TEST REPORT

Applicant	Onset Computer Corp.
Address	470 MacArthur Blvd. Bourne, MA 02532

FCC ID	WXF-ONST12
ISED IC	7936A-ONST12
Product	HOBO MX Soil Moisture and Temperature Logger
FVIN	169.5
Model/HVIN	MX-2307
Additional Models & Model Difference	MX-2306 See Section 3.1 for model differences
Date of tests	2/16/2022, 2/17/2022, 2/21/2022, 3/8/2022, 3/9/2022, 3/24/2022, 5/26/2022, 11/15/2022

The tests have been carried out according to the requirements of the following standard:

☒ **FCC Part 15, Subpart C, Section 15.247**
☒ **RSS-247 Issue 2**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Tested by Ryan Brown Sr. EMC/Wireless Engineer	Approved by Yunus Faziloglu Wireless Manager
Ryan M. Brown	Y. E. Faziloglu Date: Nov-23-2022

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
1	Original release	Jun-07-2022
2	• Corrected the EUT power input voltage listed on Radiated Emissions data tables and graphs. • Added 18-26.5GHz horn antenna to Test Equipment Used list. • Added band-edge data for 2Mbps and updated Section 3.2.2 accordingly. • Added spectrum analyzer settings to Section 4.2.3.	Nov-17-2022
3	• Corrected the list of test dates on cover page.	Nov-23-2022

1 SUMMARY OF TEST RESULTS

The EUT has been tested against the following requirements:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247), RSS-247				
STANDARD SECTION		TEST TYPE AND LIMIT	APPLICABLE	RESULT
47CFR15	RSS			
15.207	Gen 8.8	AC Power Line Conducted Emissions	N/A (Note 1)	N/A
15.205 15.209	247 3.3 247 5.5 Gen 8.9 Gen 8.10	Radiated Spurious Emissions	Y	Pass
15.247(d)	247 5.5	Conducted Spurious Emissions	Y	Pass
15.247(a)(2)	247 5.2(a)	6dB Bandwidth	Y	PASS
--	Gen 6.7	99% Occupied Bandwidth	Y	PASS
15.247(b)(3)	247 5.4(d)	Conducted Output Power	Y	PASS
15.247(e)	247 5.2(b)	Power Spectral Density	Y	PASS
15.203	Gen 6.8	Antenna Requirement	Y	PASS

Note 1: EUT is battery powered only.

2 MEASUREMENT UNCERTAINTY

The listed uncertainties are the worst-case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results. Values for measurement uncertainty are calculated per ETSI TR 100 028 (2001).

Measurement	Expanded Uncertainty k=2	Maximum allowable uncertainty
Radio frequency (@ 2.4GHz)	3.23×10^{-8}	1×10^{-7}
RF power, conducted	0.40dB	0.75dB
Maximum frequency deviation: Within 300Hz and 6kHz of audio frequency / Within 6kHz and 25kHz of audio frequency	3.4% 0.3dB	5% 3dB
Adjacent channel power	1.9dB	3dB
Conducted spurious emission of transmitter, valid up to 12.75GHz	2.39dB	3dB
Conducted emission of receivers	1.3dB	3dB
Radiated emission of transmitter, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of transmitter, valid up to 80GHz	3.3dB	6dB
Radiated emission of receiver, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of receiver, valid up to 80GHz	3.3dB	6dB
Humidity	2.37%	5%
Temperature	0.7°C	1.0°C
Time	4.1%	10%
RF Power Density, Conducted	0.4dB	3dB
DC and low frequency voltages	1.3%	3%
Voltage (AC, <10kHz)	1.3%	2%
Voltage (DC)	0.62%	1%
The above reflects a 95% confidence level		

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	HOBO MX Soil Moisture and Temperature Logger
MODEL NO.	MX-2307
ADDITIONAL MODEL	MX-2306
FCC ID	WXF-ONST12
ISED IC	7936A-ONST12
NOMINAL VOLTAGE	3.5V Battery (Min: 3.1V Max: 3.6V)
MODULATION TECHNOLOGY	DTS
MODULATION TYPES	GFSK
DATA RATES	1Mbps (GFSK), 2Mbps (GFSK)
OPERATING FREQUENCY	2402-2480MHz
EUT Power Setting	0dBm
OUTPUT POWER	-2.38dBm (0.58mW) Peak
ANTENNA TYPE	Chip Antenna, 2.0dBi Gain

List of Models and Differences

Model	Description	Tested
MX-2307	Fully populated version with soil moisture and temperature logger	Yes
MX-2306	Depopulated version of MX-2307 with soil moisture logger only	No

EUT Ports:									
Port Label	**Port Type**	**No. of ports**	**No. Populated**	**Cable Type**	**Shielded**	**Ferrites**	**Length**	**Max Length**	**In/Out Type**
Soil Moisture Sensor	Data	1	1	3-conductor	YES	YES	<3m	3m	Outdoor
Temperature Sensor	Data	1	1	4-conductor	YES	NO	<3m	3m	Outdoor

Lowest clock frequency in the device (used/generated): 32.768kHz

NOTES:

1. For a more detailed description of the EUT, please refer to the manufacturer's specifications or the user's manual.
2. For photos of the EUT, please refer to External and Internal Photos exhibits.

3.2 DESCRIPTION OF TEST MODES

40 channels are provided for BLE (GFSK):

CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

3.2.1. CONFIGURATION OF SYSTEM UNDER TEST

Two samples were provided for testing, one for radiated measurements and another with an SMA connector for conducted antenna port measurements. Both samples were powered with 3.5V battery and had a temporary port for a serial to USB cable for connection to a support laptop for putting the radio in necessary test modes. EUT configuration modes are as follows:

TEST MODE	DESCRIPTION
A	Transmit at 1Mbps GFSK
B	Transmit at 2Mbps GFSK

3.2.2. TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Following channels/modes were selected for the applicable tests below.

TEST	TEST MODE	AVAILABLE CHANNELS	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)	Notes
COP	A,B	0 to 39	0,19,39	GFSK	1,2	--
PSD	A	0 to 39	0,19,39	GFSK	1	1
CBE	A,B	0 to 39	0,39	GFSK	1,2	--
6DB	A,B	0 to 39	0,19,39	GFSK	1,2	--
OBW	A,B	0 to 39	0,19,39	GFSK	1,2	--
CSE	A	0 to 39	0,19,39	GFSK	1	1
RSE<1G	A	0 to 39	0,19, 39	GFSK	1	1, 2
RSE≥1G	A	0 to 39	0,19, 39	GFSK	1	1, 2
RBE	A,B	0 to 39	0,39	GFSK	1,2	2
PLCE	--	--	--	--	--	3

Note 1: Testing performed only on Mode A since highest output power measured was in this mode.
Note 2: For radiated emissions, worst-case orientation was found when the EUT was positioned on X axis as shown in the Test Setup Photos exhibit.
Note 3: Not applicable since EUT is battery powered only.
COP: Conducted Output Power
PSD: Power Spectral Density
CBE: Conducted Band-edge
6DB: 6dB Bandwidth
OBW: 99% Occupied Bandwidth
CSE: Conducted Spurious Emissions
RSE<1G: Radiated Spurious Emissions Below 1GHz
RSE≥1G: Radiated Spurious Emissions Above 1GHz
RBE: Radiated Band-edge
PLCE: Power Line Conducted Emissions

TEST CONDITIONS:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE<1G	22.7deg. C, 40.3%RH	3.5V Battery	RB
RE≥1G	22.7deg. C, 40.3%RH	3.5V Battery	RB
PLC	N/A	N/A	N/A
Antenna Port Measurements	20.6deg. C, 28.1%RH	3.5V Battery	RS & RB

3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C, Section 15.247

558074 D01 15.247 Meas Guidance v05r02

ANSI C63.10-2013

RSS-247 Issue 2

Note: All test items have been performed and recorded as per the above standards.

3.4 DESCRIPTION OF SUPPORT UNITS

Support Equipment	Model #	Serial #
Dell Laptop	Latitude E5410	N/A

4 TEST TYPES AND RESULTS

4.1 CONDUCTED EMISSIONS MEASUREMENT

4.1.1 LIMITS OF CONDUCTED EMISSIONS MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBµV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

NOTE: 1.The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.1.2 TEST INSTRUMENTS

N/A. EUT is battery powered only.

4.1.3 TEST PROCEDURES

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

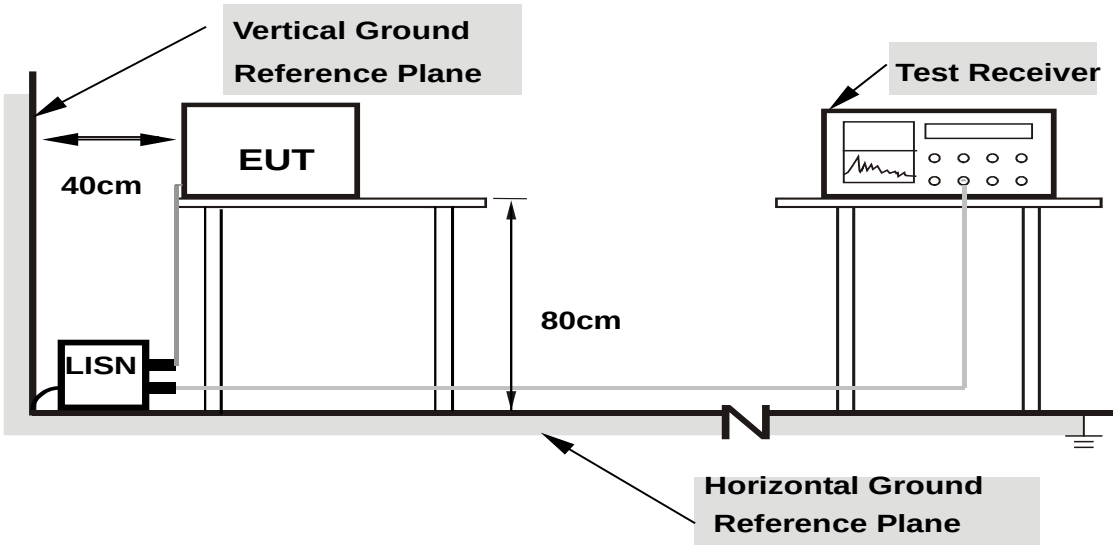
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

4.1.5 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to Test Setup Photos exhibit.

4.1.6 EUT OPERATING CONDITIONS

a. Turned on the power and connected all equipment.
b. EUT was operated according to manufacturer's specifications.

4.1.7 TEST RESULTS

N/A. EUT is battery powered only.

4.2 RADIATED EMISSIONS MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSIONS MEASUREMENT

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emissions limits specified in Section 15.209(a).

FREQUENCIES (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

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.2.2 TEST INSTRUMENTS

Rev. 3/16/2022

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
Gold	100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	1/27/2023	1/27/2022
Rental MXE EMI Receiver(1170725)	20Hz-26.5GHz	N9038A	Agilent	MY51210151	1170725	I	2/3/2023	2/3/2022
Radiated Emissions Sites	**FCC Code**	**IC Code**	**VCCI Code**	**Range**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
EMI Chamber 1	719150	2762A-6	A-0015	30-1000MHz	1685	I	12/6/2022	12/6/2020
EMI Chamber 1	719150	2762A-6	A-0015	1-18GHz	1685	I	12/8/2022	12/8/2020
EMI Chamber 2	719150	2762A-7	A-0015	30-1000MHz	1686	I	12/5/2022	12/5/2020
EMI Chamber 2	719150	2762A-7	A-0015	1-18GHz	1686	I	12/8/2022	12/8/2020
Preamps /Couplers Attenuators / Filters	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
2111 HF Preamp	0.5-18GHz	PAM-118A	COM-POWER	551063	2111	II	10/26/2022	10/26/2021
8449B HF Preamp	1-18GHz	8449B	Agilent	1149055		II	11/10/2022	11/10/2021
185710 Rental PA	9KHz-1GHz	310	SONOMA INSTRUMENT	185710		II	2/17/2023	2/17/2022
HF (Yellow)	18-26.5GHz	AFS4-18002650-60-8P-4	CS	467559	1266	II	10/26/2022	10/26/2021
2116 BRF	0.009-18000MHz	BRM50702	Micro-Tronics	G226	2116	II	11/10/2022	11/10/2021
Antennas	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
Red-White Bilog	30-2000MHz	JB1	Sunol	A091604-1	1105	I	10/25/2023	11/25/2021
HF (White) Horn	18-26.5GHz	801-WLM	Waveline	758	758	III	Verify before Use	date of test
Blue Horn	1-18Ghz	3117	ETS	157647	1861	I	4/26/2023	4/26/2021
Small Loop	10kHz-30MHz	PLA-130/A	ARA	1024	755	I	8/25/2022	8/25/2020
Large Loop	20Hz-5MHz	6511	EMCO	9704-1154	67	I	8/21/2022	8/21/2020
Meteorological Meters/Chambers		**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	11/23/2022	11/23/2020
Asset #2657		1235C97	Control Company	200435369	2657	I	7/23/2022	7/23/2020
Cables	**Range**		**Mfr**			**Cat**	**Calibration Due**	**Calibrated on**
Asset #2464	9KHz-18GHz		MegaPhase			II	11/9/2022	11/9/2021
Asset #2474	9KHz-18GHz		MegaPhase			II	11/9/2022	11/9/2021
Asset #2580	9KHz-18GHz		Pasternack			II	1/21/2023	1/21/2022
Asset #2610	9KHz-18GHz		Pasternack			II	3/16/2023	3/16/2022
Asset #2323	1-26.5GHz	TM26-S1S1-120	MEGAPHASE	17139101 002		II	9/10/2022	9/10/2021
Asset #2681	9KHz-18GHz		Pasternack			II	1/21/2023	1/21/2022
Asset #2682	9KHz-18GHz		Pasternack			II	6/17/2022	6/17/2021

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Test Instruments for Band Edge (2Mbps)

Rev. 11/16/2022

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due	Calibrated on
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	3/7/2023	3/7/2022
Radiated Emissions Sites	**FCC Code**	**IC Code**	**VCCI Code**	**Range**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
EMI Chamber 1	719150	2762A-6	A-0015	30-1000MHz	1685	I	12/6/2022	12/6/2020
EMI Chamber 1	719150	2762A-6	A-0015	1-18GHz	1685	I	12/8/2022	**12/8/2020**
Preamps /Couplers Attenuators / Filters	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
8449B HF Preamp	1-18GHz	8449B	Agilent	1149055		II	11/1/2023	11/1/2022
Antennas	**Range**	**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
Blue Horn	1-18Ghz	3117	ETS	157647	1861	I	4/26/2023	**4/26/2021**
Meteorological Meters/Chambers		**MN**	**Mfr**	**SN**	**Asset**	**Cat**	**Calibration Due**	**Calibrated on**
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	11/23/2022	11/23/2020
Asset #2657		1235C97	Control Company	200435369	2657	I	8/18/2025	8/18/2022
Cables	**Range**		**Mfr**			**Cat**	**Calibration Due**	**Calibrated on**
Asset #2474	9KHz-18GHz		MegaPhase			II	11/1/2023	**11/1/2022**
Asset #2580	9KHz-18GHz		Pasternack			II	1/21/2023	1/21/2022
Asset #2681	9KHz-18GHz		Pasternack			II	1/21/2023	1/21/2022

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

4.2.3 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.

g. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, and was placed in its intended operating position. For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

NOTES:

1. Spectrum analyzer settings used:

Freq. (MHz)	RBW	VBW	Pre-scan	Final
0.009-0.15	200Hz	1kHz	Peak	Quasi Peak
0.15-30	9kHz	30kHz	Peak	Quasi Peak
30-1000	120kHz	300kHz	Peak	Quasi Peak
>1000	1MHz	3MHz	Peak	Peak and RMS Power Avg

2. EUT was transmitting continuously (duty-cycle >98%) during all tests.

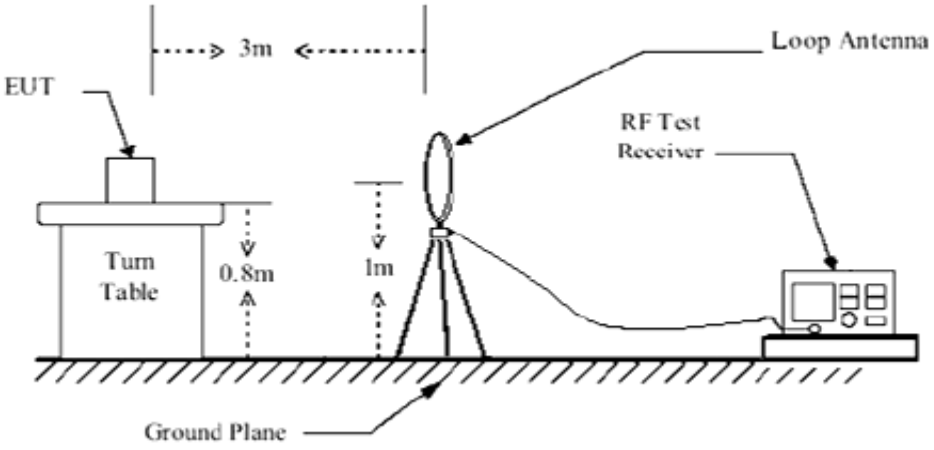
3. If peak measurements were below the applicable limit, QPk and RMS measurements were not performed.

4.2.4 DEVIATION FROM TEST STANDARD

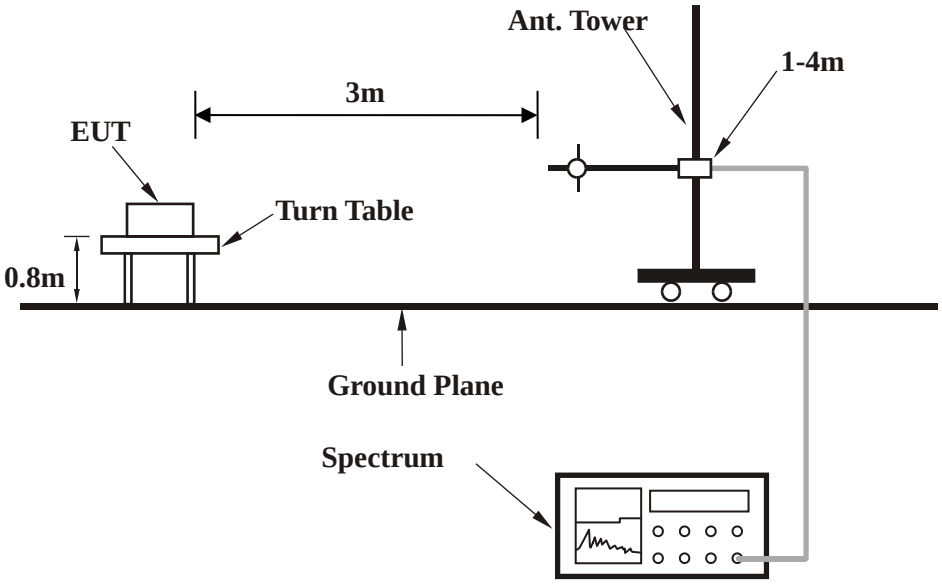
No deviation.

4.2.5 TEST SETUP

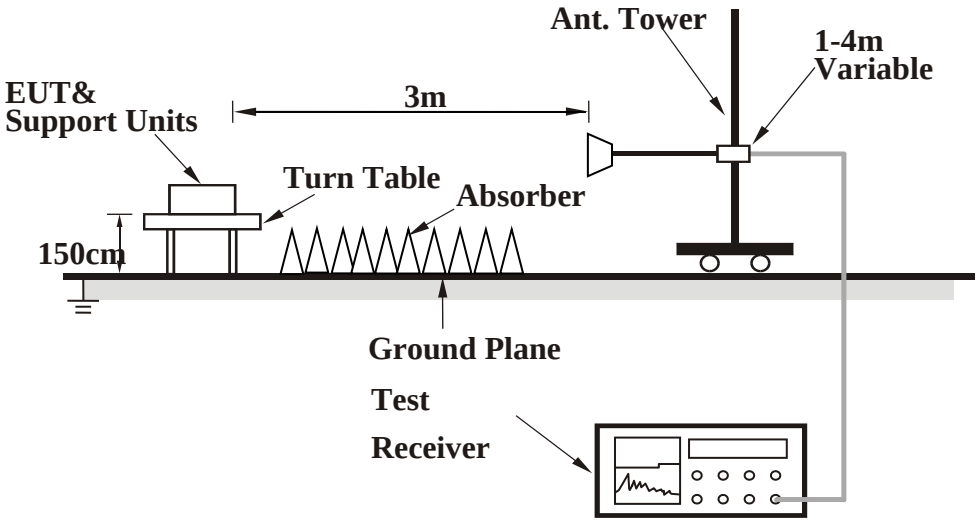
Below 30MHz test setup



Below 1GHz test setup



Above 1GHz test setup



Note: For the actual test configuration, please refer to the Test Setup Photos exhibit.

4.2.6 EUT OPERATING CONDITIONS

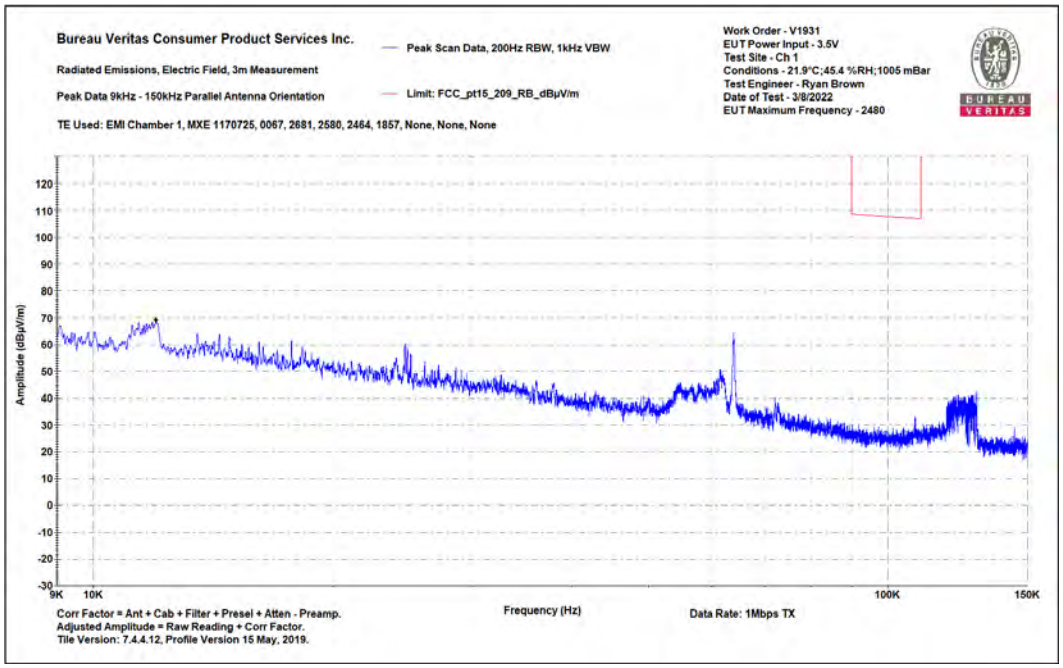
EUT was operated according to the manufacturer's specifications.

