

TEST REPORT

Application No.: SZEM2004003281CR
Applicant: Harman International Industries, Inc.
Address of Applicant: 8500 Balboa Boulevard, Northridge, California, 91329, United States
Manufacturer: Harman International Industries, Inc.
Address of Manufacturer: 8500 Balboa Boulevard, Northridge, California, 91329, United States
Factory: Kingstate Electronics(Dongguan)Co., Ltd
Address of Factory: Shi Chong Industrial Park, Shi Chong Avenue, Xiang Xi Village, Shi Pai Town, Dong Guan City, Guang Dong Province, China.
Equipment Under Test (EUT):
EUT Name: BLUETOOTH HEADSET
Model No.: UA STREAK
FCC ID: APIJBLUASTREAK
Trade Mark: JBL
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2020-04-30
Date of Test: 2020-05-07 to 2020-07-04
Date of Issue: 2020-07-14

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

Keny Xu

Keny Xu
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020-07-14		Original

Authorized for issue by:			
			
		Benson Wang /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:	Left earbuds: Li-Ion Polymer Battery 3.7V 55mAh (Charge by travel case) Right earbuds: Li-Ion Polymer Battery 3.7V 55mAh (Charge by travel case) travel case with backup battery: Li-Ion Polymer Battery 3.85V 410mAh (Charged by type-C port)
Cable:	Type-c cable: 27cm unshielded
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.0 Dual mode
Data Rate:	Support 1M/bit
Channel Spacing:	2MHz
Modulation Type:	GFSK
Number of Channels:	40
Antenna Type:	Integral Antenna
Antenna Gain:	Left earbuds: -3.03dBi; Right earbuds: -3.93dBi

4.2 Description of Support Units

The EUT has been tested as an independent unit.

4.3 Measurement Uncertainty

Item	Measurement Uncertainty
Radio Frequency	$\pm 7.25 \times 10^{-8}$
Duty cycle	$\pm 0.37\%$
Occupied Bandwidth	$\pm 3\%$
RF conducted power	$\pm 0.75\text{dB}$
RF power density	$\pm 2.84\text{dB}$
Conducted Spurious emissions	$\pm 0.75\text{dB}$
RF Radiated power	$\pm 4.5\text{dB}$ (Below 1GHz)
	$\pm 4.8\text{dB}$ (Above 1GHz)
Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz)
	$\pm 4.8\text{dB}$ (Above 1GHz)
Temperature test	$\pm 1^{\circ}\text{C}$
Humidity test	$\pm 3\%$
Supply voltages	$\pm 1\%$
Time	$\pm 3\%$

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

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No tests were sub-contracted.

4.5 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.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

Minimum 6dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2022-06-12
DC Power Supply	Rohde & Schwarz	NGSM 32/10	SEM011-04	2020-03-24	2021-03-23
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2019-09-24	2020-09-23
Measurement Software	TST	TST PASS V1.0.5	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2019-07-11	2020-07-10
				2020-07-10	2021-07-09
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2019-09-24	2020-09-23
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2019-09-24	2020-09-23
Electric and Magnetic Field Analyzer	Narda	EHP-50F	SEM022-05	2019-11-28	2020-11-27

Conducted Peak Output Power					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2022-06-12
DC Power Supply	Rohde & Schwarz	NGSM 32/10	SEM011-04	2020-03-24	2021-03-23
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2019-09-24	2020-09-23
Measurement Software	TST	TST PASS V1.0.5	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2019-07-11	2020-07-10
				2020-07-10	2021-07-09
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2019-09-24	2020-09-23
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2019-09-24	2020-09-23
Electric and Magnetic Field Analyzer	Narda	EHP-50F	SEM022-05	2019-11-28	2020-11-27



Power Spectrum Density					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2022-06-12
DC Power Supply	Rohde & Schwarz	NGSM 32/10	SEM011-04	2020-03-24	2021-03-23
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2019-09-24	2020-09-23
Measurement Software	TST	TST PASS V1.0.5	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2019-07-11	2020-07-10
				2020-07-10	2021-07-09
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2019-09-24	2020-09-23
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2019-09-24	2020-09-23
Electric and Magnetic Field Analyzer	Narda	EHP-50F	SEM022-05	2019-11-28	2020-11-27

Conducted Band Edges Measurement					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2022-06-12
DC Power Supply	Rohde & Schwarz	NGSM 32/10	SEM011-04	2020-03-24	2021-03-23
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2019-09-24	2020-09-23
Measurement Software	TST	TST PASS V1.0.5	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2019-07-11	2020-07-10
				2020-07-10	2021-07-09
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2019-09-24	2020-09-23
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2019-09-24	2020-09-23
Electric and Magnetic Field Analyzer	Narda	EHP-50F	SEM022-05	2019-11-28	2020-11-27



Conducted Spurious Emissions					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	SAEMC	MSR733	SEM001-09	2019-06-13	2022-06-12
DC Power Supply	Rohde & Schwarz	NGSM 32/10	SEM011-04	2020-03-24	2021-03-23
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2019-09-24	2020-09-23
Measurement Software	TST	TST PASS V1.0.5	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-02	2019-07-11	2020-07-10
				2020-07-10	2021-07-09
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2019-09-24	2020-09-23
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2019-09-24	2020-09-23
Electric and Magnetic Field Analyzer	Narda	EHP-50F	SEM022-05	2019-11-28	2020-11-27

Radiated Emissions which fall in the restricted bands					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2019-07-11	2020-07-10
				2020-07-10	2021-07-09
EXA Spectrum Analyzer	AgilentTechnologies Inc	N9010A	SEM004-12	2020-04-09	2021-04-08
Horn Antenna	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2019-09-24	2020-09-23
Pre-amplifier	Rohde & Schwarz	CH14-H052	SEM005-17	2020-04-01	2021-03-31
Pre-amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2020-04-01	2021-03-31
DC Power Supply	Zhao Xin	KXN-6020D	SEM011-08	2019-09-24	2020-09-23
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

Radiated Spurious Emissions					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2019-07-11	2020-07-10
				2020-07-10	2021-07-09
EXA Spectrum Analyzer	Agilent Technologies Inc	N9010A	SEM004-12	2020-04-09	2021-04-08
Horn Antenna	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2017-10-17	2020-10-16
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2019-09-24	2020-09-23
Pre-amplifier	Rohde & Schwarz	CH14-H052	SEM005-17	2020-04-01	2021-03-31
Pre-amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2020-04-01	2021-03-31
DC Power Supply	Zhao Xin	KXN-6020D	SEM011-08	2019-09-24	2020-09-23
Active Loop Antenna	ETS-Lindgren	6502	SEM003-08	2017-08-22	2020-08-21

Radiated Emissions					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
10m Semi-Anechoic Chamber	SAEMC	FSAC1018	SEM001-03	2018-03-31	2021-03-30
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM029-01	2019-07-11	2020-07-10
				2020-07-10	2021-07-09
MXE EMI receiver	KEYSIGHT	N9038A	SEM004-16	2019-12-16	2020-12-15
Trilog-Broadband Antenna	Schwarzbeck	VULB9168	SEM003-18	2019-08-08	2022-08-07
Pre-amplifier	Sonoma Instrument Co	310N	SEM005-04	2020-04-09	2021-04-08



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General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2019-09-26	2020-09-25
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2019-09-26	2020-09-25
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2019-09-26	2020-09-25
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2020-04-07	2021-04-06



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6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

6.1.2 Conclusion

Standard Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

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

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna as below: Left earbuds: -3.03dBi; Right earbuds: -3.93dBi.

Antenna location: Refer to internal photo.



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: 28.8 °C Humidity: 38 % RH Atmospheric Pressure: 1005 mbar

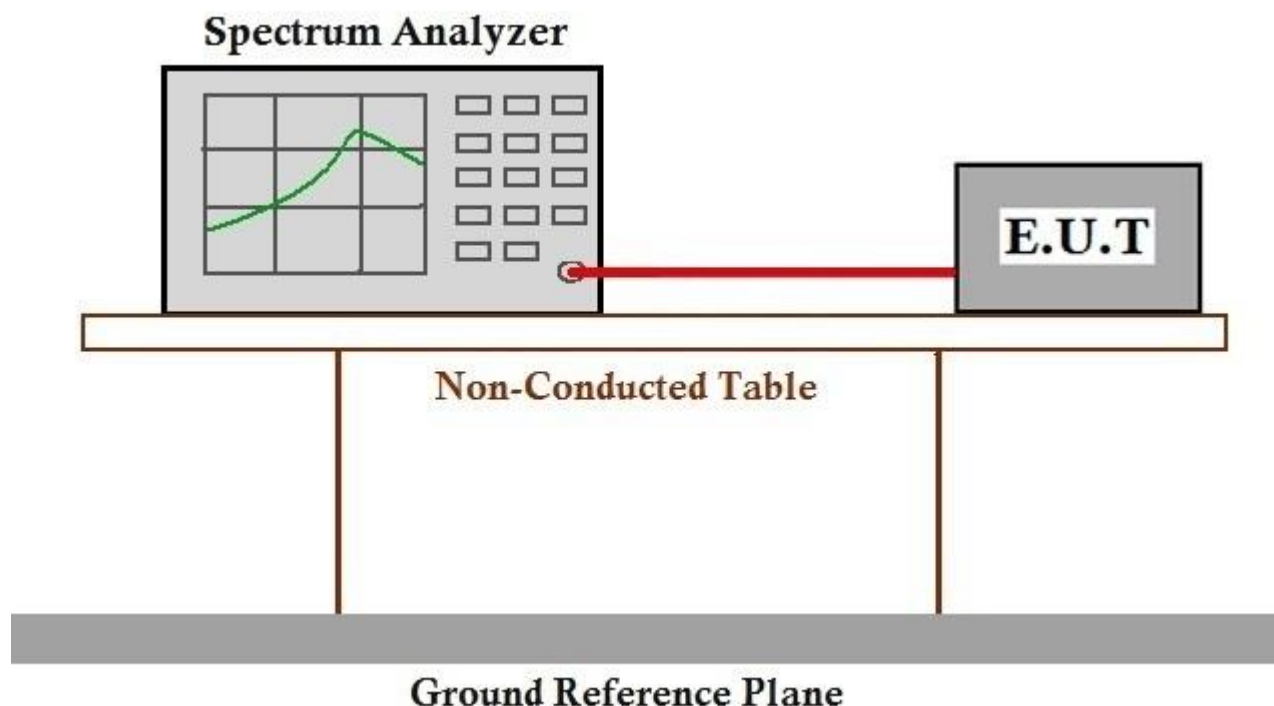
Pretest these d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

the worst case: i:TX mode(Right earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

The worst case d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

for final test: i:TX mode(Right earbuds 1M/bit of BLE)_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 15.247



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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: 28.8 °C Humidity: 38 % RH Atmospheric Pressure: 1005 mbar

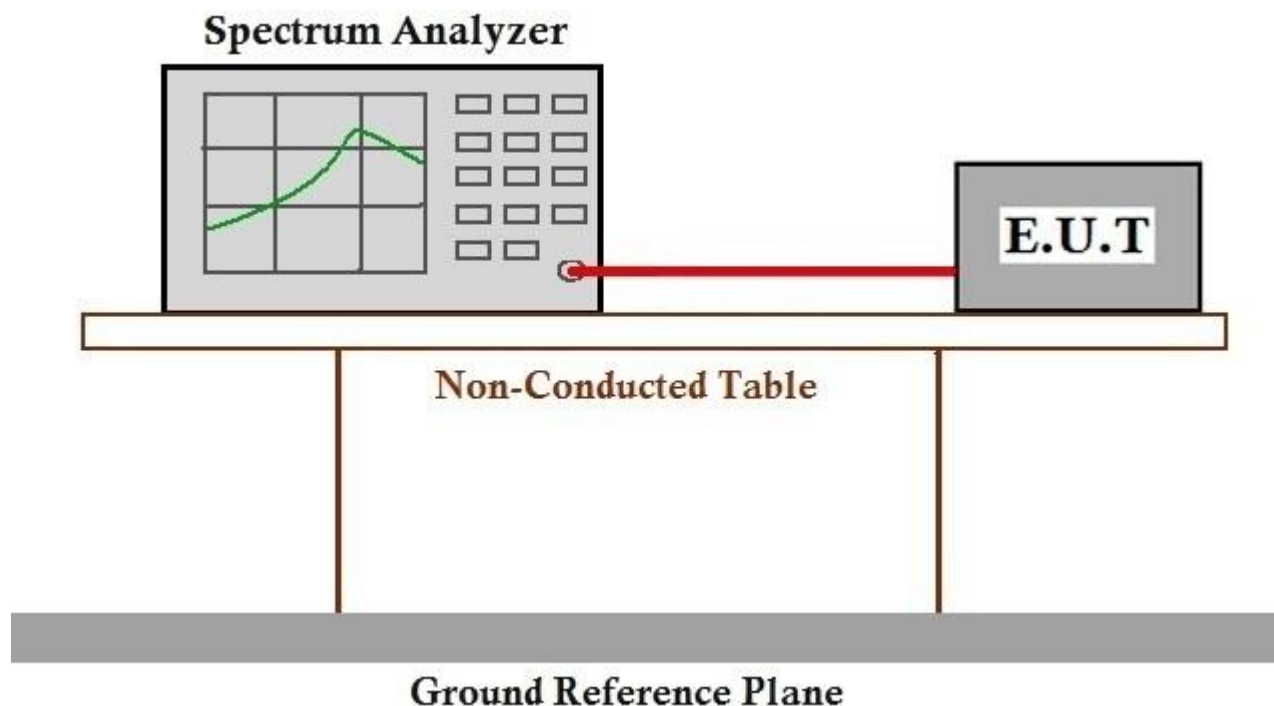
Pretest these modes to find the worst case: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

The worst case for final test: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_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 15.247

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: 28.8 °C Humidity: 38 % RH Atmospheric Pressure: 1005 mbar

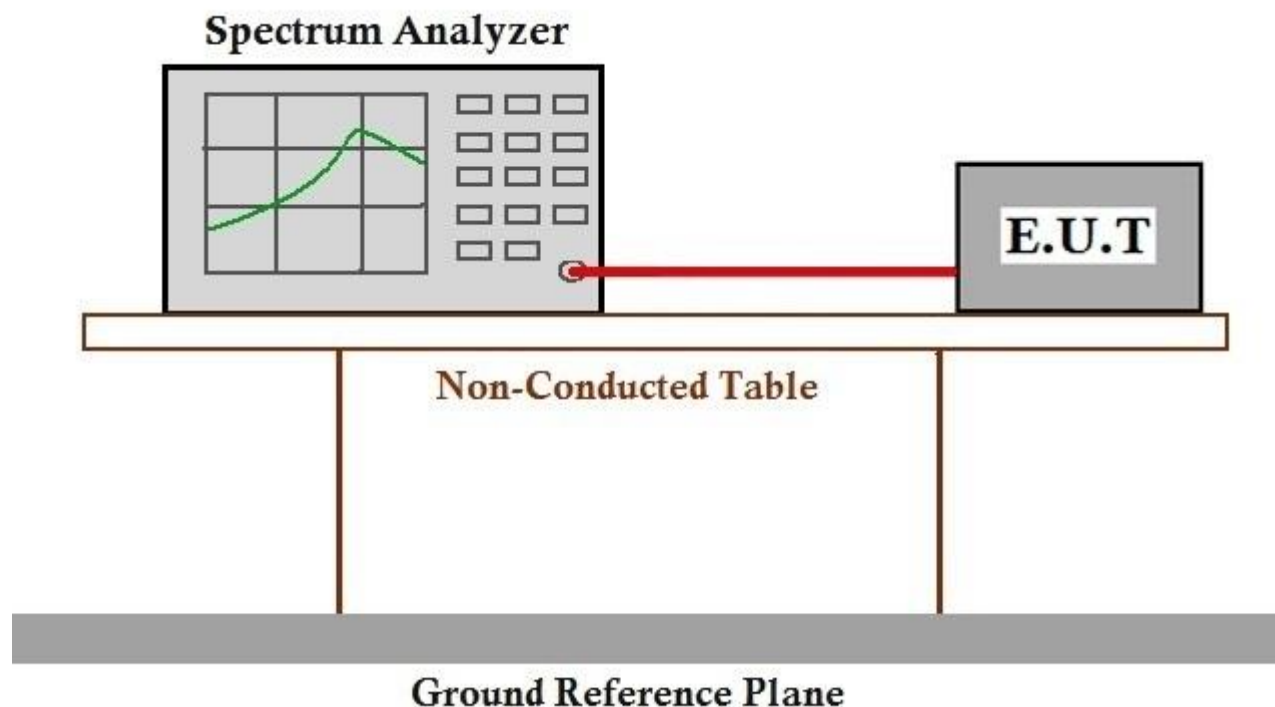
Pretest these modes to find the worst case: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

The worst case for final test: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_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 15.247

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: 28.8 °C Humidity: 38 % RH Atmospheric Pressure: 1005 mbar

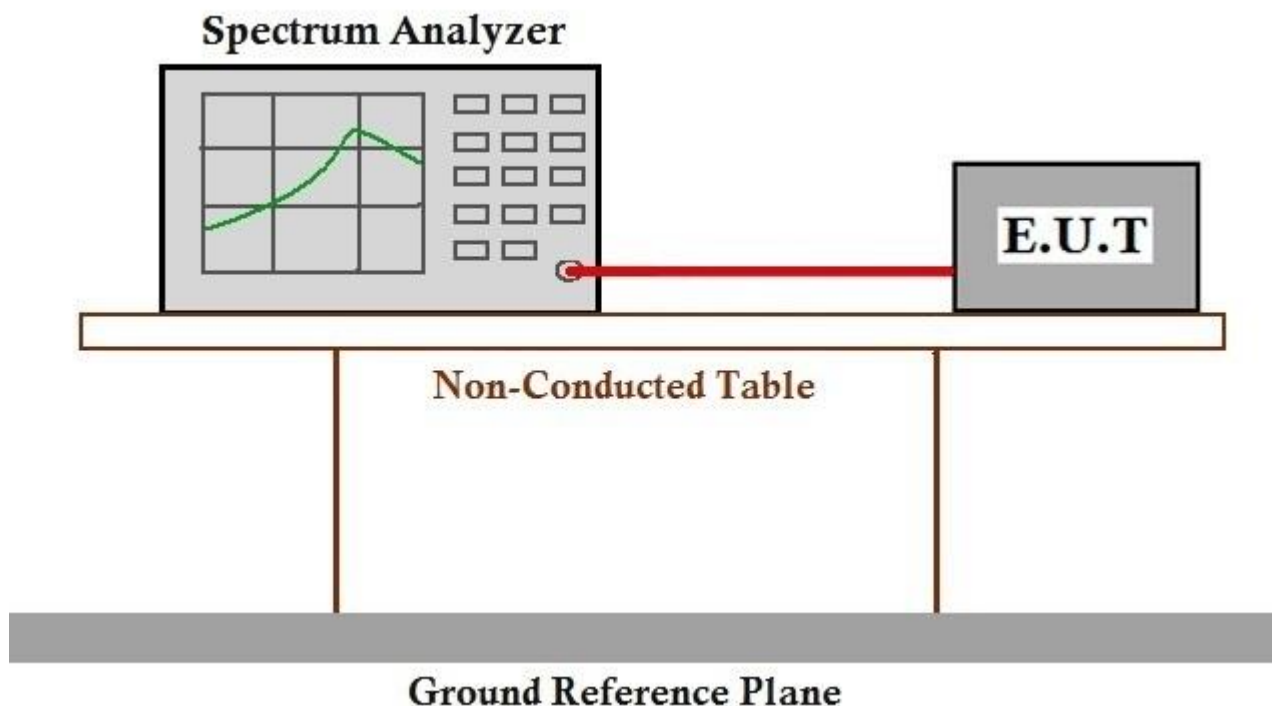
Pretest these modes to find the worst case: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

The worst case for final test: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_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 15.247

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: 28.8 °C Humidity: 38 % RH Atmospheric Pressure: 1005 mbar

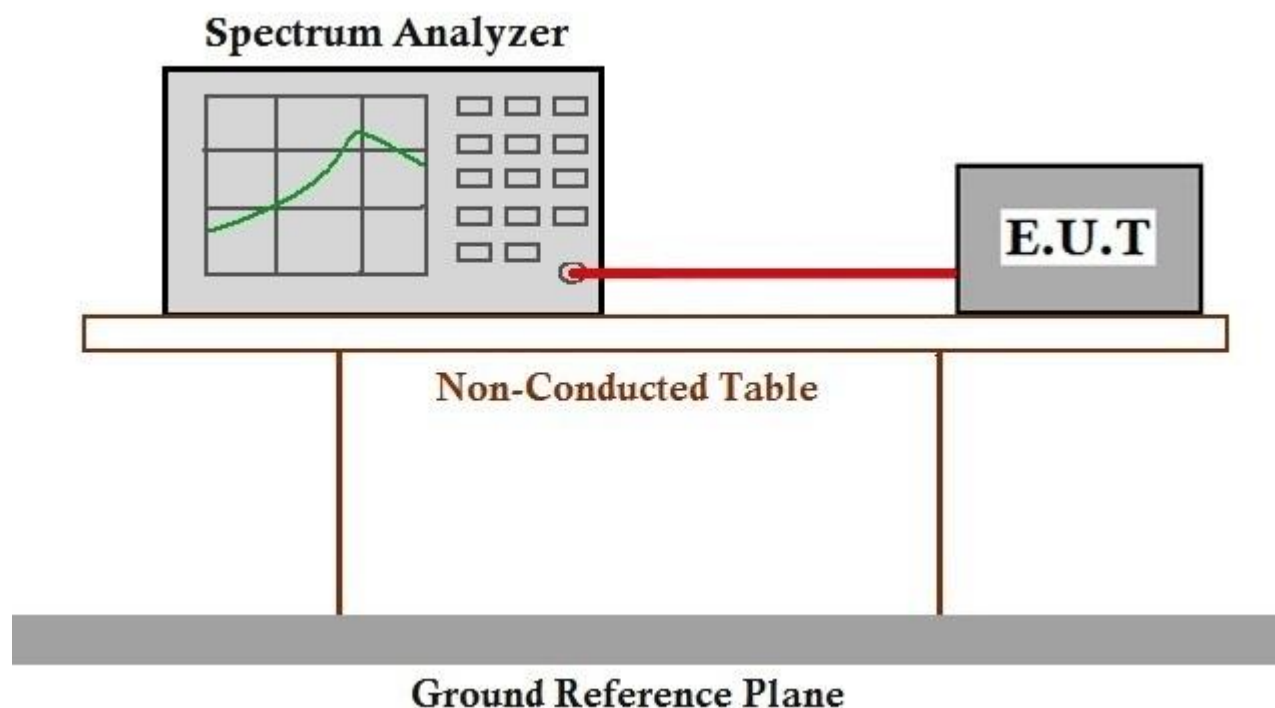
Pretest these modes to find the worst case: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

The worst case for final test: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_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 15.247

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

Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 54 % RH Atmospheric Pressure: 1005 mbar

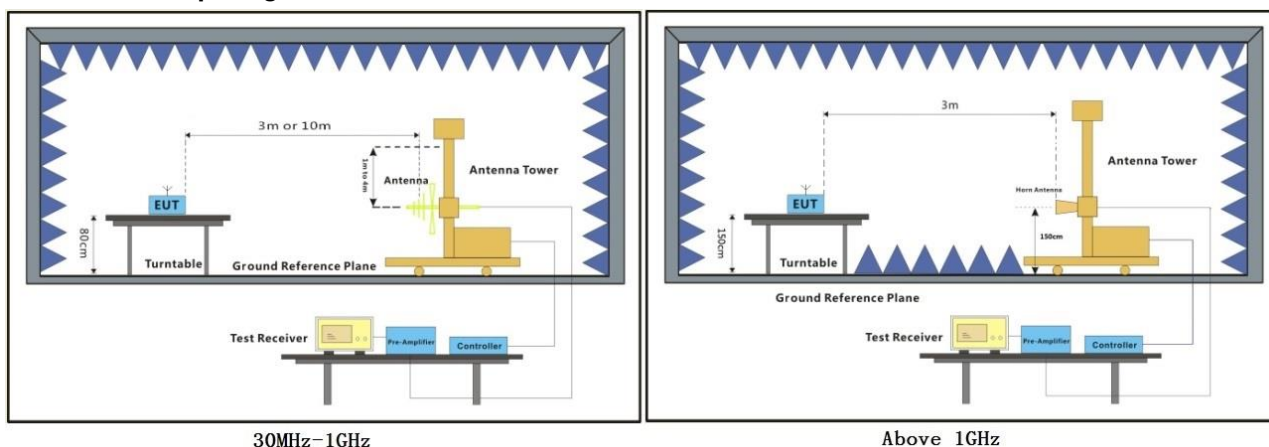
Pretest these modes to find the worst case: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

The worst case for final test: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.6.2 Test Setup Diagram



30MHz-1GHz

Above 1GHz

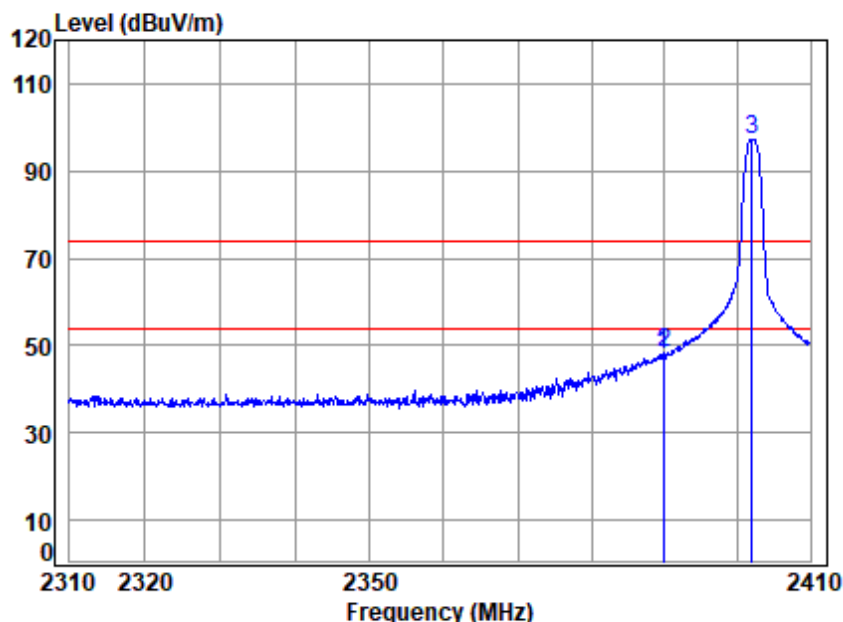
7.6.3 Measurement Procedure and Data

- 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.

