



FCC RADIO TEST REPORT

FCC ID : A4RGKV4X
Equipment : Phone
Model Name : GKV4X
Applicant : Google LLC
1600 Amphitheatre Parkway,
Mountain View, California, 94043 USA
Standard : FCC Part 15 Subpart C §15.247

The product was received on Jul. 11, 2023 and testing was performed from Sep. 28, 2023 to Nov. 08, 2023. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Approved by: Louis Wu

Sportun International Inc. Wensan Laboratory

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)



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History of this test report



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.247(b)(3) 15.247(b)(4)	Output Power	Pass	-
3.3	15.247(e)	Power Spectral Density	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	Pass	10.96 dB under the limit at 2490.48 MHz
3.6	15.207	AC Conducted Emission	Pass	20.49 dB under the limit at 0.51 MHz
3.7	15.203	Antenna Requirement	Pass	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: William Chen**Report Producer: Ming Chen**



1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
General Specs GSM/WCDMA/LTE/5G NR, Bluetooth, BLE, BLE channel sounding, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax, Wi-Fi 5GHz 802.11a/n/ac/ax, Wi-Fi 6GHz 802.11a/ax, NFC, WPC Rx and GNSS Rx.	
Antenna Type Bluetooth: <Ant.3>: IFA Antenna <Ant.4>: ILA Antenna	

EUT Information List	
S/N	Performed Test Item
38011JEKB00290	RF Conducted Measurement
36151JEKB12371	
38011JEKB00050	Radiated Spurious Emission
36151JEKB12241	
38011JEKB00085	Conducted Emission

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	Ant. 4: -0.7 Ant. 3: -1.2

Remark: The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.



1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No. TH05-HY, CO07-HY, 03CH15-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW3786

1.4 Applicable Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01
- ♦ ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.



2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

<Bluetooth – LE CS GFSK>

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	-	-	27	2429	54	2456
	-	-	28	2430	55	2457
	2	2404	29	2431	56	2458
	3	2405	30	2432	57	2459
	4	2406	31	2433	58	2460
	5	2407	32	2434	59	2461
	6	2408	33	2435	60	2462
	7	2409	34	2436	61	2463
	8	2410	35	2437	62	2464
	9	2411	36	2438	63	2465
	10	2412	37	2439	64	2466
	11	2413	38	2440	65	2467
	12	2414	39	2441	66	2468
	13	2415	40	2442	67	2469
	14	2416	41	2443	68	2470
	15	2417	42	2444	69	2471
	16	2418	43	2445	70	2472
	17	2419	44	2446	71	2473
	18	2420	45	2447	72	2474
	19	2421	46	2448	73	2475
	20	2422	47	2449	74	2476
	21	2423	48	2450	75	2477
	22	2424	49	2451	76	2478
	-	-	50	2452	-	-
	-	-	51	2453	-	-
	-	-	52	2454	-	-
	26	2428	53	2455	-	-



2.2 Test Mode

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape) and accessory (Adapter or Earphone), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst case emissions were reported in this report, and the worst mode of radiated spurious emissions is X plane, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	Data Rate / Modulation
Conducted Test Cases	Bluetooth-LE CS GFSK / GFSK
	Mode 1: Bluetooth-LE CS GFSK Tx CH02_2404 MHz_1Mbps
	Mode 2: Bluetooth-LE CS GFSK Tx CH38_2440 MHz_1Mbps
	Mode 3: Bluetooth-LE CS GFSK Tx CH76_2478 MHz_1Mbps
	Mode 4: Bluetooth-LE CS GFSK Tx CH02_2404 MHz_2Mbps
	Mode 5: Bluetooth-LE CS GFSK Tx CH38_2440 MHz_2Mbps
	Mode 6: Bluetooth-LE CS GFSK Tx CH76_2478 MHz_2Mbps



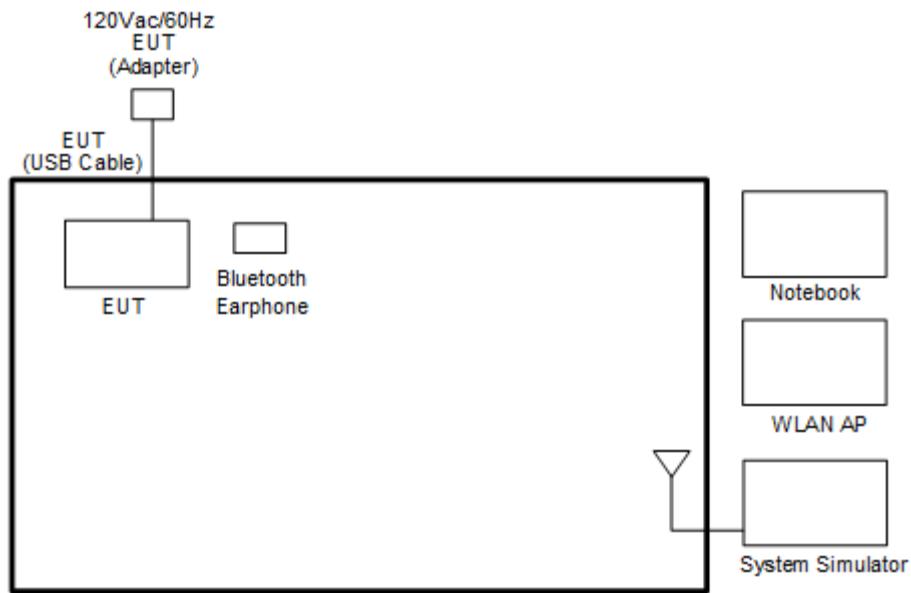
Summary table of Test Cases	
Test Item	Data Rate / Modulation
Radiated Test Cases	<p><Ant. 3></p> <p>Mode 1: Bluetooth-LE CS GFSK Tx CH02_2404 MHz_1Mbps</p> <p>Mode 2: Bluetooth-LE CS GFSK Tx CH38_2440 MHz_1Mbps</p> <p>Mode 3: Bluetooth-LE CS GFSK Tx CH76_2478 MHz_1Mbps</p> <p>Mode 4: Bluetooth-LE CS GFSK Tx CH02_2404 MHz_2Mbps</p> <p>Mode 5: Bluetooth-LE CS GFSK Tx CH38_2440 MHz_2Mbps</p> <p>Mode 6: Bluetooth-LE CS GFSK Tx CH76_2478 MHz_2Mbps</p> <p><Ant. 4></p> <p>Mode 1: Bluetooth-LE CS GFSK Tx CH02_2404 MHz_1Mbps</p> <p>Mode 2: Bluetooth-LE CS GFSK Tx CH38_2440 MHz_1Mbps</p> <p>Mode 3: Bluetooth-LE CS GFSK Tx CH76_2478 MHz_1Mbps</p> <p>Mode 4: Bluetooth-LE CS GFSK Tx CH02_2404 MHz_2Mbps</p> <p>Mode 5: Bluetooth-LE CS GFSK Tx CH38_2440 MHz_2Mbps</p> <p>Mode 6: Bluetooth-LE CS GFSK Tx CH76_2478 MHz_2Mbps</p>
AC Conducted Emission	Mode 1: 5G NR n5 Link + WLAN (2.4GHz) Link + Bluetooth on + NFC on + USB cable 3 (Charging from Adapter 2) + Handset mode ; Battery < 50%

Remark:

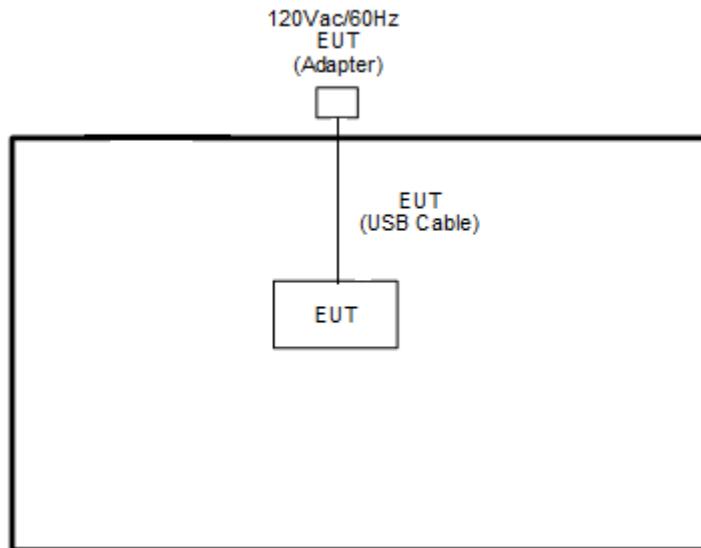
1. For Radiated Test Cases, the tests were performed with AC Adapter 1 and USB Cable 3.
2. For radiation spurious emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power.
3. During the preliminary test, both charging modes (Adapter mode and WPT Charging mode) were verified. It is determined that the adaptor mode is the worst case for official test.

2.3 Connection Diagram of Test System

<AC Conducted Emission Mode>



<Bluetooth-LE CS Tx Mode>





2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	Bluetooth Earphone	Sony Ericsson	MW600	PY700A2029	N/A	N/A
3.	WLAN AP	Netgear	RAXE500	PY320300508	N/A	Unshielded, 1.8 m
4.	Notebook	DELL	Latitude E3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

The RF test items, utility "adb command 1.0.36" was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

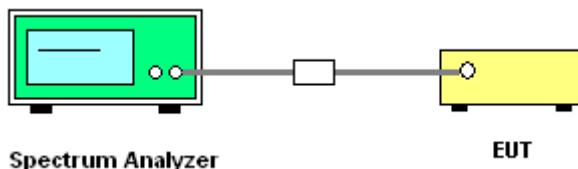
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) $\geq 3 * \text{RBW}$.
6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

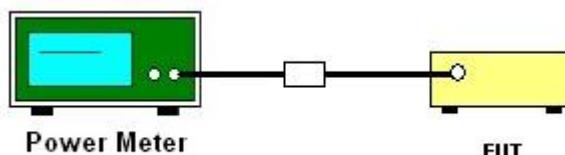
3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT is connected to the power meter by RF cable and attenuator.
3. The path loss is compensated to the results for each measurement.
4. Set the maximum power setting and enable the EUT to transmit continuously.
5. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

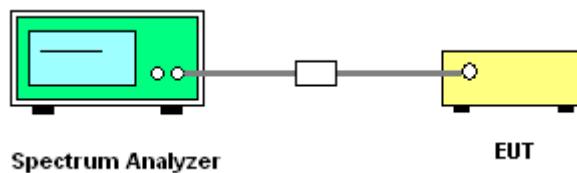
3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth (VBW) = 10 kHz. In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6 dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100 kHz is a reference level and is used as 20 dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 30 dB down from the highest emission level within the authorized band.

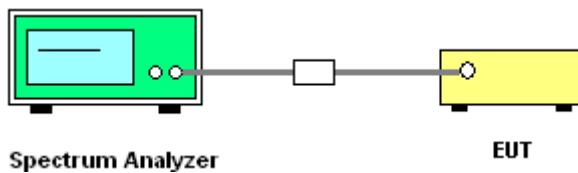
3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.4.3 Test Procedure

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Set RBW = 100 kHz, VBW = 300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges Plots

Please refer to Appendix A.

3.4.6 Test Result of Conducted Spurious Emission Plots

Please refer to Appendix A.



3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device is measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.5.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.



3.5.3 Test Procedures

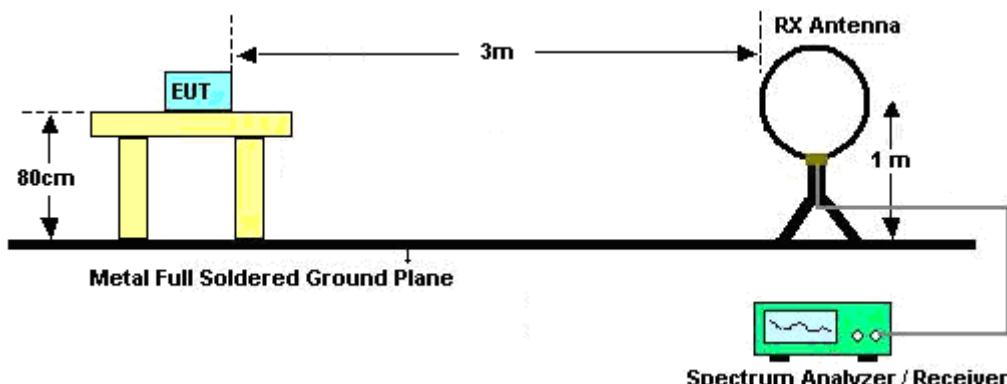
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
4. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-”.
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as “-”.
8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW = 100 kHz for $f < 1$ GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW = 3 MHz for $f \geq 1$ GHz for peak measurement.

For average measurement:

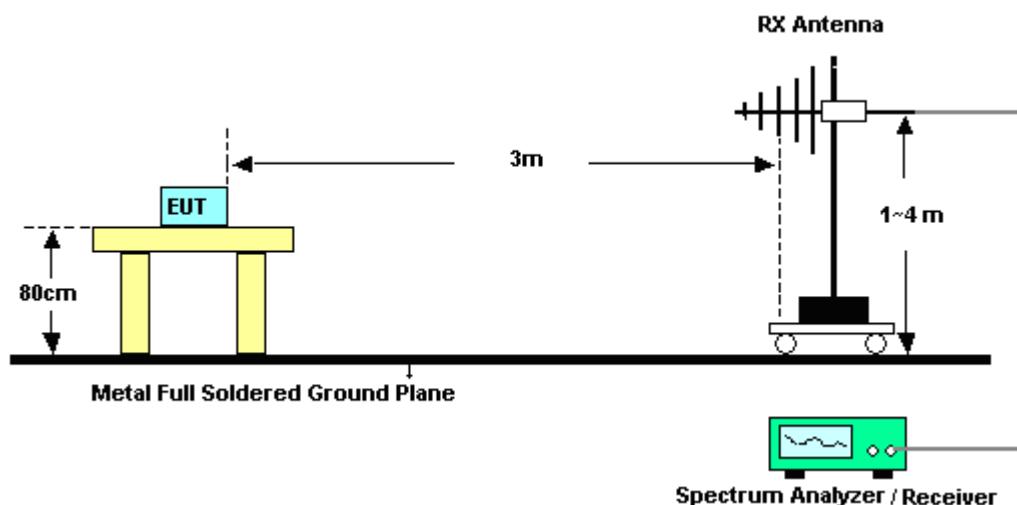
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

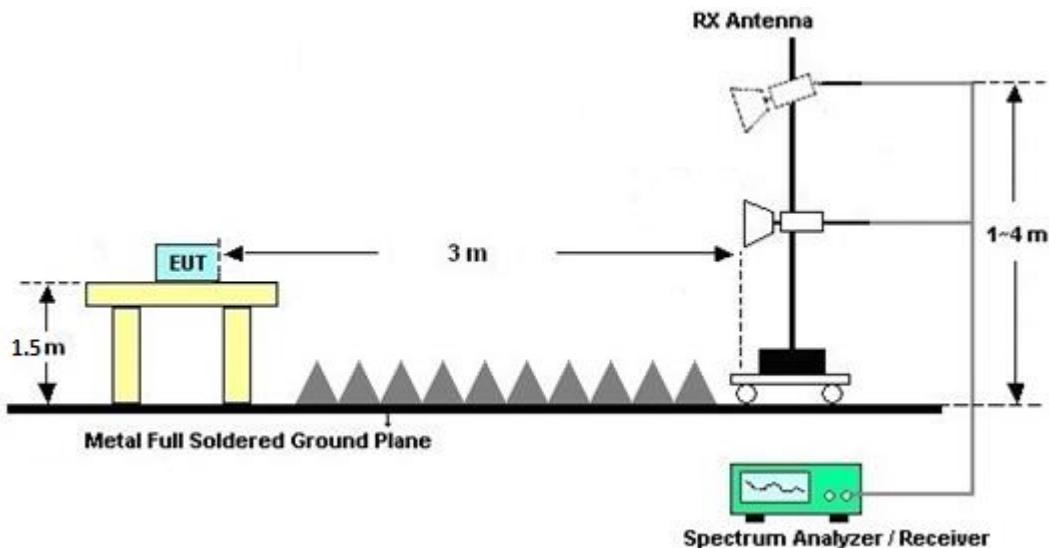
For radiated test below 30MHz



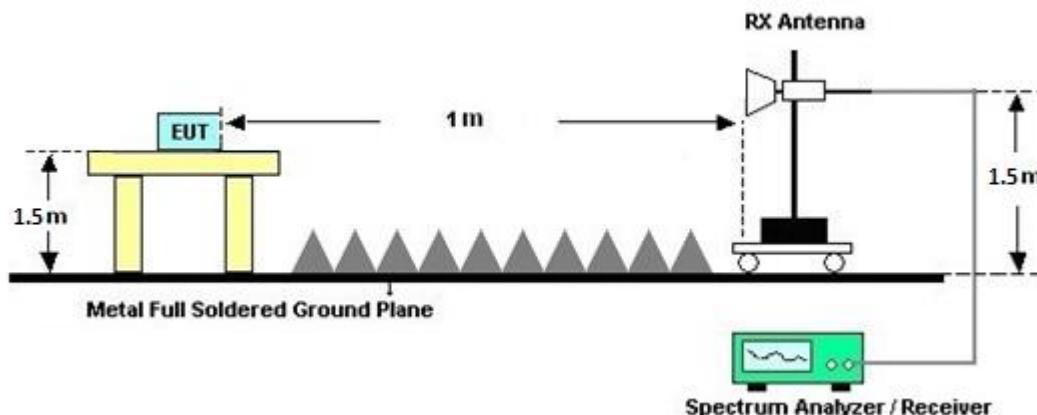
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

3.5.8 Test Result of Radiated Spurious Emission (30 MHz ~ 10th Harmonic)

Please refer to Appendix C and D.



3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

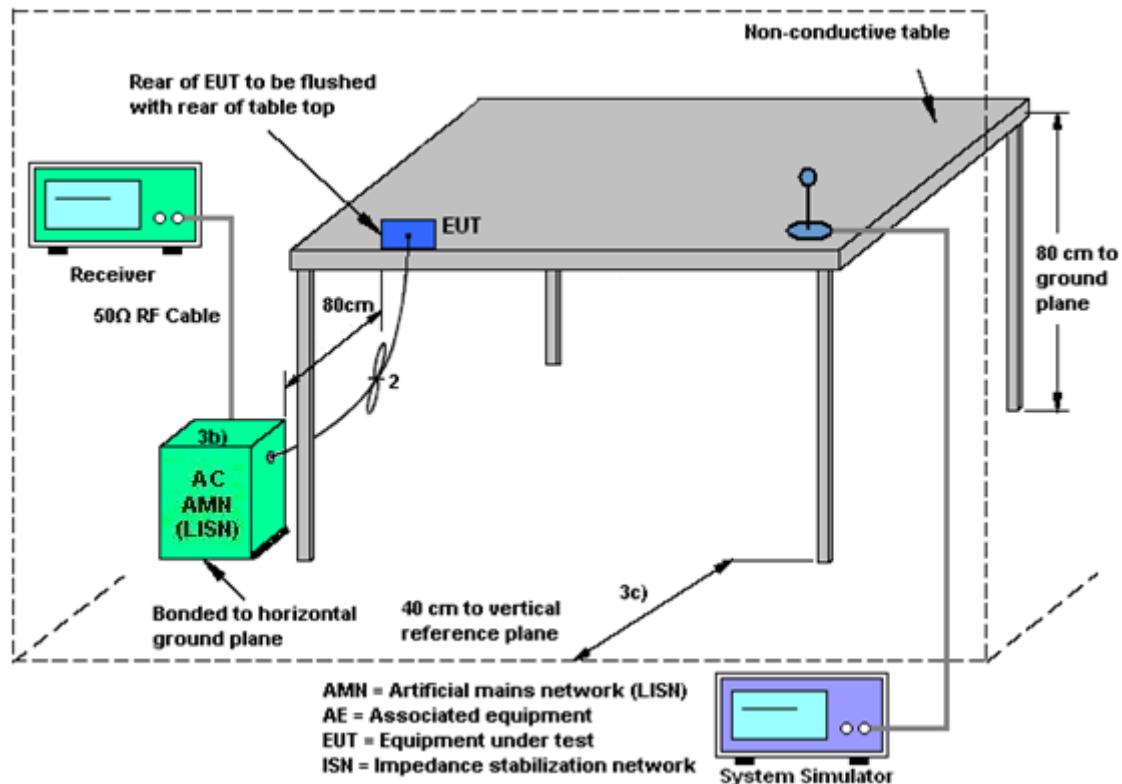
3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.6.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9 kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.7 Antenna Requirements