4.2.7 TEST RESULTS

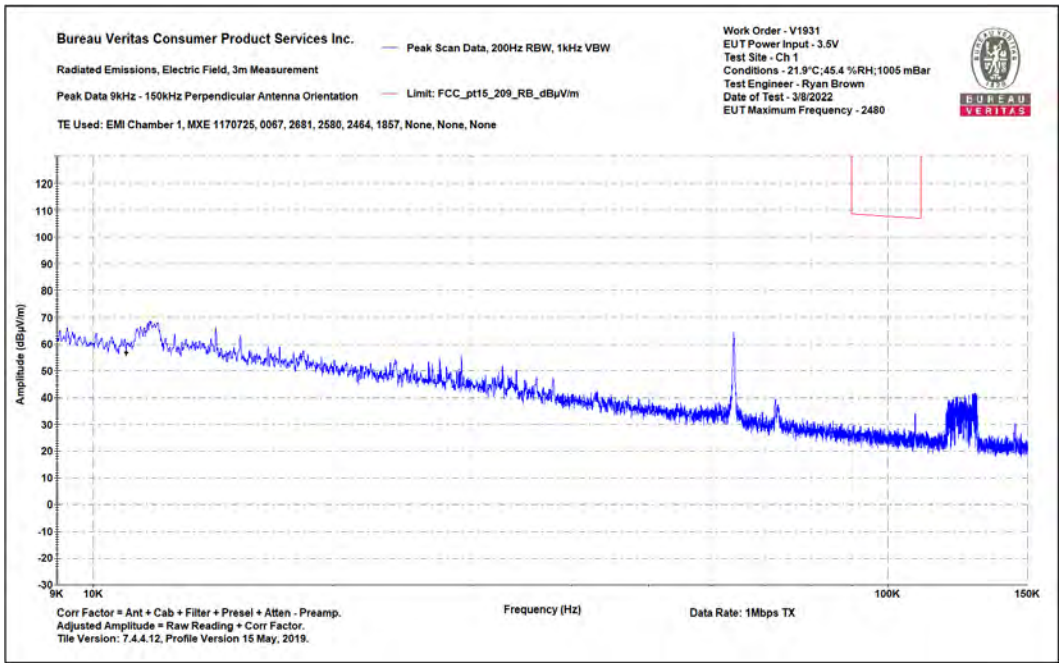
Emissions below 1GHz

Results for BLE 1Mbps GFSK Channel 0

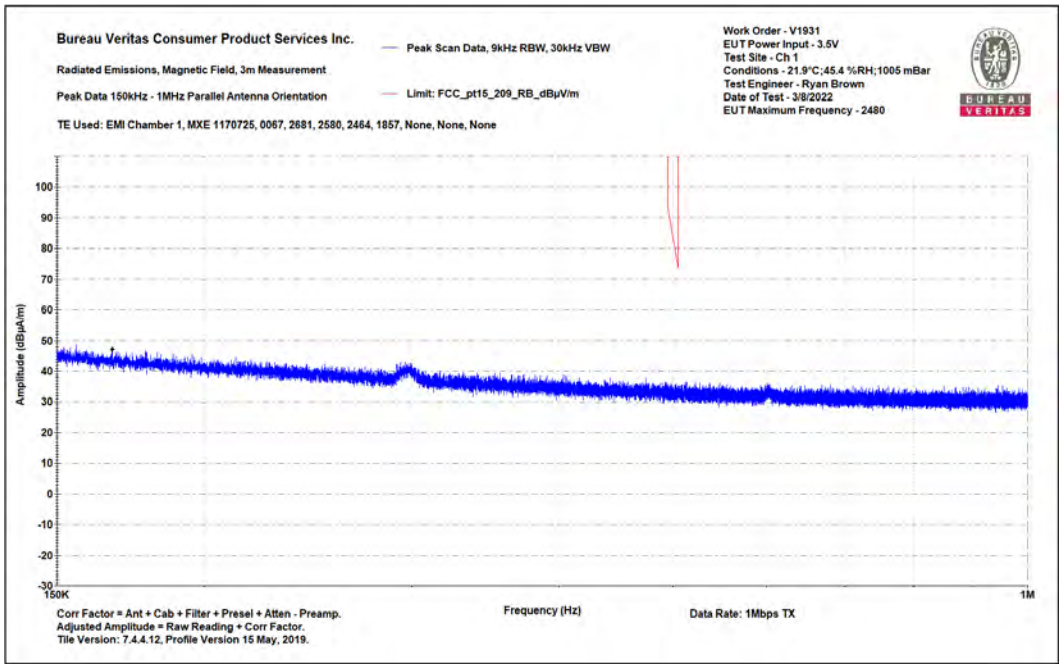
No emissions within 20dB of the limit were identified in 9kHz-30MHz range. Only plots shown below.



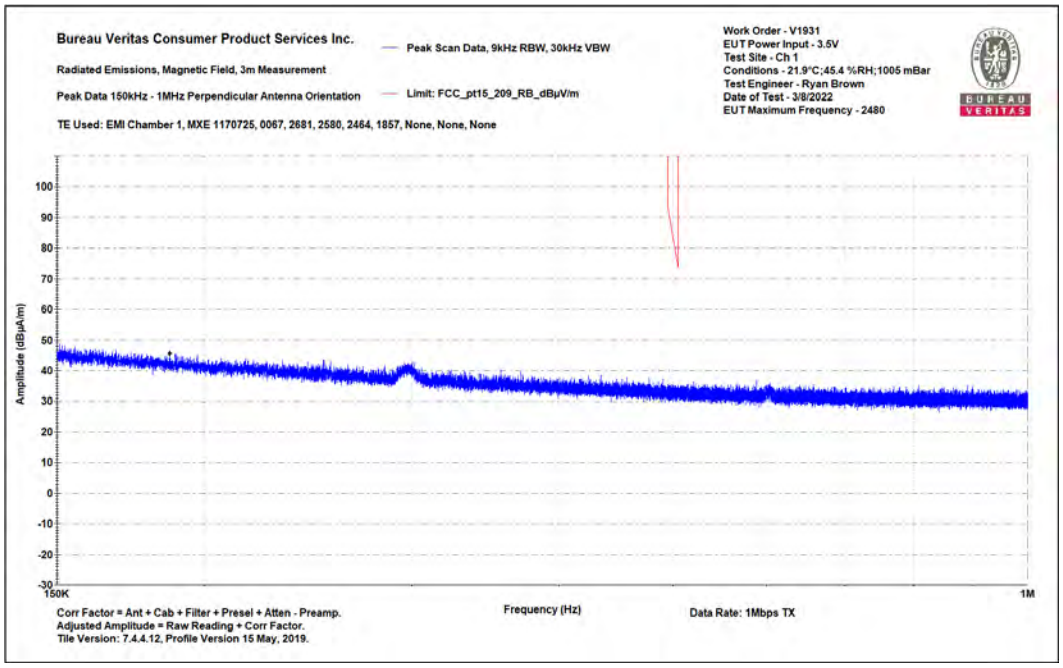
0.009-0.15MHz Parallel



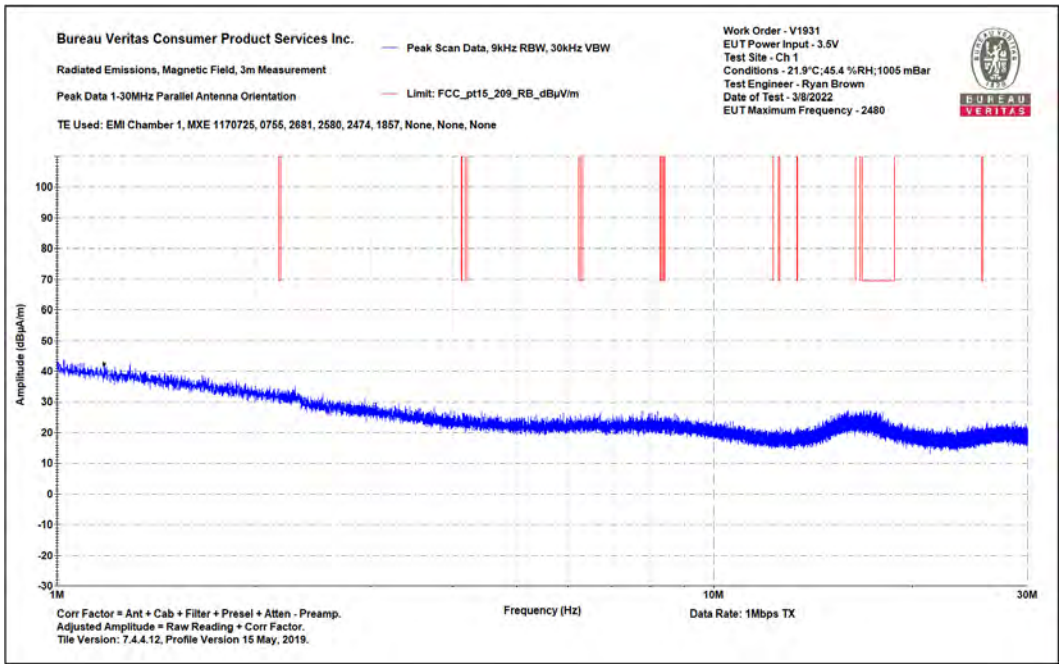
0.009-0.15MHz Perpendicular



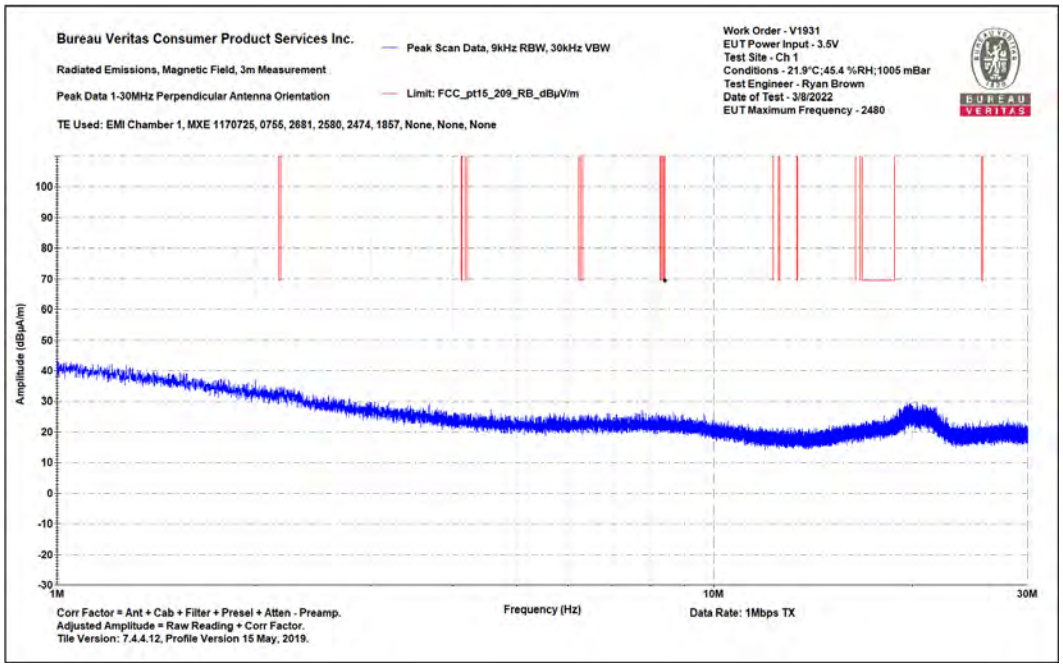
0.15-1MHz Parallel



0.15-1MHz Perpendicular



1-30MHz Parallel

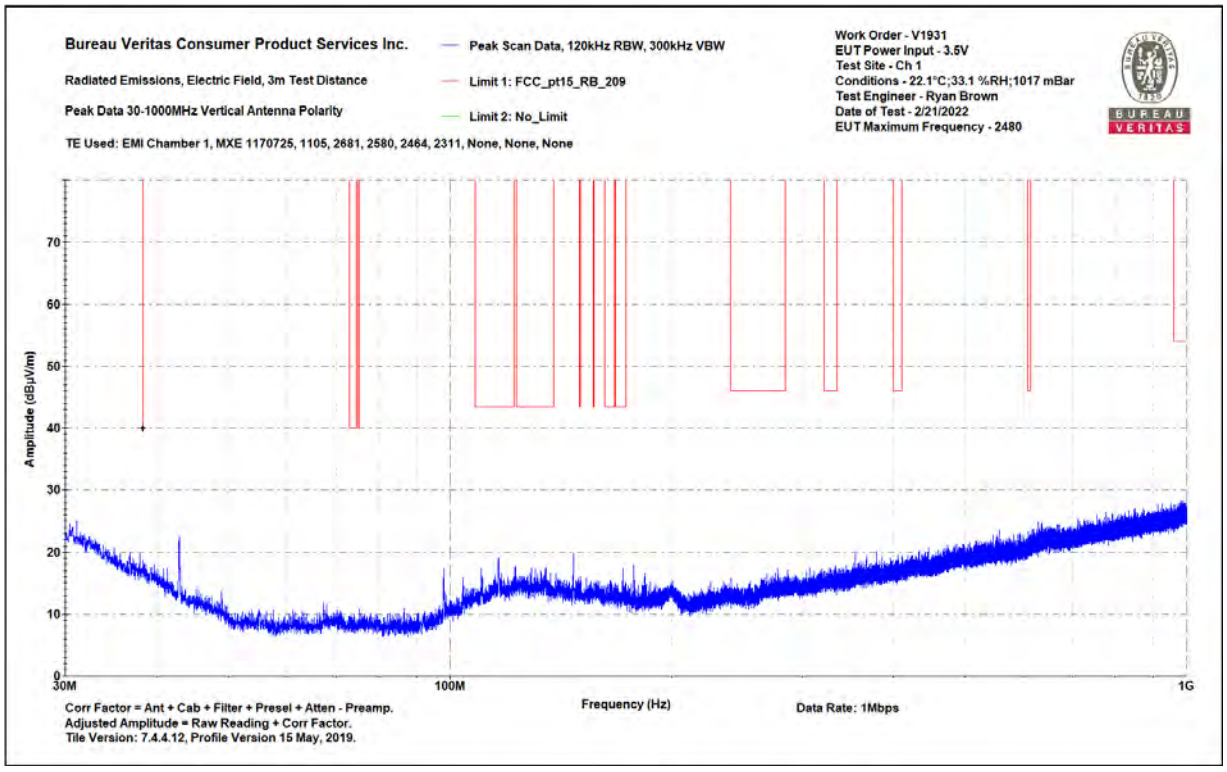


1-30MHz Perpendicular

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Vertical 30-1000MHz	Test Site - Ch 1
Notes:	Conditions - 22.1°C;33.1 %RH;1017 mBar
Data Rate: 1Mbps	Test Engineer - Ryan Brown
0	Date of Test - 2/21/2022

Frequency (MHz)	Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Lim1: FCC_pt15_RB_209 (dBµV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	Turntable Azimuth (degrees)
37.881	33.5	-13.8	19.7	40	-20.3	PASS	-20.3	100	45
609.769	32.3	-8.9	23.4	46	-22.6	PASS		150	90
985.911	31	-2.7	28.3	54	-25.7	PASS		200	180

30-1000MHz Vertical

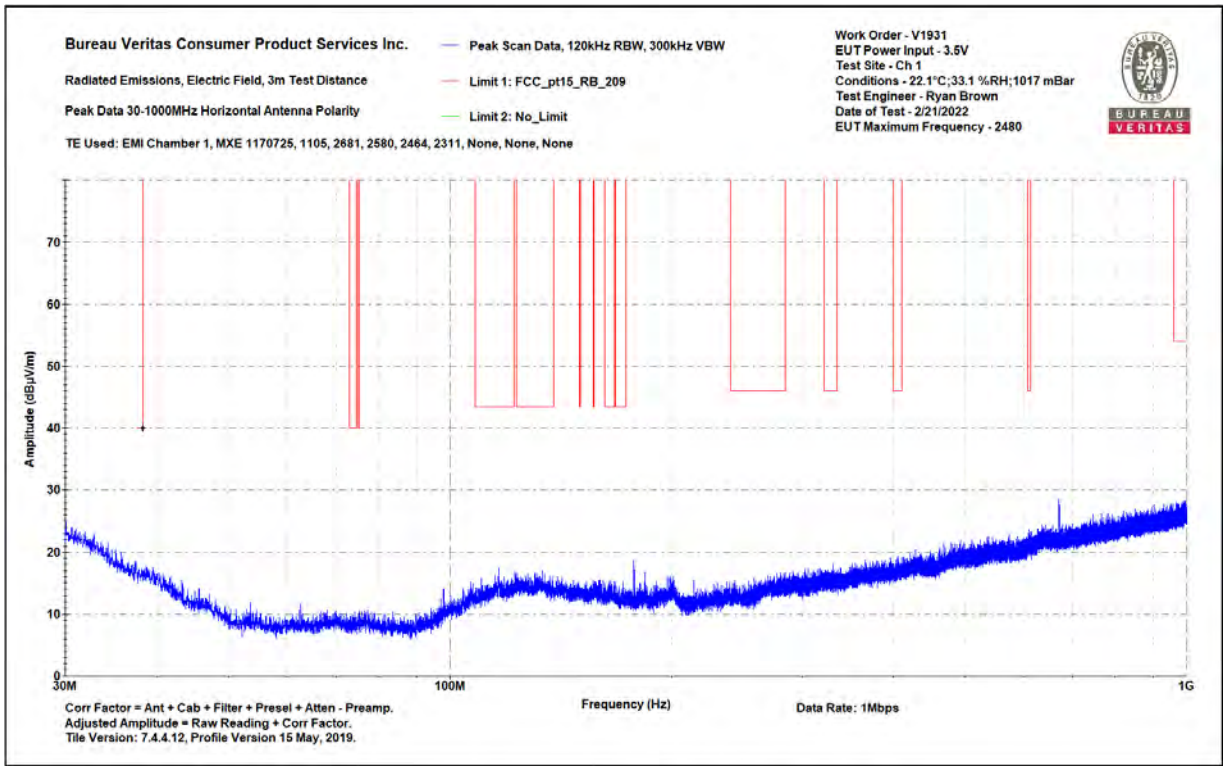


30-1000MHz Vertical

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Horizontal 30-1000MHz	Test Site - Ch 1
Notes:	Conditions - 22.1°C;33.1 %RH;1017 mBar
Data Rate: 1Mbps	Test Engineer - Ryan Brown
0	Date of Test - 2/21/2022

Frequency (MHz)	Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Lim1: FCC_pt15_RB_209 (dBµV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
405.075	32.3	-13	19.3	46	-26.7	PASS		200	90
611.273	32.6	-8.9	23.6	46	-22.4	PASS	-22.4	250	0
993.768	30.7	-2.4	28.3	54	-25.7	PASS		200	270

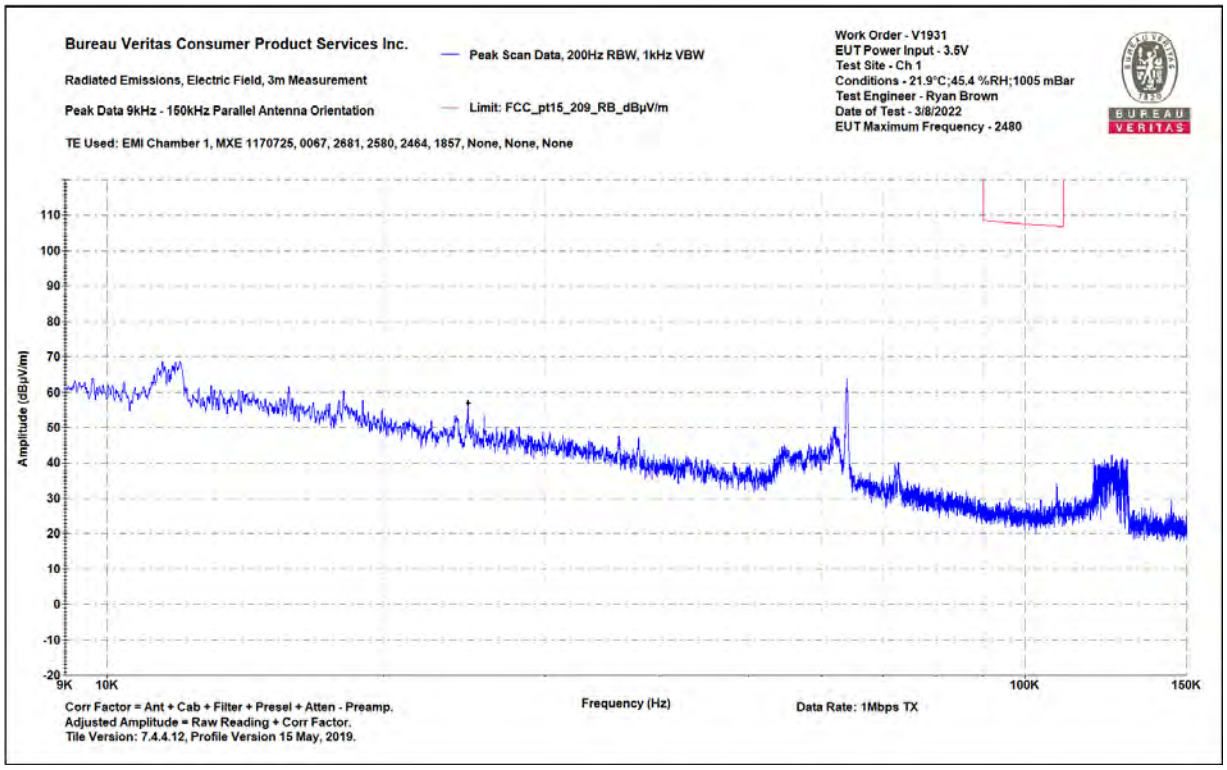
30-1000MHz Horizontal



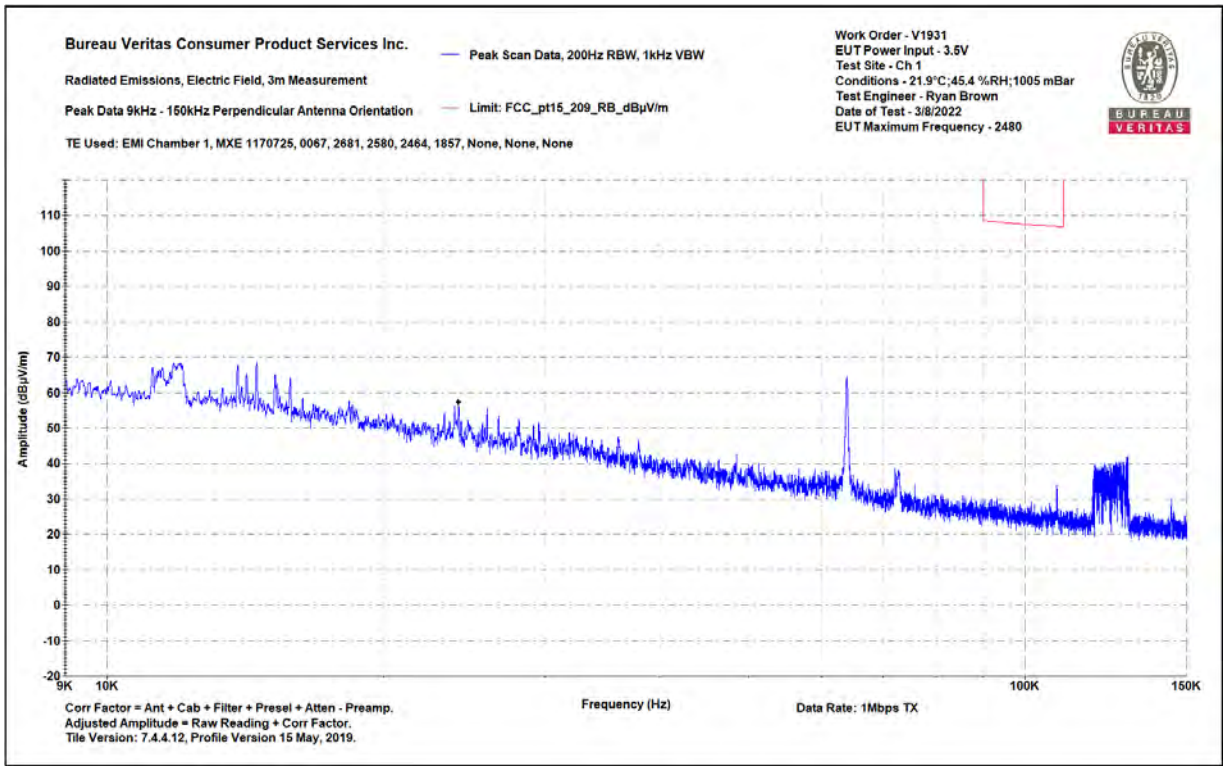
30-1000MHz Horizontal

Results for BLE 1Mbps GFSK Channel 19

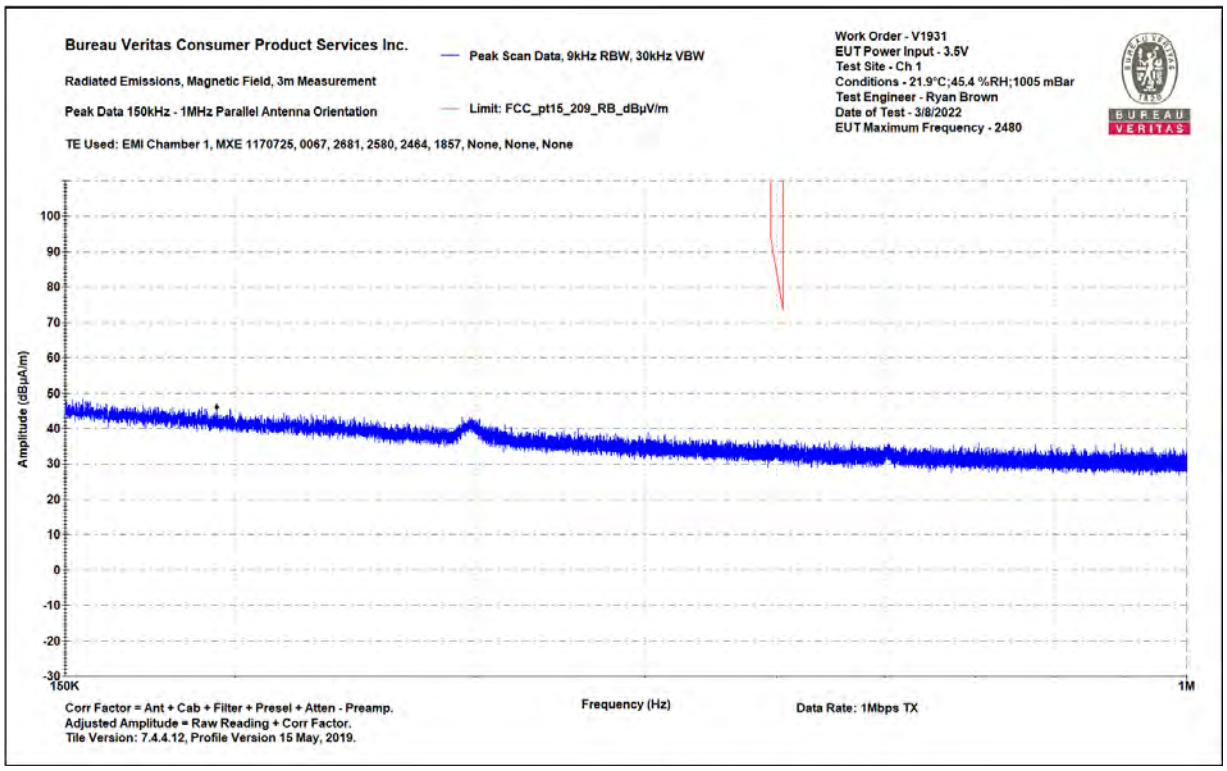
No emissions within 20dB of the limit were identified in 9kHz-30MHz range. Only plots shown below.



