



TEST REPORT

Application No.:	GZCR2107020552LM
Applicant:	SAE Technologies Development (Dongguan) Co., Ltd.
Address of Applicant:	Winnerway Industrial Area, Nancheng, Dongguan City, Guangdong Province, PRC. 523087
Manufacturer:	The same as applicant.
Address of Manufacturer:	The same as applicant.
Factory:	The same as applicant.
Address of Factory:	The same as applicant.
Equipment Under Test (EUT):	
EUT Name:	Tag
Model No.:	SN1001C
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2021-07-07
Date of Test:	2021-07-14 to 2021-07-17
Date of Issue:	2021-08-06
Test Result:	Pass*

* 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		2021-08-06		Original

Authorized for issue by			
Tested By		Kevin Zhang /Project Engineer	
Reviewed By		Ricky Liu /Reviewer	

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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 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 6.4,6.5,6.6	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

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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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 3 V (1*size CR2032 battery)
Cable(s):	None
Test Voltage:	DC 3 V
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.0 LE
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	Integral Antenna
Antenna Gain:	0 dBi declared by applicant
Firmware Version:	SV01
Hardware Version:	SN1001C V2.1
Testing Software:	nrfconnect-setup-3.7.0-ia32.exe
Sample NO.:	GZ_SP_20210738317 M1
Power Setting:	0 dBm can not changed by user
Function:	Tag with BLE function

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	±5.08dB (1GHz-6GHz);±5.14dB(above 6GHz)
Radiated Spurious Emissions (Below 1GHz)	±5.06dB (3m); ±4.46dB (10m)
Radiated Spurious Emissions (Above 1GHz)	±5.08dB (1GHz-6GHz);±5.14dB(above 6GHz)

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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

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
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Minimum 6dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Power Spectrum Density					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Conducted Band Edges Measurement					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Conducted Spurious Emissions					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

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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	2021-01-08	2022-01-07
Chamber cable(Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2020/9/9	2022/9/8
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	2021-01-08	2022-01-07
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-01-08	2022-01-07
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	2020-11-13	2021-11-12
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2020-09-17	2021-09-16
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Notch Filter (5150-5880)	Mico-Tronics	BRM50716	EMC2168	2020-07-29	2021-07-28
Horn Antenna(14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2020-09-09	2021-09-08

Radiated Spurious Emissions (Below 1GHz)

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
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	2019-02-22	2022-02-22
Amplifier(9kHz-1.3GHz)	HP	8447F	EMC2065	2021-05-19	2022-05-18
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2019-12-27	2021-12-26
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
Chamber cable(Above 1GHz)	Scoflex	KMKG-8.0m	EMC0545	2020/9/9	2022/9/8
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	2021-01-08	2022-01-07
High Pass Filter (915MHz)	FSY MICROWAVE	HM1465-9SS	EMC2079	2021-01-08	2022-01-07
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-01-08	2022-01-07
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	2020-11-13	2021-11-12
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2020-09-17	2021-09-16
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Notch Filter (5150-5880)	Mico-Tronics	BRM50716	EMC2168	2020-07-29	2021-07-28
Horn Antenna(14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27

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:

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer. 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 dBi.

Please refer to internal photos.

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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 11.9.1.1

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

7.1.1 E.U.T. Operation

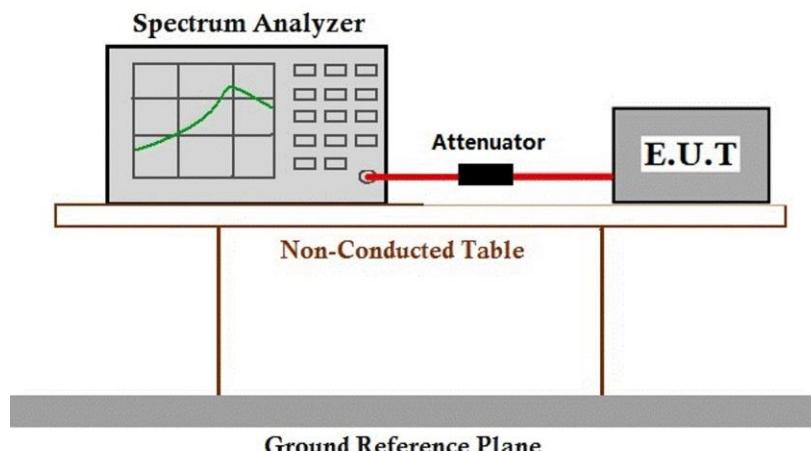
Operating Environment:

Temperature: 24.3 °C Humidity: 50.2 % RH Atmospheric Pressure: 1005 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	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

cable loss=0.9dB

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

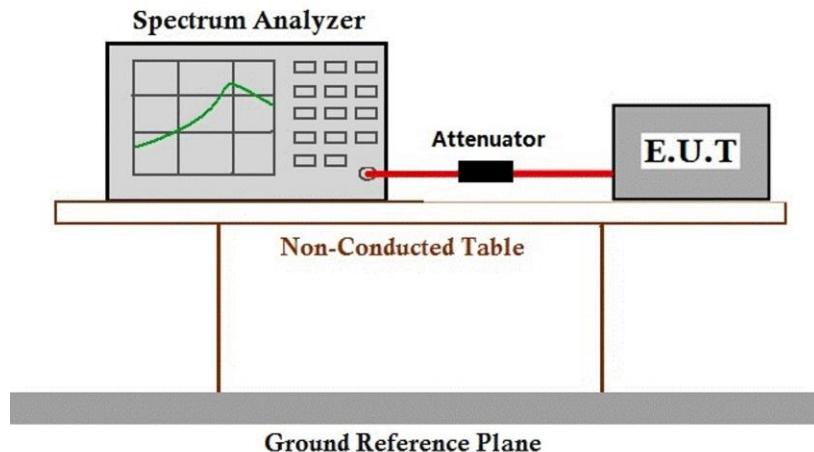
Operating Environment:

Temperature: 24.3 °C Humidity: 50.2 % RH Atmospheric Pressure: 1005 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	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

cable loss=0.9dB

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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

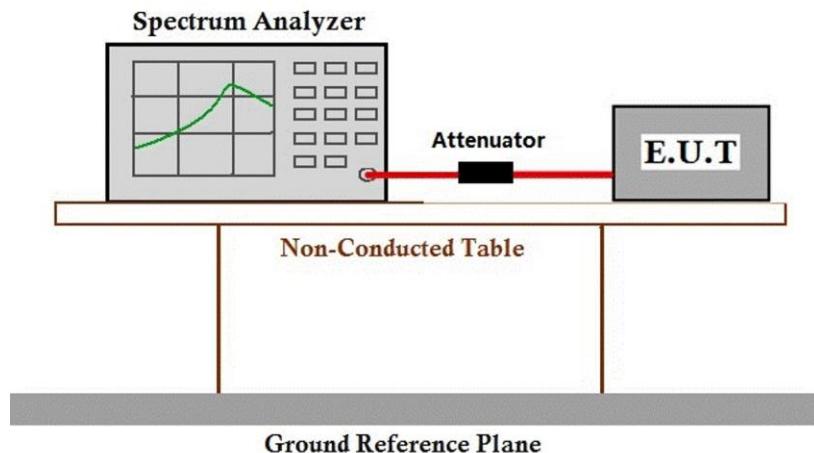
Operating Environment:

Temperature: 24.3 °C Humidity: 50.2 % RH Atmospheric Pressure: 1005 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	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

cable loss=0.9dB

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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

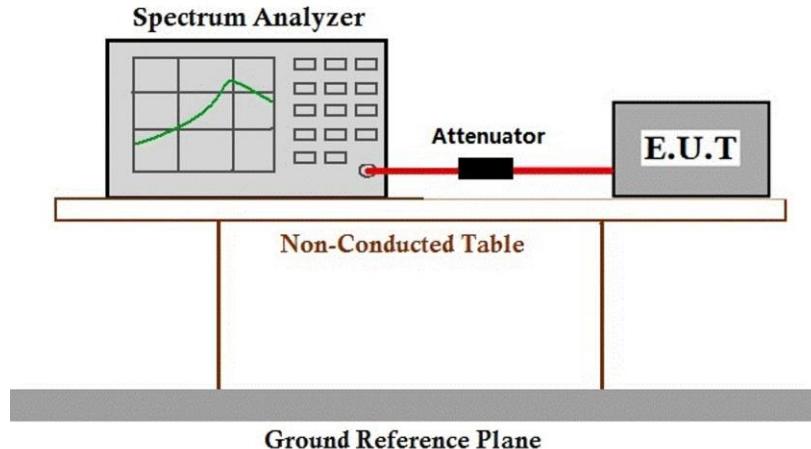
Operating Environment:

Temperature: 24.3 °C Humidity: 50.2 % RH Atmospheric Pressure: 1005 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	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

cable loss=0.9dB

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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

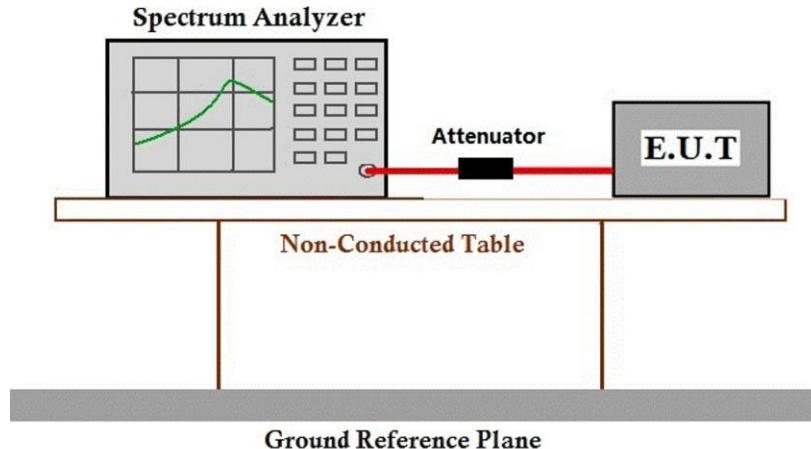
Operating Environment:

Temperature: 24.3 °C Humidity: 50.2 % RH Atmospheric Pressure: 1005 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	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

cable loss=0.9dB

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7.6 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

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.

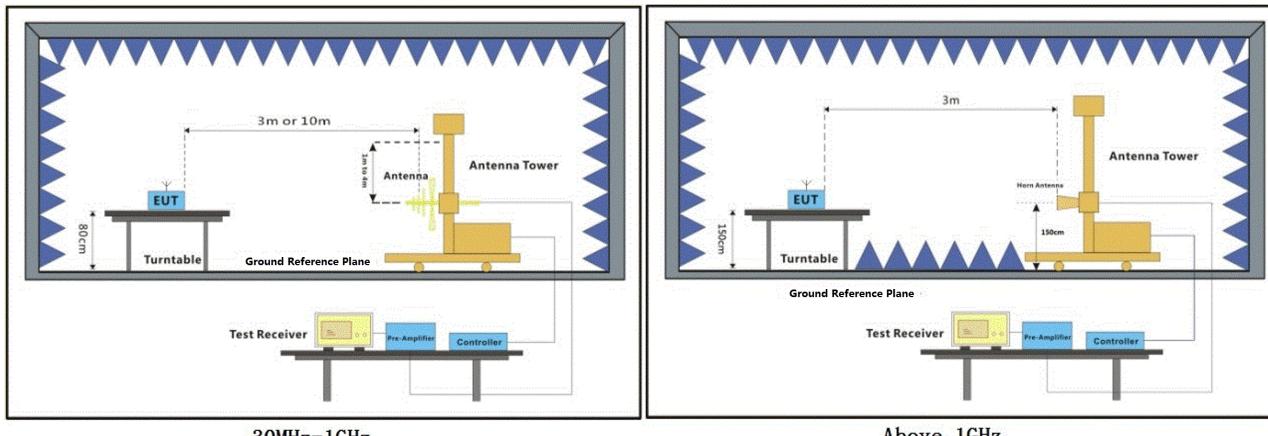
7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 25.4 °C Humidity: 56.6 % RH Atmospheric Pressure: 1005 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode / Code	Description
Final test	01	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.

Remark 3: Antenna: 3 denotes the type of antenna for above 1000MHz.

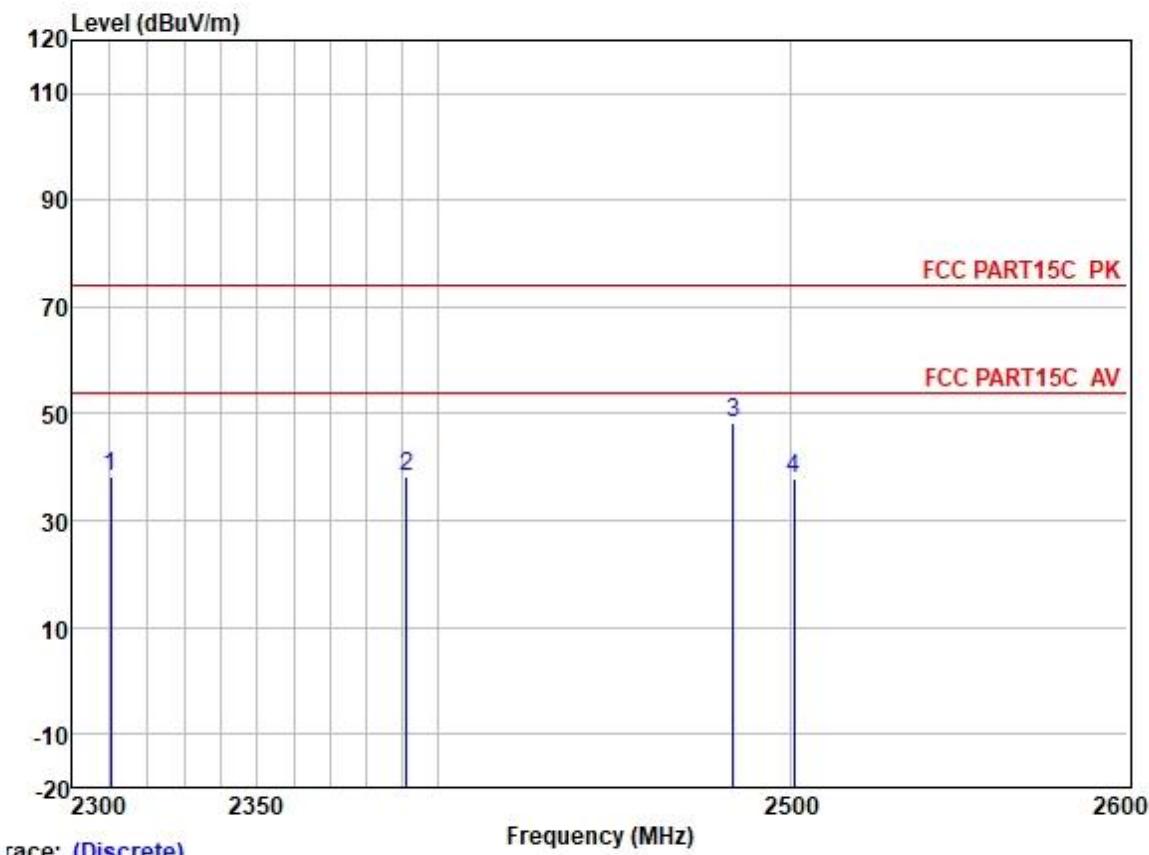


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Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; ; Channel:High



Race: (Discrete)

