



TEST REPORT

Application No.: SZCR2104020733AT (SHEM2103002575CR)
FCC ID: 2AWDCTR1000-D
Applicant: Tsingoal(Beijing) Technology Co., Ltd
Address of Applicant: Room 32021, Zhongtai Building, Shuangqing Road No.3, Haidian District, Beijing, China
Manufacturer: Tsingoal(Beijing) Technology Co., Ltd
Address of Manufacturer: Room 32021, Zhongtai Building, Shuangqing Road No.3, Haidian District, Beijing, China
Factory: Beijing Yongshixinyu Electronic Technology Co., Ltd.
Address of Factory: Maohua factory, houfengbozuodi Road, Shunyi District, Beijing, China
Equipment Under Test (EUT):
EUT Name: TICTAG
Model No.: TR1000-d
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2021-03-26
Date of Test: 2021-04-10 to 2021-04-21
Date of Issue: 2021-04-25

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

Keny Xu
EMC Laboratory Manager



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Revision Record			
Version	Description	Date	Remark
00	Original	2021-04-25	/

Authorized for issue by:				
		Foray Chen /Project Engineer		
		Eric Fu /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
Minimum 6dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass
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
Power Spectrum Density	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	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	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass

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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 3V by CR2032
Test voltage:	DC 3V
Antenna Gain:	0dBi (Provided by manufacturer)
Antenna Type:	PCB Antenna
Bluetooth Version:	V5.0 LE
Channel Spacing:	2MHz
Data Rate:	1Mbps, 2Mbps
Modulation Type:	GFSK
Number of Channels:	40
Operation Frequency:	2402MHz to 2480MHz

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
BT test board	/	Test Plate 2	/
Laptop	Lenovo	ThinkPad X100e	/

4.3 Power level setting using in test:

Channel	BLE
0	Default
19	Default
39	Default

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4.4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
4	Conduction emission	$\pm 3.0\text{dB}$ (150kHz to 30MHz)
5	RF conducted power	$\pm 0.75\text{dB}$
6	RF power density	$\pm 2.84\text{dB}$
7	Conducted Spurious emissions	$\pm 0.75\text{dB}$
8	RF Radiated power	$\pm 4.5\text{dB}$ (Below 1GHz) $\pm 4.8\text{dB}$ (Above 1GHz)
9	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz) $\pm 4.8\text{dB}$ (Above 1GHz)
10	Temperature test	$\pm 1^\circ\text{C}$
11	Humidity test	$\pm 3\%$
12	Supply voltages	$\pm 1.5\%$
13	Time	$\pm 3\%$

Remark:

The U_{lab} (lab Uncertainty) is less than U_{cispr} (CISPR Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

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4.5 Test Location

All tests were performed at:

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No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.6 Test Facility

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

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.7 Deviation from Standards

None

4.8 Abnormalities from Standard Conditions

None

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5 Equipment List

RF test system						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
1	Shielding Room	SAEMC	MSR433	SEM001-11	2019-06-13	2022-06-12
2	EXA Signal Analyzer (10Hz-26.5GHz)	KEYSIGHT	N9010A	SEM004-09	2021-04-09	2022-04-08
3	Signal Generator(9kHz-3GHz)	KEYSIGHT	N5171B	SEM006-13	2021-03-24	2022-03-23
4	MXG Vector Signal Generator	KEYSIGHT	N5182A	SEM006-14	2021-03-24	2022-03-23
5	ESG Vector Signal Generator	KEYSIGHT	E4438C	SEM006-15	2020-09-23	2021-09-22
6	DC Power Supply	KEYSIGHT	E3642A	SEM011-07	2021-03-23	2022-03-22
7	Manual Step Attenuator	KEYSIGHT	8494B	SEM021-05	2021-04-09	2022-04-08
8	Manual Step Attenuator	KEYSIGHT	8496B	SEM021-06	2021-04-09	2022-04-08
9	Power Sensor	KEYSIGHT	U2021XA	SEM009-13	2021-03-24	2022-03-23
10	Power Sensor	KEYSIGHT	U2021XA	SEM009-14	2021-03-24	2022-03-23
11	Power Sensor	KEYSIGHT	U2021XA	SEM009-15	2021-03-24	2022-03-23
12	Power Sensor	KEYSIGHT	U2021XA	SEM009-16	2021-03-24	2022-03-23
13	Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2021-03-23	2022-03-22
14	Universal Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-03	2021-03-24	2022-03-23
15	Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.6	N/A	N/A	N/A
16	Coaxial Cable	SGS	N/A	SEM028-01	2020-07-10	2021-07-09

RE in Chamber						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date	Cal. Due date
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2020-07-19	2023-07-18
2	MXE EMI receiver(3Hz-3.6GHz)	KEYSIGHT	N9038A	SEM004-15	2020-11-02	2021-11-01
3	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-02	2019-05-24	2022-05-23
4	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2021-03-24	2022-03-23
5	Pre-amplifier	Sonoma Instrument	310N	SEM005-04	2021-04-09	2022-04-08

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	(9kHz-1GHz)	Co				
6	Loop Antenna (9kHz-30MHz)	ETS-Lindgren	6502	SEM003-08	2020-08-14	2023-08-13
7	Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
8	Coaxial Cable	SGS	N/A	SEM025-01	2020-07-10	2021-07-09

RE in Chamber 2#

Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2020-07-19	2023-07-18
2	EXA Signal Analyzer (10Hz-44GHz)	Agilent Technologies Inc	N9010A	SEM004-12	2021-04-09	2022-04-08
3	Horn Antenna (800MHz-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
4	Horn Antenna (800MHz-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2021-04-13	2024-04-12
5	Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	SEM003-15	2020-11-14	2023-11-13
6	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2020-09-23	2021-09-22
7	Pre-amplifier (26-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2021-03-24	2022-03-23
8	Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
9	Coaxial Cable	SGS	N/A	SEM026-01	2020-07-10	2021-07-09

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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 PCB antenna and no consideration of replacement. The best case gain of the antenna is 0dBi.

Antenna location: Refer to Appendix (Internal Photos)



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7 Radio Spectrum Matter Test Results

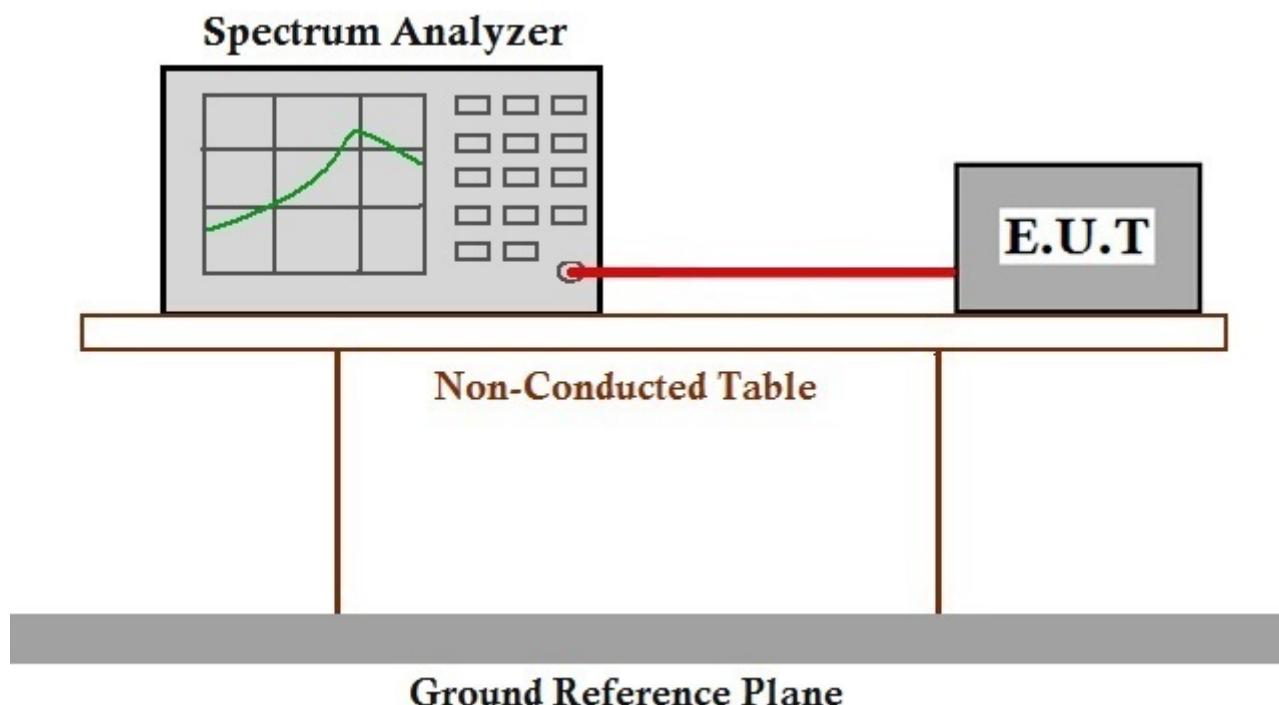
7.1 Minimum 6dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247a(2)
Test Method: ANSI C63.10 (2013) Section 11.8.1
Limit: ≥ 500 kHz

7.1.1 E.U.T. Operation

Operating Environment:
Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1001 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.1.2 Test Setup Diagram



7.1.3 Measurement Procedure and Data

The detailed test data see: Appendix A for SZCR210402073301



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7.2 Conducted Peak Output Power

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

Test Method: ANSI C63.10 (2013) Section 11.9.1

Limit:

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

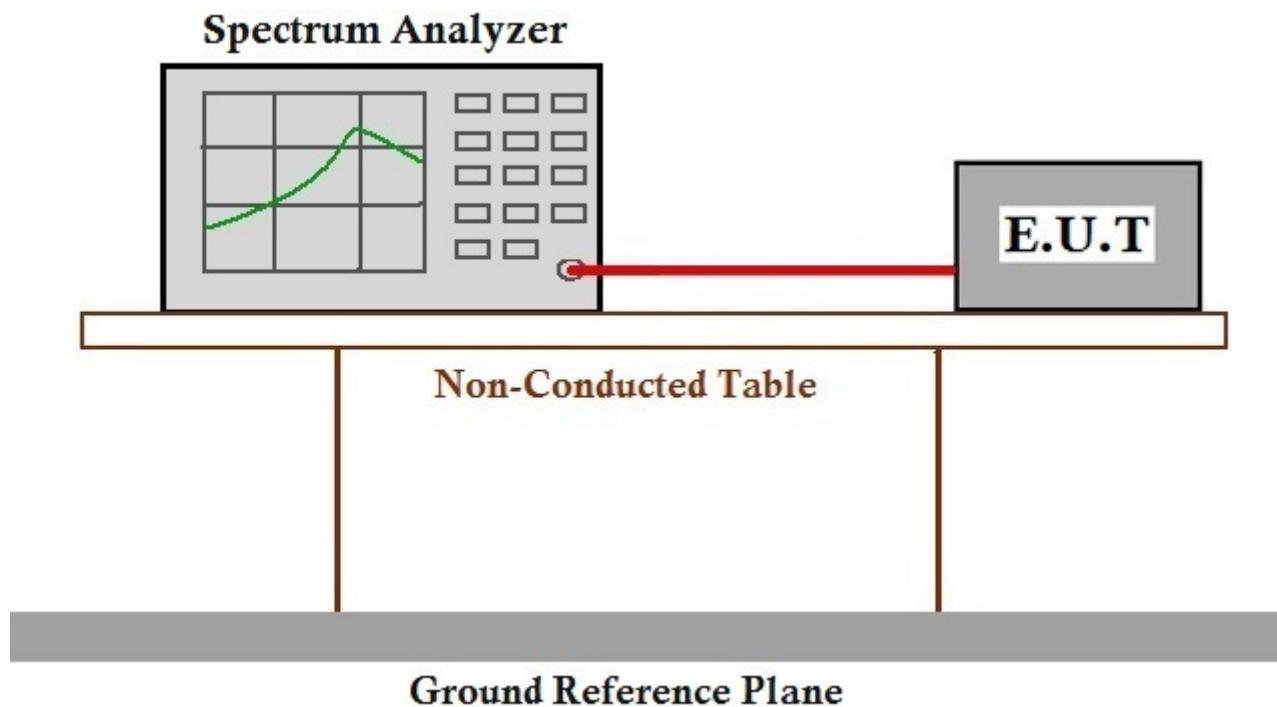
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1001 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix A for SZCR210402073301



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7.3 Power Spectrum Density

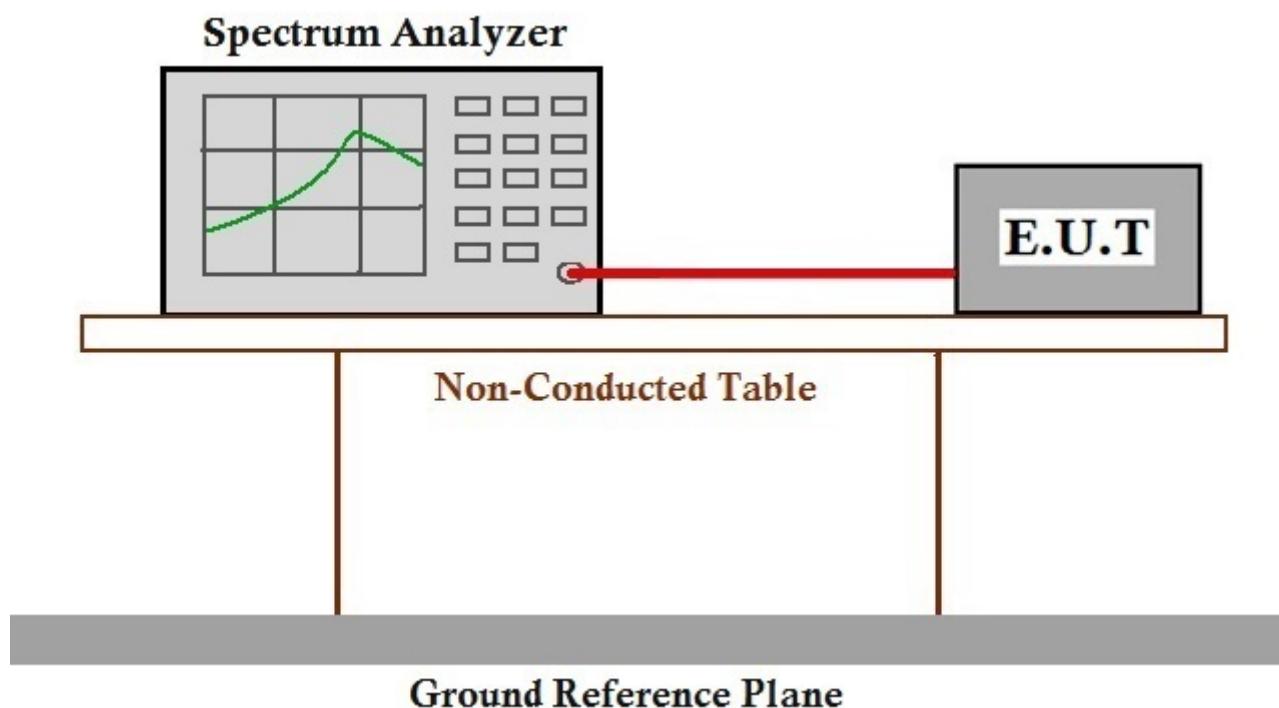
Test Requirement 47 CFR Part 15, Subpart C 15.247(e)
Test Method: ANSI C63.10 (2013) Section 11.10.2
Limit: $\leq 8\text{dBm}$ in any 3 kHz band during any time interval of continuous transmission

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1001 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

The detailed test data see: Appendix A for SZCR210402073301



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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))



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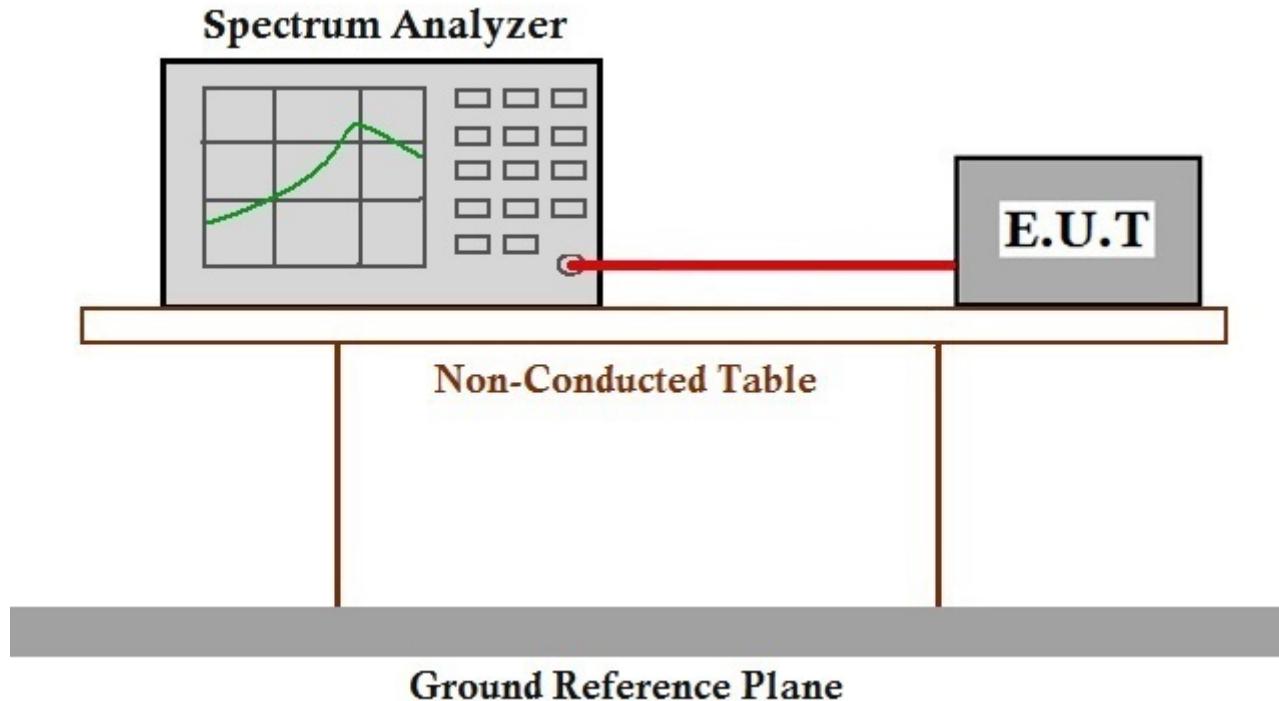
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7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1001 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.4.2 Test Setup Diagram



7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix A for SZCR210402073301



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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))



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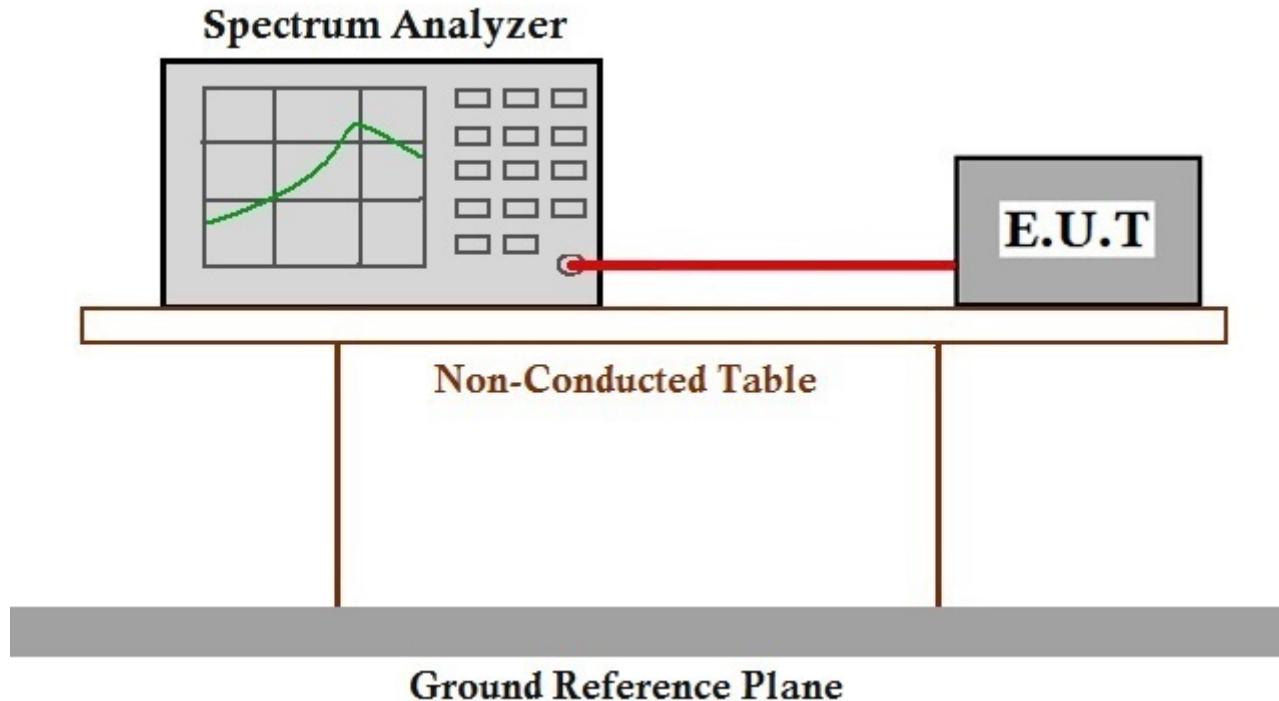
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7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1001 mbar
Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation**7.5.2 Test Setup Diagram****7.5.3 Measurement Procedure and Data**

The detailed test data see: Appendix A for SZCR210402073301



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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.



