONTAL	peak		

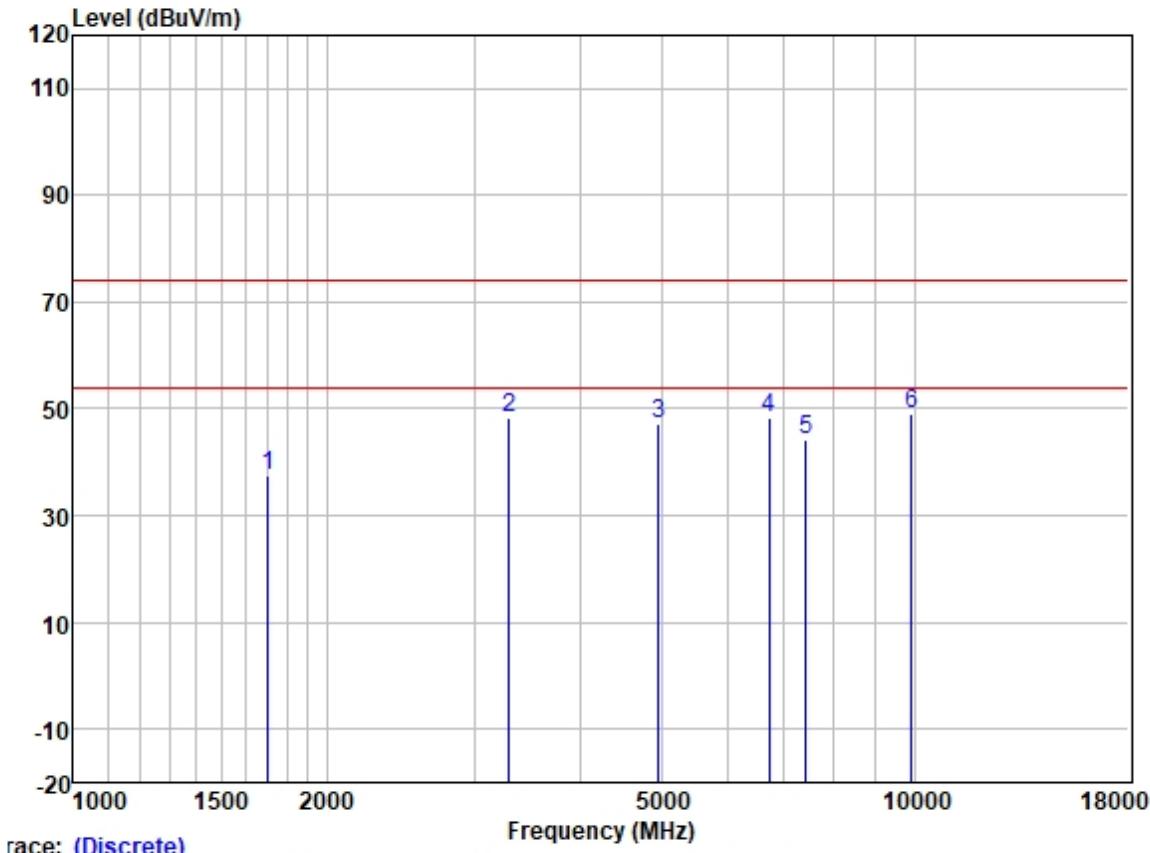
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Test Mode: 02; Polarity: Vertical; Modulation:GFSK; Channel:High

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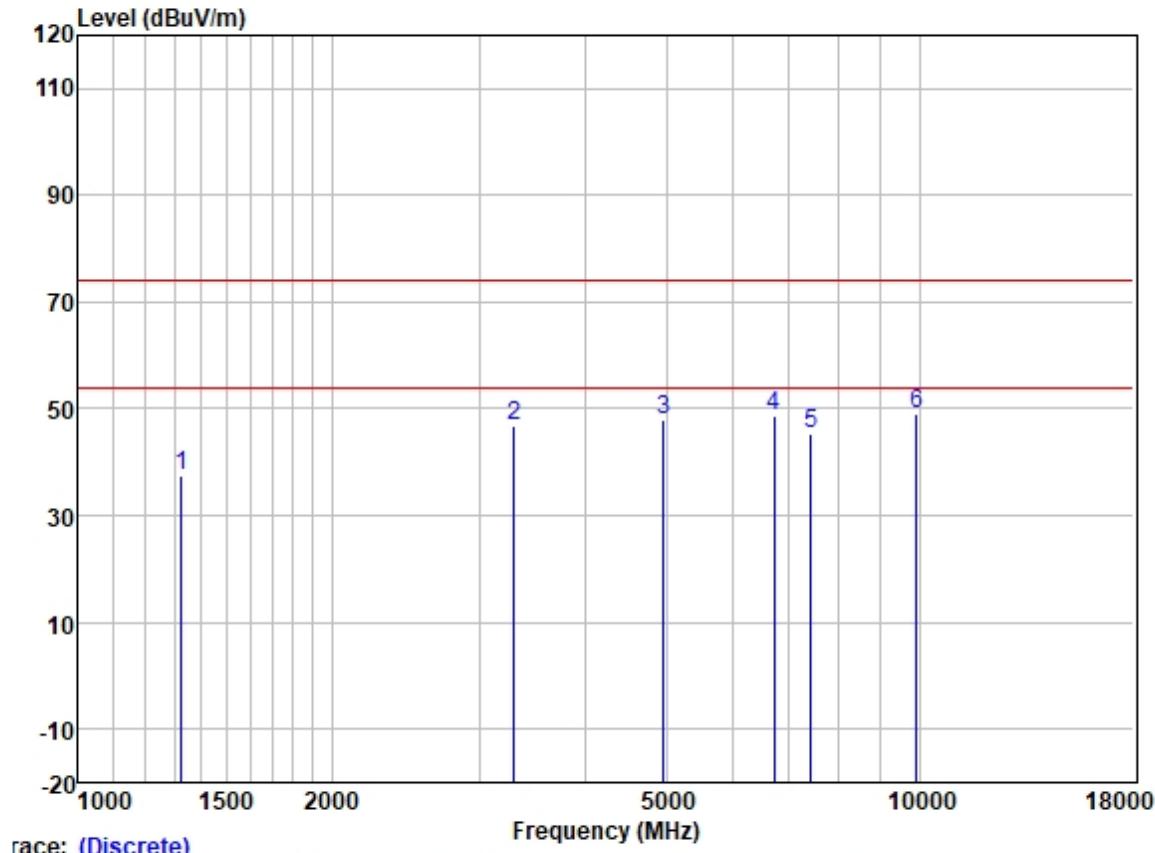
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## 8 Test Setup Photo