Freq	ReadAntenna		Cable Preamp		Limit Level	Over Line	Limit Pol/Phase	Remark
	MHz	dBuV	Level Factor	Loss Factor				
1	2310.200	45.25	27.15	3.32	37.62	38.10	74.00	-35.90 HORIZONTAL Peak
2	2390.993	45.13	27.34	3.49	37.59	38.37	74.00	-35.63 HORIZONTAL Peak
3	2483.500	54.94	27.48	3.53	37.57	48.38	74.00	-25.62 HORIZONTAL Peak
4	2500.935	44.43	27.50	3.40	37.56	37.77	74.00	-36.23 HORIZONTAL Peak

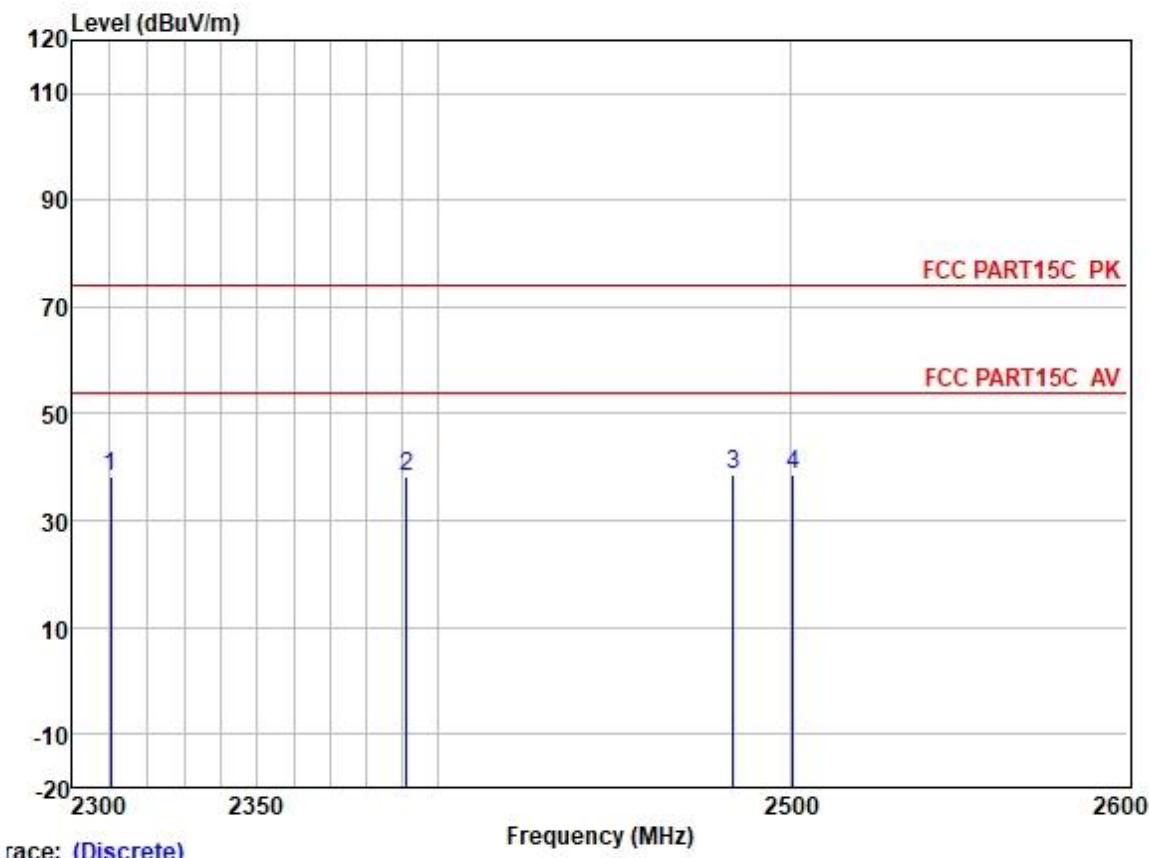
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Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; ; Channel:Low



Race: (Discrete)

Freq	ReadAntenna		Cable Preamp		Limit Level	Over Line	Limit Pol/Phase	Remark
	MHz	dBuV	Level Factor	dB				
1	2310.153	45.26	27.15	3.32	37.62	38.11	74.00	-35.89 HORIZONTAL Peak
2	2390.977	45.08	27.34	3.49	37.59	38.32	74.00	-35.68 HORIZONTAL Peak
3	2483.500	45.00	27.48	3.53	37.57	38.44	74.00	-35.56 HORIZONTAL Peak
4	2500.810	45.21	27.50	3.40	37.56	38.55	74.00	-35.45 HORIZONTAL Peak

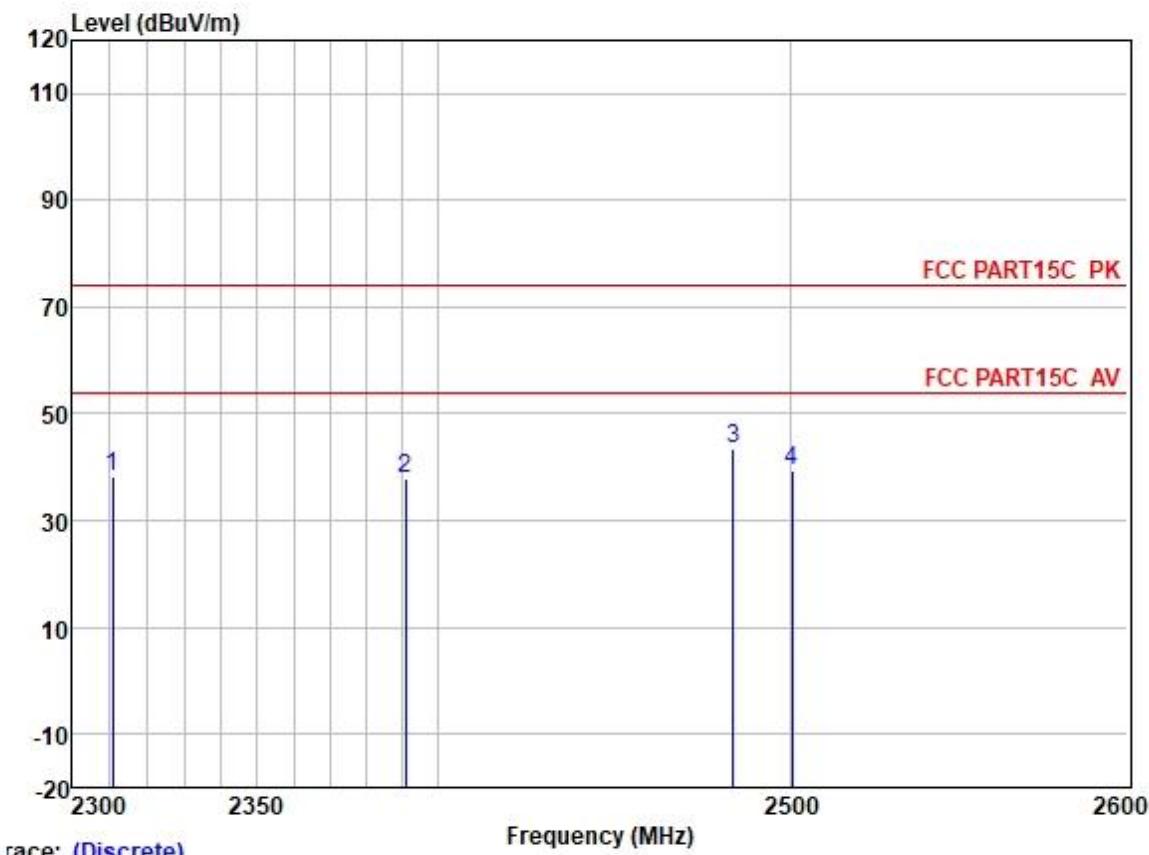
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Test Mode: 01; Polarity: Vertical; Modulation:GFSK; ; Channel:High



Race: (Discrete)

Freq	ReadAntenna		Cable Preamp		Limit Level	Over Line	Limit Pol/Phase	Remark
	Level	Factor	Loss	Factor				
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1 2310.806	45.46	27.15	3.32	37.62	38.31	74.00	-35.69	VERTICAL Peak
2 2390.696	44.72	27.34	3.49	37.59	37.96	74.00	-36.04	VERTICAL Peak
3 2483.500	49.87	27.48	3.53	37.57	43.31	74.00	-30.69	VERTICAL Peak
4 2500.502	46.15	27.50	3.40	37.56	39.49	74.00	-34.51	VERTICAL Peak

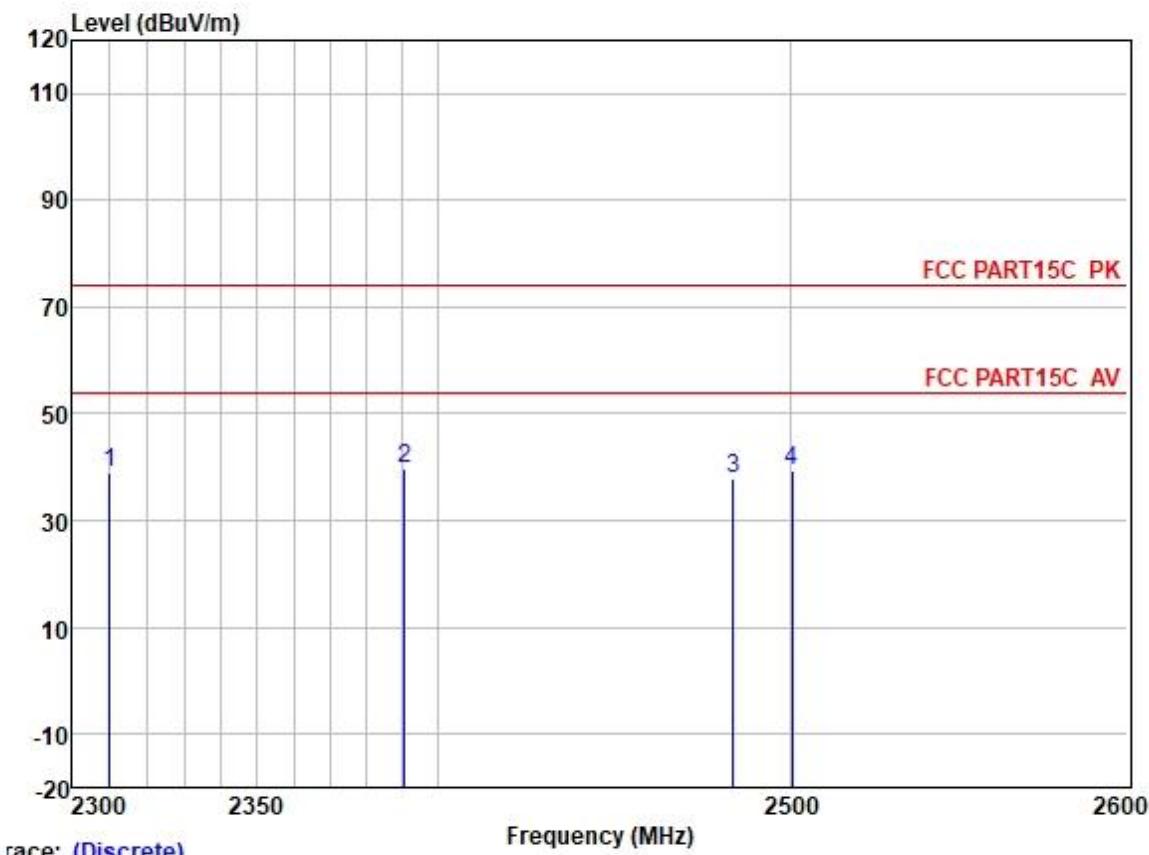
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Test Mode: 01; Polarity: Vertical; Modulation:GFSK; ; Channel:Low



Race: (Discrete)

Freq	ReadAntenna		Cable		Preamp	Loss Factor	Limit	Over	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	Level	Factor			dB	dB	dBuV/m	dBuV/m	dB	
1	2310.072	46.19	27.15	3.32	37.62	39.04	74.00	-34.96	VERTICAL	Peak		
2	2390.350	46.48	27.33	3.48	37.59	39.70	74.00	-34.30	VERTICAL	Peak		
3	2483.500	44.42	27.48	3.53	37.57	37.86	74.00	-36.14	VERTICAL	Peak		
4	2500.522	45.97	27.50	3.40	37.56	39.31	74.00	-34.69	VERTICAL	Peak		

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7.7 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

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.

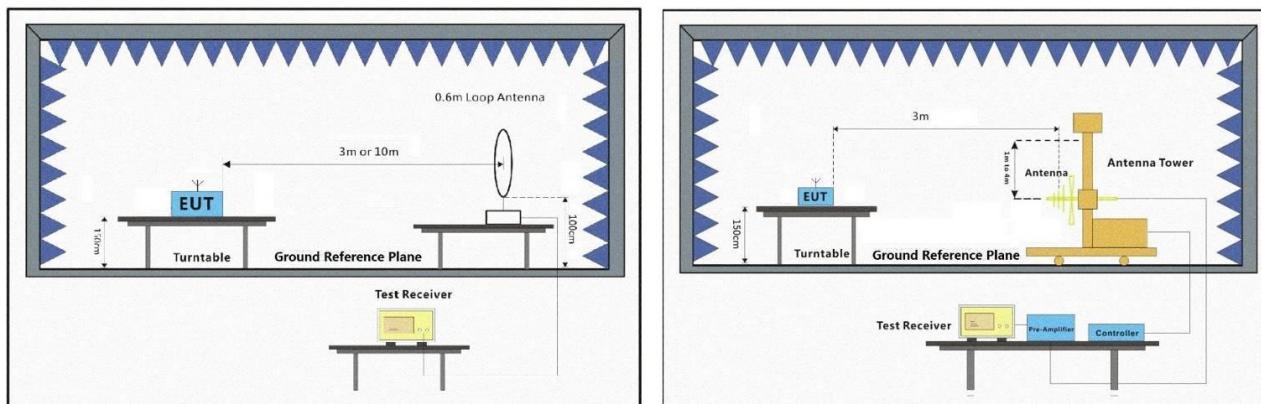
7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 23.4 °C Humidity: 50.1 % RH Atmospheric Pressure: 1005 mbar

7.7.2 Test Mode Description

Pre-scan / Mode Final test	Mode Code	Description
Final test	01	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 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.