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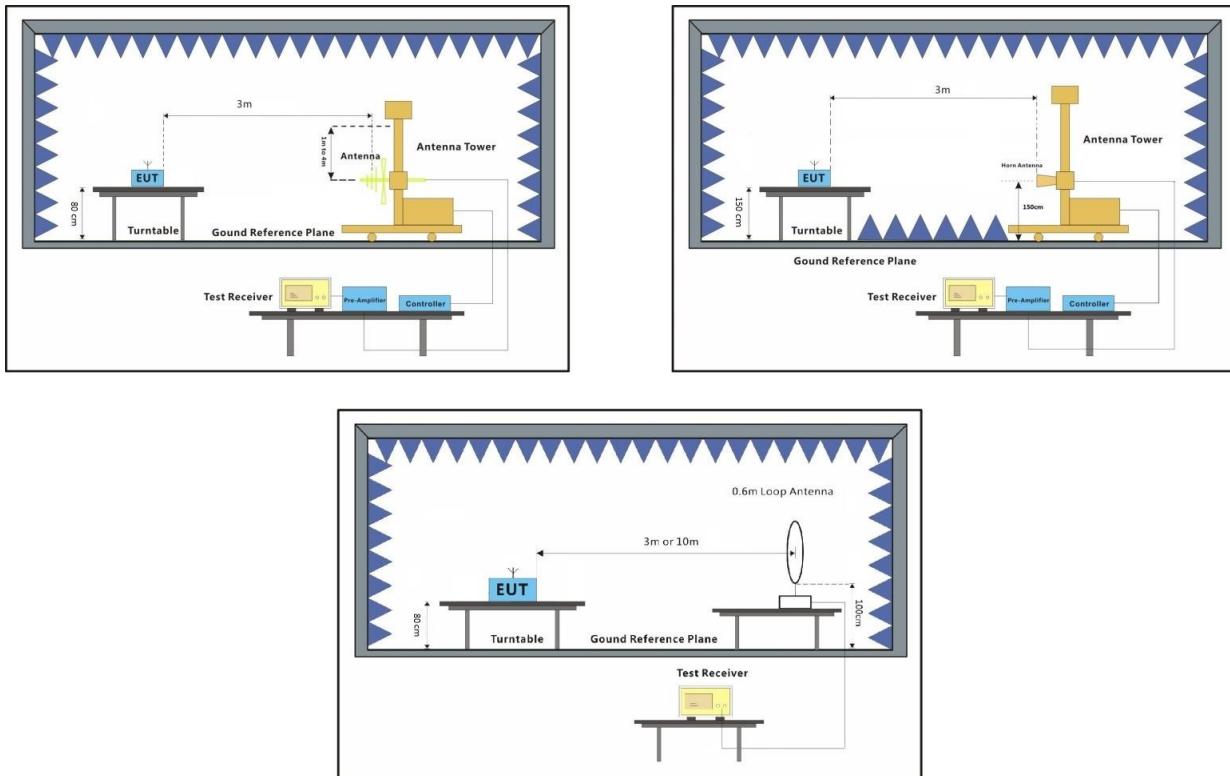
7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1001 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.6.2 Test Setup Diagram



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7.6.3 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

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

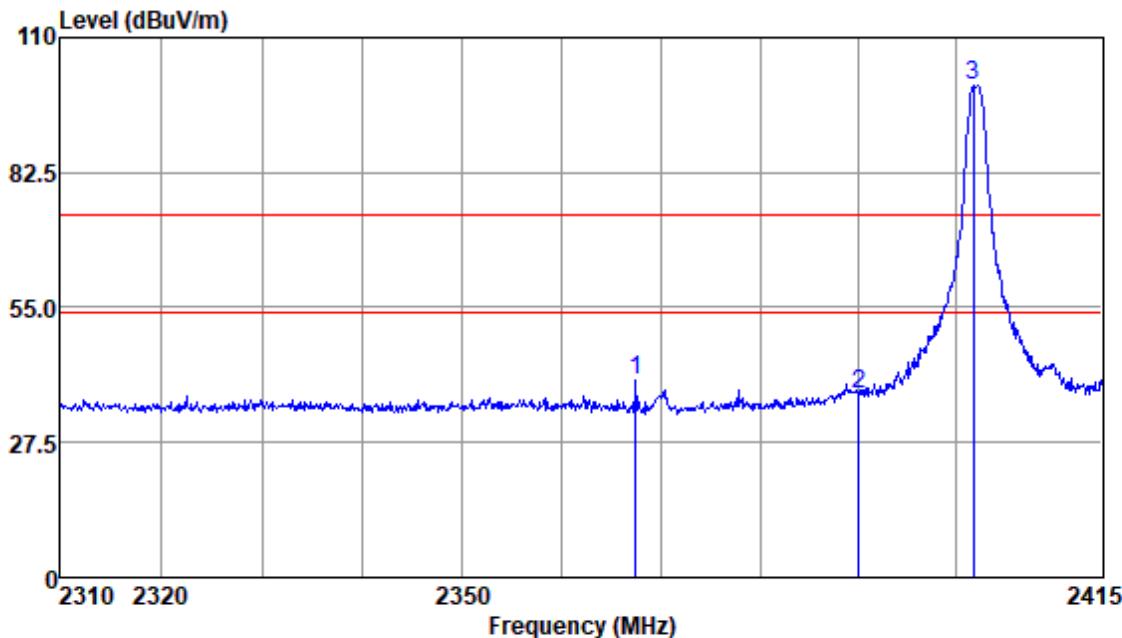
Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level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



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Date Rate:1Mbps Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2367.38	46.78	27.16	8.39	42.31	40.02	74.00	-33.98	Peak
2390.01	43.89	27.23	8.46	42.37	37.21	74.00	-36.79	Peak
2401.73	106.91	27.27	8.46	42.40	100.24	74.00	26.24	Peak

Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

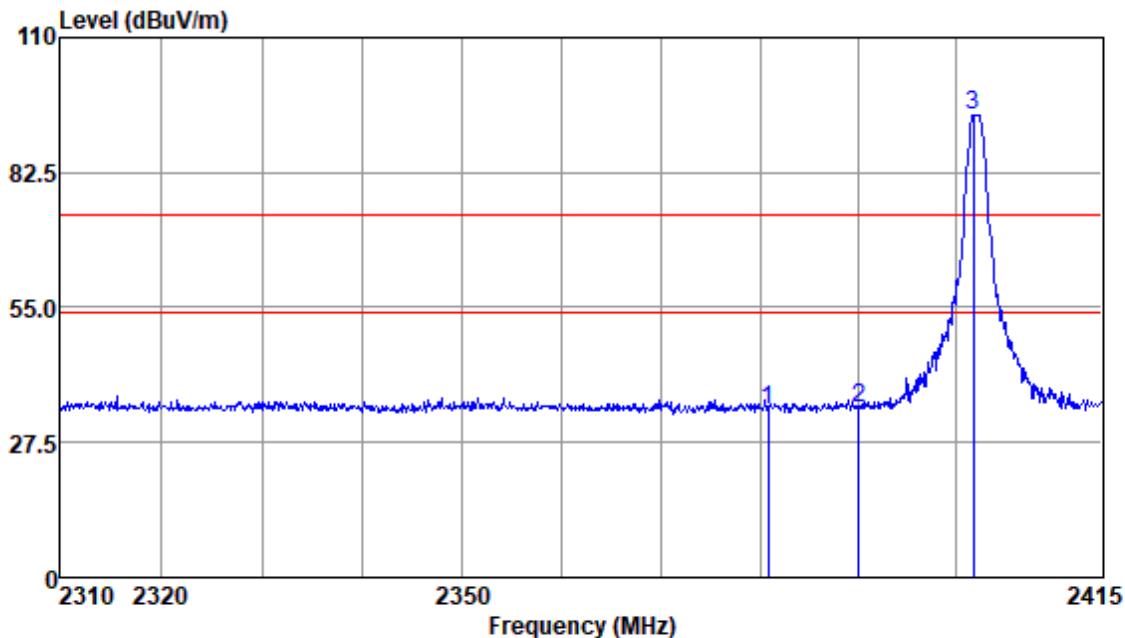
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Date Rate:1Mbps Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Emission Limit	Over Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	dB	
2380.79	40.91	27.20	8.46	42.35	34.22	74.00	-39.78	Peak	
2390.00	41.14	27.23	8.46	42.37	34.46	74.00	-39.54	Peak	
2401.73	100.96	27.27	8.46	42.40	94.29	74.00	20.29	Peak	

Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

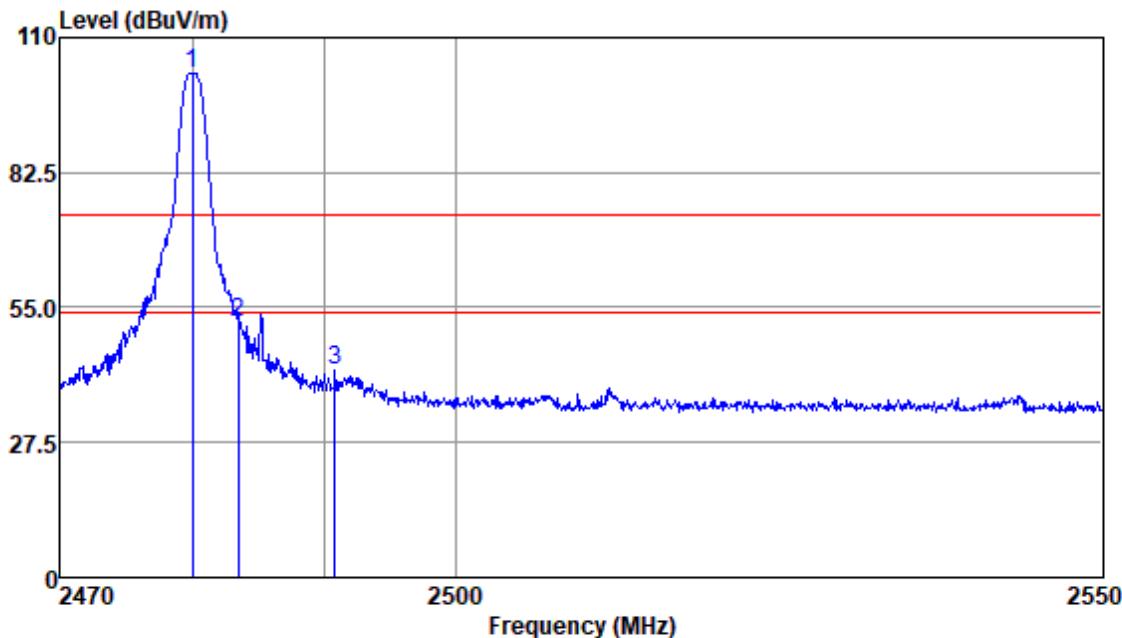
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Date Rate:1Mbps Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Emission Limit	Over Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	dB	
2480.02	109.00	27.53	8.60	42.40	102.73	74.00	28.73	Peak	
2483.50	58.09	27.55	8.60	42.40	51.84	74.00	-22.16	Peak	
2490.79	48.52	27.58	8.67	42.40	42.37	74.00	-31.63	Peak	

Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

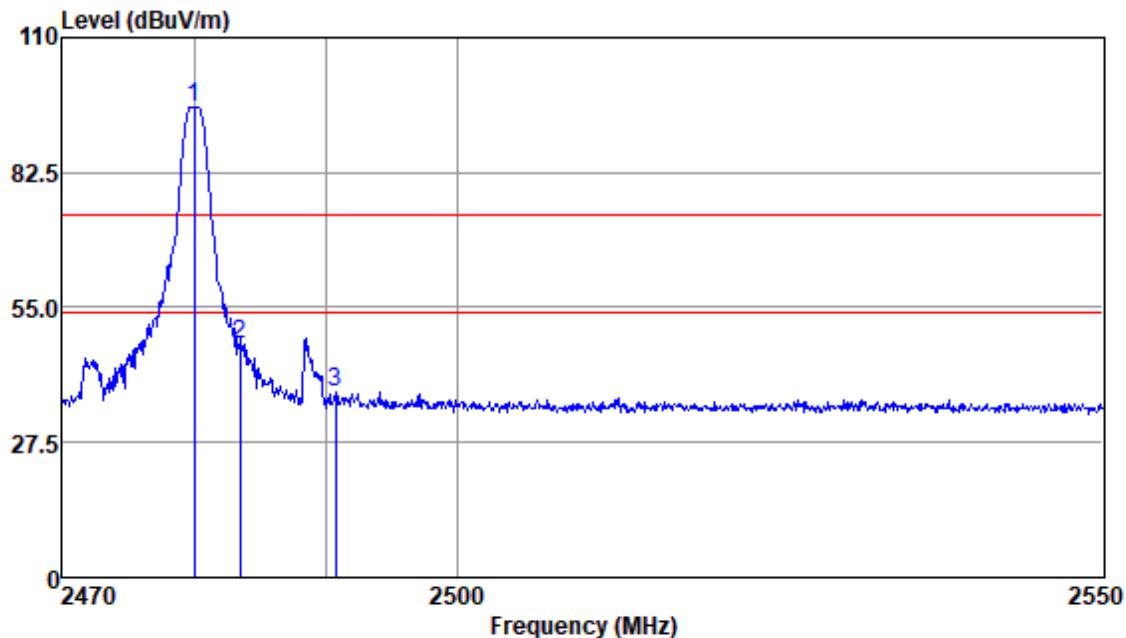
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Date Rate:1Mbps Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Antenna Polarity : VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2480.02	102.21	27.53	8.60	42.40	95.94	74.00	21.94	Peak
2483.50	53.78	27.55	8.60	42.40	47.53	74.00	-26.47	Peak
2490.71	44.07	27.58	8.67	42.40	37.92	74.00	-36.08	Peak

Note: Emission Level=Read Level+Antenna Factor+Cable loss+Preamp Factor

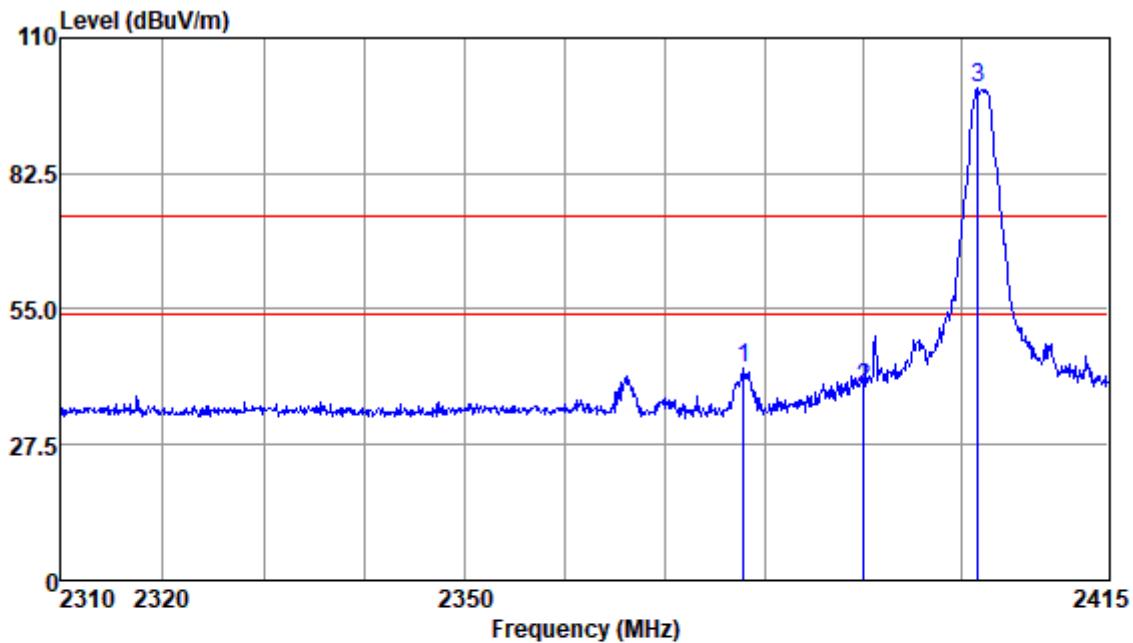
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Date Rate:2Mbps Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Antenna Polarity :HORIZONTAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2377.93	49.68	27.20	8.39	42.35	42.92	74.00	-31.08	Peak
2390.00	45.67	27.23	8.46	42.37	38.99	74.00	-35.01	Peak
2401.62	106.42	27.27	8.46	42.40	99.75	74.00	25.75	Peak

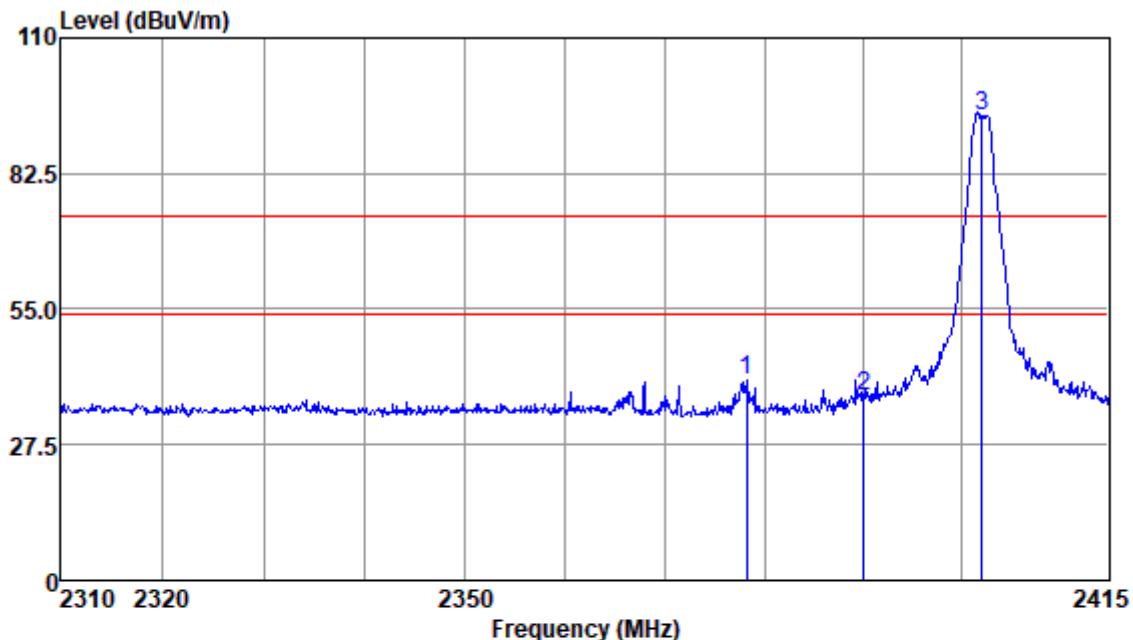
Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Antenna Polarity :VERTICAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2378.14	47.19	27.20	8.39	42.35	40.43	74.00	-33.57	Peak
2390.00	44.19	27.23	8.46	42.37	37.51	74.00	-36.49	Peak
2402.05	100.76	27.27	8.46	42.40	94.09	74.00	20.09	Peak