3.7.1 Standard Applicable

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 12, 2023	Oct. 31, 2023~Nov. 08, 2023	Sep. 11, 2024	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	41912 & 05	30MHz~1GHz	Feb. 05, 2023	Oct. 31, 2023~Nov. 08, 2023	Feb. 04, 2024	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1212	1GHz~18GHz	Mar. 23, 2023	Oct. 31, 2023~Nov. 08, 2023	Mar. 22, 2024	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	00993	18GHz~40GHz	Nov. 24, 2022	Oct. 31, 2023~Nov. 08, 2023	Nov. 23, 2023	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 26, 2022	Oct. 31, 2023~Nov. 08, 2023	Dec. 25, 2023	Radiation (03CH15-HY)
Preamplifier	EMEC	EM01G18G	060837	1GHz~18GHz	Feb. 16, 2023	Oct. 31, 2023~Nov. 08, 2023	Feb. 15, 2024	Radiation (03CH15-HY)
Preamplifier	EM Electronics	EM01G18G	060802	1GHz~18GHz	Mar. 03, 2023	Oct. 31, 2023~Nov. 08, 2023	Mar. 02, 2024	Radiation (03CH15-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz~40GHz	Jun. 27, 2023	Oct. 31, 2023~Nov. 08, 2023	Jun. 26, 2024	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20MHz~8.4GHz	Oct. 06, 2023	Oct. 31, 2023~Nov. 08, 2023	Oct. 05, 2024	Radiation (03CH15-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz~44GHz	Mar. 20, 2023	Oct. 31, 2023~Nov. 08, 2023	Mar. 19, 2024	Radiation (03CH15-HY)
Spectrum Analyzer	Keysight	N9010B	MY60241058	10Hz~44GHz	Aug. 31, 2023	Oct. 31, 2023~Nov. 08, 2023	Aug. 30, 2024	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Oct. 31, 2023~Nov. 08, 2023	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Oct. 31, 2023~Nov. 08, 2023	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24(k5)	RK-000451	N/A	N/A	Oct. 31, 2023~Nov. 08, 2023	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104, 102E	MY582185/4,5 19228/2,80395 0/2	N/A	Jun. 13, 2023	Oct. 31, 2023~Nov. 08, 2023	Jun. 12, 2024	Radiation (03CH15-HY)
Filter	Wainwright	WLJ4-1000-15 30-6000-40ST	SN4	1.53GHz Low Pass Filter	Jun. 14, 2023	Oct. 31, 2023~Nov. 08, 2023	Jun. 13, 2024	Radiation (03CH15-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN4	3GHz High Pass Filter	Jun. 14, 2023	Oct. 31, 2023~Nov. 08, 2023	Jun. 13, 2024	Radiation (03CH15-HY)
Hygrometer	TECPTEL	DTM-302	SN2	N/A	Sep. 08, 2023	Oct. 31, 2023~Nov. 08, 2023	Sep. 07, 2024	Radiation (03CH15-HY)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 17, 2022	Nov. 08, 2023	Nov. 16, 2023	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	15I00041SNO 10 (NO:248)	10MHz~6GHz	Jan. 05, 2023	Nov. 08, 2023	Jan. 04, 2024	Conducted (TH05-HY)
Power Meter	Anritsu	ML2495A	1036004	N/A	Jul. 27, 2023	Nov. 08, 2023	Jul. 26, 2024	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Jul. 27, 2023	Nov. 08, 2023	Jul. 26, 2024	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 23, 2023	Nov. 08, 2023	Aug. 22, 2024	Conducted (TH05-HY)
AC Power Source	ACPOWER	AFC-11003G	F317040033	N/A	N/A	Sep. 28, 2023	N/A	Conduction (CO07-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Sep. 28, 2023	N/A	Conduction (CO07-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Nov. 01, 2022	Sep. 28, 2023	Oct. 31, 2023	Conduction (CO07-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	Mar. 15, 2023	Sep. 28, 2023	Mar. 14, 2024	Conduction (CO07-HY)
Two-Line V-Network	TESEQ	NNB 51	45051	N/A	Mar. 05, 2023	Sep. 28, 2023	Mar. 04, 2024	Conduction (CO07-HY)
Four-Line V-Network	TESEQ	NNB 52	36122	N/A	Mar. 13, 2023	Sep. 28, 2023	Mar. 12, 2024	Conduction (CO07-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	9kHz~7GHz	Feb. 24, 2023	Sep. 28, 2023	Feb. 23, 2024	Conduction (CO07-HY)



5 Measurement Uncertainty

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	3.46 dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	6.30 dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	4.50 dB
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Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	5.50 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	5.40 dB
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Appendix A. Test Result of Conducted Test Items

Test Engineer:	Willy Chang			Temperature:	21~25		°C
Test Date:	2023/11/8			Relative Humidity:	51~54		%

<Ant.3>

TEST RESULTS DATA 6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE CS GFSK	1Mbps	1	2	2404	1.135	0.566	0.50	Pass
BLE CS GFSK	1Mbps	1	38	2440	1.159	0.610	0.50	Pass
BLE CS GFSK	1Mbps	1	76	2478	1.139	0.570	0.50	Pass

TEST RESULTS DATA Average Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE CS GFSK	1Mbps	1	2	2404	8.55	30.00	-1.20	7.35	36.00	Pass
BLE CS GFSK	1Mbps	1	38	2440	9.55	30.00	-1.20	8.35	36.00	Pass
BLE CS GFSK	1Mbps	1	76	2478	8.55	30.00	-1.20	7.35	36.00	Pass

TEST RESULTS DATA Peak Power Density

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE CS GFSK	1Mbps	1	2	2404	7.56	-11.37	-1.20	8.00	Pass
BLE CS GFSK	1Mbps	1	38	2440	8.40	-10.58	-1.20	8.00	Pass
BLE CS GFSK	1Mbps	1	76	2478	7.37	-11.59	-1.20	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

TEST RESULTS DATA <u>6dB and 99% Occupied Bandwidth</u>								
Mod.	Data Rate	NTx	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE CS GFSK	2Mbps	1	2	2404	2.230	0.544	0.50	Pass
BLE CS GFSK	2Mbps	1	38	2440	2.222	0.592	0.50	Pass
BLE CS GFSK	2Mbps	1	76	2478	2.278	0.536	0.50	Pass

TEST RESULTS DATA <u>Average Power Table</u>										
Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE CS GFSK	2Mbps	1	2	2404	8.75	30.00	-1.20	7.55	36.00	Pass
BLE CS GFSK	2Mbps	1	38	2440	9.65	30.00	-1.20	8.45	36.00	Pass
BLE CS GFSK	2Mbps	1	76	2478	8.65	30.00	-1.20	7.45	36.00	Pass

TEST RESULTS DATA <u>Peak Power Density</u>									
Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE CS GFSK	2Mbps	1	2	2404	7.11	-15.69	-1.20	8.00	Pass
BLE CS GFSK	2Mbps	1	38	2440	7.89	-14.90	-1.20	8.00	Pass
BLE CS GFSK	2Mbps	1	76	2478	6.66	-16.15	-1.20	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

<Ant.4>

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE CS GFSK	1Mbps	1	2	2404	1.157	0.518	0.50	Pass
BLE CS GFSK	1Mbps	1	38	2440	1.205	0.620	0.50	Pass
BLE CS GFSK	1Mbps	1	76	2478	1.153	0.600	0.50	Pass

TEST RESULTS DATA
Average Power Table

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE CS GFSK	1Mbps	1	2	2404	8.80	30.00	-0.70	8.10	36.00	Pass
BLE CS GFSK	1Mbps	1	38	2440	10.30	30.00	-0.70	9.60	36.00	Pass
BLE CS GFSK	1Mbps	1	76	2478	7.30	30.00	-0.70	6.60	36.00	Pass

TEST RESULTS DATA
Peak Power Density

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE CS GFSK	1Mbps	1	2	2404	8.10	-10.87	-0.70	8.00	Pass
BLE CS GFSK	1Mbps	1	38	2440	9.28	-9.70	-0.70	8.00	Pass
BLE CS GFSK	1Mbps	1	76	2478	6.28	-12.69	-0.70	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE CS GFSK	2Mbps	1	2	2404	2.266	0.508	0.50	Pass
BLE CS GFSK	2Mbps	1	38	2440	2.290	0.560	0.50	Pass
BLE CS GFSK	2Mbps	1	76	2478	2.270	0.592	0.50	Pass

TEST RESULTS DATA
Average Power Table

Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE CS GFSK	2Mbps	1	2	2404	8.90	30.00	-0.70	8.20	36.00	Pass
BLE CS GFSK	2Mbps	1	38	2440	10.40	30.00	-0.70	9.70	36.00	Pass
BLE CS GFSK	2Mbps	1	76	2478	7.40	30.00	-0.70	6.70	36.00	Pass

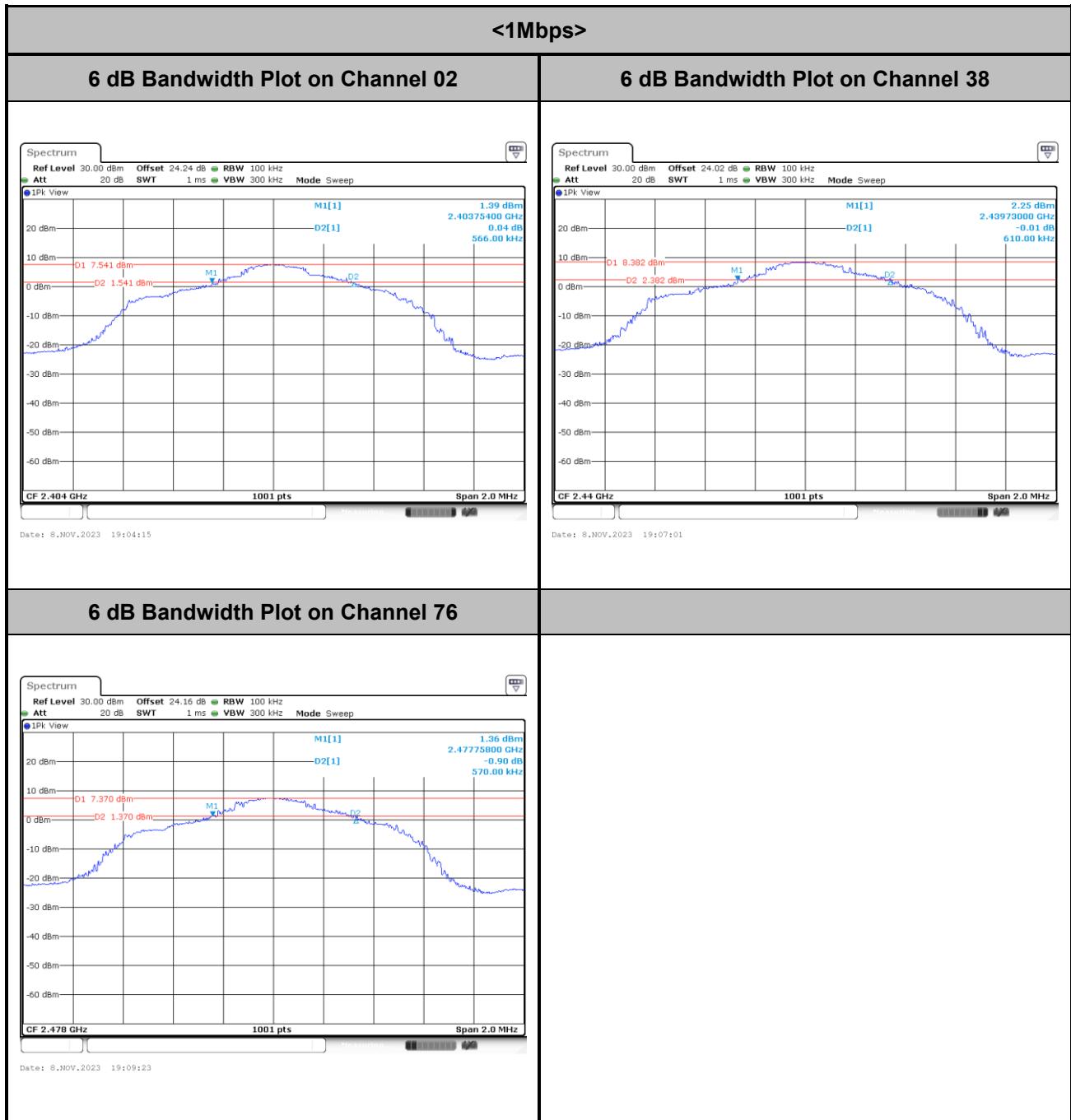
TEST RESULTS DATA
Peak Power Density

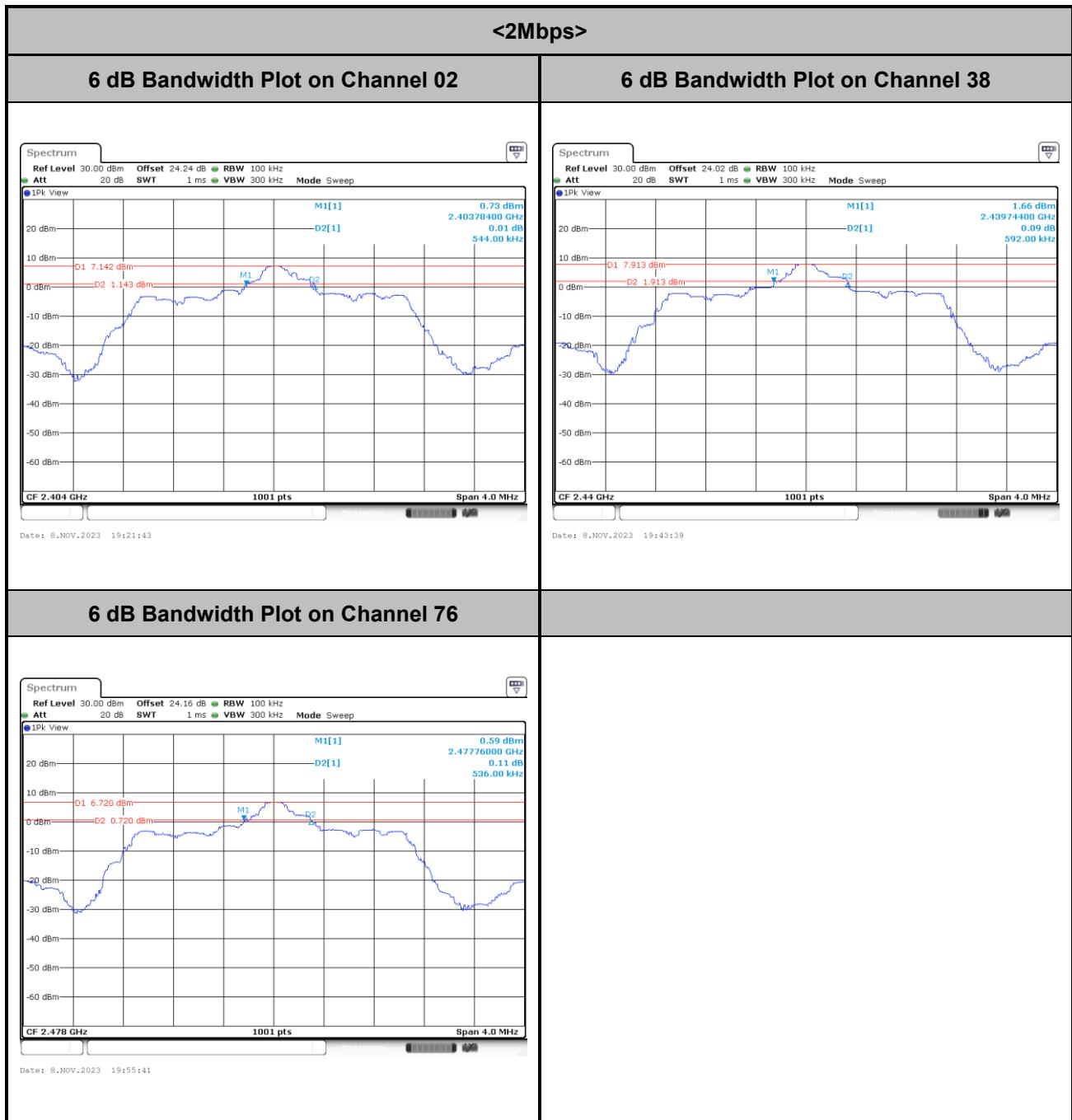
Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE CS GFSK	2Mbps	1	2	2404	6.16	-16.65	-0.70	8.00	Pass
BLE CS GFSK	2Mbps	1	38	2440	7.31	-15.41	-0.70	8.00	Pass
BLE CS GFSK	2Mbps	1	76	2478	5.67	-17.10	-0.70	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.