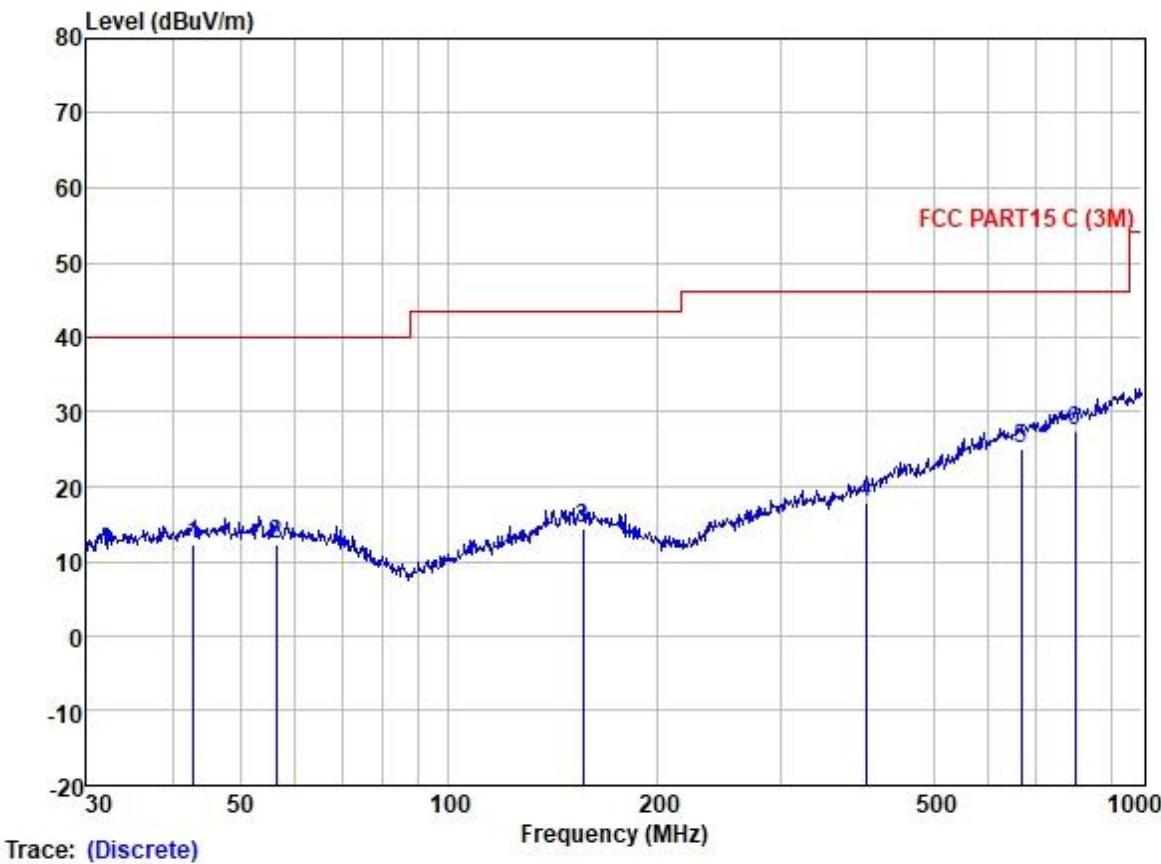
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Test Mode: 01; Polarity: Horizontal



Site : SGS
 Condition : FCC PART15 C (3M) HORIZONTAL
 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	dBuV		
1	42.75	24.65	13.74	1.11	27.17	12.33	40.00	-27.67	HORIZONTAL QP
2	56.39	24.53	13.68	1.21	27.16	12.26	40.00	-27.74	HORIZONTAL QP
3	155.91	25.09	13.70	2.30	26.81	14.28	43.50	-29.22	HORIZONTAL QP
4	399.03	25.58	15.68	3.93	27.32	17.87	46.00	-28.13	HORIZONTAL QP
5	668.14	26.89	20.68	5.61	28.17	25.01	46.00	-20.99	HORIZONTAL QP
6	798.98	26.69	22.60	6.17	28.03	27.43	46.00	-18.57	HORIZONTAL QP

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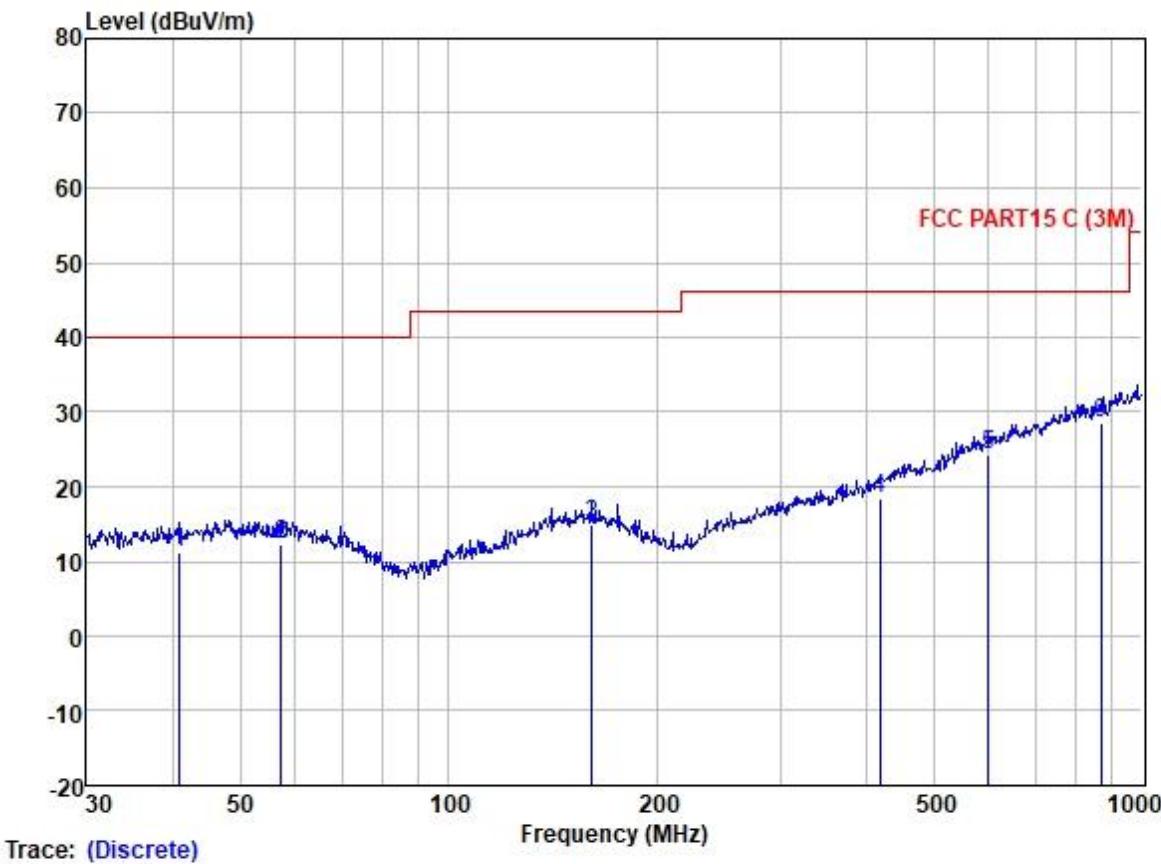
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Test Mode: 01; Polarity: Vertical



Site : SGS
Condition : FCC PART15 C (3M) VERTICAL
Job :
Model :
Power :
Test Mode :

Freq	Read	Antenna	Cable	Preamp	Measured	Limit	Over	Pol/	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	Phase	
1 40.84	23.60	13.58	1.10	27.18	11.10	40.00	-28.90	VERTICAL	QP
2 57.19	24.63	13.64	1.22	27.16	12.33	40.00	-27.67	VERTICAL	QP
3 160.91	25.70	13.60	2.34	26.79	14.85	43.50	-28.65	VERTICAL	QP
4 417.64	25.69	16.20	4.01	27.41	18.49	46.00	-27.51	VERTICAL	QP
5 599.32	27.50	19.90	5.14	28.21	24.33	46.00	-21.67	VERTICAL	QP
6 872.18	26.84	22.92	6.71	27.89	28.58	46.00	-17.42	VERTICAL	QP

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7.8 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

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.

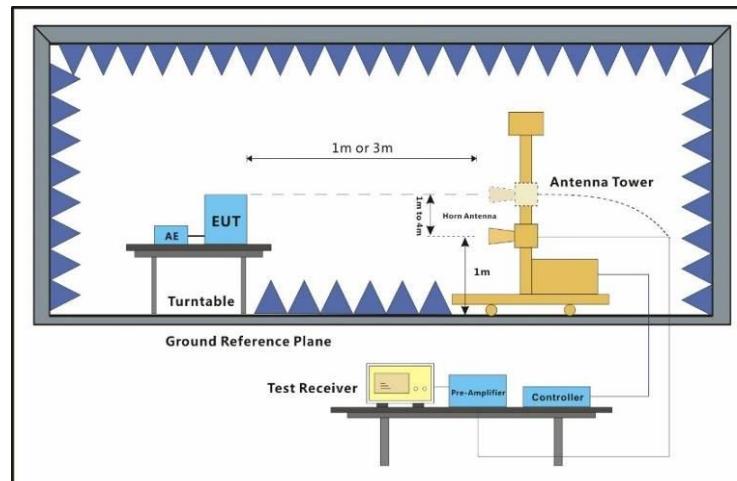
7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 25.4 °C Humidity: 56.5 % RH Atmospheric Pressure: 1005 mbar

7.8.2 Test Mode Description

Pre-scan / Mode Final test	Mode Code	Description
Final test	01	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 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.

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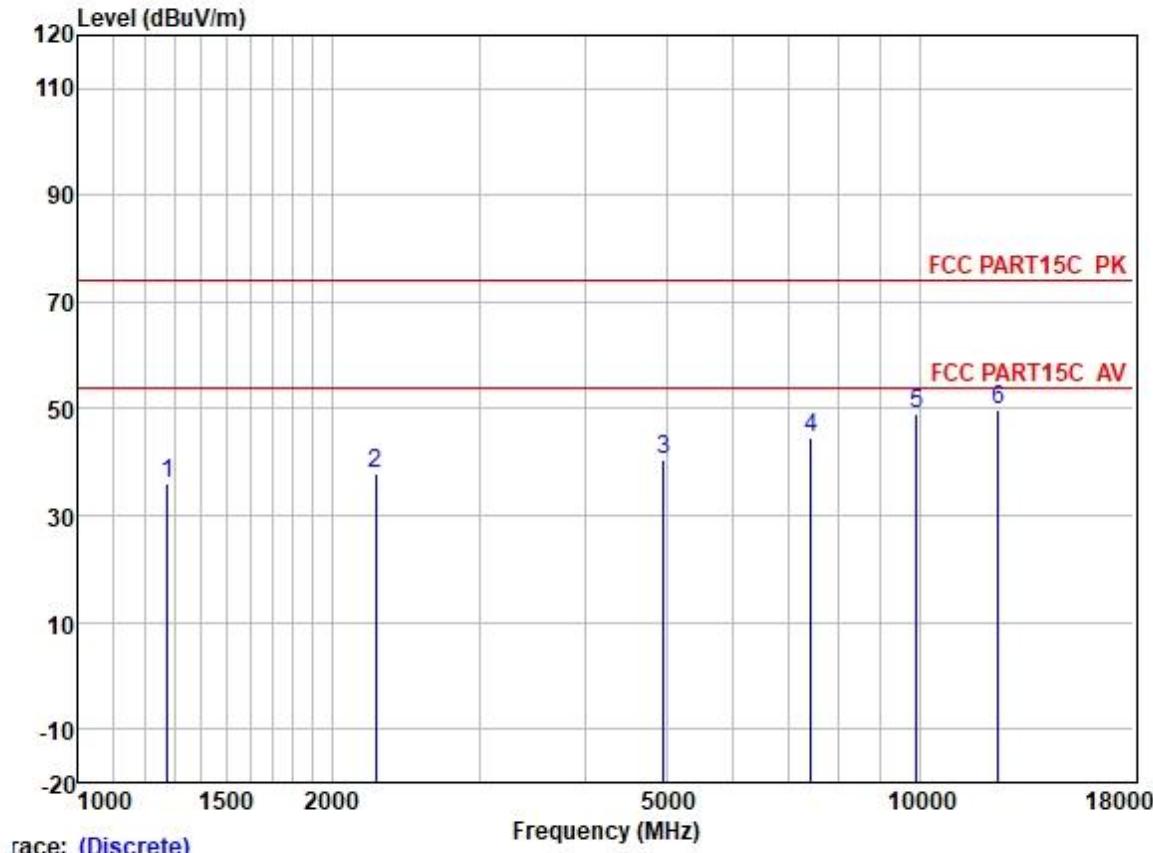
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Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; ; Channel:High



Freq	ReadAntenna		Cable Preamp		Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	Level Factor	Cable Loss Factor				
1	1274.802	46.60	25.12	2.48	38.33	35.87	74.00	-38.13 HORIZONTAL Peak
2	2259.367	45.44	26.95	3.27	37.64	38.02	74.00	-35.98 HORIZONTAL Peak
3	4960.513	39.88	31.65	5.65	36.84	40.34	74.00	-33.66 HORIZONTAL Peak
4	7440.620	39.60	36.27	6.22	37.47	44.62	74.00	-29.38 HORIZONTAL Peak
5	9920.684	40.76	38.65	6.96	37.40	48.97	74.00	-25.03 HORIZONTAL Peak
6	12400.690	40.25	38.57	7.97	36.88	49.91	74.00	-24.09 HORIZONTAL Peak

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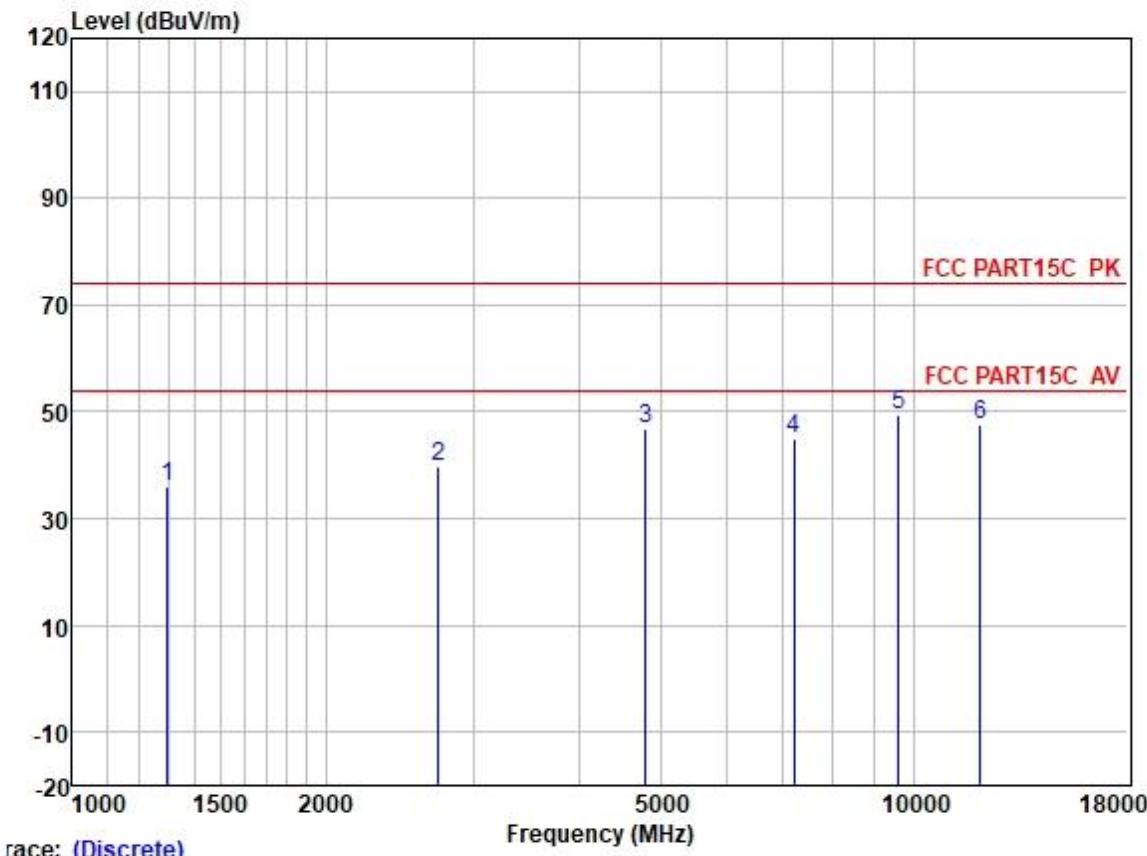
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Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; ; Channel:Low