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## 9 EUT Constructional Details (EUT Photos)

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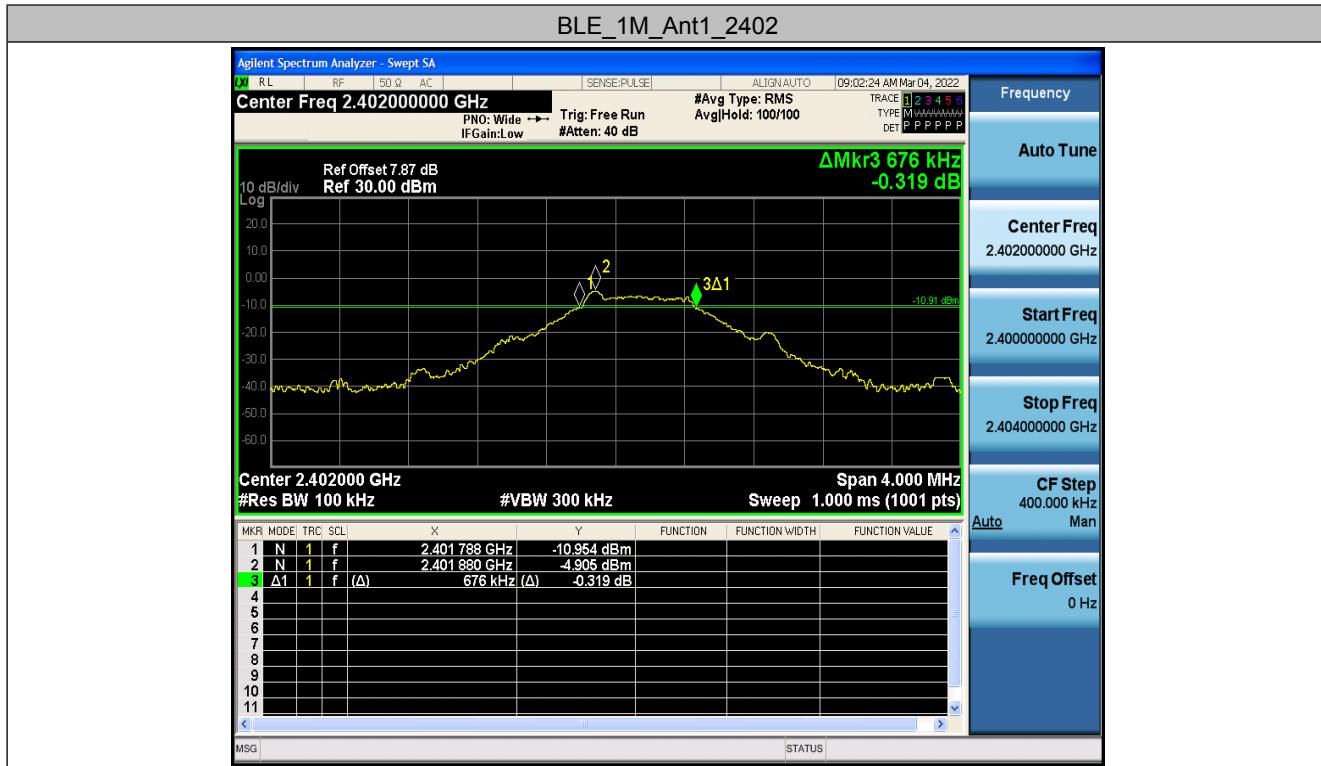
## 10 Appendix

### 10.1 Appendix A: DTS Bandwidth

#### 10.1.1 Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.676	2401.788	2402.464	>=0.5	PASS
		2440	0.664	2439.792	2440.456	>=0.5	PASS
		2480	0.660	2479.808	2480.468	>=0.5	PASS