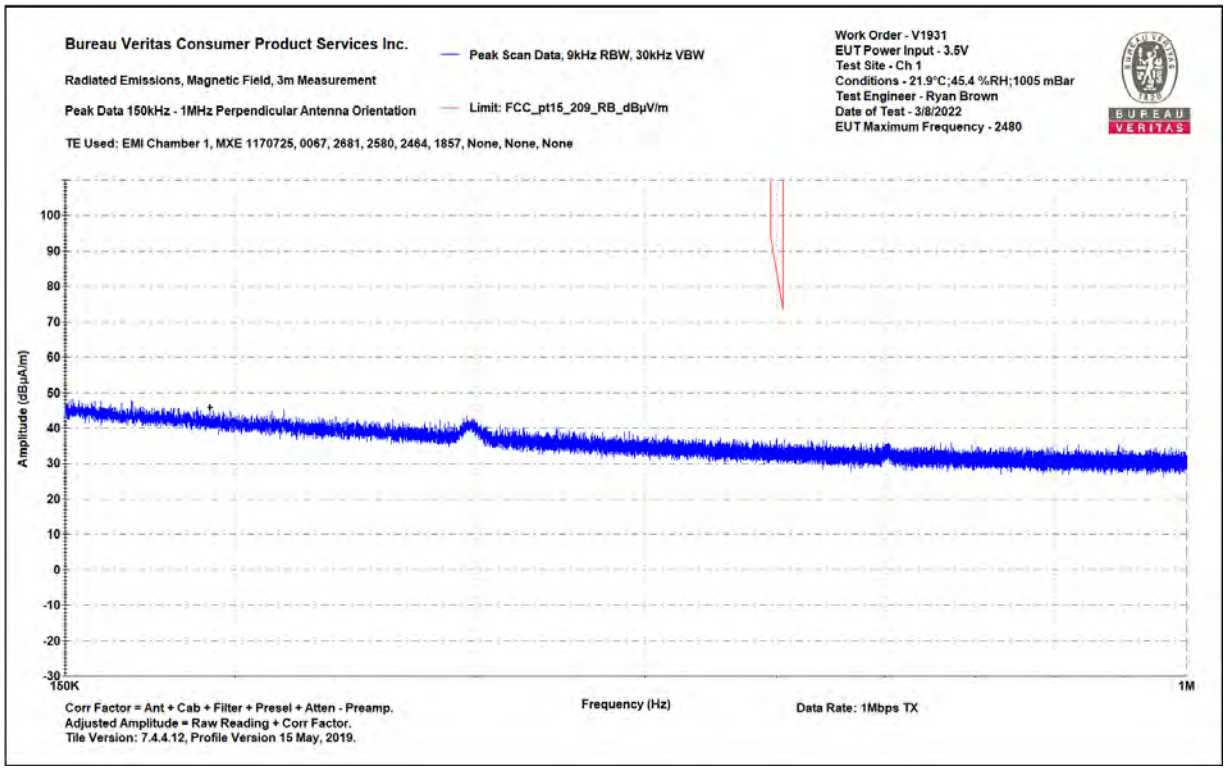
0.009-0.15MHz Parallel



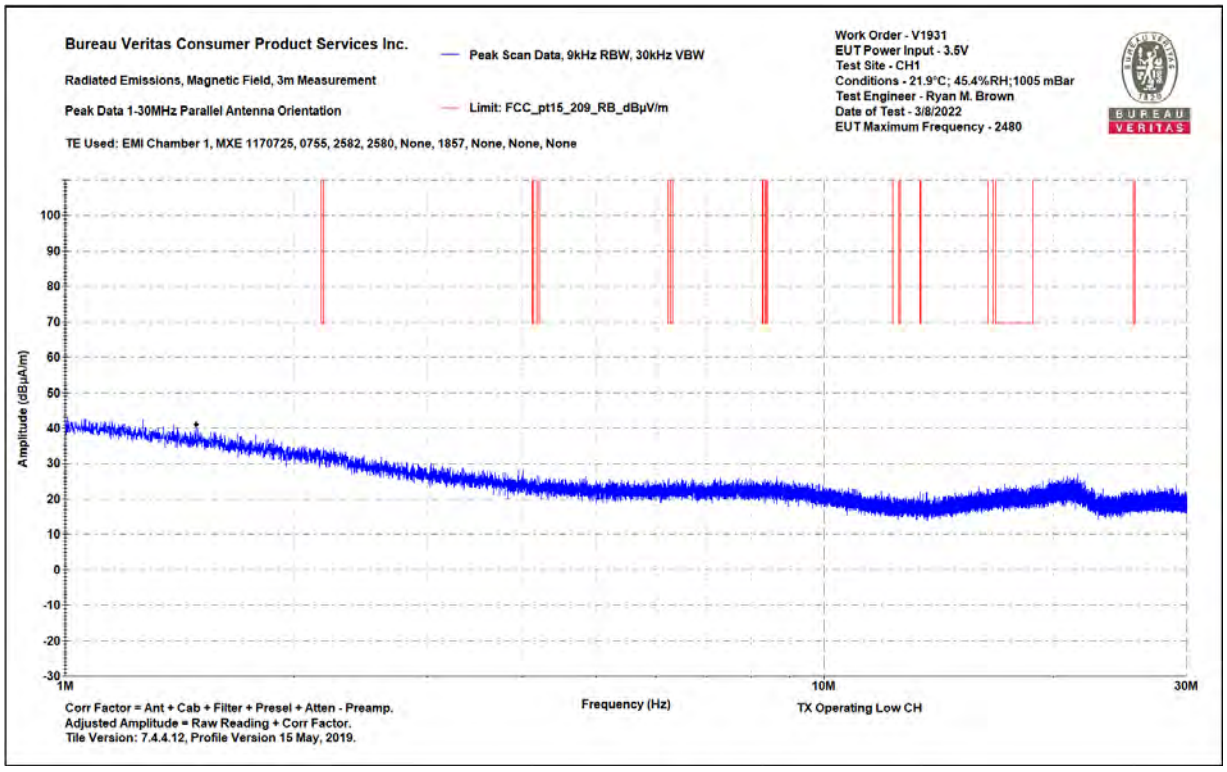
0.009-0.15MHz Perpendicular



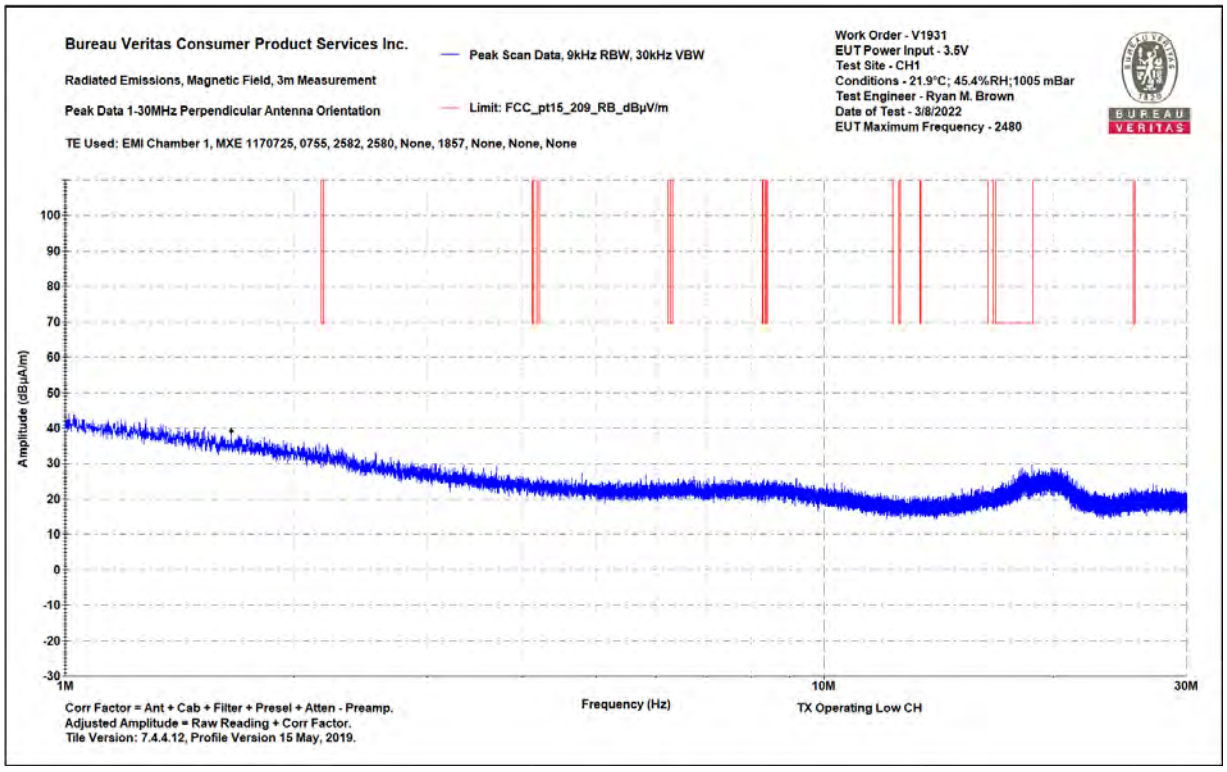
0.15-1MHz Parallel



0.15-1MHz Perpendicular



1-30MHz Parallel

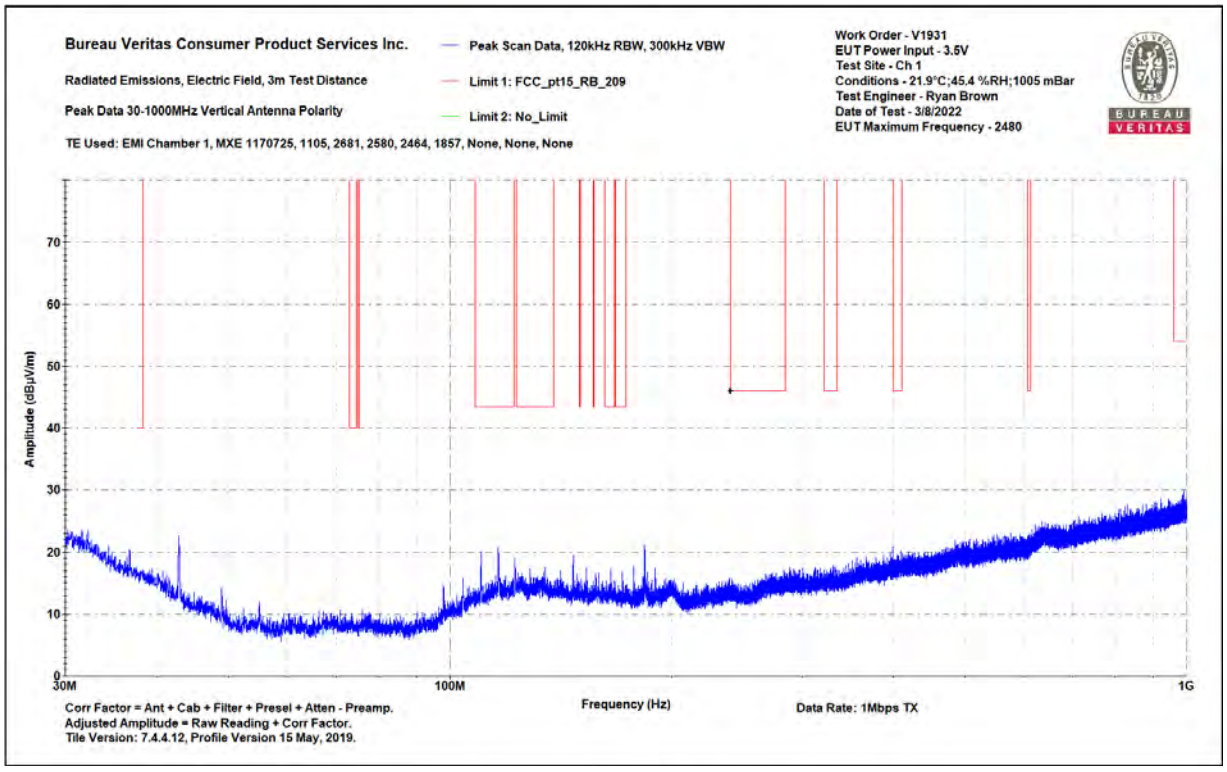


1-30MHz Perpendicular

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Vertical 30-1000MHz	Test Site - Ch 1
Notes:	Conditions - 21.9°C;45.4 %RH;1005 mBar
Data Rate: 1Mbps TX	Test Engineer - Ryan Brown
0	Date of Test - 3/8/2022

Frequency (MHz)	Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Lim1: FCC_pt15_RB_209 (dBµV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	Turntable Azimuth (degrees)
116.209	34.6	-13.7	20.9	43.5	-22.6	PASS	-22.6	250	225
611.903	30.5	-7.4	23	46	-23	PASS		200	45
990.106	30.7	-0.8	29.9	54	-24.1	PASS		250	90

30-1000MHz Vertical

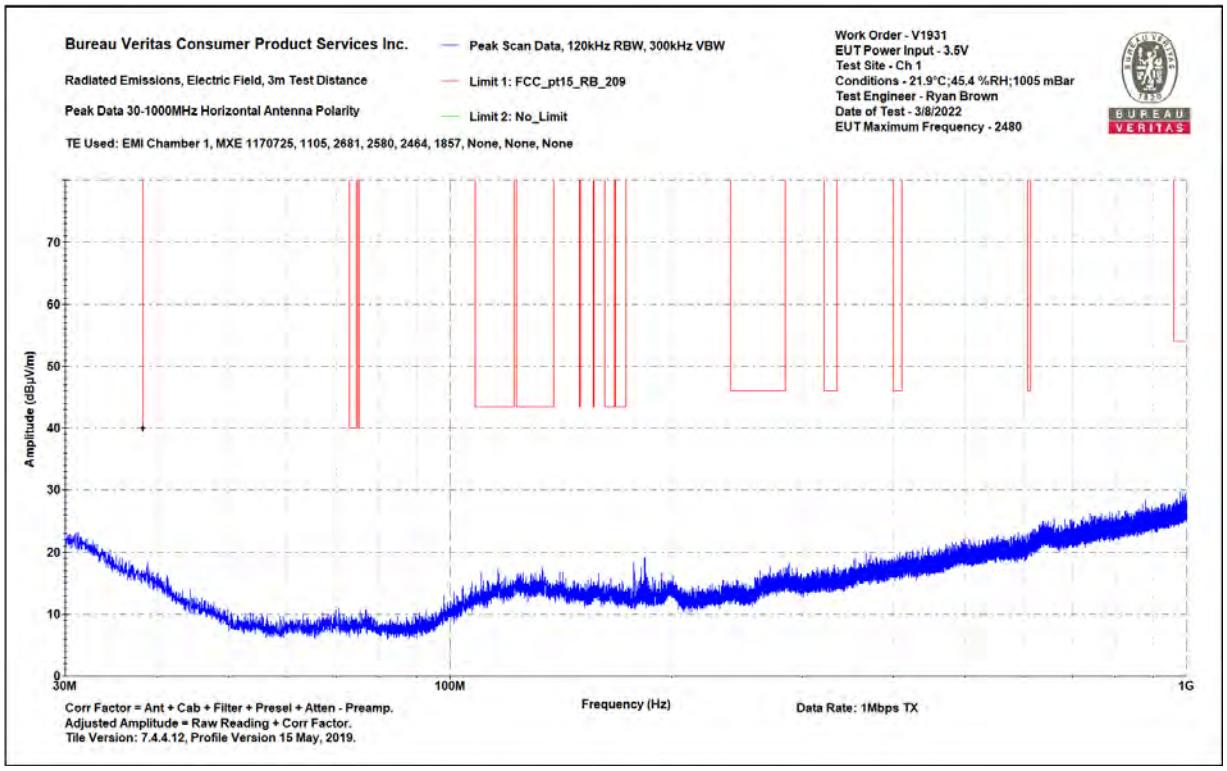


30-1000MHz Vertical

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Horizontal 30-1000MHz	Test Site - Ch 1
Notes:	Conditions - 21.9°C;45.4 %RH;1005 mBar
Data Rate: 1Mbps TX	Test Engineer - Ryan Brown
0	Date of Test - 3/8/2022

Frequency (MHz)	Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Lim1: FCC_pt15_RB_209 (dBµV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
407.16	29.9	-10.3	19.6	46	-26.4	PASS		200	225
611.976	30.4	-7.4	23	46	-23	PASS	-23	150	45
978.369	30.9	-1.3	29.6	54	-24.4	PASS		150	270