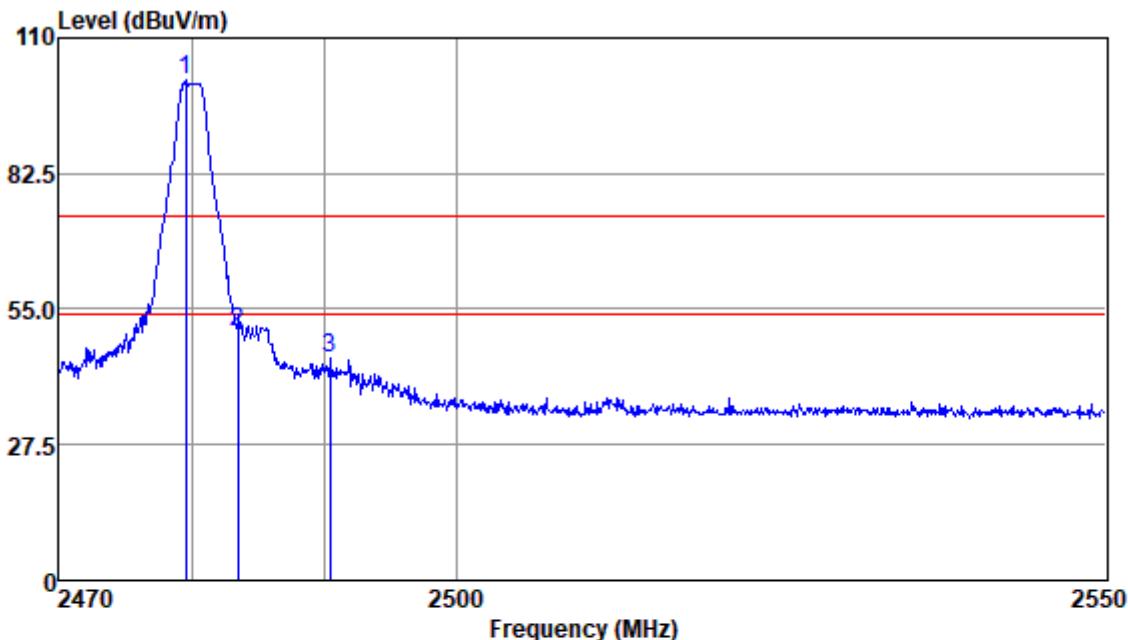
Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Antenna Polarity :HORIZONTAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2479.55	107.71	27.53	8.60	42.40	101.44	74.00	27.44	Peak
2483.50	56.39	27.55	8.60	42.40	50.14	74.00	-23.86	Peak
2490.48	51.13	27.58	8.67	42.40	44.98	74.00	-29.02	Peak

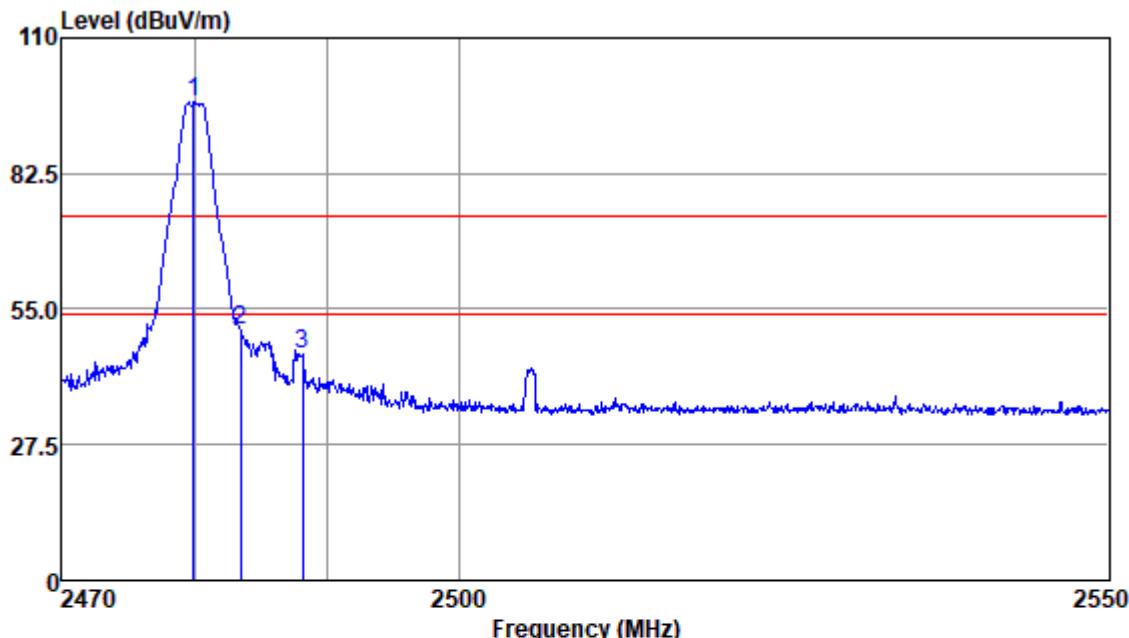
Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

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Date Rate:2Mbps Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Antenna Polarity : VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit	Over Line	Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB		
2479.94	103.14	27.53	8.60	42.40	96.87	74.00	22.87		Peak
2483.50	57.00	27.55	8.60	42.40	50.75	74.00	-23.25		Peak
2488.18	51.91	27.55	8.67	42.40	45.73	74.00	-28.27		Peak

Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

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7.7 Radiated Spurious Emissions

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.

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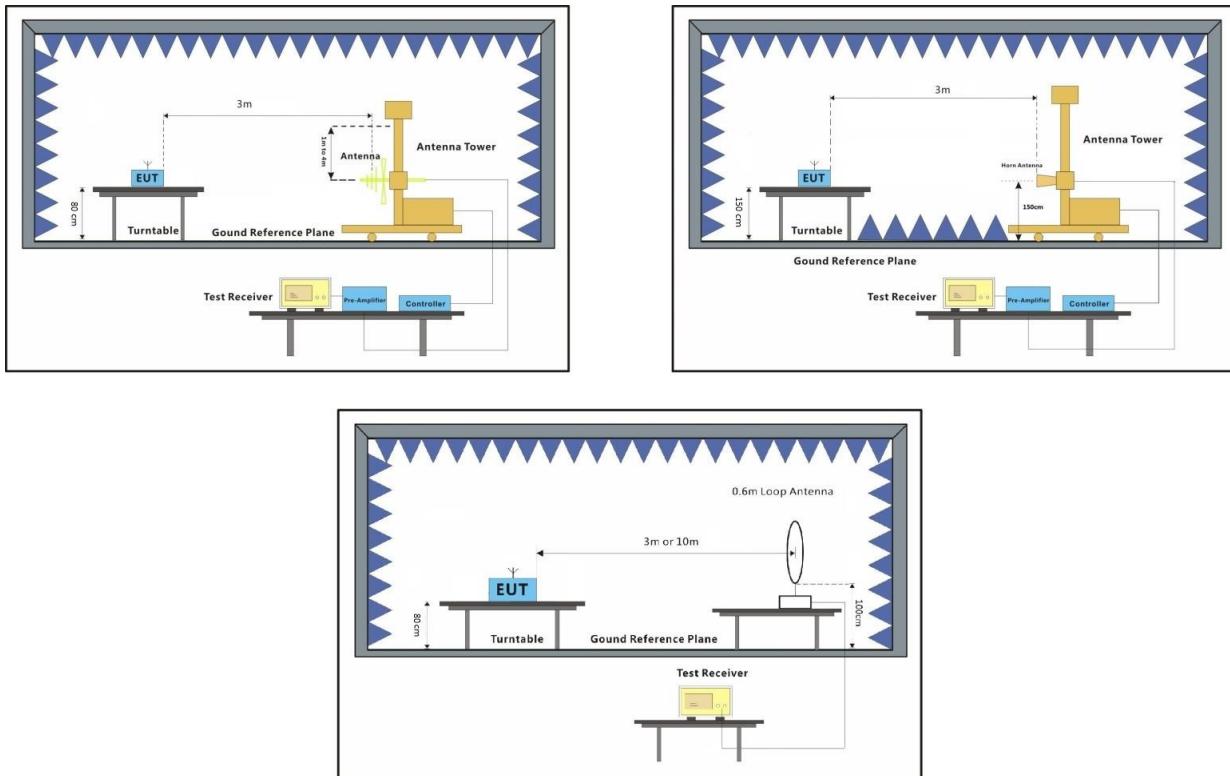
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7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1001 mbar

Test mode a:TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.7.2 Test Setup Diagram

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7.7.3 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark:

1) For emission below 1GHz, 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 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

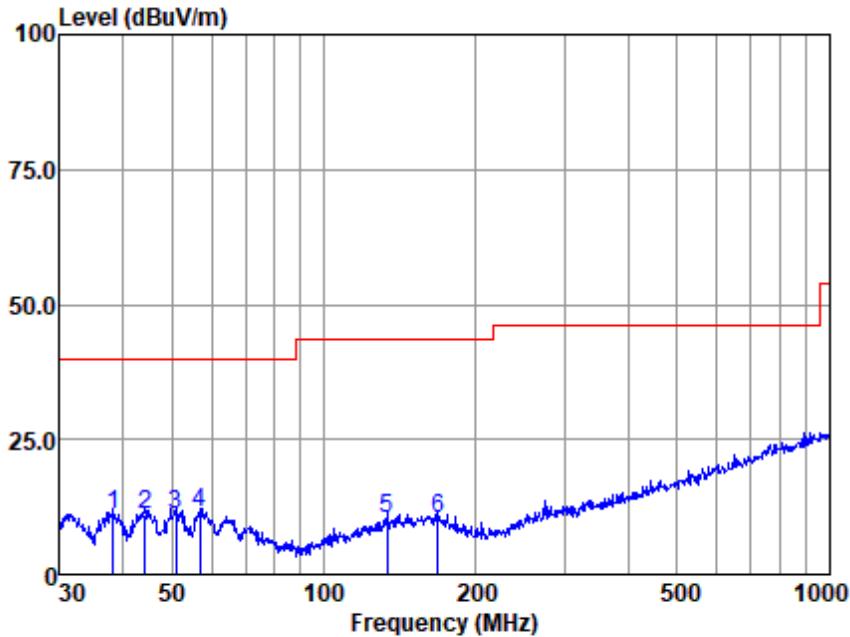
4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower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

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Below 1GHz

Mode:a; Polarization:Horizontal



Antenna Polarity :HORIZONTAL

EUT/Project :2574CR

Test mode :a

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark	
	Level	Factor	Loss	Factor	Level	Line	Limit		
1	38.346	39.70	12.95	0.86	42.32	11.19	40.00	-28.81	QP
2	44.275	38.91	13.46	0.94	42.30	11.01	40.00	-28.99	QP
3	50.942	38.81	13.64	1.02	42.30	11.17	40.00	-28.83	QP
4	56.792	39.27	13.28	1.08	42.30	11.33	40.00	-28.67	QP
5	133.619	38.77	12.07	1.75	42.23	10.36	43.50	-33.14	QP
6	168.414	37.82	12.87	1.97	42.20	10.46	43.50	-33.04	QP

Note: Emission Level=Read Level+Antenna Factor+Cable loss+Preamp Factor



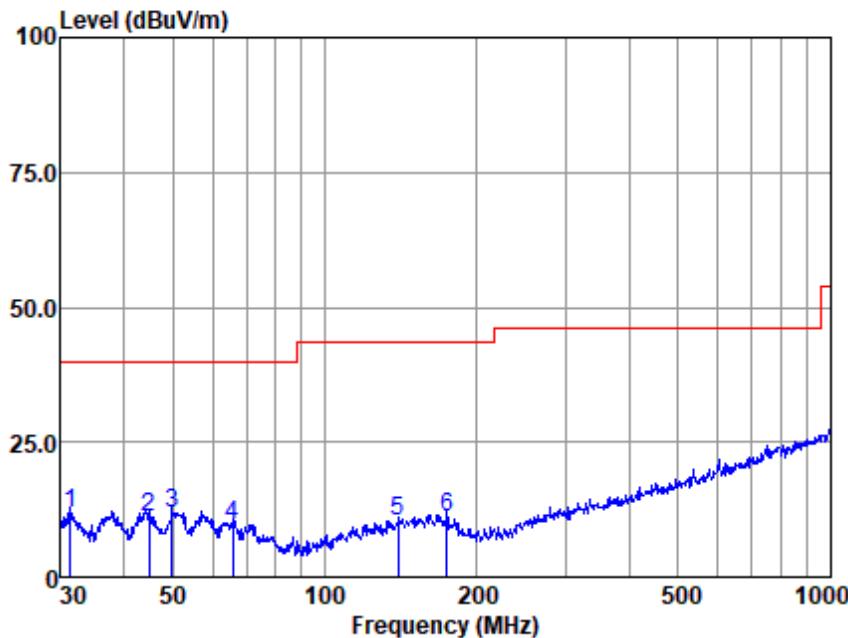
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Mode:a; Polarization:Vertical



Antenna Polarity : VERTICAL

EUT/Project : 2574CR

Test mode : a

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	31.399	41.15	12.26	0.80	42.38	11.83	40.00	-28.17 QP
2	44.901	39.04	13.49	0.95	42.30	11.18	40.00	-28.82 QP
3	49.881	39.44	13.69	1.00	42.30	11.83	40.00	-28.17 QP
4	65.573	38.44	12.30	1.17	42.30	9.61	40.00	-30.39 QP
5	139.851	38.11	12.50	1.79	42.22	10.18	43.50	-33.32 QP
6	174.424	38.98	12.36	2.02	42.20	11.16	43.50	-32.34 QP

Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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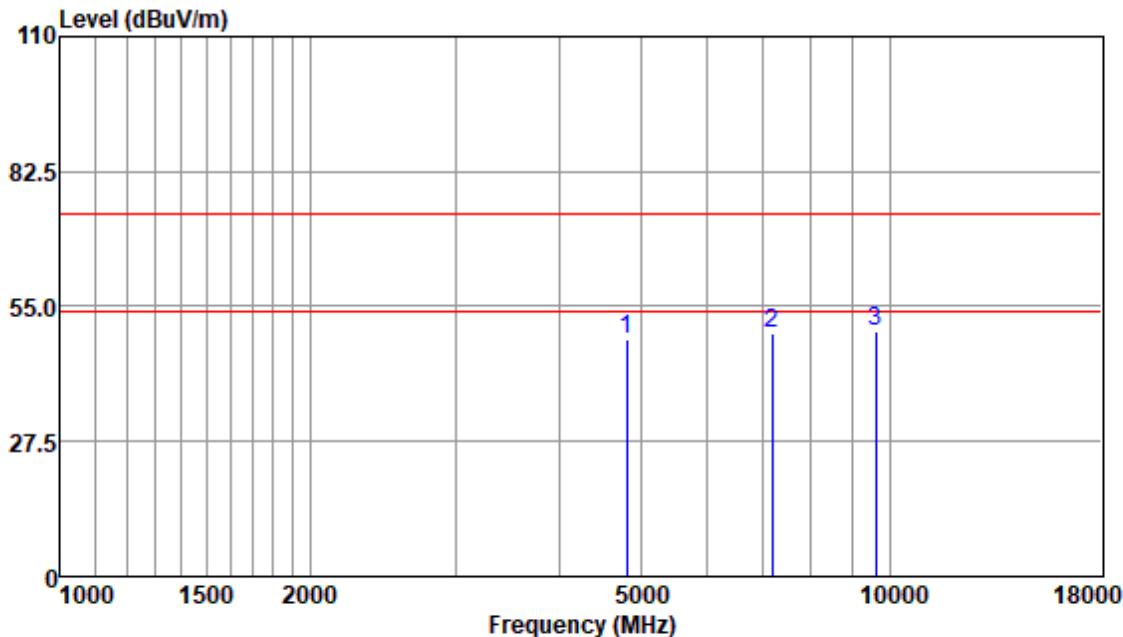
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Above 1GHz

Date Rate:1Mbps Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Antenna Polarity :HORIZONTAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4808.00	47.01	31.22	12.62	42.40	48.45	74.00	-25.55	Peak
7206.00	40.46	36.34	15.28	42.74	49.34	74.00	-24.66	Peak
9608.00	37.88	38.21	16.48	42.66	49.91	74.00	-24.09	Peak

Note: Emission Level=Read Level+Antenna Factor+Cable loss+Preamp Factor



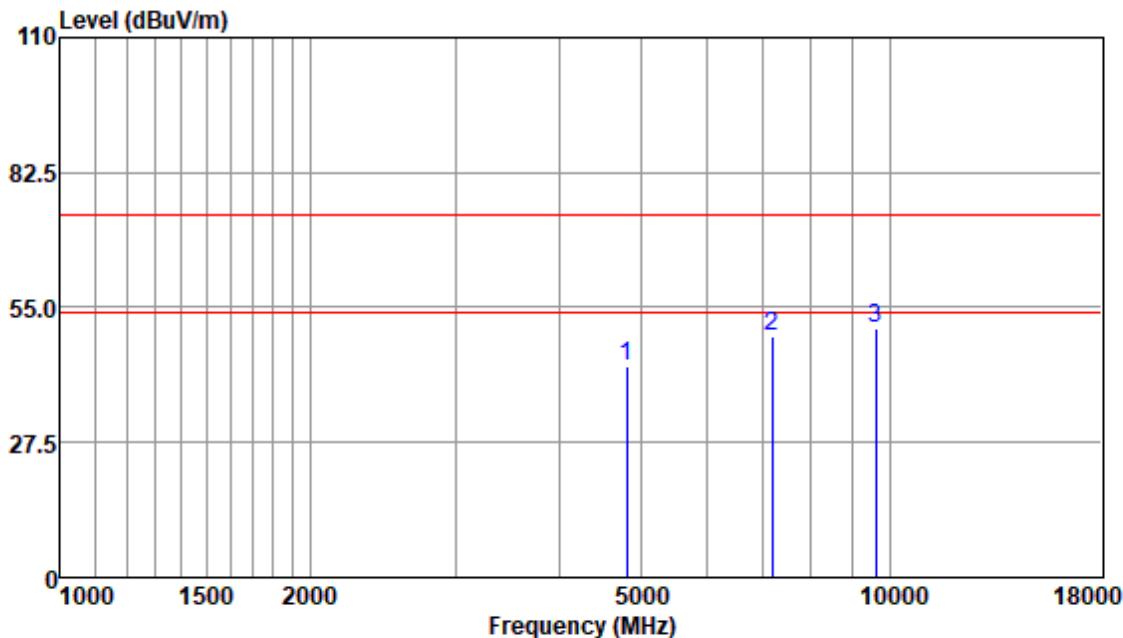
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Date Rate:1Mbps Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4808.00	41.66	31.22	12.62	42.40	43.10	74.00	-30.90	Peak
7206.00	40.10	36.34	15.28	42.74	48.98	74.00	-25.02	Peak
9608.00	38.52	38.21	16.48	42.66	50.55	74.00	-23.45	Peak