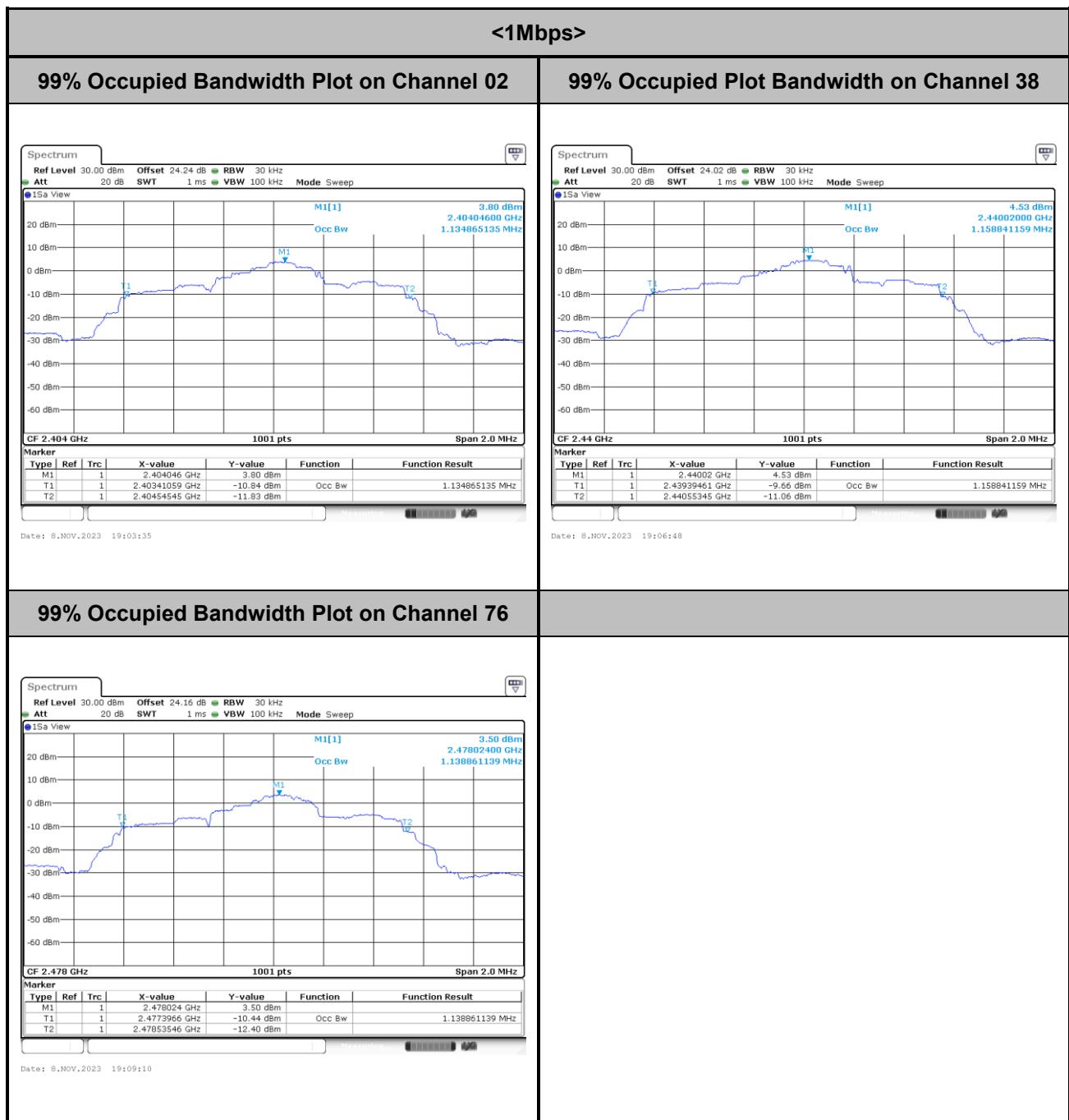
<Ant. 3>

6dB Bandwidth

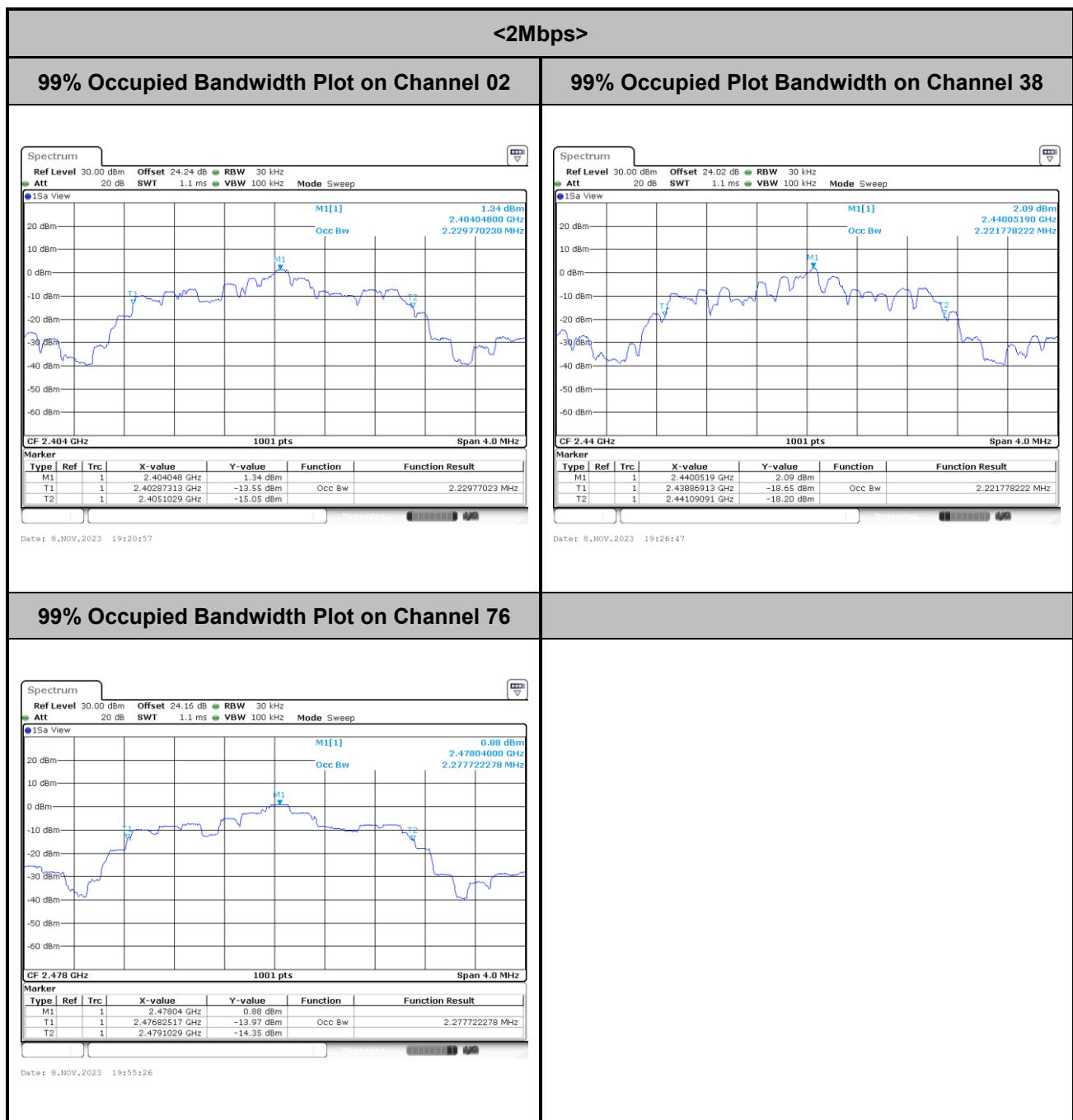




99% Occupied Bandwidth

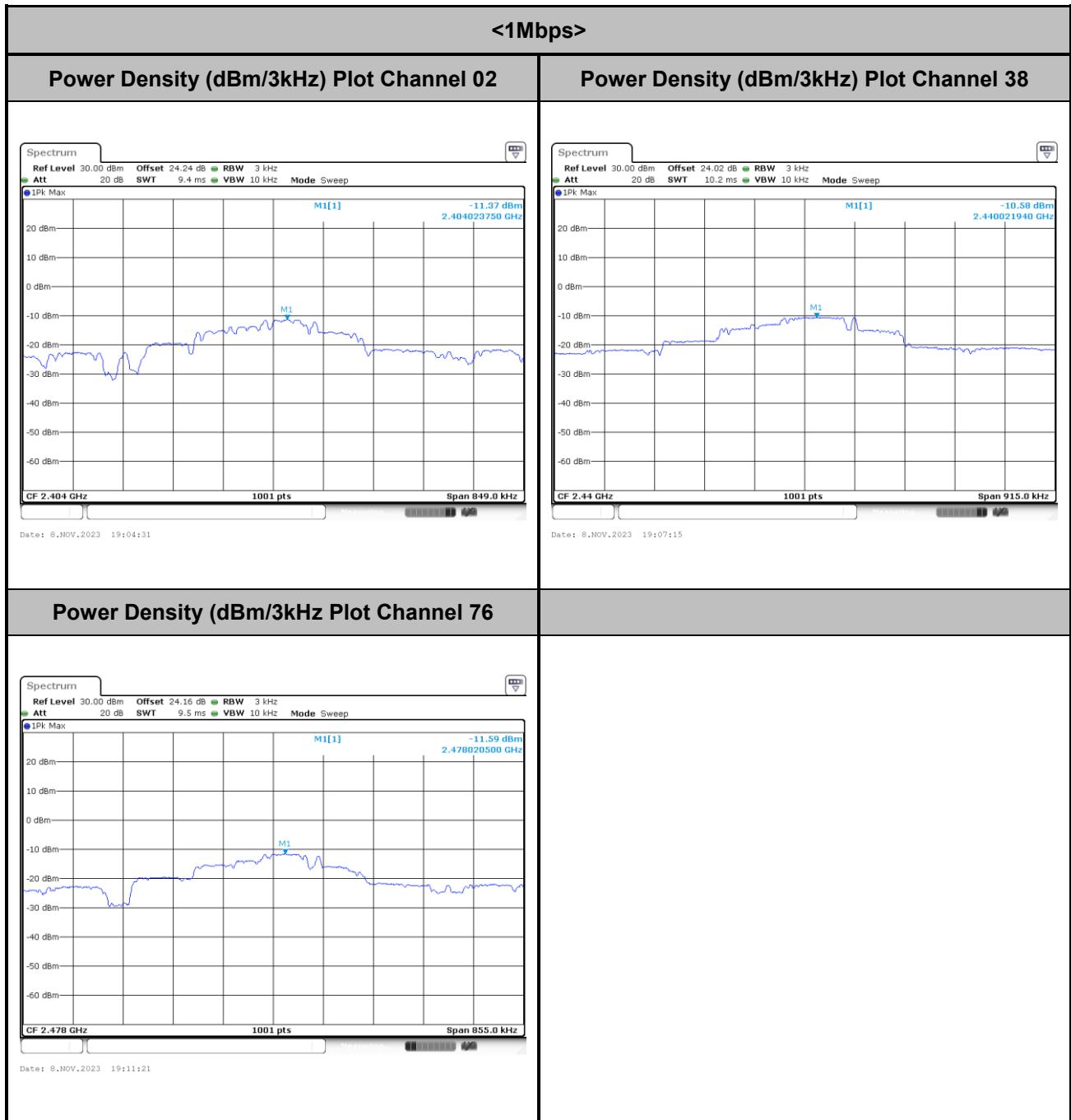


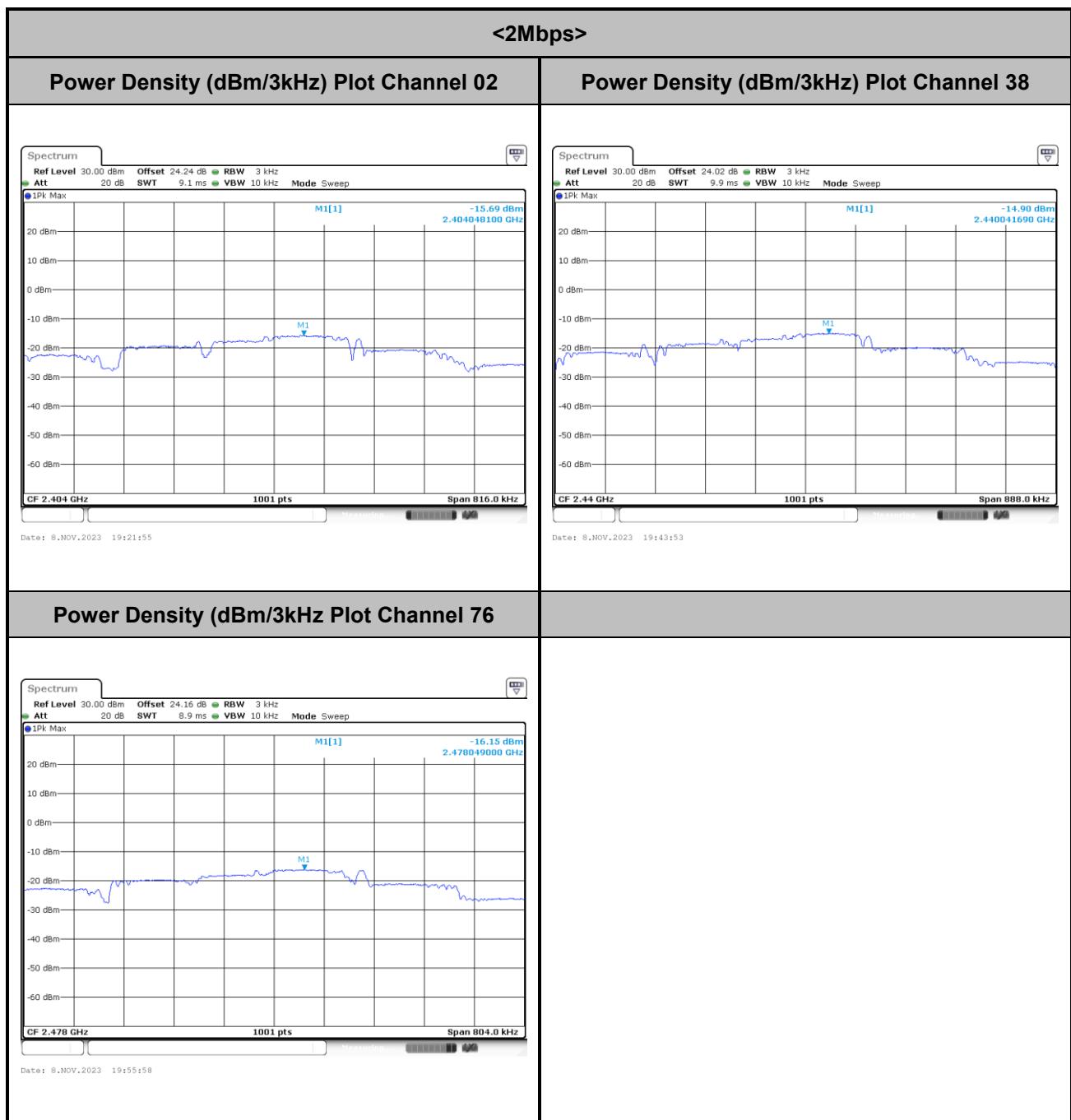
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.





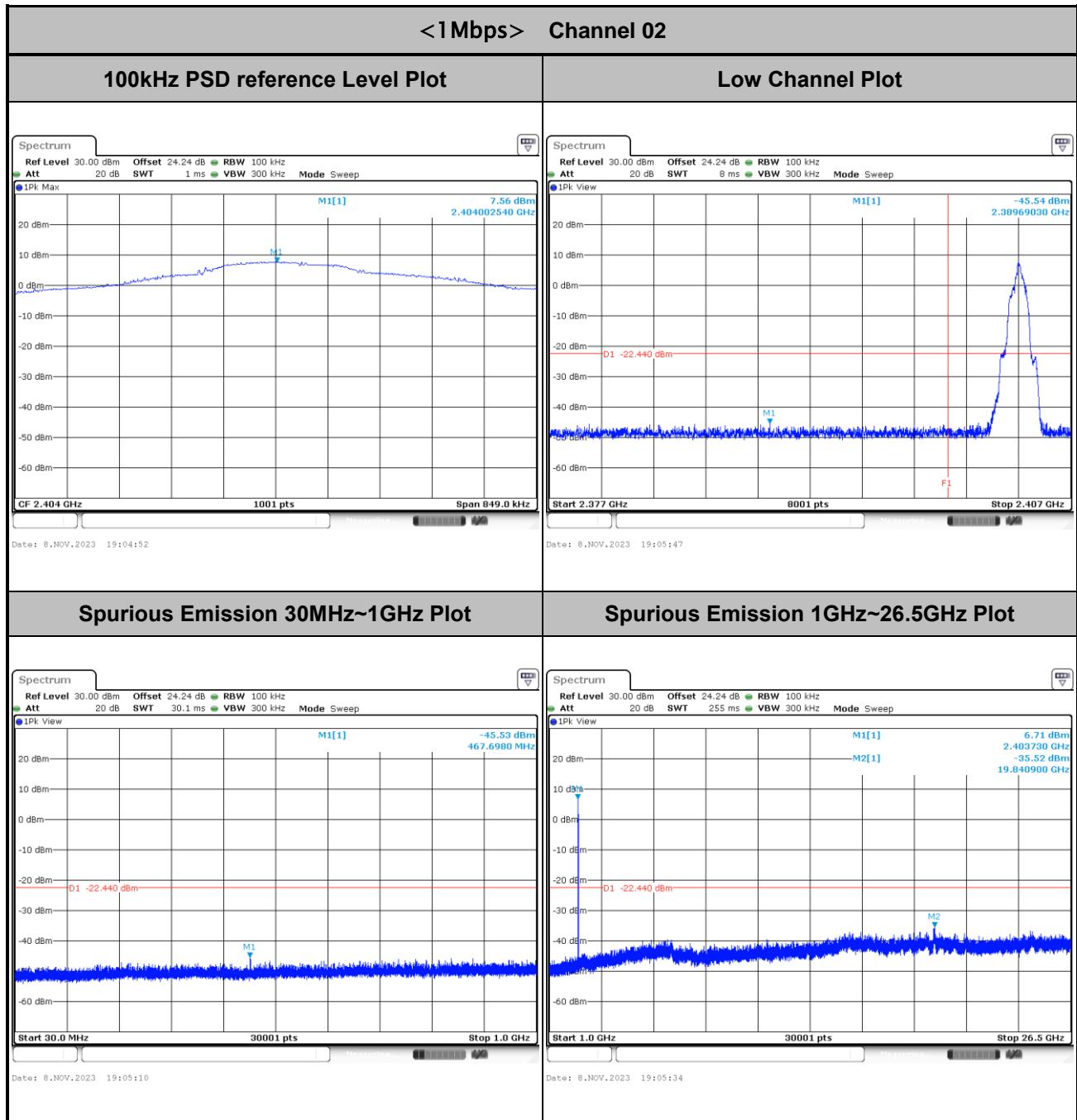
Power Spectral Density (dBm/3kHz)