Source: (Discrete)

Freq	ReadAntenna		Cable Preamp		Limit Level	Over Line	Limit Pol/Phase	Remark
	MHz	dBuV	Level Factor	Loss Factor				
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	1297.103	46.49	25.19	2.58	38.31	35.95	74.00	-38.05 HORIZONTAL Peak
2	2726.337	45.77	27.92	3.62	37.46	39.85	74.00	-34.15 HORIZONTAL Peak
3	4804.419	46.88	31.42	5.40	36.83	46.87	74.00	-27.13 HORIZONTAL Peak
4	7206.429	40.87	35.54	5.98	37.38	45.01	74.00	-28.99 HORIZONTAL Peak
5	9608.540	41.52	38.37	7.07	37.42	49.54	74.00	-24.46 HORIZONTAL Peak
6	12010.940	37.69	38.90	8.19	37.10	47.68	74.00	-26.32 HORIZONTAL Peak

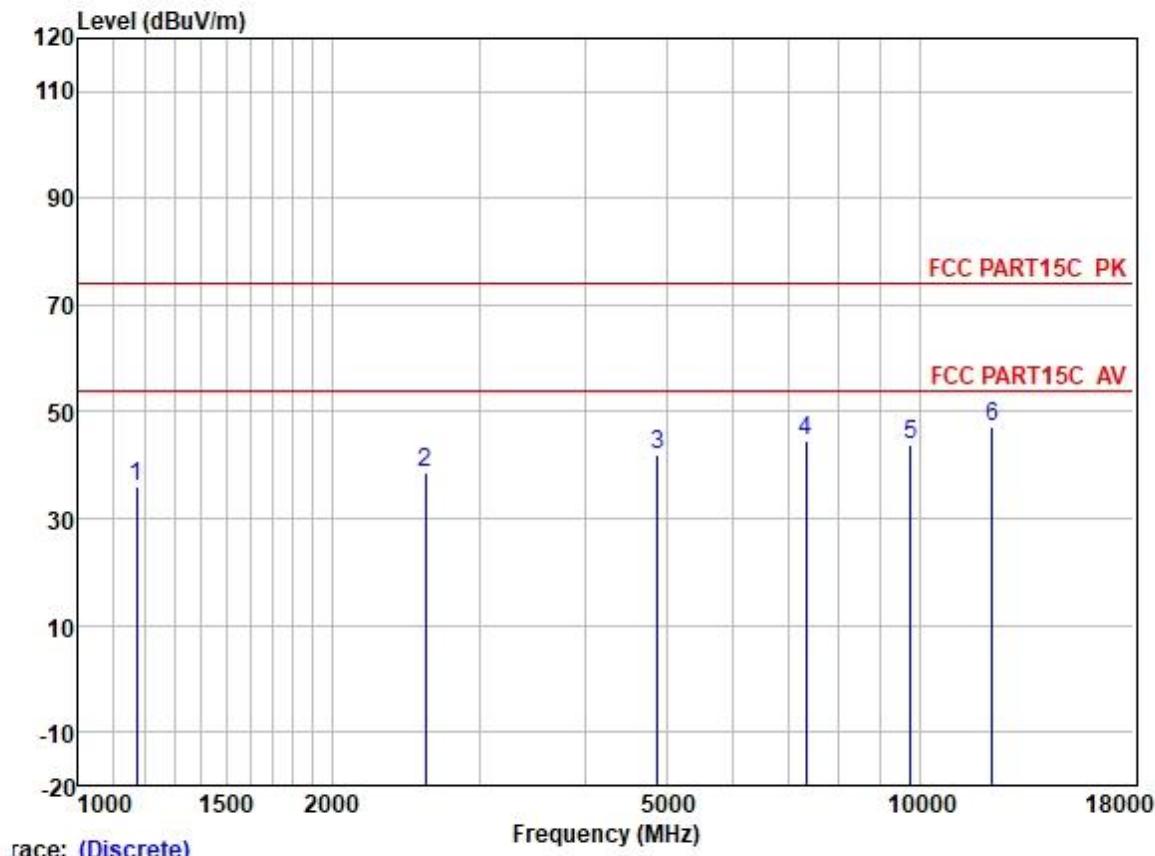
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Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; ; Channel:middle



Race: (Discrete)

Freq	ReadAntenna		Cable		Preamp	Limit	Over	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	Level	Factor							
1	1172.303	47.56	24.56	2.39	38.40	36.11	74.00	-37.89	HORIZONTAL	Peak	
2	2588.122	45.00	27.61	3.49	37.52	38.58	74.00	-35.42	HORIZONTAL	Peak	
3	4884.333	41.62	31.56	5.52	36.84	41.86	74.00	-32.14	HORIZONTAL	Peak	
4	7326.305	40.06	36.00	6.13	37.43	44.76	74.00	-29.24	HORIZONTAL	Peak	
5	9768.146	35.71	38.53	7.01	37.41	43.84	74.00	-30.16	HORIZONTAL	Peak	
6	12205.950	37.34	38.74	8.08	37.00	47.16	74.00	-26.84	HORIZONTAL	Peak	

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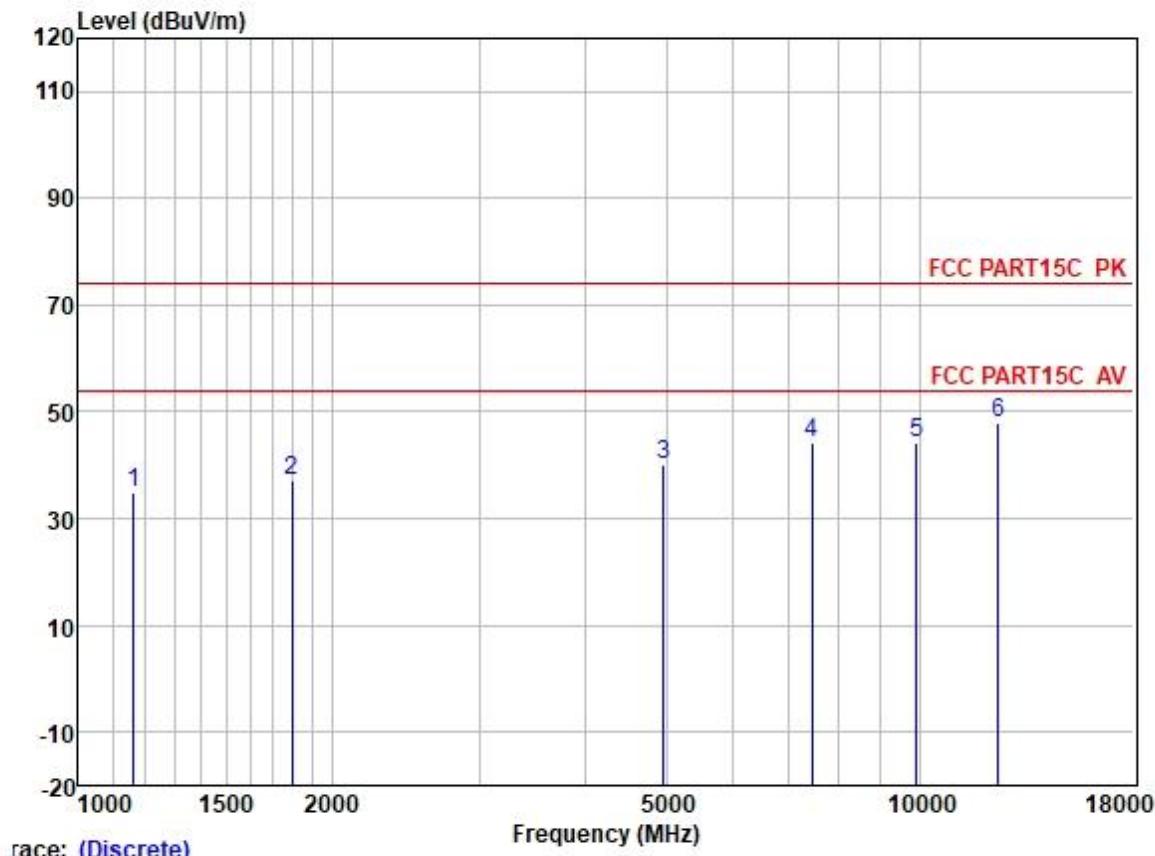
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Test Mode: 01; Polarity: Vertical; Modulation:GFSK; ; Channel:High



Race: (Discrete)

Freq	ReadAntenna		Cable Preamp		Limit Level	Over Line	Limit Pol/Phase	Remark
	MHz	dBuV	dB/m	dB				
1	1162.182	46.37	24.53	2.40	38.42	34.88	74.00	-39.12 VERTICAL Peak
2	1792.937	46.01	25.93	2.99	37.81	37.12	74.00	-36.88 VERTICAL Peak
3	4960.443	39.57	31.65	5.65	36.84	40.03	74.00	-33.97 VERTICAL Peak
4	7440.918	39.34	36.27	6.22	37.47	44.36	74.00	-29.64 VERTICAL Peak
5	9920.918	35.84	38.65	6.96	37.40	44.05	74.00	-29.95 VERTICAL Peak
6	12400.950	38.31	38.57	7.97	36.88	47.97	74.00	-26.03 VERTICAL Peak

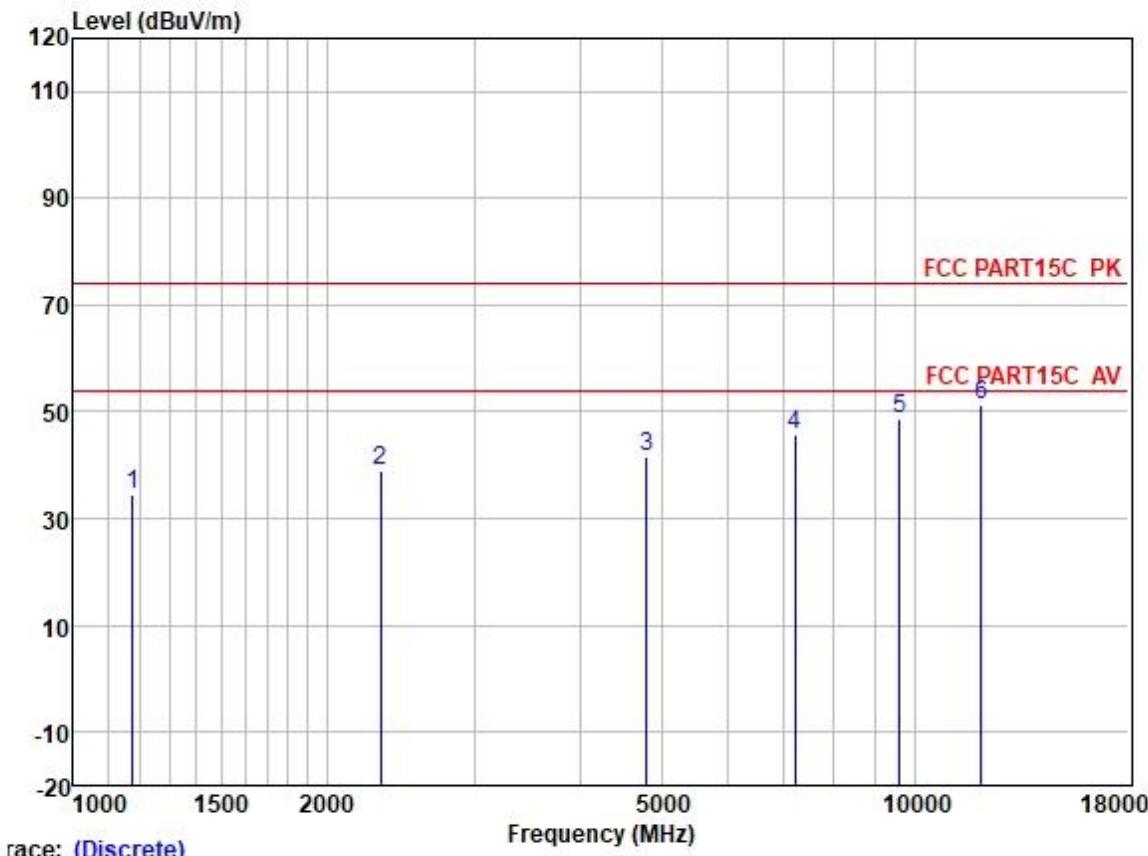
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Test Mode: 01; Polarity: Vertical; Modulation:GFSK; ; Channel:Low



Race: (Discrete)

Freq	ReadAntenna		Cable Preamp		Limit Level	Over Line	Limit Pol/Phase	Remark
	MHz	dBuV	Level Factor	Loss Factor				
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	1175.697	45.81	24.58	2.38	38.40	34.37	74.00	-39.63 VERTICAL Peak
2	2318.912	46.24	27.17	3.33	37.62	39.12	74.00	-34.88 VERTICAL Peak
3	4804.011	41.73	31.42	5.40	36.83	41.72	74.00	-32.28 VERTICAL Peak
4	7206.464	41.44	35.54	5.98	37.38	45.58	74.00	-28.42 VERTICAL Peak
5	9608.430	40.63	38.37	7.07	37.42	48.65	74.00	-25.35 VERTICAL Peak
6	12010.560	41.22	38.90	8.19	37.10	51.21	74.00	-22.79 VERTICAL Peak

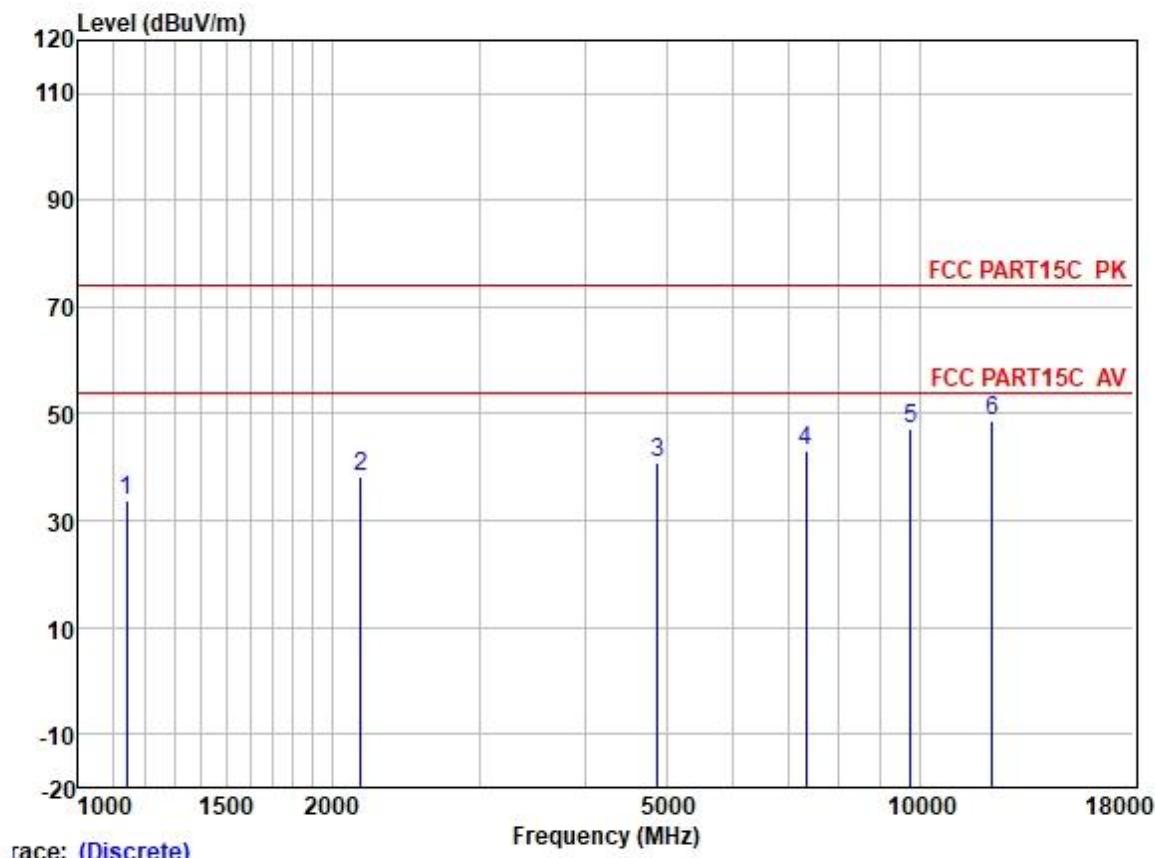
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Test Mode: 01; Polarity: Vertical; Modulation:GFSK; ; Channel:middle