Mode:d; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low

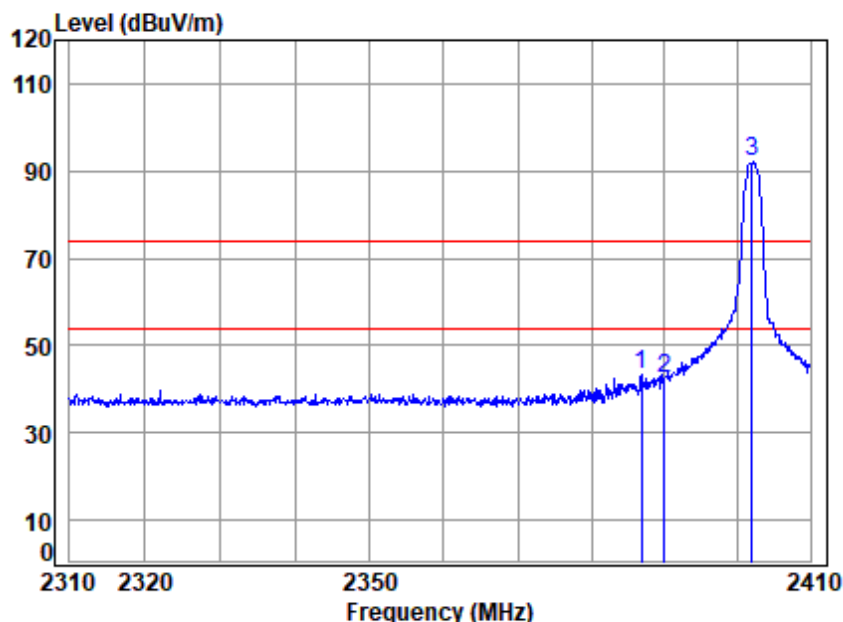


Site : chamber
Condition: 3m HORIZONTAL
Job No : 03278CR/03281CR
Mode : 2402 Band edge
Note : BLE L

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2389.761	3.69	28.52	40.97	56.66	47.90	74.00	-26.10	peak
2	2390.000	3.69	28.52	40.97	56.94	48.18	74.00	-25.82	peak
3 *	2402.000	3.63	28.54	40.98	105.98	97.17	74.00	23.17	peak



Mode:d; Polarization:Vertical; Modulation:GFSK; ; Channel:Low

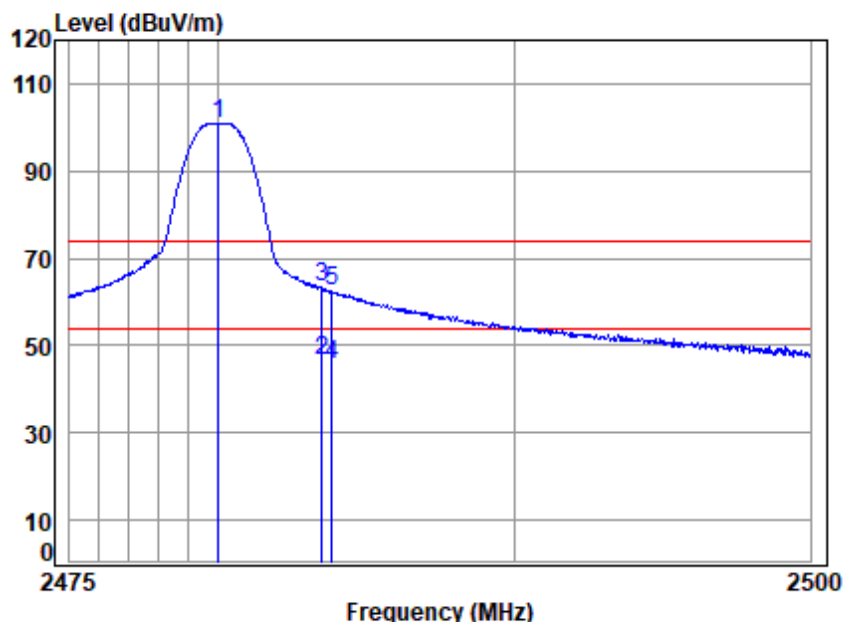


Site : chamber
Condition: 3m VERTICAL
Job No : 03278CR/03281CR
Mode : 2402 Band edge
Note : BLE L

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2386.826	3.71	28.51	40.97	51.97	43.22	74.00	-30.78	peak
2	2390.000	3.69	28.52	40.97	51.11	42.35	74.00	-31.65	peak
3 *	2402.000	3.63	28.54	40.98	100.76	91.95	74.00	17.95	peak



Mode:d; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 03278CR/03281CR
Mode : 2480 Band edge
Note : BLE L

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 *	2480.000	3.99	28.67	41.01	109.34	100.99	74.00	26.99	peak
2	2483.500	4.01	28.67	41.01	54.94	46.61	54.00	-7.39	Average
3	2483.500	4.01	28.67	41.01	71.64	63.31	74.00	-10.69	peak
4	2483.821	4.01	28.67	41.01	54.01	45.68	54.00	-8.32	Average
5	2483.821	4.01	28.67	41.01	70.75	62.42	74.00	-11.58	peak

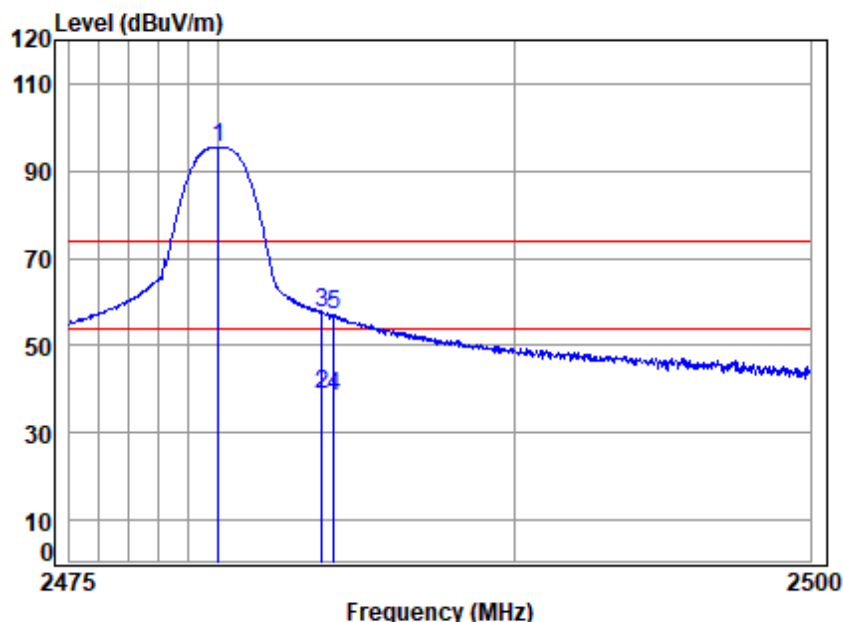


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Mode:d; Polarization:Vertical; Modulation:GFSK; ; Channel:High

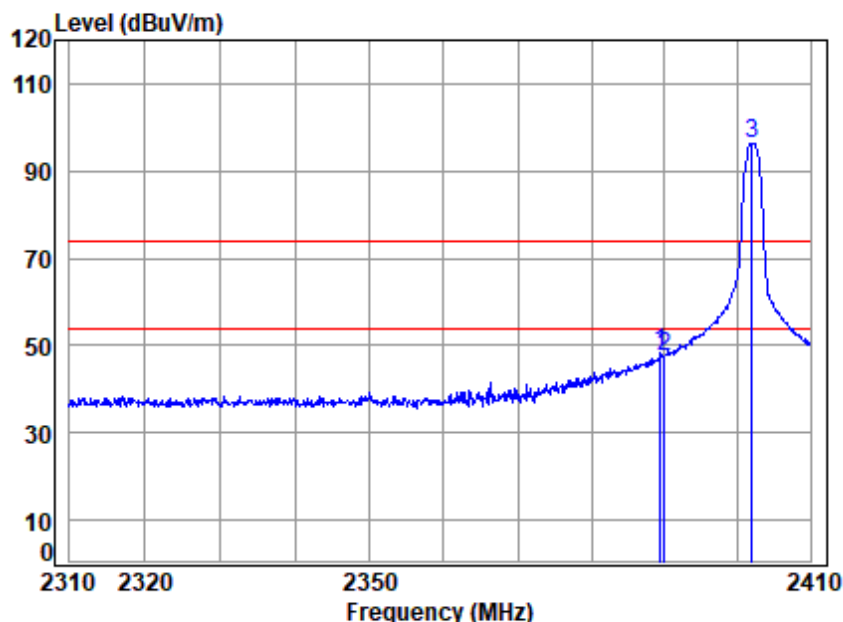


Site : chamber
Condition: 3m VERTICAL
Job No : 03278CR/03281CR
Mode : 2480 Band edge
Note : BLE L

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 *	2480.000	3.99	28.67	41.01	103.61	95.26	74.00	21.26	peak
2	2483.500	4.01	28.67	41.01	47.29	38.96	54.00	-15.04	Average
3	2483.500	4.01	28.67	41.01	65.59	57.26	74.00	-16.74	peak
4	2483.896	4.01	28.67	41.01	46.69	38.36	54.00	-15.64	Average
5	2483.896	4.01	28.67	41.01	65.39	57.06	74.00	-16.94	peak



Mode:i; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low

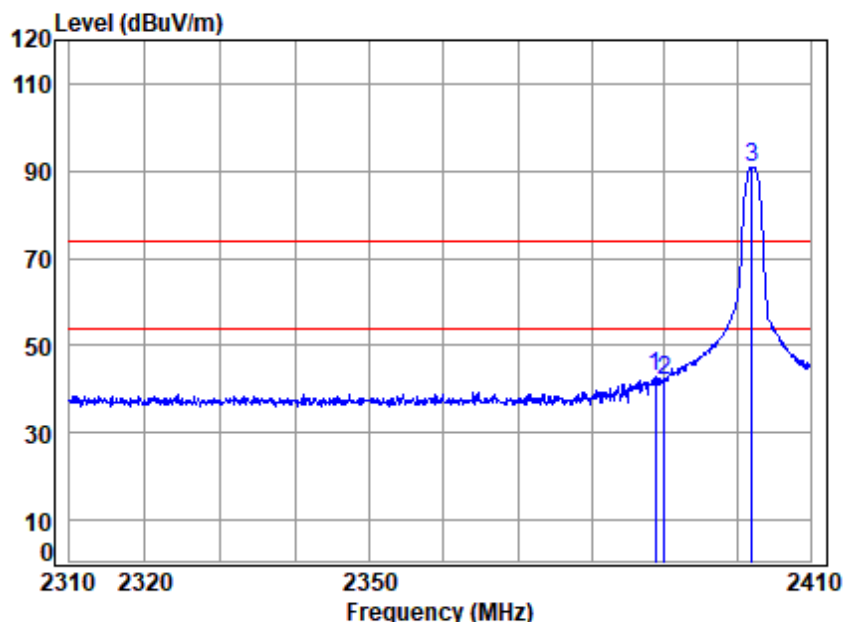


Site : chamber
Condition: 3m HORIZONTAL
Job No : 03278CR/03281CR
Mode : 2402 Band edge
Note : BLE R

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2389.356	3.69	28.52	40.97	56.98	48.22	74.00	-25.78	peak
2	2390.000	3.69	28.52	40.97	56.20	47.44	74.00	-26.56	peak
3 *	2402.000	3.63	28.54	40.98	104.94	96.13	74.00	22.13	peak



Mode:i; Polarization:Vertical; Modulation:GFSK; ; Channel:Low

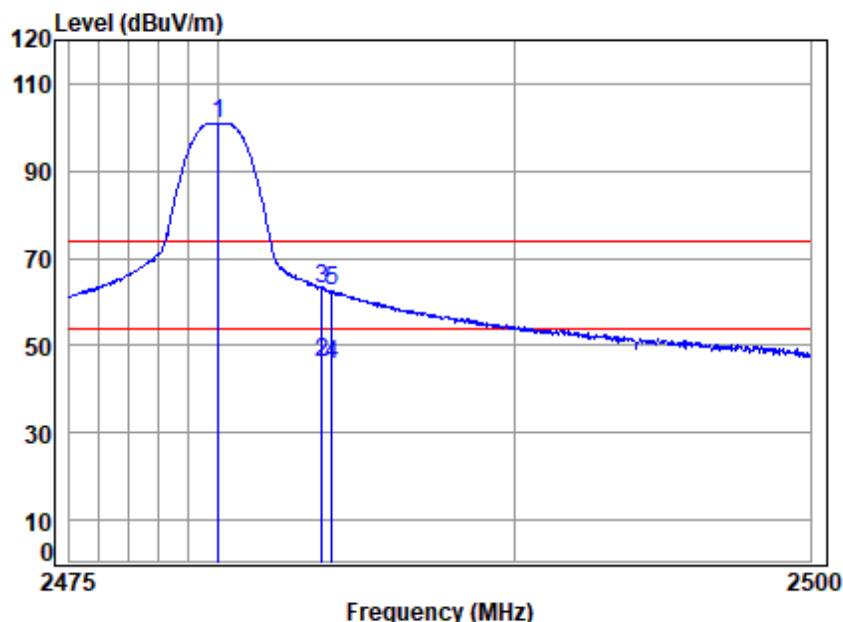


Site : chamber
Condition: 3m VERTICAL
Job No : 03278CR/03281CR
Mode : 2402 Band edge
Note : BLE R

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2388.748	3.69	28.52	40.97	51.62	42.86	74.00	-31.14	peak
2	2390.000	3.69	28.52	40.97	50.83	42.07	74.00	-31.93	peak
3 *	2402.000	3.63	28.54	40.98	99.60	90.79	74.00	16.79	peak



Mode:i; Polarization:Horizontal; Modulation:GFSK; ; Channel:High

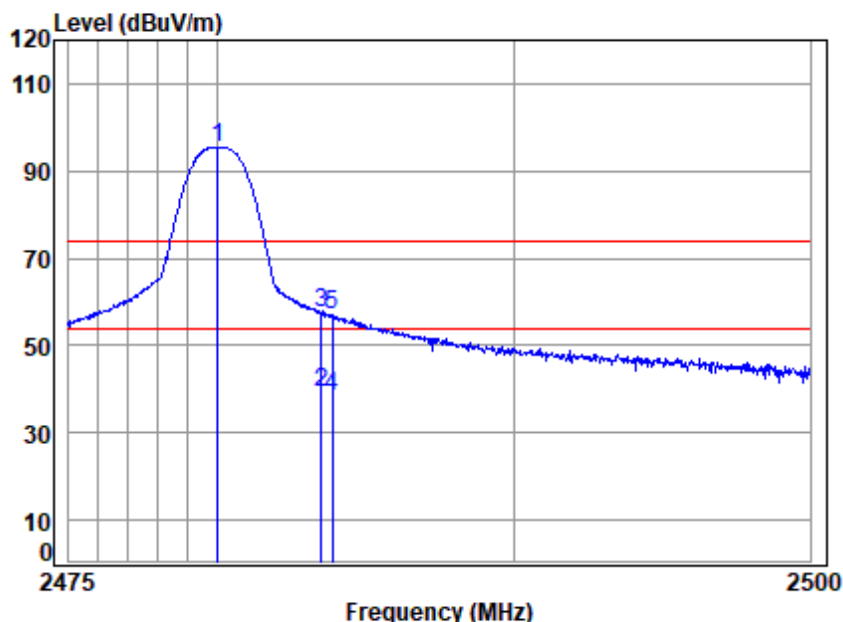


Site : chamber
Condition: 3m HORIZONTAL
Job No : 03278CR/03281CR
Mode : 2480 Band edge
Note : BLE R

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 *	2480.000	3.99	28.67	41.01	109.38	101.03	74.00	27.03	peak
2	2483.500	4.01	28.67	41.01	54.24	45.91	54.00	-8.09	Average
3	2483.500	4.01	28.67	41.01	71.25	62.92	74.00	-11.08	peak
4	2483.821	4.01	28.67	41.01	53.84	45.51	54.00	-8.49	Average
5	2483.821	4.01	28.67	41.01	70.74	62.41	74.00	-11.59	peak



Mode:i; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m VERTICAL
Job No : 03278CR/03281CR
Mode : 2480 Band edge
Note : BLE R

		Cable	Ant	Preamp	Read		Limit	Over	
Freq		Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz		dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 *	2480.000	3.99	28.67	41.01	103.62	95.27	74.00	21.27	peak
2	2483.500	4.01	28.67	41.01	47.37	39.04	54.00	-14.96	Average
3	2483.500	4.01	28.67	41.01	65.97	57.64	74.00	-16.36	peak
4	2483.871	4.01	28.67	41.01	46.74	38.41	54.00	-15.59	Average
5	2483.871	4.01	28.67	41.01	65.14	56.81	74.00	-17.19	peak



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

Measurement Distance: 10m (Below 1GHz) and 3m (Above 1GHz)

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: 25 °C Humidity: 45 % RH Atmospheric Pressure: 1005 mbar

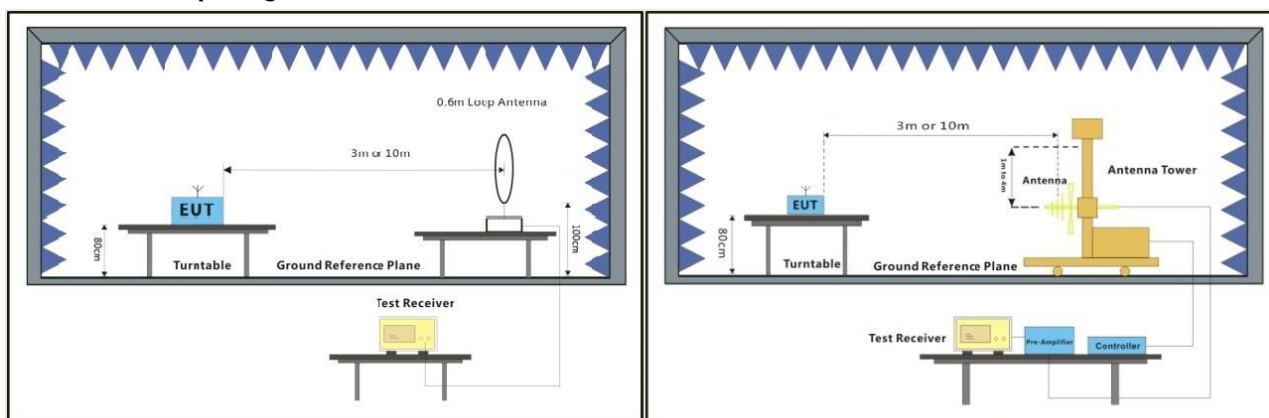
Pretest these modes to find the worst case: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

i:TX mode(Right earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

The worst case for final test: d:TX mode(Left earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

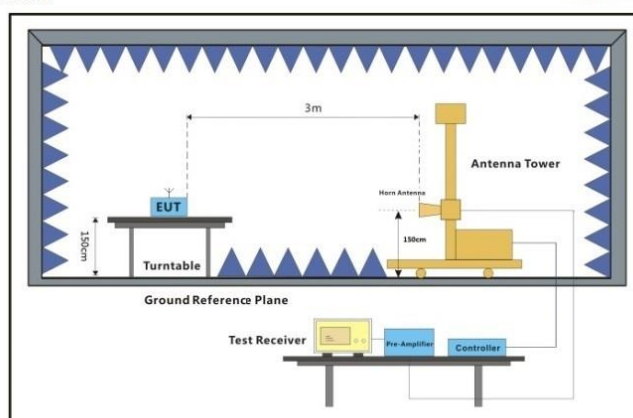
i:TX mode(Right earbuds 1M/bit of BLE)_Keep the EUT in continuously transmitting mode with GFSK modulation.

7.7.2 Test Setup Diagram



Below 30MHz

30MHz~1GHz



Above 1GHz



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.

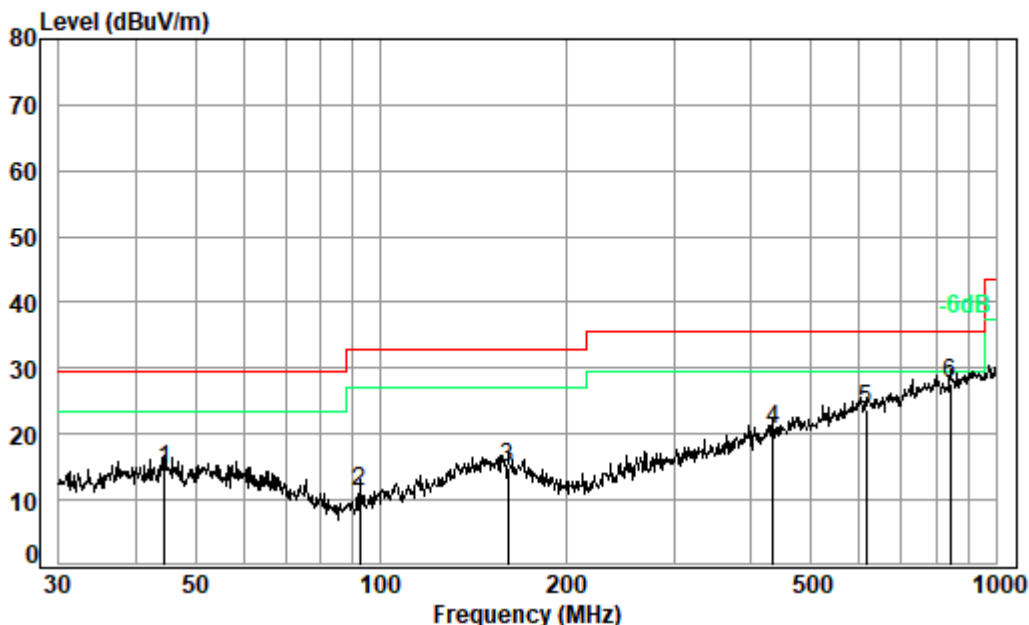
Remark:

- 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 in the report.

30MHz~1GHz

QP value:

Mode: d Polarization: Horizontal;



Condition: 10m HORIZONTAL

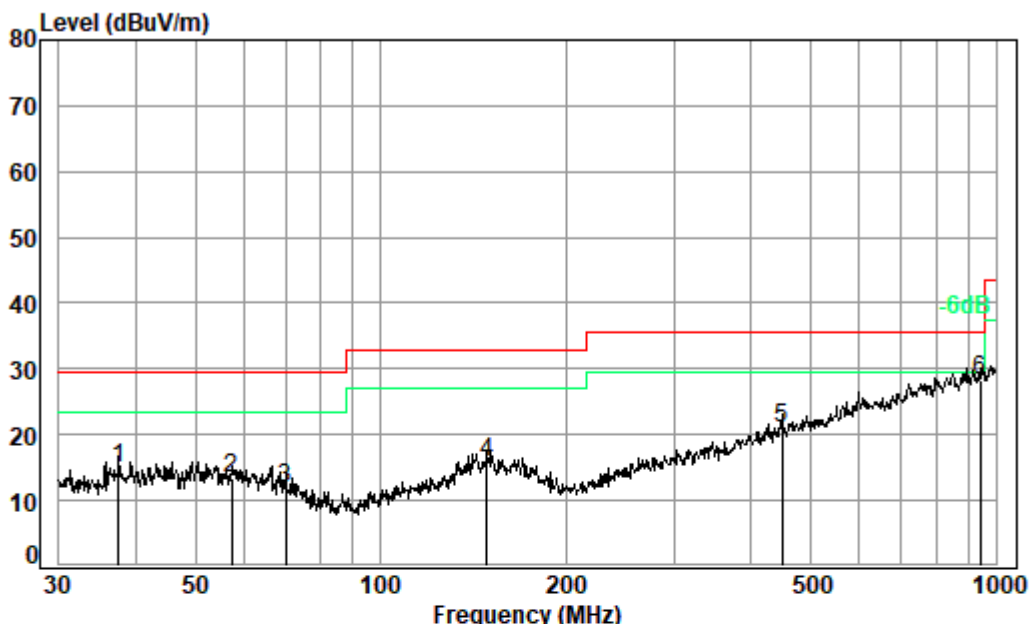
Job No. : 03281CR

Test Mode: d

		Ant	Preamp	Cable	Read	Limit	Over	
	Freq	Factor	Factor	Loss	Level	Line	Limit	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB
1	44.587	20.36	32.44	0.95	25.74	14.61	29.50	-14.89 QP
2	92.462	14.42	32.33	1.22	27.83	11.14	33.00	-21.86 QP
3	160.909	19.75	32.30	1.50	25.97	14.92	33.00	-18.08 QP
4	434.065	22.82	32.23	2.66	27.33	20.58	35.60	-15.02 QP
5	614.214	26.42	32.06	3.17	26.06	23.59	35.60	-12.01 QP
6 pp	842.130	28.62	31.75	3.38	27.49	27.74	35.60	-7.86 QP



Mode :d; Polarization: Vertical



Condition: 10m VERTICAL

Job No. : 03281CR

Test Mode: d

	Ant Freq	Preamp Factor	Cable Loss	Read Level	Limit Level	Over Limit	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	37.548	19.89	32.42	0.90	26.47	14.84	29.50 -14.66 QP
2	57.191	19.62	32.43	1.03	25.08	13.30	29.50 -16.20 QP
3	70.090	17.57	32.39	1.08	25.63	11.89	29.50 -17.61 QP
4	148.963	20.15	32.30	1.47	26.39	15.71	33.00 -17.29 QP
5	449.556	23.48	32.29	2.70	27.09	20.98	35.60 -14.62 QP
6 pp	942.131	29.81	31.29	3.48	26.16	28.16	35.60 -7.44 QP



The test was performed at a 10m test site. According to below formulate and the test data at 10m test distance,

$$L_3 / L_{10} = D_{10} / D_3$$

Note:

L_3 : Level @ 3m distance. Unit: $\mu\text{V/m}$;

L_{10} : Level @ 10m distance. Unit: $\mu\text{V/m}$;

D_3 : 3m distance. Unit: m

D_{10} : 10m distance. Unit: m

The level at 3m test distance is below:

Frequency (MHz)	Level @ 10m (dBuV/m)	Level @ 10m ($\mu\text{V/m}$)	Level @ 3m ($\mu\text{V/m}$)	Level @ 3m (dBuV/m)	Limit @ 3m (dBuV/m)	Margin (dB)	Ant. Polarization
37.55	14.84	5.52	18.40	25.30	40.00	-14.70	V
57.19	13.30	4.62	15.41	23.76	40.00	-16.24	V
70.09	11.89	3.93	13.10	22.35	40.00	-17.65	V
148.96	15.71	6.10	20.34	26.17	43.50	-17.33	V
449.56	20.98	11.19	37.31	31.44	46.00	-14.56	V
942.13	28.16	25.59	85.29	38.62	46.00	-7.38	V
44.59	14.61	5.38	17.92	25.07	40.00	-14.93	H
92.46	11.14	3.61	12.02	21.60	43.50	-21.90	H
160.91	14.92	5.57	18.57	25.38	43.50	-18.12	H
434.07	20.58	10.69	35.64	31.04	46.00	-14.96	H
614.21	23.59	15.12	50.39	34.05	46.00	-11.95	H
842.13	27.74	24.38	81.26	38.20	46.00	-7.80	H



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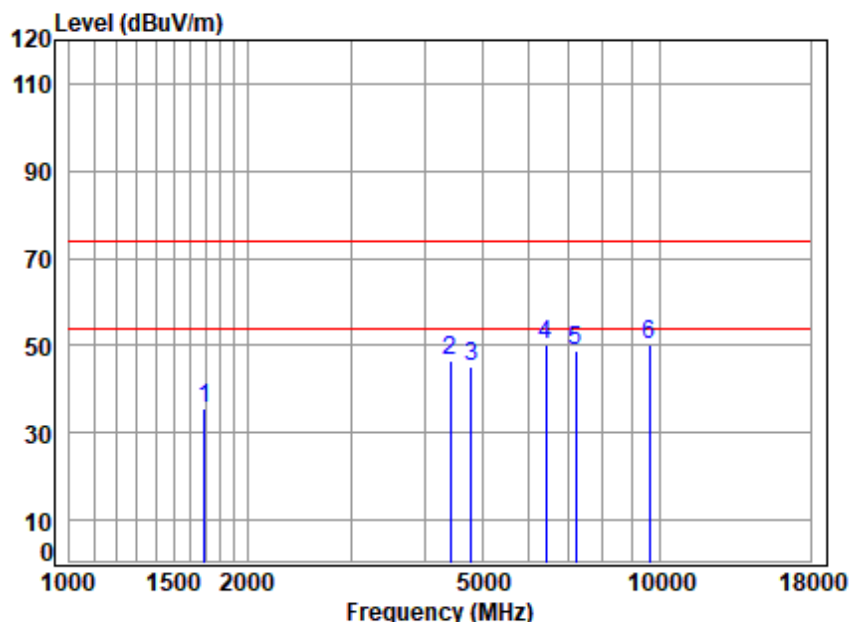
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Above 1GHz

Mode:d; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low

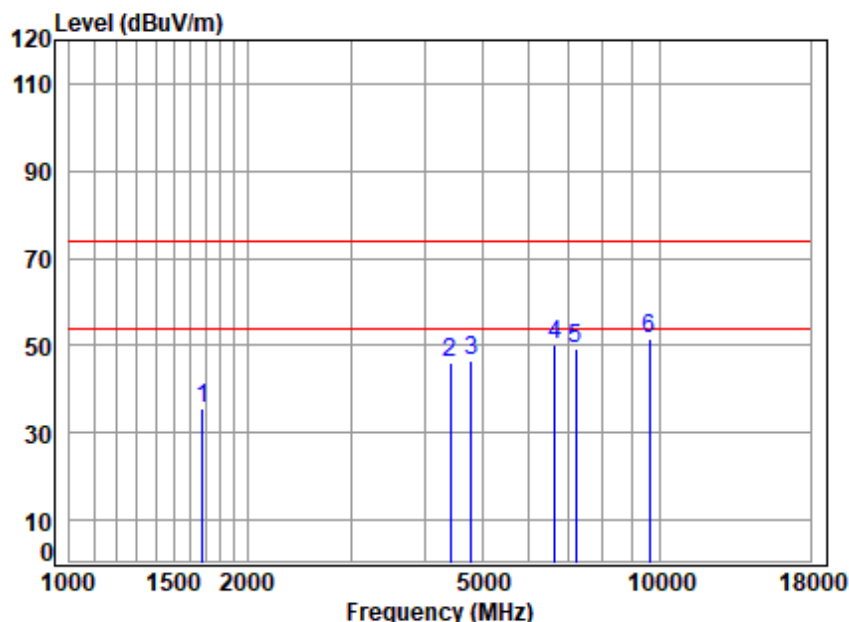


Site : chamber
Condition: 3m HORIZONTAL
Job No : 03278CR/03281CR
Mode : 2402 TX SE
Note : BLE L

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1692.231	3.28	26.64	40.63	46.52	35.81	74.00	-38.19	peak
2	4417.841	6.63	33.46	42.49	48.73	46.33	74.00	-27.67	peak
3	4804.000	6.80	33.97	42.77	47.27	45.27	74.00	-28.73	peak
4	6414.167	7.63	35.52	42.00	49.08	50.23	74.00	-23.77	peak
5	7206.000	8.44	36.07	41.58	46.04	48.97	74.00	-25.03	peak
6	9608.000	9.17	37.67	38.57	42.14	50.41	74.00	-23.59	peak