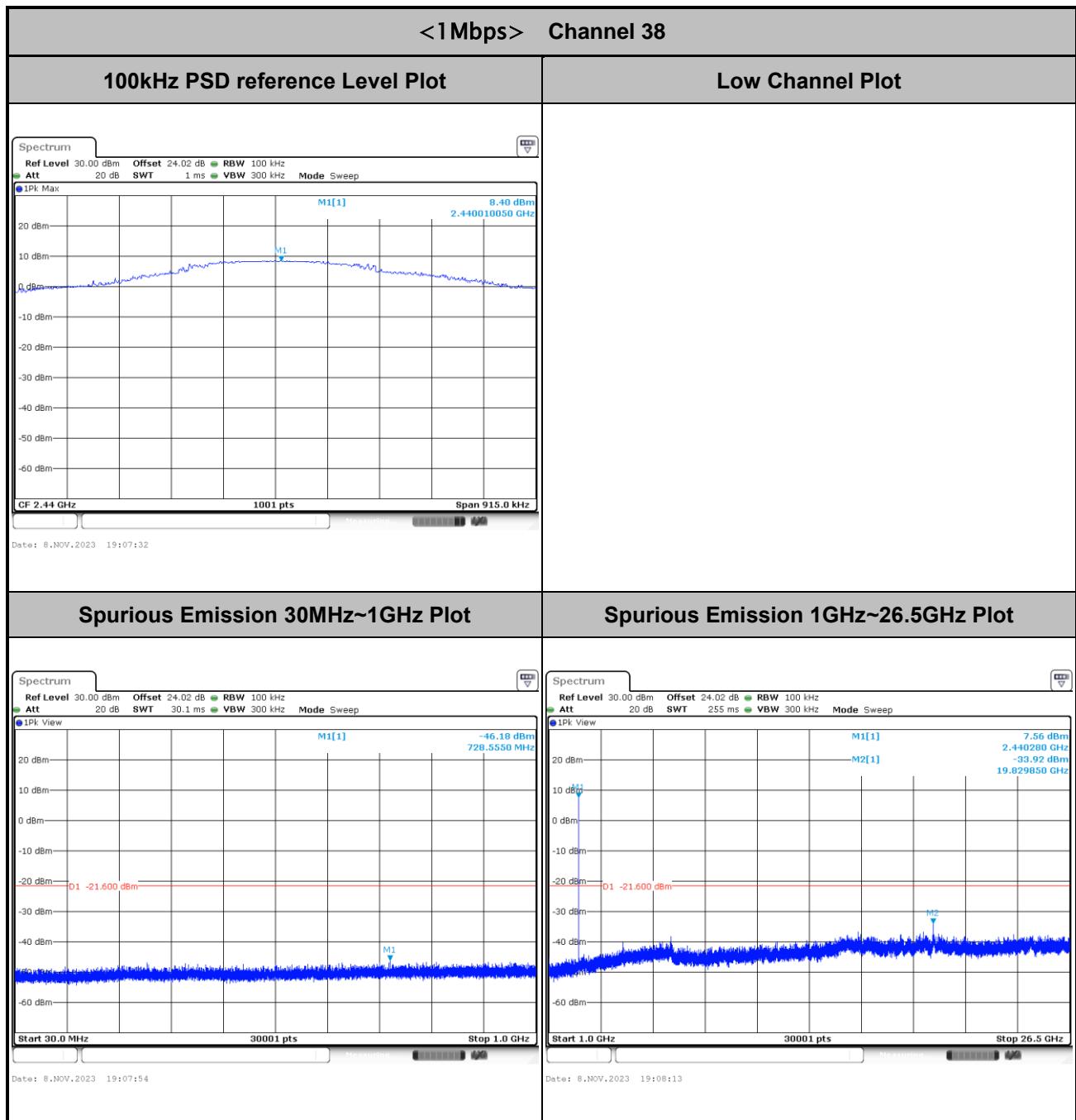


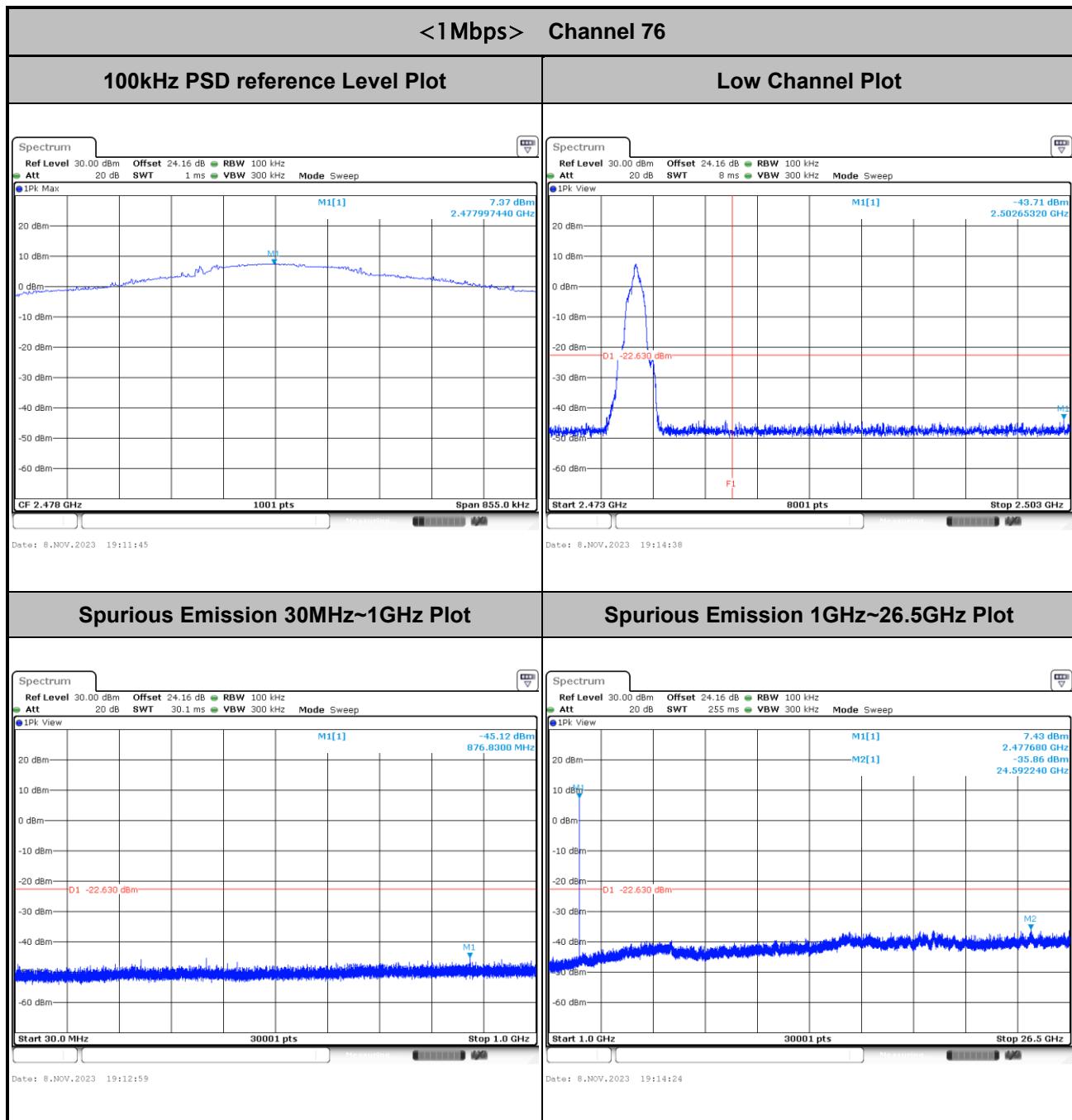


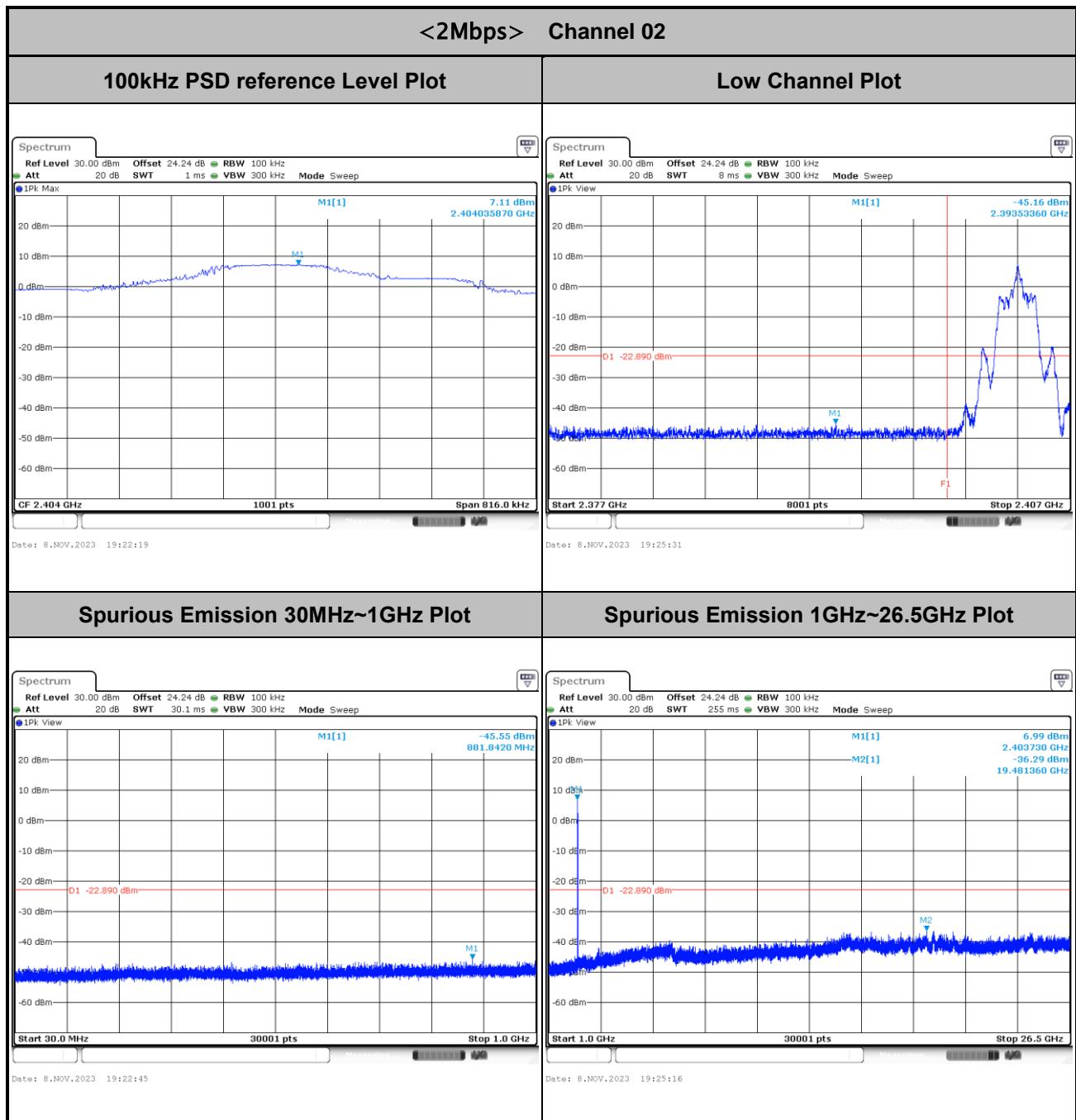


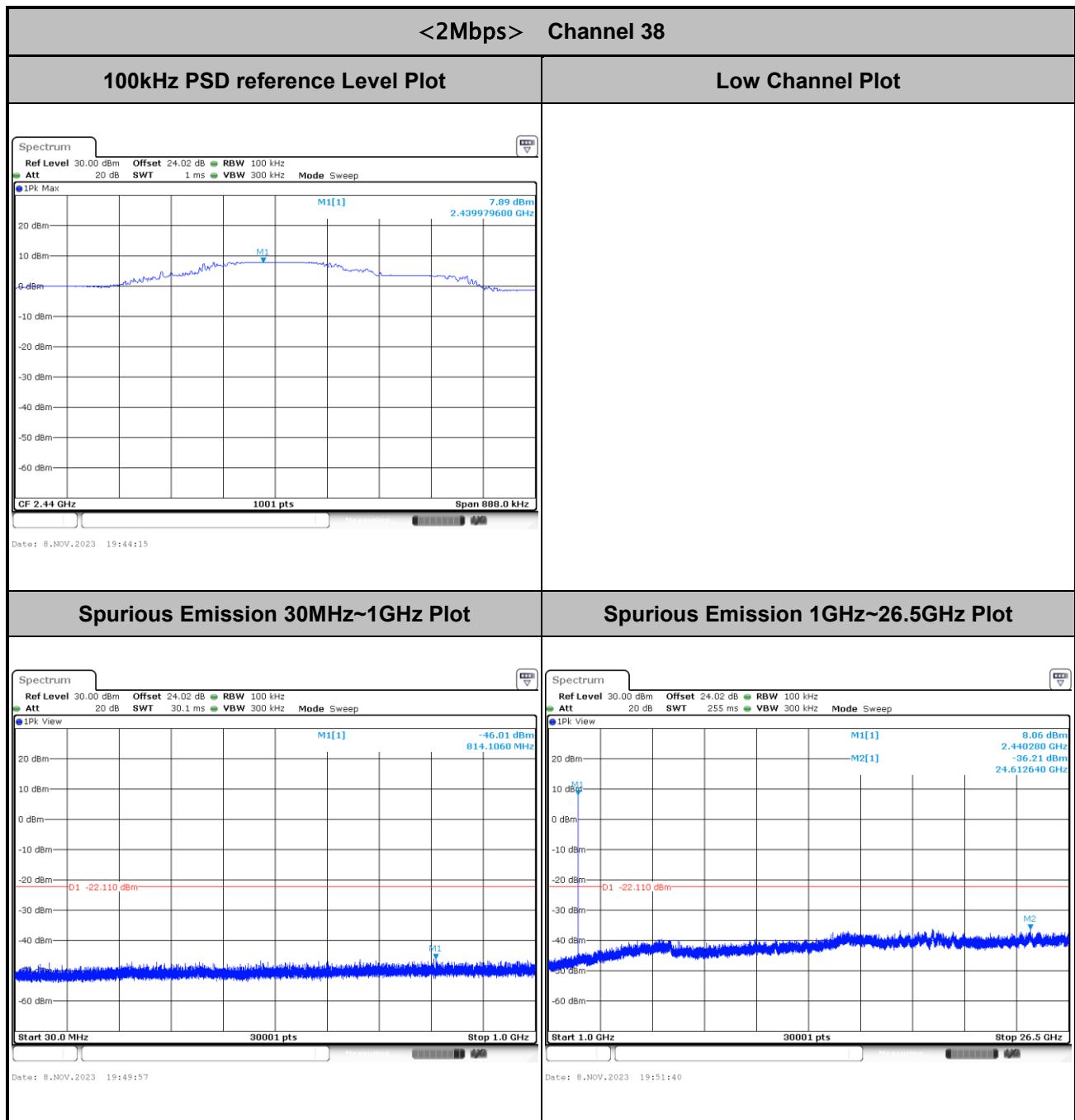
Band Edge and Spurious Emission

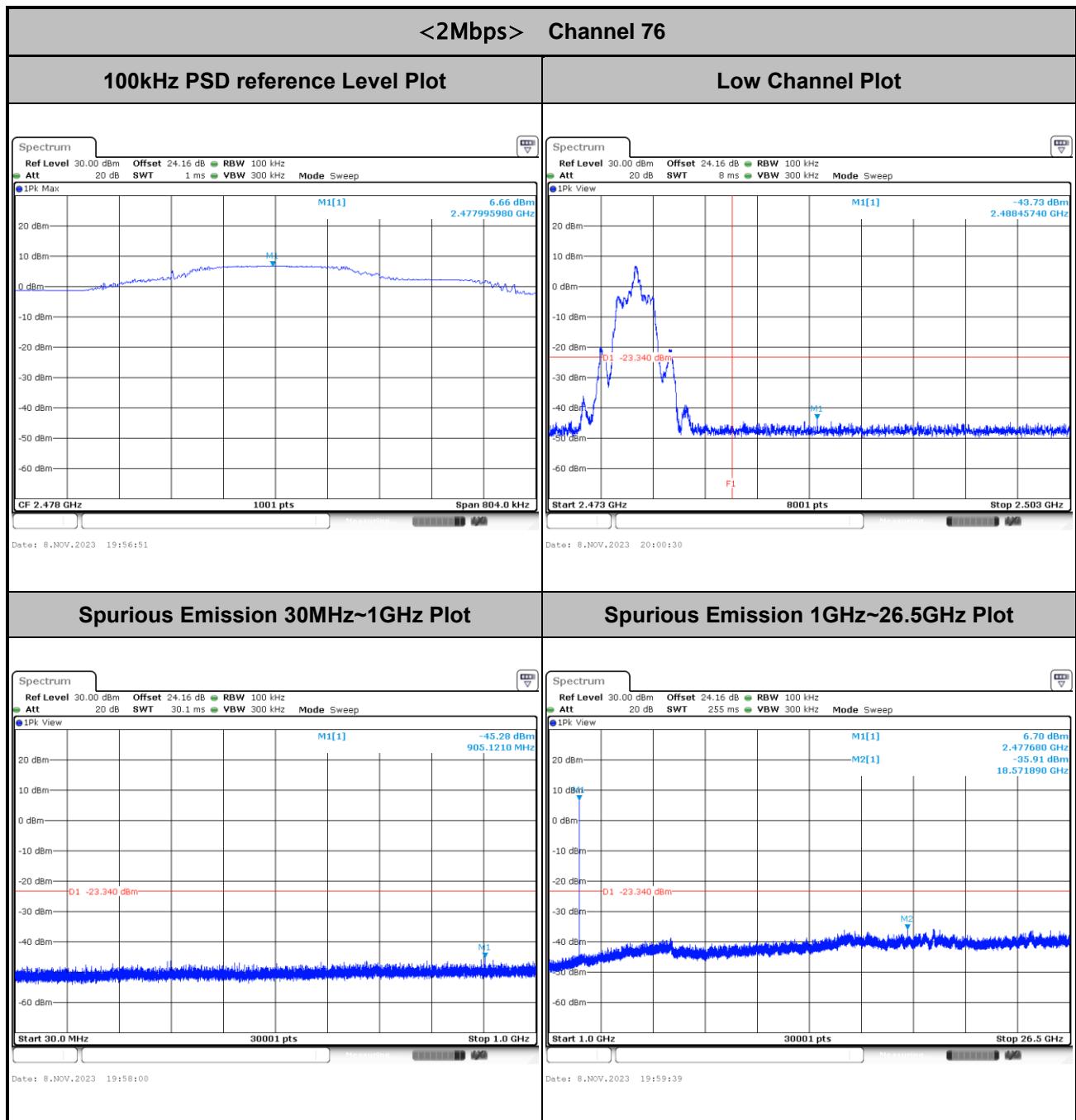






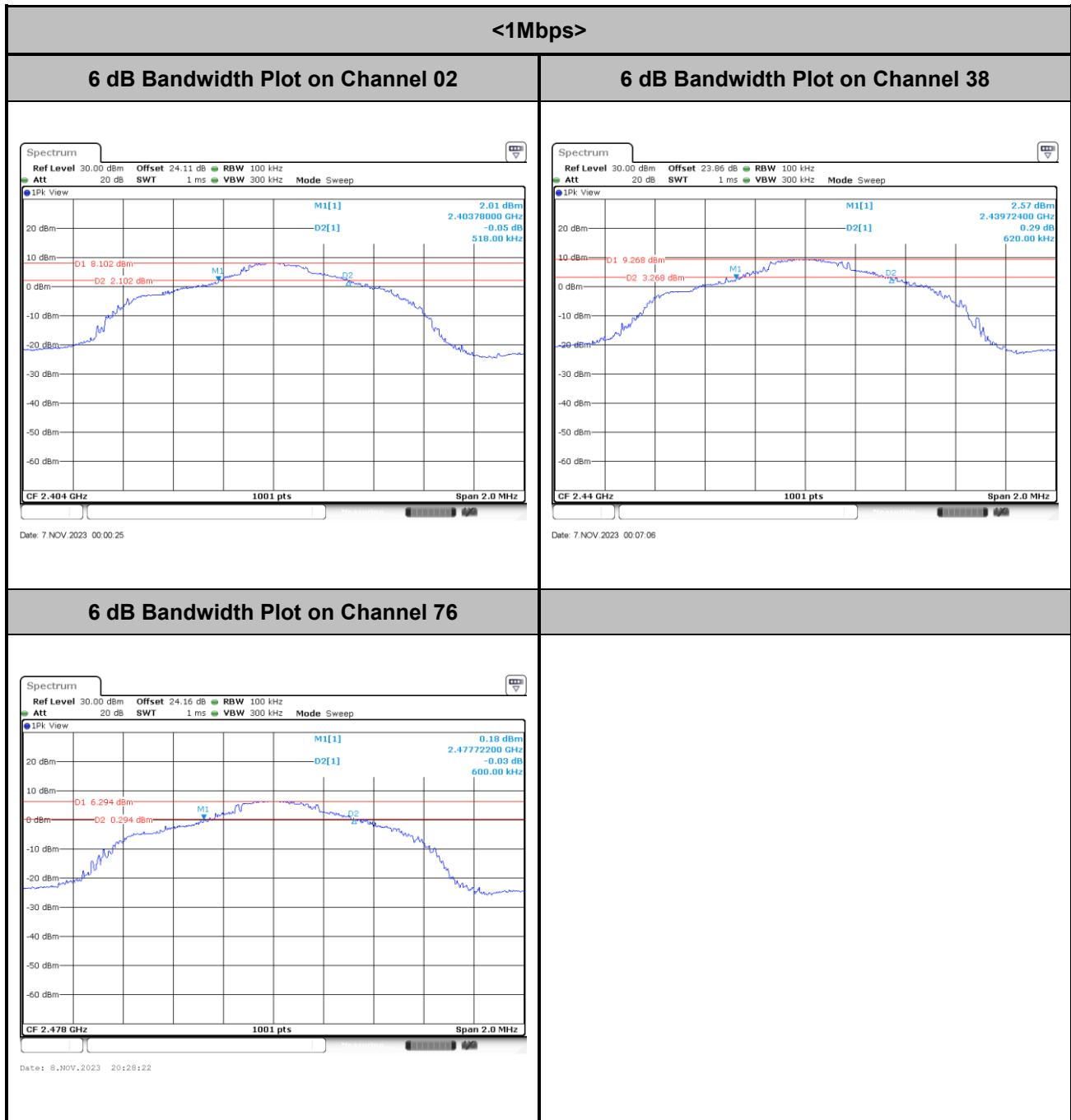


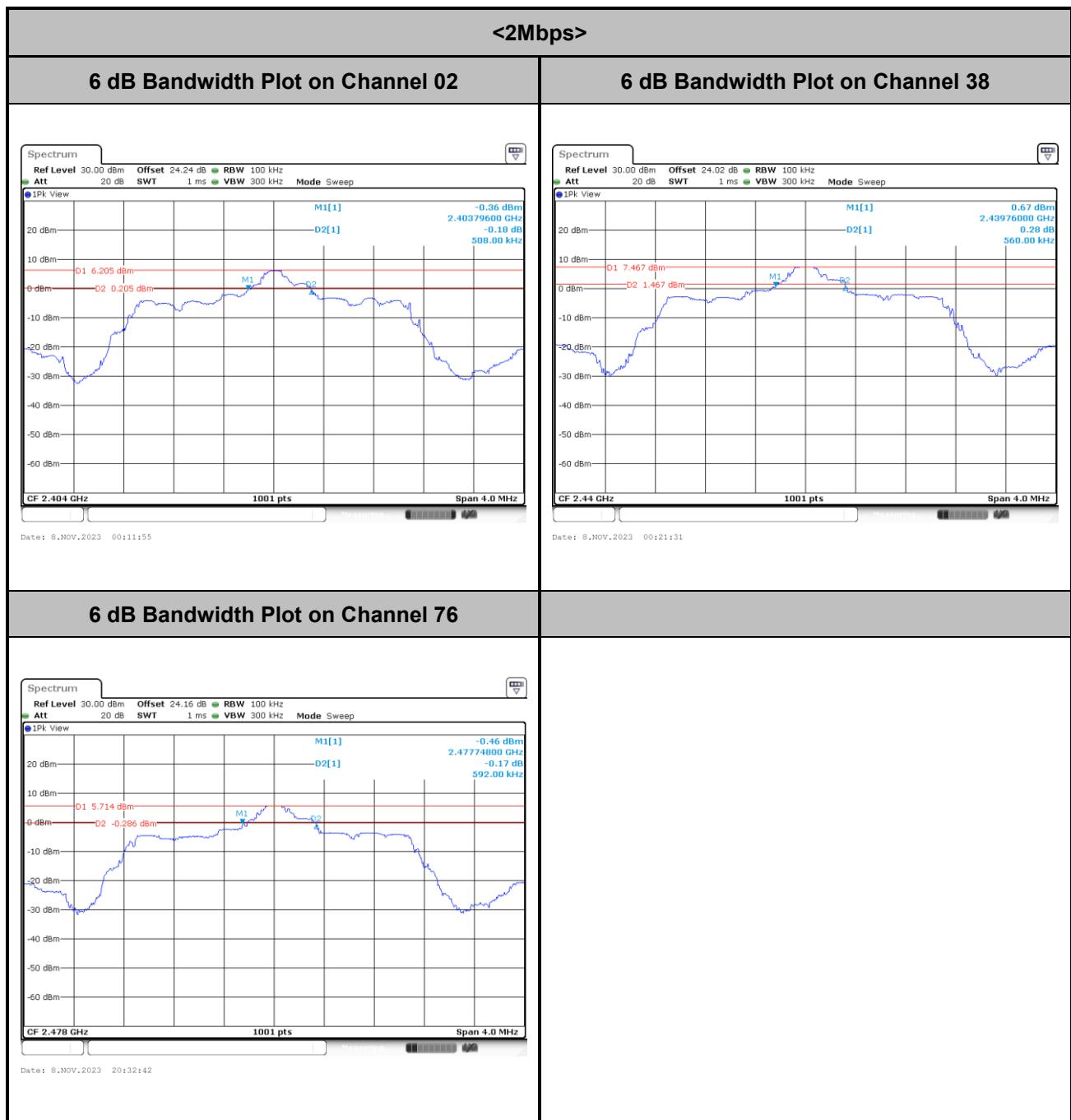