#### 10.1.2 Test Graphs



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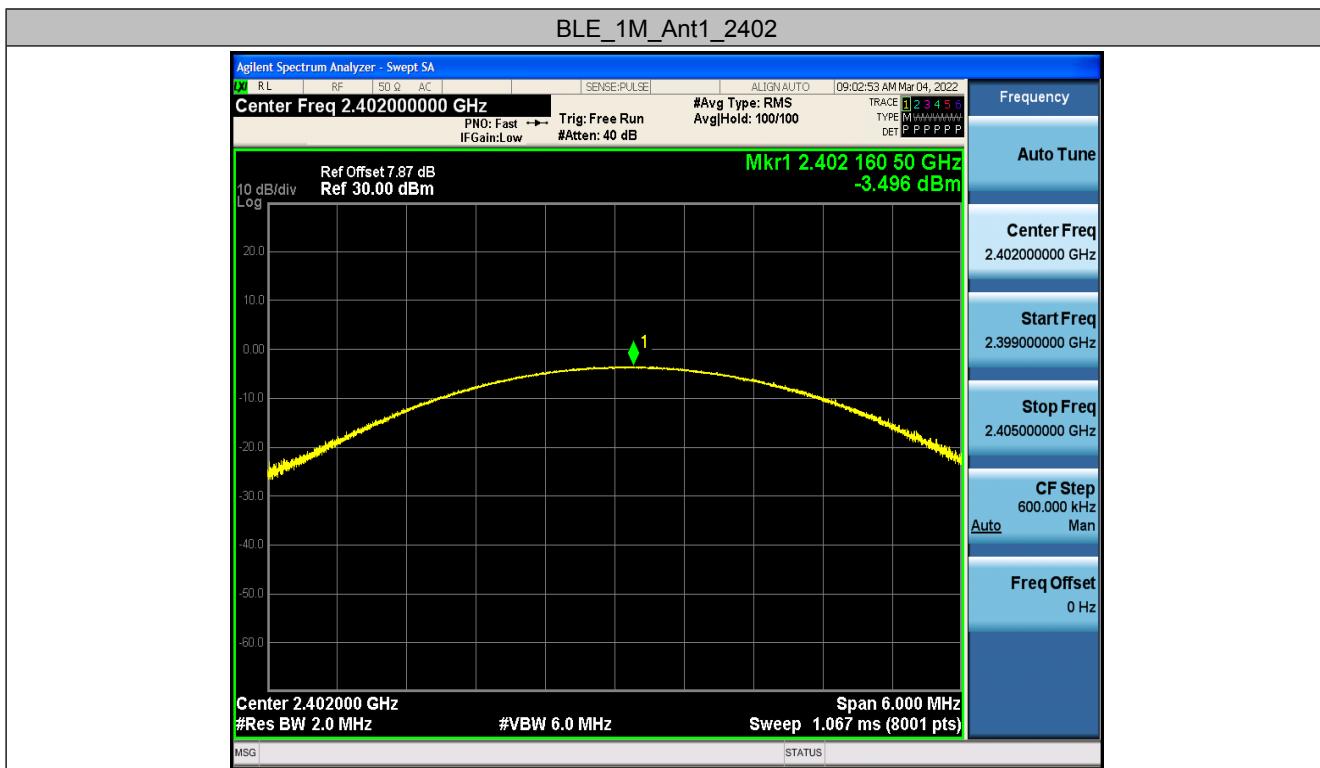
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**10.2 Appendix B: Maximum conducted output power****10.2.1 Test Result**

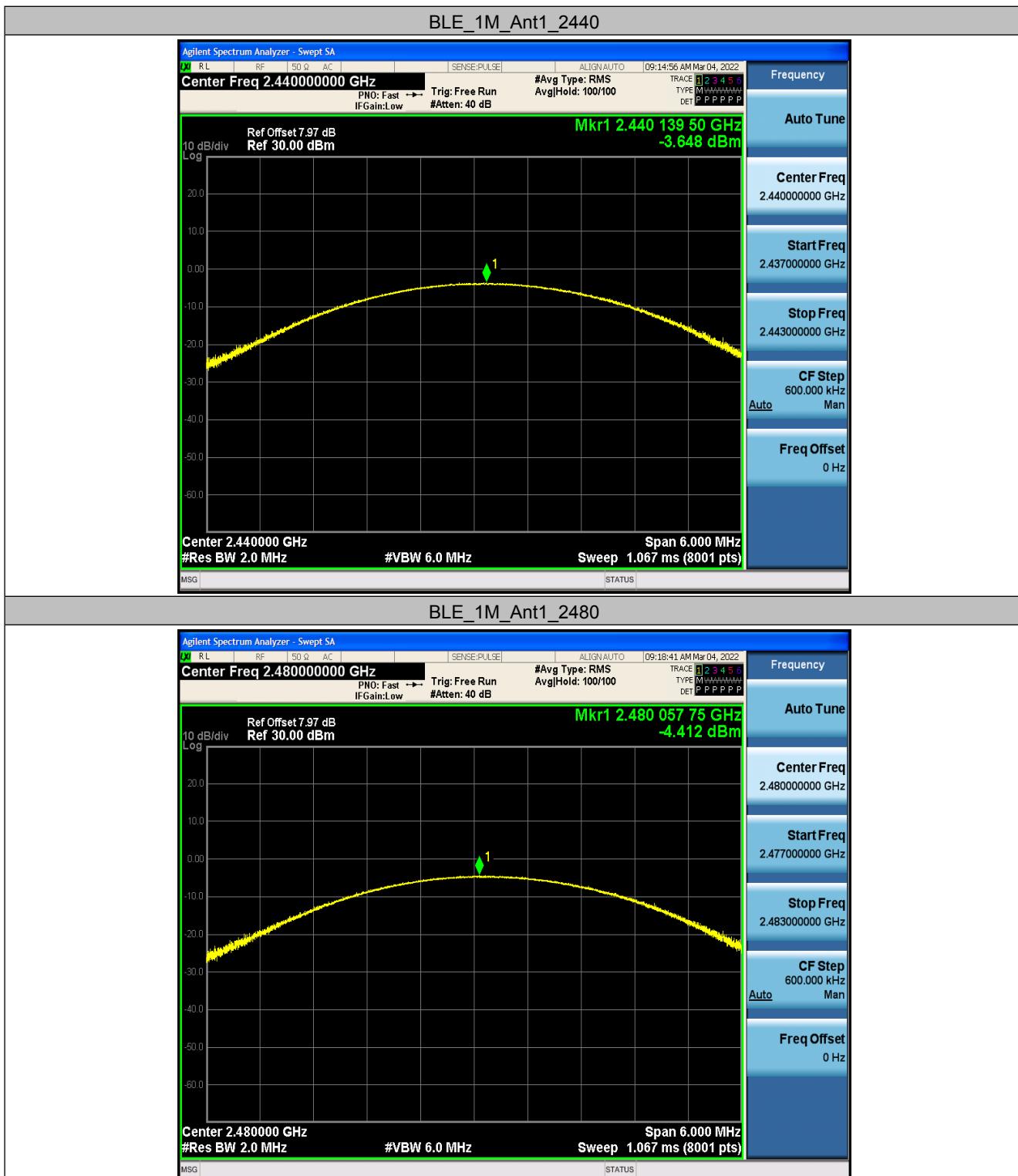
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	-3.5	<=30	PASS
		2440	-3.65	<=30	PASS
		2480	-4.41	<=30	PASS