Mode:d; Polarization:Vertical; Modulation:GFSK; ; Channel:Low

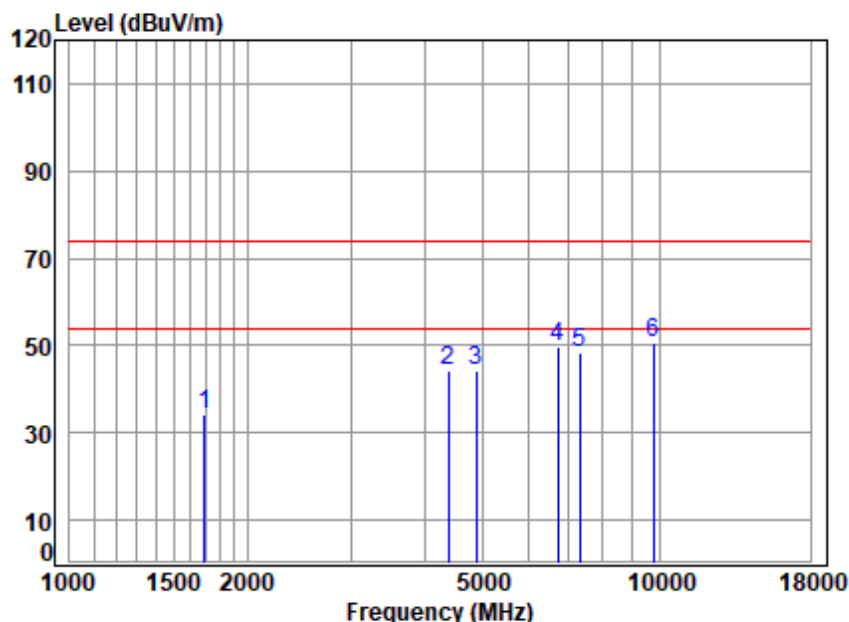


Site : chamber
Condition: 3m VERTICAL
Job No : 03278CR/03281CR
Mode : 2402 TX SE
Note : BLE L

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1682.477	3.25	26.60	40.62	46.27	35.50	74.00	-38.50	peak
2	4417.841	6.63	33.46	42.49	48.40	46.00	74.00	-28.00	peak
3	4804.000	6.80	33.97	42.77	48.50	46.50	74.00	-27.50	peak
4	6640.542	8.14	35.69	41.87	48.03	49.99	74.00	-24.01	peak
5	7206.000	8.44	36.07	41.58	46.42	49.35	74.00	-24.65	peak
6	9608.000	9.17	37.67	38.57	43.44	51.71	74.00	-22.29	peak



Mode:d; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle

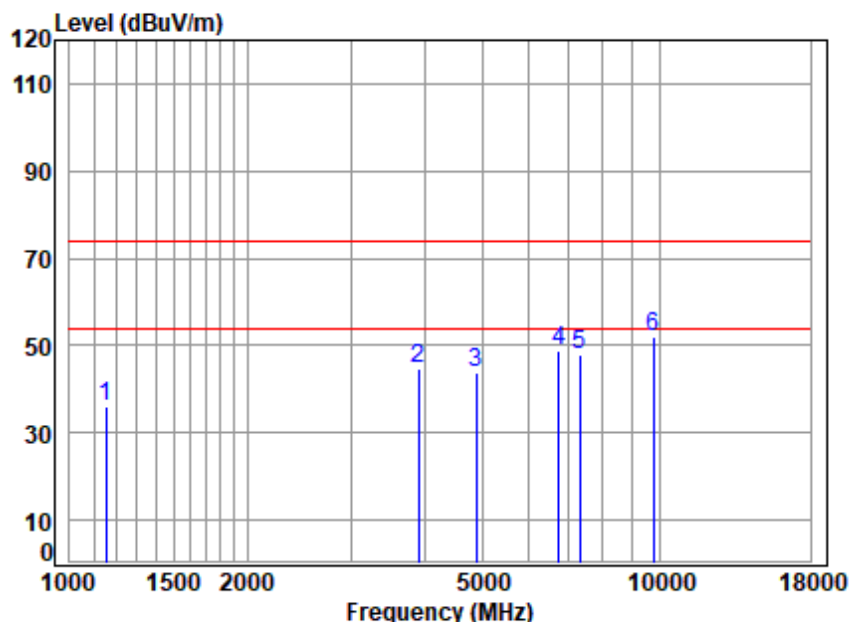


Site : chamber
Condition: 3m HORIZONTAL
Job No : 03278CR/03281CR
Mode : 2440 TX SE
Note : BLE L

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1692.231	3.28	26.64	40.63	45.00	34.29	74.00	-39.71	peak
2	4392.376	6.66	33.42	42.47	46.87	44.48	74.00	-29.52	peak
3	4880.000	7.02	34.06	42.82	45.91	44.17	74.00	-29.83	peak
4	6717.762	8.28	35.73	41.83	47.63	49.81	74.00	-24.19	peak
5	7323.000	8.36	36.16	41.52	45.16	48.16	74.00	-25.84	peak
6	9764.000	9.30	37.76	38.34	41.94	50.66	74.00	-23.34	peak



Mode:d; Polarization:Vertical; Modulation:GFSK; ; Channel:middle

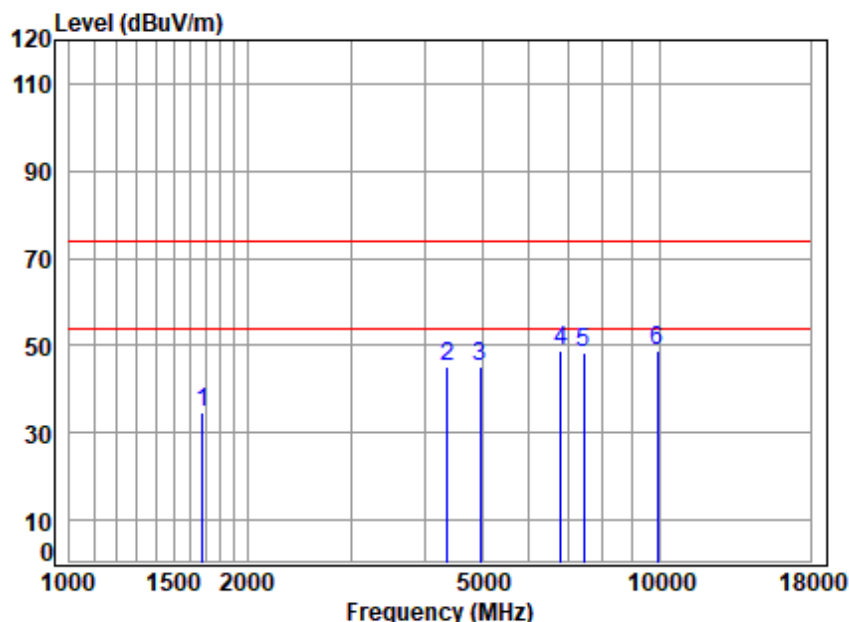


Site : chamber
Condition: 3m VERTICAL
Job No : 03278CR/03281CR
Mode : 2440 TX SE
Note : BLE L

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1152.148	2.42	24.37	40.24	49.61	36.16	74.00	-37.84	peak
2	3901.516	6.01	32.51	42.07	48.28	44.73	74.00	-29.27	peak
3	4880.000	7.02	34.06	42.82	45.50	43.76	74.00	-30.24	peak
4	6756.708	8.14	35.76	41.81	46.94	49.03	74.00	-24.97	peak
5	7323.000	8.36	36.16	41.52	44.70	47.70	74.00	-26.30	peak
6	9764.000	9.30	37.76	38.34	43.44	52.16	74.00	-21.84	peak



Mode:d; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



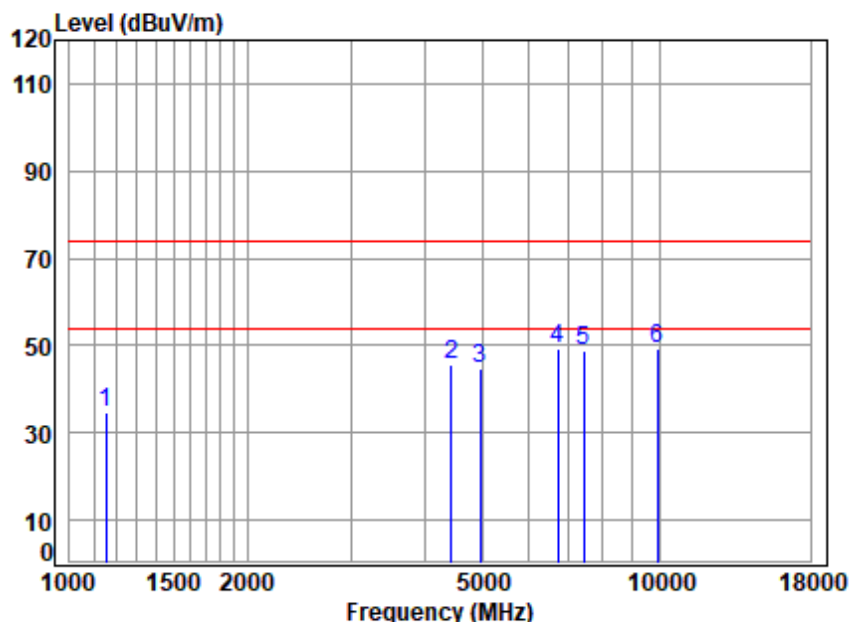
Site : chamber
Condition: 3m HORIZONTAL
Job No : 03278CR/03281CR
Mode : 2480 TX SE
Note : BLE L

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1682.477	3.25	26.60	40.62	45.42	34.65	74.00	-39.35	peak
2	4367.058	6.56	33.37	42.45	47.72	45.20	74.00	-28.80	peak
3	4960.000	7.02	34.15	42.87	47.03	45.33	74.00	-28.67	peak
4	6795.879	8.00	35.78	41.79	46.82	48.81	74.00	-25.19	peak
5	7440.000	8.10	36.25	41.46	45.49	48.38	74.00	-25.62	peak
6	9920.000	8.96	37.85	38.12	40.29	48.98	74.00	-25.02	peak



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Mode:d; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m VERTICAL
Job No : 03278CR/03281CR
Mode : 2480 TX SE
Note : BLE L

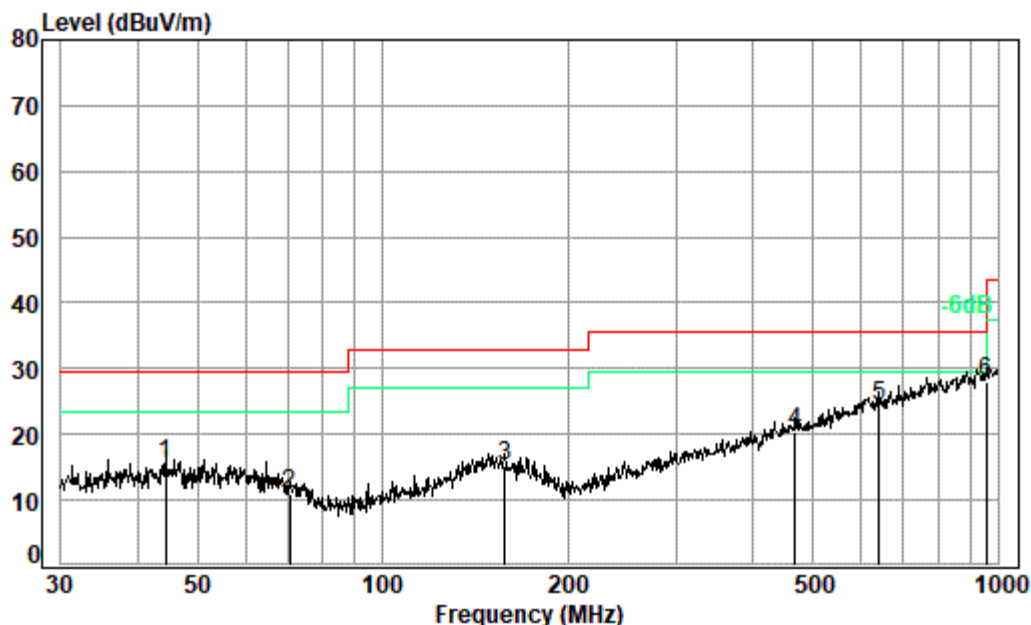
	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1152.148	2.42	24.37	40.24	48.30	34.85	74.00	-39.15	peak
2	4443.453	6.55	33.50	42.51	48.13	45.67	74.00	-28.33	peak
3	4960.000	7.02	34.15	42.87	46.51	44.81	74.00	-29.19	peak
4	6717.762	8.28	35.73	41.83	46.93	49.11	74.00	-24.89	peak
5	7440.000	8.10	36.25	41.46	45.75	48.64	74.00	-25.36	peak
6	9920.000	8.96	37.85	38.12	40.51	49.20	74.00	-24.80	peak



30MHz~1GHz

QP value:

Mode: i; Polarization: Horizontal;



Condition: 10m HORIZONTAL

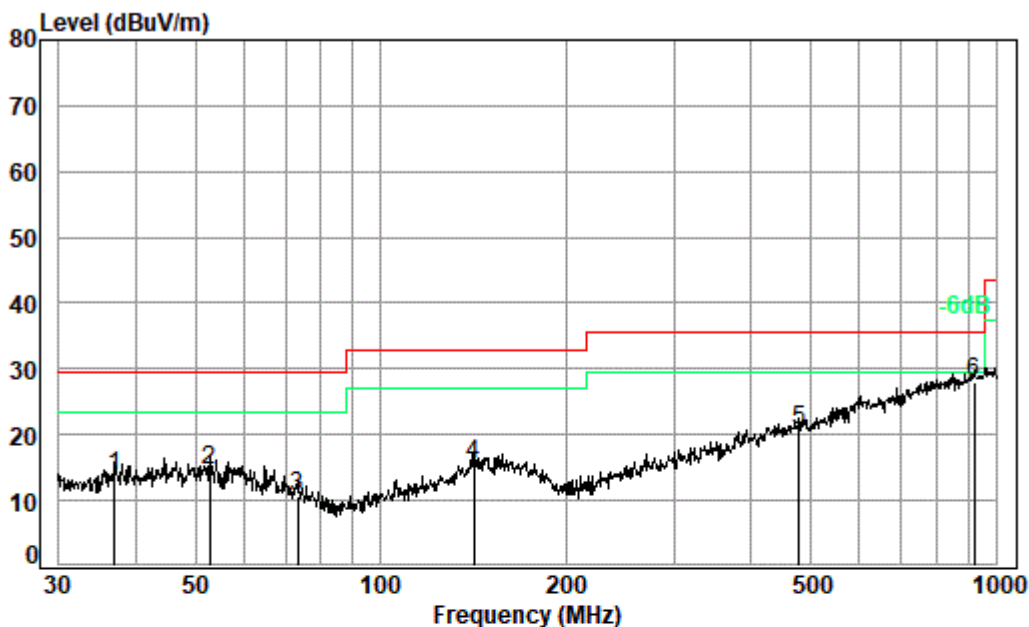
Job No. : 03281CR

Test Mode: i

		Ant	Preamp	Cable	Read	Limit	Over	
	Freq	Factor	Factor	Loss	Level	Line	Limit	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB
1	44.431	20.34	32.44	0.95	26.64	15.49	29.50	-14.01 QP
2	70.584	17.39	32.39	1.08	24.78	10.86	29.50	-18.64 QP
3	158.112	19.87	32.30	1.49	26.10	15.16	33.00	-17.84 QP
4	468.876	23.69	32.36	2.79	26.29	20.41	35.60	-15.19 QP
5	640.611	26.31	32.12	3.19	26.94	24.32	35.60	-11.28 QP
6 pp	955.438	29.88	31.22	3.51	25.86	28.03	35.60	-7.57 QP



Mode :i; Polarization: Vertical



Condition: 10m VERTICAL

Job No. : 03281CR

Test Mode: i

	Ant Freq	Preamp Factor	Cable Loss	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	37.025	19.76	32.41	0.90	25.52	13.77	29.50	-15.73 QP
2	52.760	19.98	32.45	1.00	26.08	14.61	29.50	-14.89 QP
3	73.359	16.56	32.38	1.11	25.39	10.68	29.50	-18.82 QP
4	141.826	19.79	32.30	1.45	26.44	15.38	33.00	-17.62 QP
5	478.846	23.70	32.40	2.84	26.42	20.56	35.60	-15.04 QP
6 pp	922.516	29.80	31.40	3.45	26.07	27.92	35.60	-7.68 QP



The test was performed at a 10m test site. According to below formulate and the test data at 10m test distance,

$$L_3 / L_{10} = D_{10} / D_3$$

Note:

L_3 : Level @ 3m distance. Unit: $\mu\text{V/m}$;

L_{10} : Level @ 10m distance. Unit: $\mu\text{V/m}$;

D_3 : 3m distance. Unit: m

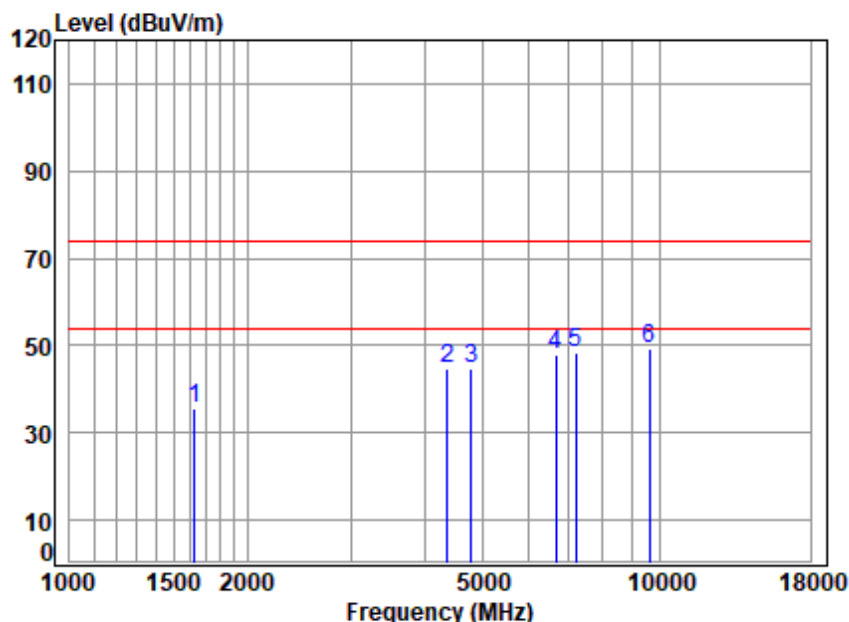
D_{10} : 10m distance. Unit: m

The level at 3m test distance is below:

Frequency (MHz)	Level @ 10m (dBuV/m)	Level @ 10m ($\mu\text{V/m}$)	Level @ 3m ($\mu\text{V/m}$)	Level @ 3m (dBuV/m)	Limit @ 3m (dBuV/m)	Margin (dB)	Ant. Polarization
37.025	13.77	4.88	16.27	24.23	40.00	-15.77	V
52.760	14.61	5.38	17.92	25.07	40.00	-14.93	V
73.359	10.68	3.42	11.40	21.14	40.00	-18.86	V
141.826	15.38	5.87	19.58	25.84	43.50	-17.66	V
478.846	20.56	10.67	35.55	31.02	46.00	-14.98	V
922.516	17.92	7.87	26.23	28.38	46.00	-17.62	V
44.431	15.49	5.95	19.83	25.95	40.00	-14.05	H
70.584	10.86	3.49	11.64	21.32	40.00	-18.68	H
158.112	15.16	5.73	19.09	25.62	43.50	-17.88	H
468.876	20.41	10.48	34.94	30.87	46.00	-15.13	H
640.611	24.32	16.44	54.81	34.78	46.00	-11.22	H
955.438	28.03	25.21	84.02	38.49	46.00	-7.51	H

Above 1GHz

Mode:i; Polarization:Horizontal; Modulation:GFSK; ; Channel:Low

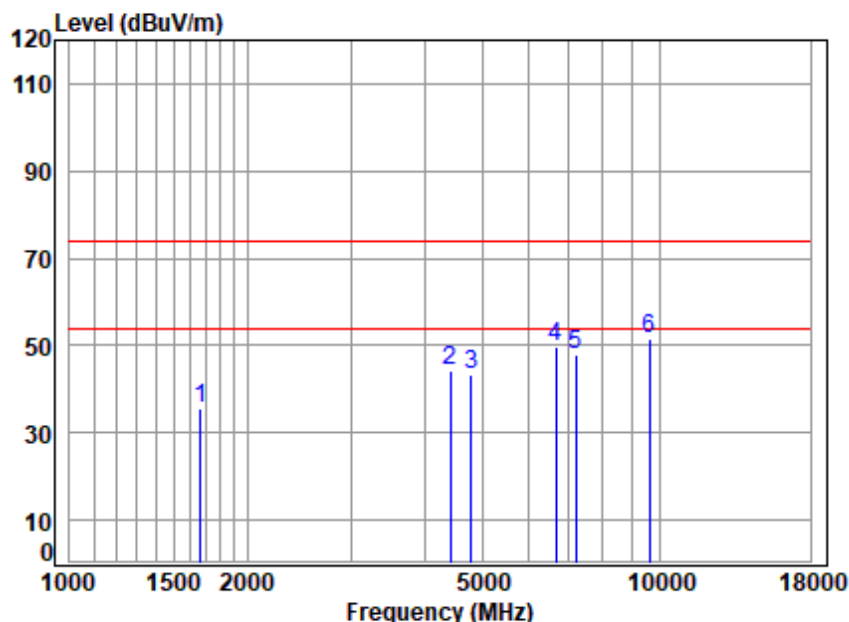


Site : chamber
Condition: 3m HORIZONTAL
Job No : 03278CR/03281CR
Mode : 2402 TX SE
Note : BLE R

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1629.825	3.06	26.38	40.59	46.63	35.48	74.00	-38.52	peak
2	4367.058	6.56	33.37	42.45	47.13	44.61	74.00	-29.39	peak
3	4804.000	6.80	33.97	42.77	46.56	44.56	74.00	-29.44	peak
4	6679.040	8.27	35.71	41.85	46.00	48.13	74.00	-25.87	peak
5	7206.000	8.44	36.07	41.58	45.30	48.23	74.00	-25.77	peak
6	9608.000	9.17	37.67	38.57	40.82	49.09	74.00	-24.91	peak



Mode:i; Polarization:Vertical; Modulation:GFSK; ; Channel:Low

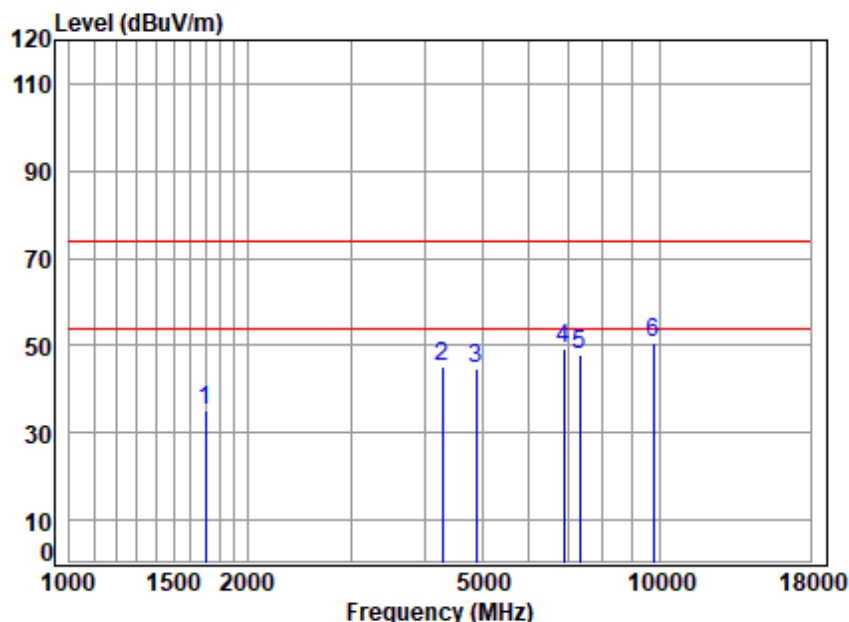


Site : chamber
Condition: 3m VERTICAL
Job No : 03278CR/03281CR
Mode : 2402 TX SE
Note : BLE R

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1667.951	3.20	26.54	40.61	46.33	35.46	74.00	-38.54	peak
2	4417.841	6.63	33.46	42.49	46.43	44.03	74.00	-29.97	peak
3	4804.000	6.80	33.97	42.77	45.41	43.41	74.00	-30.59	peak
4	6679.040	8.27	35.71	41.85	47.48	49.61	74.00	-24.39	peak
5	7206.000	8.44	36.07	41.58	45.13	48.06	74.00	-25.94	peak
6	9608.000	9.17	37.67	38.57	43.35	51.62	74.00	-22.38	peak



Mode:i; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle



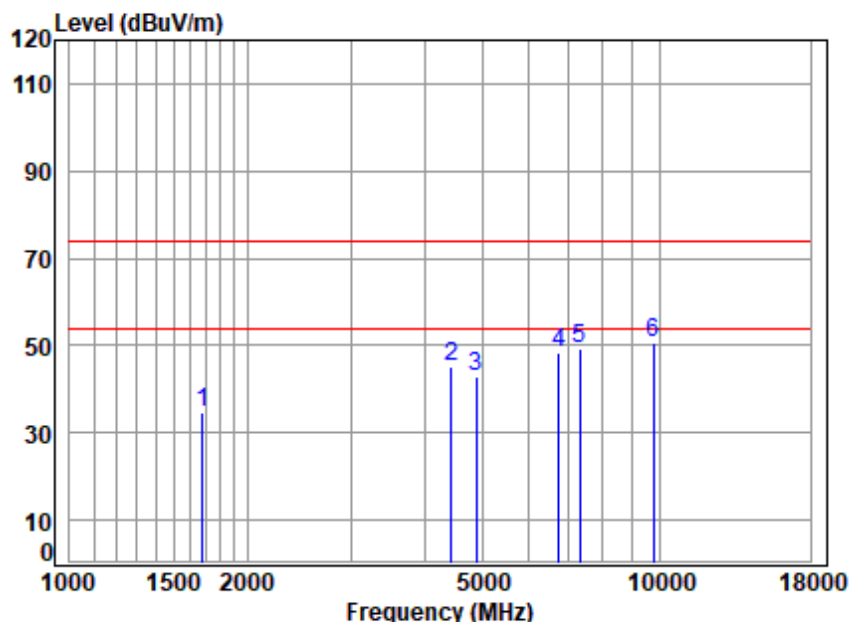
Site : chamber
Condition: 3m HORIZONTAL
Job No : 03278CR/03281CR
Mode : 2440 TX SE
Note : BLE R

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1702.042	3.30	26.68	40.63	45.60	34.95	74.00	-39.05	peak
2	4291.977	6.29	33.24	42.39	48.00	45.14	74.00	-28.86	peak
3	4880.000	7.02	34.06	42.82	46.56	44.82	74.00	-29.18	peak
4	6874.906	7.87	35.83	41.75	47.13	49.08	74.00	-24.92	peak
5	7323.000	8.36	36.16	41.52	44.97	47.97	74.00	-26.03	peak
6	9764.000	9.30	37.76	38.34	42.05	50.77	74.00	-23.23	peak



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Mode:i; Polarization:Vertical; Modulation:GFSK; ; Channel:middle

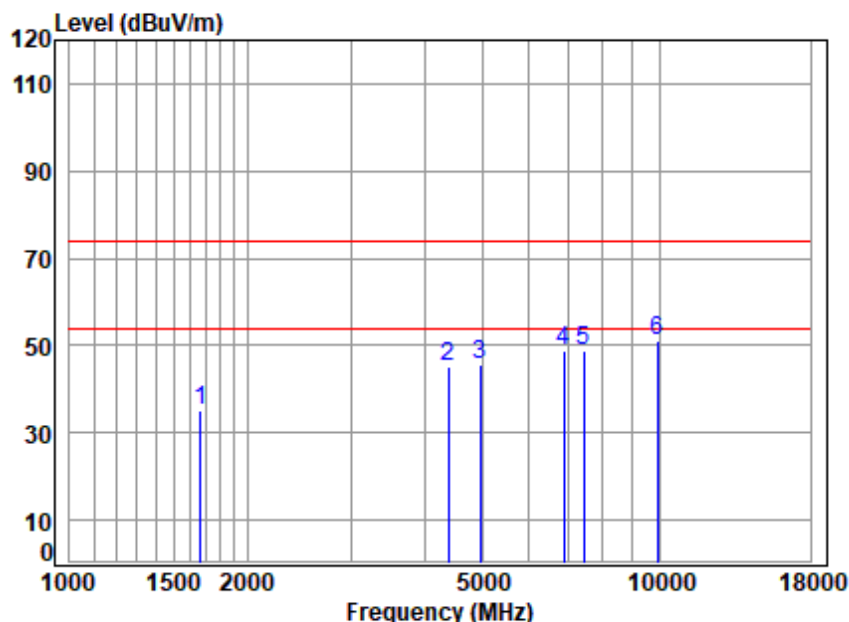


Site : chamber
Condition: 3m VERTICAL
Job No : 03278CR/03281CR
Mode : 2440 TX SE
Note : BLE R

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1682.477	3.25	26.60	40.62	45.30	34.53	74.00	-39.47	peak
2	4443.453	6.55	33.50	42.51	47.58	45.12	74.00	-28.88	peak
3	4880.000	7.02	34.06	42.82	44.78	43.04	74.00	-30.96	peak
4	6737.207	8.21	35.75	41.82	46.29	48.43	74.00	-25.57	peak
5	7323.000	8.36	36.16	41.52	46.18	49.18	74.00	-24.82	peak
6	9764.000	9.30	37.76	38.34	42.14	50.86	74.00	-23.14	peak



Mode:i; Polarization:Horizontal; Modulation:GFSK; ; Channel:High



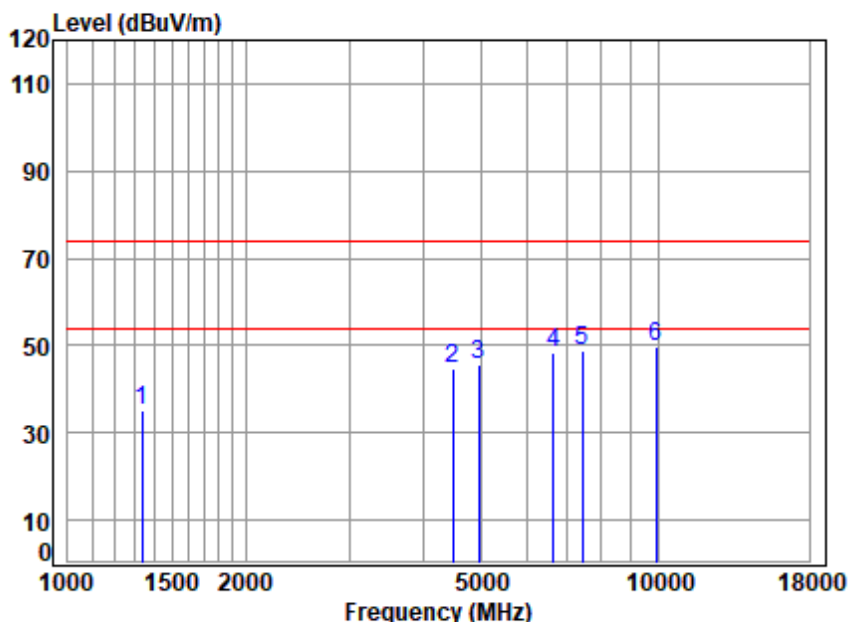
Site : chamber
Condition: 3m HORIZONTAL
Job No : 03278CR/03281CR
Mode : 2480 TX SE
Note : BLE R

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1667.951	3.20	26.54	40.61	45.87	35.00	74.00	-39.00	peak
2	4379.699	6.61	33.39	42.46	47.75	45.29	74.00	-28.71	peak
3	4960.000	7.02	34.15	42.87	47.17	45.47	74.00	-28.53	peak
4	6874.906	7.87	35.83	41.75	46.81	48.76	74.00	-25.24	peak
5	7440.000	8.10	36.25	41.46	45.94	48.83	74.00	-25.17	peak
6	9920.000	8.96	37.85	38.12	42.30	50.99	74.00	-23.01	peak



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Mode:i; Polarization:Vertical; Modulation:GFSK; ; Channel:High



Site : chamber
Condition: 3m VERTICAL
Job No : 03278CR/03281CR
Mode : 2480 TX SE
Note : BLE R

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit	Over	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1335.141	2.71	25.17	40.39	47.75	35.24	74.00	-38.76	peak
2	4482.150	6.43	33.57	42.54	47.04	44.50	74.00	-29.50	peak
3	4960.000	7.02	34.15	42.87	47.25	45.55	74.00	-28.45	peak
4	6640.542	8.14	35.69	41.87	46.52	48.48	74.00	-25.52	peak
5	7440.000	8.10	36.25	41.46	45.74	48.63	74.00	-25.37	peak
6	9920.000	8.96	37.85	38.12	40.99	49.68	74.00	-24.32	peak



8 Photographs

8.1 Test Setup

Please refer to setup photos.