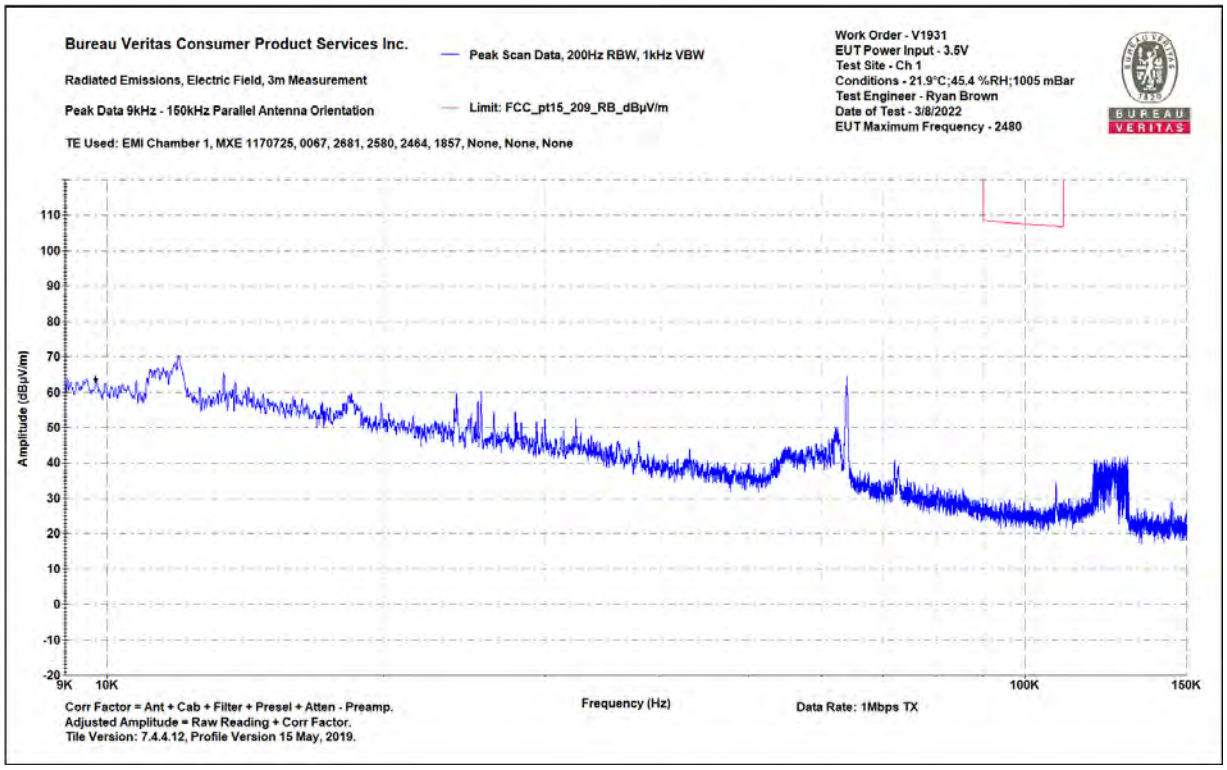
30-1000MHz Horizontal



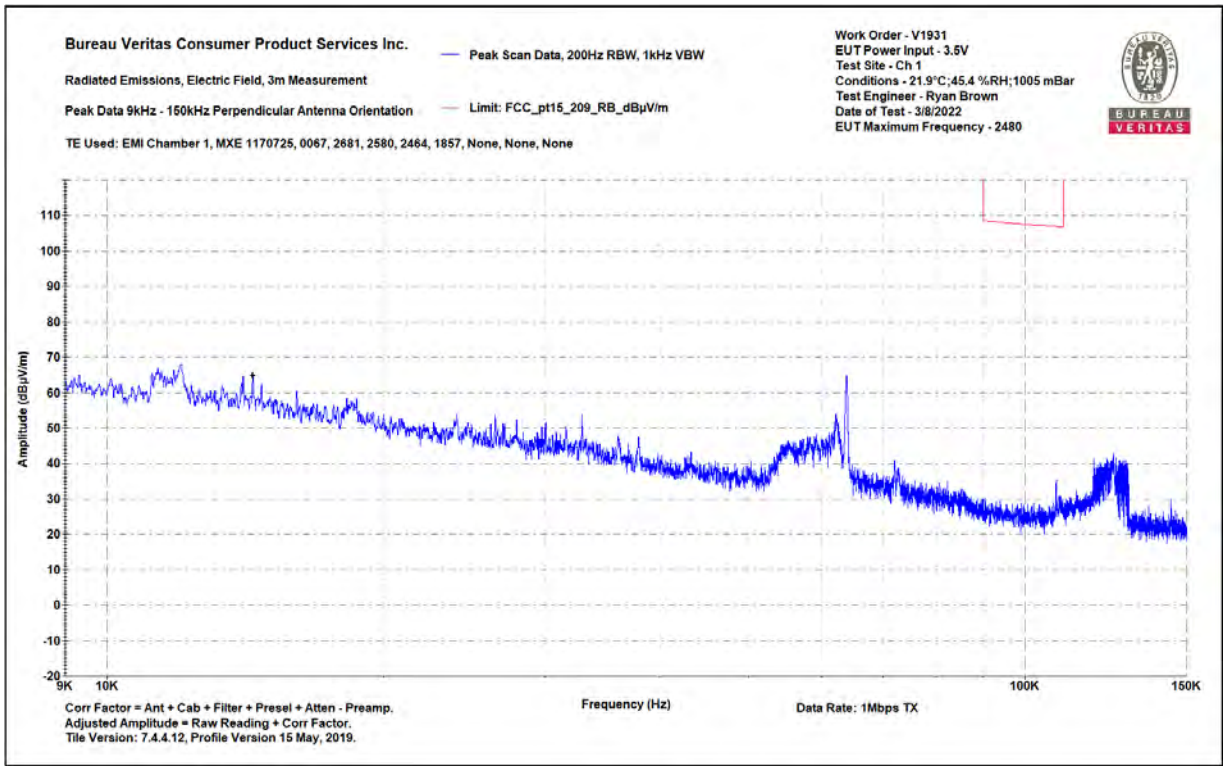
30-1000MHz Horizontal

Results for BLE 1Mbps GFSK Channel 39

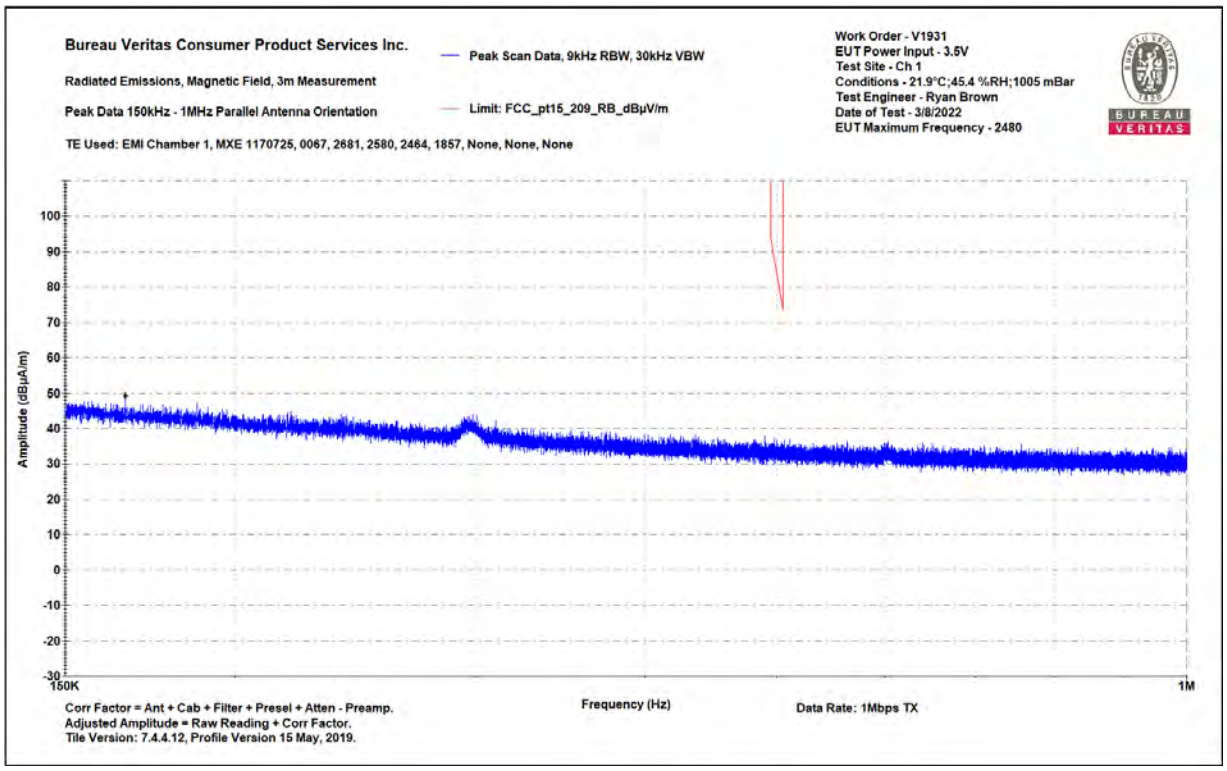
No emissions within 20dB of the limit were identified in 9kHz-30MHz range. Only plots shown below.



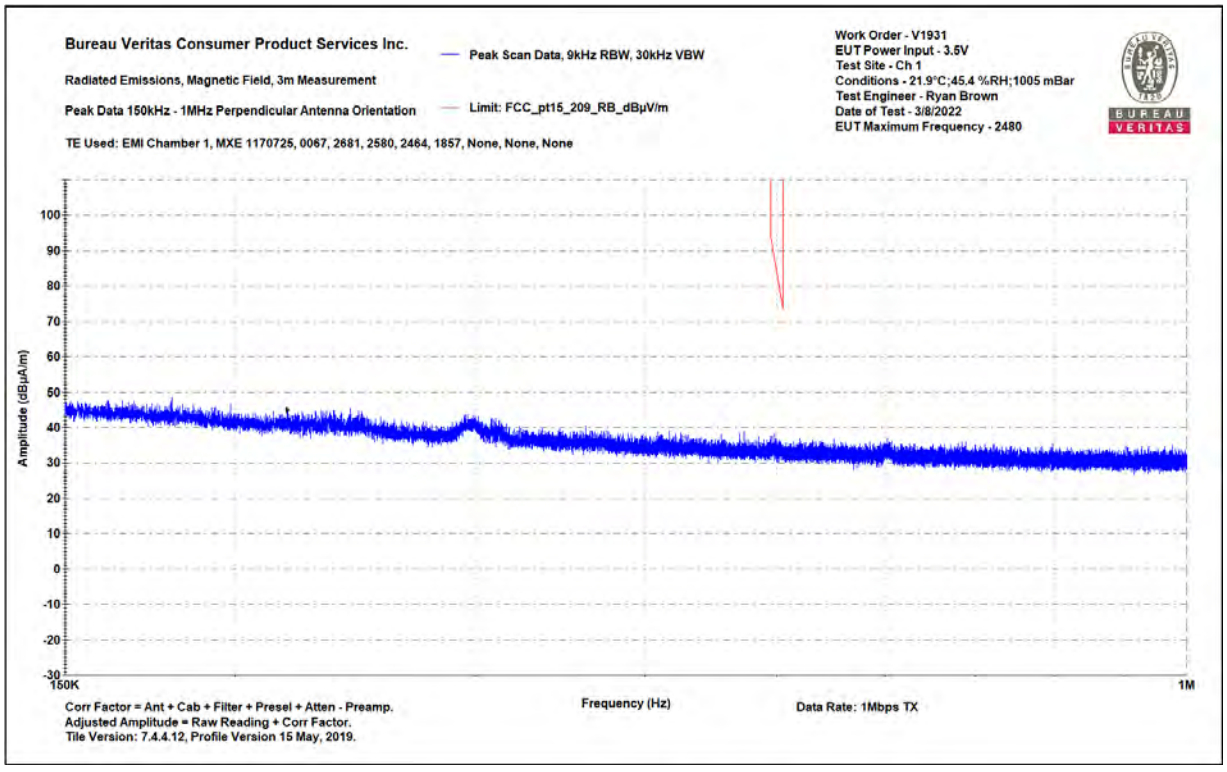
0.009-0.15MHz Parallel



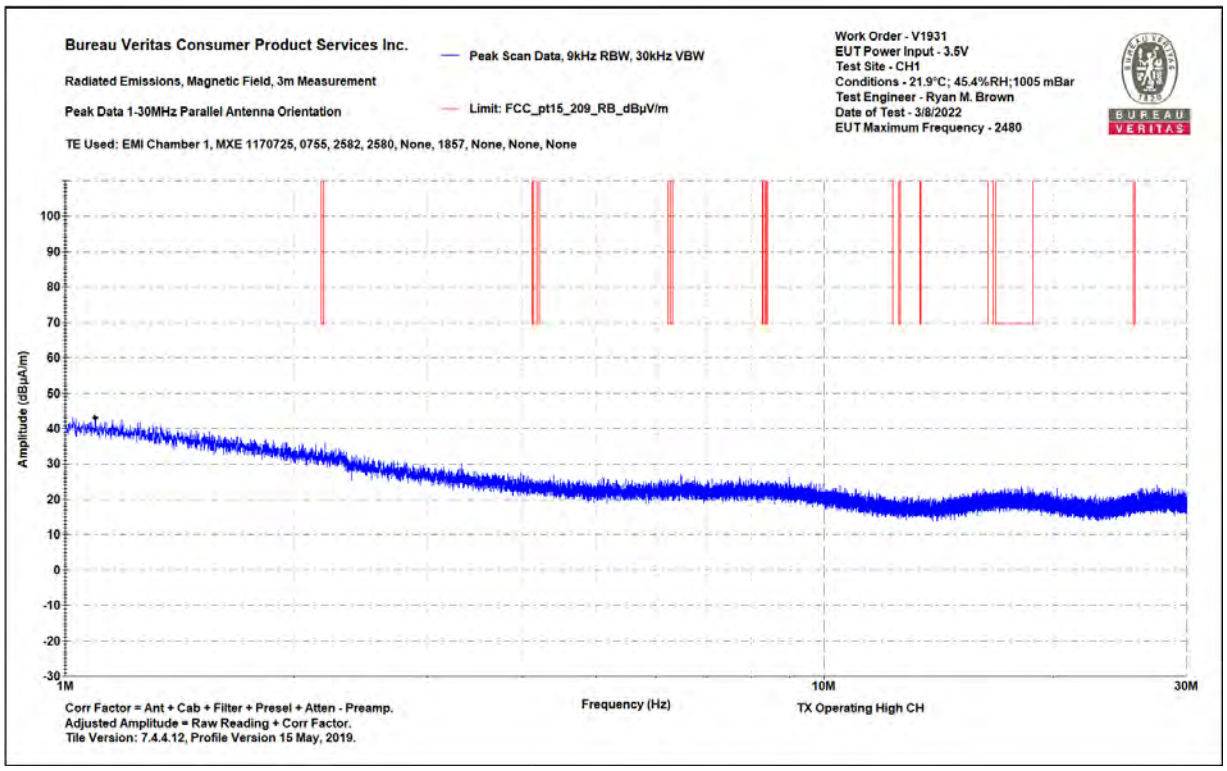
0.009-0.15MHz Perpendicular



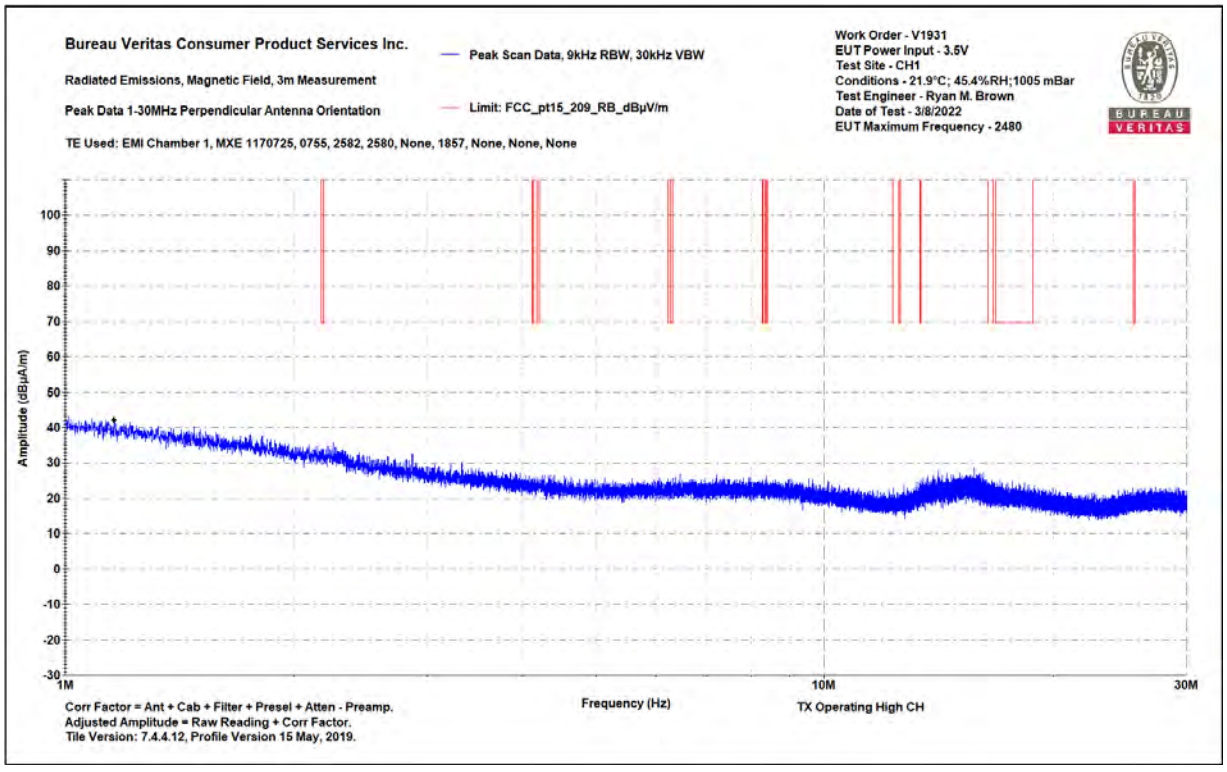
0.15-1MHz Parallel



0.15-1MHz Perpendicular



1-30MHz Parallel

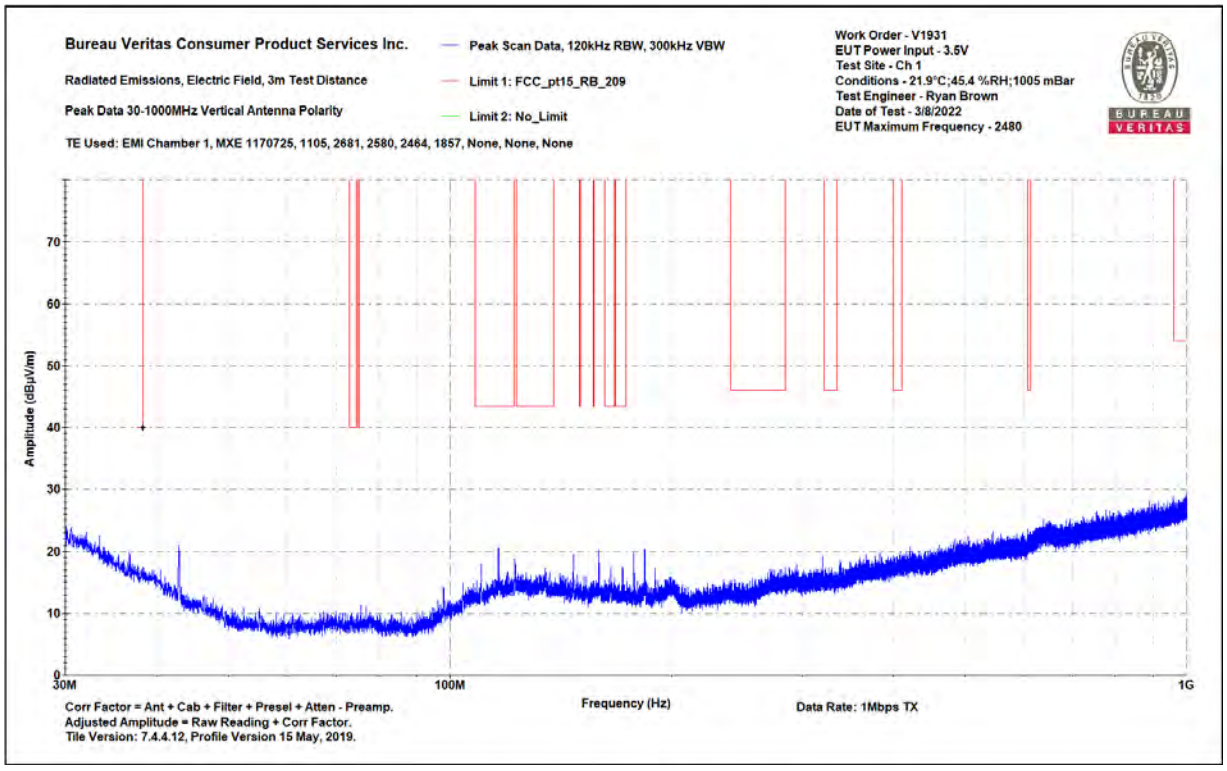


1-30MHz Perpendicular

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Vertical 30-1000MHz	Test Site - Ch 1
Notes:	Conditions - 21.9°C;45.4 %RH;1005 mBar
Data Rate: 1Mbps TX	Test Engineer - Ryan Brown
0	Date of Test - 3/8/2022

Frequency (MHz)	Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Lim1: FCC_pt15_RB_209 (dBµV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	Turntable Azimuth (degrees)
116.306	34.3	-13.7	20.5	43.5	-23	PASS		100	0
612.437	30.6	-7.4	23.2	46	-22.8	PASS	-22.8	250	90
997.187	29.6	-0.6	29	54	-25	PASS		100	0

30-1000MHz Vertical

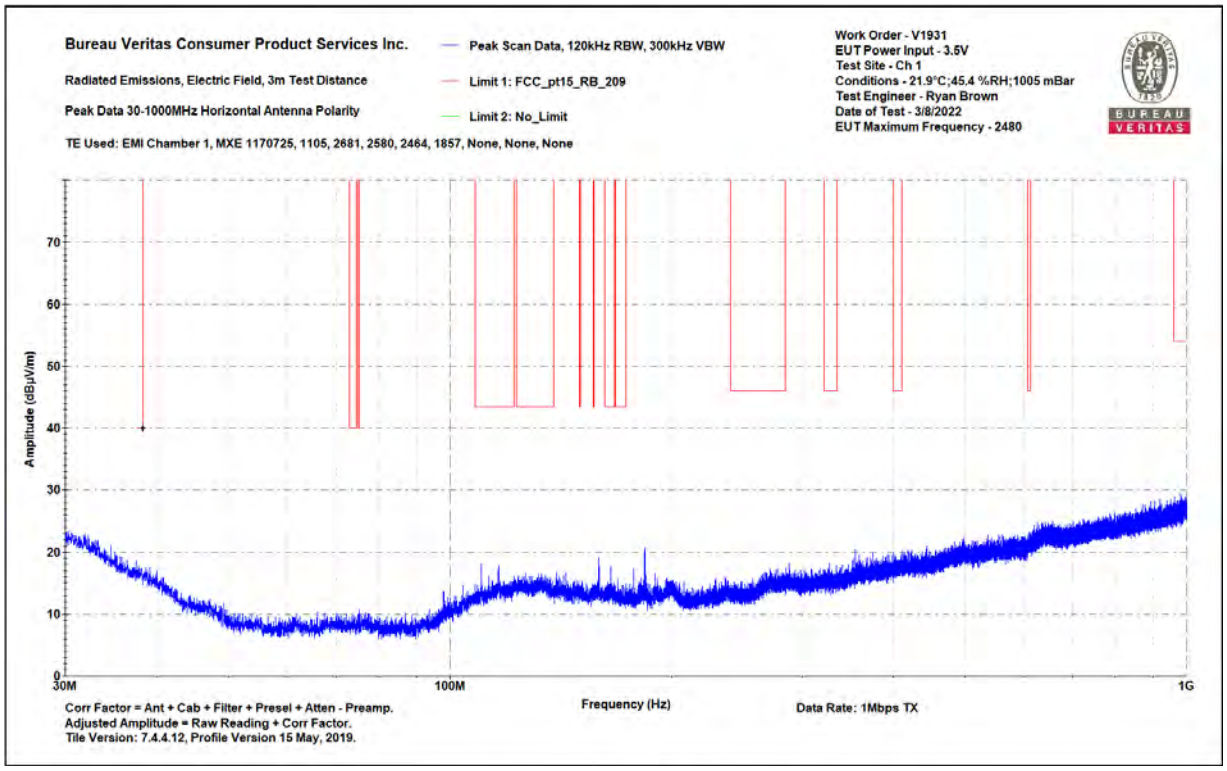


30-1000MHz Vertical

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Horizontal 30-1000MHz	Test Site - Ch 1
Notes:	Conditions - 21.9°C;45.4 %RH;1005 mBar
Data Rate: 1Mbps TX	Test Engineer - Ryan Brown
0	Date of Test - 3/8/2022

Frequency (MHz)	Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Lim1: FCC_pt15_RB_209 (dBµV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
110.171	32.6	-14.5	18.1	43.5	-25.4	PASS		250	270
610.933	30.7	-7.4	23.2	46	-22.8	PASS	-22.8	200	180
981.061	30.7	-1.2	29.5	54	-24.5	PASS		100	0

30-1000MHz Horizontal



30-1000MHz Horizontal

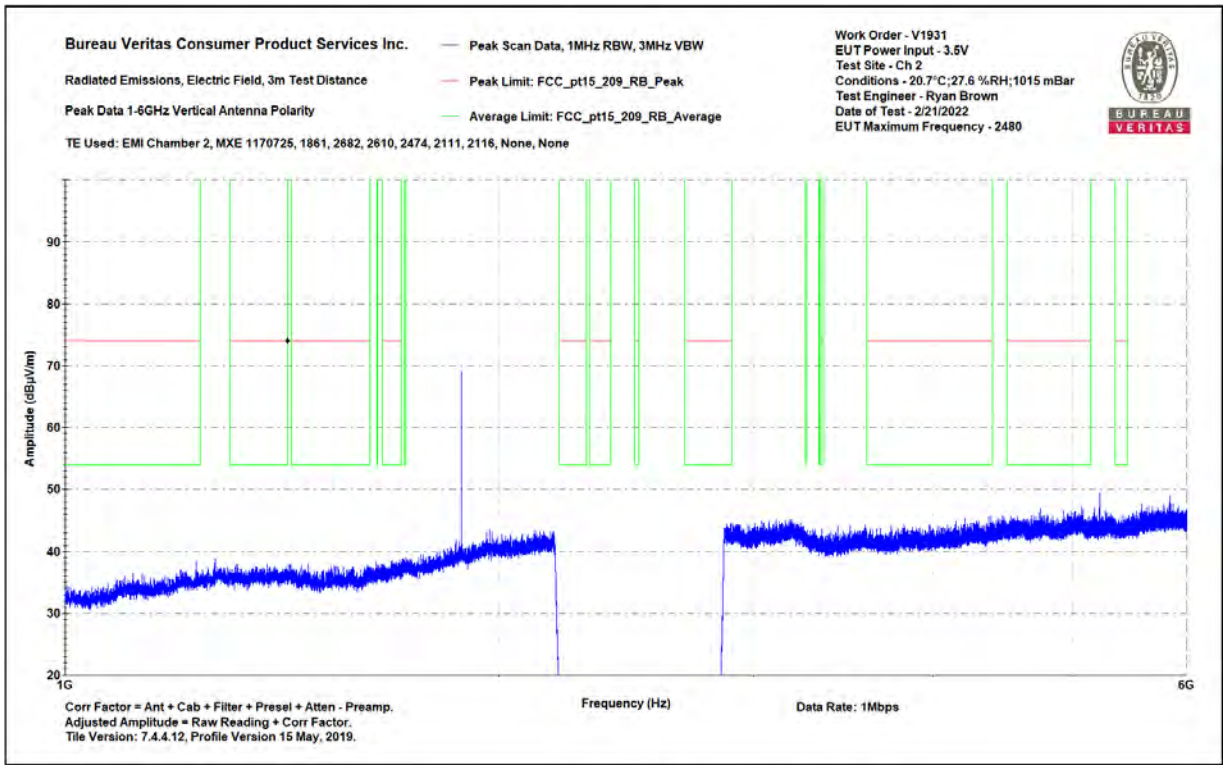
Emissions above 1GHz

Results for BLE 1Mbps GFSK Channel 0

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Vertical 1-6GHz	Test Site - Ch 2
Notes:	Conditions - 20.7°C;27.6 %RH;1015 mBar
Data Rate: 1Mbps	Test Engineer - Ryan Brown
0	Date of Test - 2/21/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_RB_Peak (dBµV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Margin to Average Limit (dB)	Average Limit Test Result (Pass/Fail)	Average Limit Worst Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
2899.5	47.9	-4.3	43.6	74	-30.4	PASS		54	-10.4	PASS		200	151
3267	46.8	-4.9	41.9	74	-32.1	PASS		54	-12.1	PASS		100	125
4400	48.6	-4	44.6	74	-29.4	PASS		54	-9.4	PASS		300	235
5149.88	47.5	-2.8	44.7	74	-29.3	PASS	-29.3	54	-9.3	PASS	-9.3	300	140