**10.2.2 Test Graphs**

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**10.3 Appendix C: Maximum power spectral density****10.3.1 Test Result**

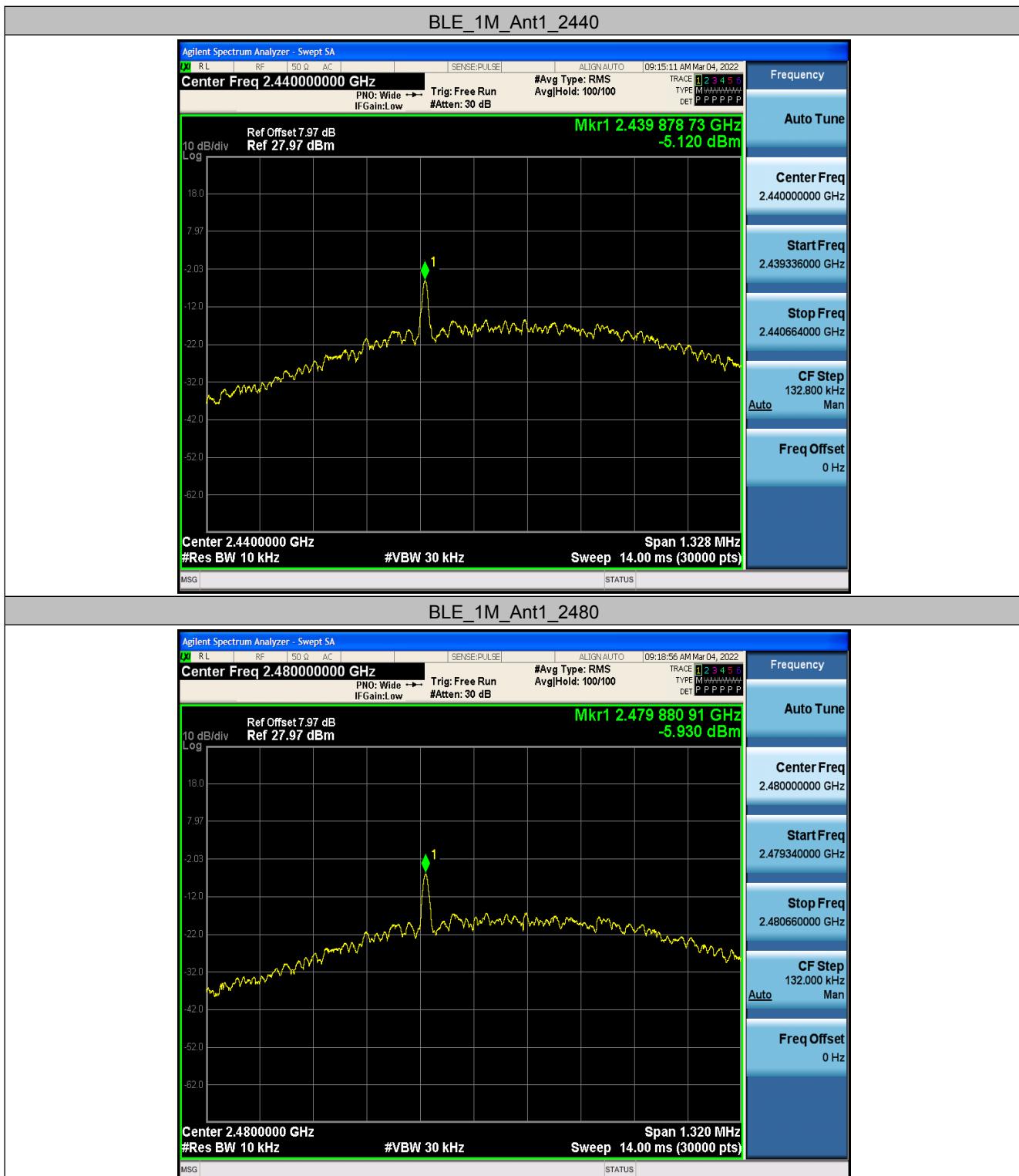
TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-4.91	<=8	PASS
		2440	-5.12	<=8	PASS
		2480	-5.93	<=8	PASS