Race: (Discrete)

Freq	ReadAntenna		Cable Preamp		Limit	Over	Limit Pol/Phase	Remark
	MHz	dBuV	Level Factor	Cable Loss Factor	Preamp Factor			
1	1142.201	45.33	24.47	2.30	38.42	33.68	74.00	-40.32 VERTICAL Peak
2	2163.504	46.08	26.47	3.19	37.66	38.08	74.00	-35.92 VERTICAL Peak
3	4884.203	40.59	31.56	5.52	36.84	40.83	74.00	-33.17 VERTICAL Peak
4	7326.668	38.50	36.00	6.13	37.43	43.20	74.00	-30.80 VERTICAL Peak
5	9768.018	39.24	38.53	7.01	37.41	47.37	74.00	-26.63 VERTICAL Peak
6	12210.750	38.82	38.74	8.08	37.00	48.64	74.00	-25.36 VERTICAL Peak

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8 Appendix

8.1 Appendix A: DTS Bandwidth

8.1.1 Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.700	2401.764	2402.464	>=0.5	PASS
		2440	0.688	2439.776	2440.464	>=0.5	PASS
		2480	0.680	2479.776	2480.456	>=0.5	PASS
BLE_2M	Ant1	2402	1.152	2401.524	2402.676	>=0.5	PASS
		2440	1.188	2439.504	2440.692	>=0.5	PASS
		2480	1.168	2479.516	2480.684	>=0.5	PASS

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8.1.2 Test Graphs



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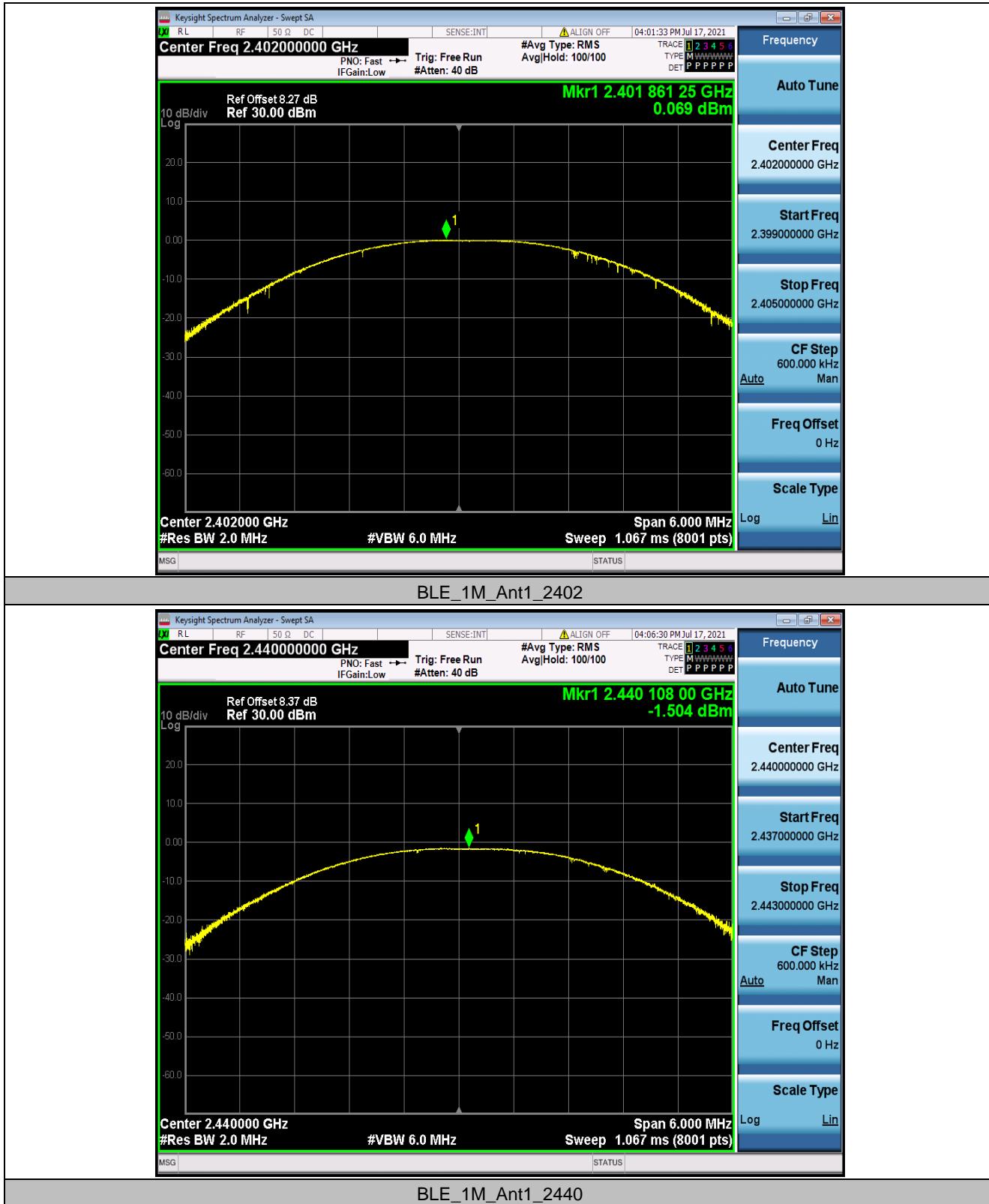
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8.2 Appendix B: Maximum conducted output power**8.2.1 Test Result**

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	0.07	<=30	PASS
		2440	-1.5	<=30	PASS
		2480	-1.97	<=30	PASS
BLE_2M	Ant1	2402	-0.1	<=30	PASS
		2440	-1.58	<=30	PASS
		2480	-2.02	<=30	PASS

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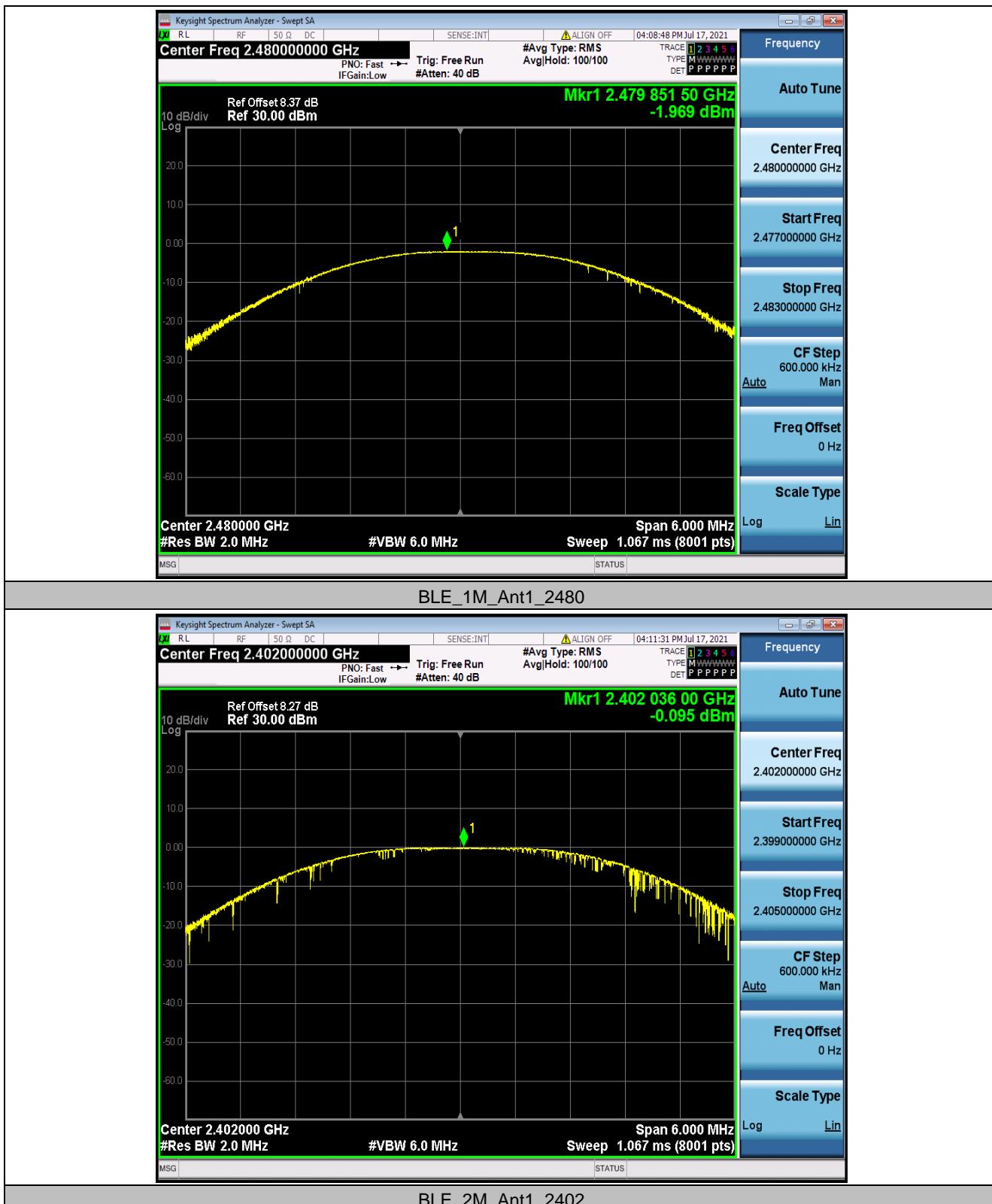
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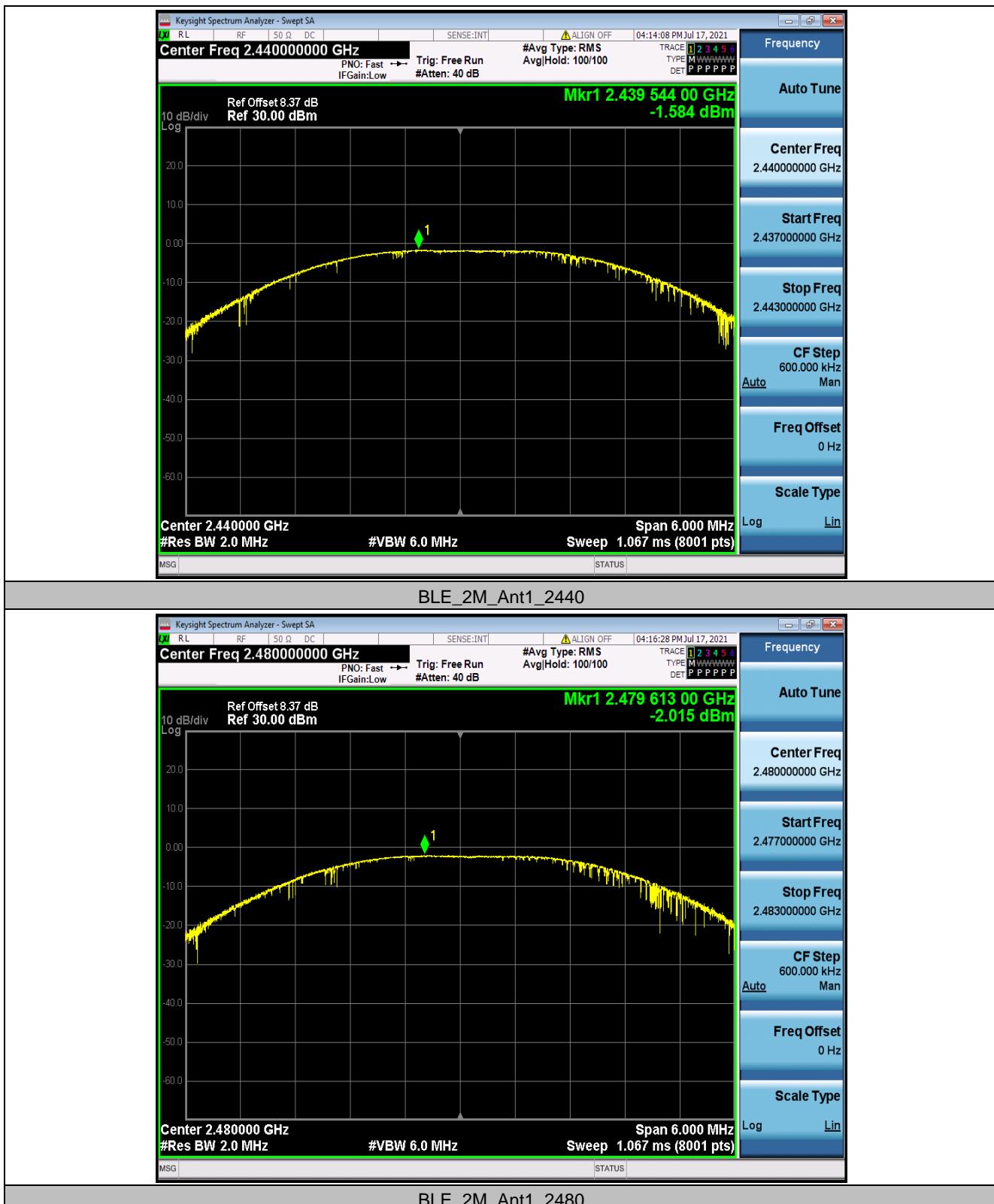
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8.3 Appendix C: Maximum power spectral density**8.3.1 Test Result**

TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-9.78	<=8	PASS
		2440	-11.48	<=8	PASS
		2480	-12.01	<=8	PASS
BLE_2M	Ant1	2402	-10.92	<=8	PASS
		2440	-12.43	<=8	PASS
		2480	-12.97	<=8	PASS