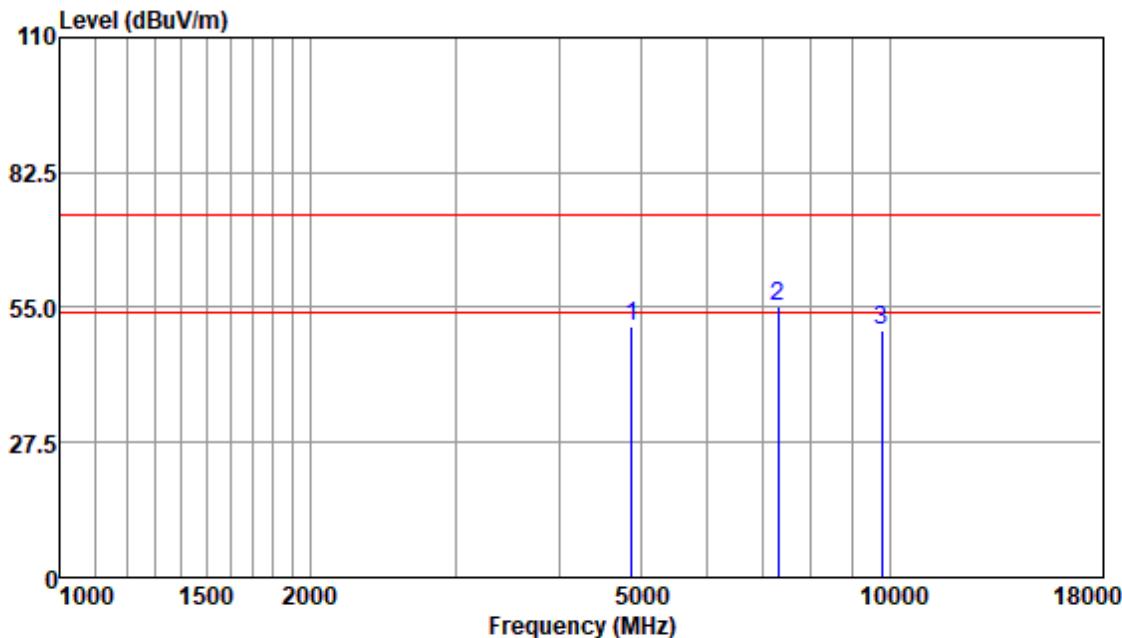
Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Date Rate:1Mbps Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle



Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4880.00	49.50	31.36	12.67	42.40	51.13	54.00	-2.87	Average
7320.00	46.07	36.67	15.30	42.77	55.27	74.00	-18.73	Peak
9760.00	37.95	38.35	16.60	42.60	50.30	74.00	-23.70	Peak

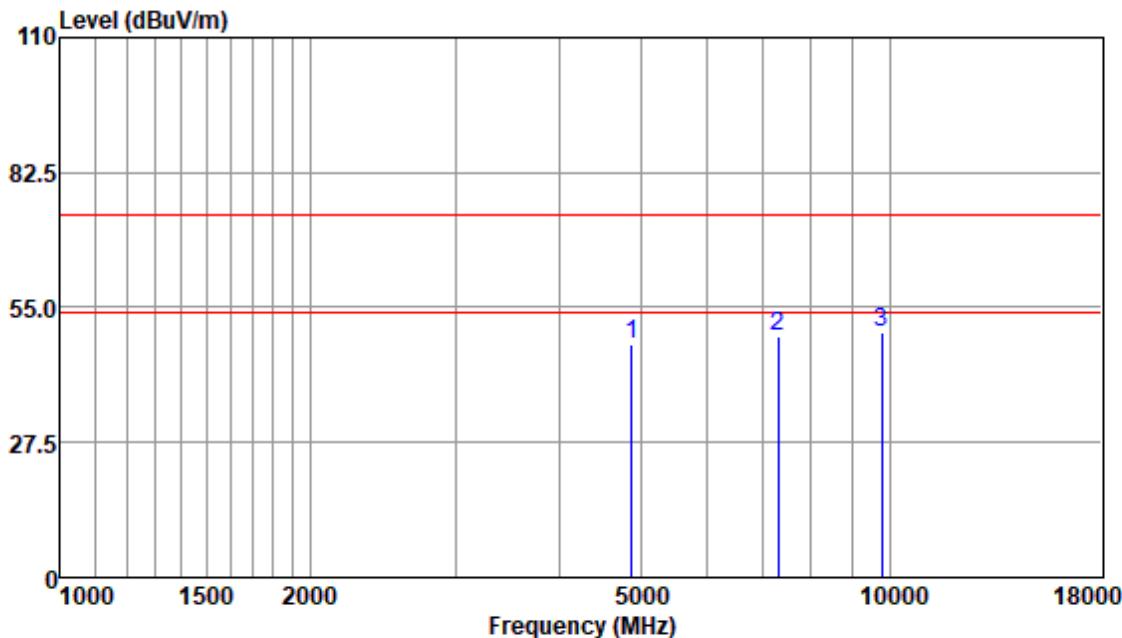
Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Date Rate:1Mbps Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:middle



Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4880.00	45.89	31.36	12.67	42.40	47.52	74.00	-26.48	Peak
7320.00	40.04	36.67	15.30	42.77	49.24	74.00	-24.76	Peak
9760.00	37.74	38.35	16.60	42.60	50.09	74.00	-23.91	Peak

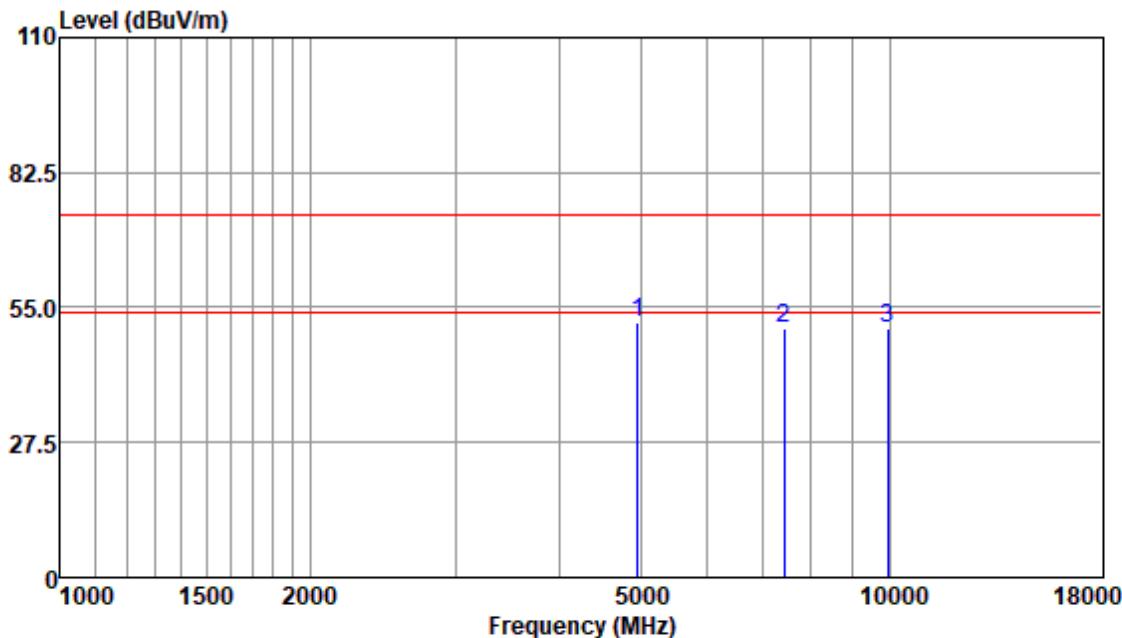
Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Date Rate:1Mbps Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
4960.00	50.28	31.52	12.72	42.40	52.12	74.00	-21.88	Peak
7440.00	41.19	36.94	15.33	42.79	50.67	74.00	-23.33	Peak
9920.00	37.85	38.52	16.72	42.53	50.56	74.00	-23.44	Peak

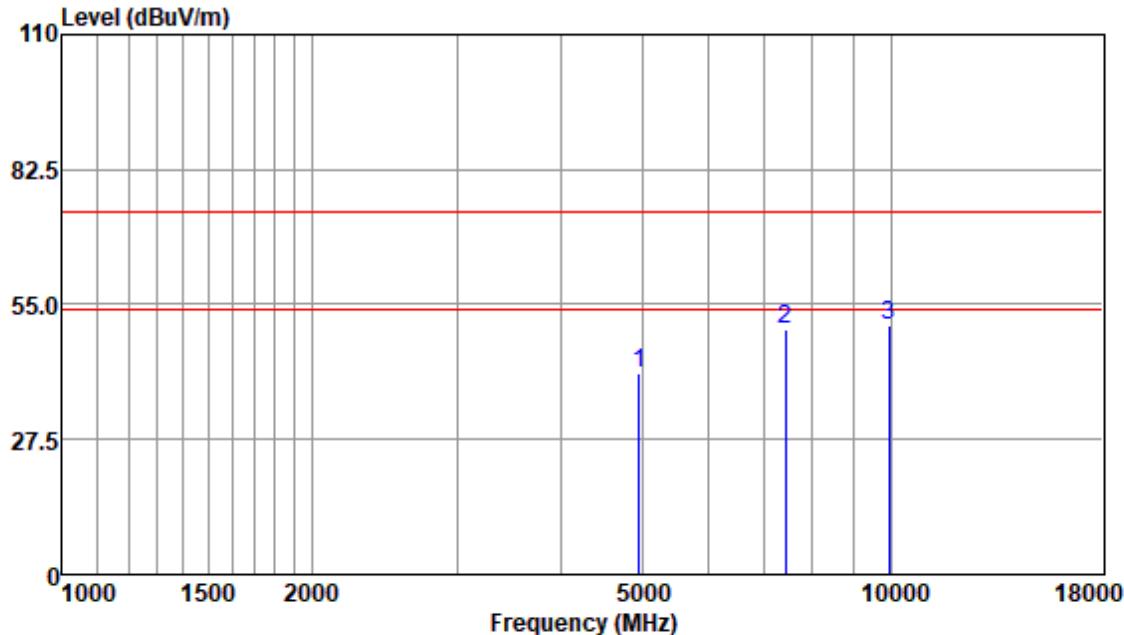
Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Date Rate:1Mbps Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Antenna Polarity : VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4960.00	38.98	31.52	12.72	42.40	40.82	74.00	-33.18	Peak
7440.00	40.42	36.94	15.33	42.79	49.90	74.00	-24.10	Peak
9920.00	37.97	38.52	16.72	42.53	50.68	74.00	-23.32	Peak

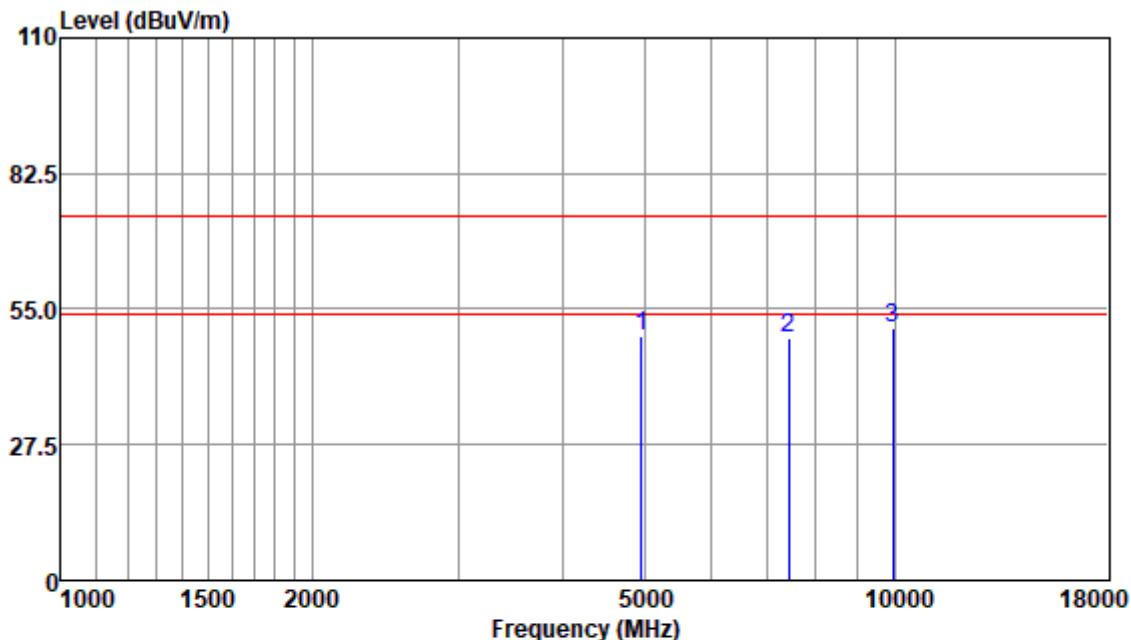
Note: Emission Level = Read Level + Antenna Factor + Cable loss - Preamp Factor



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Date Rate:2Mbps Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low



Antenna Polarity :HORIZONTAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4960.00	47.60	31.52	12.72	42.40	49.44	74.00	-24.56	Peak
7440.00	39.55	36.94	15.33	42.79	49.03	74.00	-24.97	Peak
9920.00	38.40	38.52	16.72	42.53	51.11	74.00	-22.89	Peak

Note: Emission Level=Read Level+Antenna Factor+Cable loss+Preamp Factor

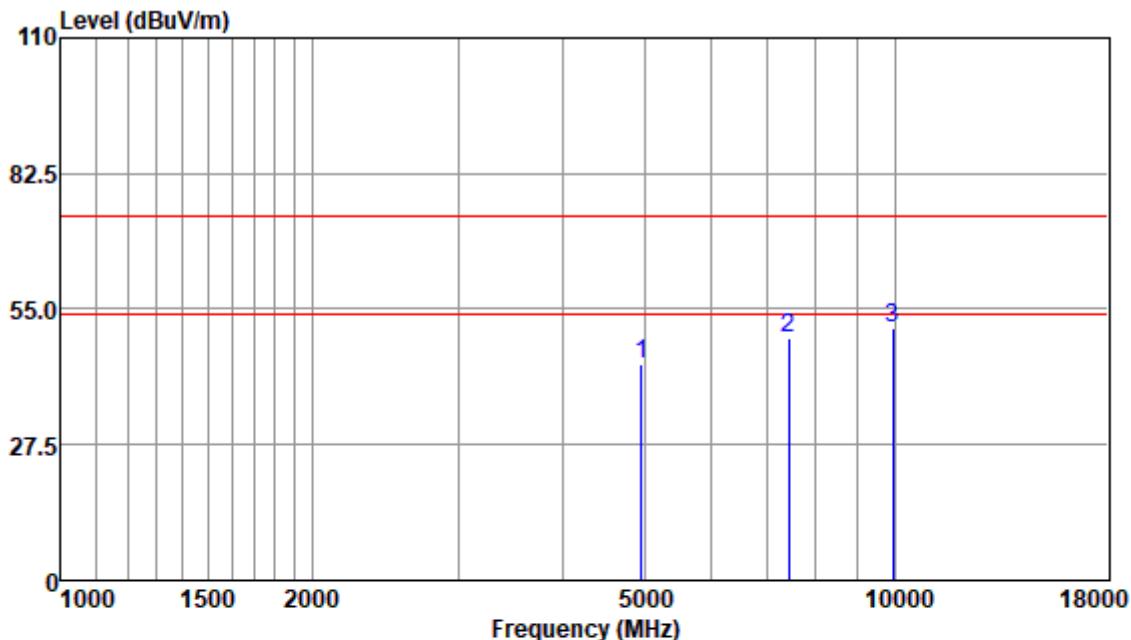
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Date Rate:2Mbps Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Antenna Polarity :VERTICAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4960.00	41.88	31.52	12.72	42.40	43.72	74.00	-30.28	Peak
7440.00	39.76	36.94	15.33	42.79	49.24	74.00	-24.76	Peak
9920.00	38.44	38.52	16.72	42.53	51.15	74.00	-22.85	Peak

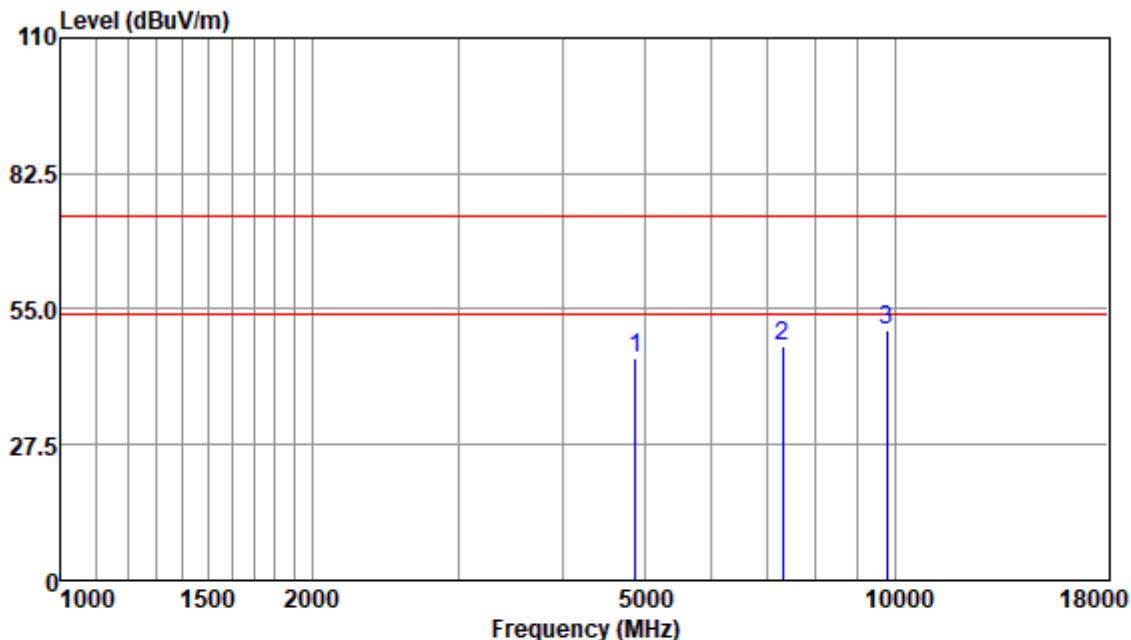
Note: Emission Level=Read Level+Antenna Factor+Cable loss+Preamp Factor



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Date Rate:2Mbps Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle



Antenna Polarity :HORIZONTAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4880.00	43.61	31.36	12.67	42.40	45.24	74.00	-28.76	Peak
7320.00	38.40	36.67	15.30	42.77	47.60	74.00	-26.40	Peak
9760.00	38.31	38.35	16.60	42.60	50.66	74.00	-23.34	Peak

Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

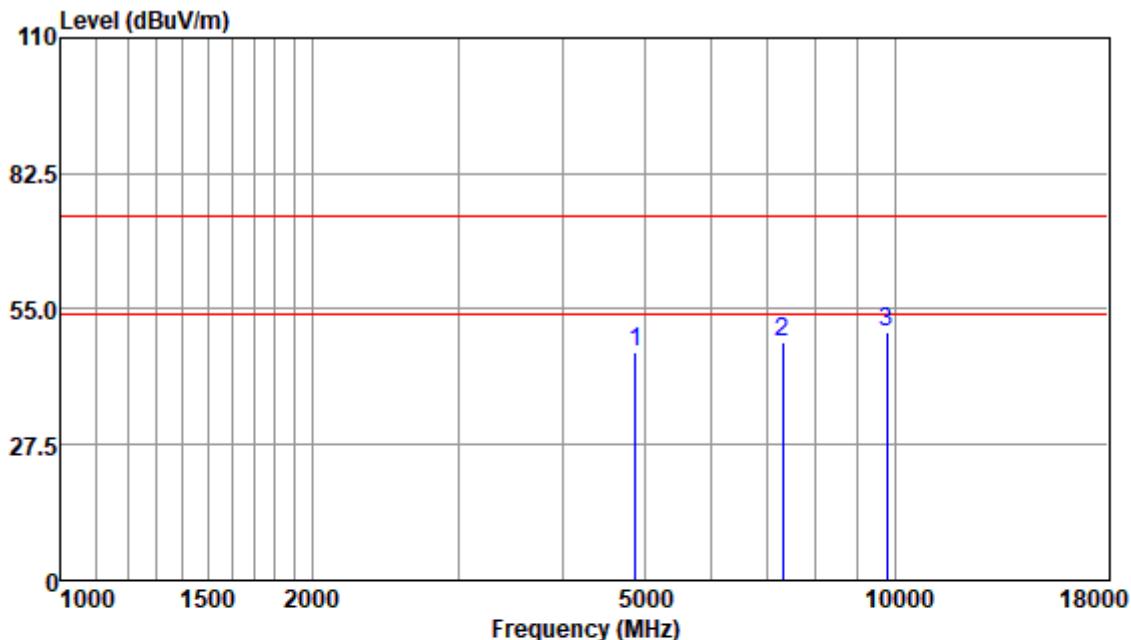
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Date Rate:2Mbps Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:middle