8.2 EUT Constructional Details (EUT Photos)

Please refer to external and internal photos for details.



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9 Appendix

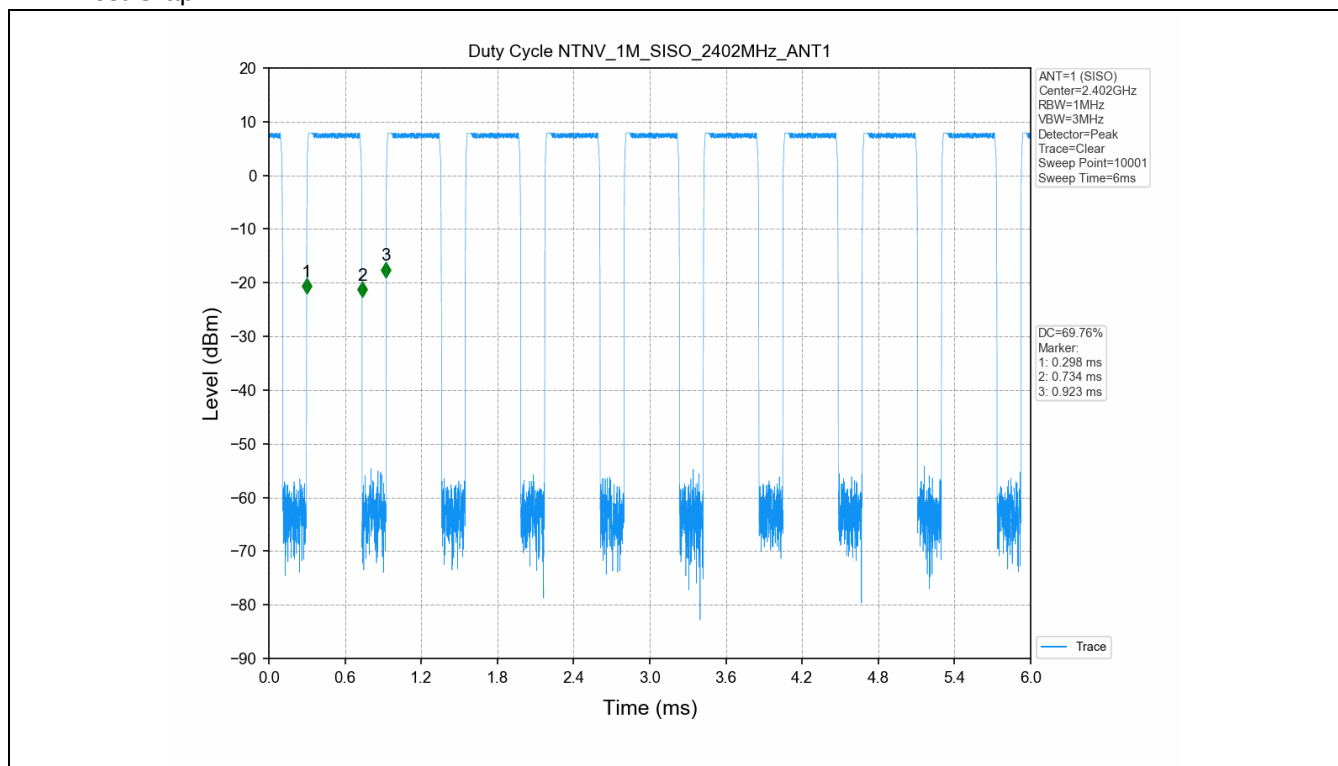
9.1 Appendix 15.247 – Left earbuds

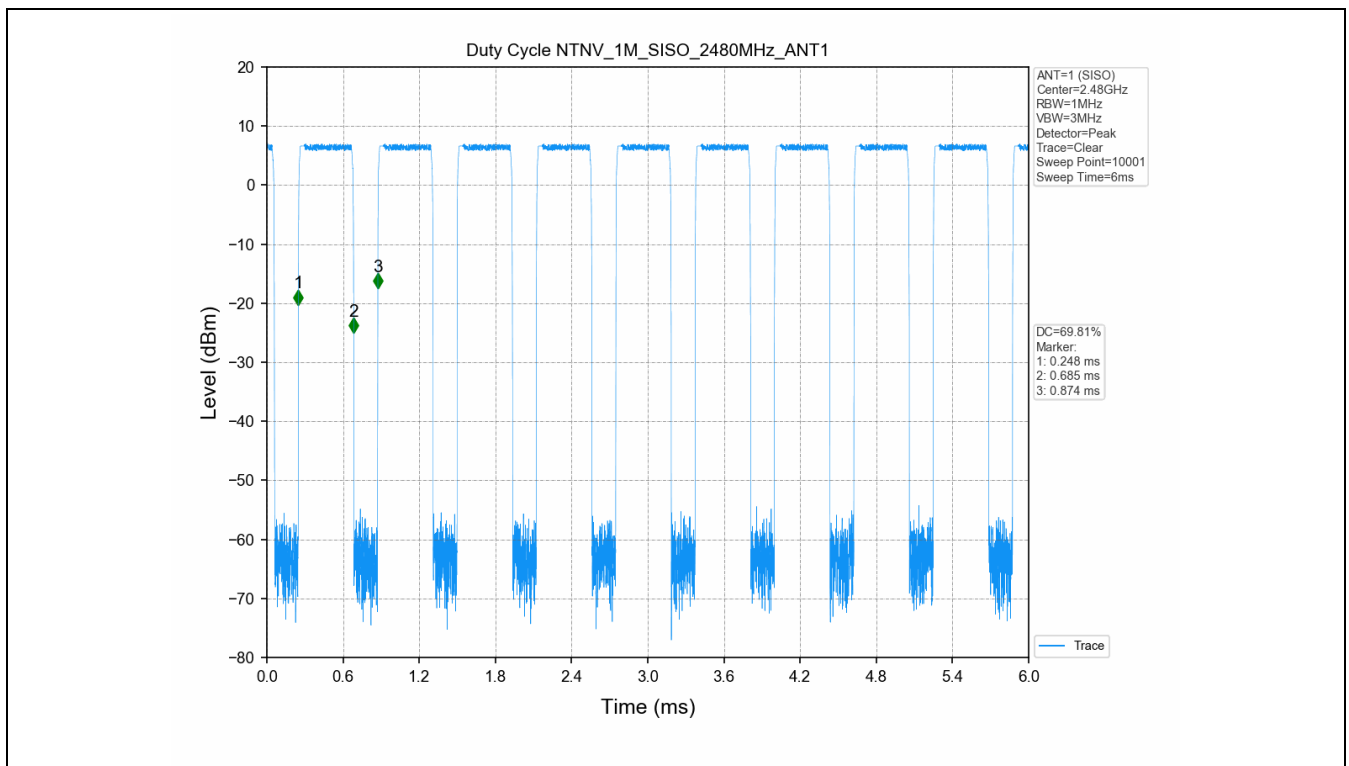
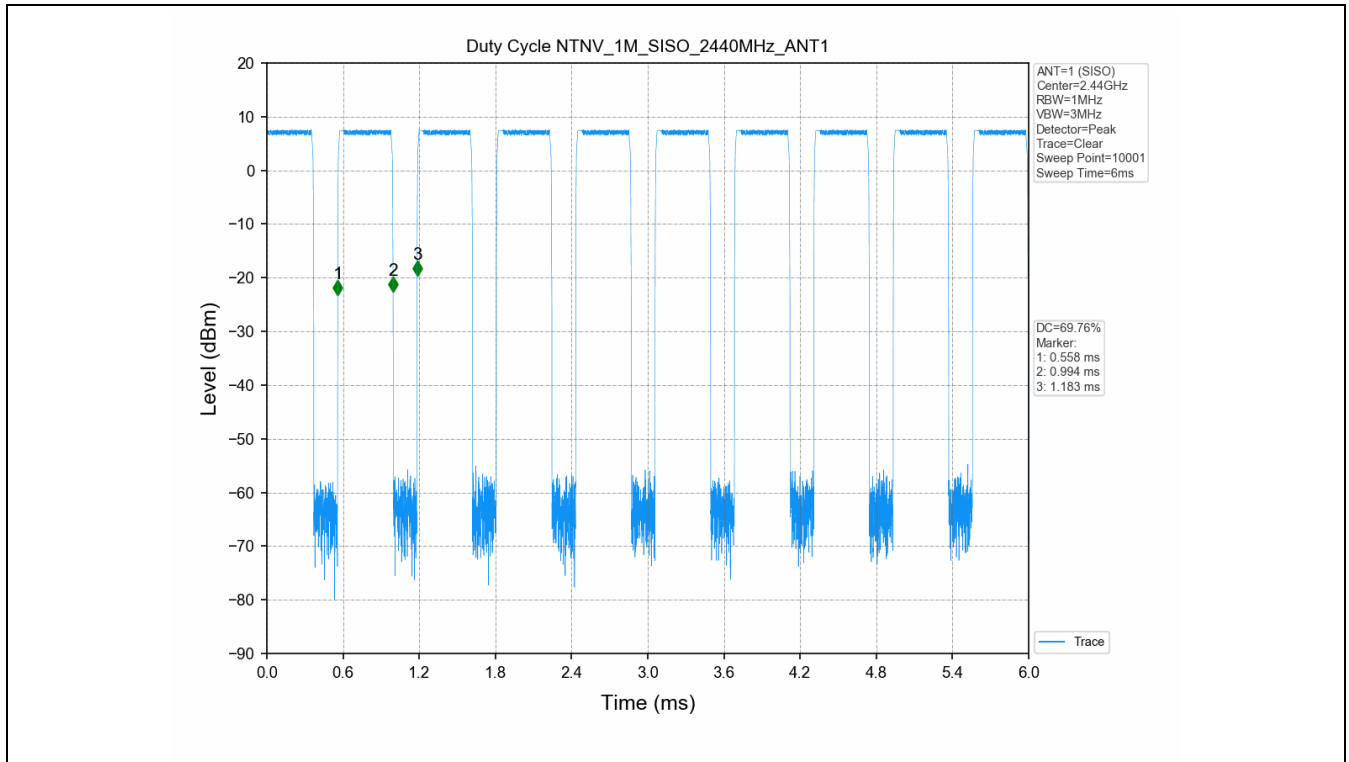
1. Duty Cycle

1.1 Test Result

Test Mode	Channel Frequency(MHz)	TX Type	ANT No.	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
1M	2402	SISO	1	0.436	0.625	69.76	1.56
	2440	SISO	1	0.436	0.625	69.76	1.56
	2480	SISO	1	0.437	0.626	69.81	1.56

1.2 Test Graph





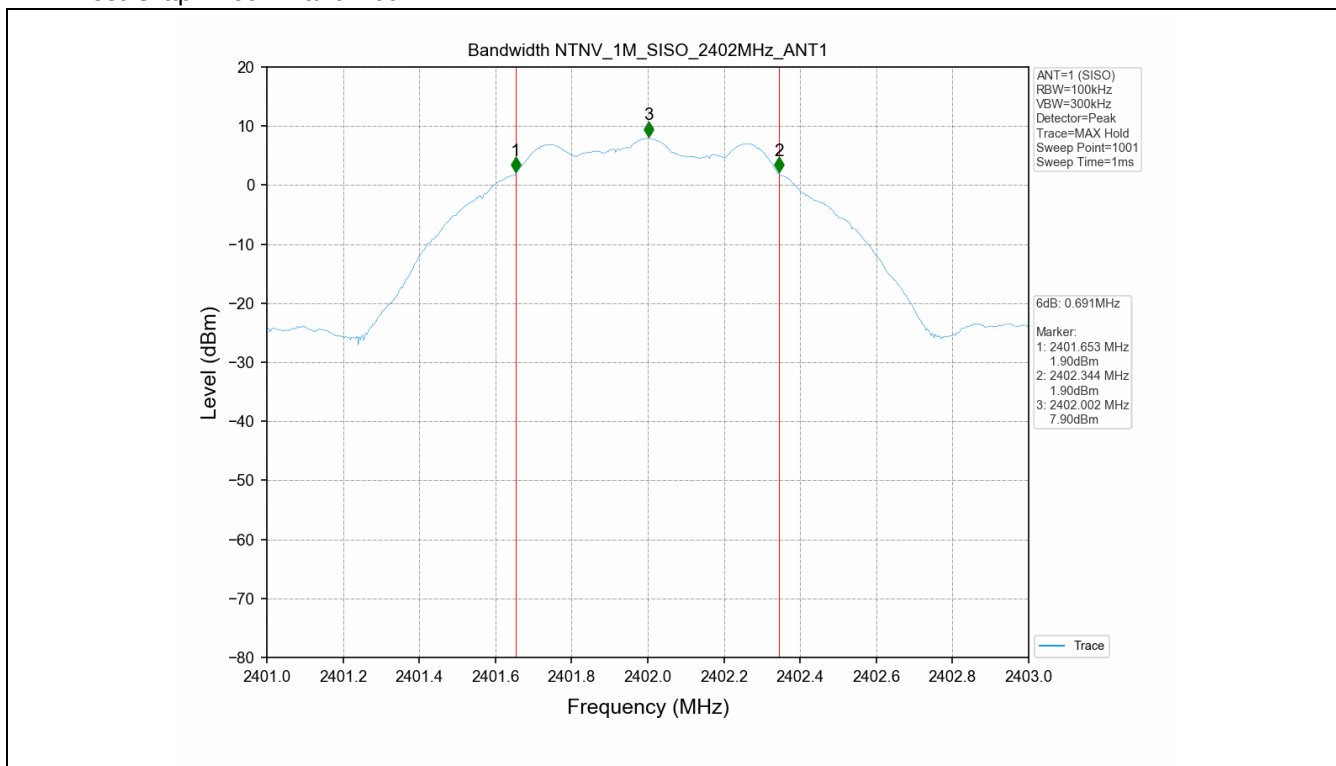
2. Bandwidth

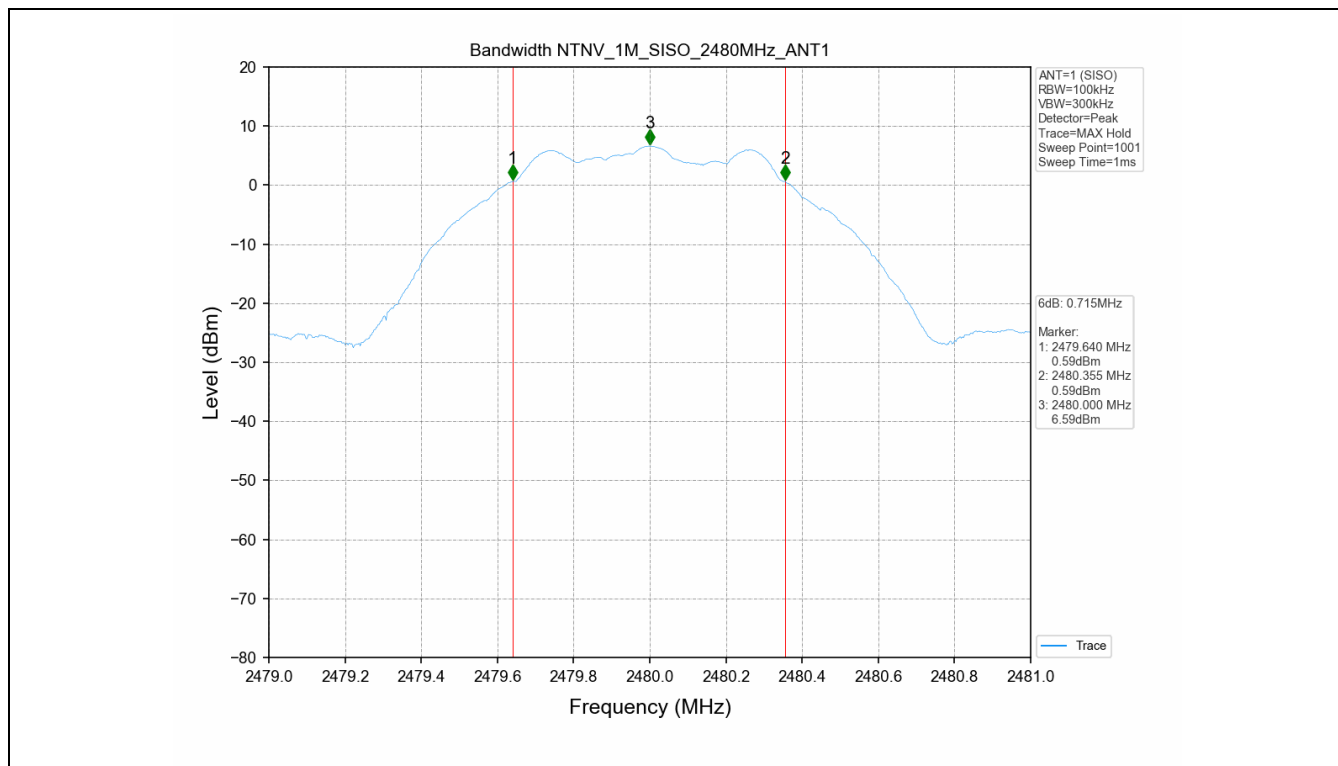
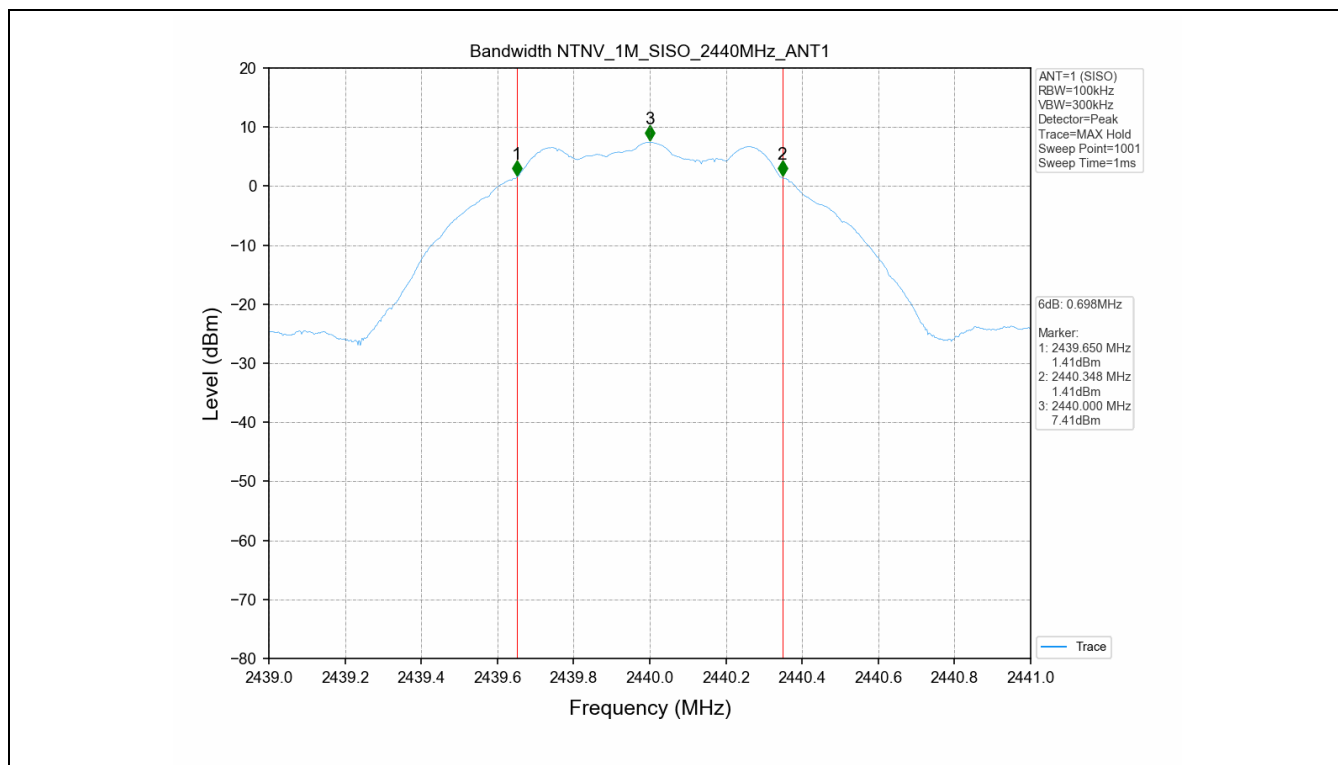
2.1 Test Result

Test Mode	Frequency (MHz)	TX Type	ANT No.	6dB Bandwidth		Verdict
				Test Result (MHz)	Limits (MHz)	
1M	2402	SISO	1	0.691	≥0.5	PASS
	2440	SISO	1	0.698	≥0.5	PASS
	2480	SISO	1	0.715	≥0.5	PASS

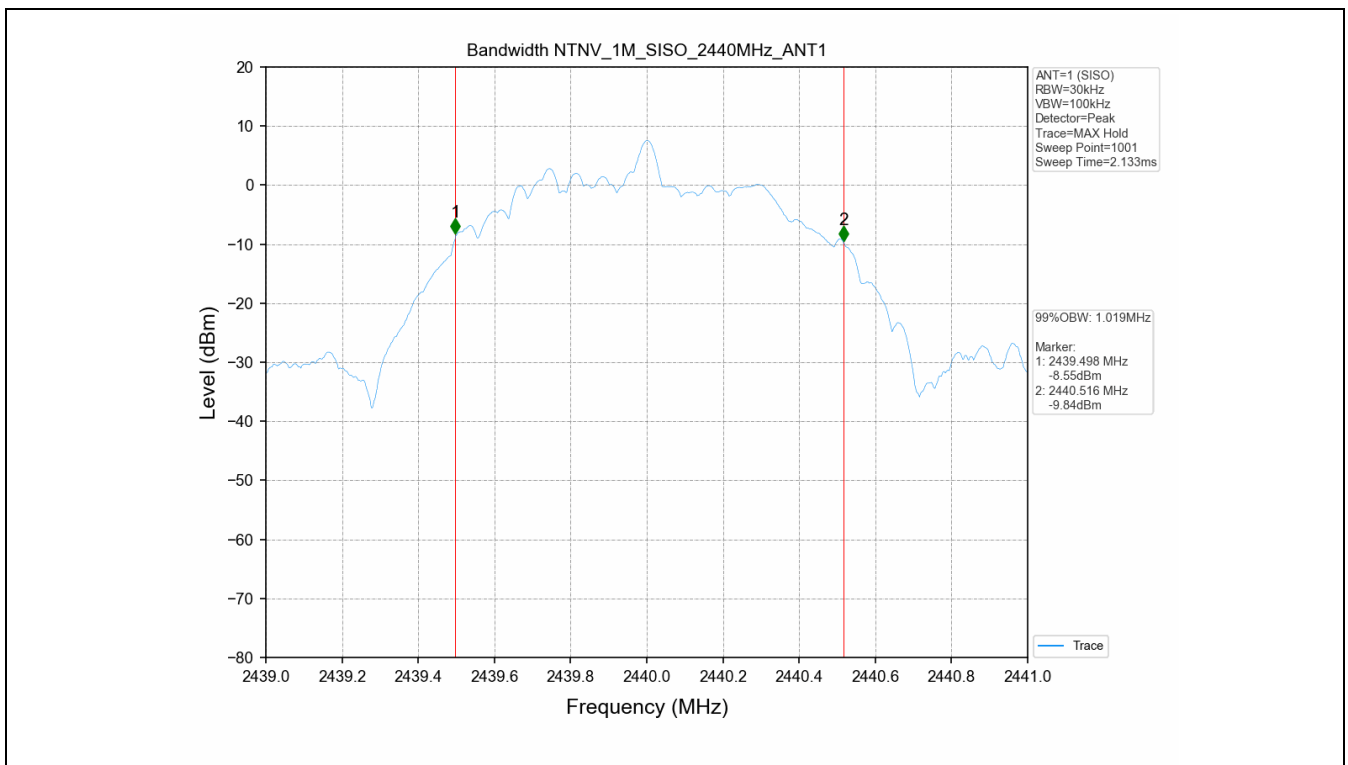
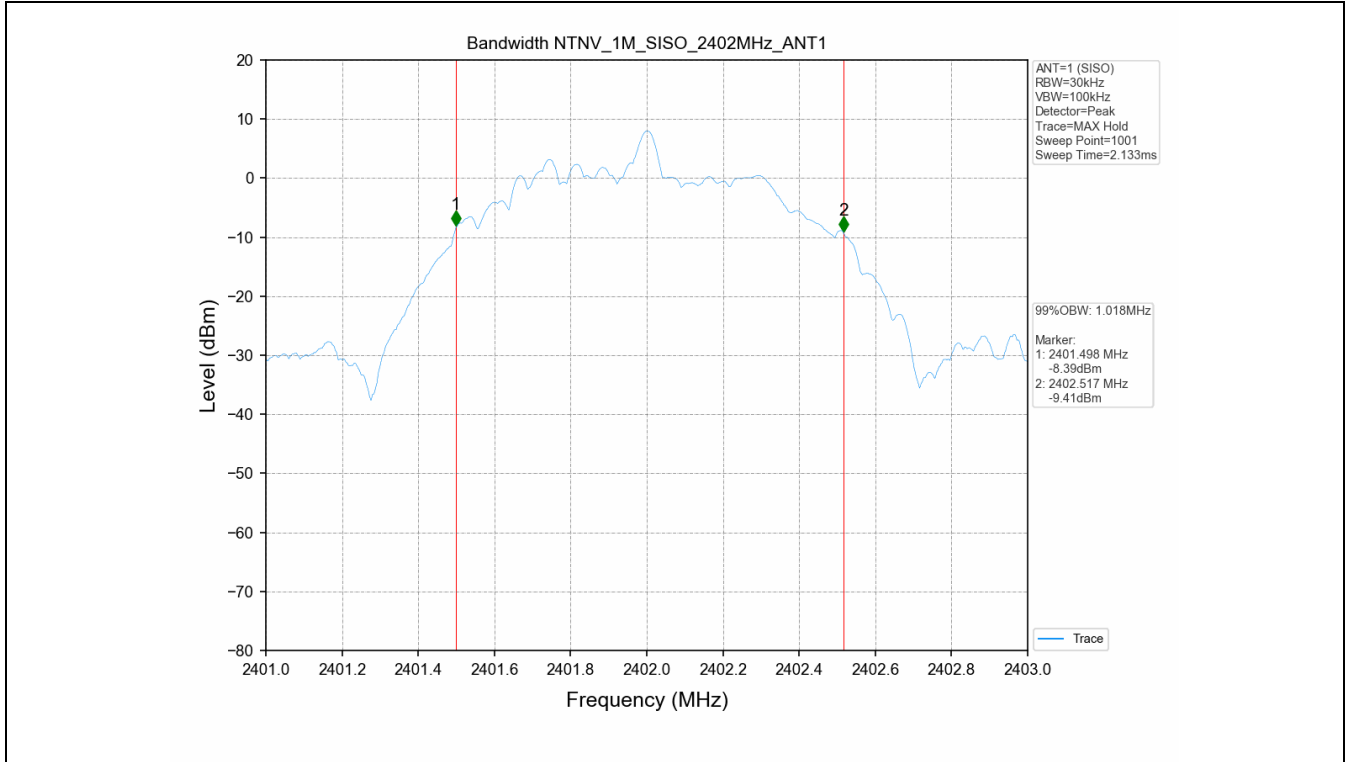
Test Mode	Frequency (MHz)	TX Type	ANT No.	99% Occupied Bandwidth	
				Test Result (MHz)	
1M	2402	SISO	1	1.018	Only for Report Use
	2440	SISO	1	1.019	Only for Report Use
	2480	SISO	1	1.019	Only for Report Use