**10.3.2 Test Graphs**

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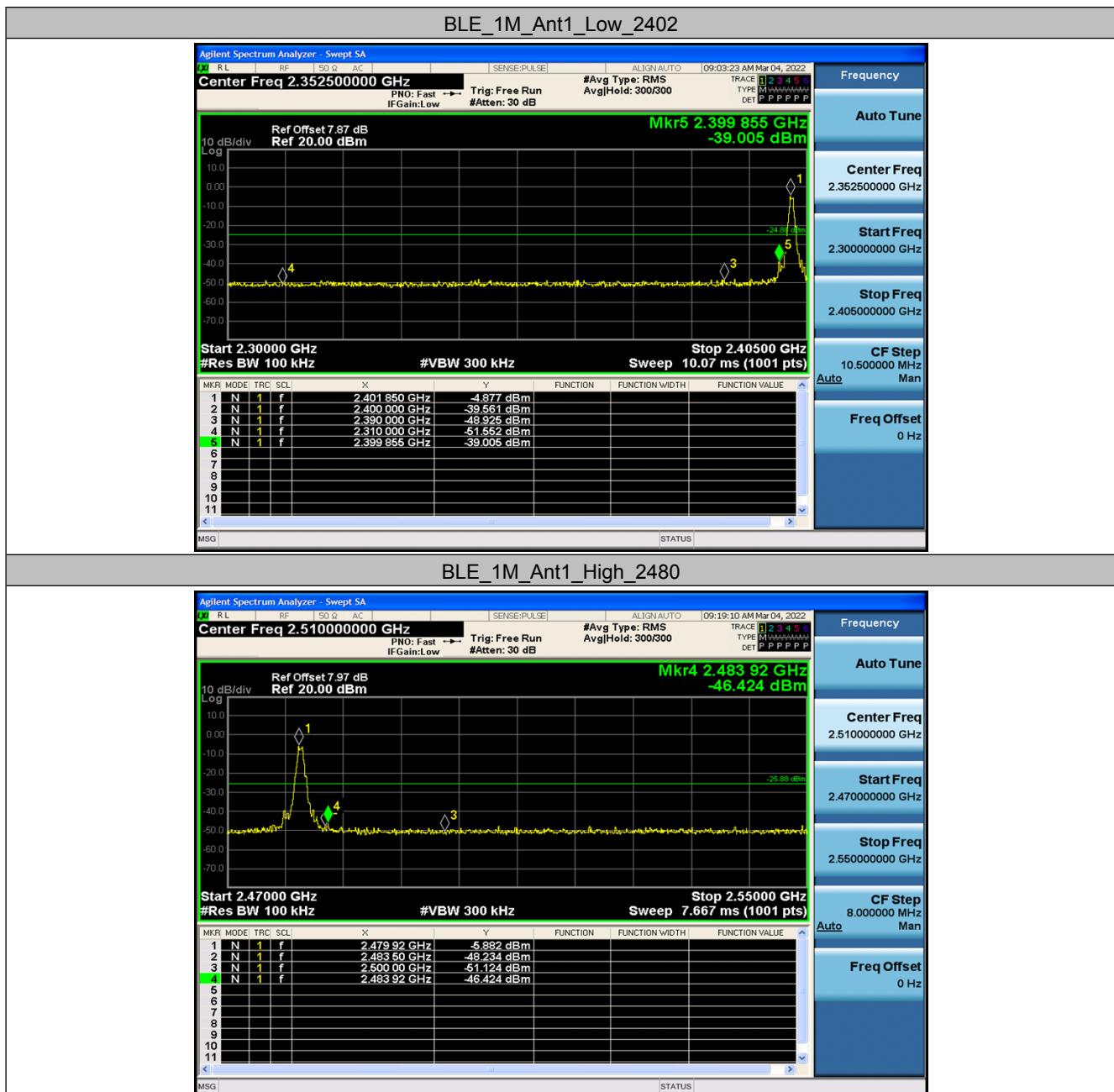
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## 10.4 Appendix D: Band edge measurements

## 10.4.1 Test Result

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	-4.88	-39.01	<=-24.88	PASS
		High	2480	-5.88	-46.42	<=-25.88	PASS

## 10.4.2 Test Graphs



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**10.5 Appendix E: Conducted Spurious Emission****10.5.1 Test Result**

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	-4.89	-4.89	---	PASS
			30~1000	---	-57.844	<=-24.893	PASS
			1000~26500	---	-39.676	<=-24.893	PASS
		2440	Reference	-5.09	-5.09	---	PASS
			30~1000	---	-57.347	<=-25.09	PASS
			1000~26500	---	-40.561	<=-25.09	PASS
		2480	Reference	-5.91	-5.91	---	PASS
			30~1000	---	-57.182	<=-25.913	PASS
			1000~26500	---	-40.025	<=-25.913	PASS