1-6GHz Vertical

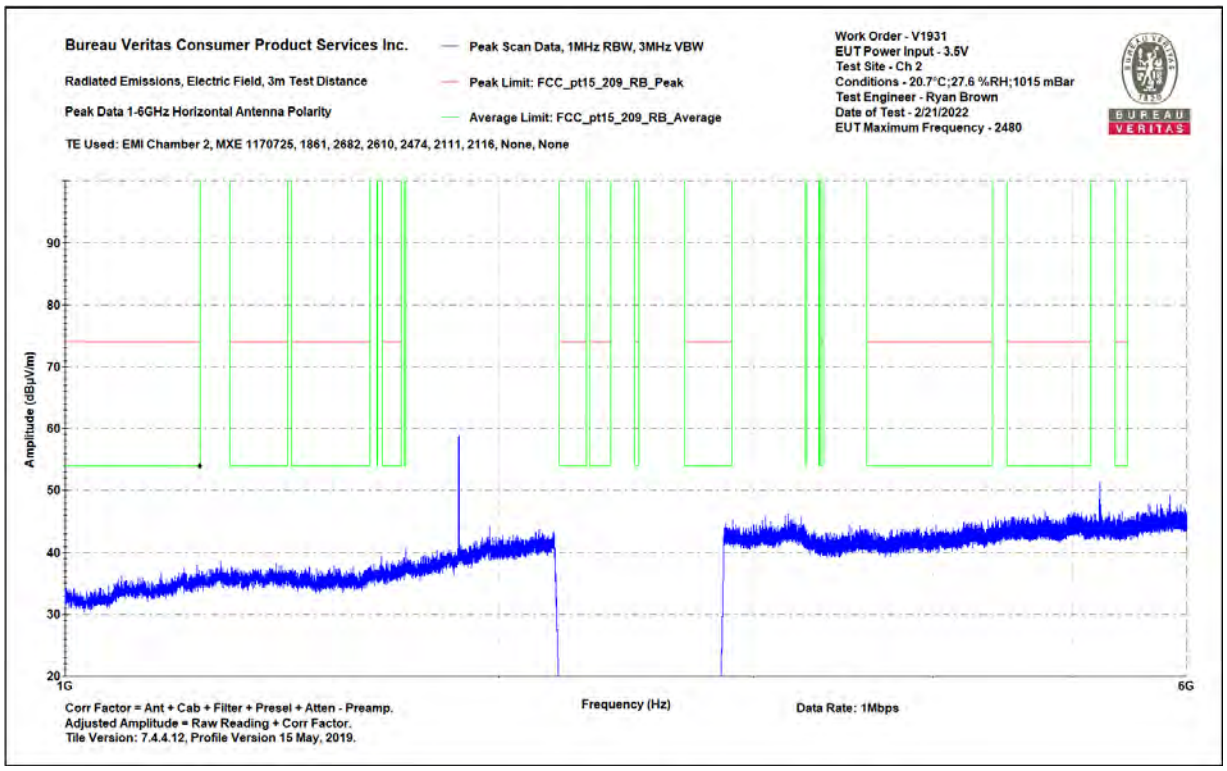


1-6GHz Vertical

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Horizontal 1-6GHz	Test Site - Ch 2
Notes:	Conditions - 20.7°C;27.6 %RH;1015 mBar
Data Rate: 1Mbps	Test Engineer - Ryan Brown
0	Date of Test - 2/21/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_RB_Peak (dBµV/m)	Margin to Peak Limit (dB)	Peak Limit Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Margin to Avg Limit (dB)	Avg Limit Results (Pass/Fail)	Avg Limit Worst Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
2900	47.4	-4.3	43.1	74	-30.9	PASS		54	-10.9	PASS		300	260
3267	47	-4.9	42.1	74	-31.9	PASS		54	-11.9	PASS		300	141
5147.25	48.7	-2.8	45.9	74	-28.1	PASS	-28.1	54	-8.1	PASS	-8.1	100	235

1-6GHz Horizontal

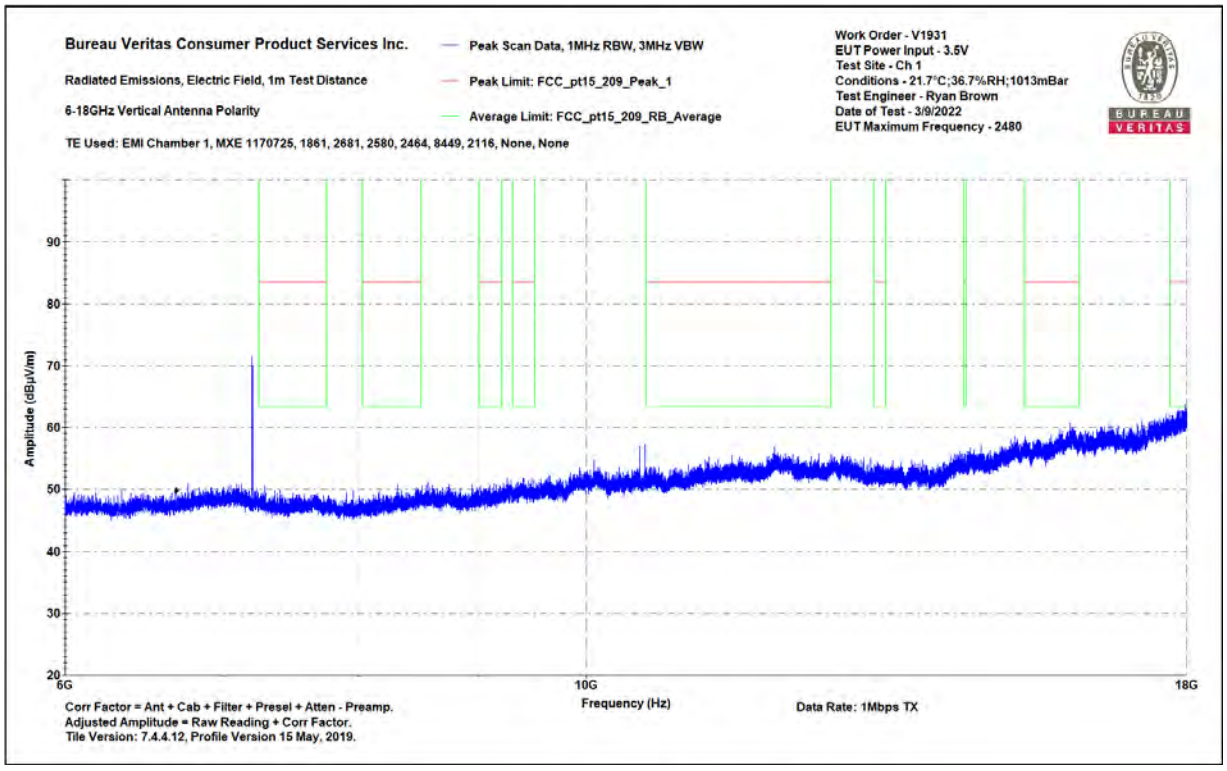


1-6GHz Horizontal

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 1m Distance	EUT Power Input - 3.5V
6-18GHz Vertical Data	Test Site - Ch 1
Notes:	Conditions - 21.7°C;36.7%RH;1013mBar
Data Rate: 1Mbps TX	Test Engineer - Ryan Brown
0	Date of Test - 3/9/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_Peak_1 (dBµV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
9393.9	42.6	34	5.4	47.9	83.5	-35.6	PASS		39.4	63.5	-24.1	PASS		100	78
12696.2	41.6	33.6	9.4	51	83.5	-32.5	PASS		43.1	63.5	-20.4	PASS		195	181
15352.1	44.2	35	11	55.2	83.5	-28.3	PASS		46	63.5	-17.5	PASS		100	66
17997.8	45.3	35	15.9	61.2	83.5	-22.3	PASS	-22.3	50.9	63.5	-12.6	PASS	-12.6	126	127

6-18GHz Vertical



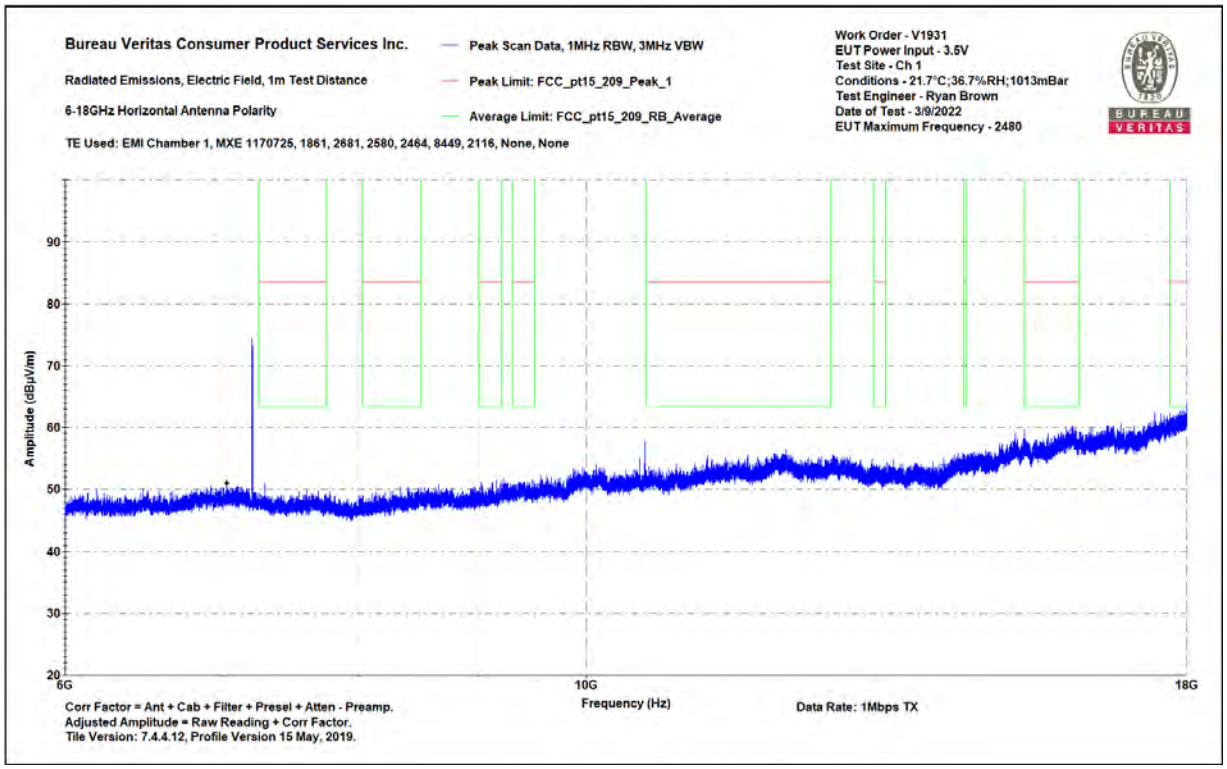
6-18GHz Vertical

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 1m Distance
6-18GHz Horizontal Data
Notes:
Data Rate: 1Mbps TX

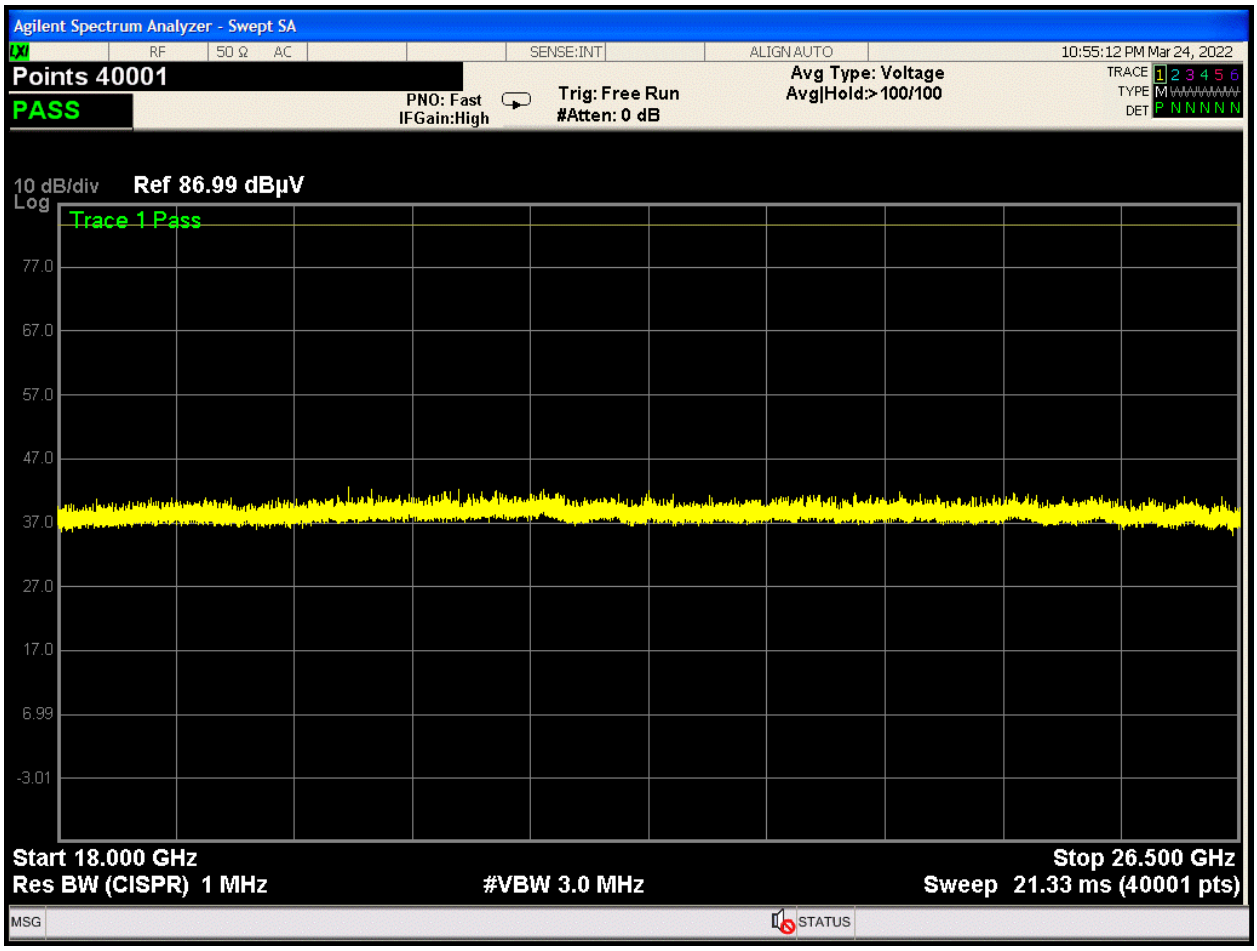
Work Order - V1931
EUT Power Input - 3.5V
Test Site - Ch 1
Conditions - 21.7°C;36.7%RH;1013mBar
Test Engineer - Ryan Brown
Date of Test - 3/9/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_Peak_1 (dBµV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
9481.4	43.1	34.3	5.1	48.2	83.5	-35.3	PASS		39.5	63.5	-24	PASS		108	19
12696	41.6	33.6	9.4	51	83.5	-32.5	PASS		43.1	63.5	-20.4	PASS		129	290
15355	42.7	34.9	11.1	53.8	83.5	-29.7	PASS		46	63.5	-17.5	PASS		148	78
17994.7	42.3	35	15.8	58.1	83.5	-25.4	PASS	-25.4	50.8	63.5	-12.7	PASS	-12.7	115	107

6-18GHz Horizontal



6-18GHz Horizontal


Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:55:12 PM Mar 24, 2022
Points 40001
PASS
PNO: Fast
IFGain:High
Trig: Free Run
#Atten: 0 dB
Avg Type: Voltage
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
10 dB/div
Log
Ref 86.99 dBµV
Trace 1 Pass
77.0
67.0
57.0
47.0
37.0
27.0
17.0
6.99
-3.01
Start 18.000 GHz
Res BW (CISPR) 1 MHz
#VBW 3.0 MHz
Stop 26.500 GHz
Sweep 21.33 ms (40001 pts)
MSG
STATUS

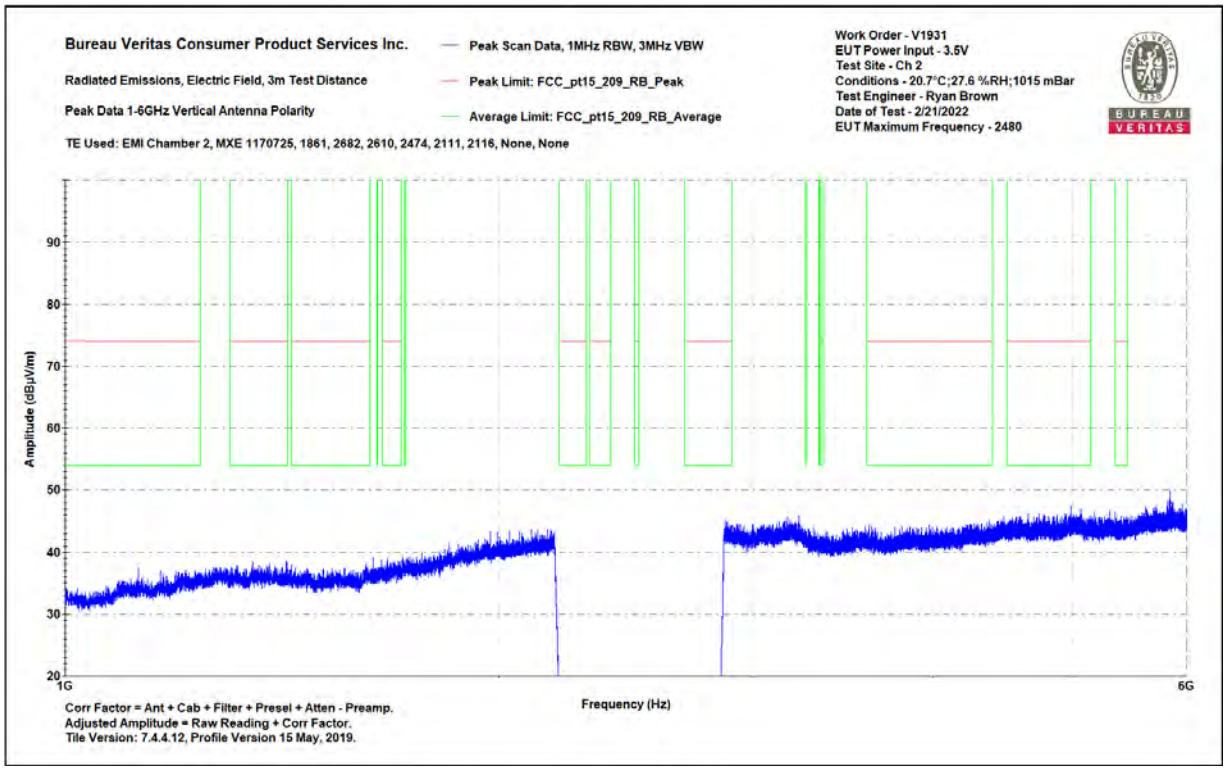
18-26.5GHz

Results for BLE 1Mbps GFSK Channel 19

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Vertical 1-6GHz	Test Site - Ch 2
Notes:	Conditions - 20.7°C;27.6 %RH;1015 mBar
Data Rate: 1Mbps	Test Engineer - Ryan Brown
0	Date of Test - 2/21/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_RB_Peak (dBµV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Margin to Average Limit (dB)	Average Limit Test Result (Pass/Fail)	Average Limit Worst Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
2899.88	47.9	-4.3	43.6	74	-30.4	PASS		54	-10.4	PASS		100	187
4399.88	48.1	-4	44.1	74	-29.9	PASS		54	-9.9	PASS		300	93
5149.13	47.5	-2.8	44.8	74	-29.2	PASS	-29.2	54	-9.2	PASS	-9.2	100	46

1-6GHz Vertical

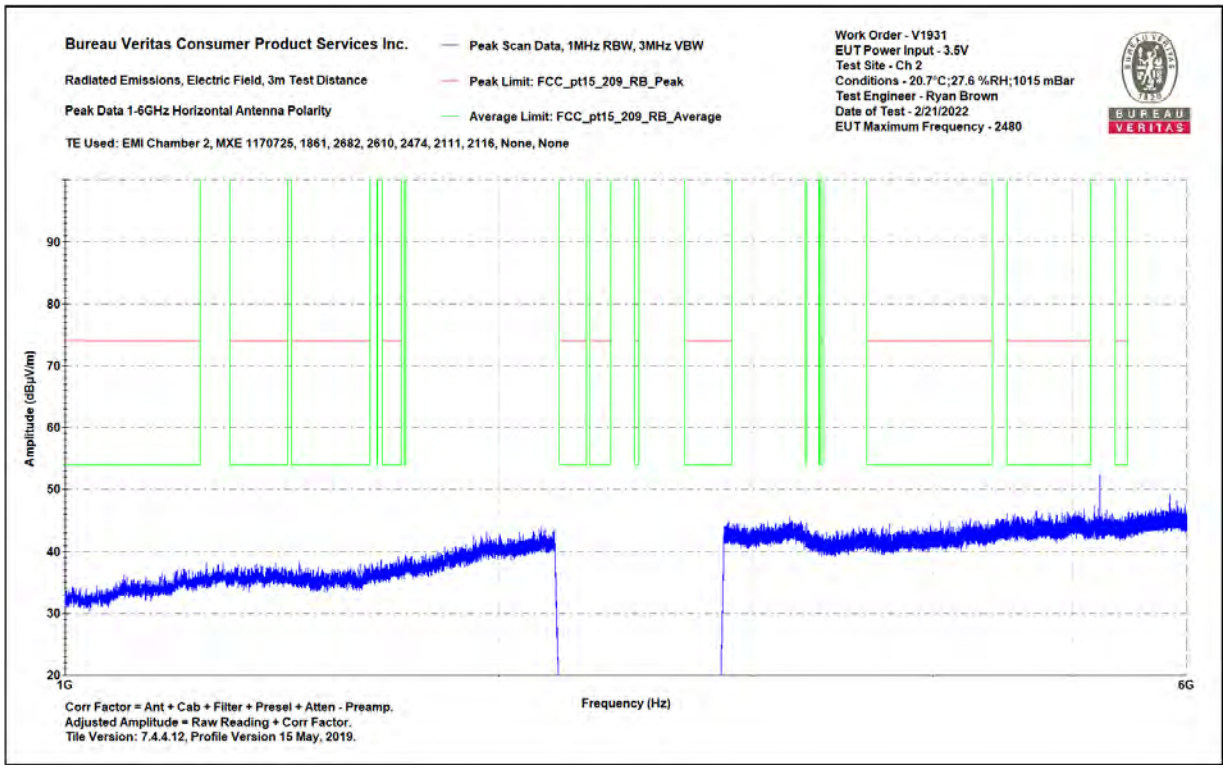


1-6GHz Vertical

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Horizontal 1-6GHz	Test Site - Ch 2
Notes:	Conditions - 20.7°C;27.6 %RH;1015 mBar
0	Test Engineer - Ryan Brown
	Date of Test - 2/21/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_RB_Peak (dBµV/m)	Margin to Peak Limit (dB)	Peak Limit Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Margin to Avg Limit (dB)	Avg Limit Results (Pass/Fail)	Avg Limit Worst Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
3267	46.3	-4.9	41.4	74	-32.6	PASS		54	-12.6	PASS		100	68
3267	46.3	-4.9	41.4	74	-32.6	PASS		54	-12.6	PASS		100	68
3339	47.3	-5.9	41.5	74	-32.5	PASS		54	-12.5	PASS		100	187
3339	47.3	-5.9	41.5	74	-32.5	PASS		54	-12.5	PASS		100	187
5149.38	47.3	-2.8	44.6	74	-29.4	PASS		54	-9.4	PASS		100	0
5459.75	47.7	-2.5	45.1	74	-28.9	PASS	-28.9	54	-8.9	PASS	-8.9	100	92