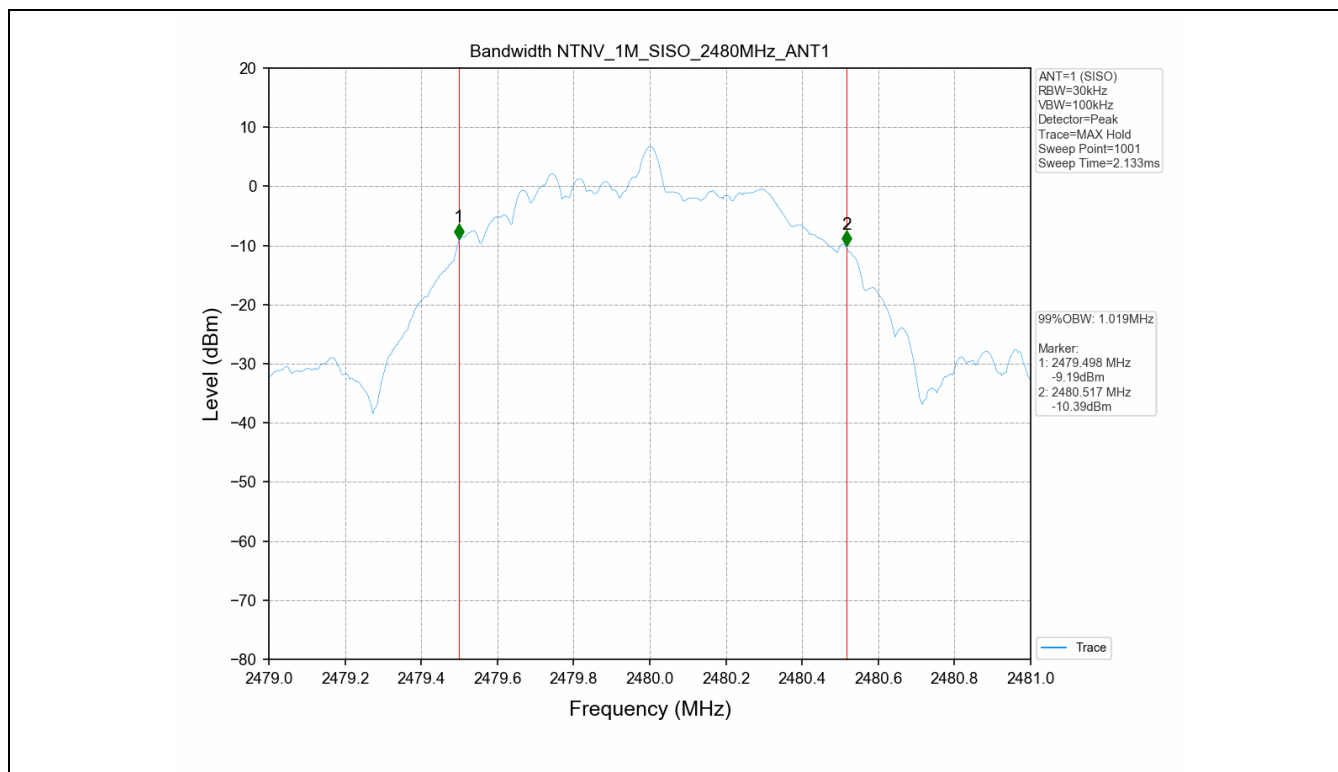
2.2 Test Graph - 6dB Bandwidth





2.3 Test Graph - 99% Occupied Bandwidth





3. Maximum Conducted Output Power

3.1 Test Result

Test Mode	Frequency (MHz)	Tx Type	Measured Peak Output Power (dBm)	Limits (dBm)	Verdict
			Ant 1		
1M	2402	SISO	7.94	30	PASS
	2440	SISO	7.63	30	PASS
	2480	SISO	7.05	30	PASS



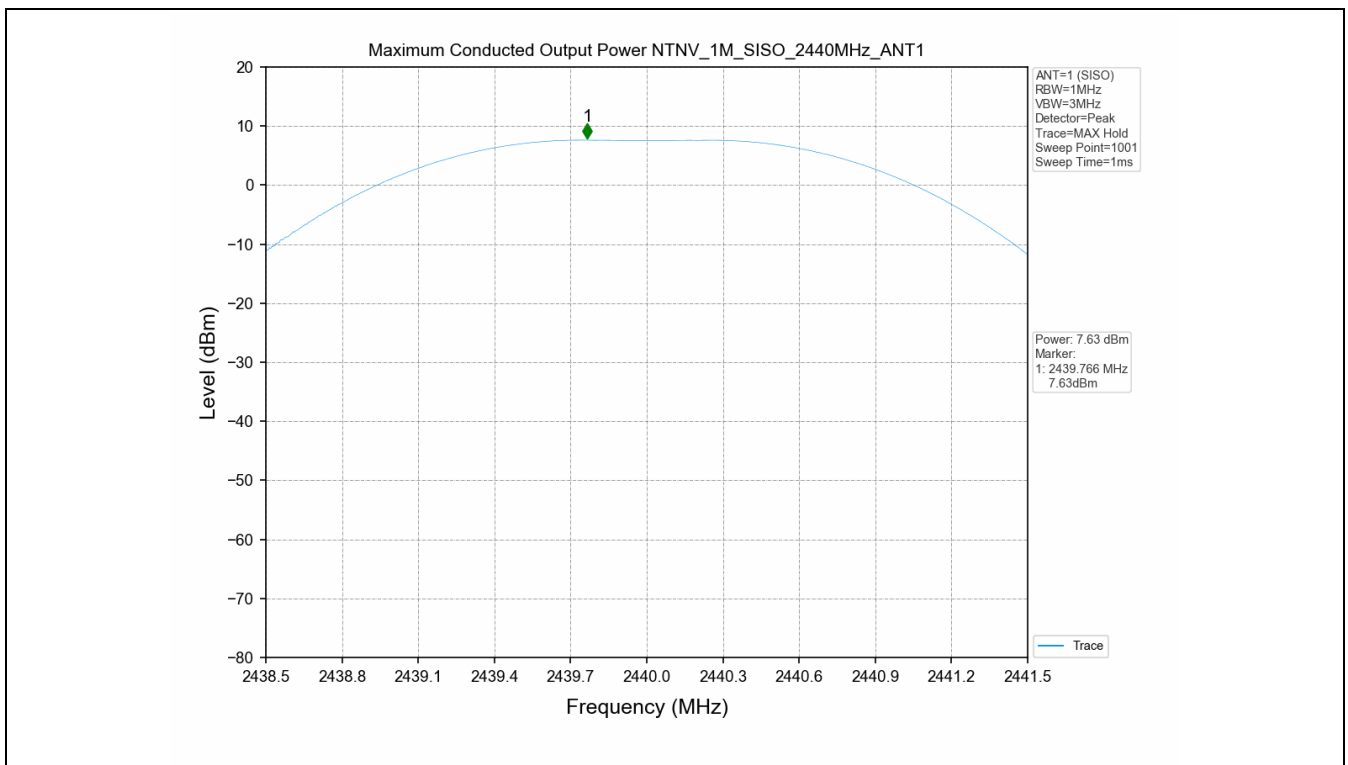
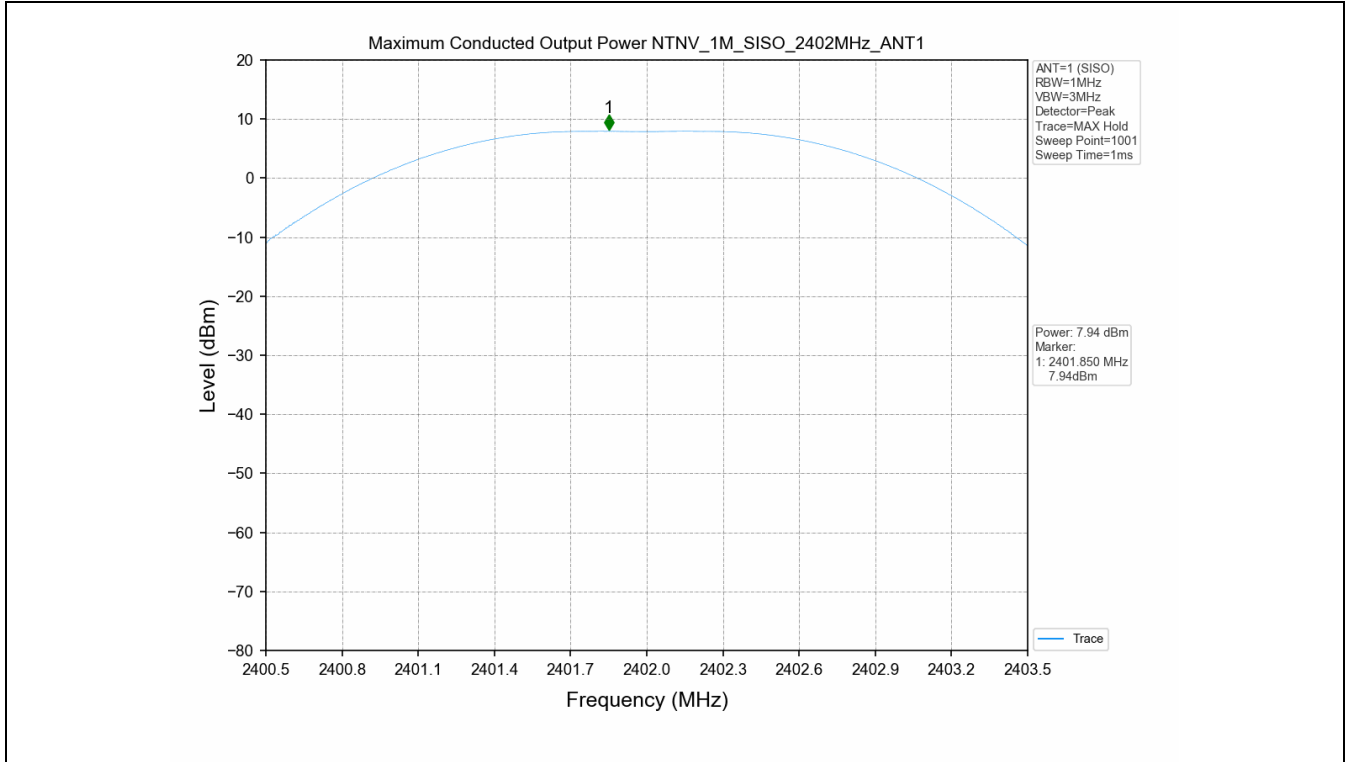
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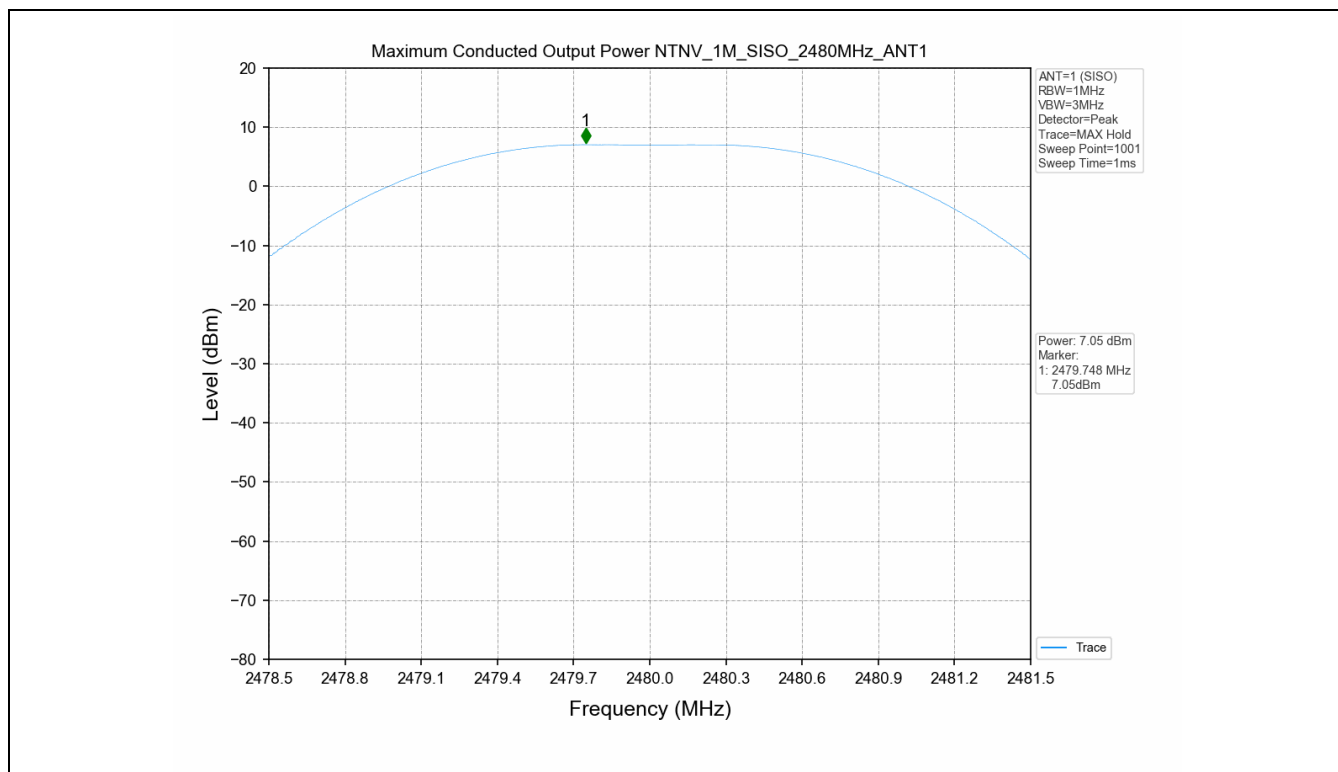
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3.2 Test Graph



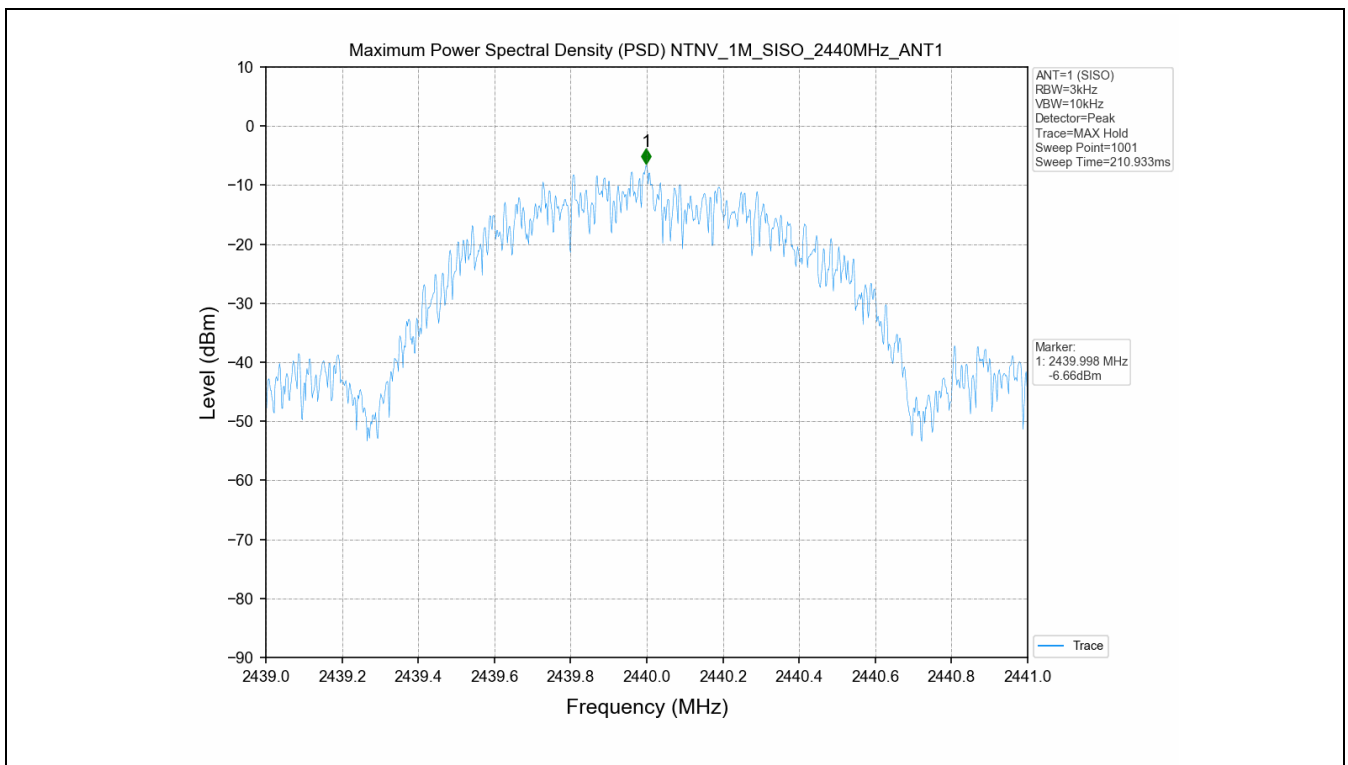
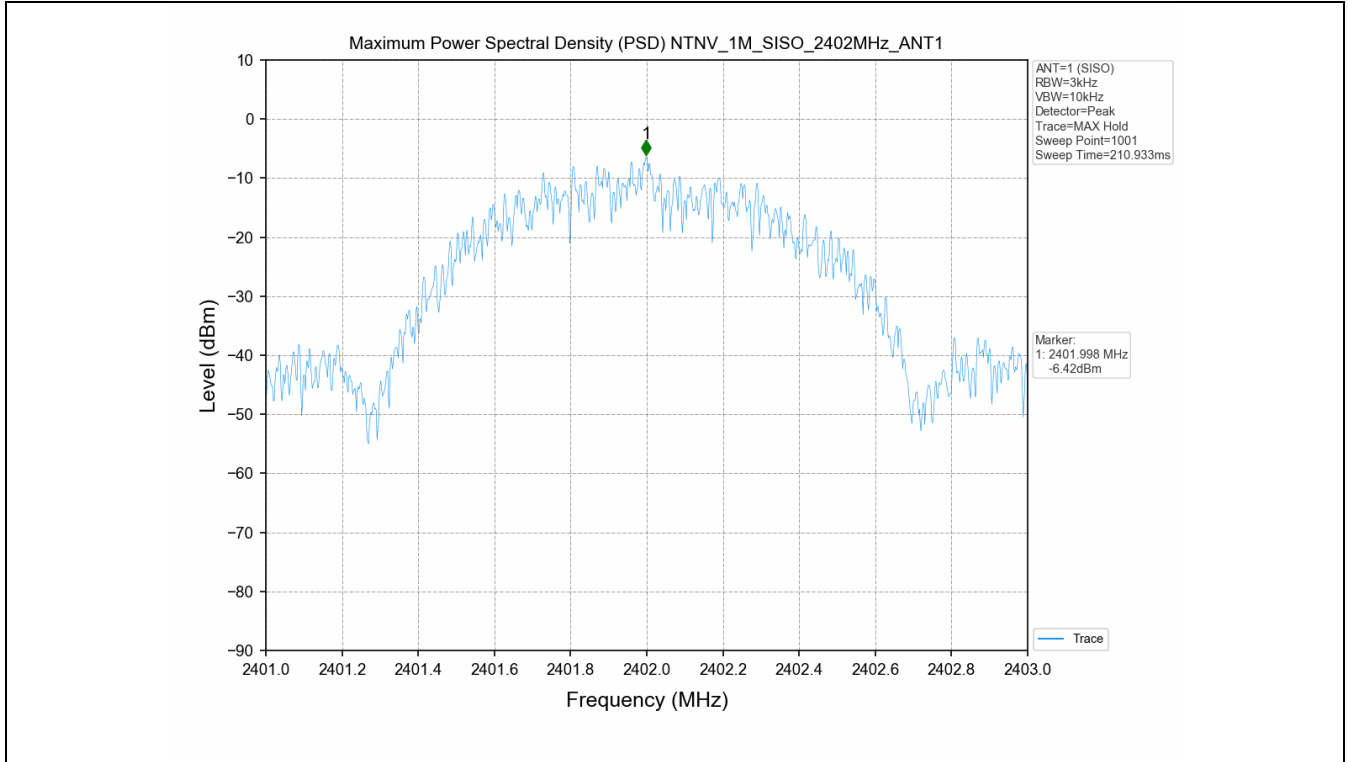


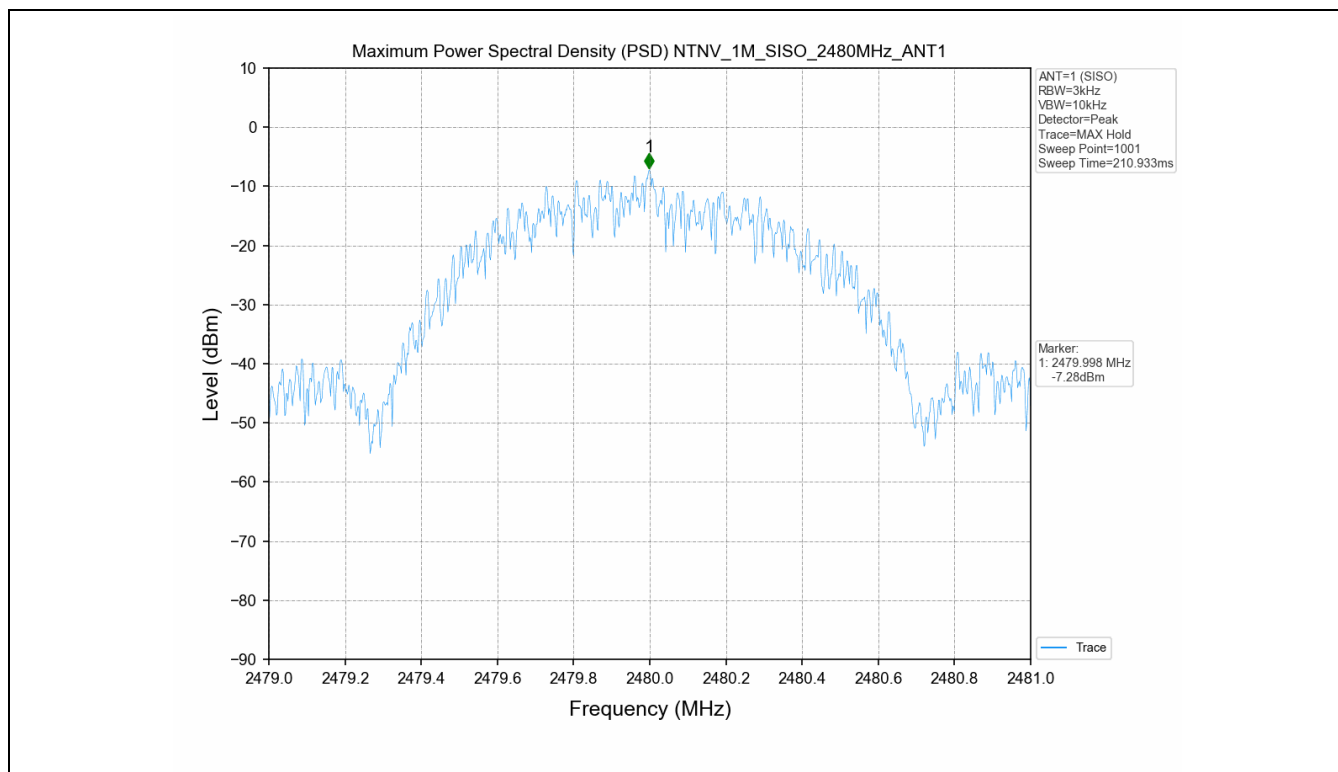
4. Maximum Power Spectral Density (PSD)

4.1 Test Result

Test Mode	Frequency (MHz)	Tx Type	Maximum Power Spectral Density (dBm/3KHz)	Limits (dBm/3kHz)	Verdict
			Ant 1		
1M	2402	SISO	-6.42	≤8	PASS
	2440	SISO	-6.66	≤8	PASS
	2480	SISO	-7.28	≤8	PASS

4.2 Test Graph





5. Unwanted Emissions in Non-restricted Frequency Bands

5.1 Test Result

Test Mode	Frequency (MHz)	TX Type	ANT No.	Spurious Conducted Emission (dBm)	Limits (dBm)	Verdict
1M	2402	SISO	1	Refer to test graph	-12.10	PASS
	2440	SISO	1	Refer to test graph	-12.10	PASS
	2480	SISO	1	Refer to test graph	-12.10	PASS