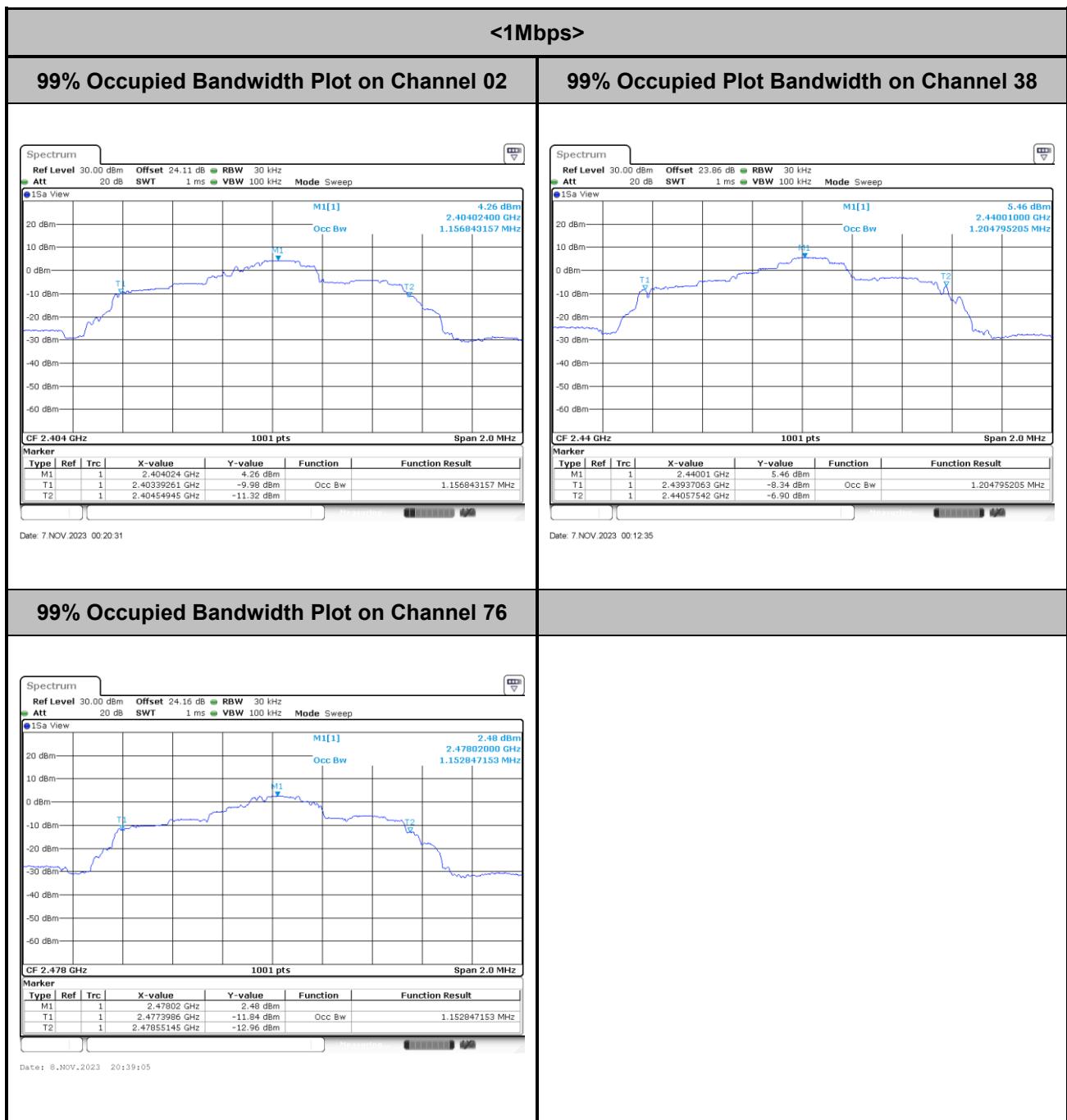
<Ant. 4>

6dB Bandwidth

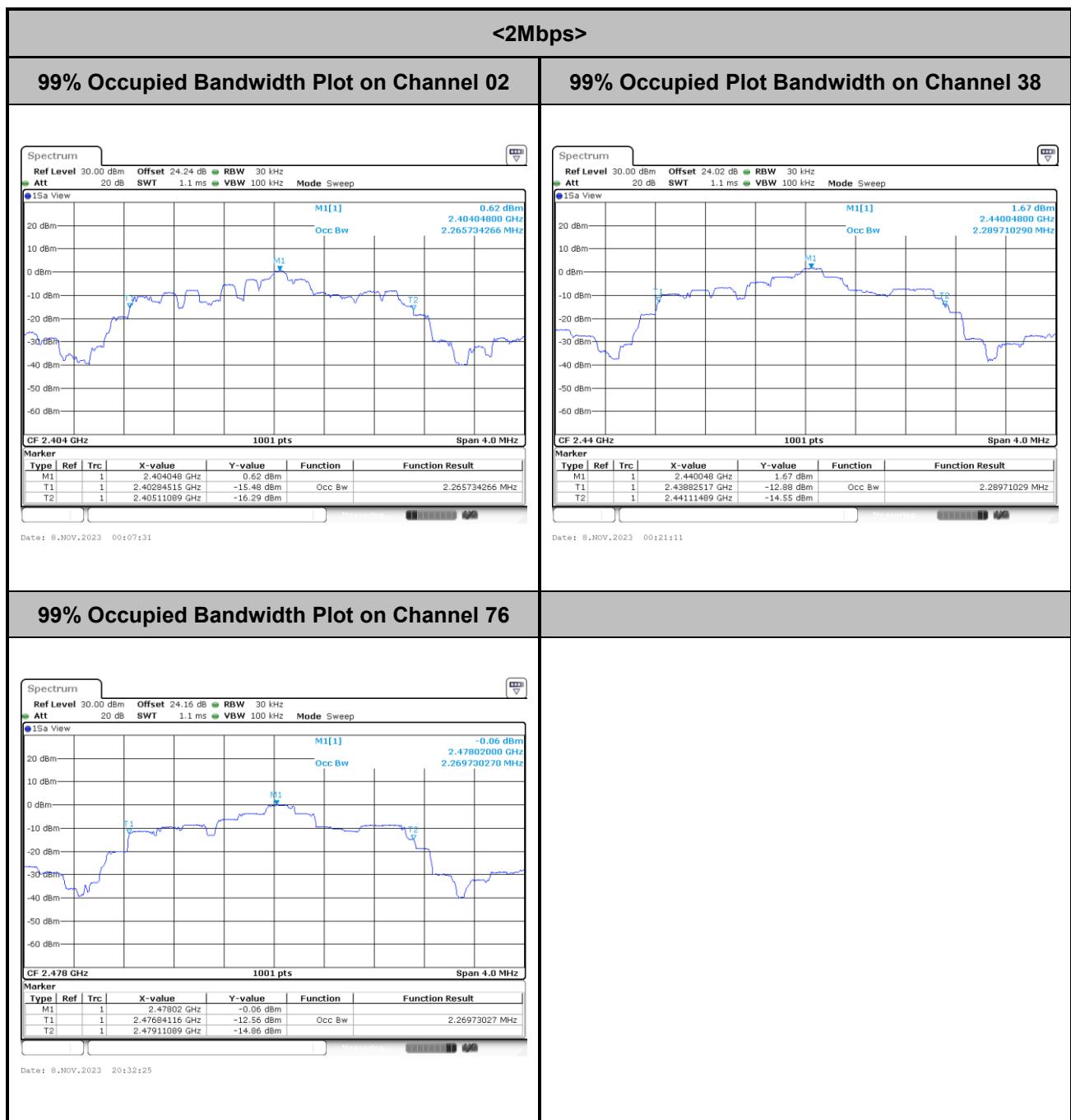




99% Occupied Bandwidth

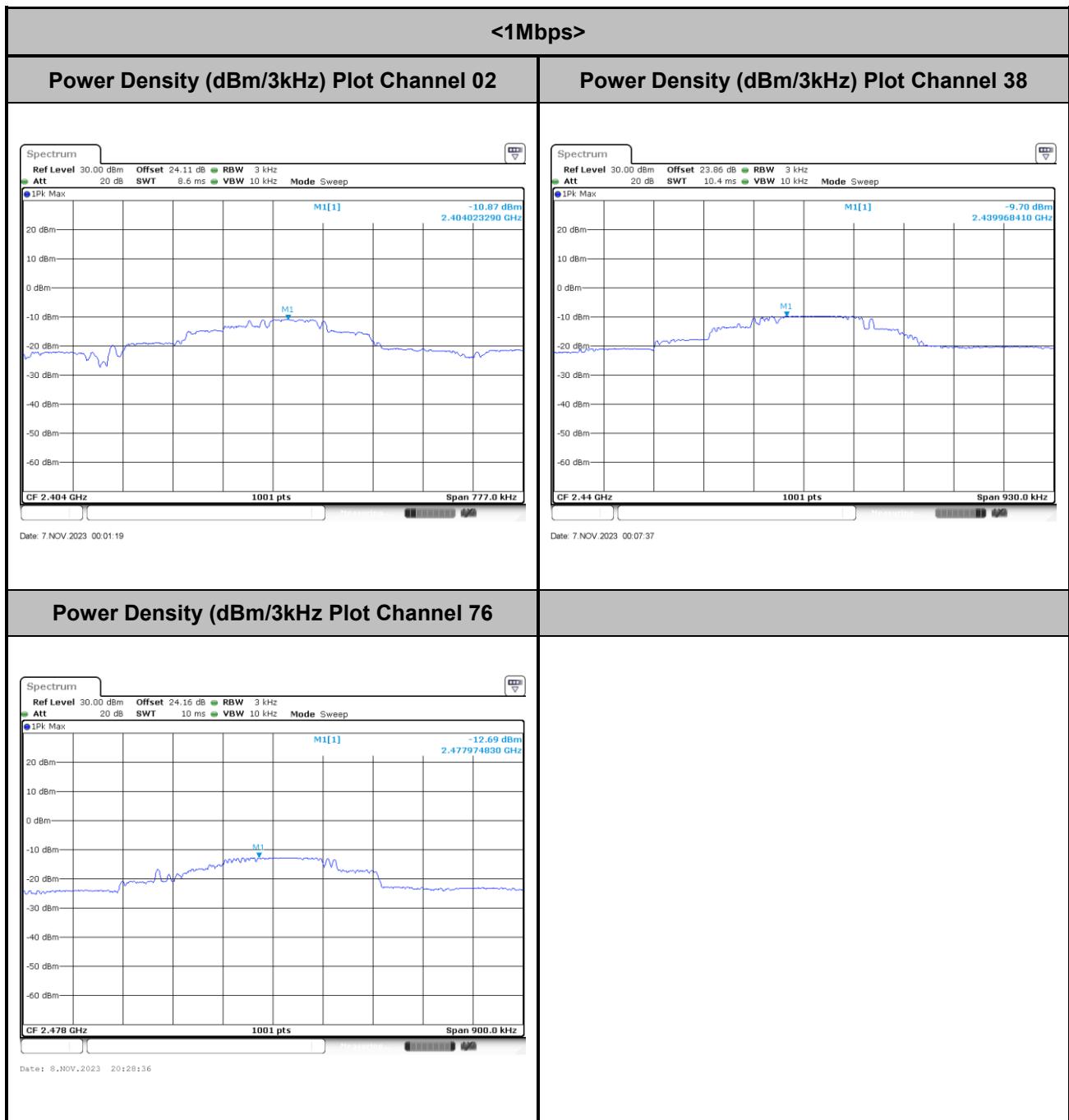


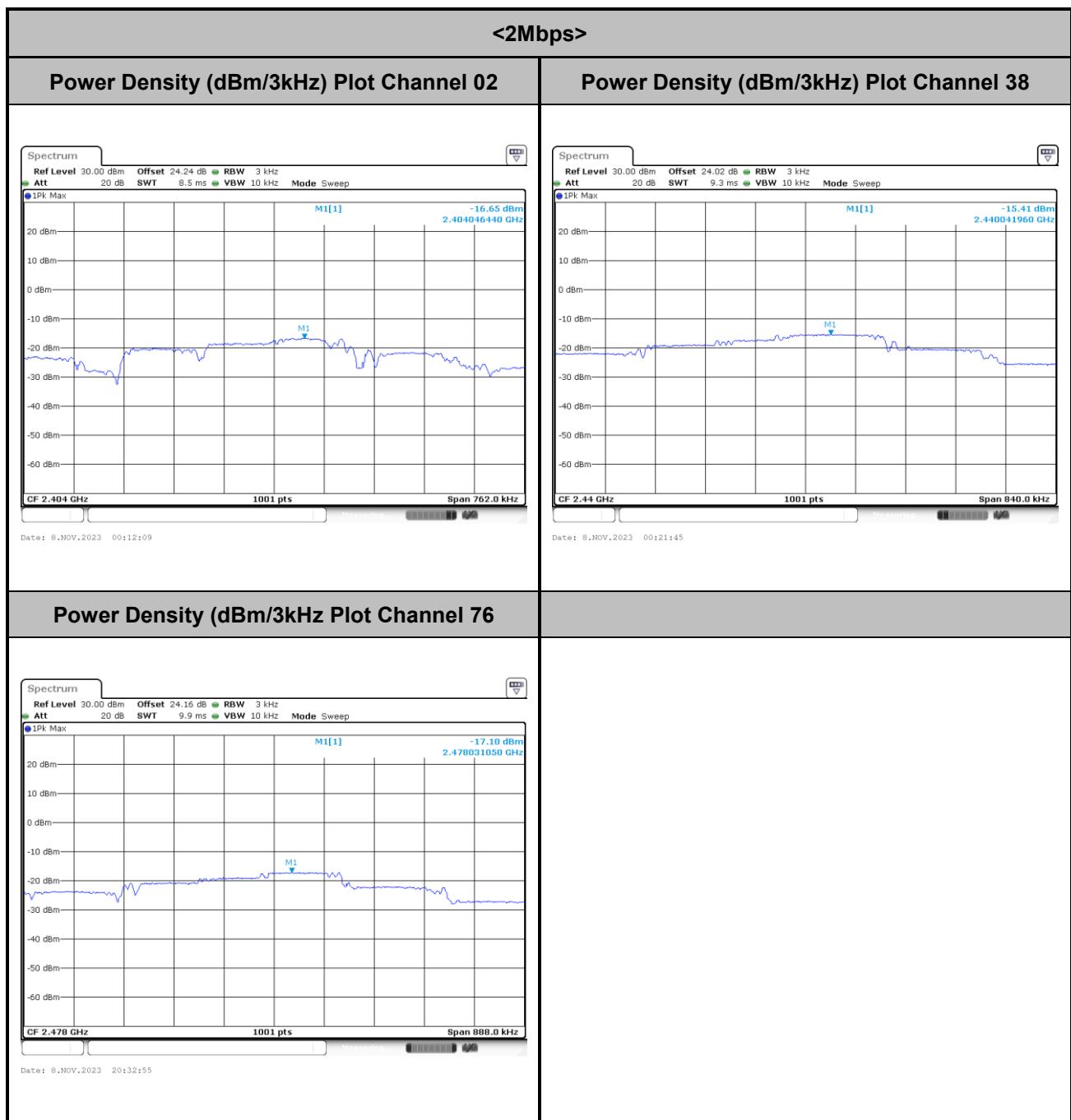
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.





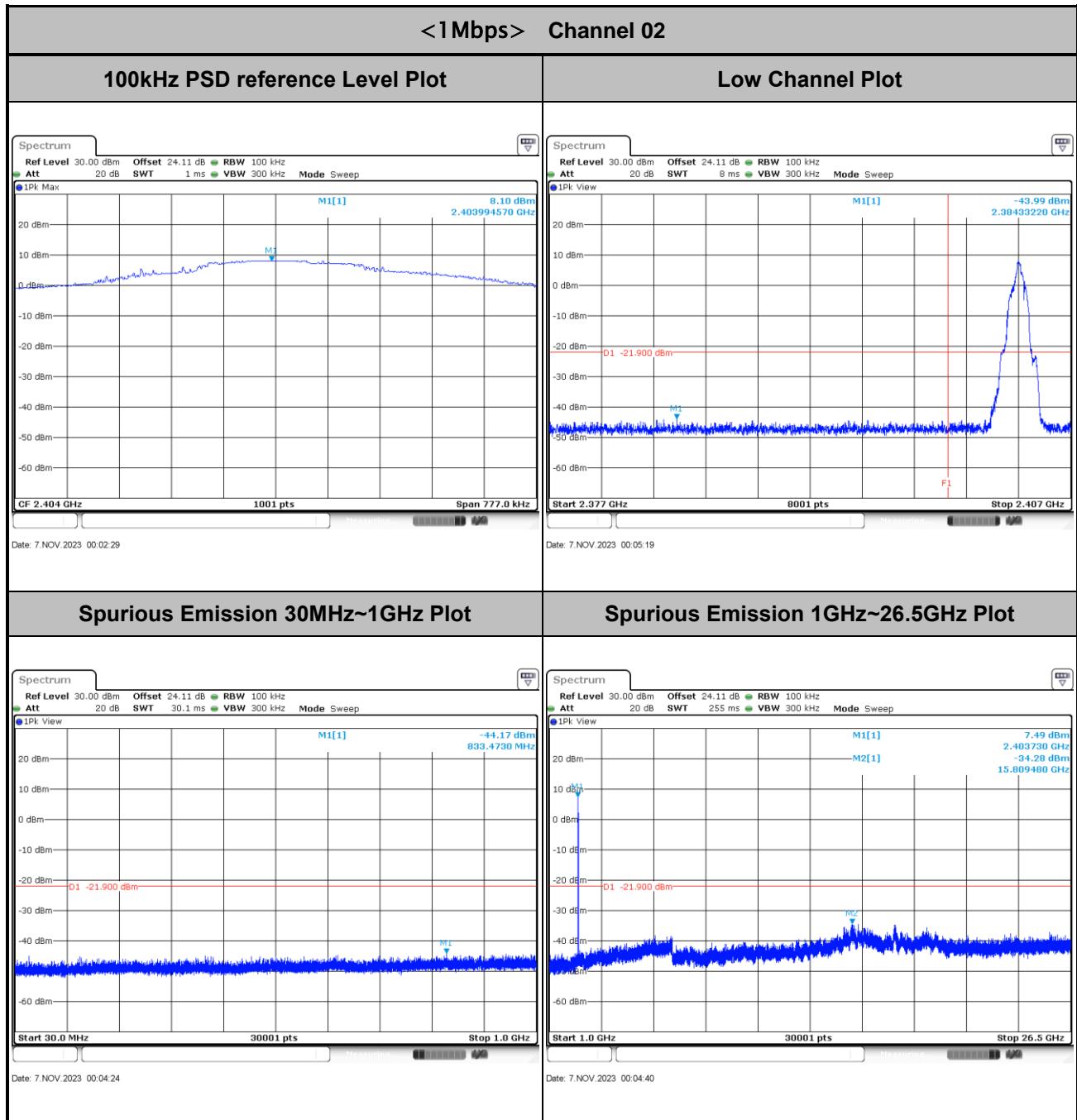
Power Spectral Density (dBm/3kHz)