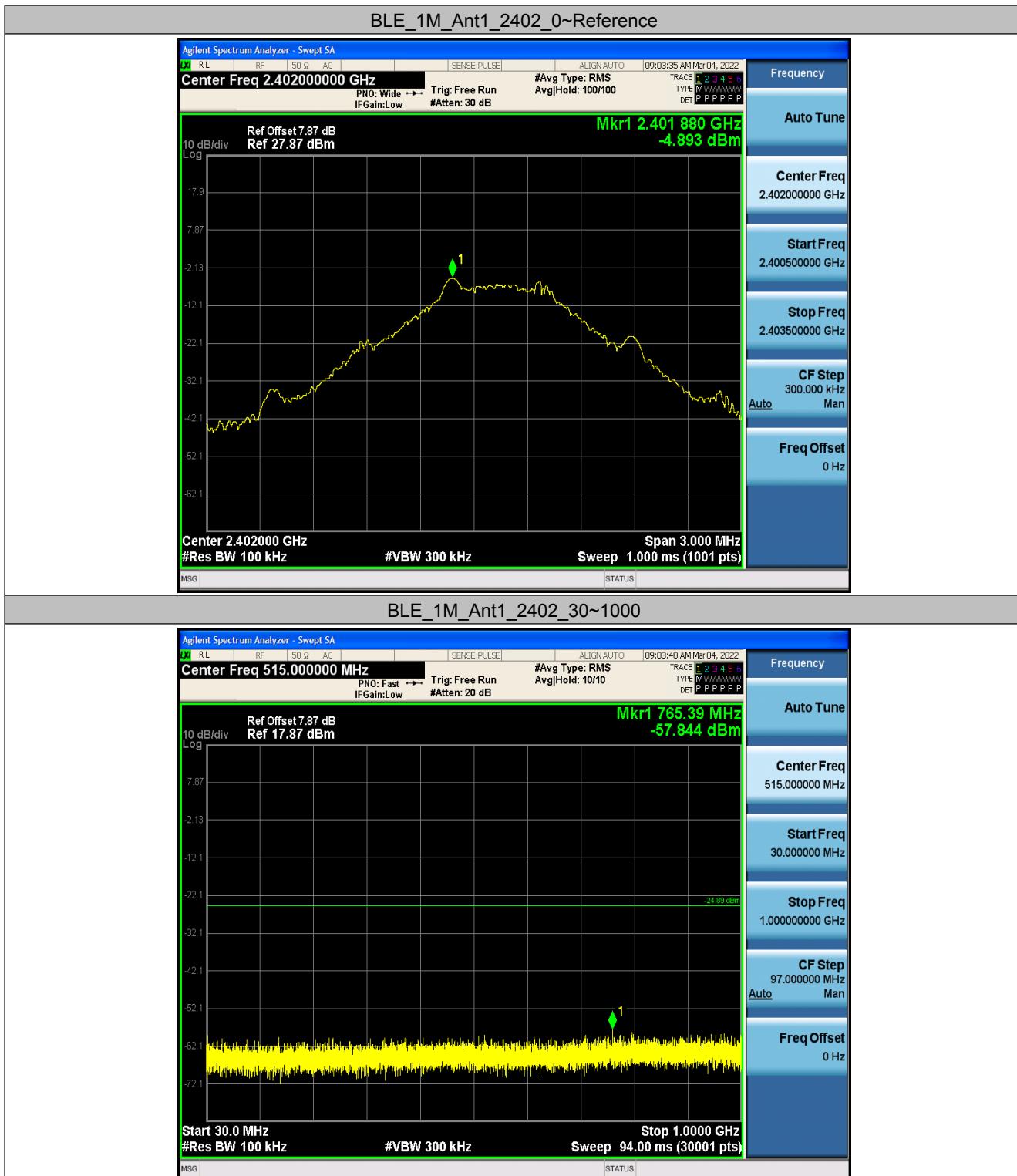
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## 10.5.2 Test Graphs