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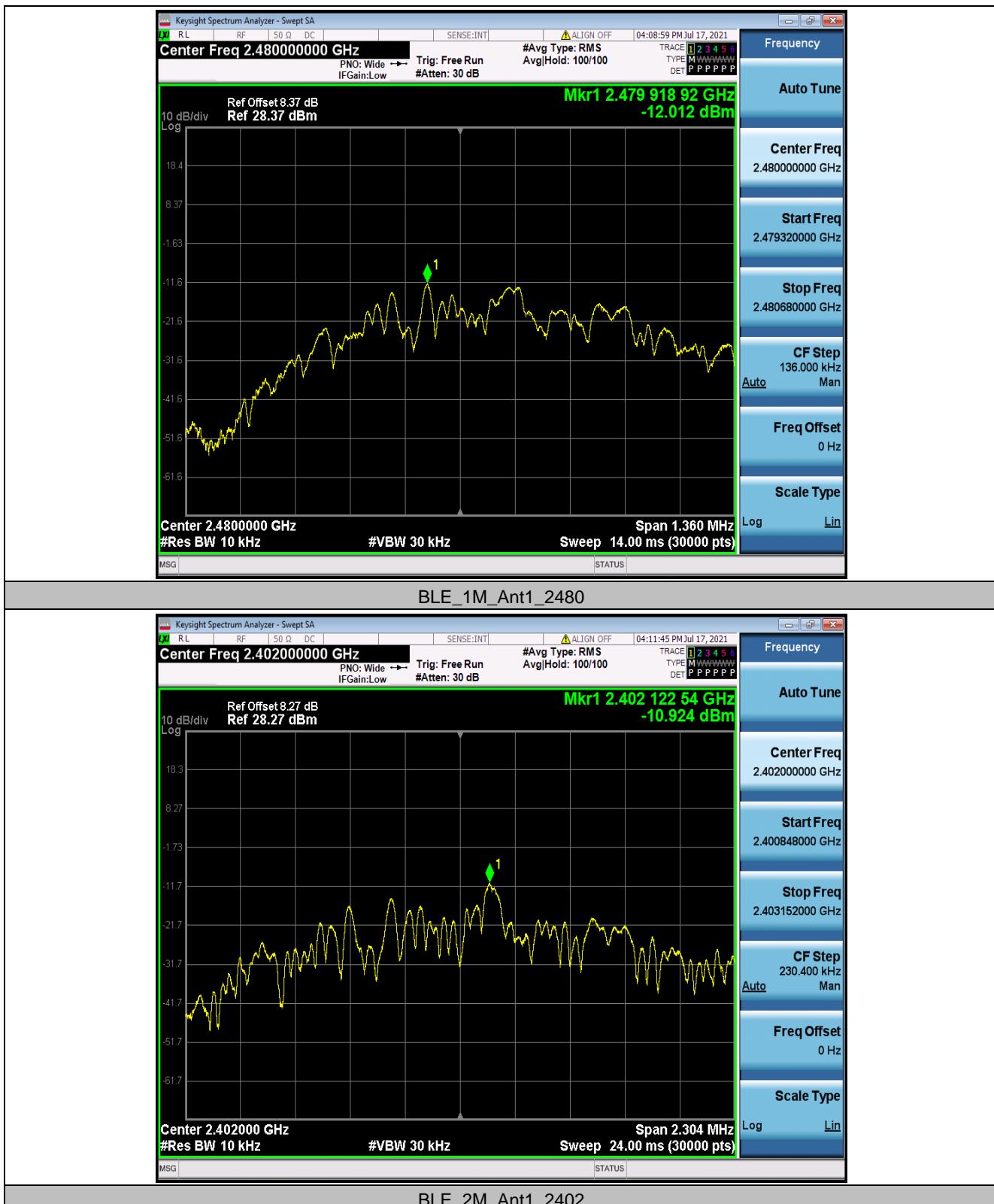


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8.3.2 Test Graphs

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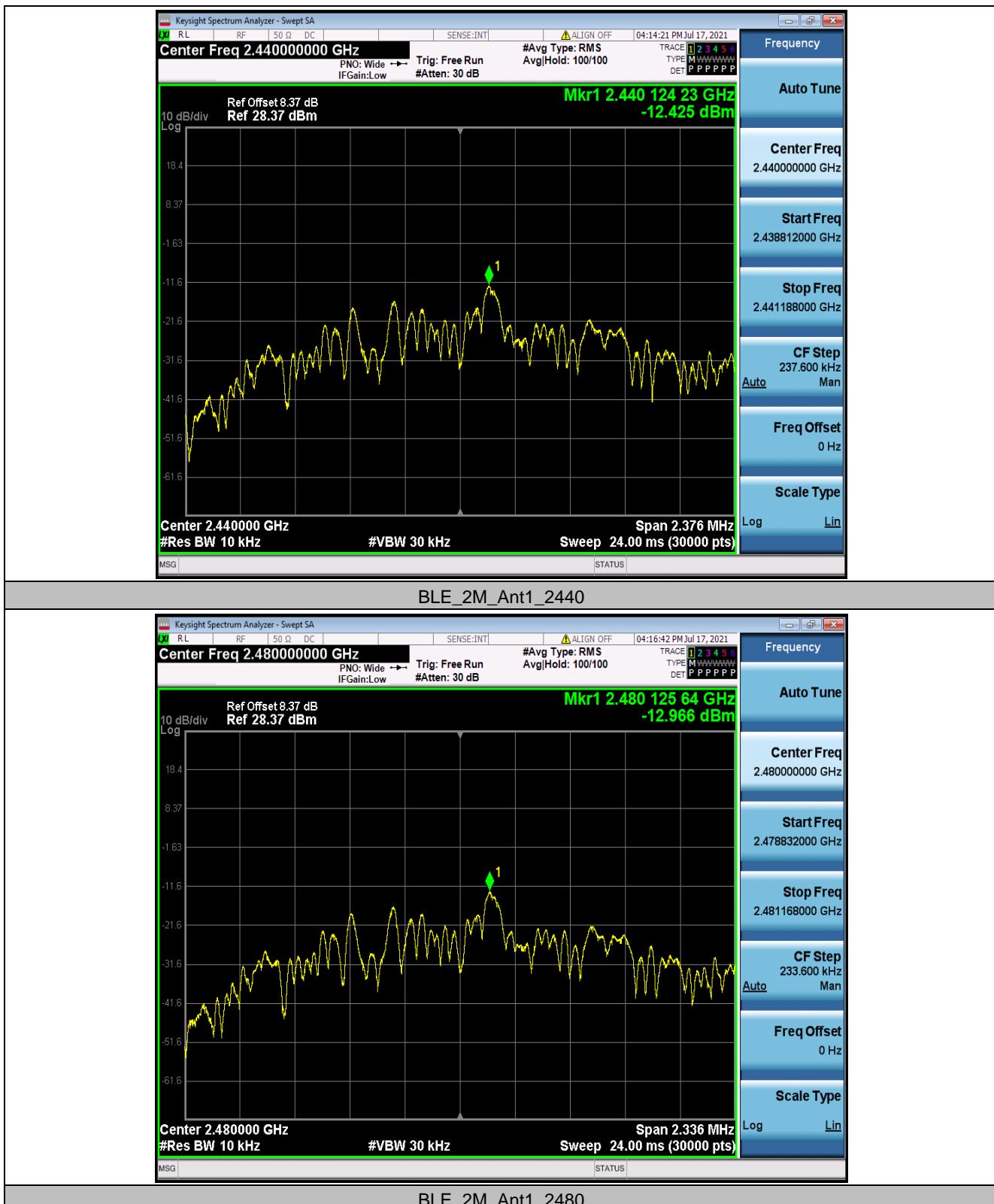
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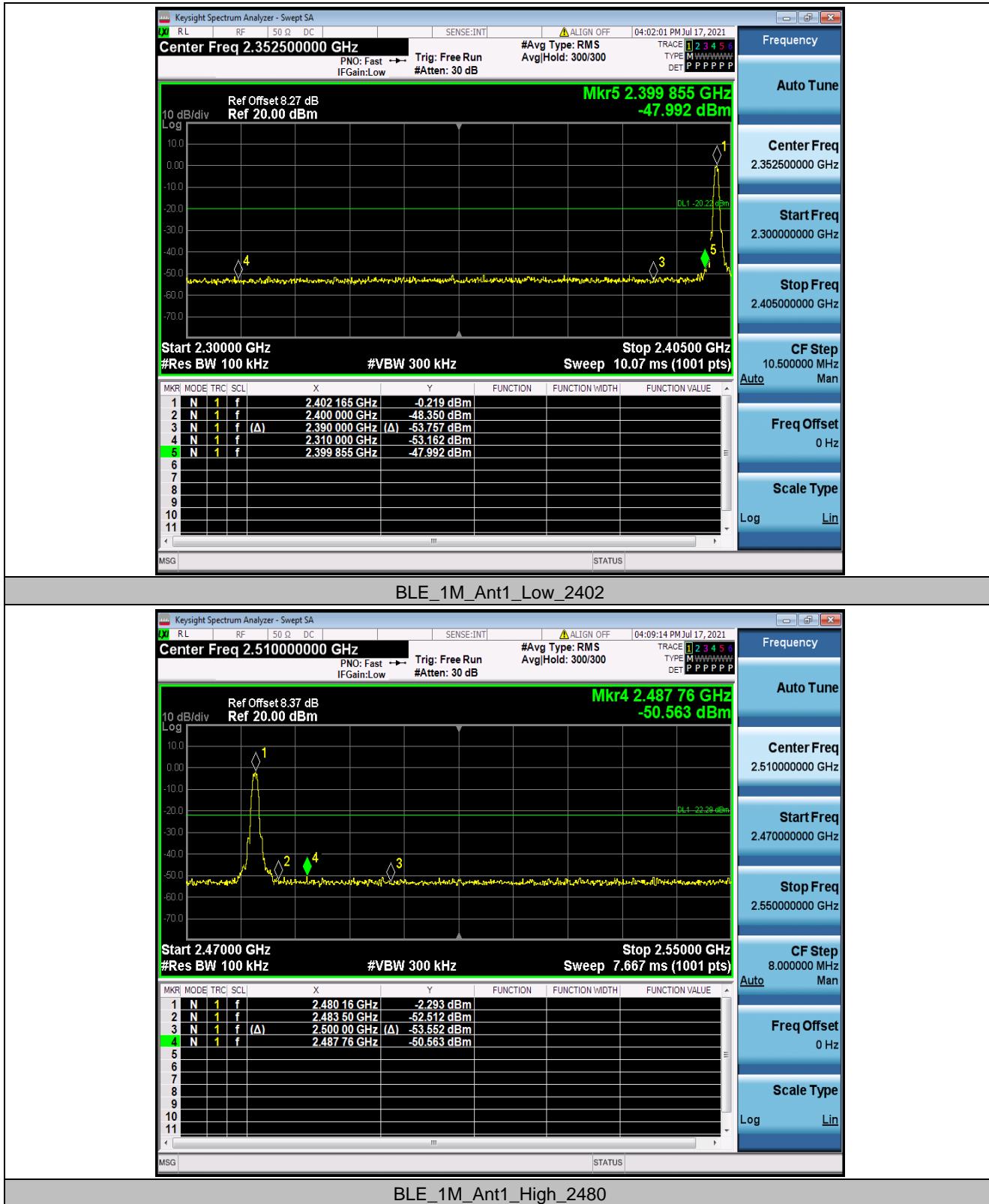
8.4 Appendix D: Band edge measurements**8.4.1 Test Result**

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	-0.22	-47.99	<=-20.22	PASS
		High	2480	-2.29	-50.56	<=-22.29	PASS
BLE_2M	Ant1	Low	2402	-0.26	-37.35	<=-20.26	PASS
		High	2480	-2.34	-50.3	<=-22.34	PASS

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8.4.2 Test Graphs



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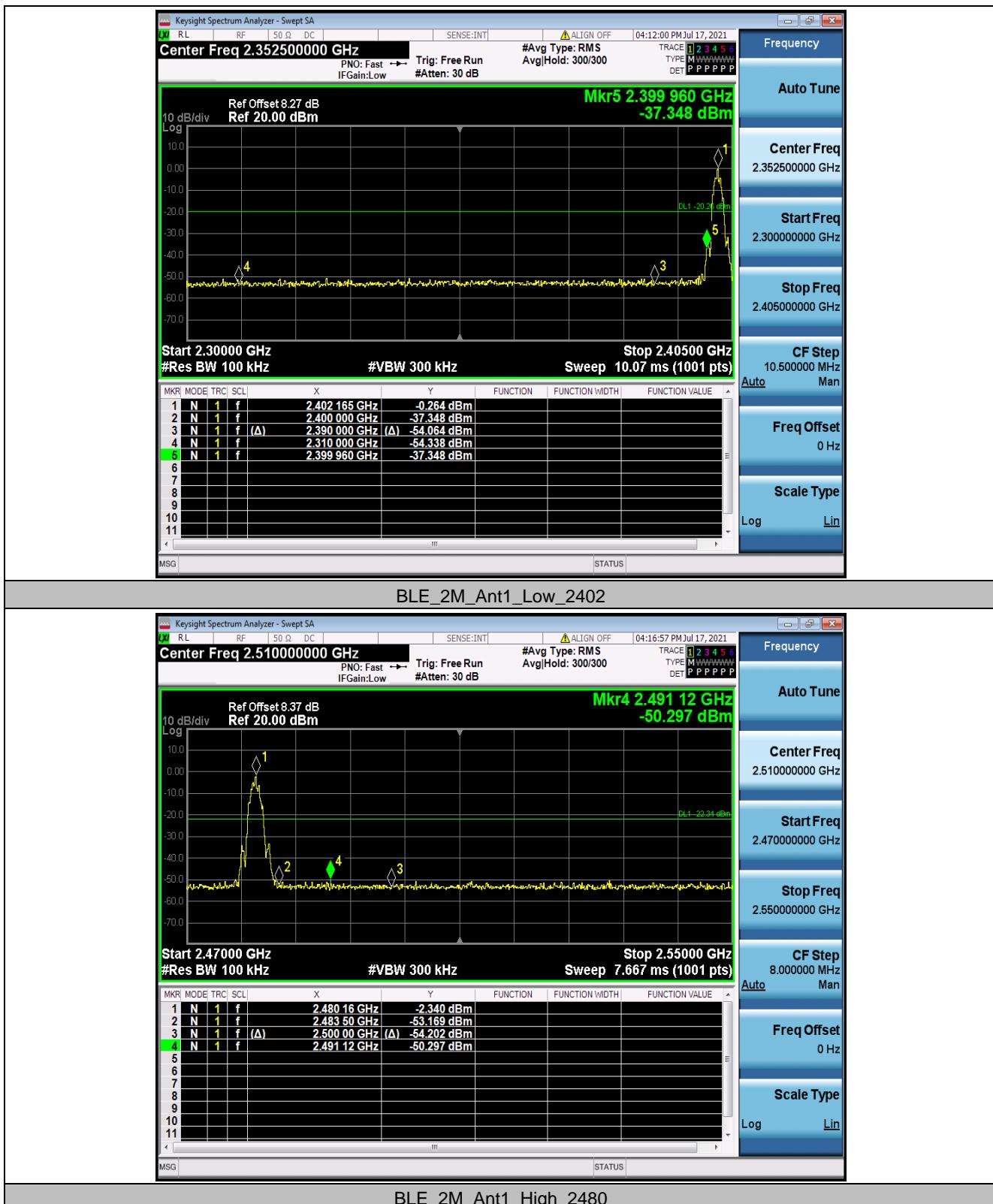
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8.5 Appendix E: Conducted Spurious Emission**8.5.1 Test Result**

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	-0.33	-0.33	---	PASS
			30~1000	30~1000	-60.704	<=-20.331	PASS
			1000~26500	1000~26500	-53.228	<=-20.331	PASS
		2440	Reference	-2.23	-2.23	---	PASS
			30~1000	30~1000	-62.981	<=-22.226	PASS
			1000~26500	1000~26500	-49.735	<=-22.226	PASS
		2480	Reference	-2.42	-2.42	---	PASS
			30~1000	30~1000	-62.604	<=-22.418	PASS
			1000~26500	1000~26500	-49.406	<=-22.418	PASS
BLE_2M	Ant1	2402	Reference	-0.49	-0.49	---	PASS
			30~1000	30~1000	-62.786	<=-20.49	PASS
			1000~26500	1000~26500	-48.173	<=-20.49	PASS
		2440	Reference	-1.96	-1.96	---	PASS
			30~1000	30~1000	-62.848	<=-21.955	PASS
			1000~26500	1000~26500	-50.168	<=-21.955	PASS
		2480	Reference	-2.50	-2.50	---	PASS
			30~1000	30~1000	-62.362	<=-22.5	PASS
			1000~26500	1000~26500	-51.374	<=-22.5	PASS