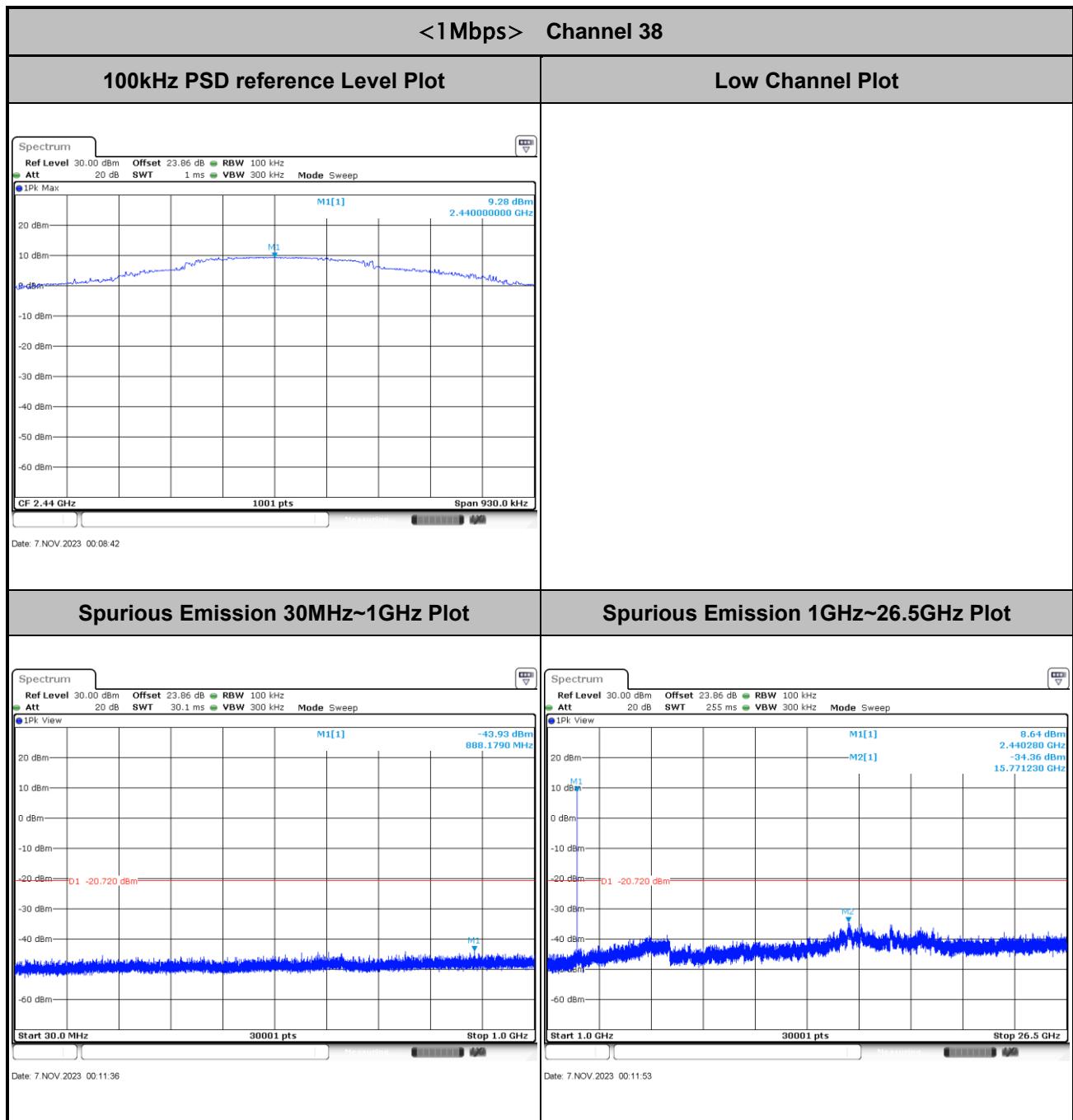


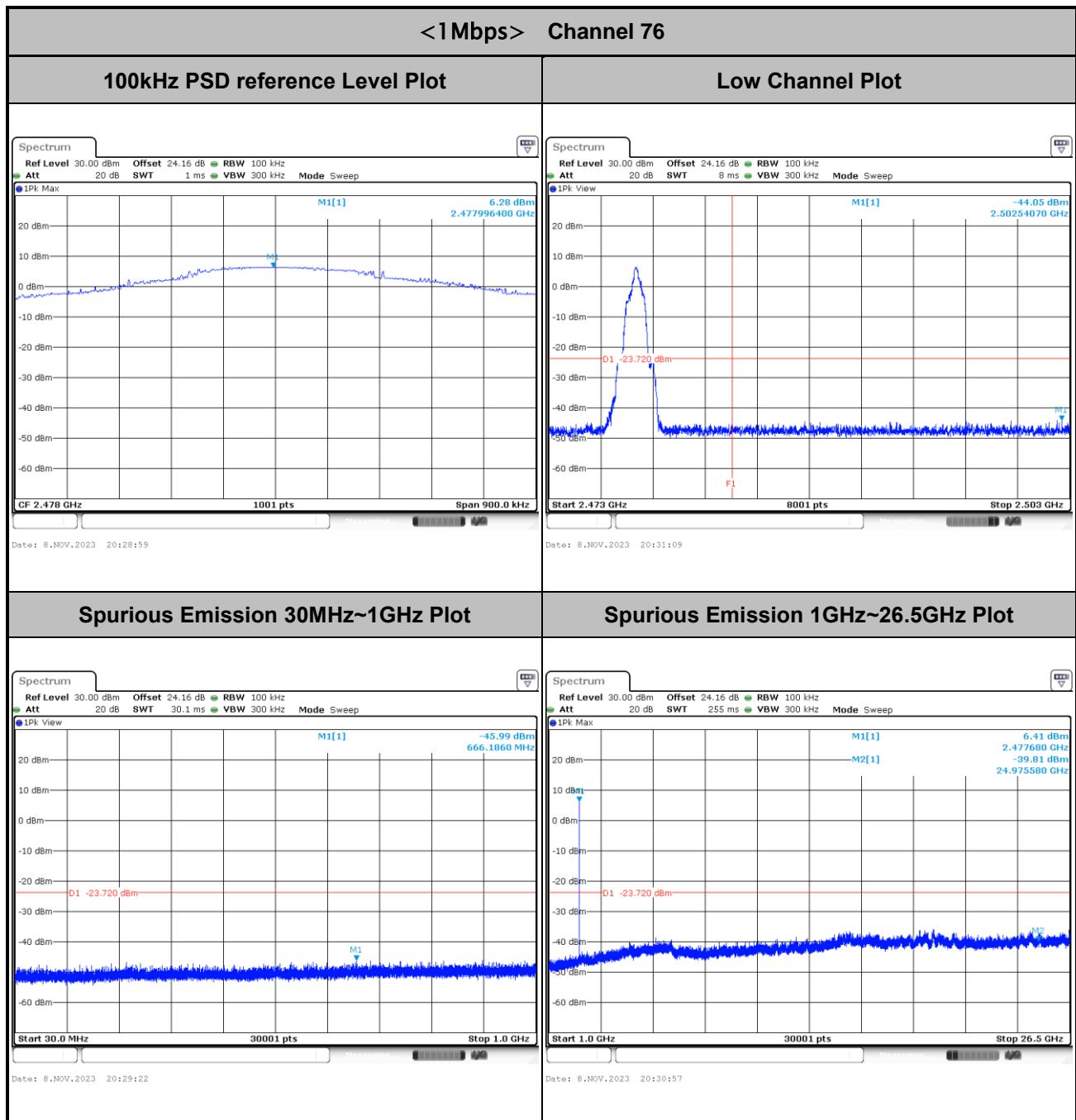


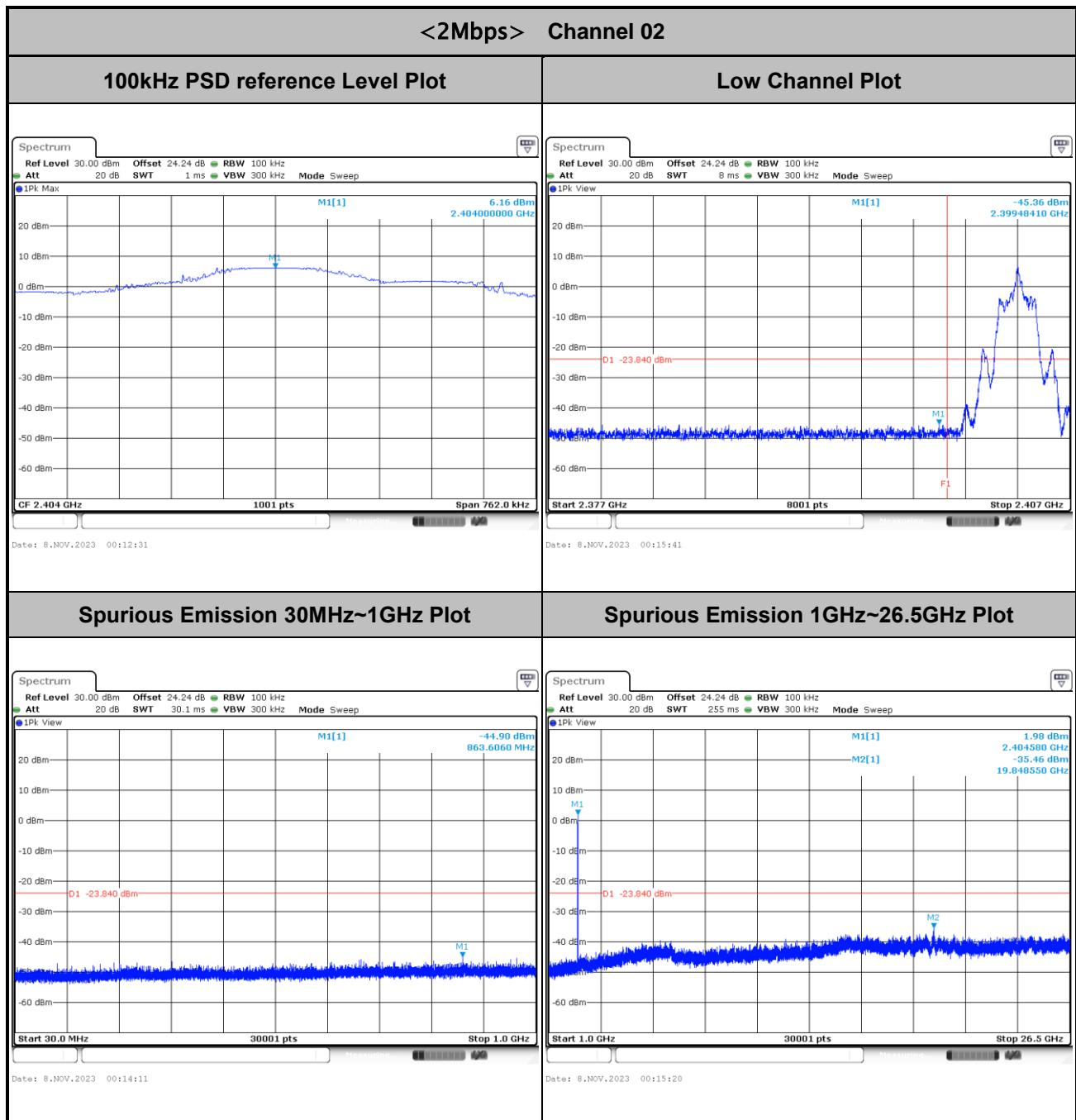


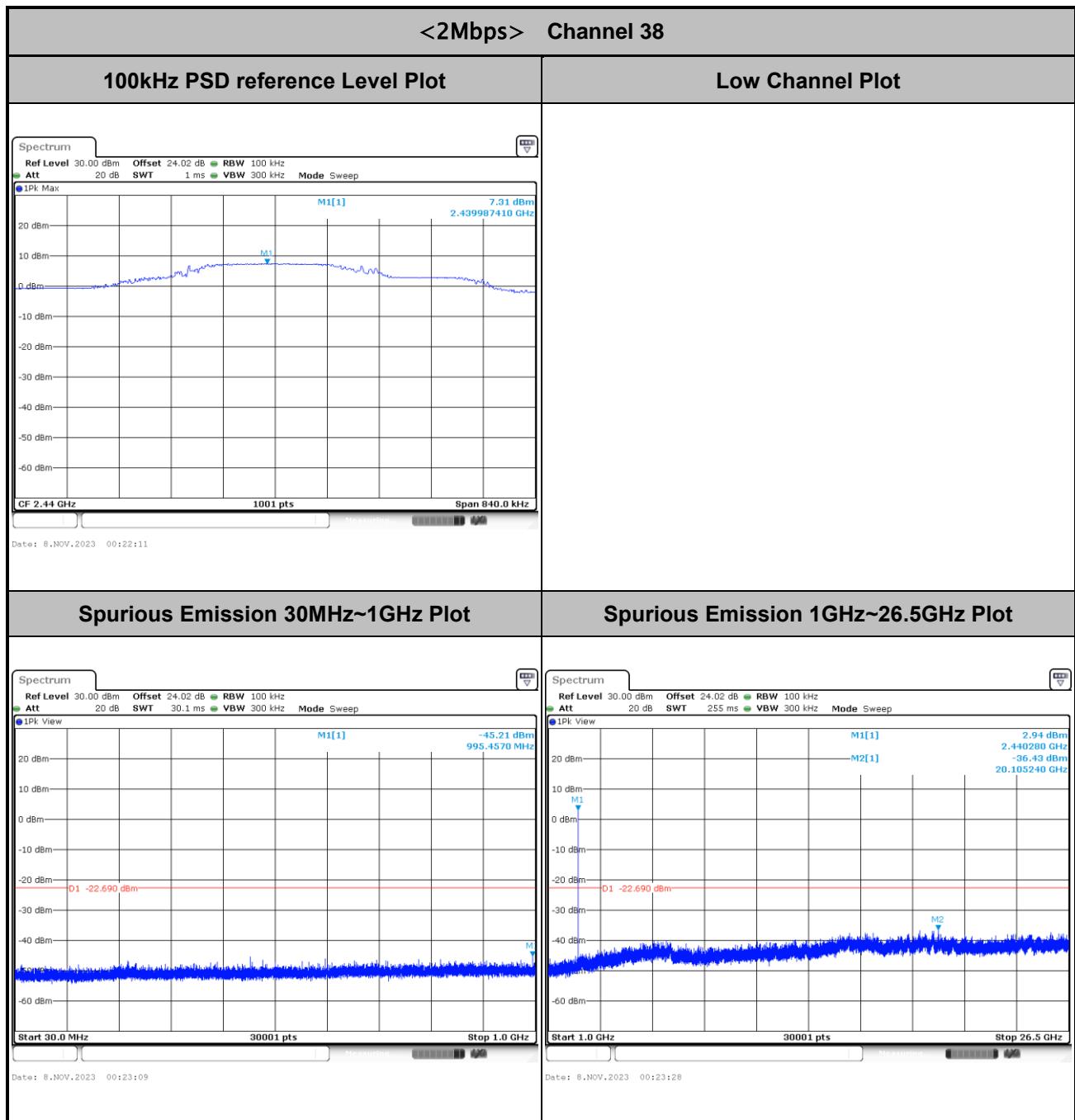
Band Edge and Spurious Emission

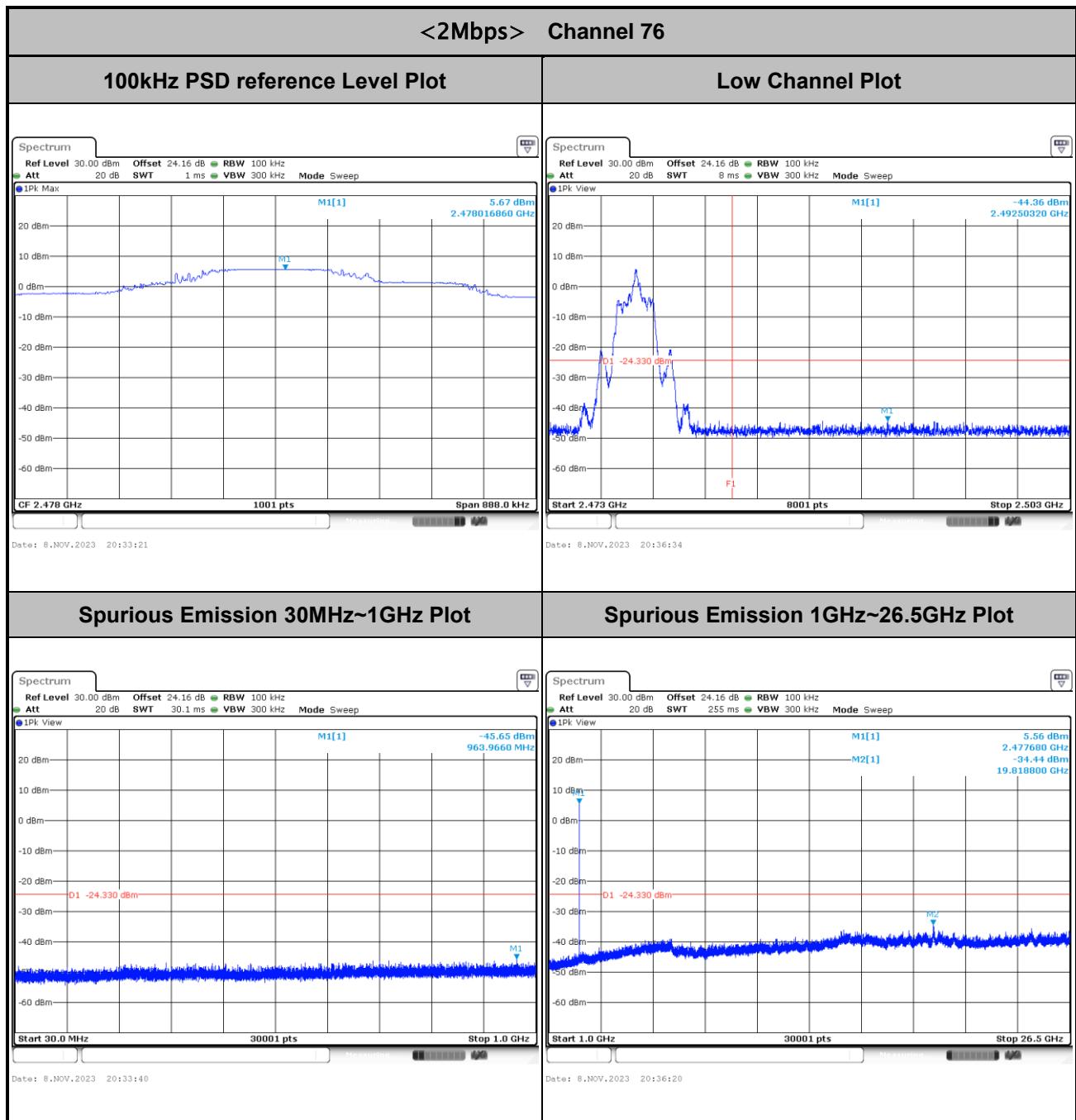














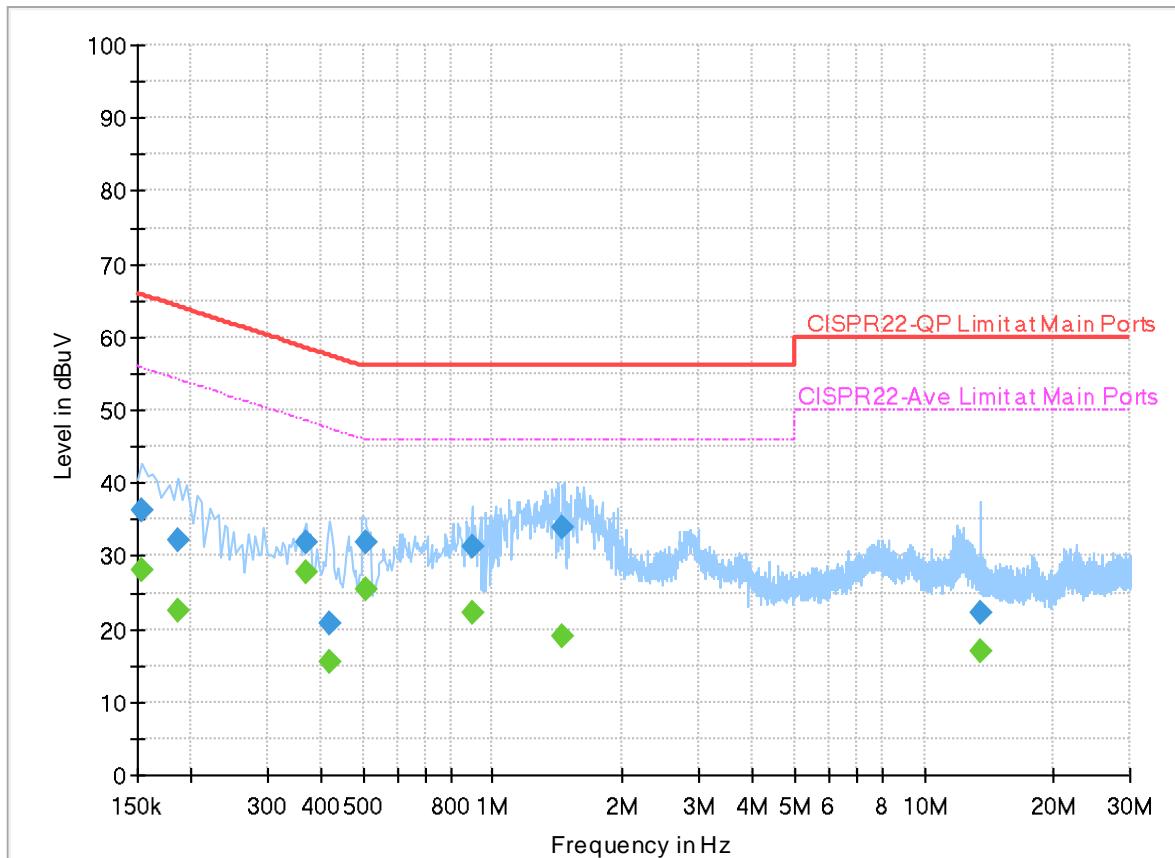
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Louis Chung	Temperature :	23.4~26.7°C
		Relative Humidity :	62.3~67.1%

EUT Information

Report NO : 380307
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Line

Full Spectrum



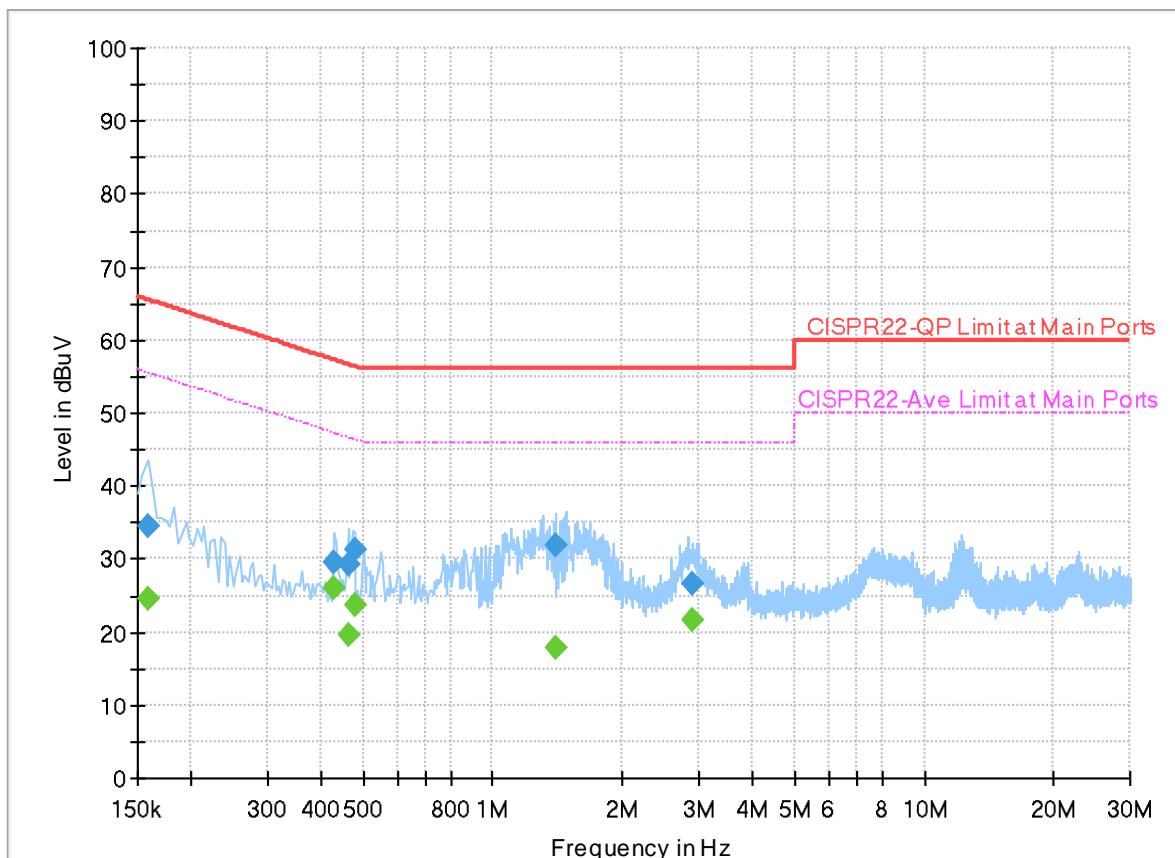
Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.154000	---	27.93	55.78	27.85	L1	OFF	19.9
0.154000	36.38	---	65.78	29.40	L1	OFF	19.9
0.186000	---	22.66	54.21	31.55	L1	OFF	19.9
0.186000	32.02	---	64.21	32.19	L1	OFF	19.9
0.370000	---	27.81	48.50	20.69	L1	OFF	19.9
0.370000	31.87	---	58.50	26.63	L1	OFF	19.9
0.418000	---	15.58	47.49	31.91	L1	OFF	20.0
0.418000	20.65	---	57.49	36.84	L1	OFF	20.0
0.506000	---	25.51	46.00	20.49	L1	OFF	20.0
0.506000	31.94	---	56.00	24.06	L1	OFF	20.0
0.894000	---	22.20	46.00	23.80	L1	OFF	20.0
0.894000	31.25	---	56.00	24.75	L1	OFF	20.0
1.454000	---	19.14	46.00	26.86	L1	OFF	20.0
1.454000	33.87	---	56.00	22.13	L1	OFF	20.0
13.566000	---	17.05	50.00	32.95	L1	OFF	20.1
13.566000	22.25	---	60.00	37.75	L1	OFF	20.1

EUT Information

Report NO : 380307
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Neutral

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.158000	---	24.50	55.57	31.07	N	OFF	19.9
0.158000	34.36	---	65.57	31.21	N	OFF	19.9
0.430000	---	25.90	47.25	21.35	N	OFF	20.0
0.430000	29.60	---	57.25	27.65	N	OFF	20.0
0.462000	---	19.61	46.66	27.05	N	OFF	20.0
0.462000	29.31	---	56.66	27.35	N	OFF	20.0
0.478000	---	23.57	46.37	22.80	N	OFF	20.0
0.478000	31.19	---	56.37	25.18	N	OFF	20.0
1.394000	---	17.79	46.00	28.21	N	OFF	20.0
1.394000	31.80	---	56.00	24.20	N	OFF	20.0
2.918000	---	21.73	46.00	24.27	N	OFF	20.0
2.918000	26.65	---	56.00	29.35	N	OFF	20.0