Antenna Polarity :VERTICAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4880.00	44.69	31.36	12.67	42.40	46.32	74.00	-27.68	Peak
7320.00	38.97	36.67	15.30	42.77	48.17	74.00	-25.83	Peak
9760.00	37.90	38.35	16.60	42.60	50.25	74.00	-23.75	Peak

Note: Emission Level=Read Level+Antenna Factor+Cable loss+Preamp Factor

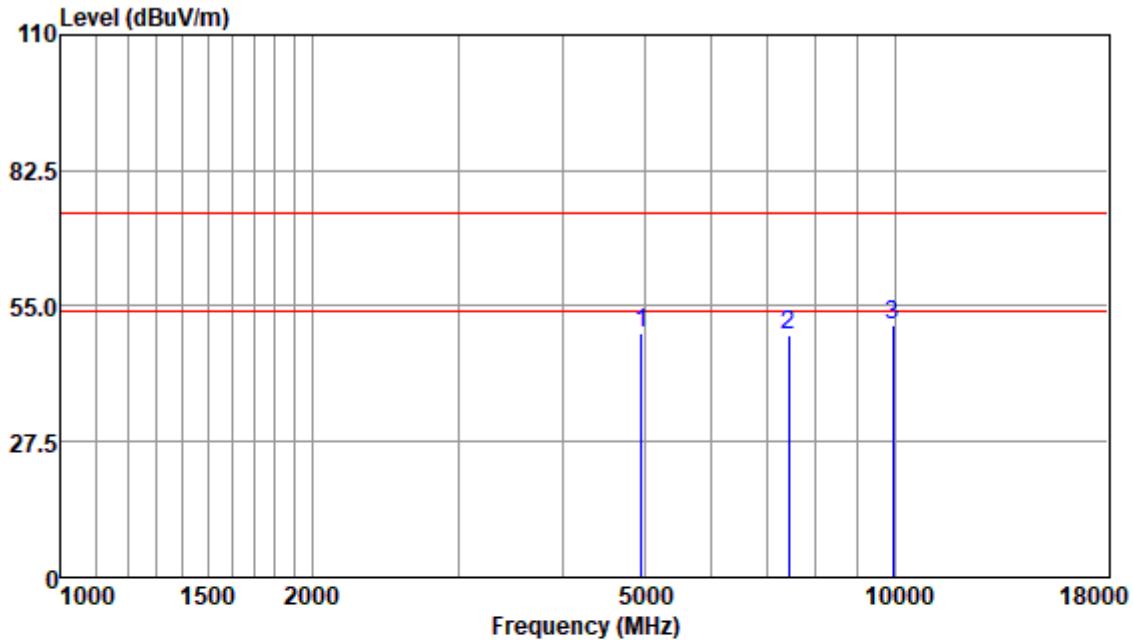
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Date Rate:2Mbps Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Antenna Polarity :HORIZONTAL

Freq	Read	Antenna	Cable	Preamp	Emission	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4960.00	47.60	31.52	12.72	42.40	49.44	74.00	-24.56	Peak
7440.00	39.55	36.94	15.33	42.79	49.03	74.00	-24.97	Peak
9920.00	38.40	38.52	16.72	42.53	51.11	74.00	-22.89	Peak

Note: Emission Level=Read Level+Antenna Factor+Cable loss+Preamp Factor

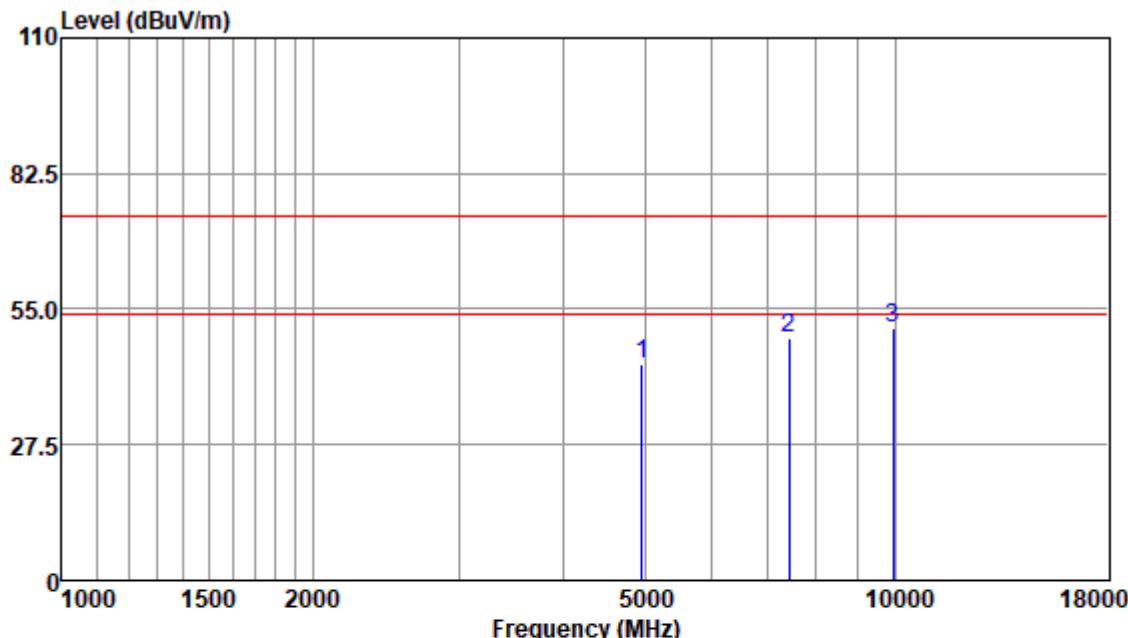
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Date Rate:2Mbps Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
4960.00	41.88	31.52	12.72	42.40	43.72	74.00	-30.28	Peak
7440.00	39.76	36.94	15.33	42.79	49.24	74.00	-24.76	Peak
9920.00	38.44	38.52	16.72	42.53	51.15	74.00	-22.85	Peak

Note: Emission Level=Read Level+Antenna Factor+Cable loss+Preamp Factor



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8 Photographs

9 Test Setup Photographs

Refer to the < Test Setup photos-FCC>.

10 EUT Constructional Details

Refer to the < External Photos > & < Internal Photos >.

Appendix A for SZCR210402073301

1.6dB Bandwidth

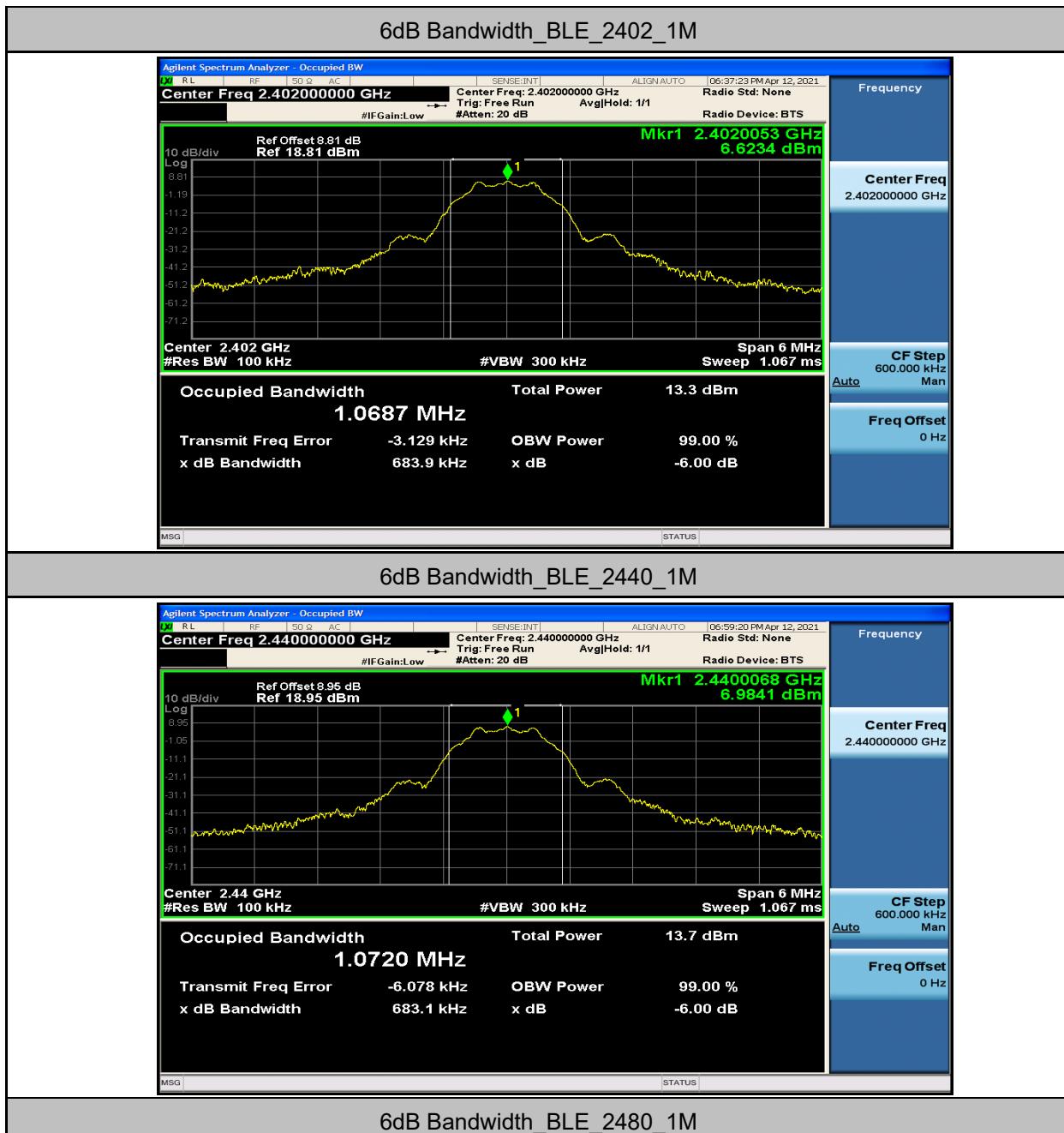
Test Mode	Test Channel	EBW[MHz]		Limit	Verdict
		1M	2M		
BLE	2402	0.68	1.16	0.5	PASS
BLE	2440	0.68	1.16	0.5	PASS
BLE	2480	0.68	1.16	0.5	PASS

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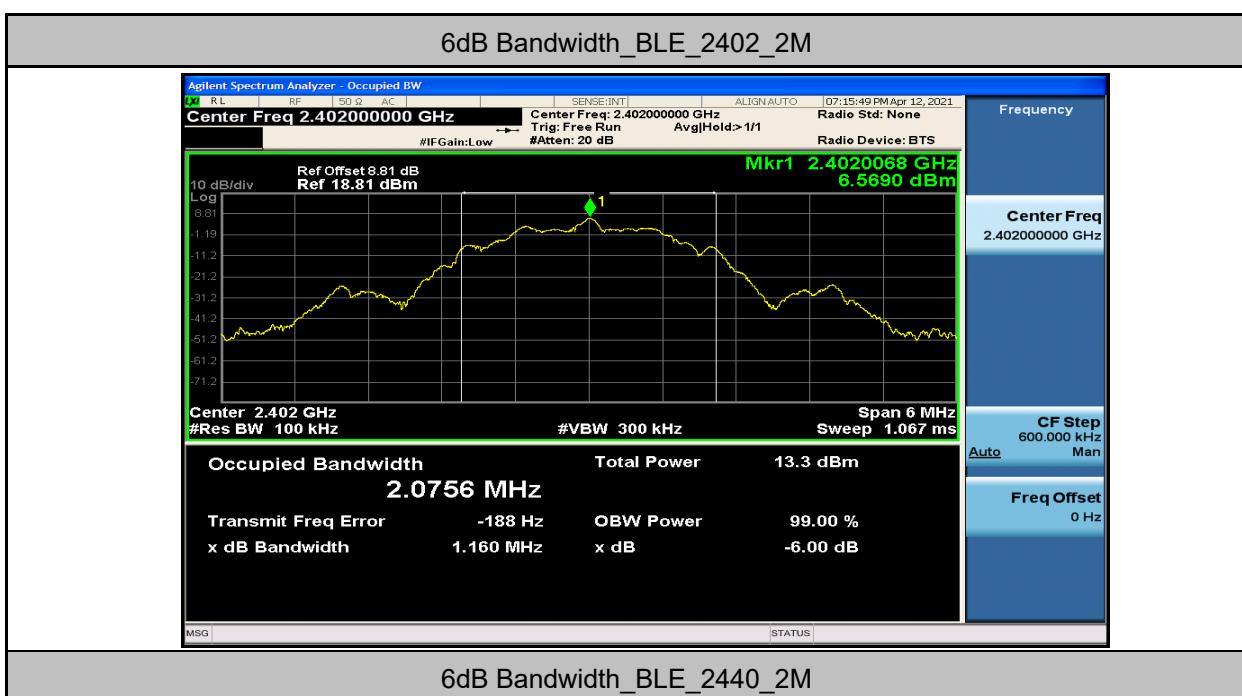
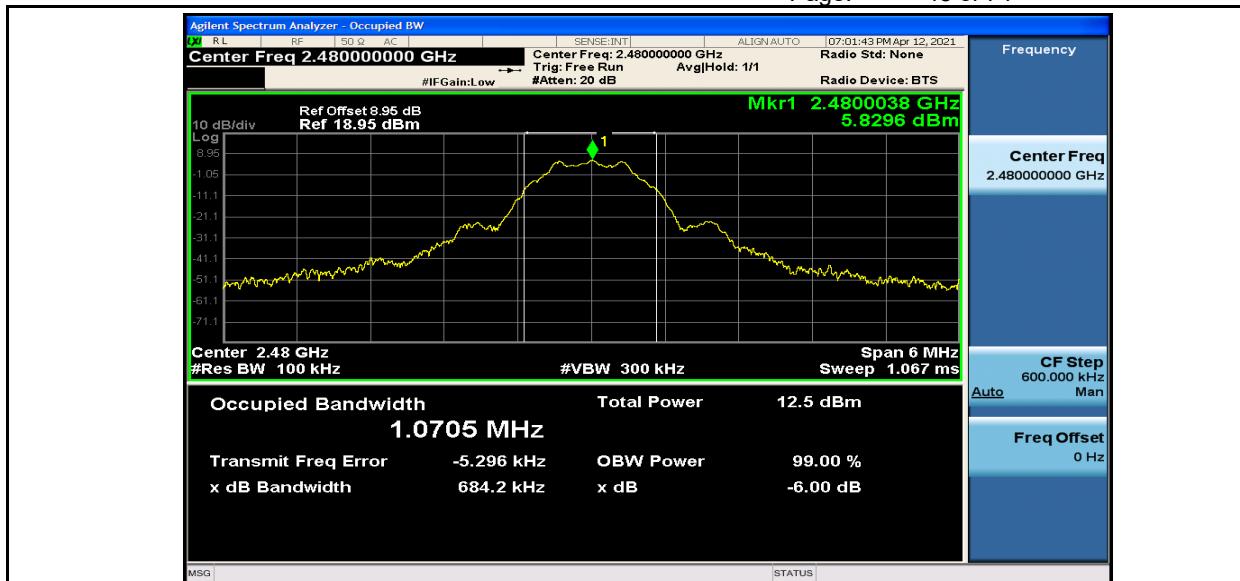


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2.Occupied Bandwidth

Test Mode	Test Channel	OBW[MHz]		Limit[MHz]	Verdict
		1M	2M		
BLE	2402	1.04	2.04	---	PASS
BLE	2440	1.04	2.04	---	PASS
BLE	2480	1.04	2.04	---	PASS



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Occupied Bandwidth_BLE_2402_1M



Occupied Bandwidth_BLE_2440_1M



Occupied Bandwidth_BLE_2480_1M

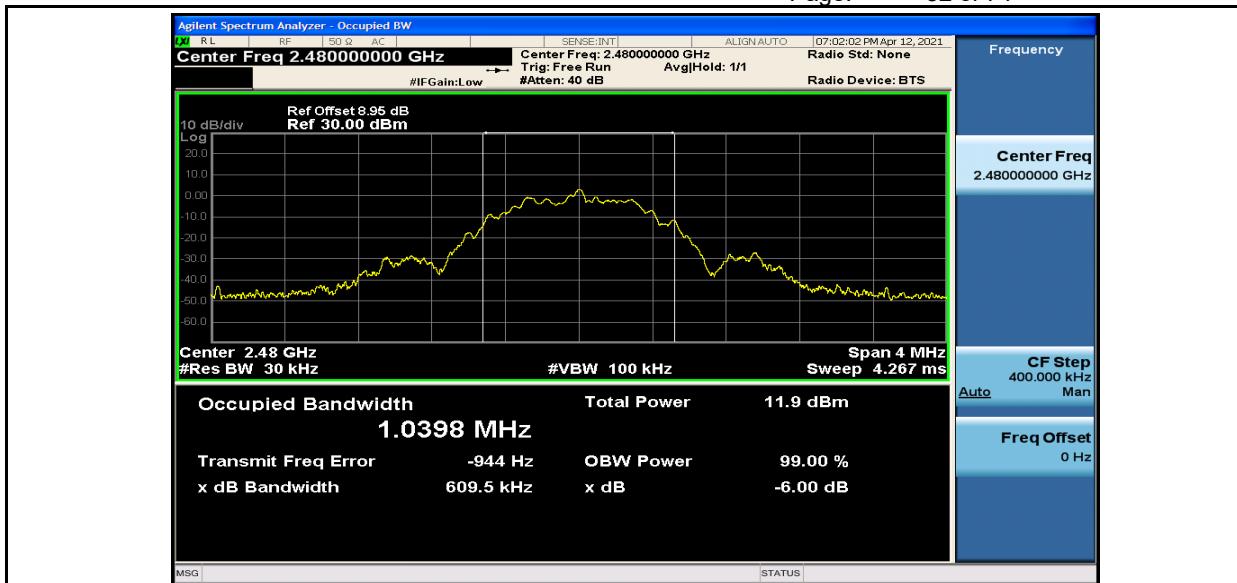
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Occupied Bandwidth_BLE_2402_2M



Occupied Bandwidth_BLE_2440_2M



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3. Maximum peak conducted output power

Test Mode	Test Channel	Power[dBm]		Limit[dBm]	Verdict
		1M	2M		
BLE	2402	6.81	6.77	30	PASS
BLE	2440	7.12	7.13	30	PASS
BLE	2480	5.94	5.96	30	PASS