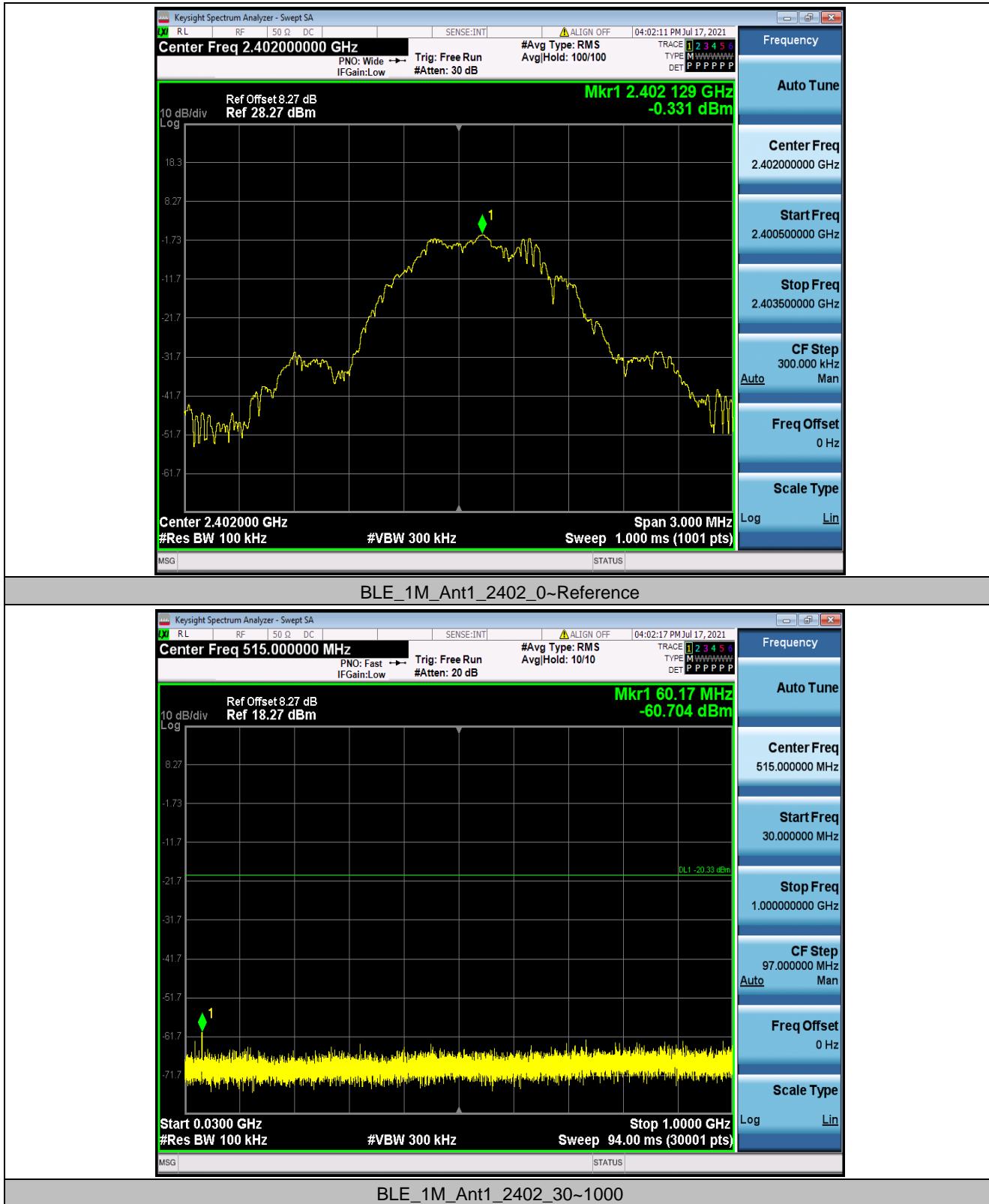
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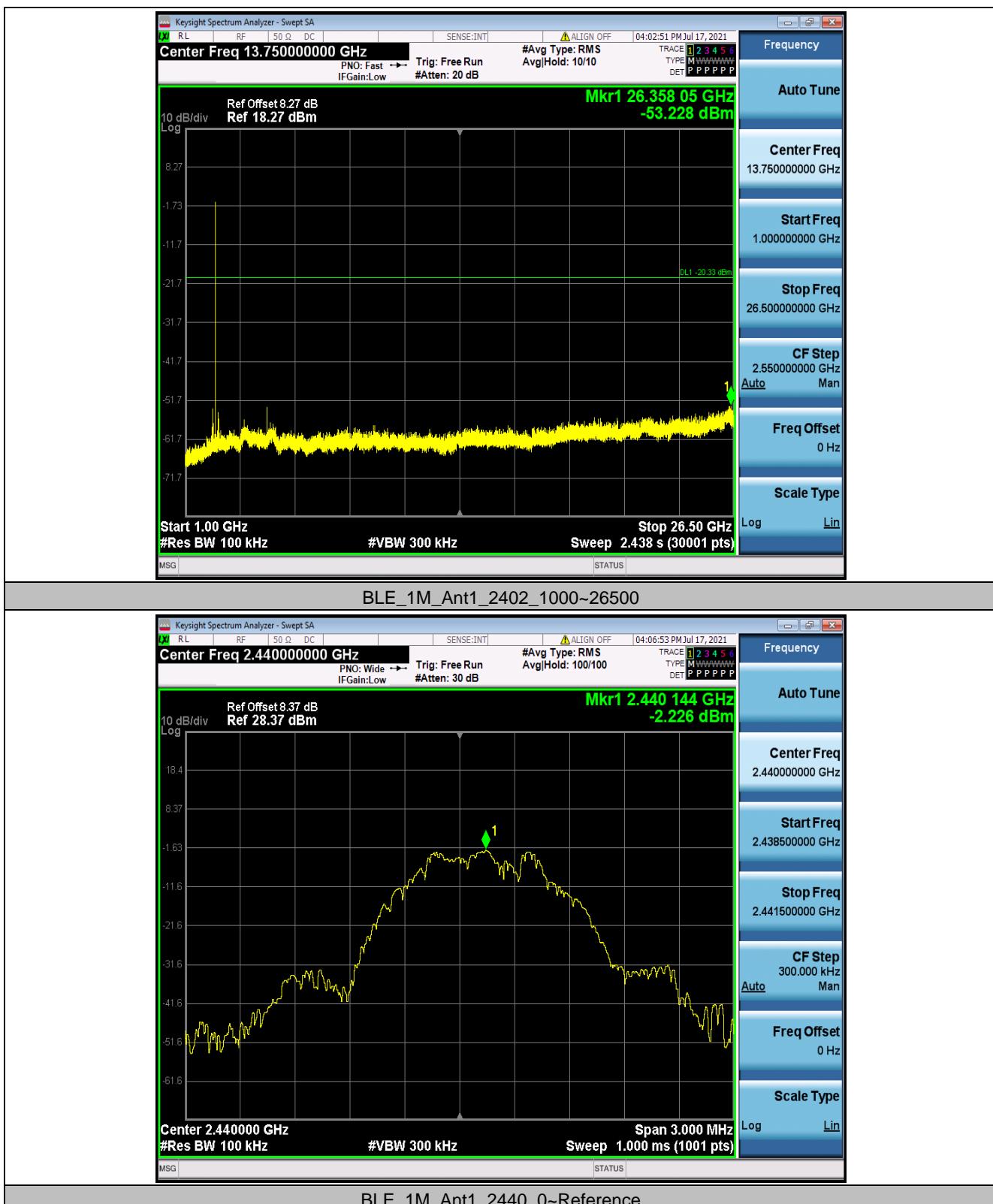
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8.5.2 Test Graphs





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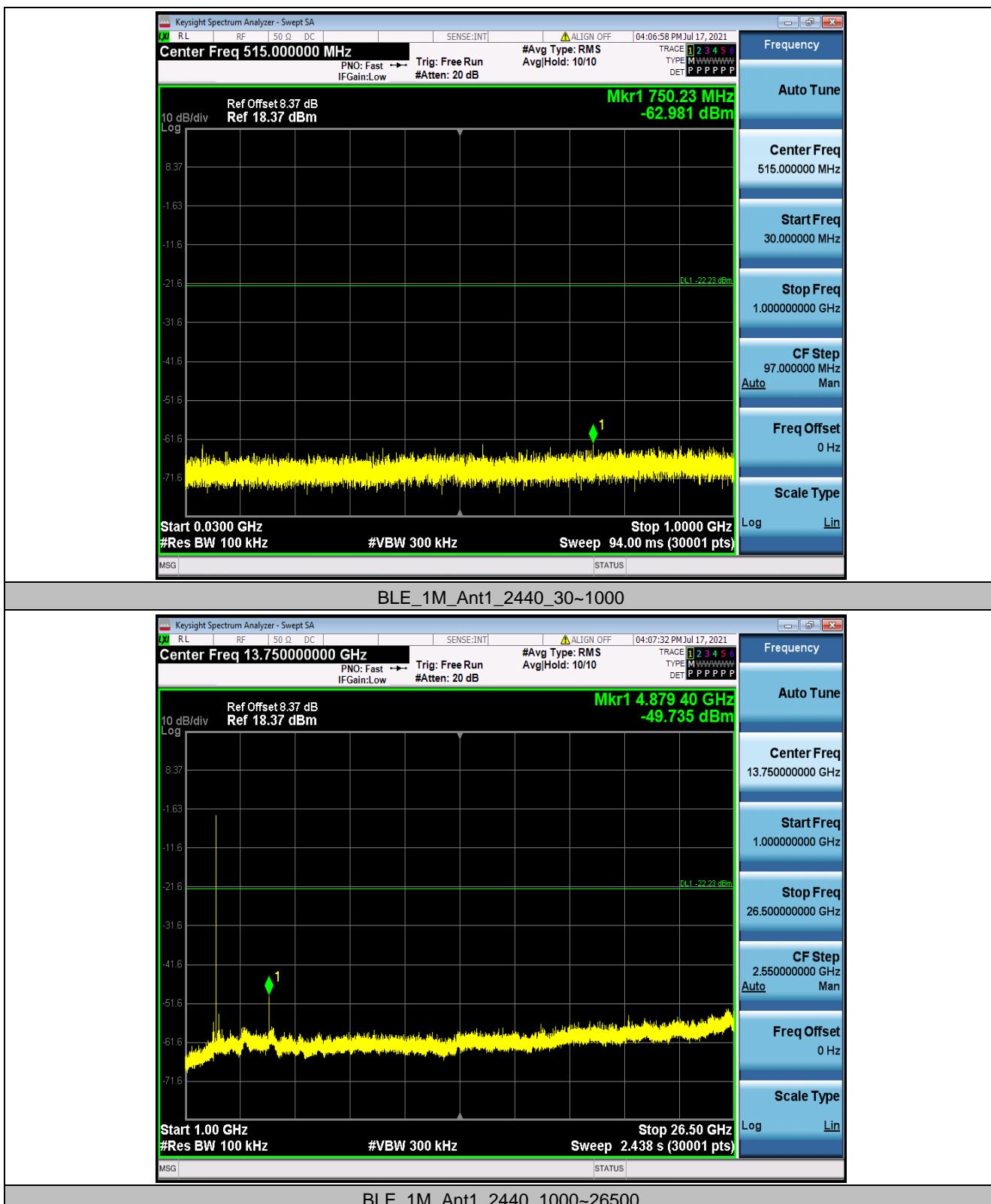