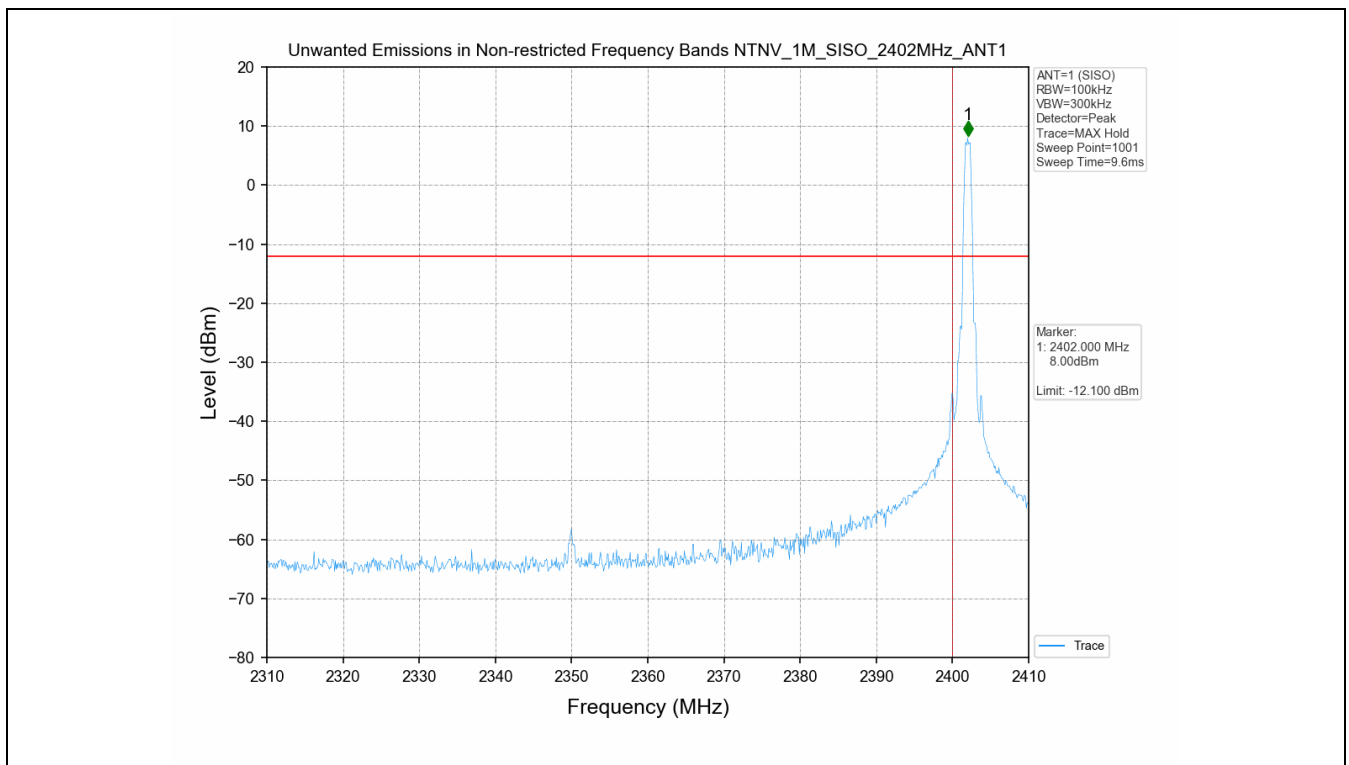
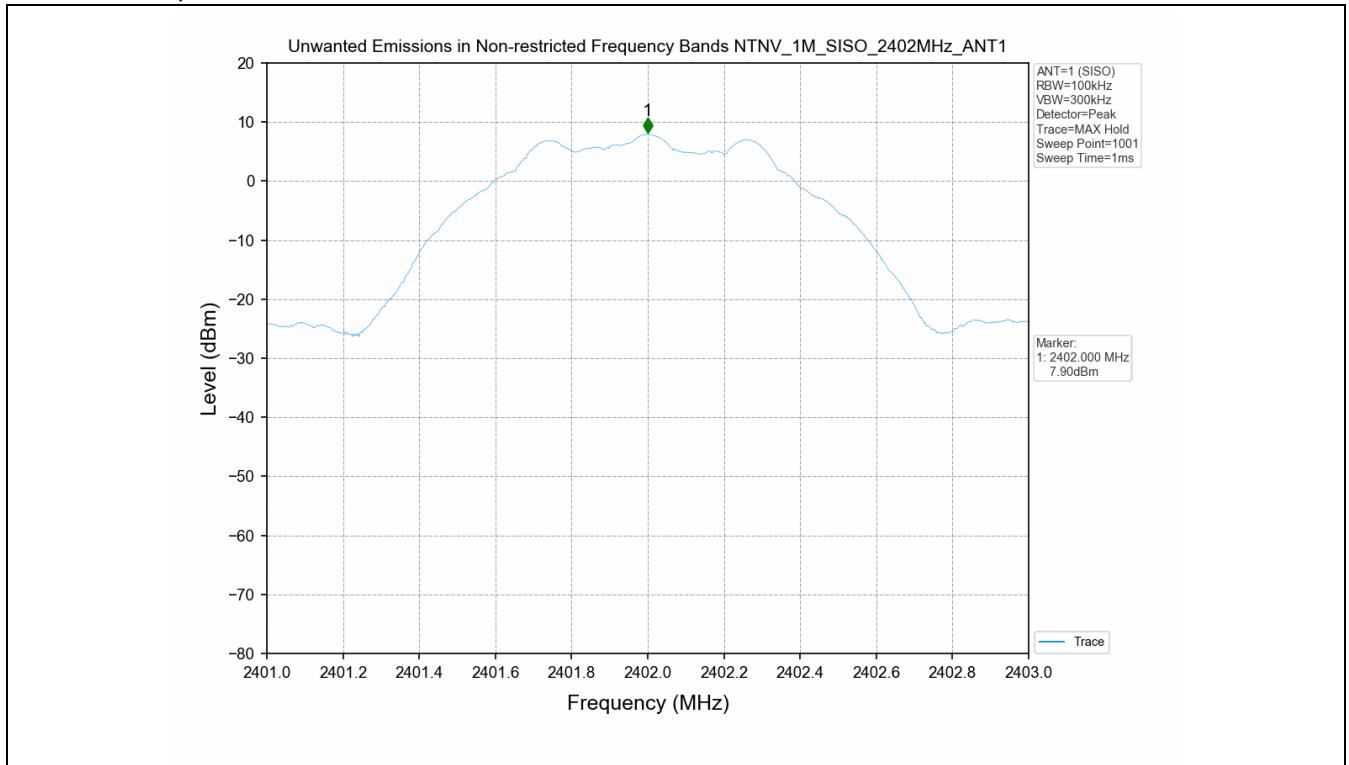
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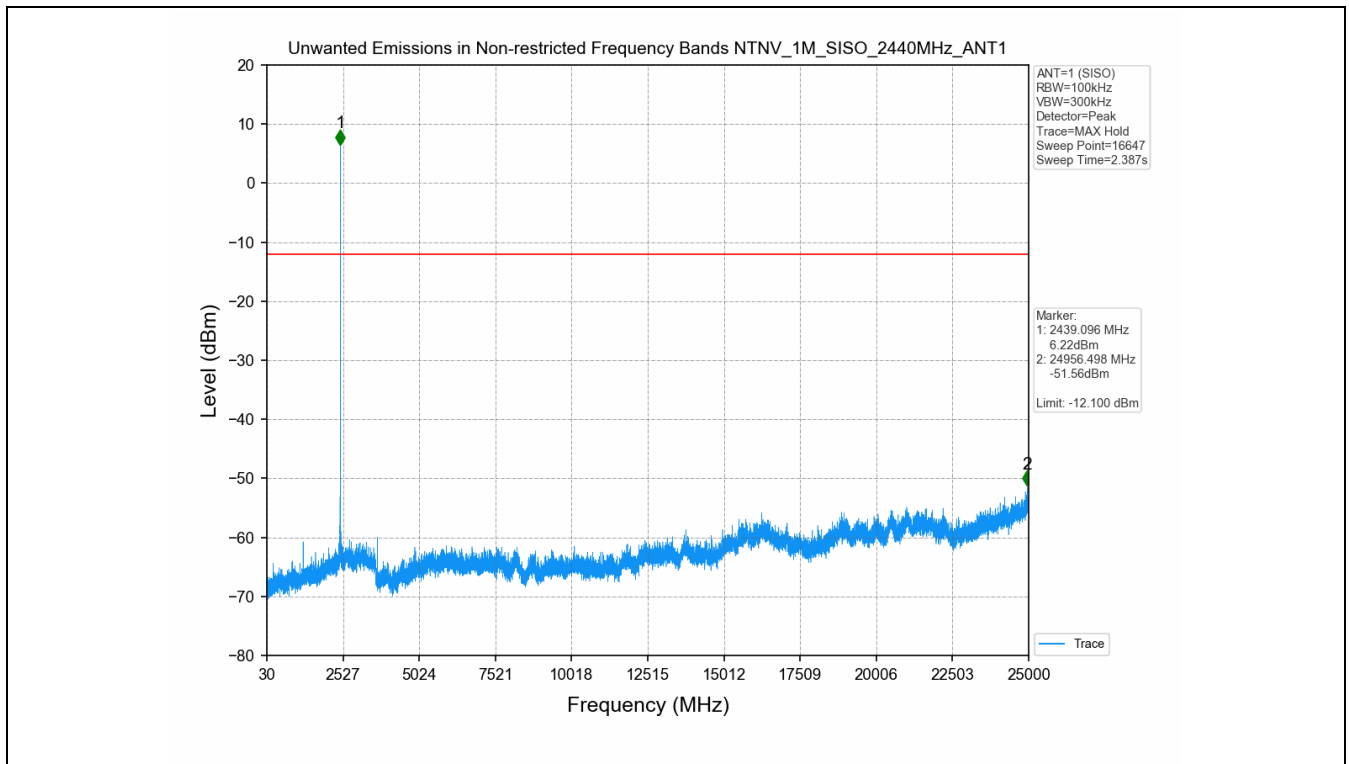
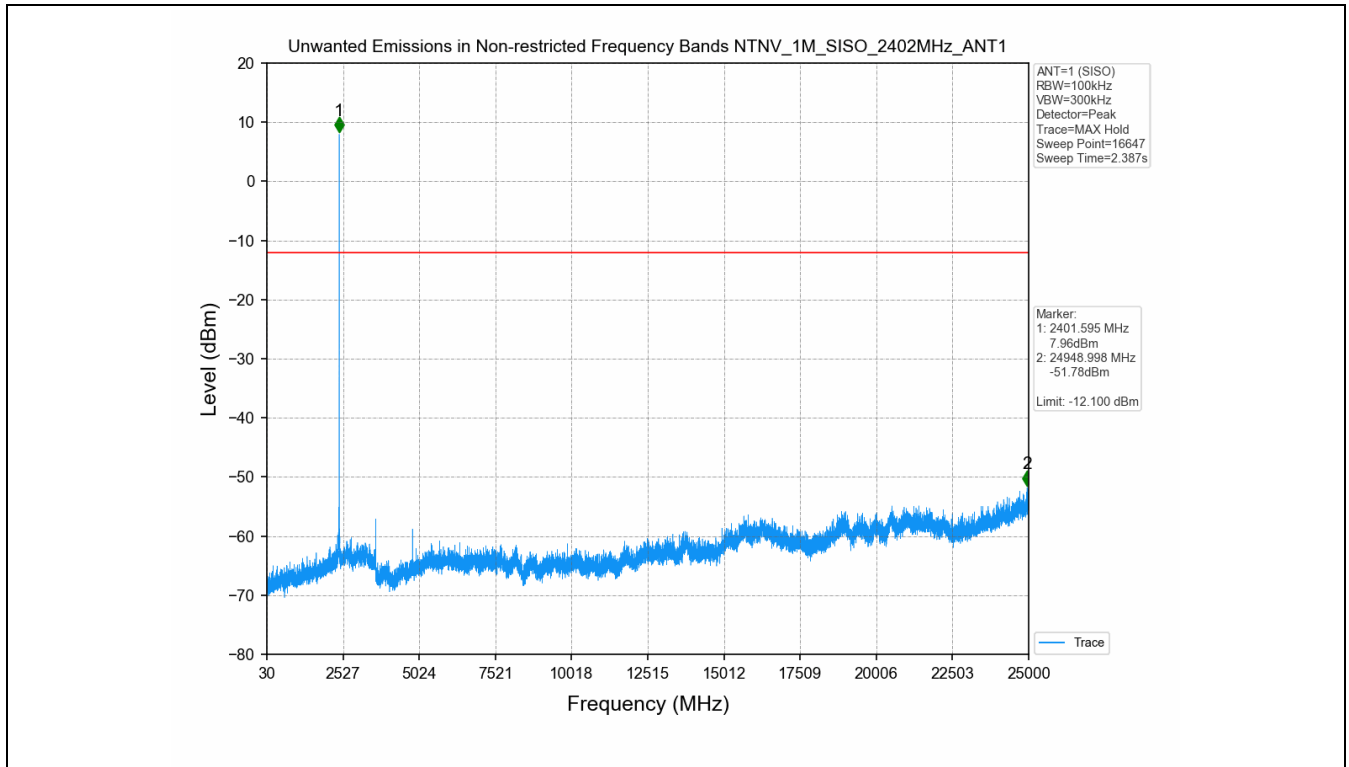
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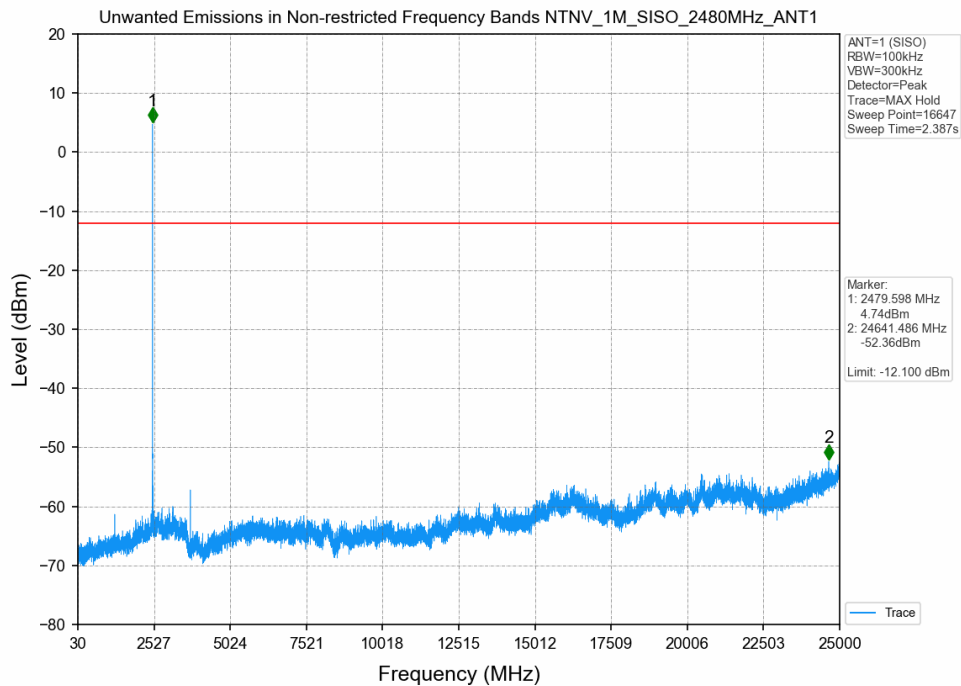
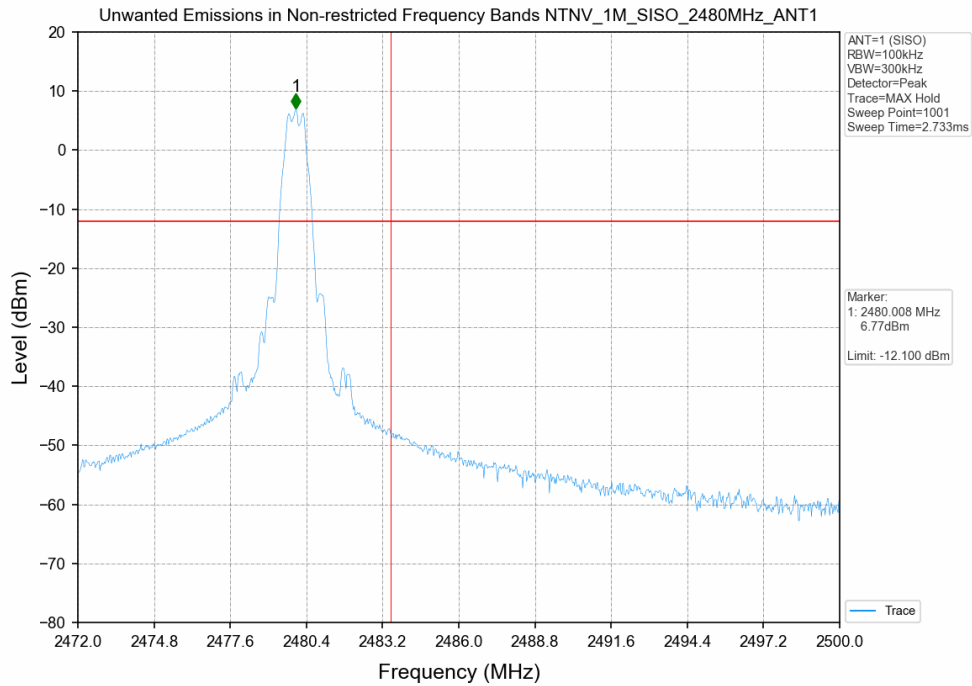
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5.2 Test Graph







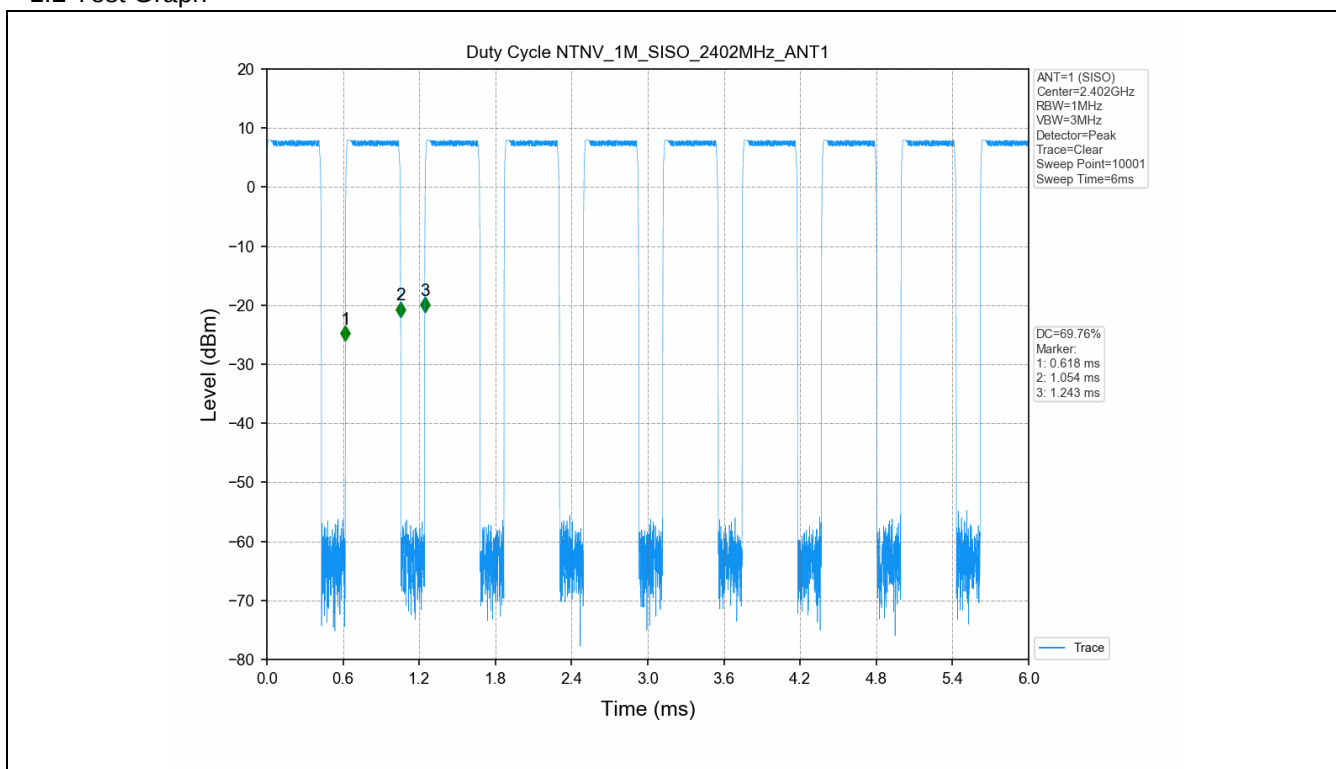
9.2 Appendix 15.247 – Right earbuds

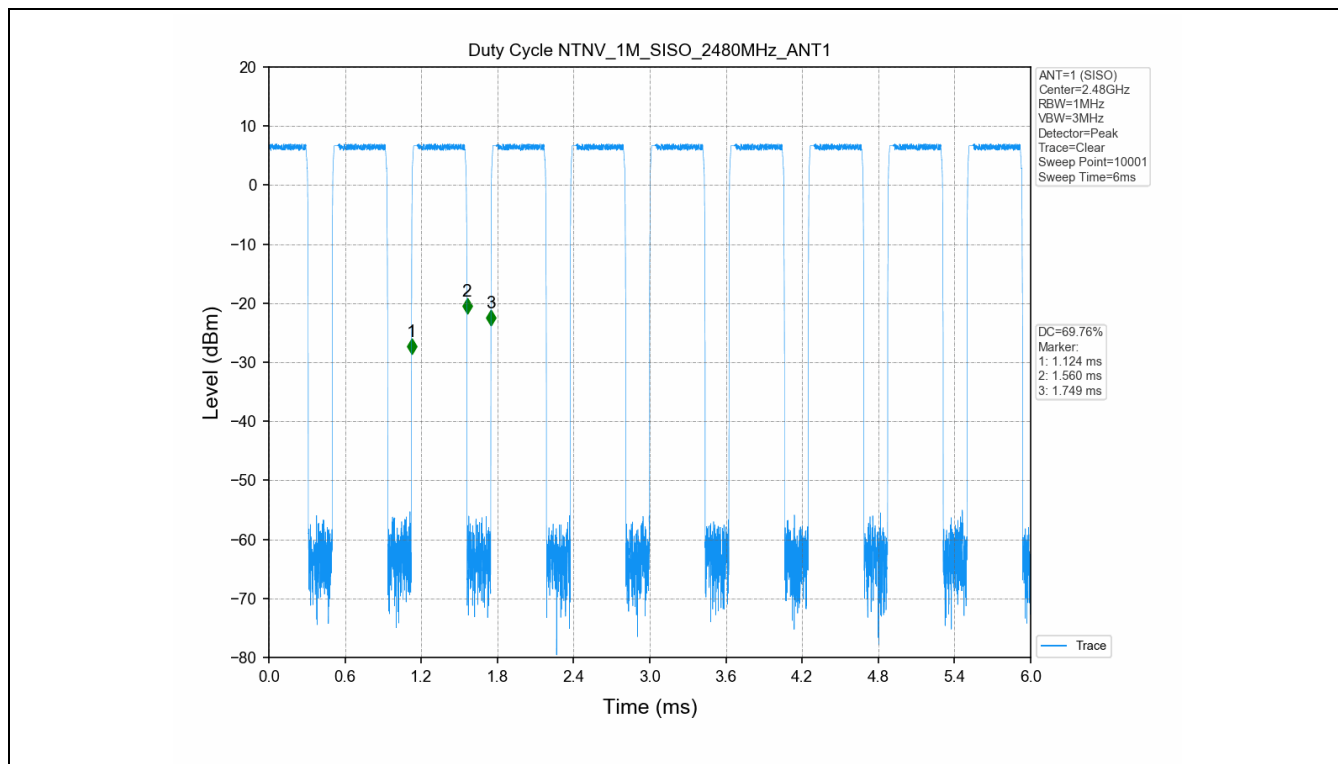
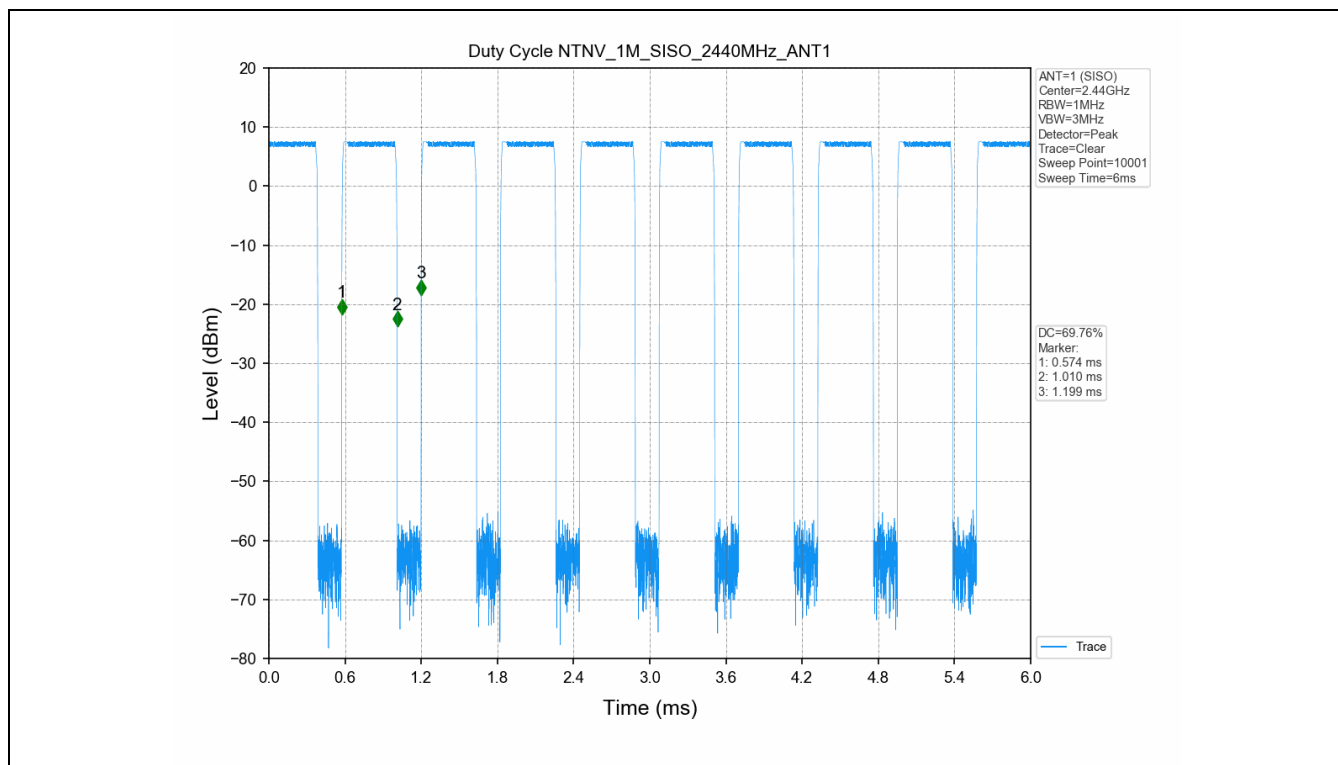
1. Duty Cycle

1.1 Test Result

Test Mode	Channel Frequency(MHz)	TX Type	ANT No.	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
1M	2402	SISO	1	0.436	0.625	69.76	1.56
	2440	SISO	1	0.436	0.625	69.76	1.56
	2480	SISO	1	0.436	0.625	69.76	1.56