1-6GHz Horizontal

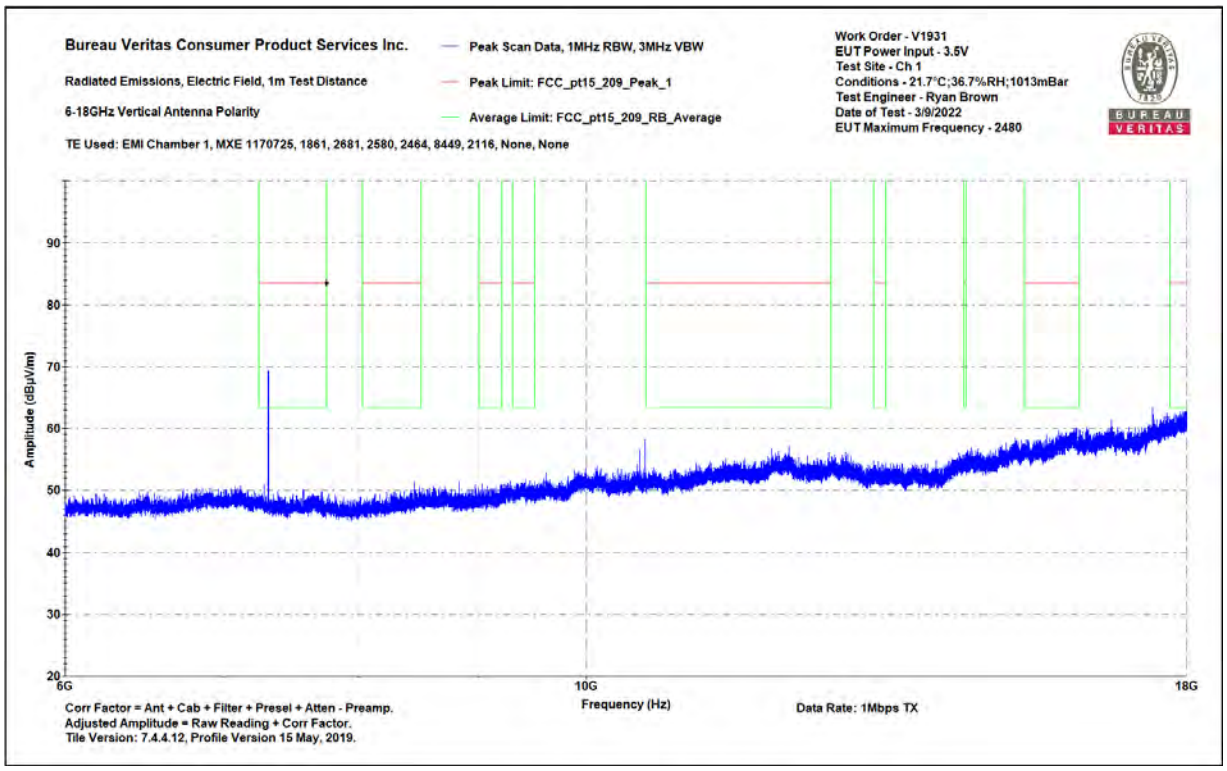


1-6GHz Horizontal

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 1m Distance	EUT Power Input - 3.5V
6-18GHz Vertical Data	Test Site - Ch 1
Notes:	Conditions - 21.7°C;36.7%RH;1013mBar
Data Rate: 1Mbps TX	Test Engineer - Ryan Brown
0	Date of Test - 3/9/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_Peak_1 (dBµV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
7319.3	59.7	49.7	4.4	64.1	83.5	-19.4	PASS	-19.4	54.1	63.5	-9.4	PASS	-9.4	200	301
9417.8	45.7	33.9	5.5	51.3	83.5	-32.2	PASS		39.4	63.5	-24.1	PASS		200	217
12695	41.8	33.6	9.4	51.3	83.5	-32.2	PASS		43	63.5	-20.5	PASS		200	296
15350.2	42.4	34.9	11	53.5	83.5	-30	PASS		46	63.5	-17.5	PASS		123	91
17998.1	43.6	34.9	15.9	59.4	83.5	-24.1	PASS		50.8	63.5	-12.7	PASS		200	237

6-18GHz Vertical



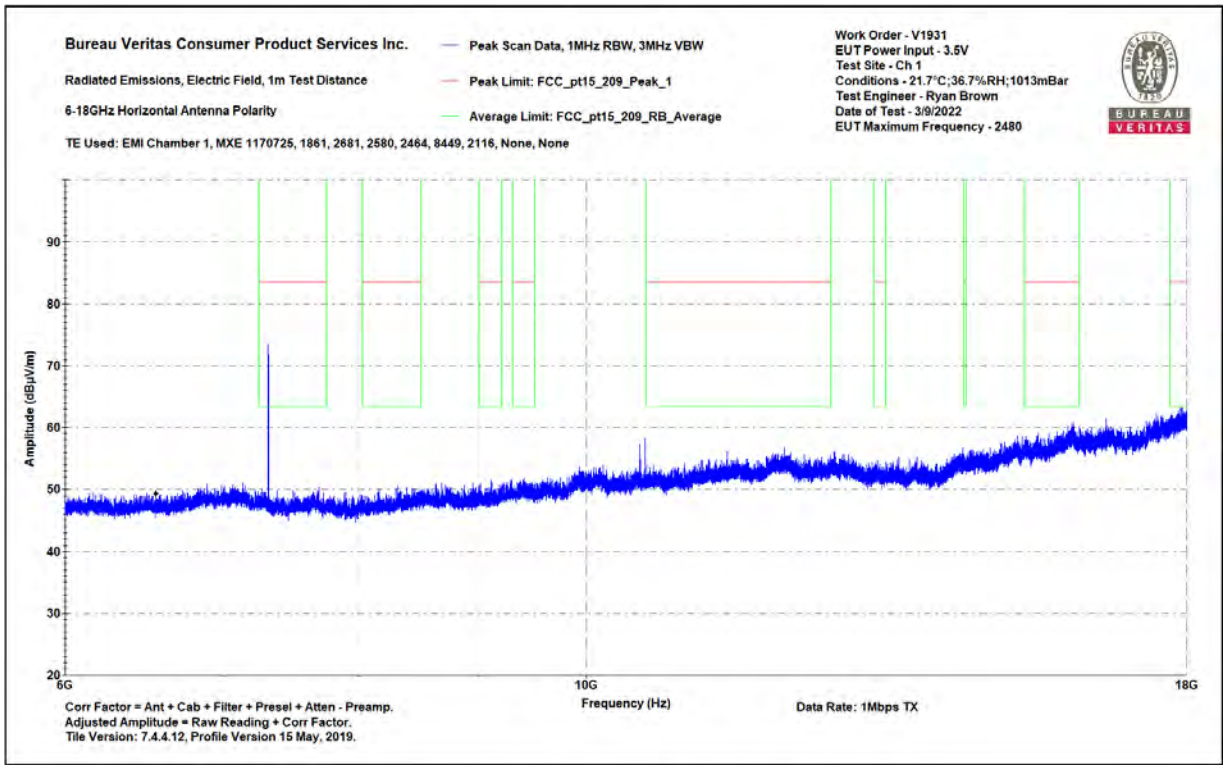
6-18GHz Vertical

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 1m Distance
6-18GHz Horizontal Data
Notes:
Data Rate: 1Mbps TX

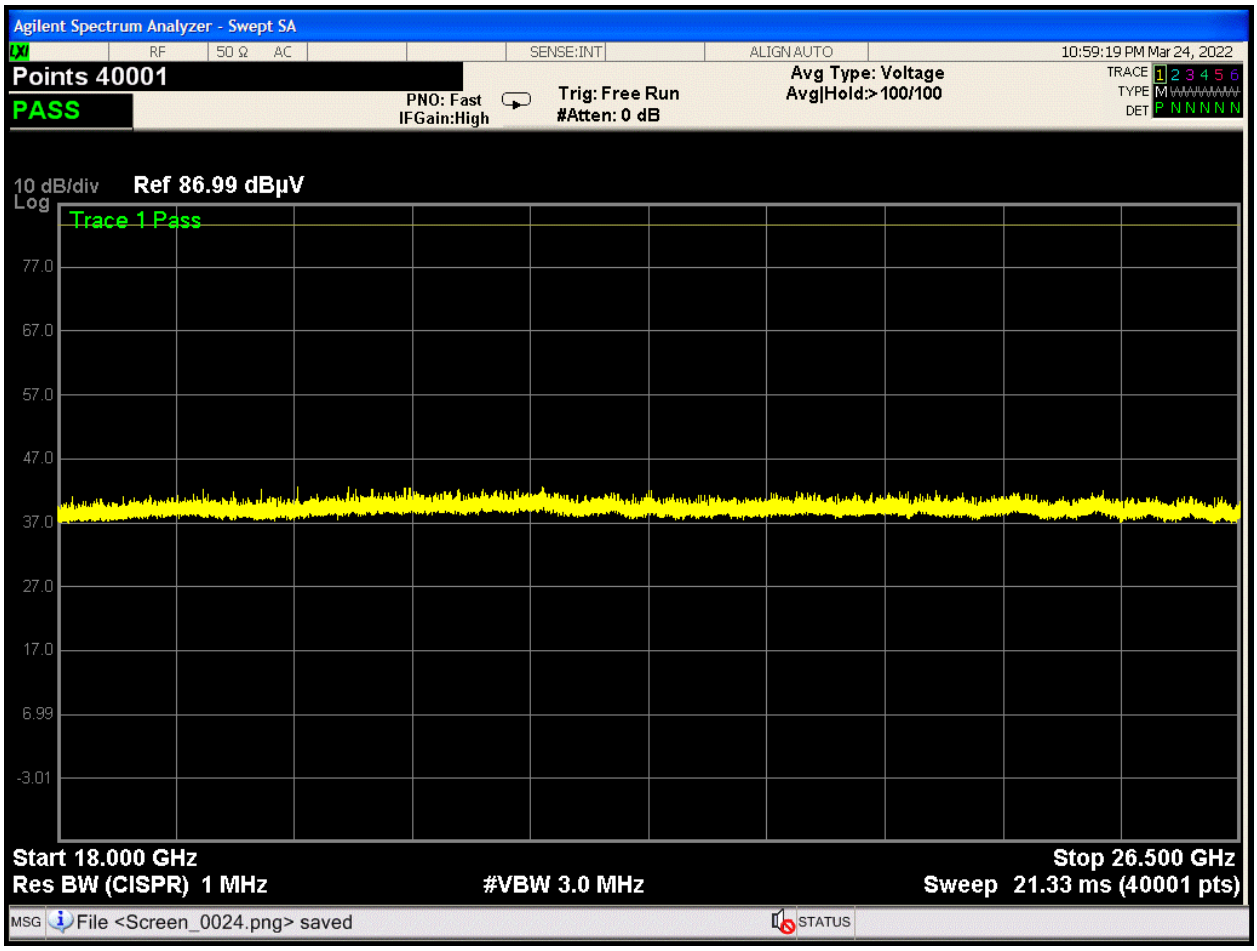
Work Order - V1931
EUT Power Input - 3.5V
Test Site - Ch 1
Conditions - 21.7°C;36.7%RH;1013mBar
Test Engineer - Ryan Brown
Date of Test - 3/9/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_Peak_1 (dBµV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
7319.4	69	58.8	4.4	73.4	83.5	-10.1	PASS	-10.1	63.2	63.5	-0.3	PASS	-0.3	175	13
9406.7	41.8	33.9	5.5	47.3	83.5	-36.2	PASS		39.4	63.5	-24.1	PASS		100	277
12694.6	43.7	33.6	9.4	53.1	83.5	-30.4	PASS		43	63.5	-20.5	PASS		108	244
17997.6	44.3	34.9	15.9	60.2	83.5	-23.3	PASS		50.8	63.5	-12.7	PASS		149	228

6-18GHz Horizontal



6-18GHz Horizontal


Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:59:19 PM Mar 24, 2022
Points 40001
PASS
PNO: Fast
IFGain:High
Trig: Free Run
#Atten: 0 dB
Avg Type: Voltage
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
10 dB/div
Log
Ref 86.99 dBµV
Trace 1 Pass
77.0
67.0
57.0
47.0
37.0
27.0
17.0
6.99
-3.01
Start 18.000 GHz
Res BW (CISPR) 1 MHz
#VBW 3.0 MHz
Stop 26.500 GHz
Sweep 21.33 ms (40001 pts)
MSG
File <Screen_0024.png> saved
STATUS

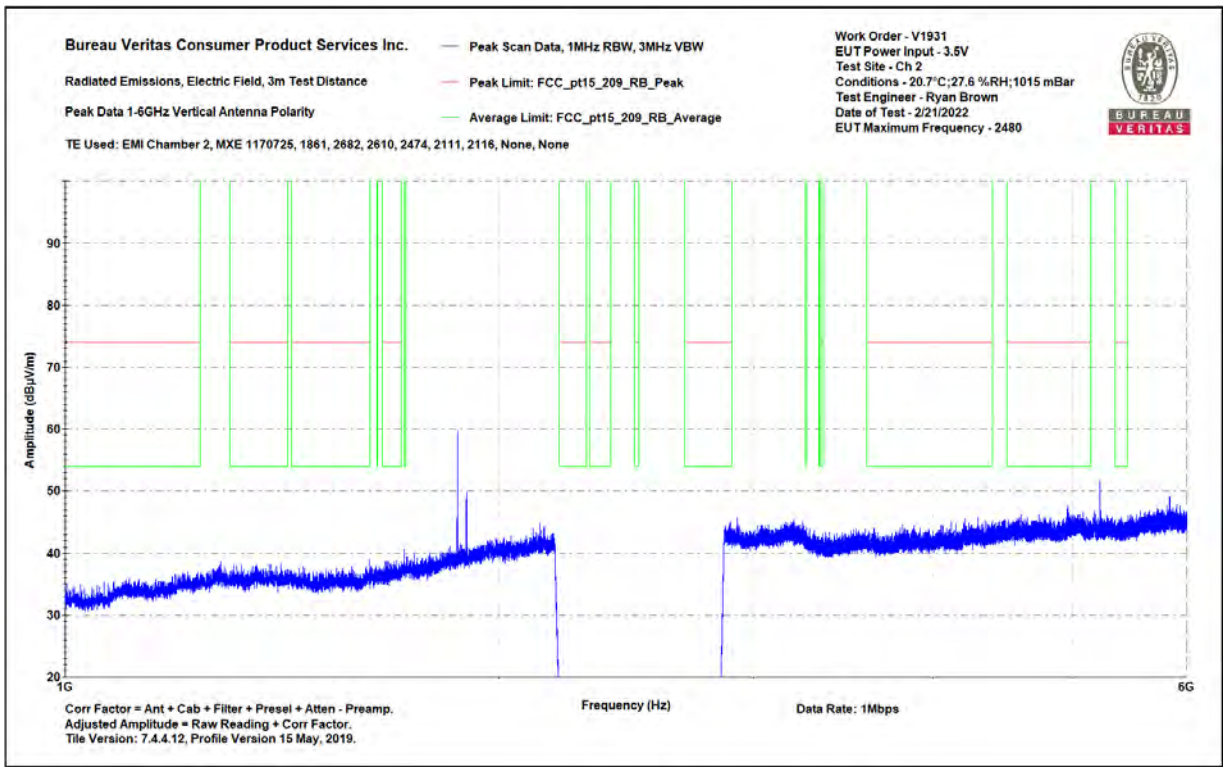
18-26.5GHz

Results for BLE 1Mbps GFSK Channel 39

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Vertical 1-6GHz	Test Site - Ch 2
Notes:	Conditions - 20.7°C;27.6 %RH;1015 mBar
Data Rate: 1Mbps	Test Engineer - Ryan Brown
0	Date of Test - 2/21/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_RB_Peak (dBµV/m)	Margin to Peak Limit (dB)	Peak Limit Test Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Margin to Average Limit (dB)	Average Limit Test Result (Pass/Fail)	Average Limit Worst Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
2899.13	48.2	-4.3	43.8	74	-30.2	PASS		54	-10.2	PASS		300	139
4398	49.2	-4	45.1	74	-28.9	PASS		54	-8.9	PASS		300	93
5149.5	48	-2.8	45.2	74	-28.8	PASS	-28.8	54	-8.8	PASS	-8.8	300	0

1-6GHz Vertical

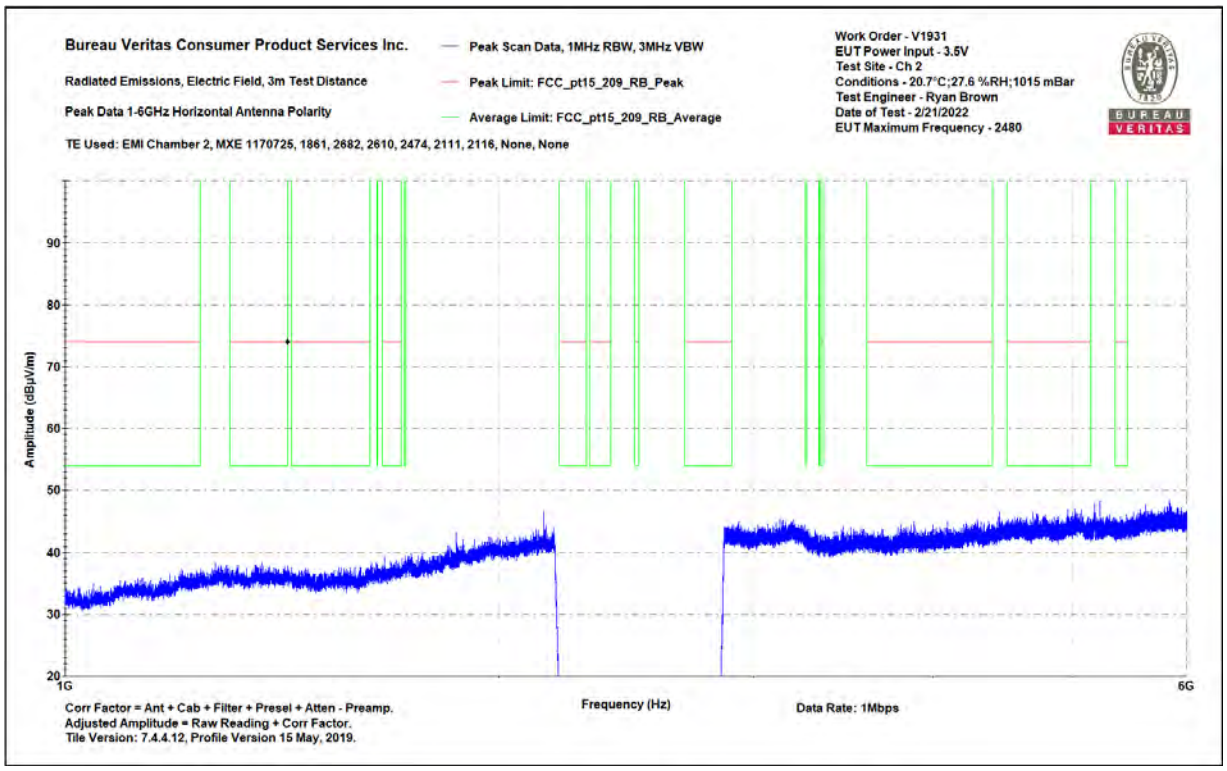


1-6GHz Vertical

Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 3.5V
Top Peaks Horizontal 1-6GHz	Test Site - Ch 2
Notes:	Conditions - 20.7°C;27.6 %RH;1015 mBar
Data Rate: 1Mbps	Test Engineer - Ryan Brown
0	Date of Test - 2/21/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_RB_Peak (dBµV/m)	Margin to Peak Limit (dB)	Peak Limit Results (Pass/Fail)	Peak Limit Worst Margin (dB)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Margin to Avg Limit (dB)	Avg Limit Results (Pass/Fail)	Avg Limit Worst Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
2899.63	48.4	-4.3	44.1	74	-29.9	PASS		54	-9.9	PASS		300	0
4399.88	48.5	-4	44.5	74	-29.5	PASS		54	-9.5	PASS		200	151
5149.25	47.6	-2.8	44.8	74	-29.2	PASS	-29.2	54	-9.2	PASS	-9.2	200	175

1-6GHz Horizontal



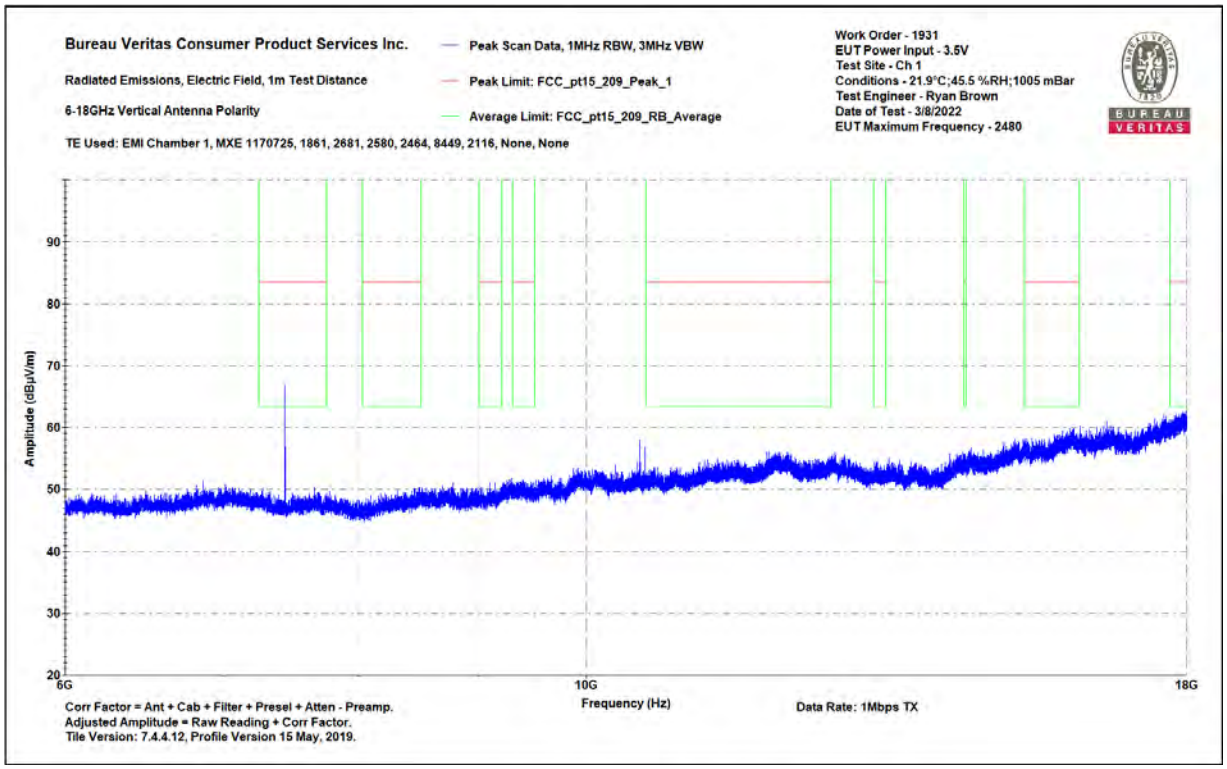
1-6GHz Horizontal

Bureau Veritas Consumer Product Services Inc.
Radiated Emissions Electric Field 1m Distance
6-18GHz Vertical Data
Notes:
Data Rate: 1Mbps TX

Work Order - V1931
EUT Power Input - 3.5V
Test Site - Ch 1
Conditions - 21.9°C;45.5 %RH;1005 mBar
Test Engineer - Ryan Brown
Date of Test - 3/8/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_Peak_1 (dBµV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
7440.8	59.5	48.6	3.8	63.3	83.5	-20.2	PASS	-20.2	52.4	63.5	-11.1	PASS	-11.1	200	293
9394.5	44.6	34.1	5.4	50	83.5	-33.5	PASS		39.5	63.5	-24	PASS		126	176
12696.5	42.8	33.6	9.4	52.3	83.5	-31.2	PASS		43.1	63.5	-20.4	PASS		200	253
17998.9	44.3	35	15.9	60.2	83.5	-23.3	PASS		50.9	63.5	-12.6	PASS		104	110