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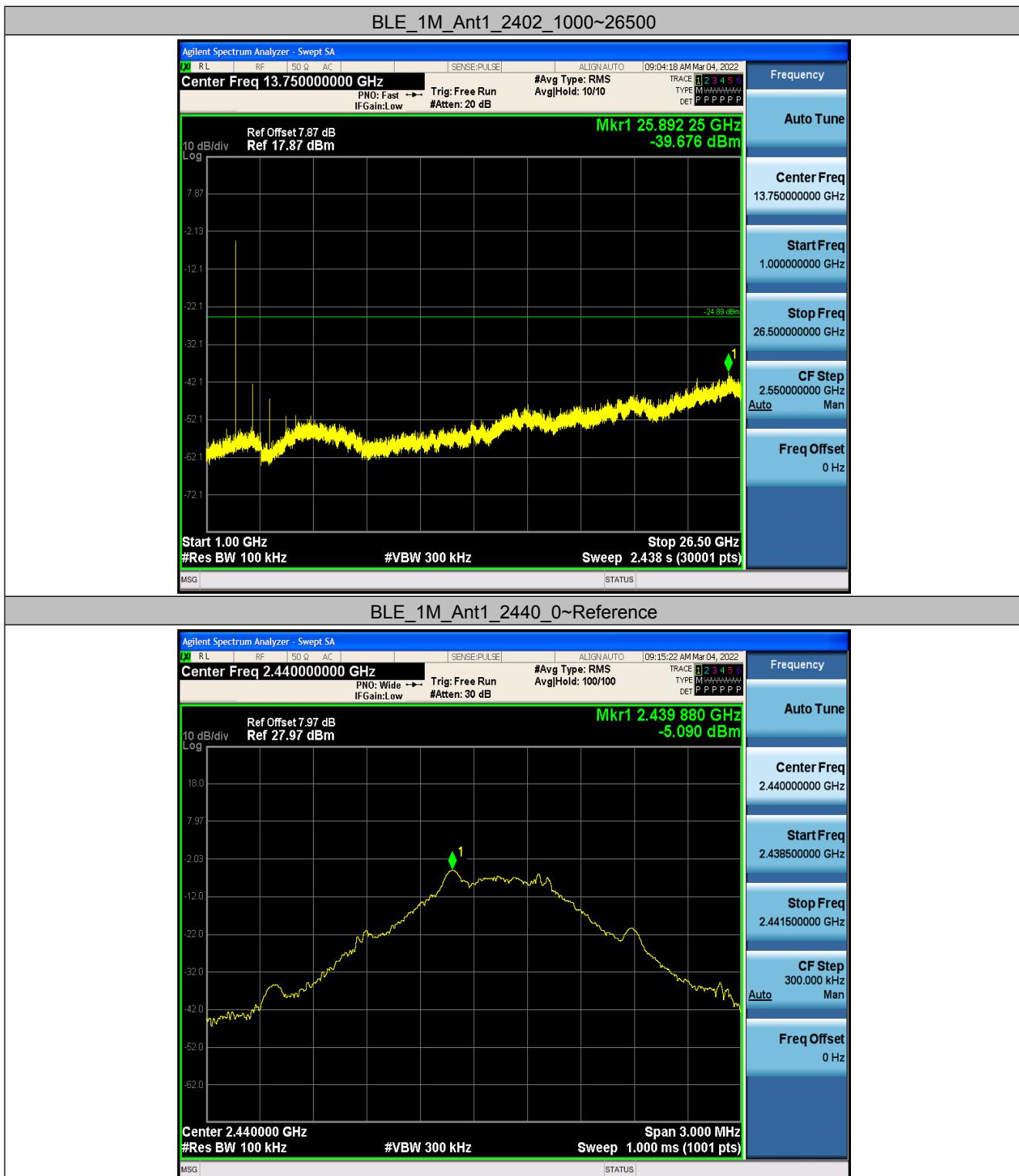
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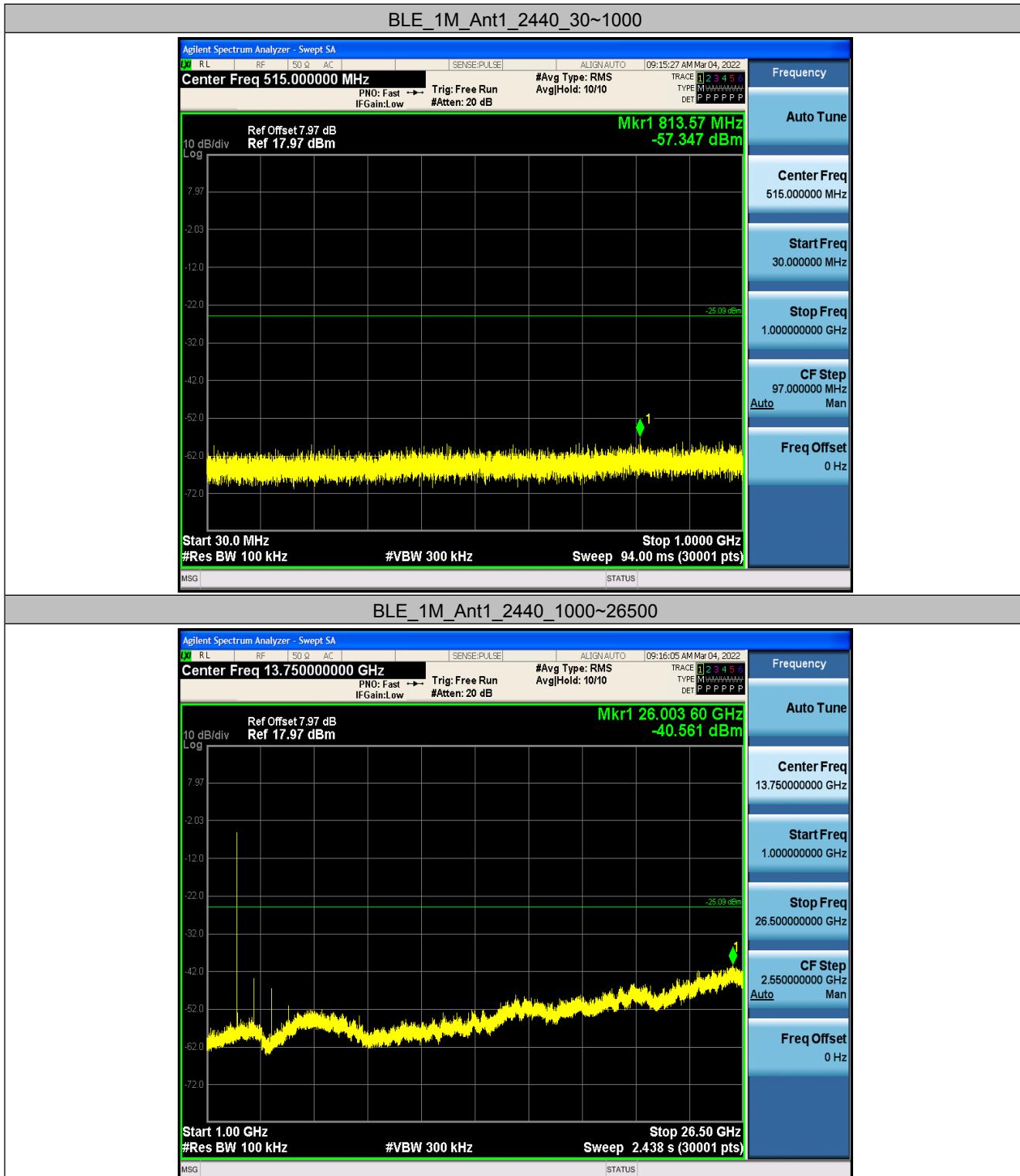