1.2 Test Graph





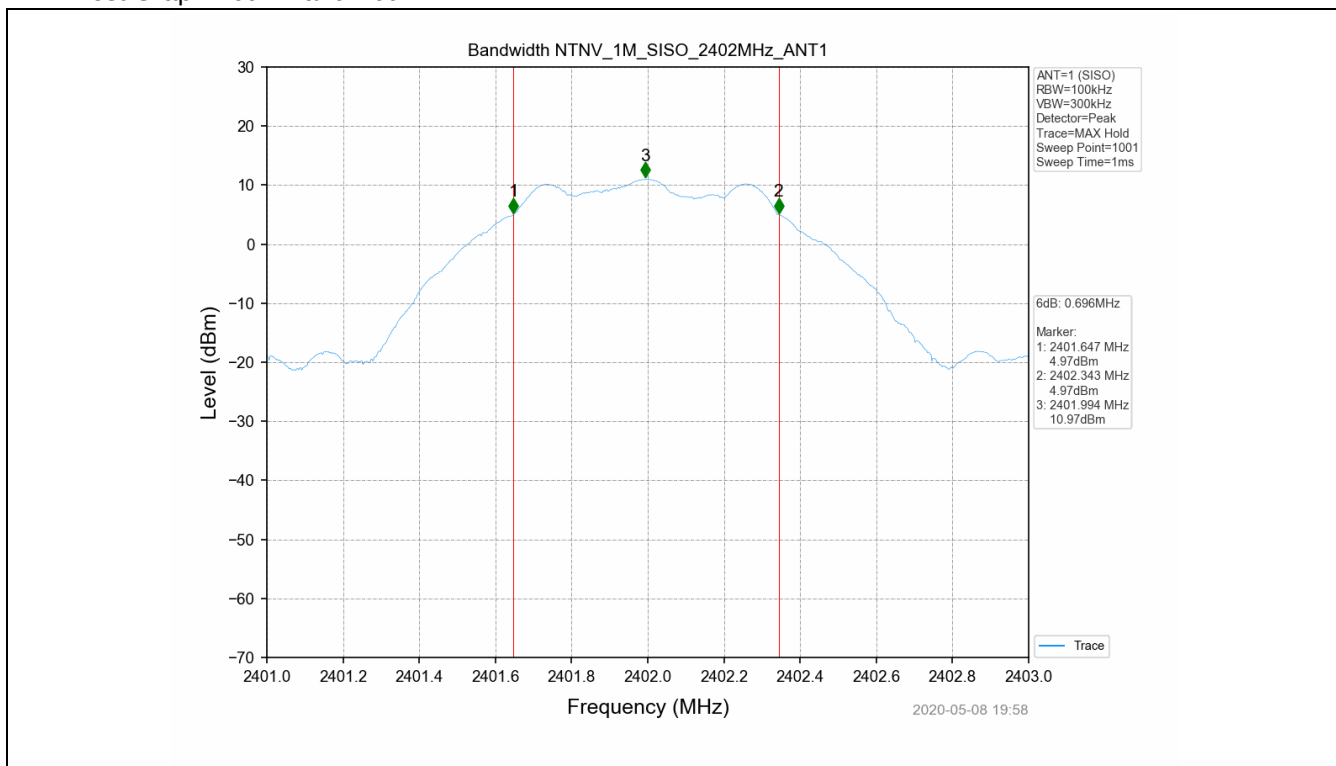
2. Bandwidth

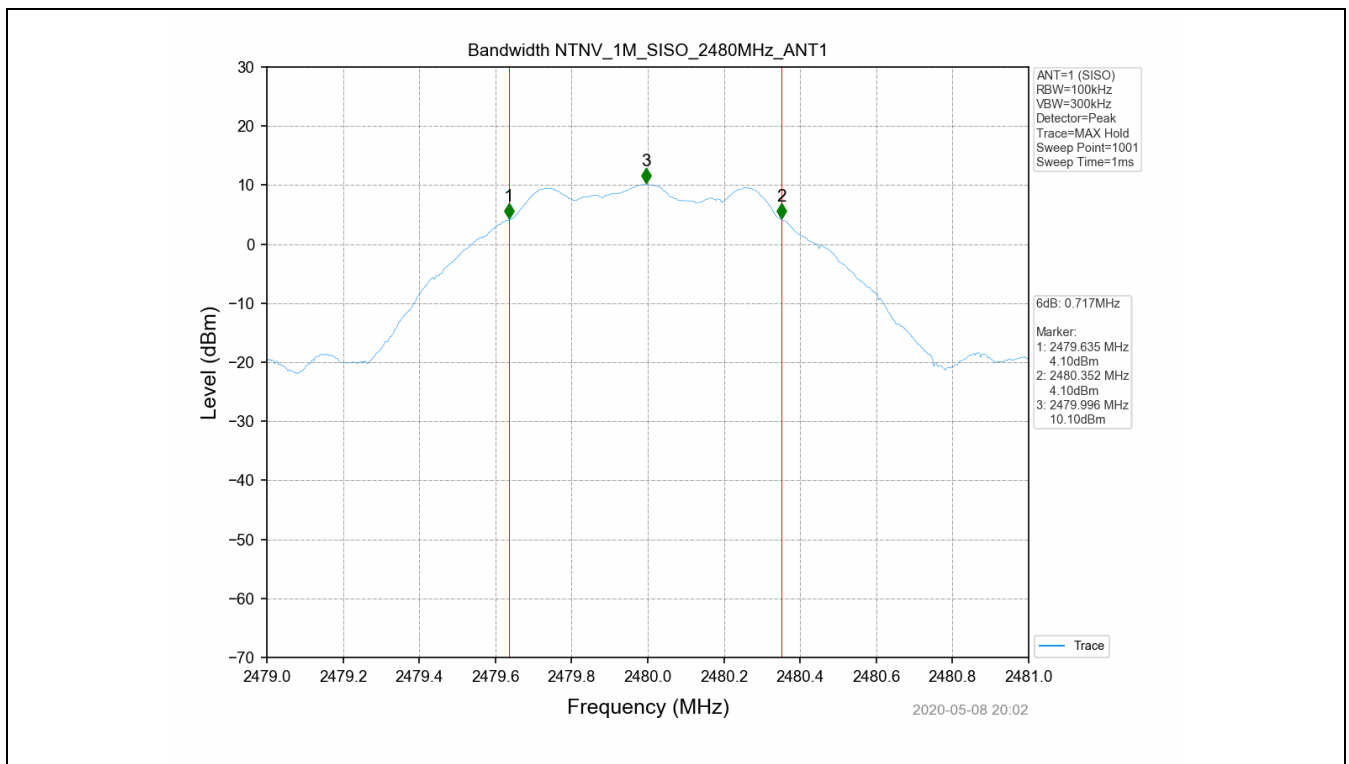
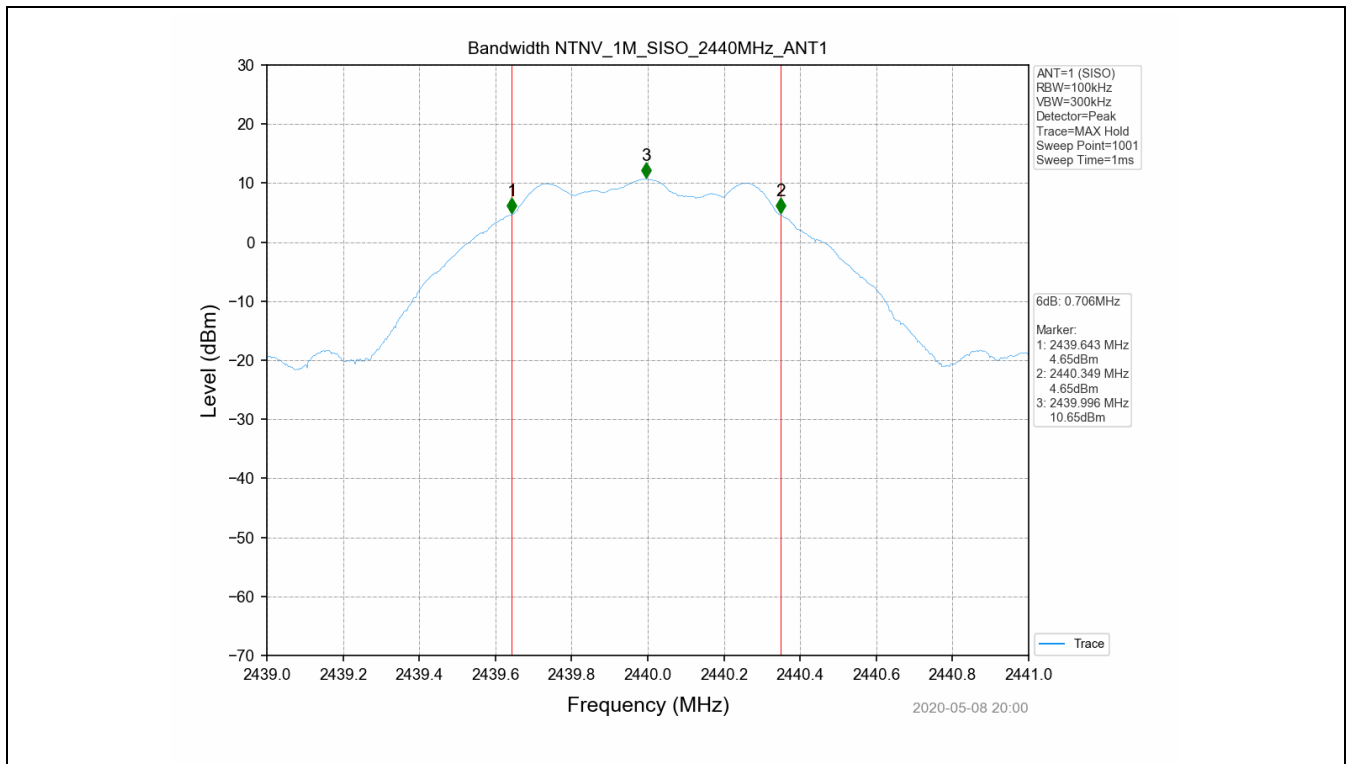
2.1 Test Result

Test Mode	Frequency (MHz)	TX Type	ANT No.	6dB Bandwidth		Verdict
				Test Result (MHz)	Limits (MHz)	
1M	2402	SISO	1	0.696	≥0.5	PASS
	2440	SISO	1	0.706	≥0.5	PASS
	2480	SISO	1	0.717	≥0.5	PASS

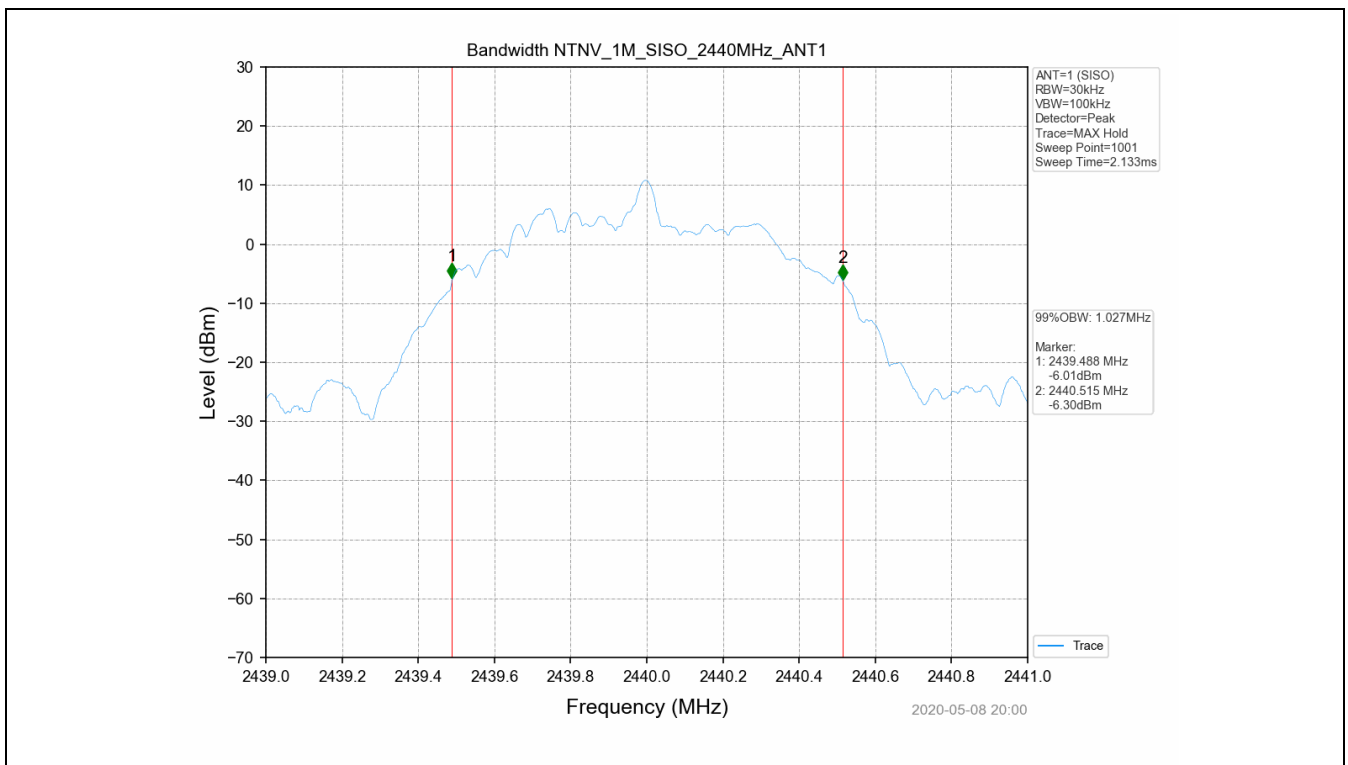
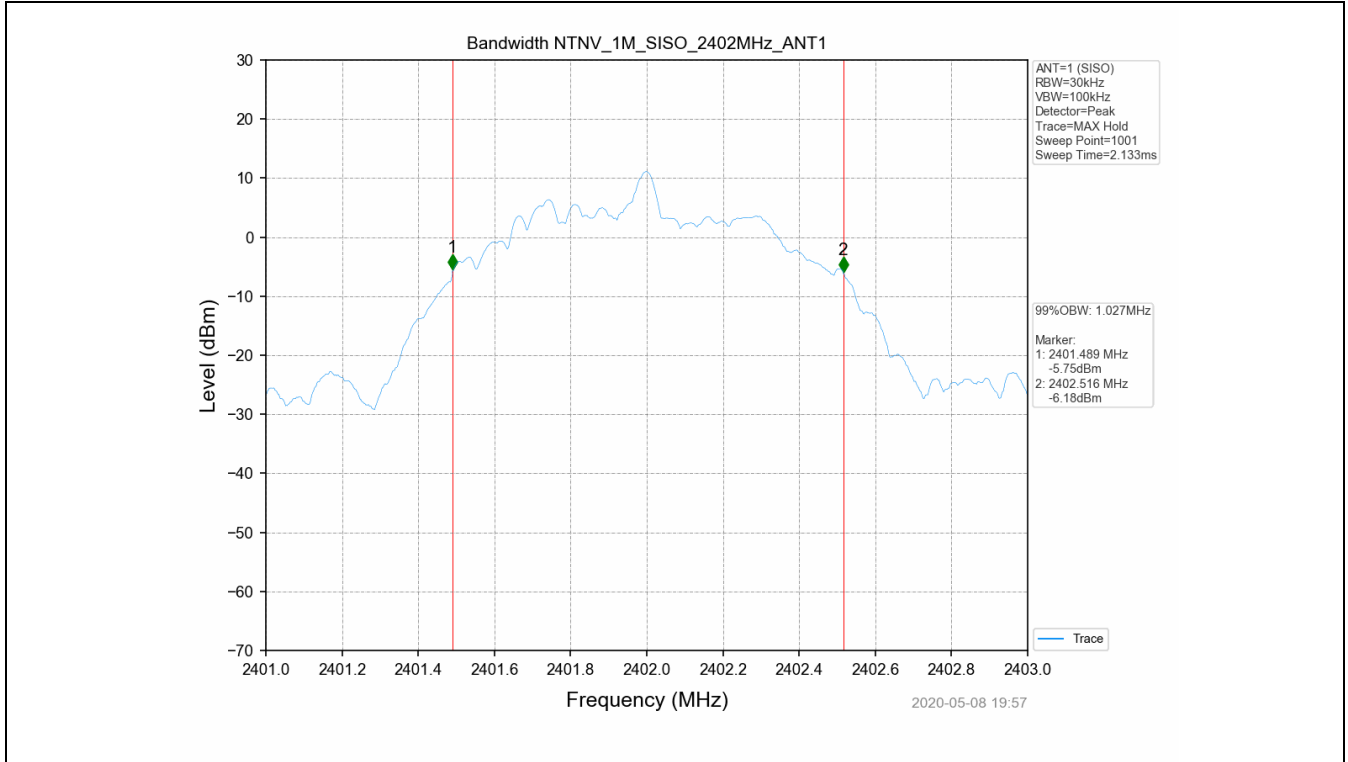
Test Mode	Frequency (MHz)	TX Type	ANT No.	99% Occupied Bandwidth	
				Test Result (MHz)	
1M	2402	SISO	1	1.027	Only for Report Use
	2440	SISO	1	1.027	Only for Report Use
	2480	SISO	1	1.027	Only for Report Use

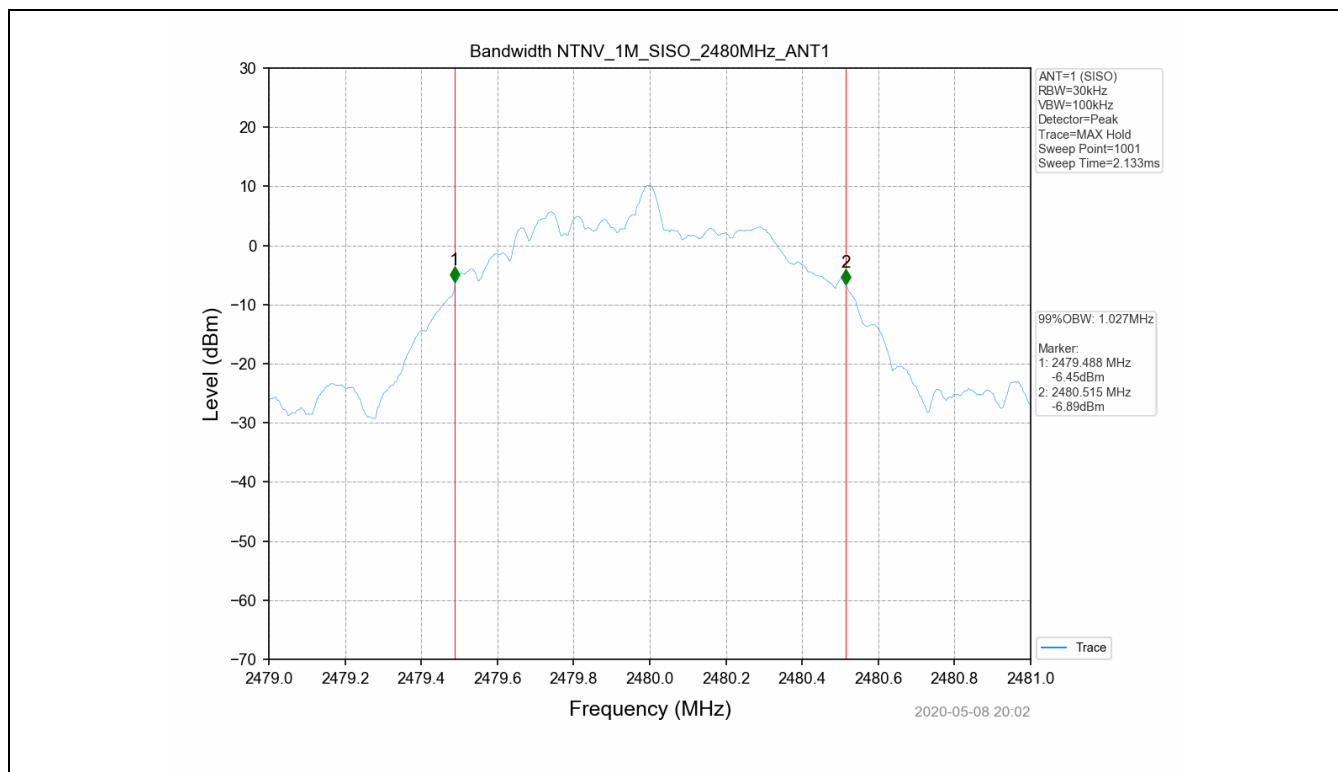
2.2 Test Graph - 6dB Bandwidth





2.3 Test Graph - 99% Occupied Bandwidth





3. Maximum Conducted Output Power

3.1 Test Result

Test Mode	Frequency (MHz)	Tx Type	Measured Peak Output Power (dBm)	Limits (dBm)	Verdict
			Ant 1		
1M	2402	SISO	7.96	30	PASS
	2440	SISO	7.62	30	PASS
	2480	SISO	7.05	30	PASS



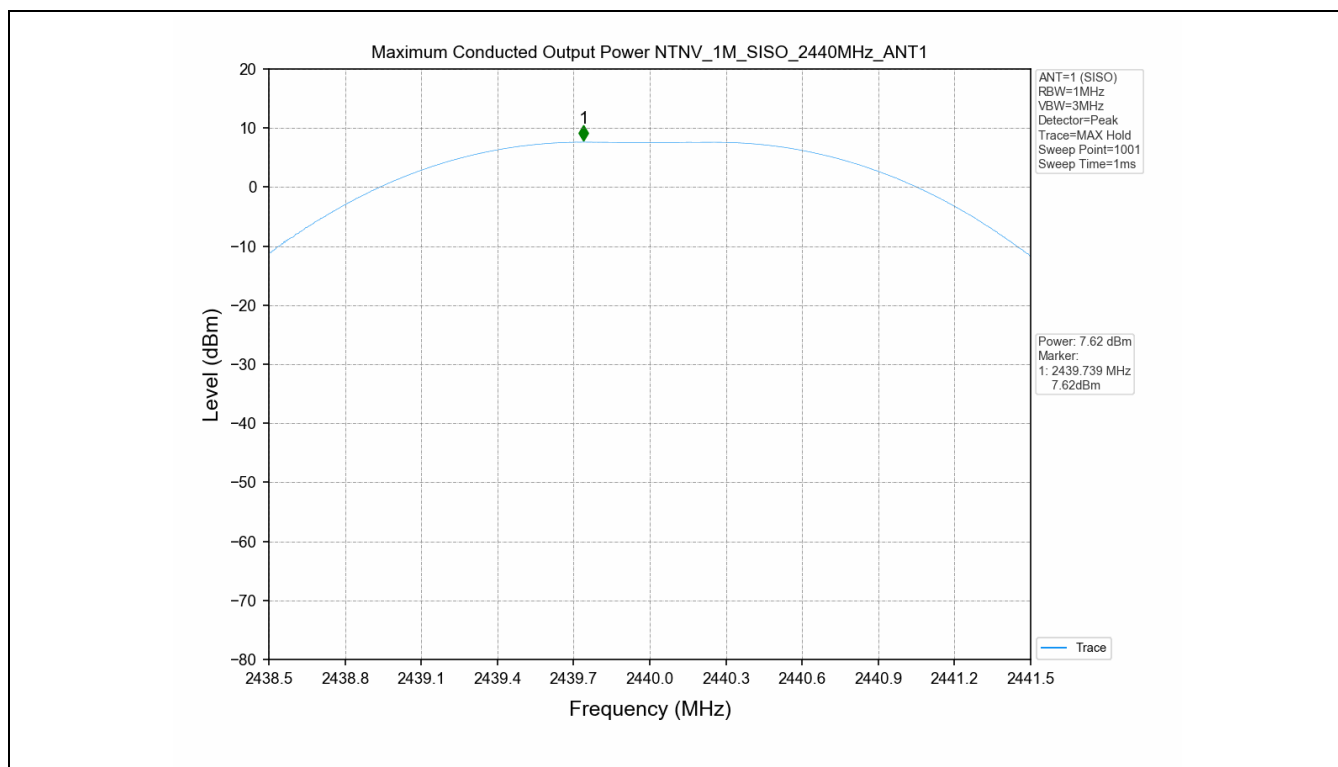
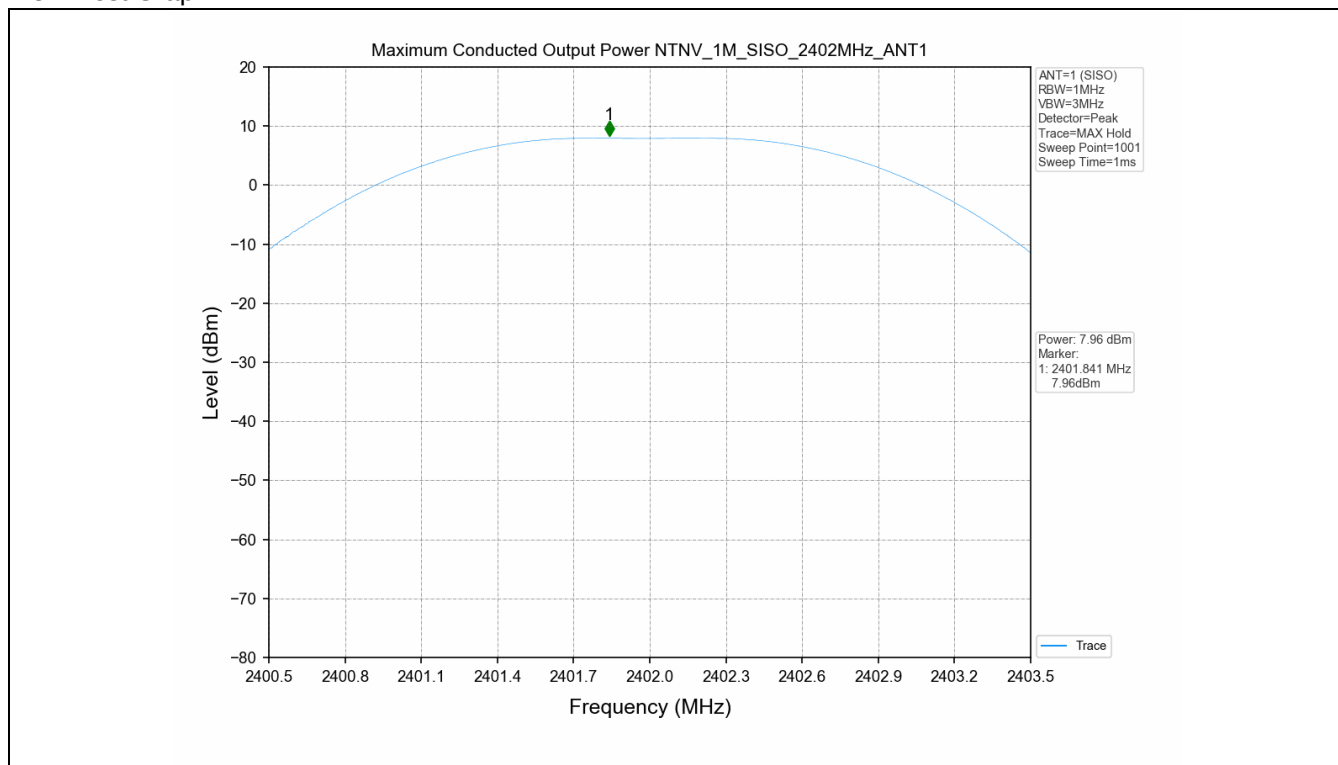
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3.2 Test Graph