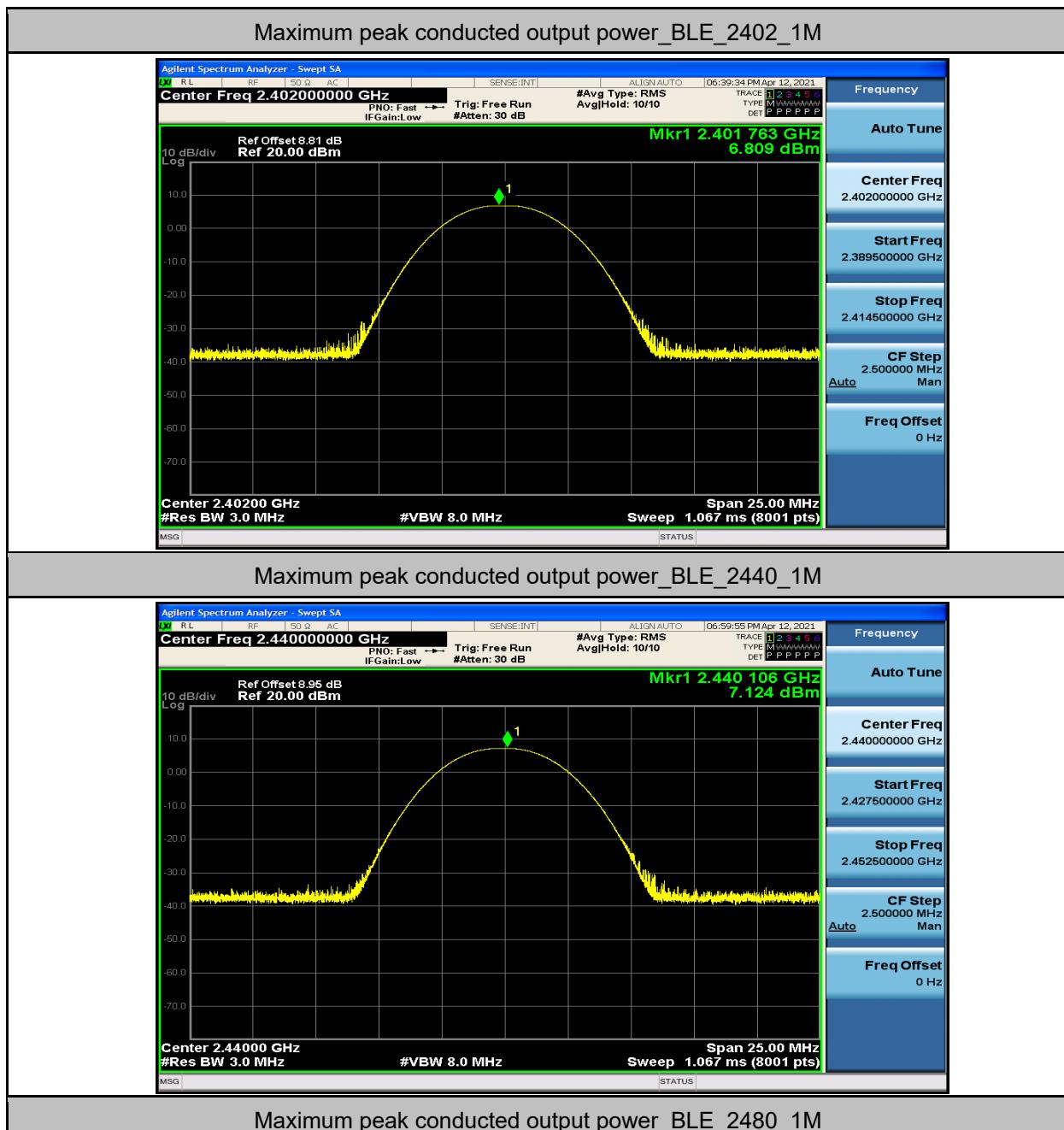


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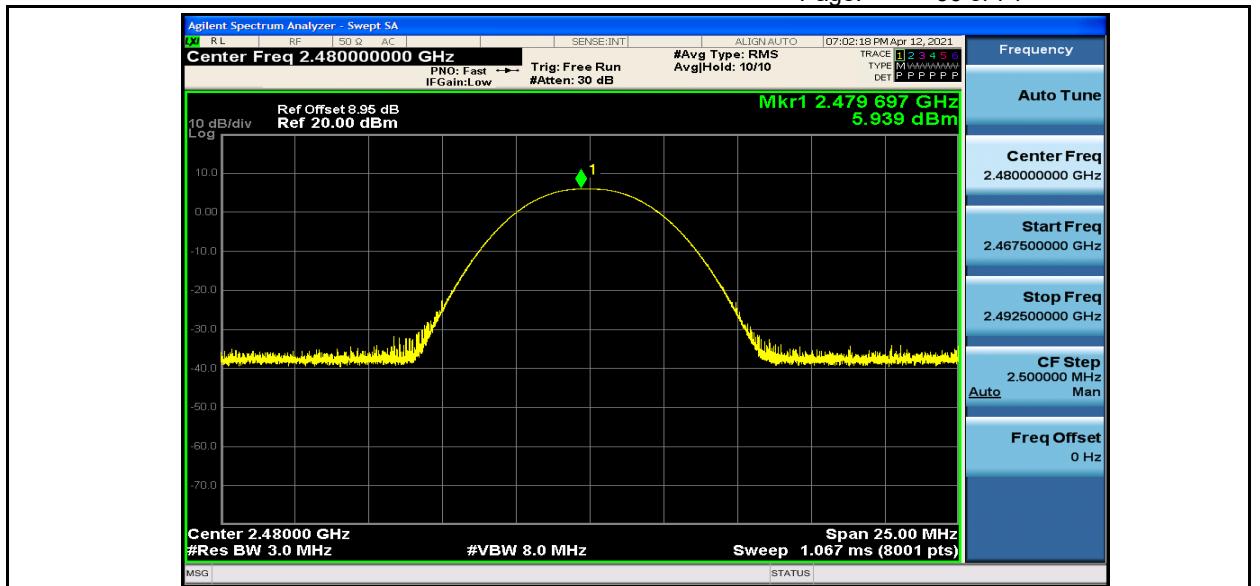


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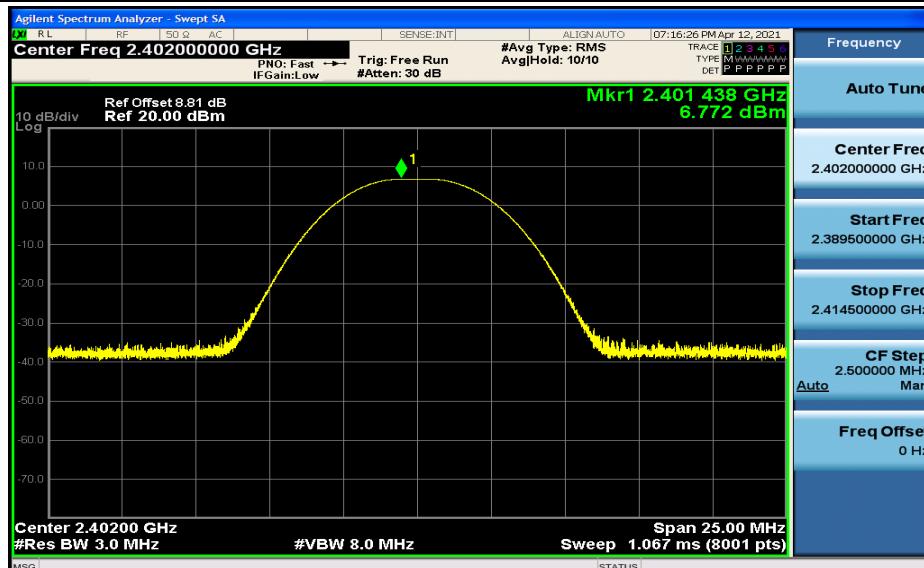
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Maximum peak conducted output power_BLE_2402_2M

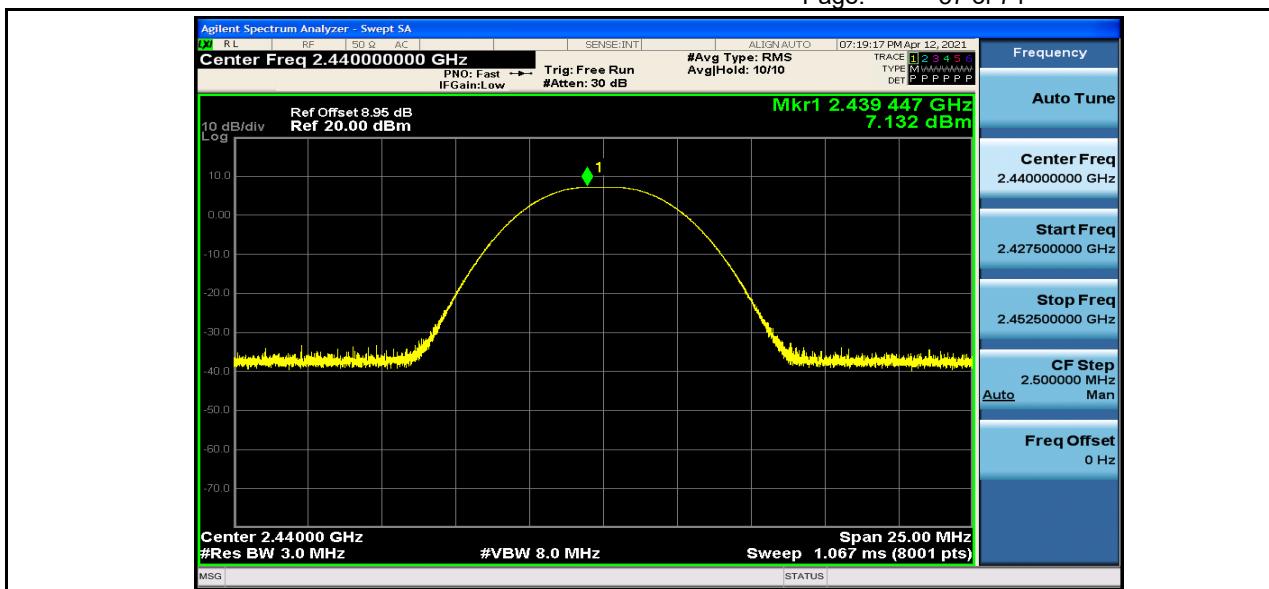


Maximum peak conducted output power_BLE_2440_2M

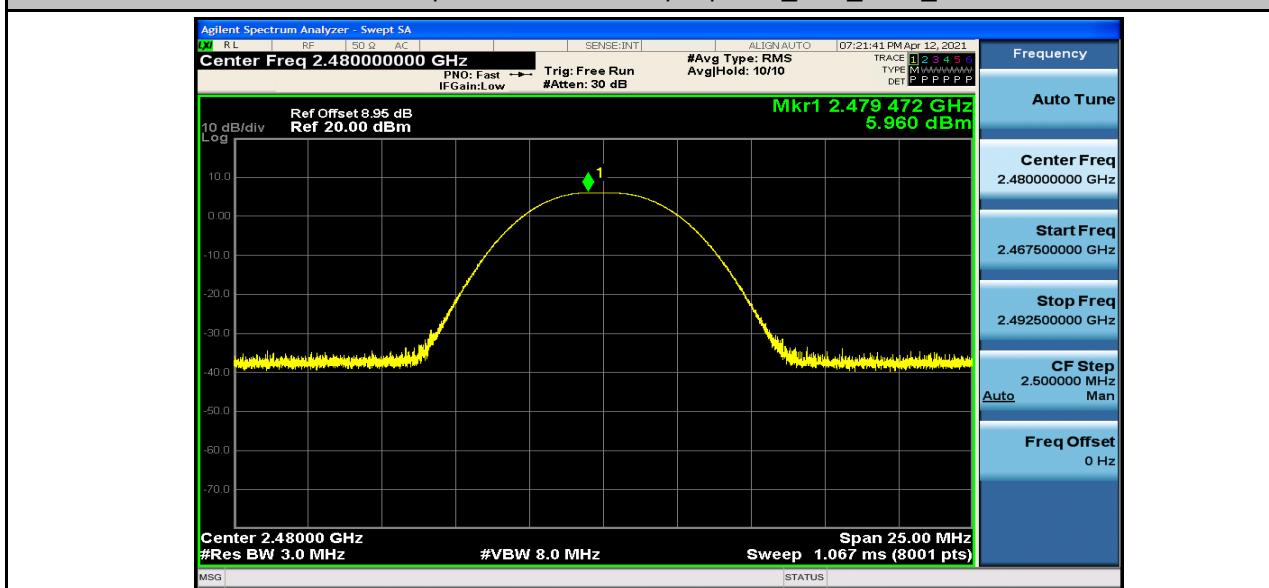


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Maximum peak conducted output power_BLE_2480_2M



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4. Maximum Peak power spectral density

Test Mode	Test Channel	PSD[dBm/3kHz]		Limit[dBm/3kHz]	Verdict
		1M	2M		
BLE	2402	-11.09	-11.55	8.00	PASS
BLE	2440	-10.63	-11.09	8.00	PASS
BLE	2480	-11.76	-12.47	8.00	PASS

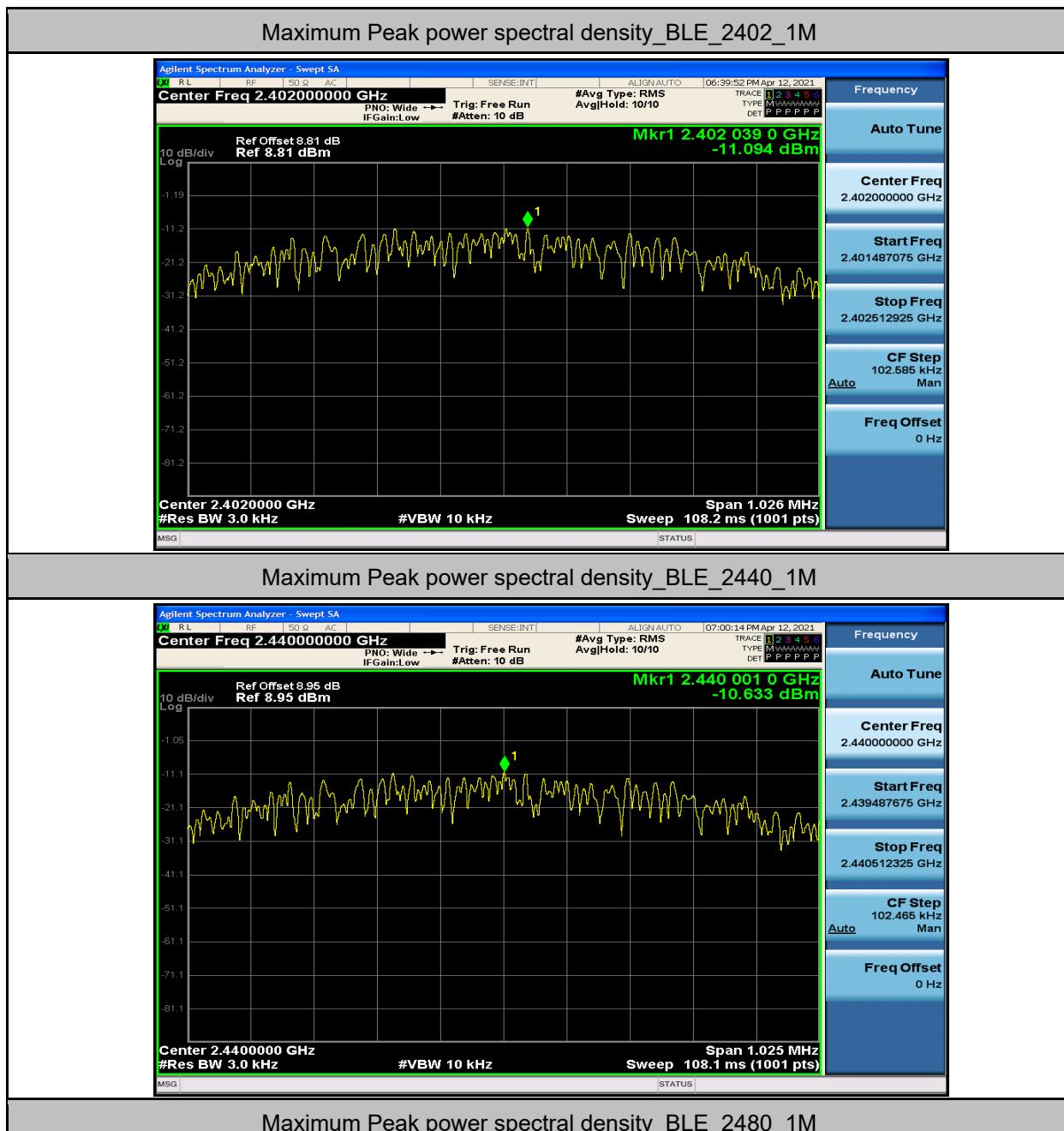


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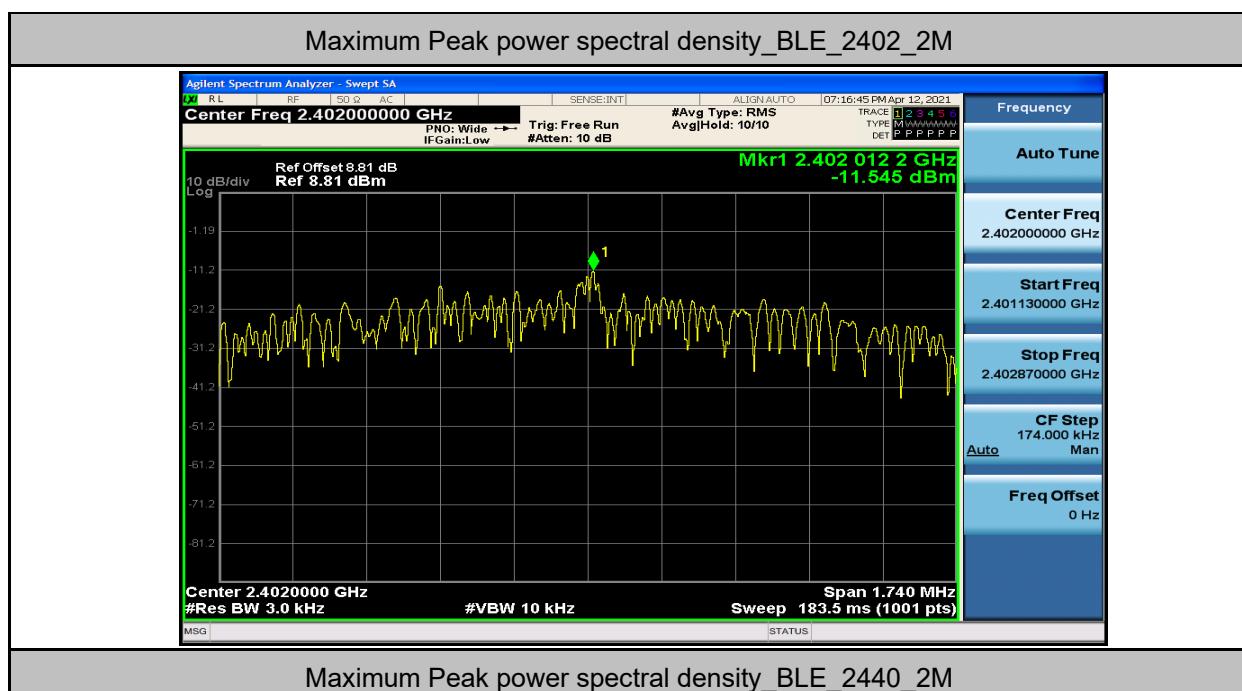
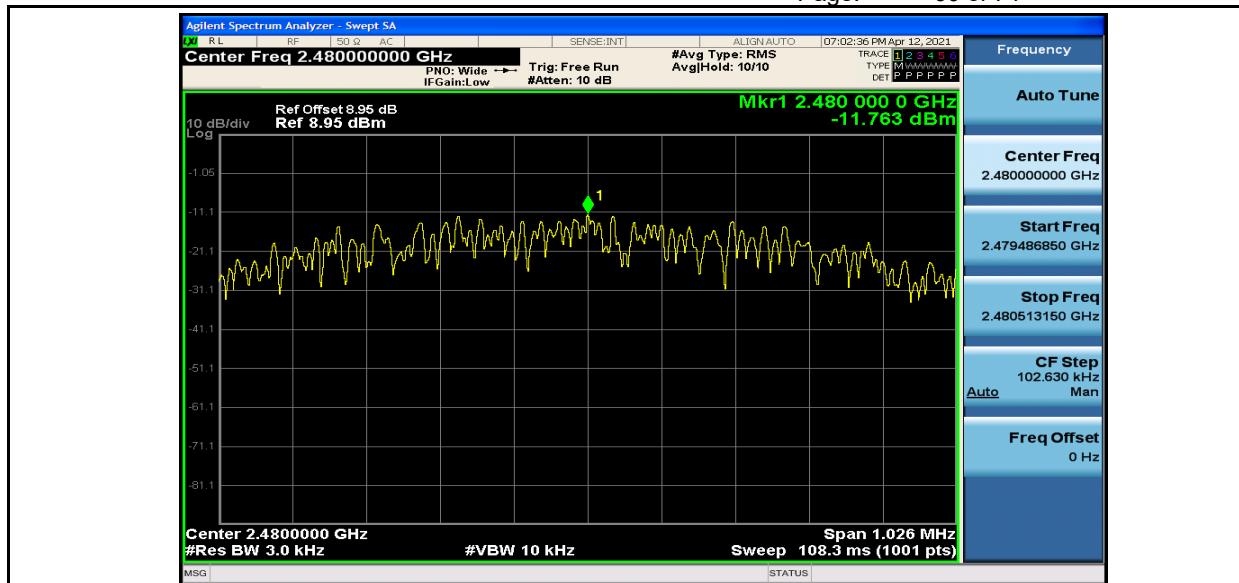
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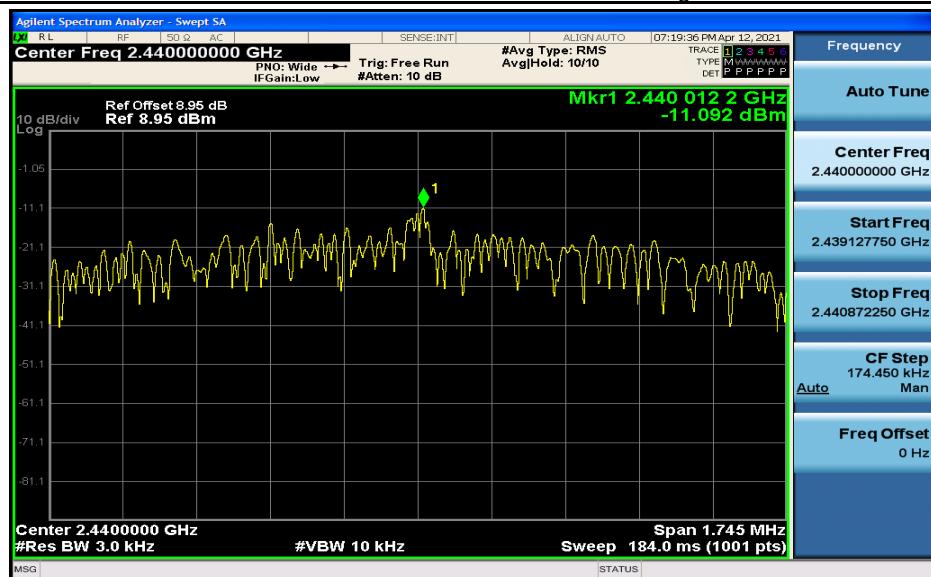
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Maximum Peak power spectral density_BLE_2480_2M