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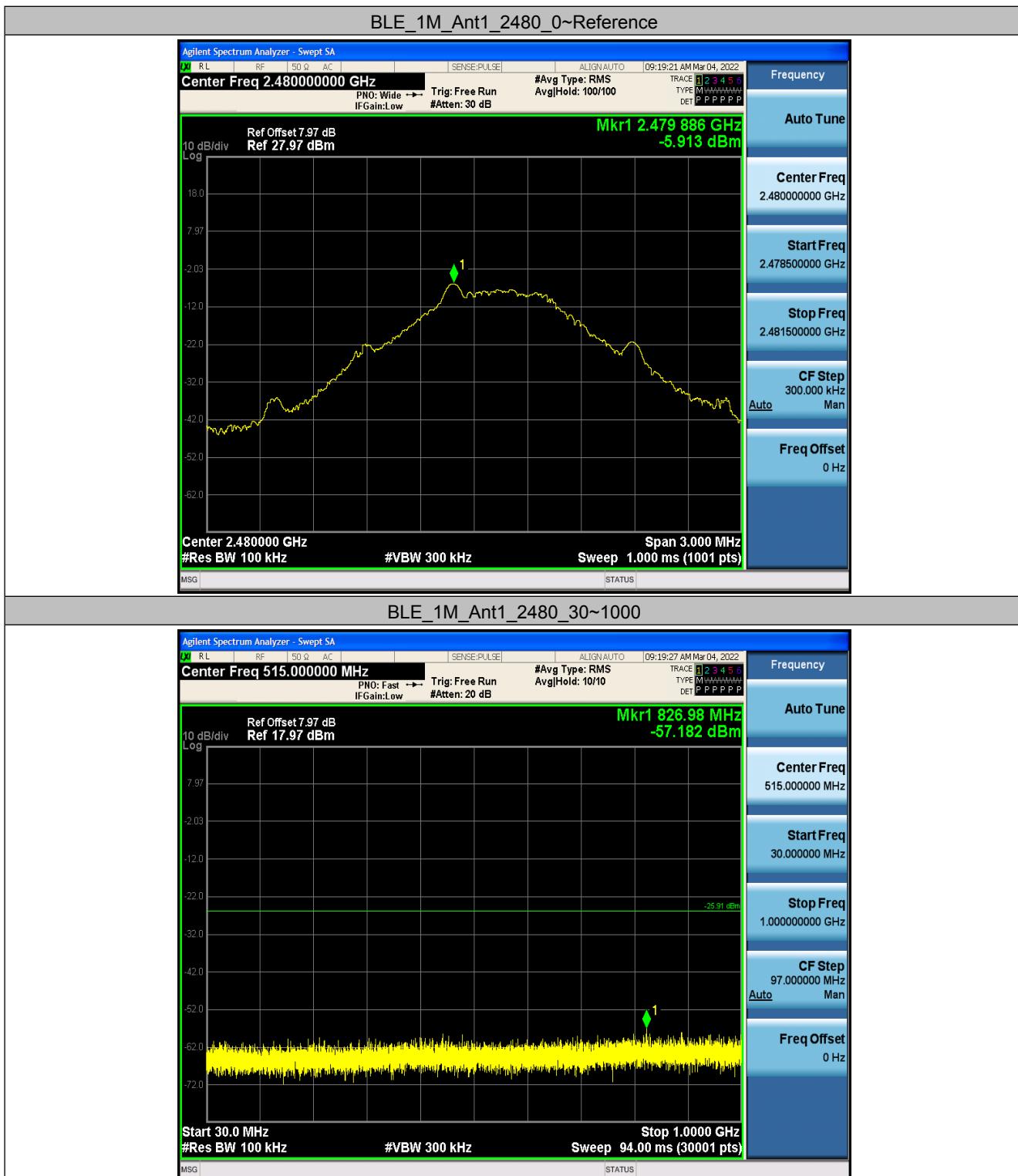
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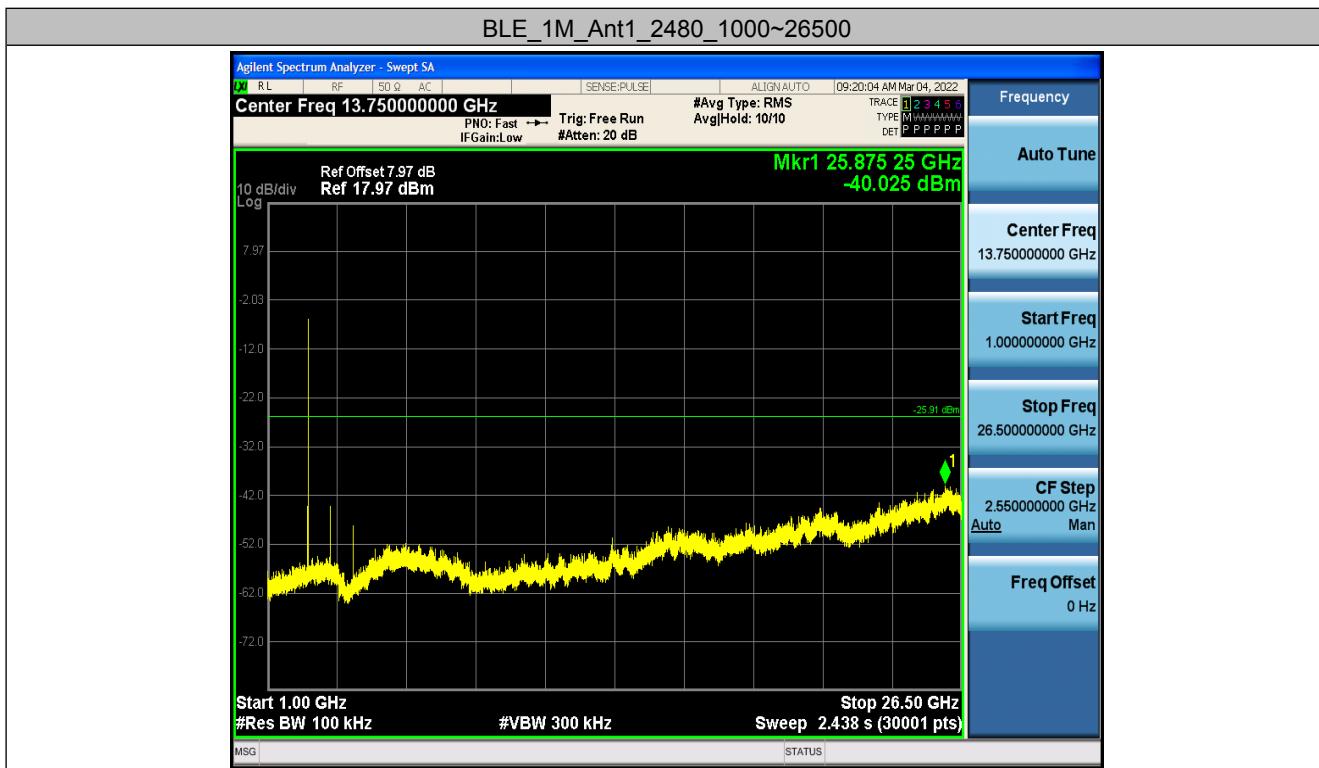
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