Appendix C. Radiated Spurious Emission

Test Engineer :	Bigshow Wang, Quentin Liu and Danel Lee	Temperature :	21~26°C
		Relative Humidity :	45~60%

<GFSK 1Mbps>
<Ant. 3>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency (MHz)	Level (dB μ V/m)	Margin (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna	Path Loss (dB)	Preamp Factor (dB)	Ant	Table	Peak Pos (cm)	Avg. Pos (deg)	Peak (P/A)	Pol. (H/V)
BLE CH 02 2404MHz		2381.604	50.17	-23.83	74	44.06	27.36	15.52	36.77	297	216	P	H		
		2354.166	42.51	-11.49	54	36.5	27.31	15.48	36.78	297	216	A	H		
	*	2404	104.23	-	-	98.04	27.42	15.54	36.77	297	216	P	H		
	*	2404	102.63	-	-	96.44	27.42	15.54	36.77	297	216	A	H		
															H
															H
		2318.976	50.14	-23.86	74	44.25	27.24	15.43	36.78	300	293	P	V		
		2330.196	42.39	-11.61	54	36.46	27.26	15.45	36.78	300	293	A	V		
	*	2404	102.19	-	-	96	27.42	15.54	36.77	300	293	P	V		
	*	2404	101.18	-	-	94.99	27.42	15.54	36.77	300	293	A	V		
BLE CH 38 2440MHz		2382.8	50	-24	74	43.88	27.37	15.52	36.77	100	273	P	H		
		2365.58	42.03	-11.97	54	35.99	27.33	15.49	36.78	100	273	A	H		
	*	2440	103.99	-	-	97.61	27.56	15.59	36.77	100	273	P	H		
	*	2440	102.72	-	-	96.34	27.56	15.59	36.77	100	273	A	H		
		2496.08	50.3	-23.7	74	43.64	27.78	15.65	36.77	100	273	P	H		
		2486.84	42.67	-11.33	54	36.05	27.75	15.64	36.77	100	273	A	H		
		2382.66	49.87	-24.13	74	43.75	27.37	15.52	36.77	372	292	P	V		
		2385.32	42.18	-11.82	54	36.06	27.37	15.52	36.77	372	292	A	V		
	*	2440	102.86	-	-	96.48	27.56	15.59	36.77	372	292	P	V		
	*	2440	101.69	-	-	95.31	27.56	15.59	36.77	372	292	A	V		
		2496.5	50.97	-23.03	74	44.3	27.79	15.65	36.77	372	292	P	V		
		2486.14	42.74	-11.26	54	36.13	27.74	15.64	36.77	372	292	A	V		



BLE CH 76 2478MHz	*	2478	102.88	-	-	96.31	27.71	15.63	36.77	100	213	P	H	
	*	2478	102.41	-	-	95.84	27.71	15.63	36.77	100	213	A	H	
		2497.63	50.45	-23.55	74	43.78	27.79	15.65	36.77	100	213	P	H	
		2495.26	42.75	-11.25	54	36.09	27.78	15.65	36.77	100	213	A	H	
													H	
													H	
	*	2478	101.24	-	-	94.67	27.71	15.63	36.77	400	302	P	V	
	*	2478	100.27	-	-	93.7	27.71	15.63	36.77	400	302	A	V	
		2495.89	50.28	-23.72	74	43.62	27.78	15.65	36.77	400	302	P	V	
		2495.47	42.9	-11.1	54	36.24	27.78	15.65	36.77	400	302	A	V	
													V	
													V	
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.													



2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dB μ V/m)	Margin (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 02 2404MHz		4808	39.29	-34.71	74	56.4	32.15	8.5	57.76	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H



BLE	Note	Frequency (MHz)	Level (dB μ V/m)	Margin (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 38 2440MHz		4880	40.02	-33.98	74	56.66	32.58	8.56	57.78	-	-	P	H
		7320	44.47	-29.53	74	56.11	36.68	10.34	58.66	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		4880	39.63	-34.37	74	56.27	32.58	8.56	57.78	-	-	P	V
		7320	45.03	-28.97	74	56.67	36.68	10.34	58.66	-	-	P	V
													V
													V
													V
													V
													V
													V
													V
													V
													V





Emission after 18GHz

2.4GHz BLE (SHF)

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
2.4GHz BLE SHF	23904	39.43	-34.57	74	57.32	38.54	-2.59	53.84	-	-	P	H	
	24120	39.37	-34.63	74	56.94	38.69	-2.56	53.7	-	-	P	V	
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												



Emission below 1GHz

2.4GHz BLE (LF)



<GFSK 2Mbps>

<Ant. 3>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 02 2404MHz		2353.86	50.18	-23.82	74	44.17	27.31	15.48	36.78	100	326	P	H
		2380.992	43.02	-10.98	54	36.92	27.36	15.51	36.77	100	326	A	H
	*	2404	103.13	-	-	96.94	27.42	15.54	36.77	100	326	P	H
	*	2404	101.53	-	-	95.34	27.42	15.54	36.77	100	326	A	H
													H
													H
		2313.774	49.95	-24.05	74	44.08	27.23	15.42	36.78	100	246	P	V
		2347.842	42.38	-11.62	54	36.39	27.3	15.47	36.78	100	246	A	V
	*	2404	105.23	-	-	99.04	27.42	15.54	36.77	100	246	P	V
	*	2404	103.18	-	-	96.99	27.42	15.54	36.77	100	246	A	V
BLE CH 38 2440MHz		2334.64	49.94	-24.06	74	44	27.27	15.45	36.78	100	326	P	H
		2368.8	42.47	-11.53	54	36.41	27.34	15.5	36.78	100	326	A	H
	*	2440	104.22	-	-	97.84	27.56	15.59	36.77	100	326	P	H
	*	2440	102.47	-	-	96.09	27.56	15.59	36.77	100	326	A	H
		2491.11	50.7	-23.3	74	44.07	27.76	15.64	36.77	100	326	P	H
		2485.86	42.67	-11.33	54	36.06	27.74	15.64	36.77	100	326	A	H
		2387.84	49.96	-24.04	74	43.83	27.38	15.52	36.77	100	248	P	V
		2363.34	42.54	-11.46	54	36.5	27.33	15.49	36.78	100	248	A	V
	*	2440	105.06	-	-	98.68	27.56	15.59	36.77	100	248	P	V
	*	2440	102.44	-	-	96.06	27.56	15.59	36.77	100	248	A	V
		2493	50.78	-23.22	74	44.13	27.77	15.65	36.77	100	248	P	V
		2485.37	42.65	-11.35	54	36.04	27.74	15.64	36.77	100	248	A	V



BLE CH 76 2478MHz	*	2478	103.68	-	-	97.11	27.71	15.63	36.77	116	325	P	H
	*	2478	100.67	-	-	94.1	27.71	15.63	36.77	116	325	A	H
		2483.74	51.88	-22.12	74	45.28	27.73	15.64	36.77	116	325	P	H
		2490.16	42.77	-11.23	54	36.14	27.76	15.64	36.77	116	325	A	H
													H
													H
	*	2478	103.82	-	-	97.25	27.71	15.63	36.77	100	259	P	V
	*	2478	100.8	-	-	94.23	27.71	15.63	36.77	100	259	A	V
		2485.24	51.76	-22.24	74	45.15	27.74	15.64	36.77	100	259	P	V
		2485.54	42.71	-11.29	54	36.1	27.74	15.64	36.77	100	259	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dB μ V/m)	Margin (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 02 2404MHz		4808	39.65	-34.35	74	56.76	32.15	8.5	57.76	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													V
													V
													V
													V
													V
													V
													V
													V







<GFSK 1Mbps>
<Ant. 4>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 02 2404MHz		2358.246	50.49	-23.51	74	44.47	27.32	15.48	36.78	100	119	P	H
		2366.61	42.18	-11.82	54	36.14	27.33	15.49	36.78	100	119	A	H
	*	2404	99.98	-	-	93.79	27.42	15.54	36.77	100	119	P	H
	*	2404	98.78	-	-	92.59	27.42	15.54	36.77	100	119	A	H
													H
													H
		2341.212	50.36	-23.64	74	44.4	27.28	15.46	36.78	376	314	P	V
		2379.36	42.38	-11.62	54	36.28	27.36	15.51	36.77	376	314	A	V
	*	2404	94.99	-	-	88.8	27.42	15.54	36.77	376	314	P	V
	*	2404	94.58	-	-	88.39	27.42	15.54	36.77	376	314	A	V
													V
													V
BLE CH 38 2440MHz		2318.26	49.54	-24.46	74	43.65	27.24	5.51	36.78	100	100	P	H
		2343.88	42.67	-11.33	54	36.7	27.29	5.54	36.78	100	100	A	H
	*	2440	104.3	-	-	97.92	27.56	5.67	36.77	100	100	P	H
	*	2440	102.47	-	-	96.09	27.56	5.67	36.77	100	100	A	H
		2489.22	51.41	-22.59	74	44.78	27.76	5.72	36.77	100	100	P	H
		2497.83	42.59	-11.41	54	35.92	27.79	5.73	36.77	100	100	A	H
		2315.74	50.48	-23.52	74	44.6	27.23	5.51	36.78	375	272	P	V
		2387.56	42.26	-11.74	54	36.13	27.38	5.6	36.77	375	272	A	V
	*	2440	97.35	-	-	90.97	27.56	5.67	36.77	375	272	P	V
	*	2440	96.11	-	-	89.73	27.56	5.67	36.77	375	272	A	V
		2488.45	50.13	-23.87	74	43.51	27.75	5.72	36.77	375	272	P	V
		2490.48	43.04	-10.96	54	36.41	27.76	15.64	36.77	375	272	A	V



BLE CH 76 2478MHz	*	2478	103.73	-	-	97.16	27.71	15.63	36.77	100	98	P	H
	*	2478	101.82	-	-	95.25	27.71	15.63	36.77	100	98	A	H
		2492.38	50.22	-23.78	74	43.57	27.77	15.65	36.77	100	98	P	H
		2491.93	42.65	-11.35	54	36	27.77	15.65	36.77	100	98	A	H
													H
													H
	*	2478	99.7	-	-	93.13	27.71	15.63	36.77	400	291	P	V
	*	2478	98.78	-	-	92.21	27.71	15.63	36.77	400	291	A	V
		2493.91	50.94	-23.06	74	44.28	27.78	15.65	36.77	400	291	P	V
		2487.28	42.82	-11.18	54	36.2	27.75	15.64	36.77	400	291	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dB μ V/m)	Margin (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 02 2404MHz		4808	39.24	-34.76	74	56.35	32.15	8.5	57.76	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H







Emission after 18GHz

2.4GHz BLE (SHF)

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.	
												Line	Level	Factor
												(MHz)	(dB μ V/m)	(dB)
2.4GHz BLE SHF	24183	39.08	-34.92	74	56.49	38.79	-2.55	53.65	-	-	P	H		
														H
														H
														H
														H
														H
														H
														H
	22275	39.37	-34.63	74	58.9	38.21	-3.09	54.65	-	-	P	V		
														V
														V
														V
														V
														V
														V
														V
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.													



Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.	
												Line	Level	Factor
												(dB/m)	(dB)	(dB)
2.4GHz BLE LF		30.72	24.55	-15.45	40	31.98	24.24	0.72	32.39	-	-		P	H
		88.14	22.97	-20.53	43.5	39.64	14.49	1.25	32.41	-	-		P	H
		163.2	21.87	-21.63	43.5	36.42	16.15	1.7	32.4	-	-		P	H
		505.6	25.33	-20.67	46	31.07	23.94	2.71	32.39	-	-		P	H
		662.4	27.62	-18.38	46	30.61	26.28	3.11	32.38	-	-		P	H
		859.2	30.93	-15.07	46	30.06	29.12	3.5	31.75	-	-		P	H
														H
														H
														H
														H
														H
														H
														H
														H
														H
														H
														H
														H
														H
														V
														V
														V
														V
														V
														V
														V
														V
	Remark	1.	No other spurious found.											
		2.	All results are PASS against limit line.											
		3.	The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.											



<GFSK 2Mbps>
<Ant. 4>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 02 2404MHz		2380.788	50.36	-23.64	74	44.26	27.36	15.51	36.77	100	94	P	H
		2321.526	42.45	-11.55	54	36.56	27.24	15.43	36.78	100	94	A	H
	*	2404	99.87	-	-	93.68	27.42	15.54	36.77	100	94	P	H
	*	2404	97.67	-	-	91.48	27.42	15.54	36.77	100	94	A	H
													H
													H
		2339.274	50.14	-23.86	74	44.18	27.28	15.46	36.78	376	298	P	V
		2371.2	42.31	-11.69	54	36.25	27.34	15.5	36.78	376	298	A	V
	*	2404	97.41	-	-	91.22	27.42	15.54	36.77	376	298	P	V
	*	2404	94.82	-	-	88.63	27.42	15.54	36.77	376	298	A	V
													V
													V
BLE CH 38 2440MHz		2383.92	50.03	-23.97	74	43.91	27.37	15.52	36.77	291	320	P	H
		2378.88	42.33	-11.67	54	36.23	27.36	15.51	36.77	291	320	A	H
	*	2440	99.96	-	-	93.58	27.56	15.59	36.77	291	320	P	H
	*	2440	98.19	-	-	91.81	27.56	15.59	36.77	291	320	A	H
		2492.23	50.17	-23.83	74	43.52	27.77	15.65	36.77	291	320	P	H
		2497.34	42.67	-11.33	54	36	27.79	15.65	36.77	291	320	A	H
		2313.22	49.73	-24.27	74	43.86	27.23	15.42	36.78	305	65	P	V
		2374.4	42.17	-11.83	54	36.09	27.35	15.51	36.78	305	65	A	V
	*	2440	104.04	-	-	97.66	27.56	15.59	36.77	305	65	P	V
	*	2440	101.17	-	-	94.79	27.56	15.59	36.77	305	65	A	V
		2483.76	50.55	-23.45	74	43.94	27.74	15.64	36.77	305	65	P	V
		2500	42.64	-11.36	54	35.96	27.8	15.65	36.77	305	65	A	V



BLE CH 76 2478MHz	*	2478	103.57	-	-	97	27.71	15.63	36.77	327	80	P	H
	*	2478	101.52	-	-	94.95	27.71	15.63	36.77	327	80	A	H
		2484.01	51.07	-22.93	74	44.46	27.74	15.64	36.77	327	80	P	H
		2484.4	42.66	-11.34	54	36.05	27.74	15.64	36.77	327	80	A	H
													H
													H
	*	2478	101.83	-	-	95.26	27.71	15.63	36.77	399	291	P	V
	*	2478	99.39	-	-	92.82	27.71	15.63	36.77	399	291	A	V
		2492.2	50.6	-23.4	74	43.95	27.77	15.65	36.77	399	291	P	V
		2484.1	42.68	-11.32	54	36.07	27.74	15.64	36.77	399	291	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dB μ V/m)	Margin (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 02 2404MHz		4808	39.24	-34.76	74	56.35	32.15	8.5	57.76	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H





**Note symbol**

*	Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is over limit line.
P/A	Peak or Average
H/V	Horizontal or Vertical



A calculation example for radiated spurious emission is shown as below:

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
			Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.		
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A) (H/V)	
BLE CH 00 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)

2. Level(dB μ V/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB μ V) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dB μ V/m) - Limit Line(dB μ V/m)

For Peak Limit @ 2390MHz:

1. Level(dB μ V/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB μ V) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dB μ V) - 35.86 (dB)

= 55.45 (dB μ V/m)

2. Over Limit(dB)

= Level(dB μ V/m) - Limit Line(dB μ V/m)

= 55.45(dB μ V/m) - 74(dB μ V/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dB μ V/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB μ V) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dB μ V) - 35.86 (dB)

= 43.54 (dB μ V/m)

2. Over Limit(dB)

= Level(dB μ V/m) - Limit Line(dB μ V/m)

= 43.54(dB μ V/m) - 54(dB μ V/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".



Appendix D. Radiated Spurious Emission Plots

Test Engineer :	Bigshow Wang, Quentin Liu and Danel Lee	Temperature :	21~26°C
		Relative Humidity :	45~60%

Note symbol

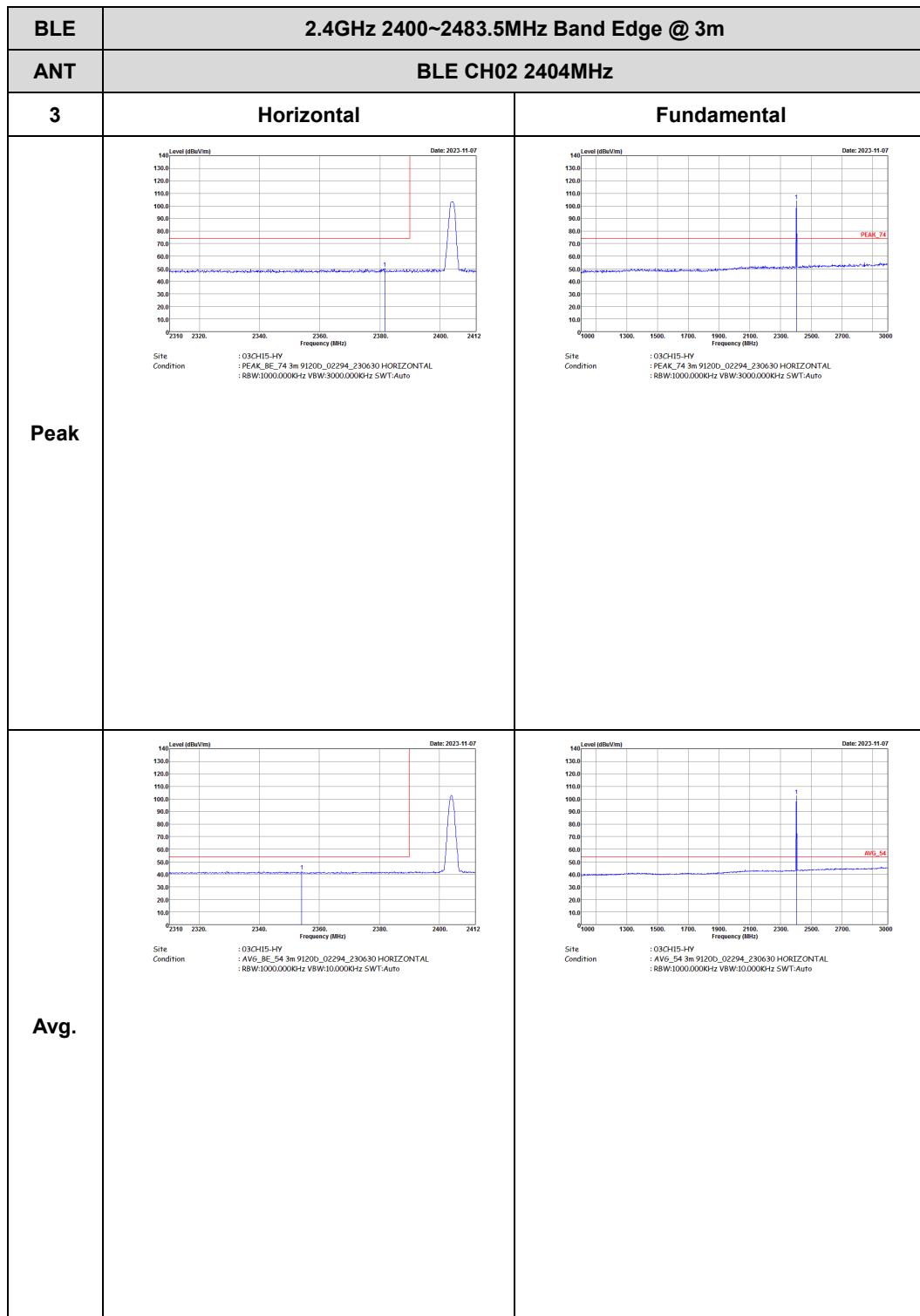
-L	Low channel location
-R	High channel location