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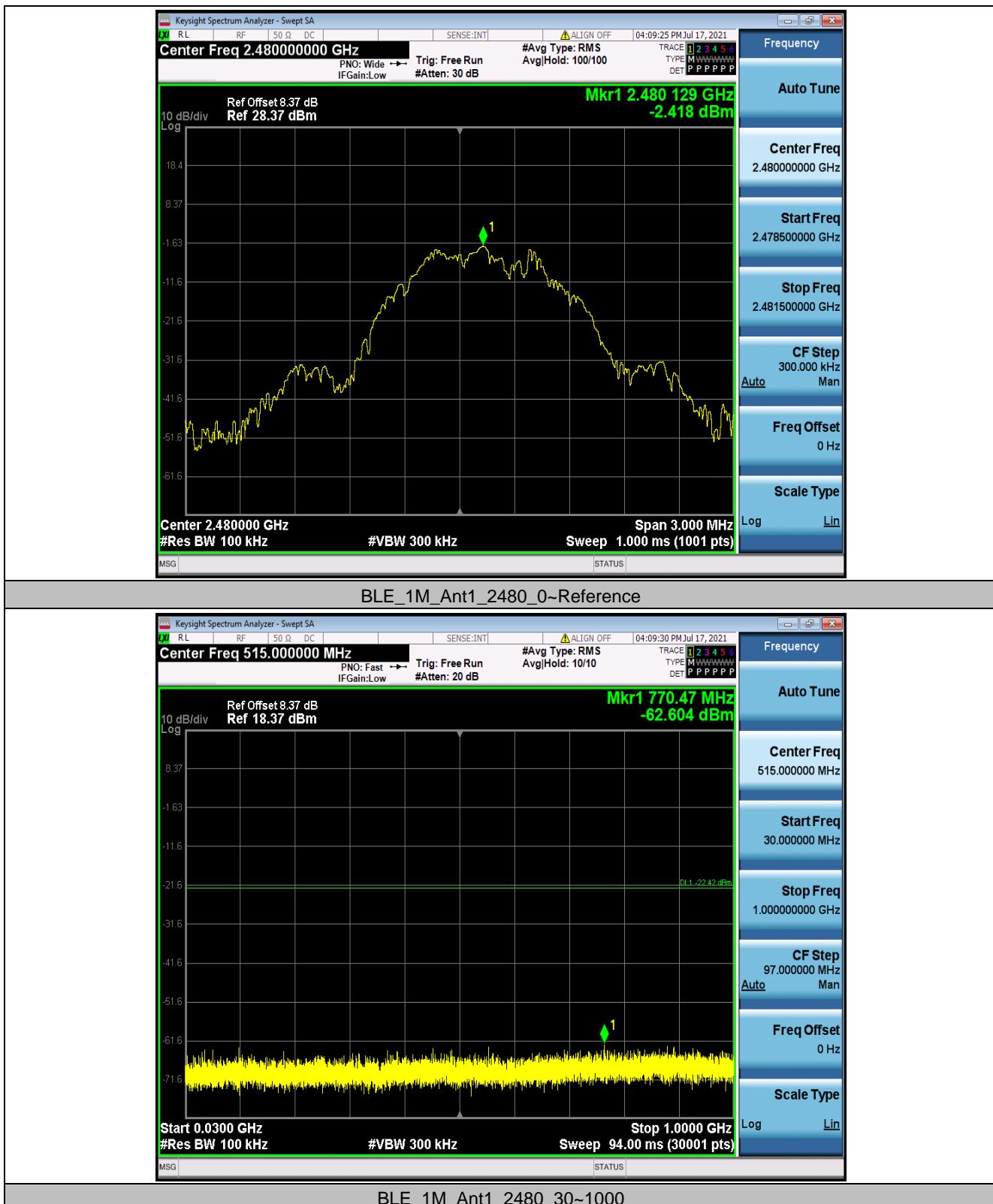
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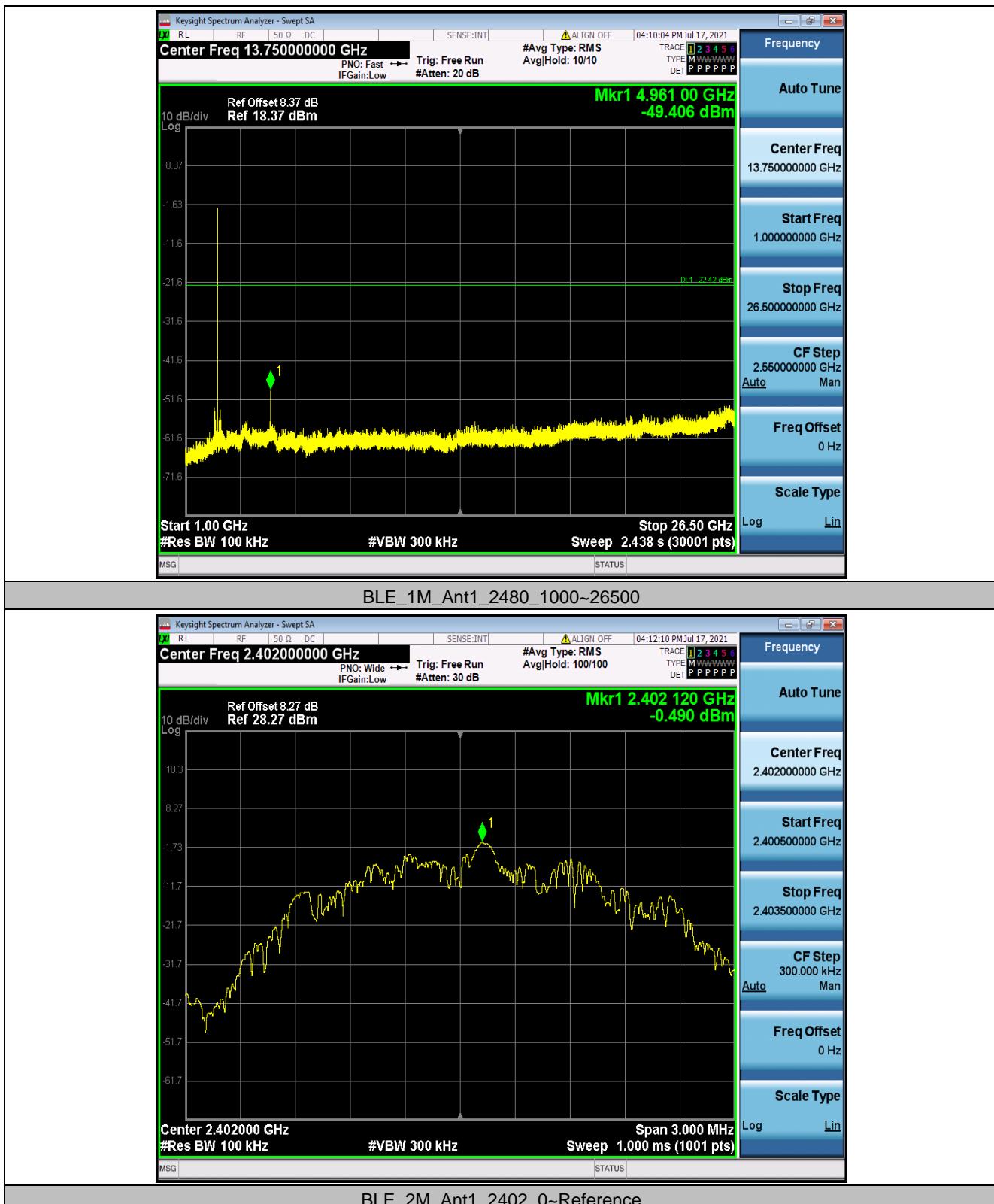
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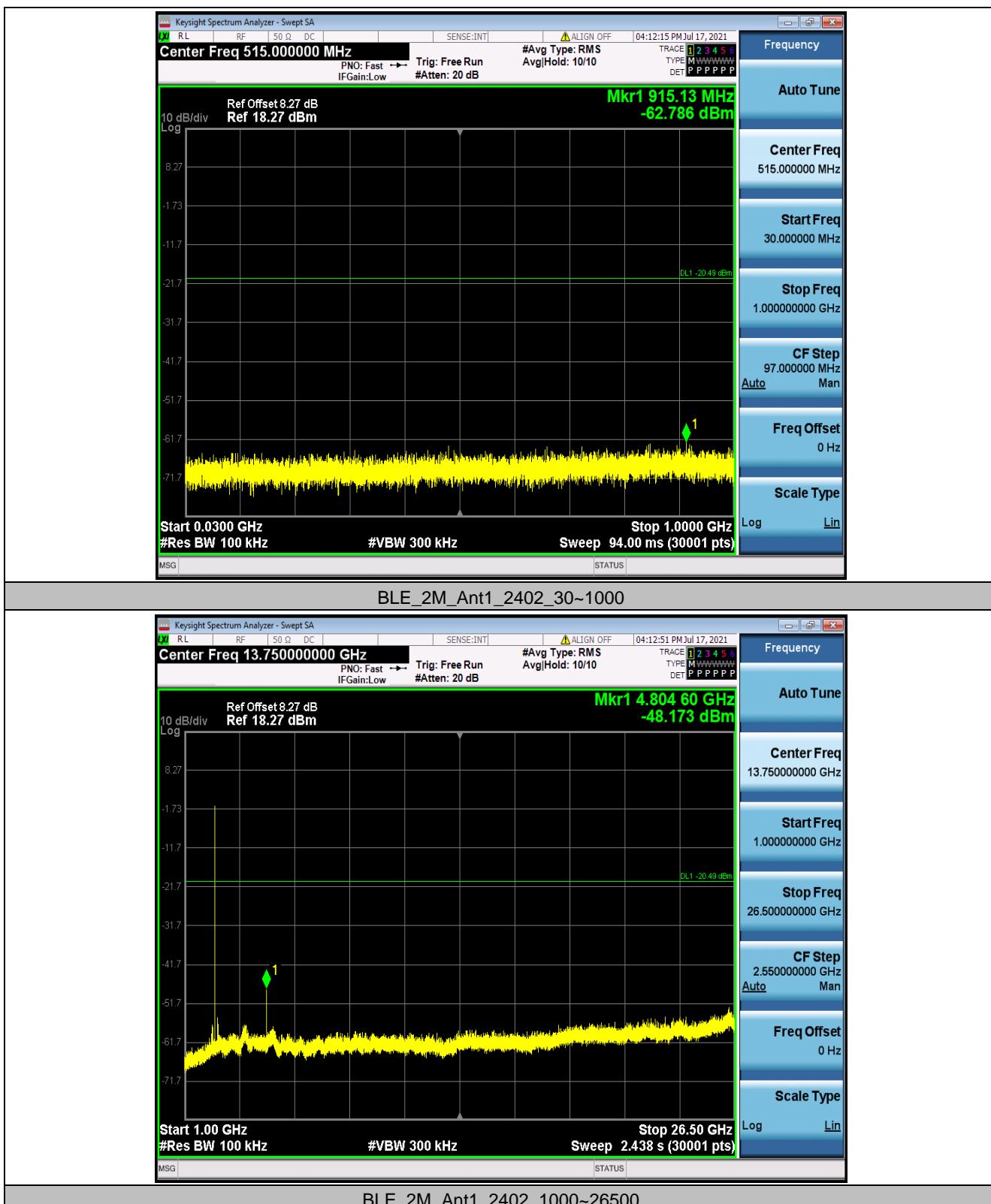


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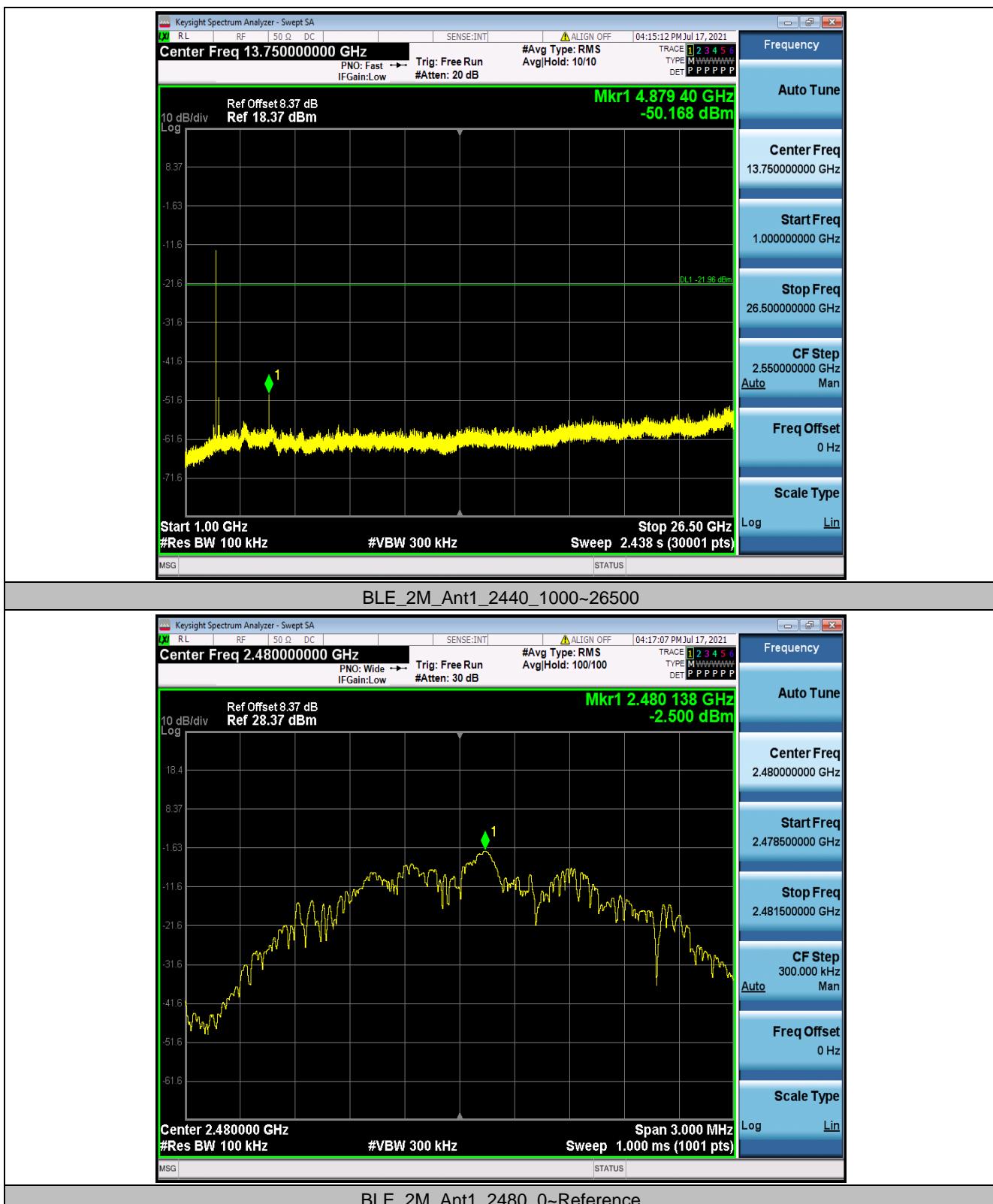


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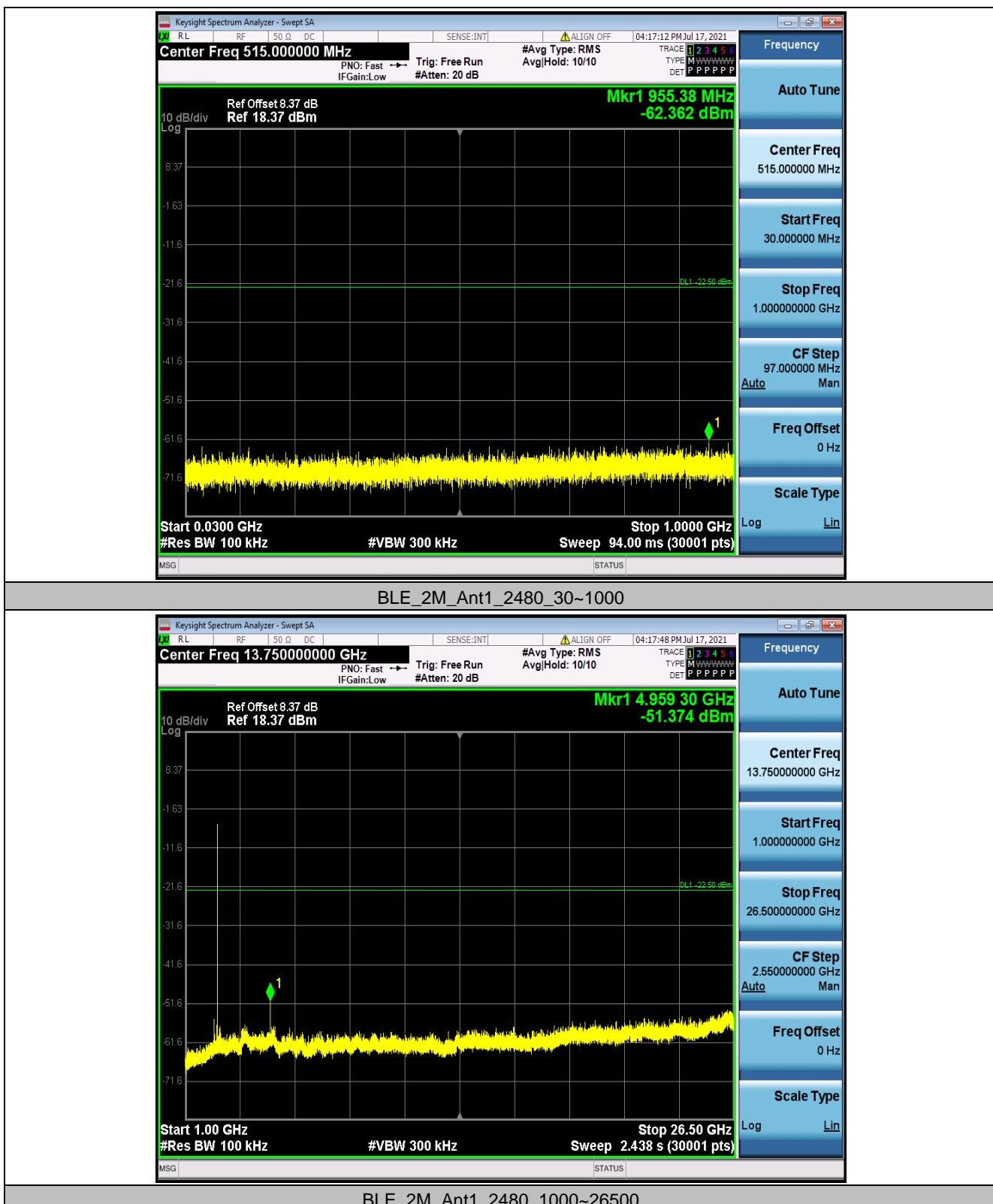
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- End of the Report -