6-18GHz Vertical

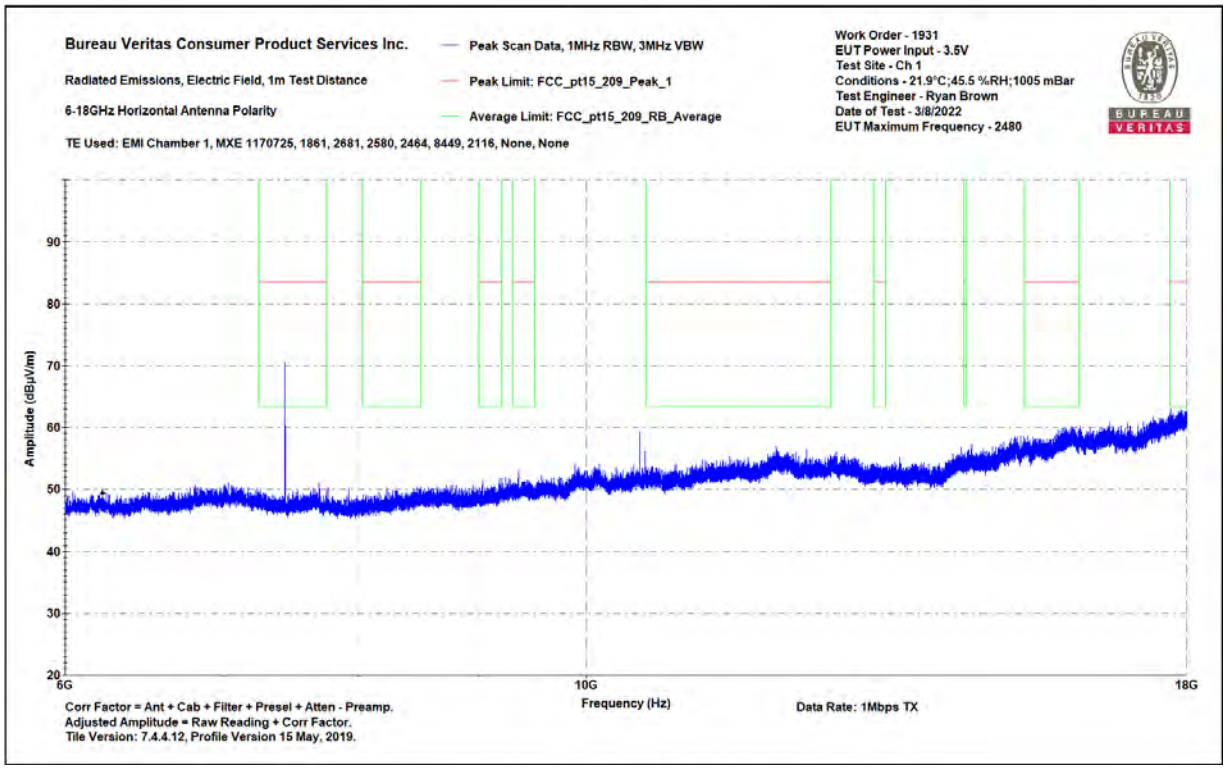


6-18GHz Vertical

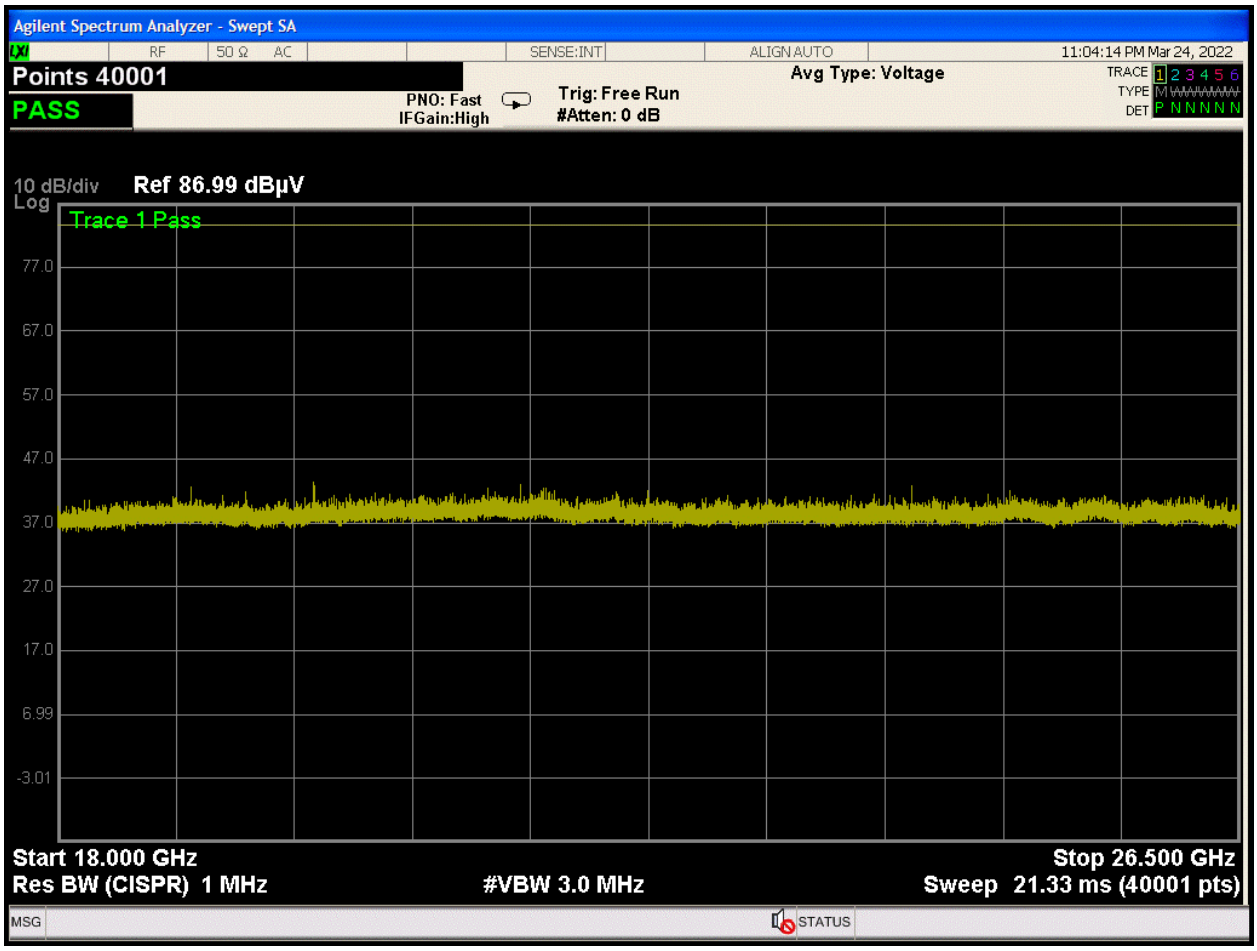
Bureau Veritas Consumer Product Services Inc.	Work Order - V1931
Radiated Emissions Electric Field 1m Distance	EUT Power Input - 3.5V
6-18GHz Horizontal Data	Test Site - Ch 1
Notes:	Conditions - 21.9°C;45.5 %RH;1005 mBar
Data Rate: 1Mbps TX	Test Engineer - Ryan Brown
0	Date of Test - 3/8/2022

Frequency (MHz)	Raw Peak Reading (dBµV)	Raw Avg Reading (dBµV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBµV/m)	Pk Lim: FCC_pt15_209_Peak_1 (dBµV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBµV/m)	Av Lim: FCC_pt15_209_RB_Average (dBµV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)	Antenna Height (cm)	EUT Azimuth (degrees)
7440.8	67.9	57.4	3.8	71.7	83.5	-11.8	PASS	-11.8	61.2	63.5	-2.3	PASS	-2.3	155	1
9356.8	41.9	34	4.9	46.7	83.5	-36.8	PASS		38.9	63.5	-24.6	PASS		197	260
12696.8	42.2	33.7	9.4	51.6	83.5	-31.9	PASS		43.2	63.5	-20.3	PASS		176	75
17998.3	44.7	35.1	15.9	60.6	83.5	-22.9	PASS		50.9	63.5	-12.6	PASS		143	11

6-18GHz Horizontal



6-18GHz Horizontal



18-26.5GHz

BLE 1Mbps GFSK Radiated Band-edge:

Radiated Emissions Table

Date: 26-May-22 **Company:** Onset Computer **Work Order:** V1931
Engineer: Ryan M. Brown **EUT Desc:** HOBO MX Soil Moisture and Temperature Logger **EUT Operating Voltage/Frequency:** Battery
Temp: **Humidity:** **Pressure:**
Frequency Range: Band Edge **Measurement Distance:** 3 m
Notes: **EUT Max Freq:** 2480

Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak Limit (dBµV/m)	Peak Margin (dB)	Peak Result (Pass/Fail)	FCC Class B High Frequency - Average Limit (dBµV/m)	Average Margin (dB)	Average Result (Pass/Fail)
Low CH 2402														
V	2390.0	47.42	47.4	42.6	32.2	9.7	46.7	46.7	74.0	-27.3	Pass	54.0	-7.3	Pass
H	2390.0	46.52	46.5	42.6	32.2	9.7	45.8	45.8	74.0	-28.2	Pass	54.0	-8.2	Pass
				---	---	---	---	---	---	---	---	---	---	---
High CH 2480				---	---	---	---	---	---	---	---	---	---	---
V	2483.5	53.22	37.1	42.7	32.4	9.9	52.8	36.7	74.0	-21.2	Pass	54.0	-17.3	Pass
H	2483.5	51.15	37.9	42.7	32.4	9.9	50.8	37.5	74.0	-23.2	Pass	54.0	-16.5	Pass
				---	---	---	---	---	---	---	---	---	---	---

Table Result: Pass by -7.3 dB ***Worst Freq:*** 2390.0 MHz

Test Site: EMI Chamber 1 **Cable 1:** Asset #2681 **Cable 2:** Asset #2580 **Cable 3:** Asset #2464
Analyzer: Asset #1327 **Preamp:** Asset #2111 **Antenna:** Blue Horn **Preselector:** ---
CSsoft Radiated Emissions Calculator v 1.017.222
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor

BLE 2Mbps GFSK Radiated Band-edge:

Radiated Emissions Table

Date: 15-Nov-22 **Company:** Onset Computer **Work Order:** V1931
Engineer: Ryan M. Brown **EUT Desc:** HOBO MX Soil Moisture and Temperature Logger **EUT Operating Voltage/Frequency:** Battery
Temp: 21.2C **Humidity:** 33% **Pressure:** 1025
Frequency Range: Band Edge **Measurement Distance:** 3 m
Notes: **EUT Max Freq:** 2480

Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
2Mbps				---	---	---	---	---	---	---	---	---	---	---
Low Ch 2402				---	---	---	---	---	---	---	---	---	---	---
V	2390.0	46.7	46.7	38.5	32.0	9.6	49.8	49.8	74.0	-24.2	Pass	54.0	-4.2	Pass
H	2390.0	45.3	45.3	38.5	32.0	9.6	48.4	48.4	74.0	-25.6	Pass	54.0	-5.6	Pass
				---	---	---	---	---	---	---	---	---	---	---
High CH 2480				---	---	---	---	---	---	---	---	---	---	---
V	2483.5	52.9	37.7	38.6	32.8	9.9	57.0	41.8	74.0	-17.0	Pass	54.0	-12.2	Pass
H	2483.5	46.6	46.6	38.6	32.8	9.9	50.7	50.7	74.0	-23.3	Pass	54.0	-3.3	Pass
				---	---	---	---	---	---	---	---	---	---	---

Table Result: Pass by -3.3 dB ***Worst Freq:*** 2483.5 MHz

Test Site: EMI Chamber 1 **Cable 1:** Asset #2681 **Cable 2:** Asset #2580 **Cable 3:** Asset #2474
Analyzer: Asset #2093 **Preamp:** 8449 **Antenna:** Blue Horn **Preselector:** ---
CSsoft Radiated Emissions Calculator v 1.017.222

Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor

4.3 CHANNEL BANDWIDTH MEASUREMENT 6dB BW & 99% OBW

4.3.1 LIMIT OF 6dB CHANNEL BANDWIDTH

The minimum 6 dB bandwidth shall be 500 kHz.

4.3.2 TEST INSTRUMENTS

Equipment	Manufacturer	Asset No.	Model No.	Serial No.	Last Cal.	Next Cal.
Cable	Carlisle	2595	UTiFLEX		1/21/2022	1/21/2023
Signal Analyzer	Rohde-Schwarz	2200	FSV 40	101551	10/26/2021	10/26/2022

4.3.3 TEST PROCEDURE

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

99% OBW

a. The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.

b. The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.

c. Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

d. Step a) through step c) might require iteration to adjust within the specified range.

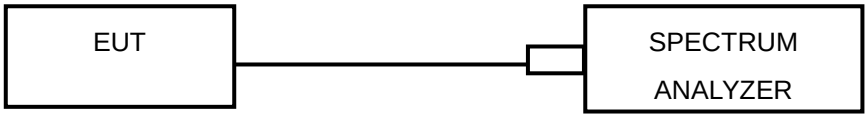
e. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

f. Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

4.3.5 TEST SETUP



4.3.6 TEST RESULTS

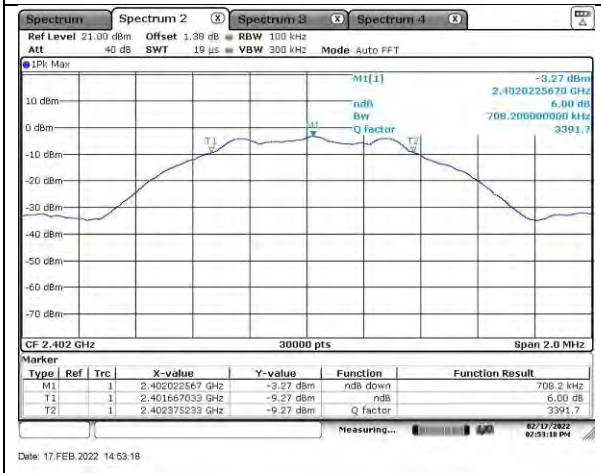
BLE (GFSK)

1Mbps:

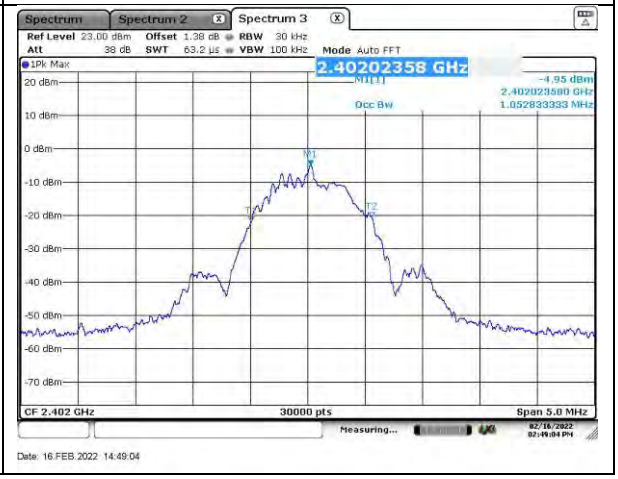
CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	99% OBW (MHz)	PASS / FAIL
0	2402	0.708	1.053	PASS
19	2440	0.716	1.055	PASS
39	2480	0.707	1.056	PASS

CH0

6dB Bandwidth

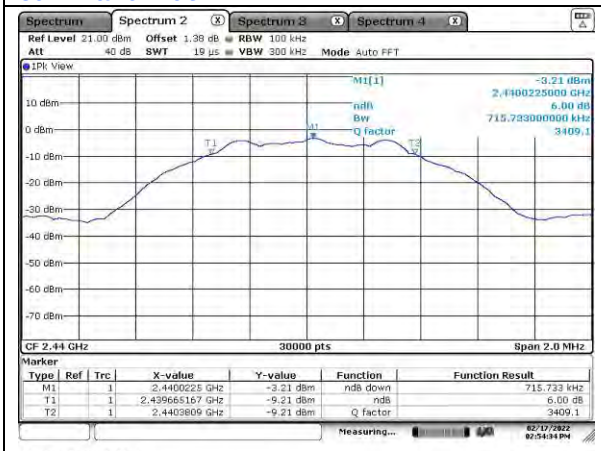


99% OBW



CH19

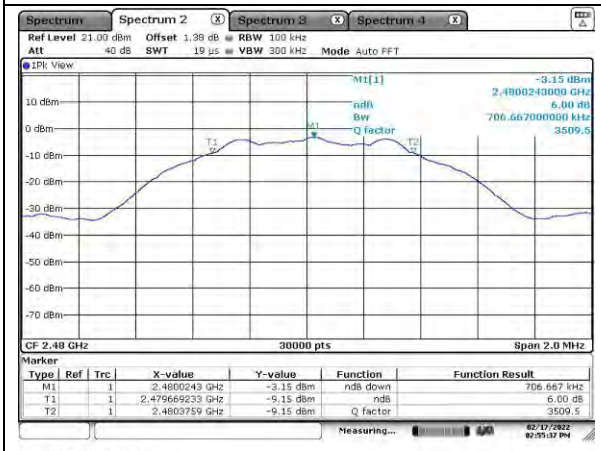
6dB Bandwidth



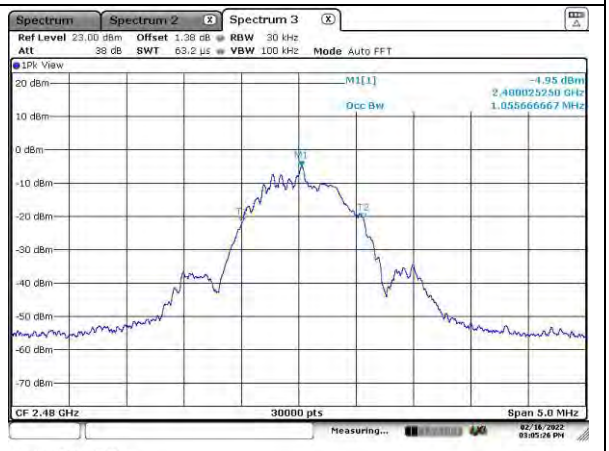
99% OBW

CH39

6dB Bandwidth



99% OBW

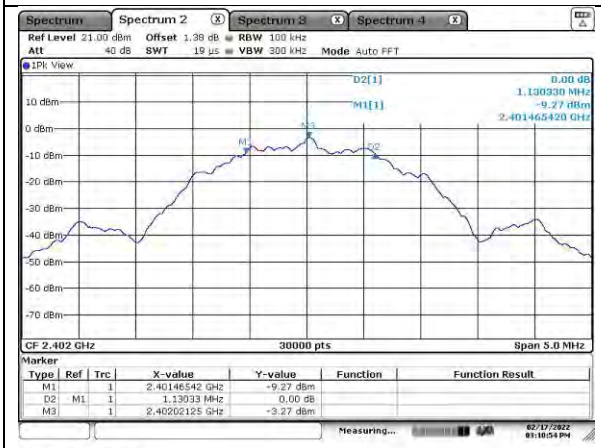


2Mbps:

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	99% OBW (MHz)	PASS / FAIL
0	2402	1.130	2.044	PASS
19	2440	1.132	2.048	PASS
39	2480	1.142	2.052	PASS

CH0

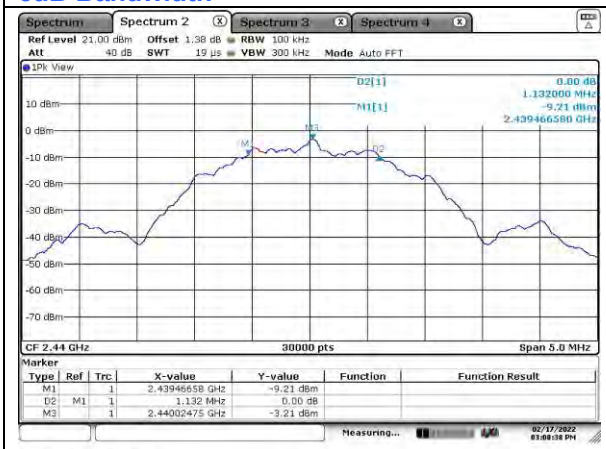
6dB Bandwidth



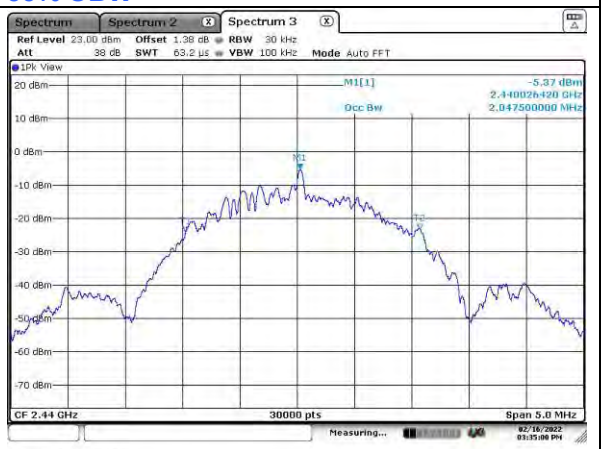
99% OBW

CH19

6dB Bandwidth

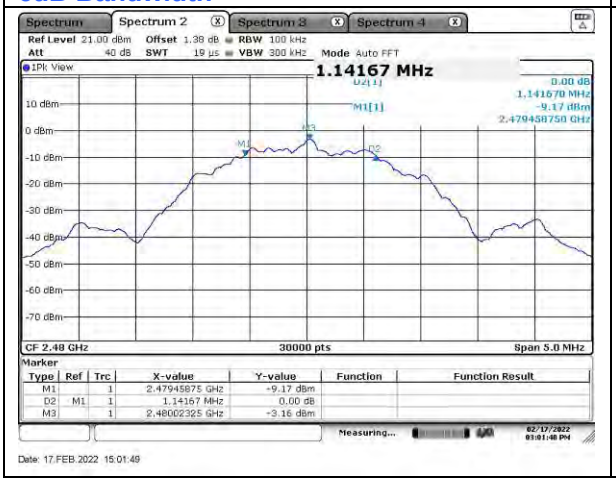


99% OBW

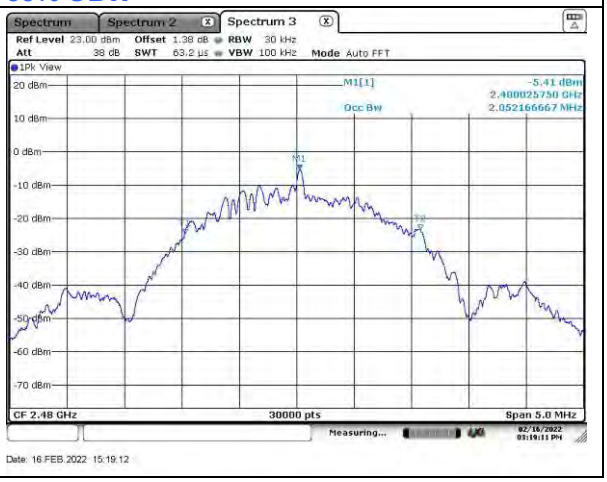


CH39

6dB Bandwidth



99% OBW

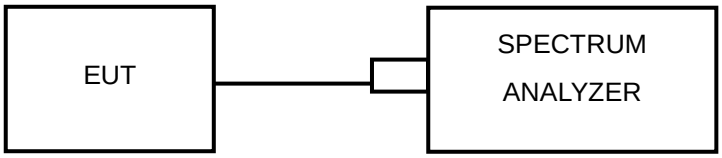


4.4 CONDUCTED OUTPUT POWER

4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz band: 1 Watt (30dBm)

4.4.2 TEST SETUP



4.4.3 TEST INSTRUMENTS

Refer to section 4.3.2.

4.4.4 TEST PROCEDURES

Per 11.9.1.1 of ANSI C63.10, for peak conducted output power measurement when RBW ≥ DTS bandwidth.

4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

4.4.6 EUT OPERATING CONDITIONS

EUT was operated according to manufacturer's specifications.