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5. Band-edge for RF Conducted Emissions

Test Mode	Test Channel	Carrier Power[dBm]		Max. Spurious Level [dBm]		Limit [dBm]	Verdict
		1M	2M	1M	2M		
BLE	2402	6.62	6.58	-44.94	-28.47	-13.39	PASS
BLE	2480	5.78	5.75	-55.66	-53.24	-14.22	PASS

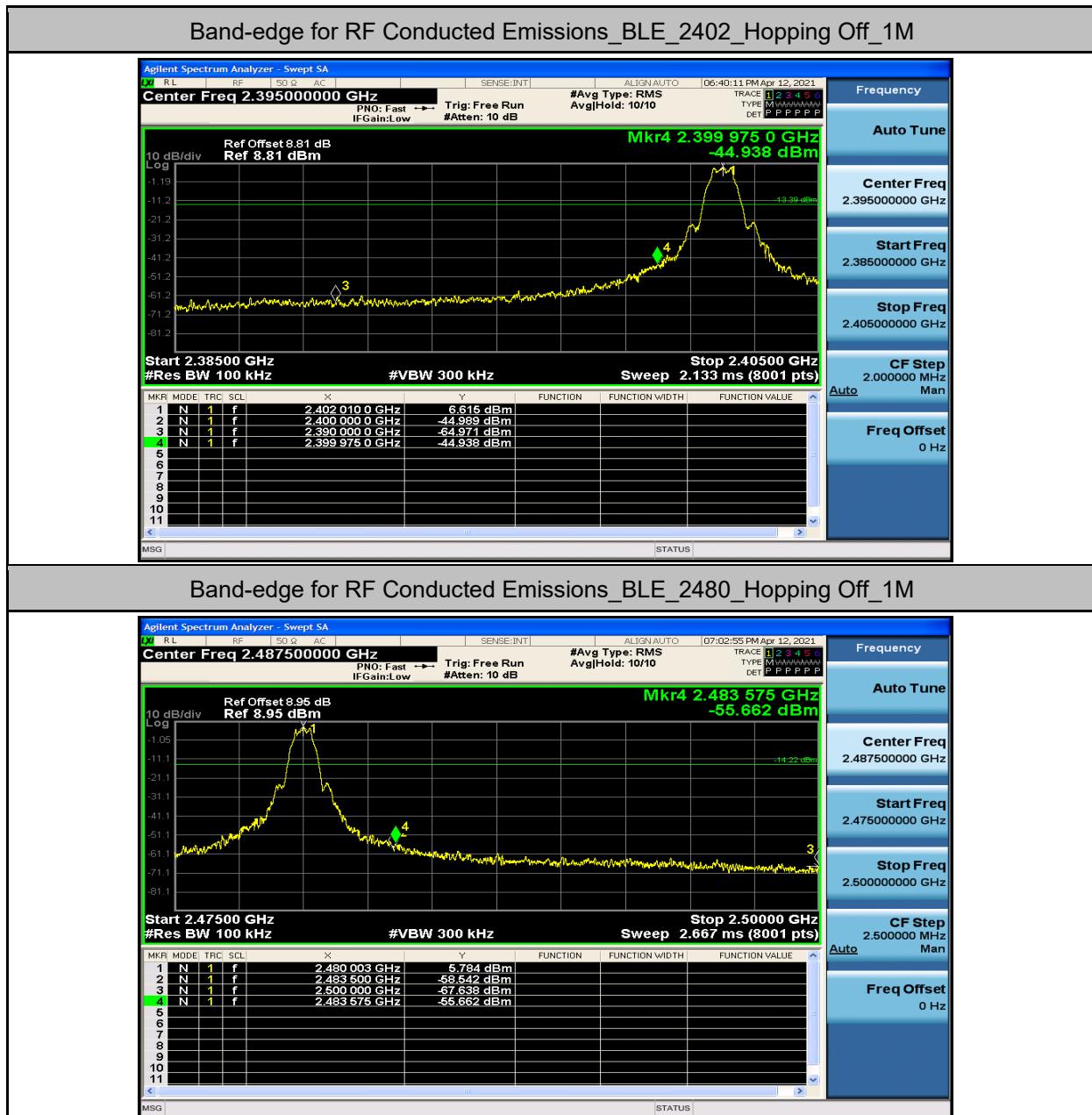


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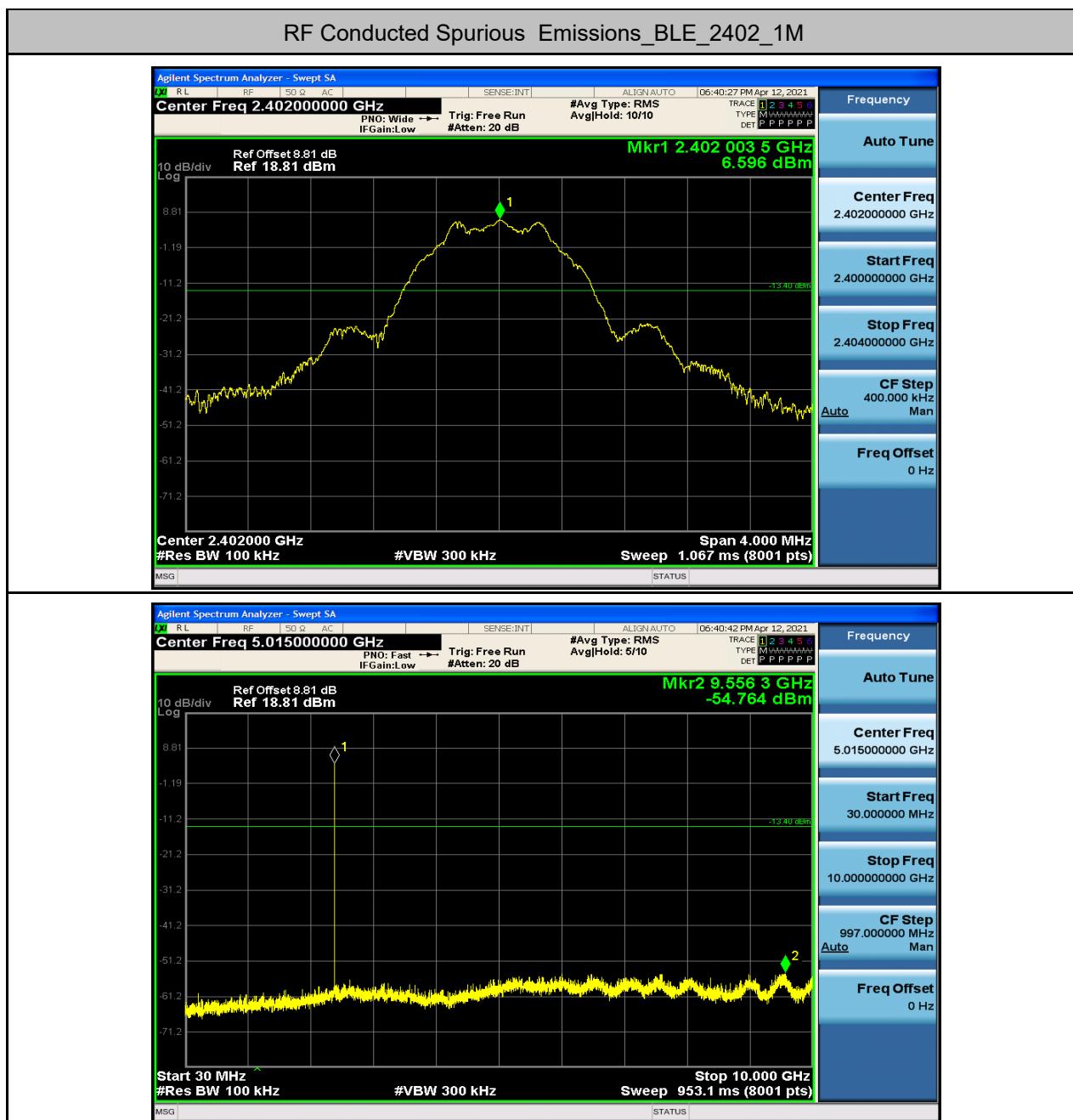
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6.RF Conducted Spurious Emissions

Test Mode	Test Channel	StartFre [MHz]	StopFre [MHz]	RBW [kHz]	VBW [kHz]	Pref[dBm]		Max. Level [dBm]		Limit [dBm]		Verdict
						1M	2M	1M	2M	1M	2M	
BLE	2402	30	10000	100	300	6.60	6.54	-54.76	-53.42	<-13.40	<-13.46	PASS
BLE	2402	10000	26000	100	300	6.596	6.543	-44.769	-43.729	<-13.404	<-13.457	PASS
BLE	2440	30	10000	100	300	6.99	6.97	-51.58	-47.87	<-13.01	<-13.03	PASS
BLE	2440	10000	26000	100	300	6.986	6.967	-42.959	-43.226	<-13.014	<-13.033	PASS
BLE	2480	30	10000	100	300	5.81	5.79	-50.45	-52.15	<-14.19	<-14.21	PASS
BLE	2480	10000	26000	100	300	5.81	5.79	-43.771	-43.332	<-14.19	<-14.21	PASS