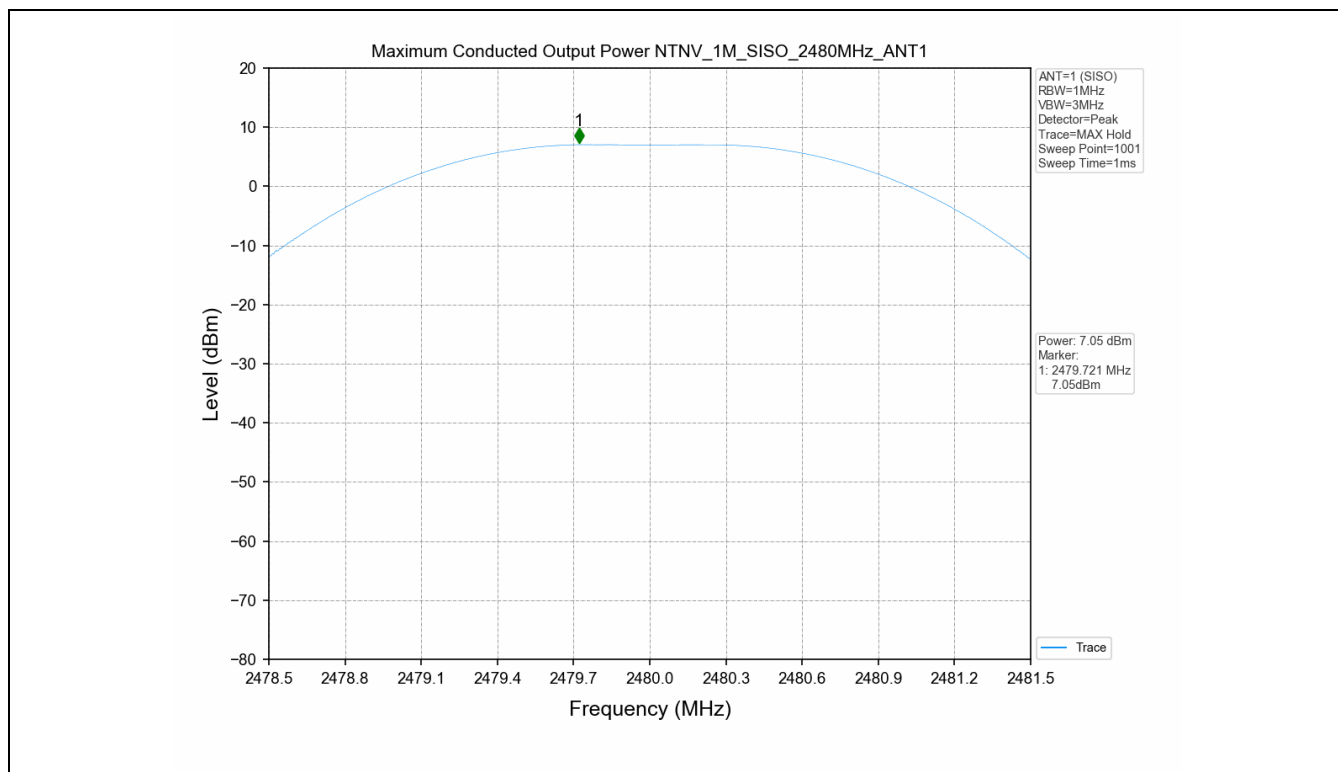


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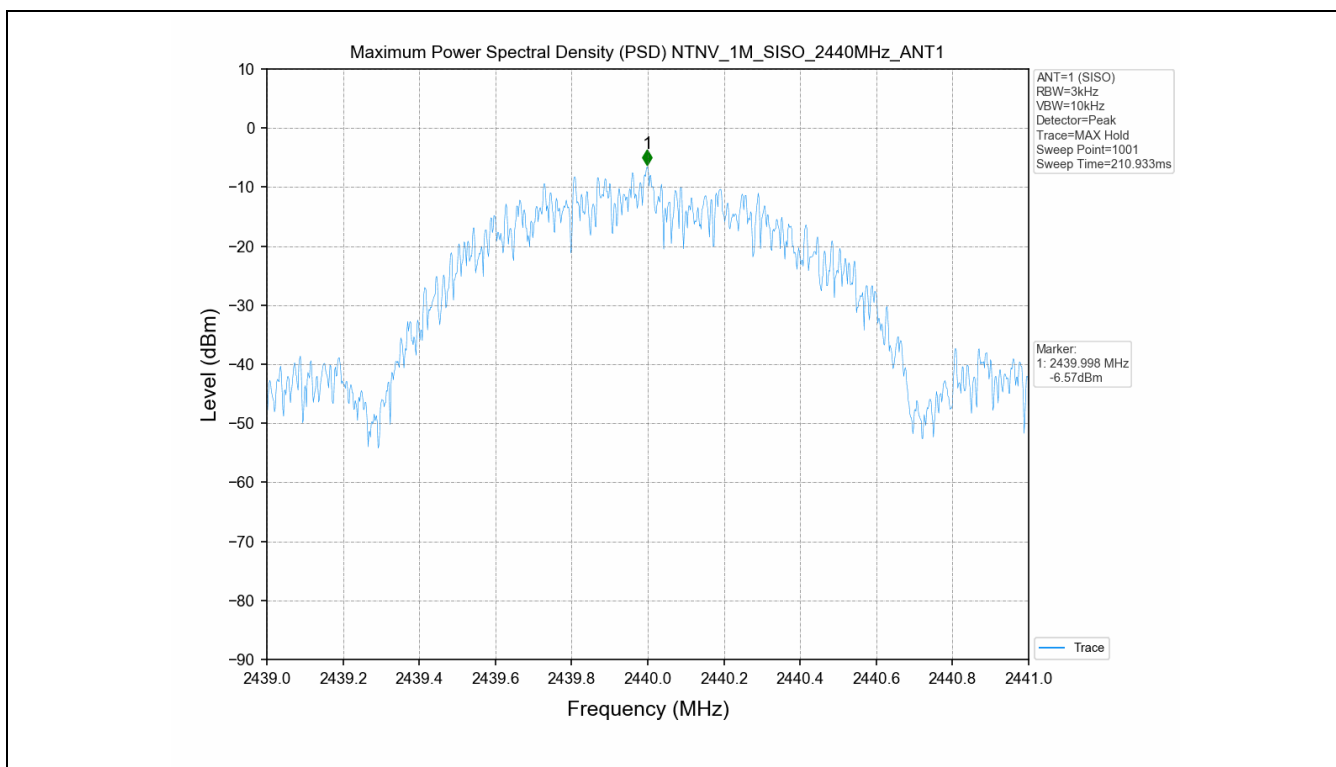
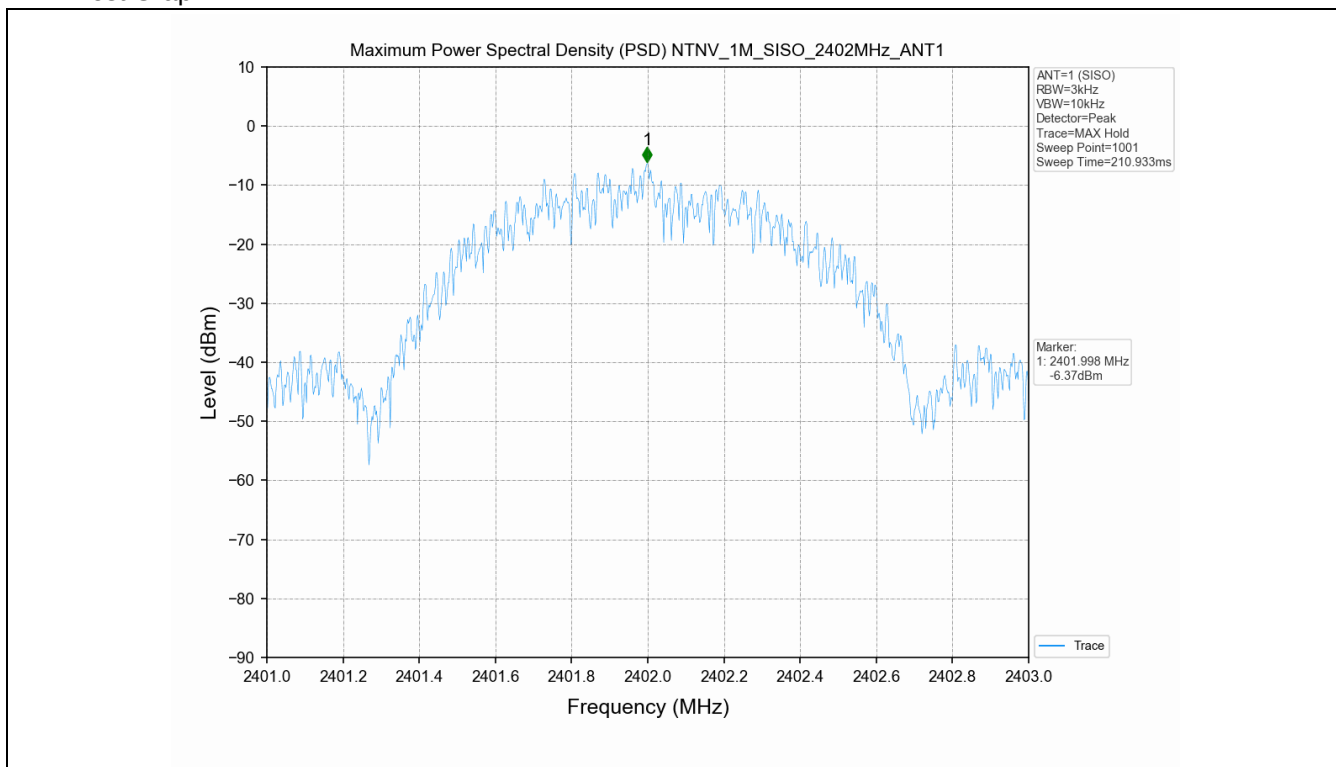


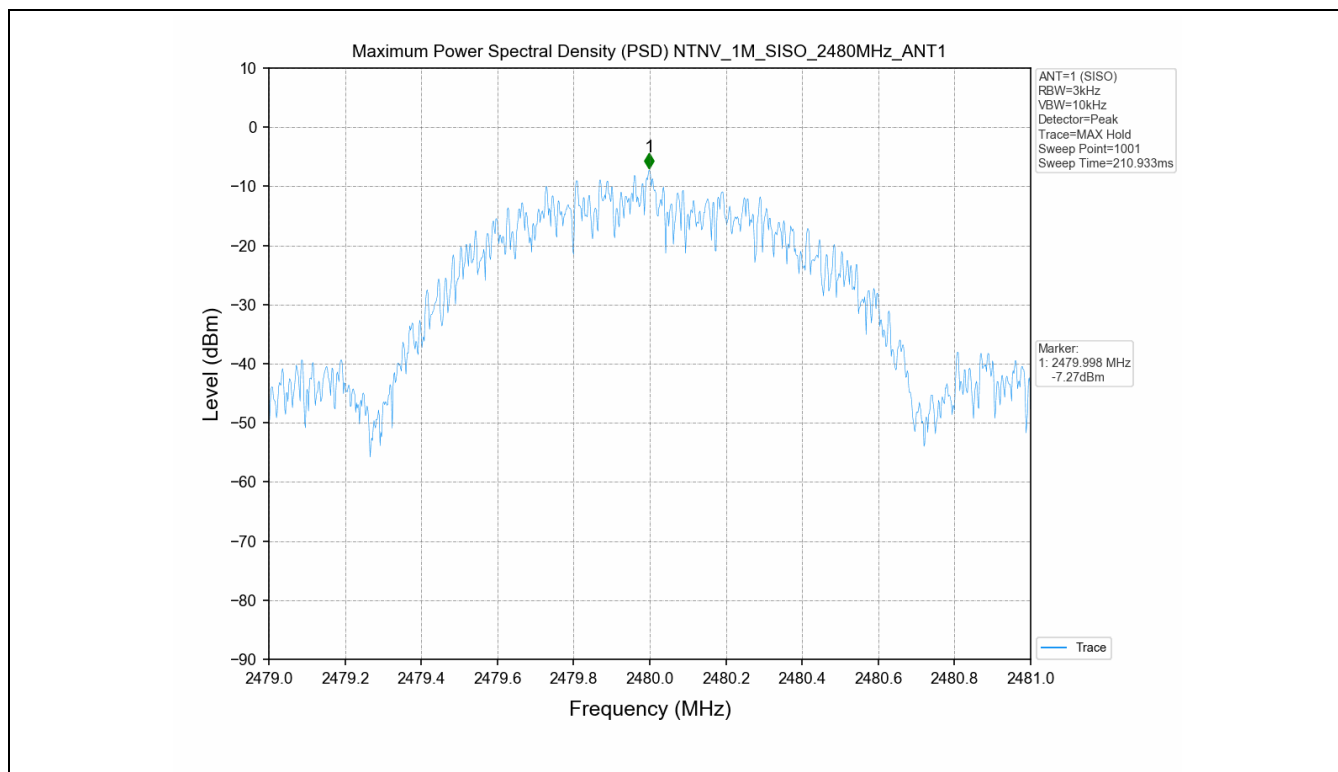
4. Maximum Power Spectral Density (PSD)

4.1 Test Result

Test Mode	Frequency (MHz)	Tx Type	Maximum Power Spectral Density (dBm/3KHz)	Limits (dBm/3kHz)	Verdict
			Ant 1		
1M	2402	SISO	-6.37	≤8	PASS
	2440	SISO	-6.57	≤8	PASS
	2480	SISO	-7.27	≤8	PASS

4.2 Test Graph





5. Unwanted Emissions in Non-restricted Frequency Bands

5.1 Test Result

Test Mode	Frequency (MHz)	TX Type	ANT No.	Spurious Conducted Emission (dBm)	Limits (dBm)	Verdict
1M	2402	SISO	1	Refer to test graph	-12.08	PASS
	2440	SISO	1	Refer to test graph	-12.08	PASS
	2480	SISO	1	Refer to test graph	-12.08	PASS



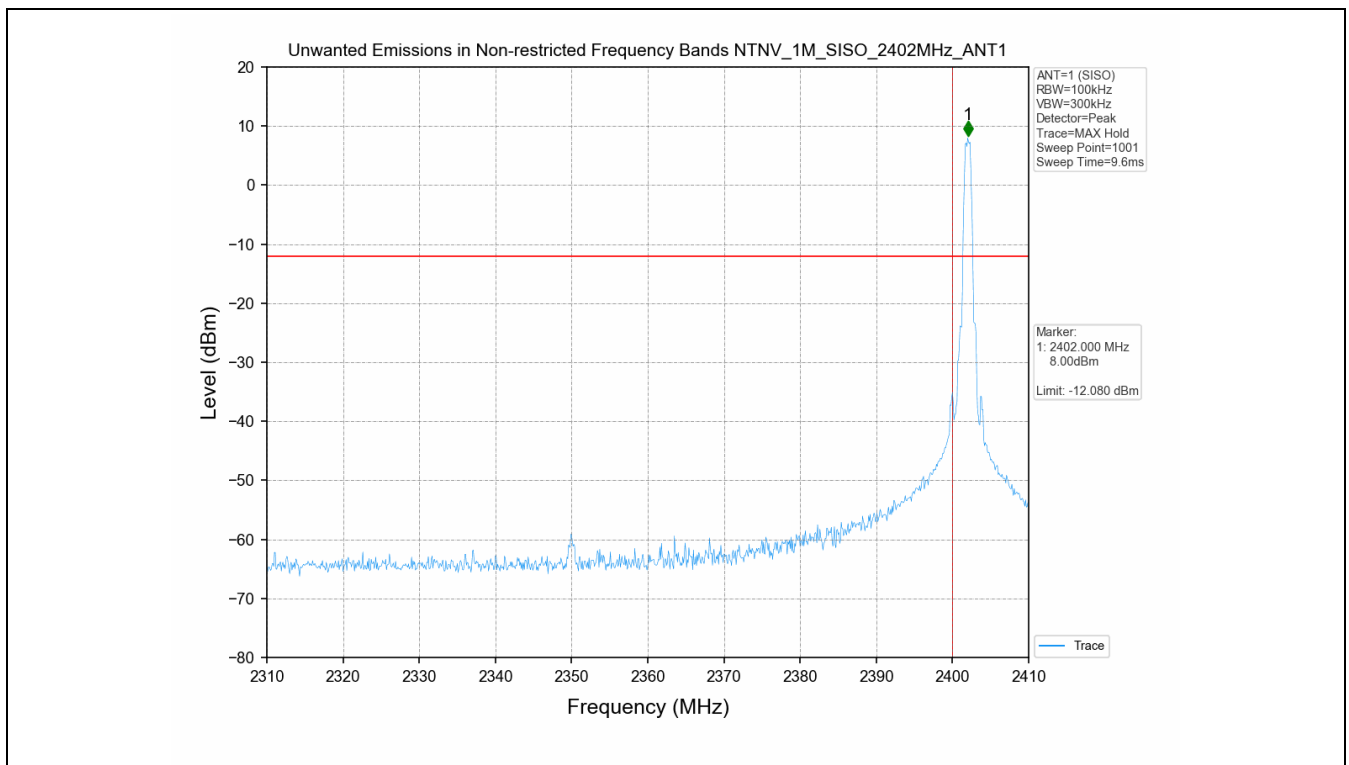
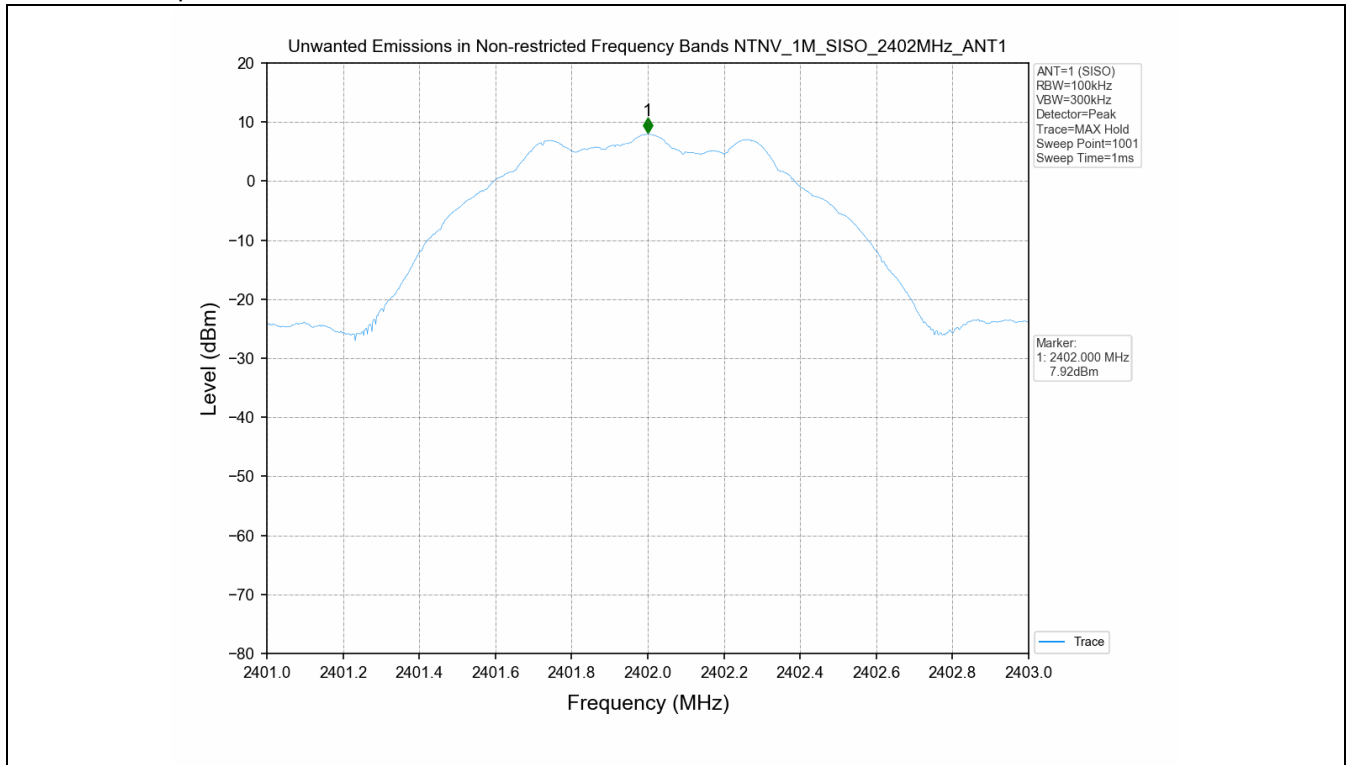
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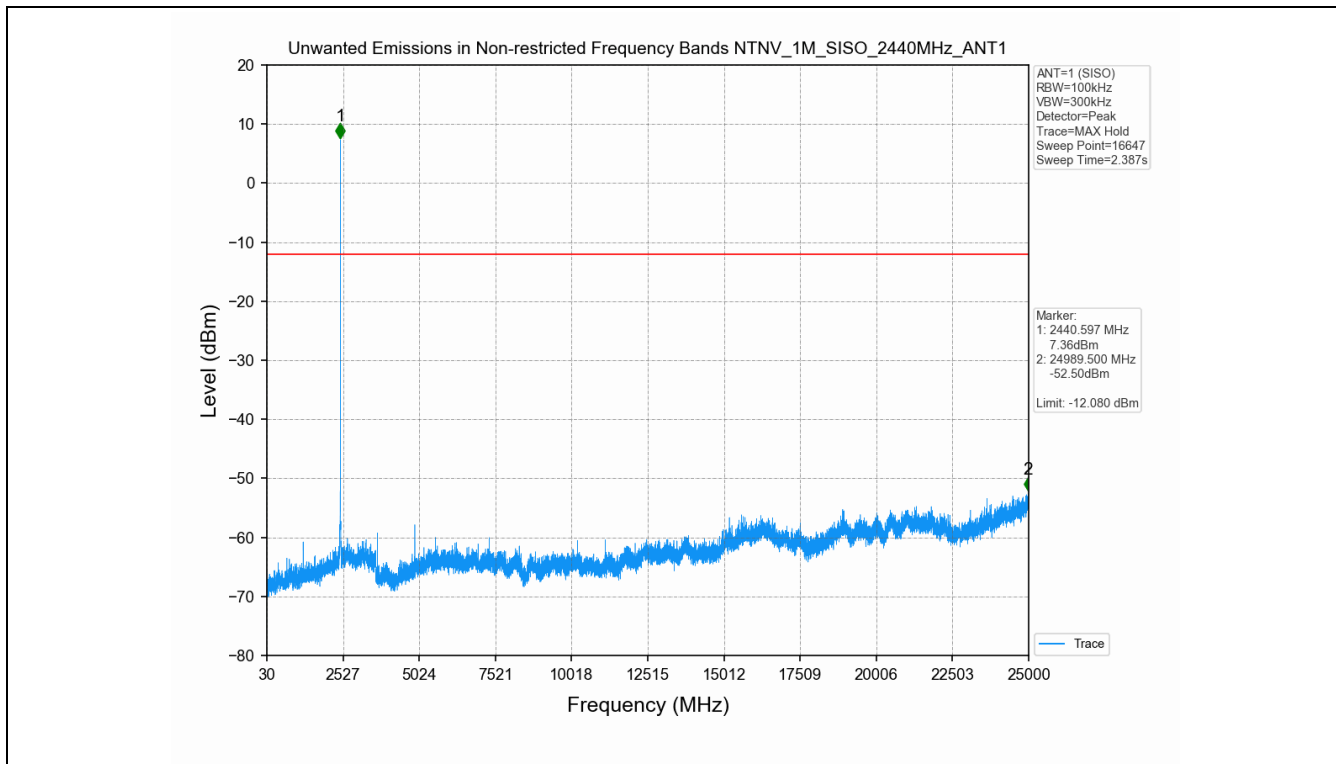
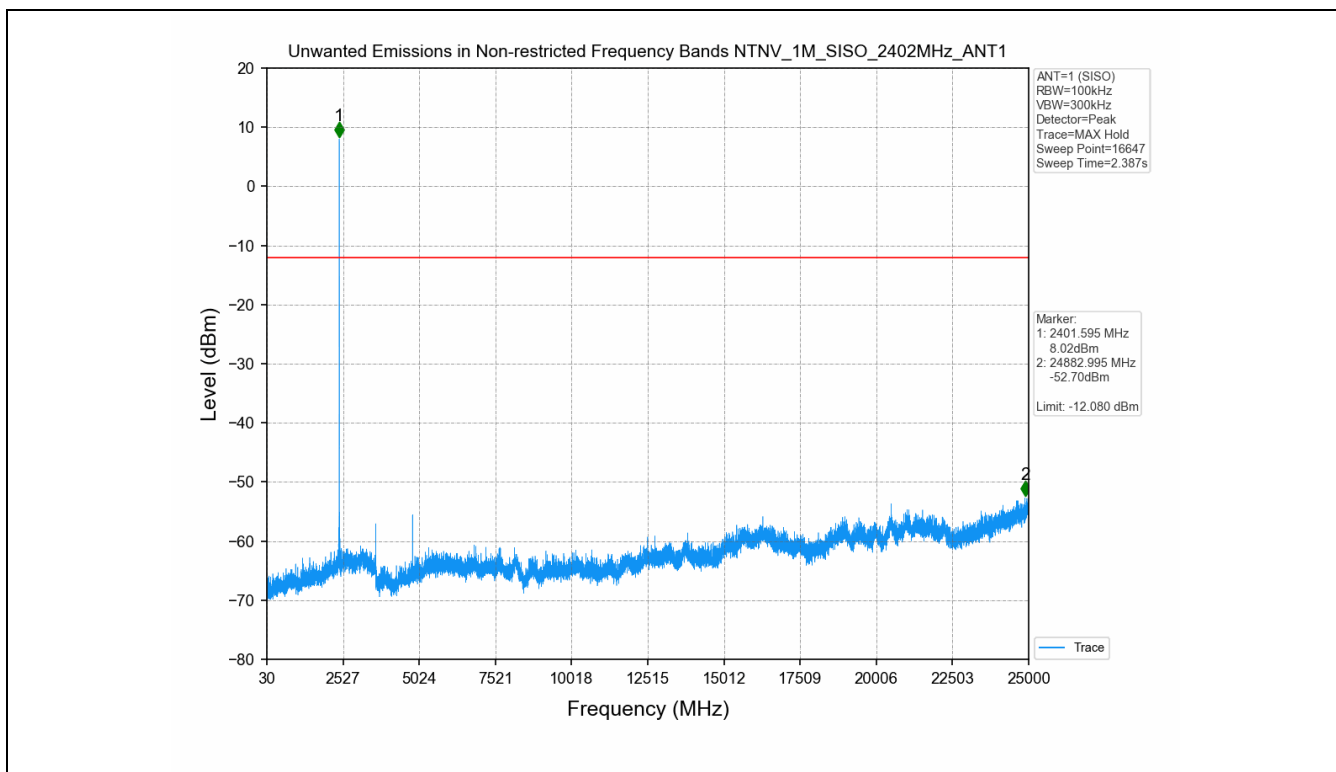
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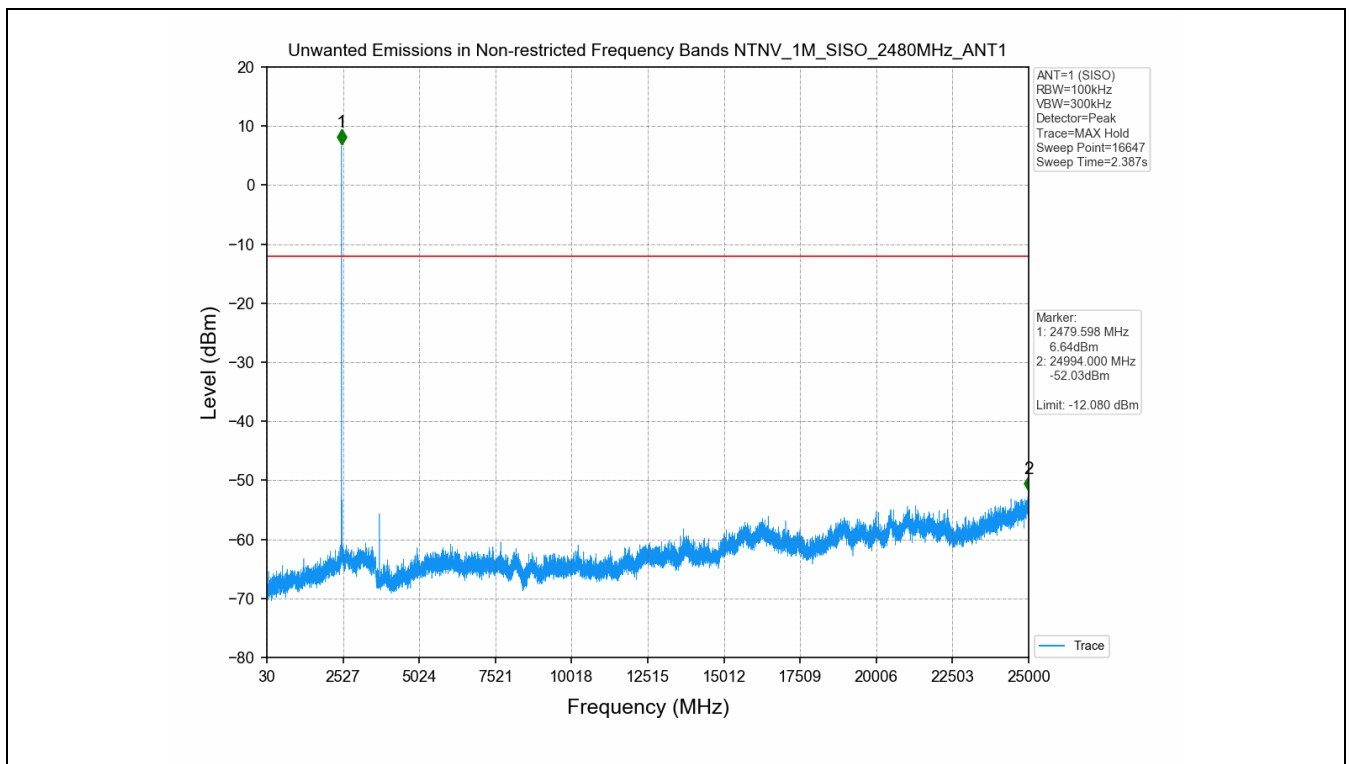
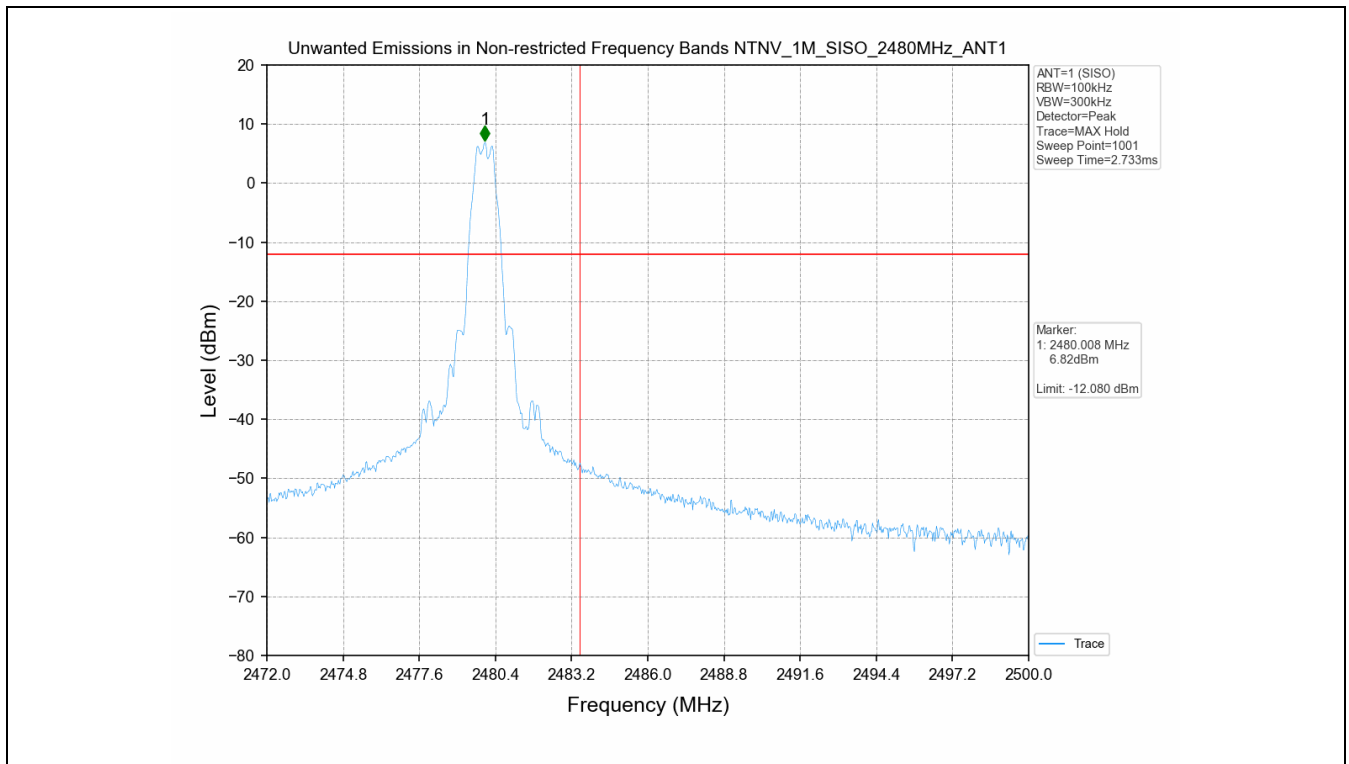
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5.2 Test Graph







- End of the Report -