4.4.7 TEST RESULTS

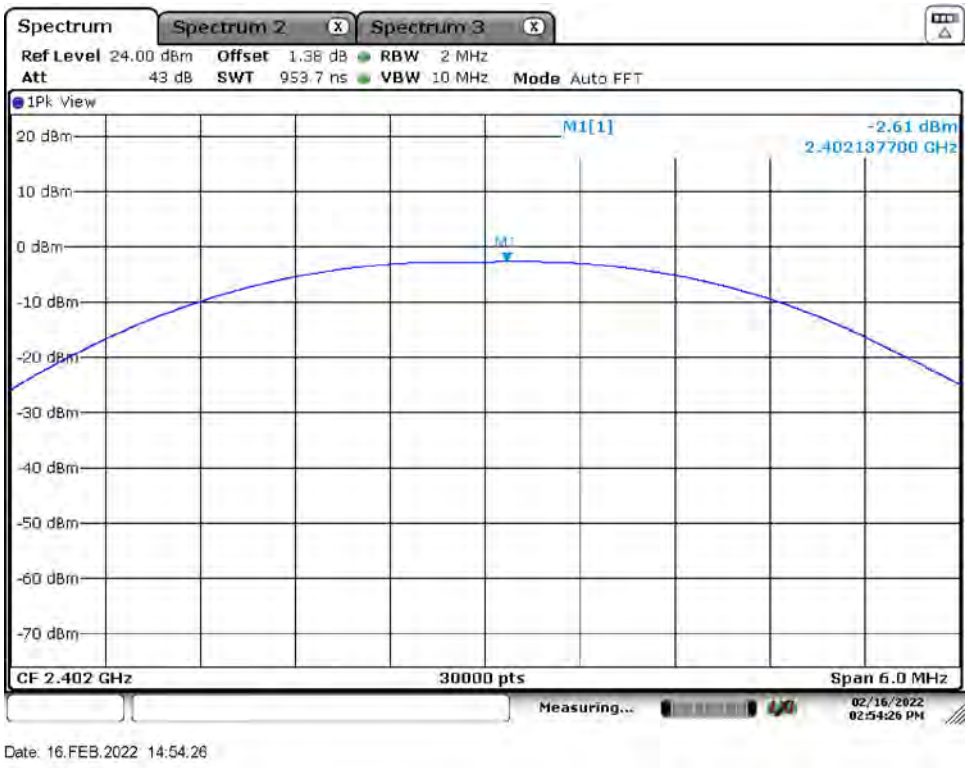
4.4.7.1 MAXIMUM PEAK OUTPUT POWER

BLE (GFSK)

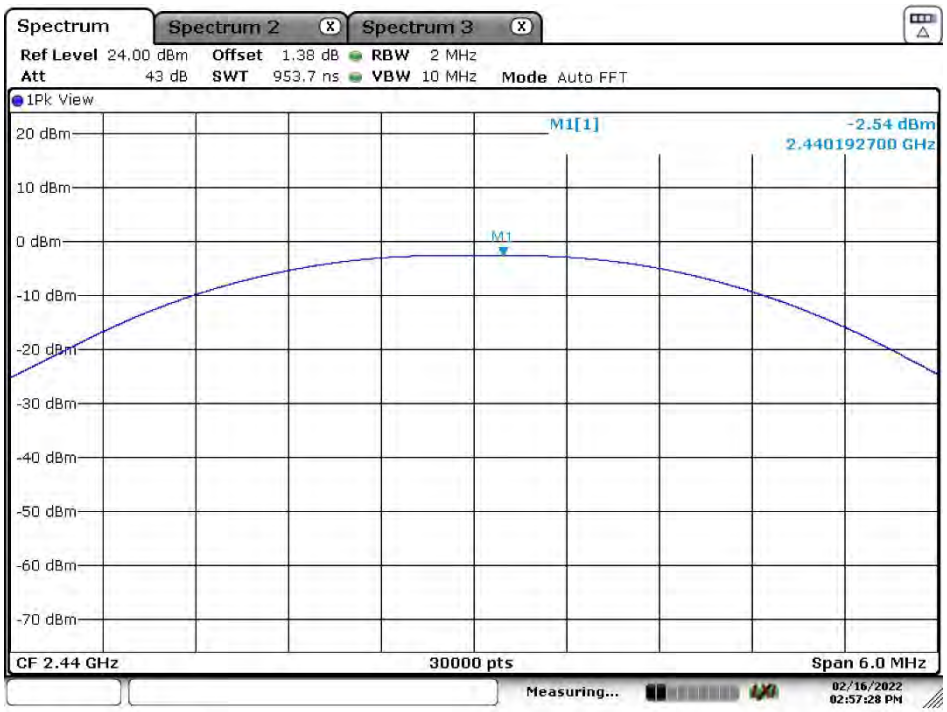
1Mbps:

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
0	2402	-2.61	0.55	1	PASS
19	2440	-2.54	0.56	1	PASS
39	2480	-2.38	0.58	1	PASS

CH0

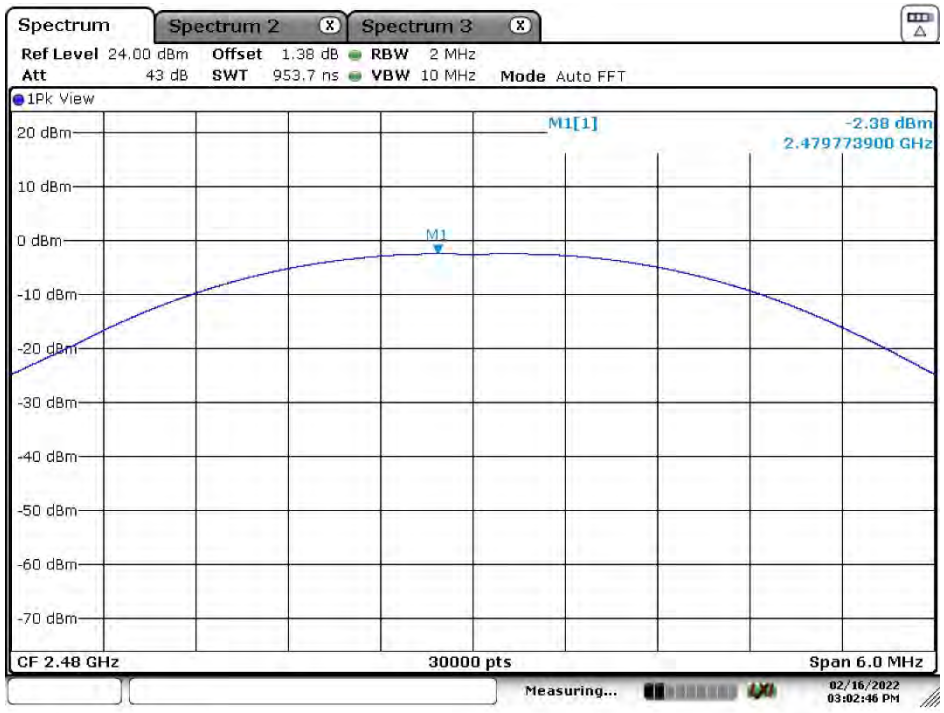


CH19



Date: 16.FEB.2022 14:57:28

CH39



Date: 16.FEB.2022 15:02:47

2Mbps:

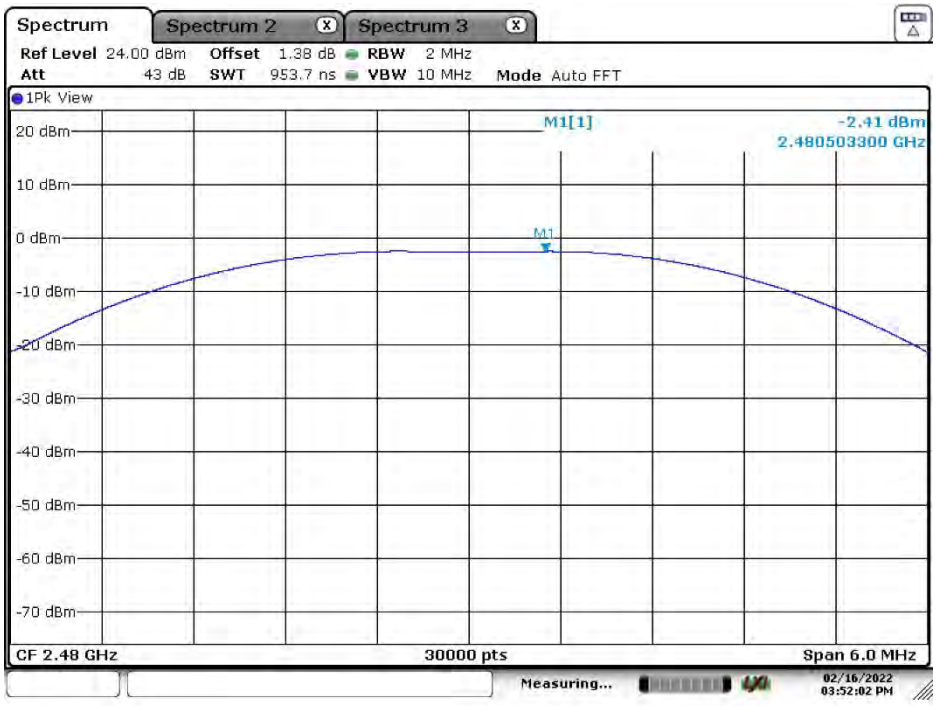
CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
0	2402	-2.61	0.55	1	PASS
19	2440	-2.60	0.55	1	PASS
39	2480	-2.41	0.57	1	PASS

CH0

CH19

Date: 16.FEB.2022 16:15:17

CH39



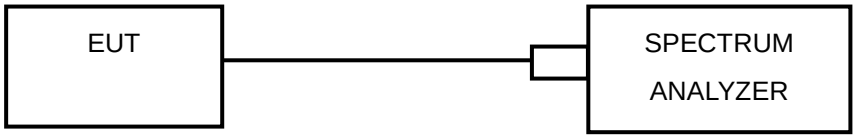
Date: 16.FEB.2022 15:52:03

4.5 POWER SPECTRAL DENSITY MEASUREMENT

4.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The limit for Power Spectral Density is 8dBm/3KHz.

4.5.2 TEST SETUP



4.5.3 TEST INSTRUMENTS

Refer to section 4.3.2.

4.5.4 TEST PROCEDURE

1. Set the span to 1.5 times the DTS bandwidth
2. Set the RBW = 3 kHz, VBW ≥ 3 x RBW, Detector = peak.
3. Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

4.5.6 EUT OPERATING CONDITION

EUT was operated according to manufacturer's specifications.

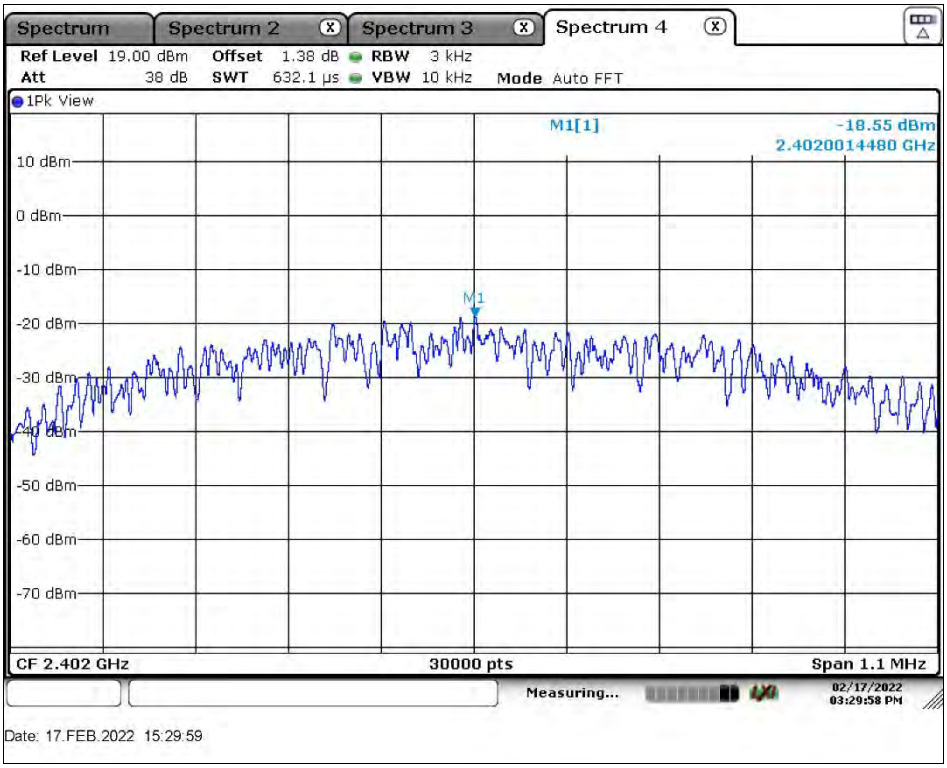
4.5.7 TEST RESULTS

BT-LE (GFSK)

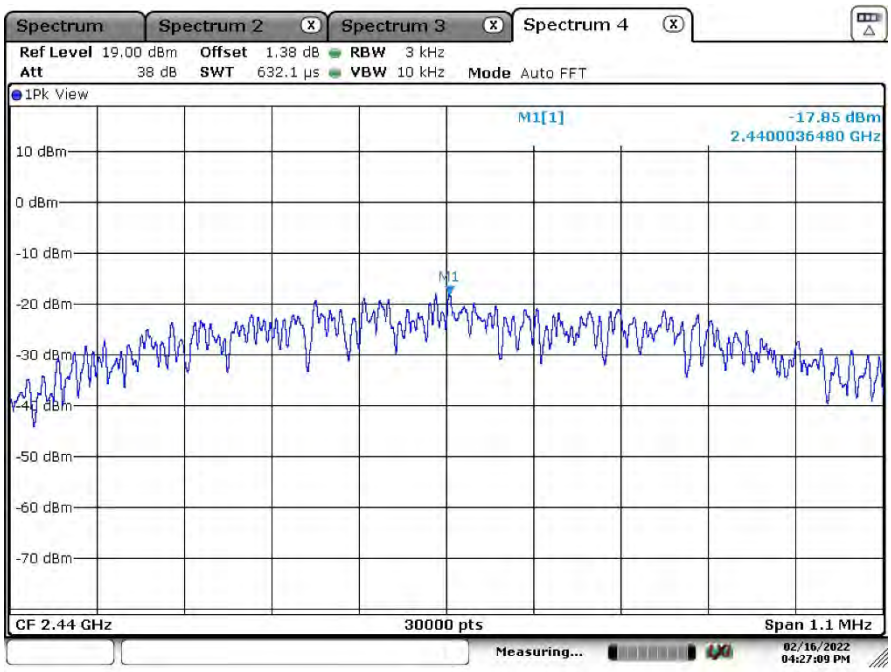
1Mbps:

Channel	FREQ. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	2402	-18.55	8	PASS
19	2440	-17.85	8	PASS
39	2480	-18.68	8	PASS

CH0

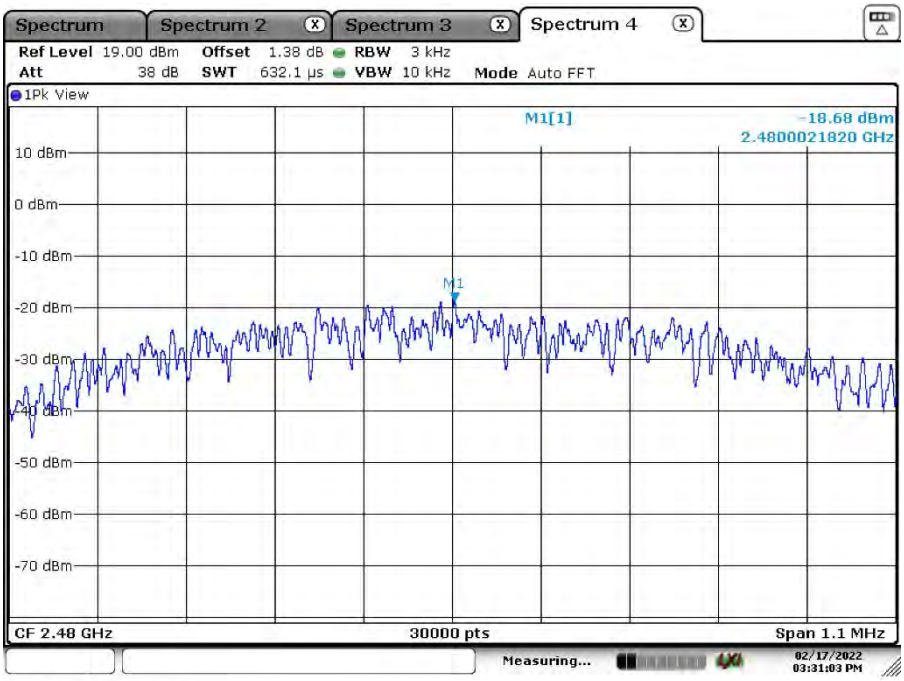


CH19



Date: 16.FEB.2022 16:27:10

CH39



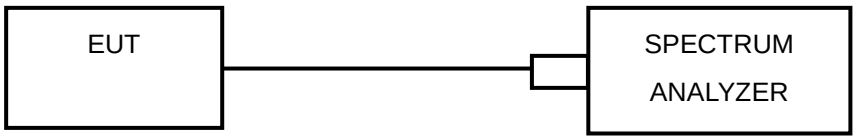
Date: 17.FEB.2022 15:31:04

4.6 OUT OF BAND EMISSION MEASUREMENT

4.6.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.6.2 TEST SETUP



4.6.3 TEST INSTRUMENTS

Refer to section 4.3.2.

4.6.4 TEST PROCEDURE

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Set span to encompass the spectrum to be examined
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

4.6.6 EUT OPERATING CONDITION

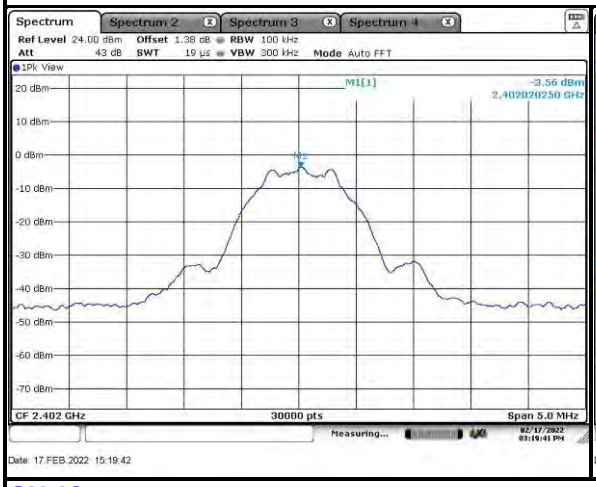
Conducted Spurious Emissions: 1Mbps data rate only
Conducted Band-edge: Both 1Mbps and 2Mbps data rates

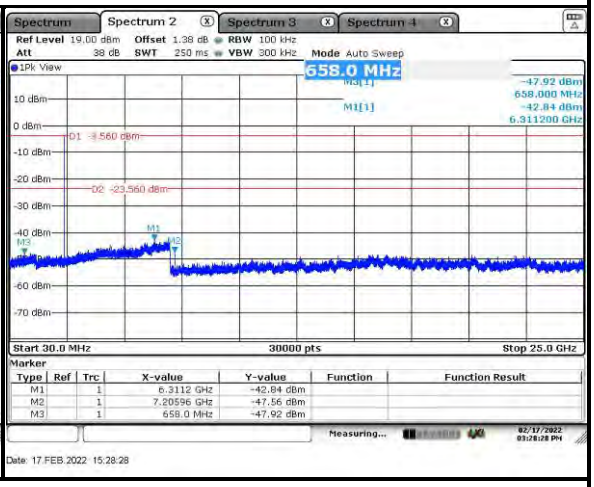
4.6.7 TEST RESULTS

BLE (GFSK)

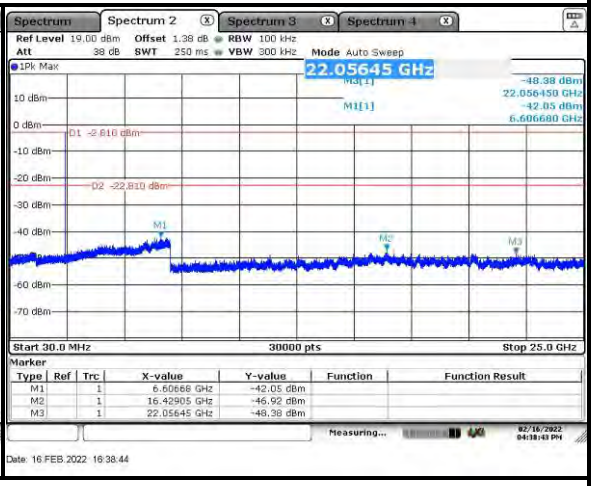
1Mbps Conducted Spurious Emissions:

CH 0

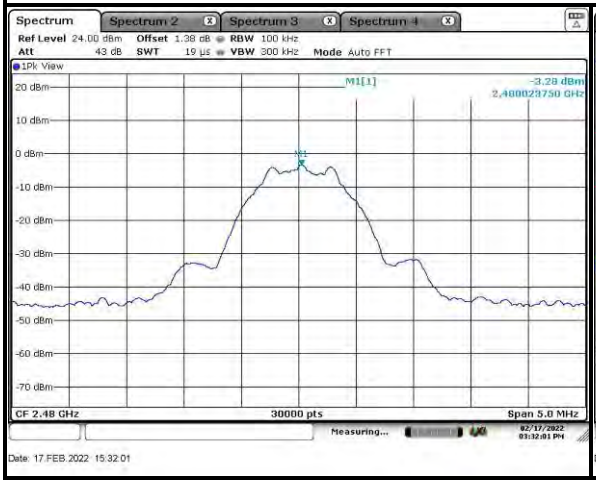


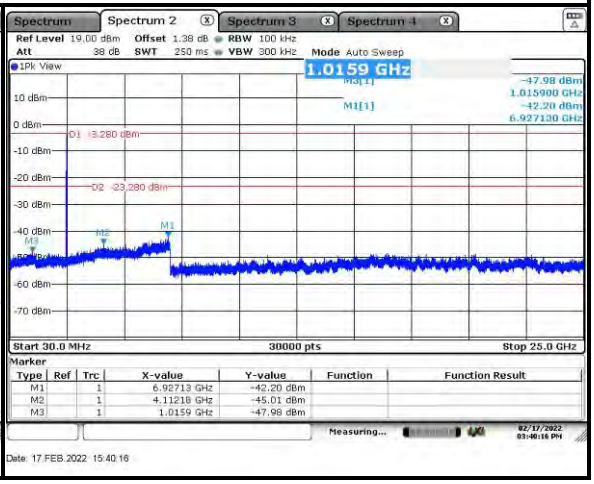


CH 19

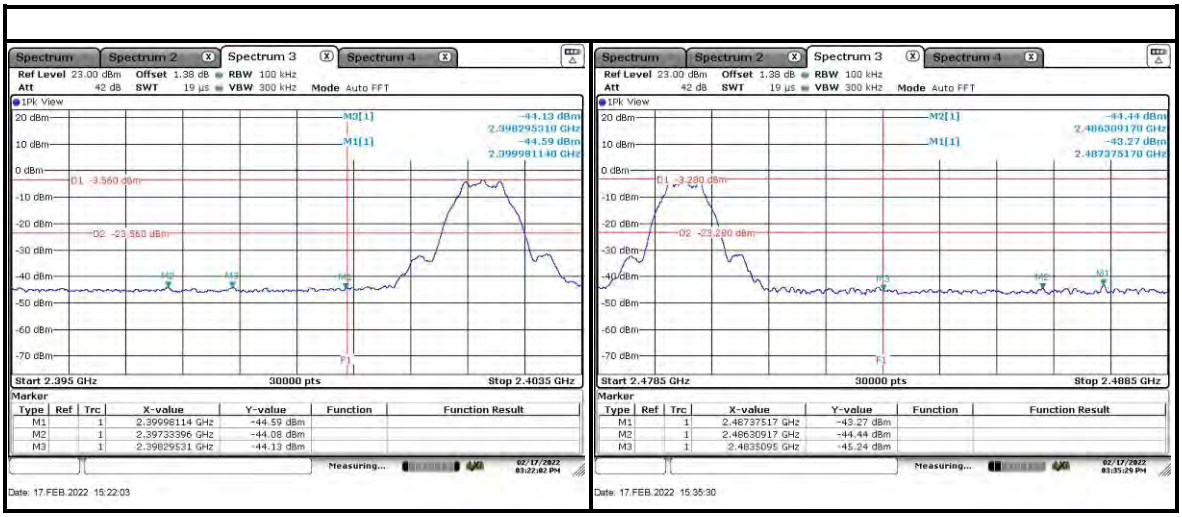


CH 39





1Mbps Conducted Band-edge:



2Mbps Conducted Band-edge:

5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the Test Setup Photos exhibit.

6 APPENDIX A – MODIFICATIONS

No modifications were made to the EUT during testing.

---END OF REPORT---