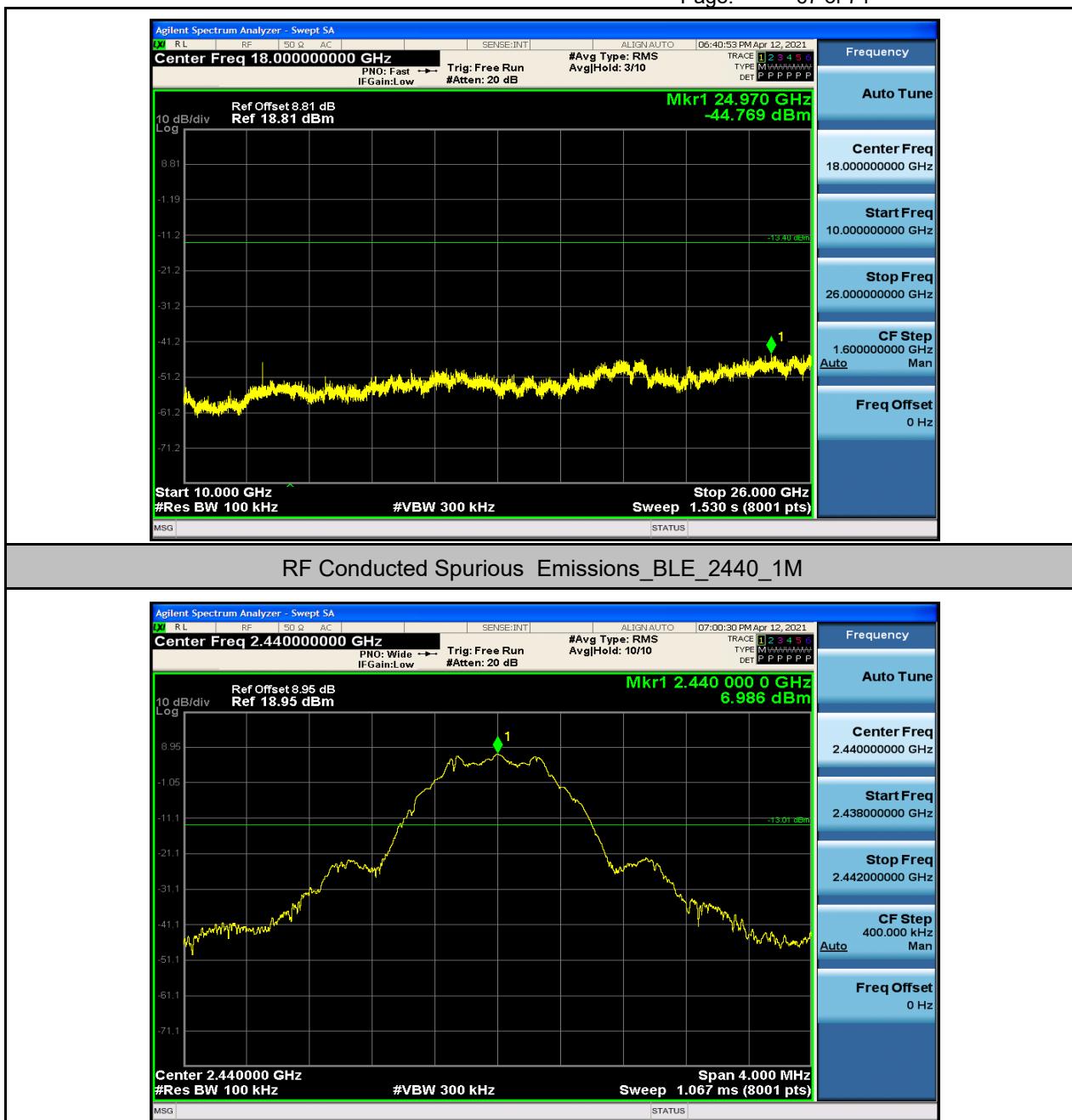
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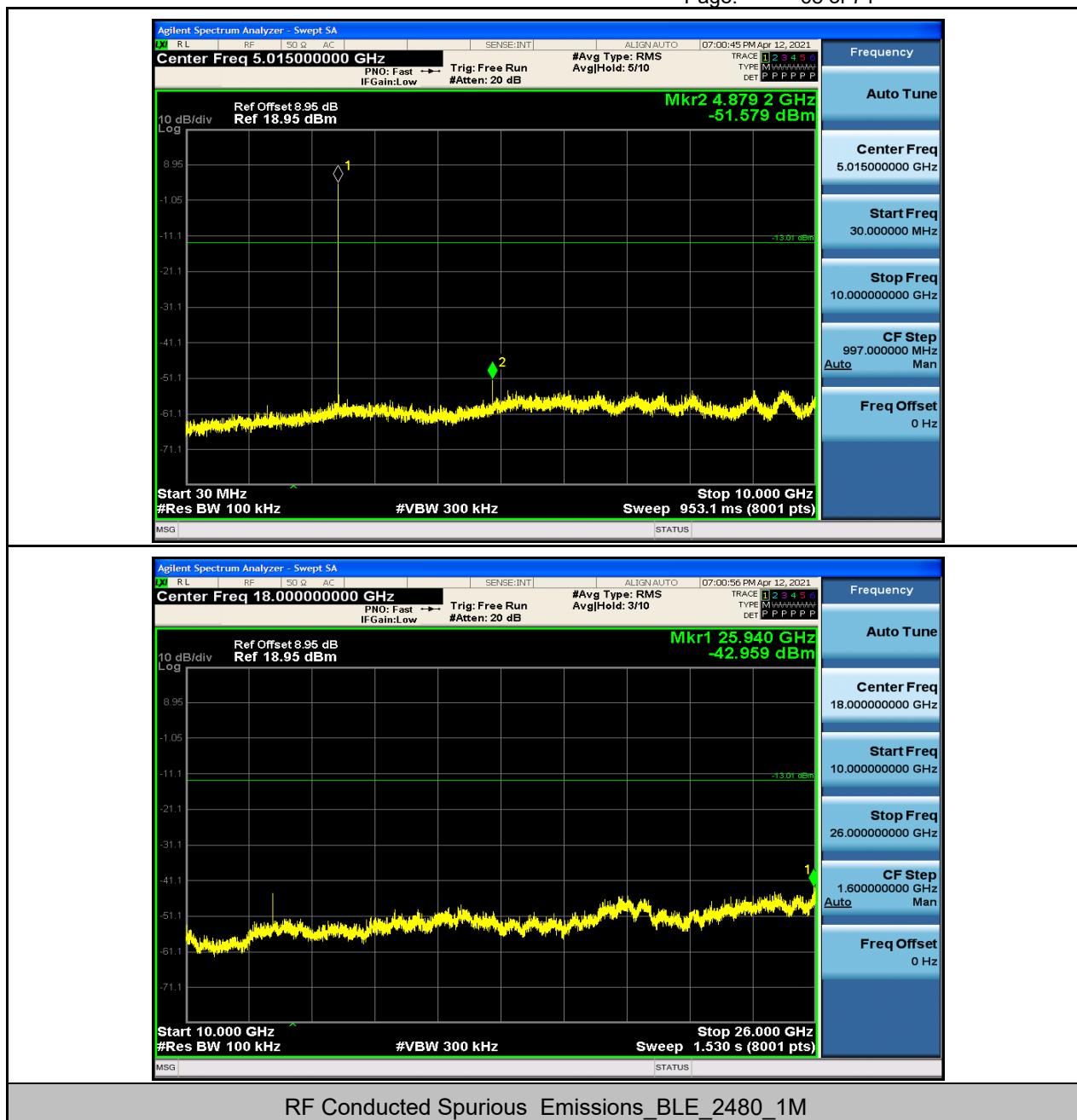
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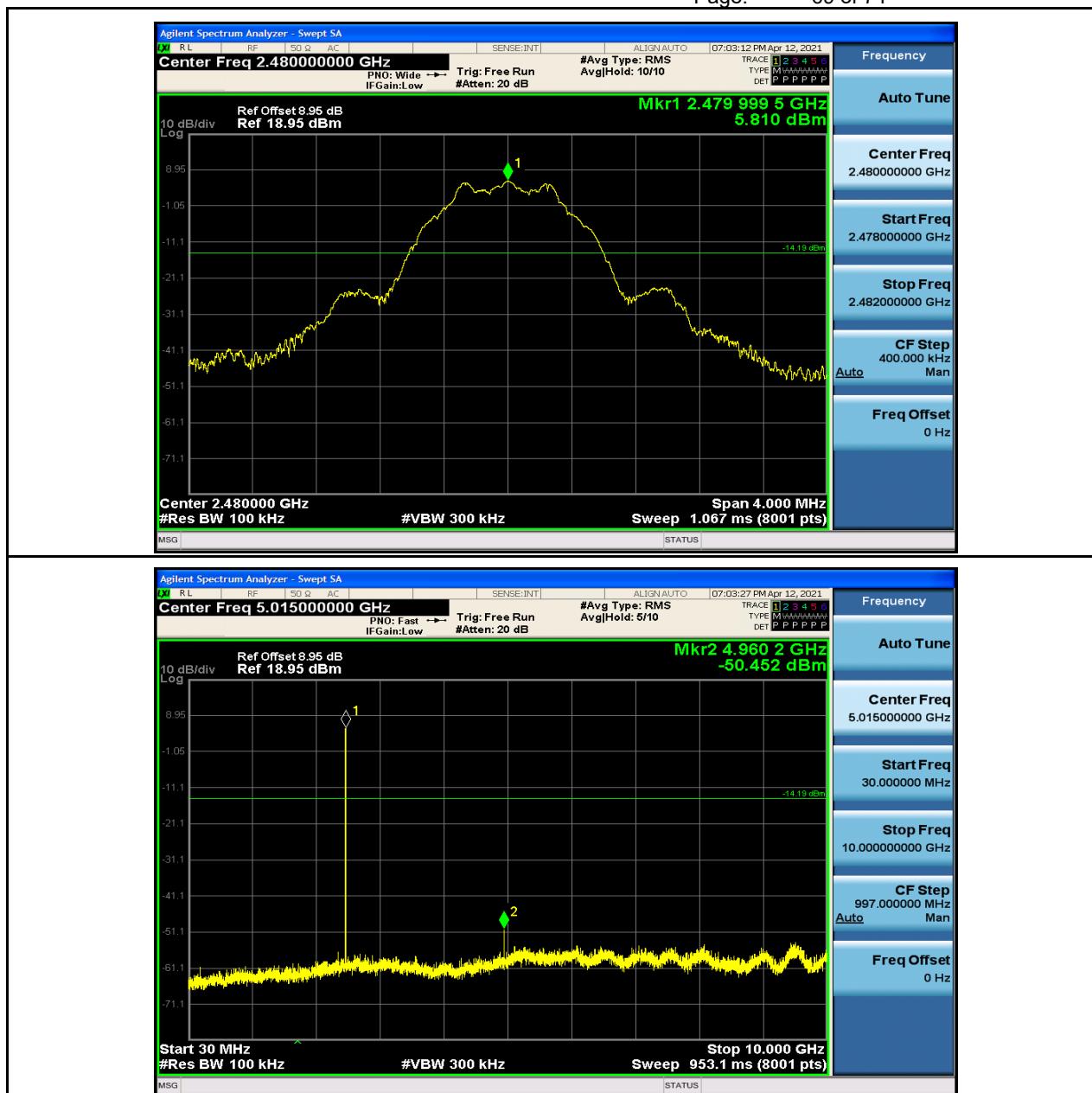
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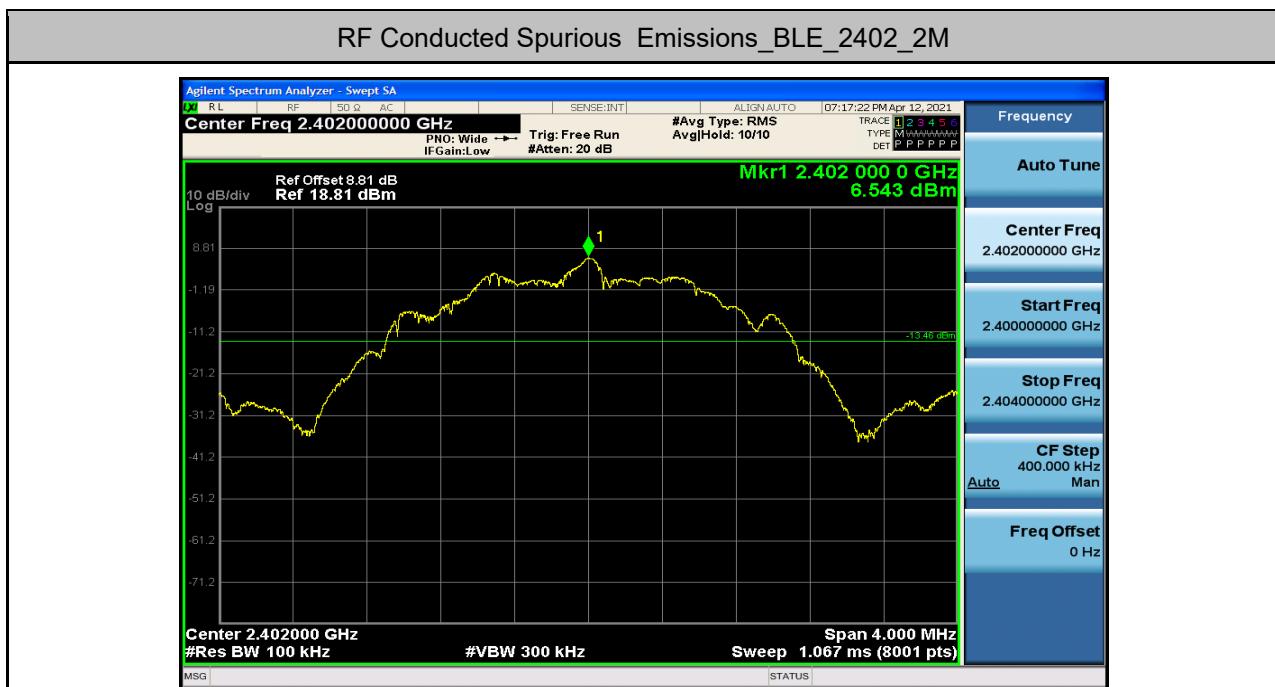
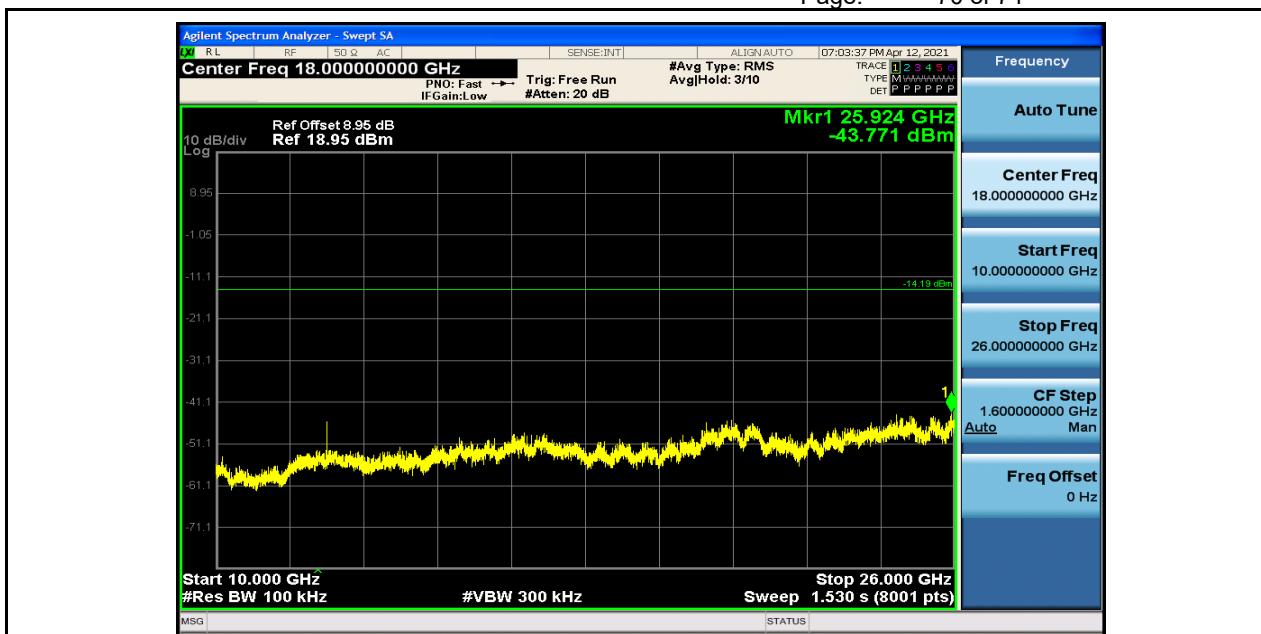
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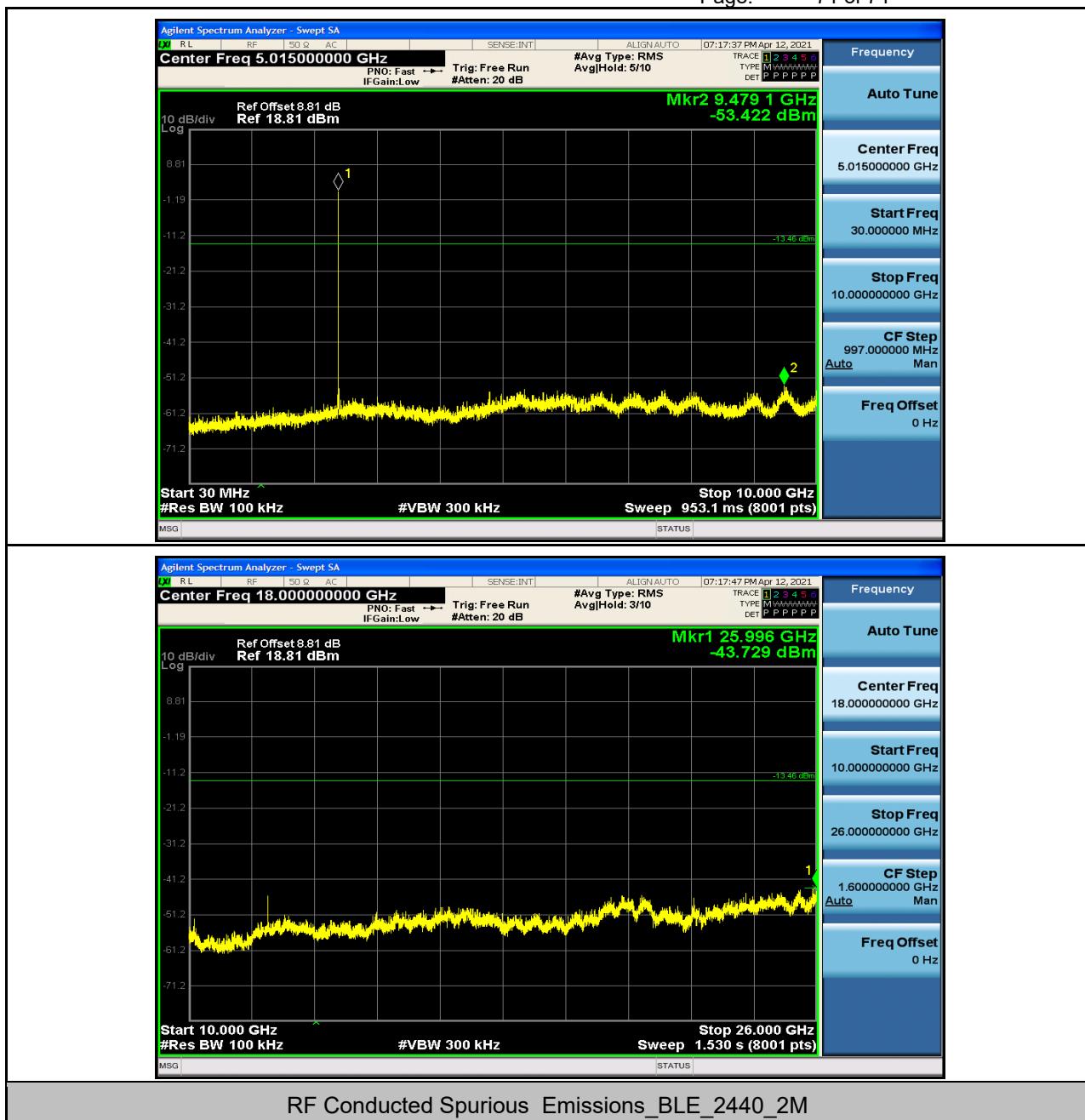
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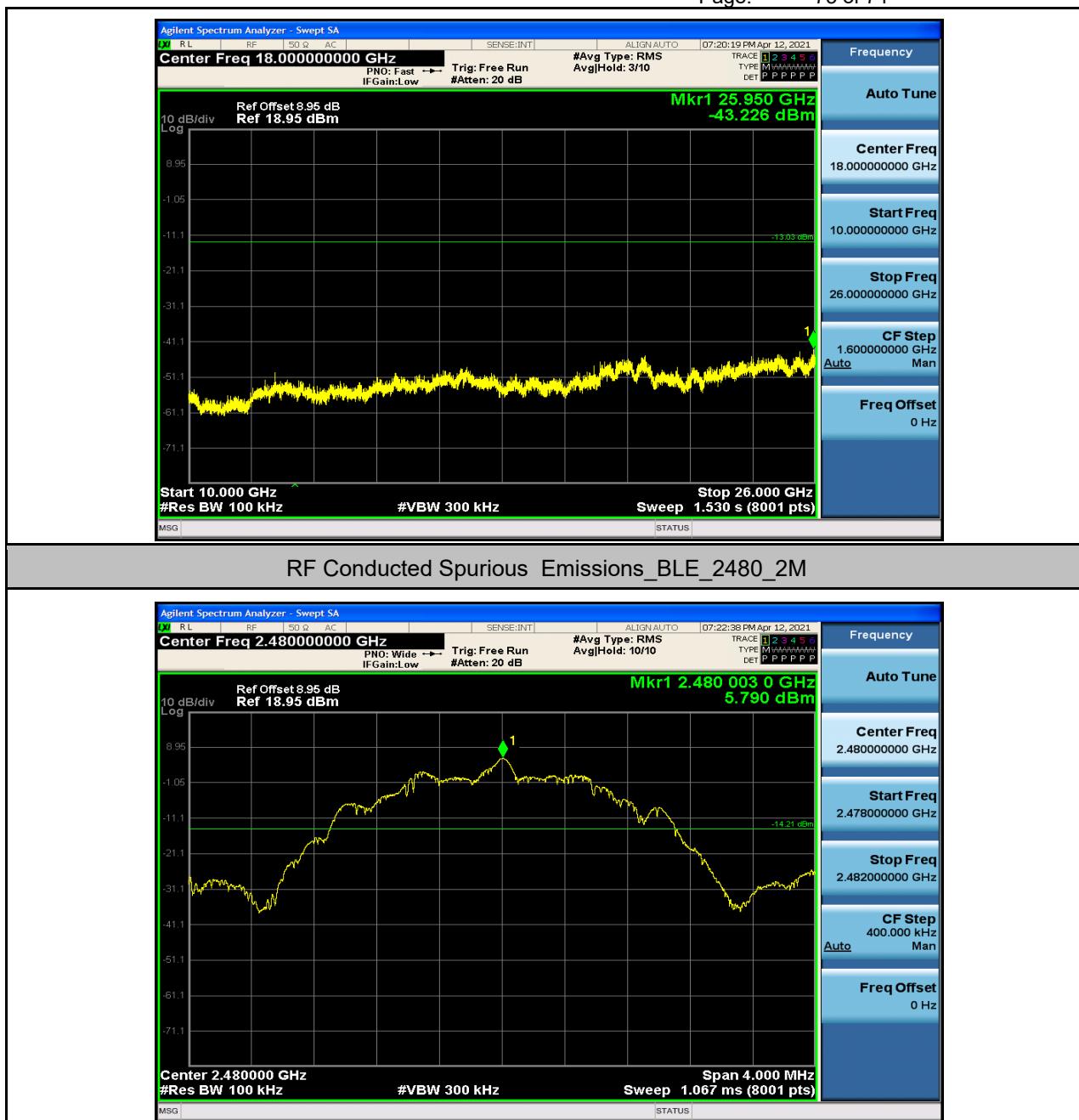
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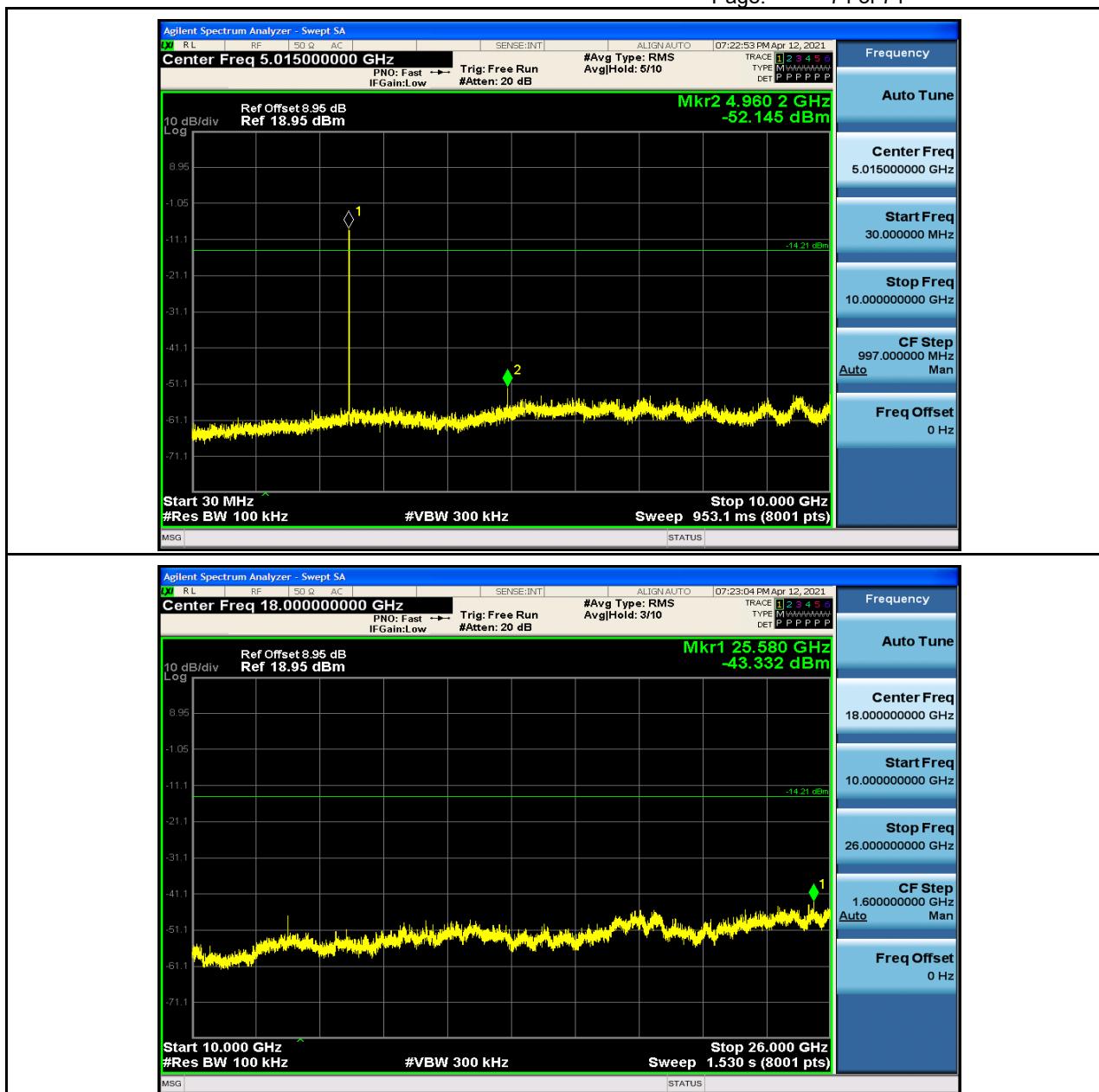
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