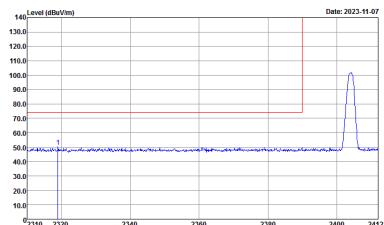
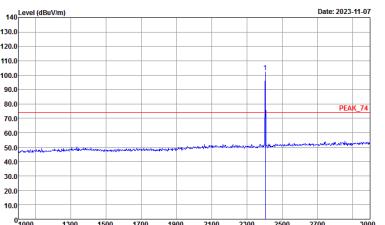
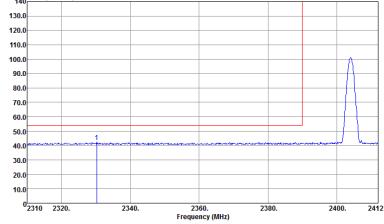
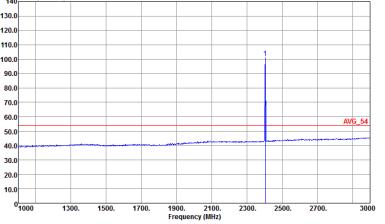
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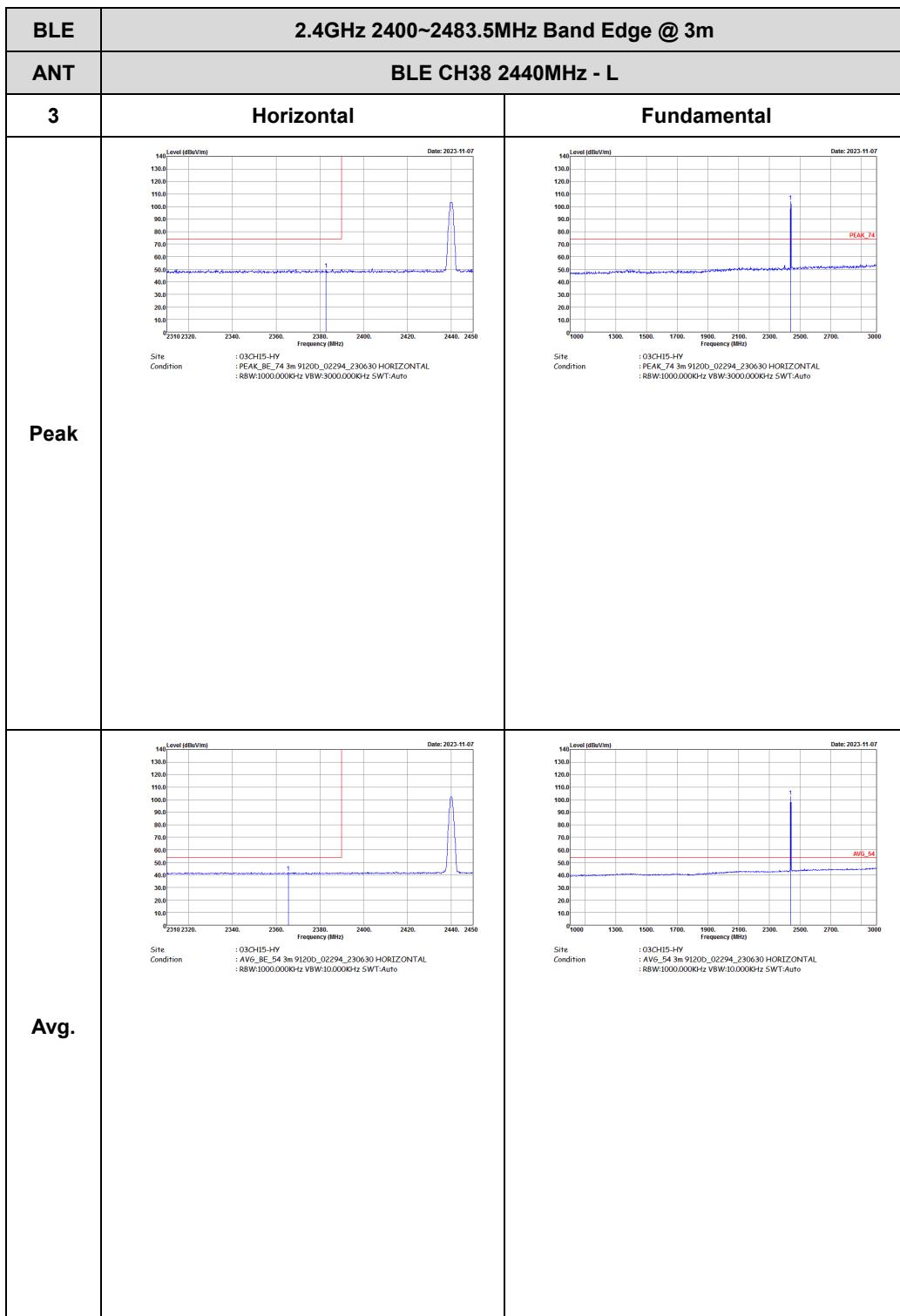
2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

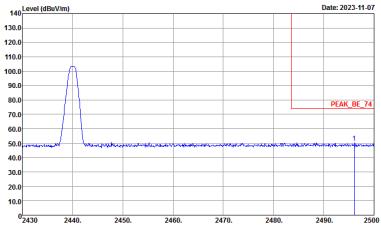
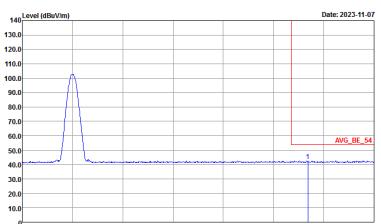




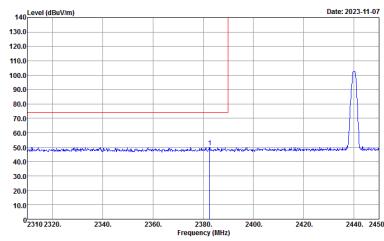
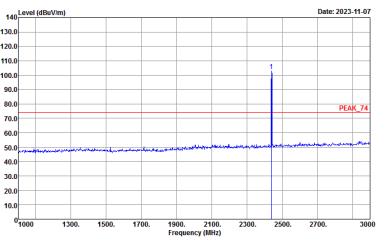
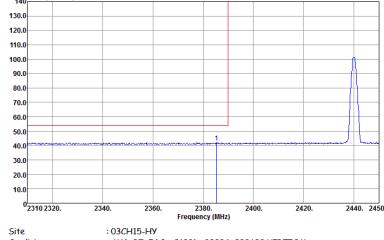
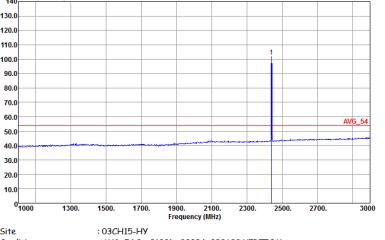
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH02 2404MHz	
3	Vertical	Fundamental
Peak	 <p>Site : 03CH15-H-Y Condition : PEAK_BE_74 3m 91200_02294_230630 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH15-H-Y Condition : PEAK_74 3m 91200_02294_230630 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg	 <p>Site : 03CH15-H-Y Condition : AVG_BE_54 3m 91200_02294_230630 VERTICAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	 <p>Site : 03CH15-H-Y Condition : AVG_54 3m 91200_02294_230630 VERTICAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>



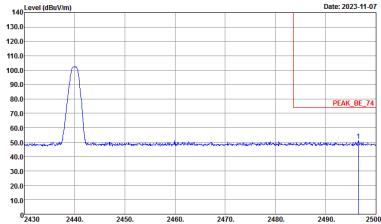
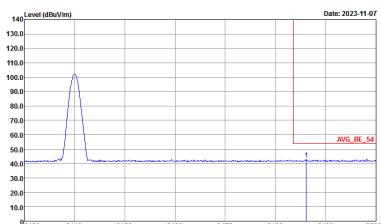


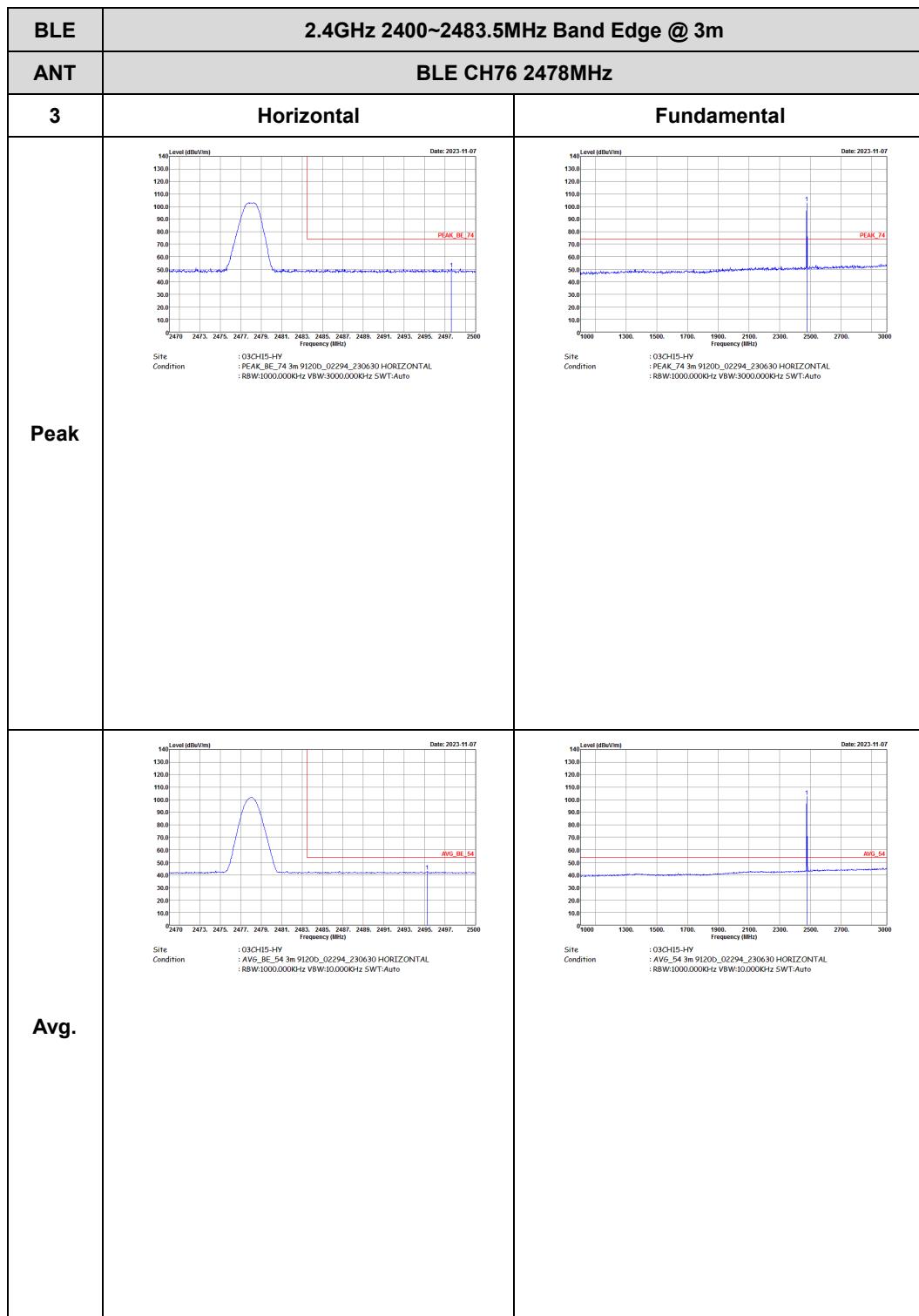
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH38 2440MHz - R	
3	Horizontal	Fundamental
Peak	 <p>Level (dBuV/m)</p> <p>Date: 2023-11-07</p> <p>Site : 03CH15-HY</p> <p>Condition : PEAK_BE_74 3m 91200_02294_230630 HORIZONTAL</p> <p>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	Left blank
Avg.	 <p>Level (dBuV/m)</p> <p>Date: 2023-11-07</p> <p>Site : 03CH15-HY</p> <p>Condition : AVG_BE_54 3m 91200_02294_230630 HORIZONTAL</p> <p>: RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	Left blank

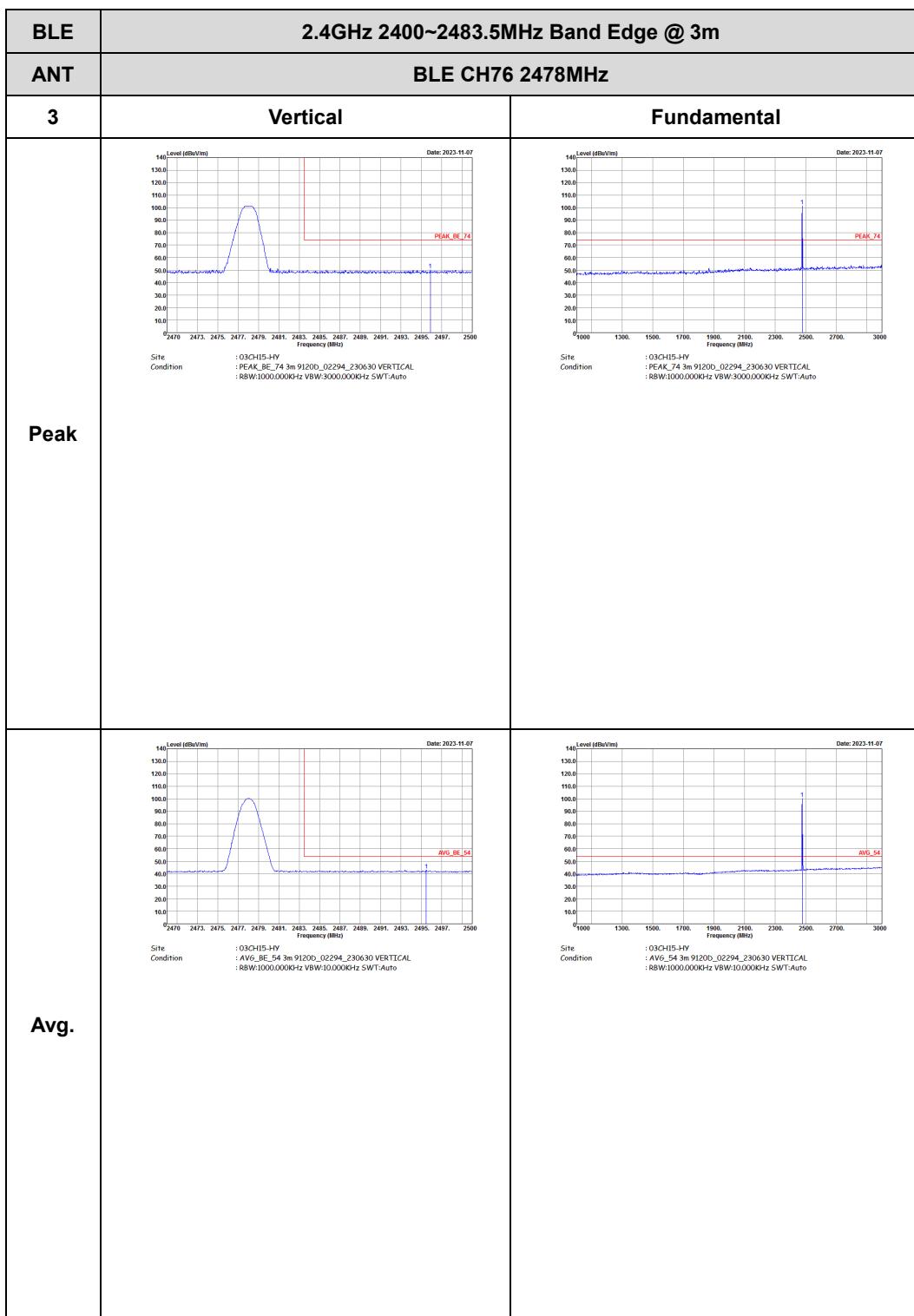


BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH38 2440MHz - L	
3	Vertical	Fundamental
Peak	 <p>Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_02294_230630 VERTICAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto</p>	 <p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_02294_230630 VERTICAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto</p>
Avg.	 <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_02294_230630 VERTICAL : RBW:1000.0000Hz VBW:10.0000Hz SWT:Auto</p>	 <p>Site : 03CH15-HY Condition : AVG_54 3m 91200_02294_230630 VERTICAL : RBW:1000.0000Hz VBW:10.0000Hz SWT:Auto</p>



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH38 2440MHz - R	
3	Vertical	Fundamental
Peak	 <p>Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_02294_230630 VERTICAL : RBW:1000.0000Hz VBW:3000.000KHz SWT:Auto</p>	Left blank
Avg.	 <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_02294_230630 VERTICAL : RBW:1000.0000Hz VBW:10.000KHz SWT:Auto</p>	Left blank

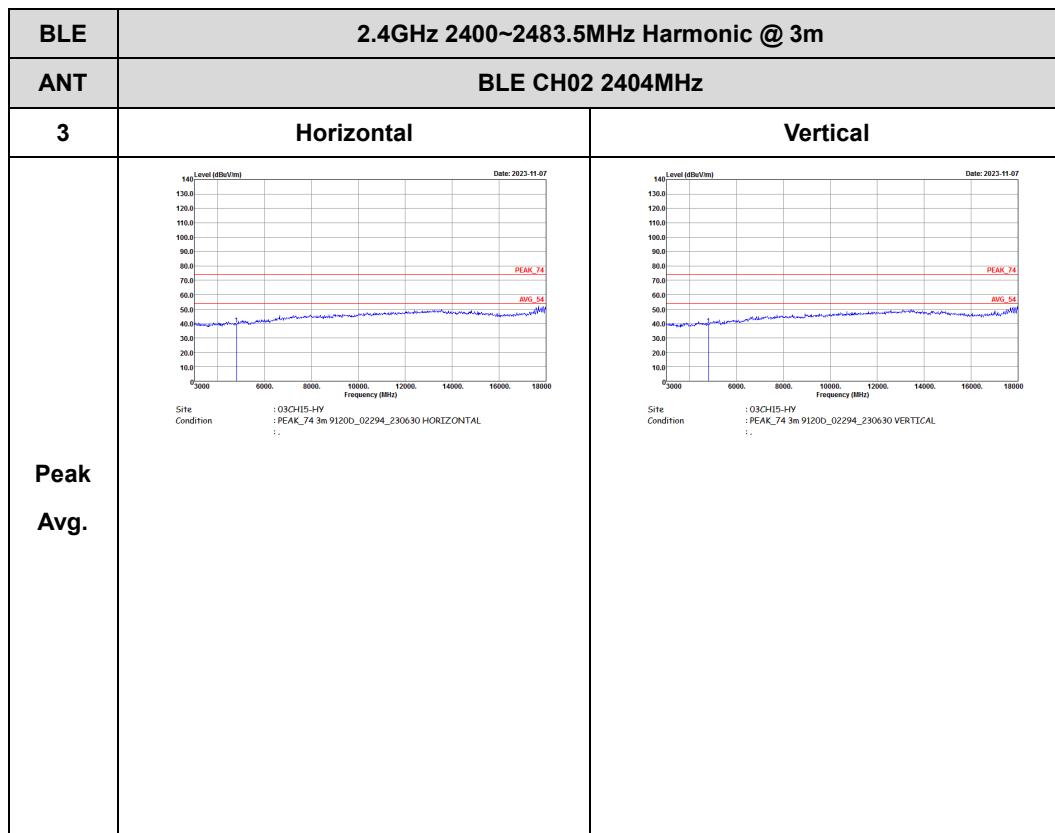


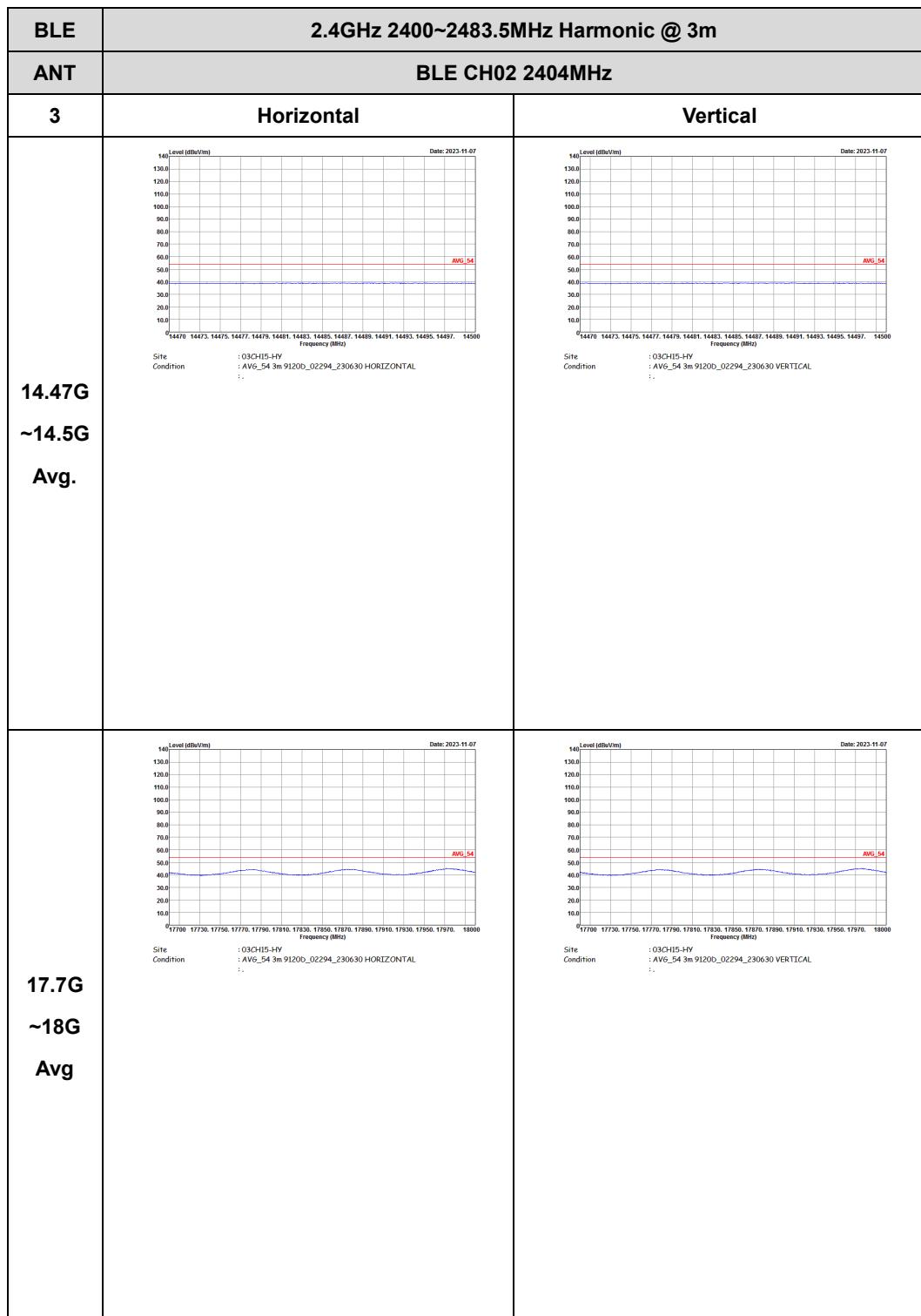


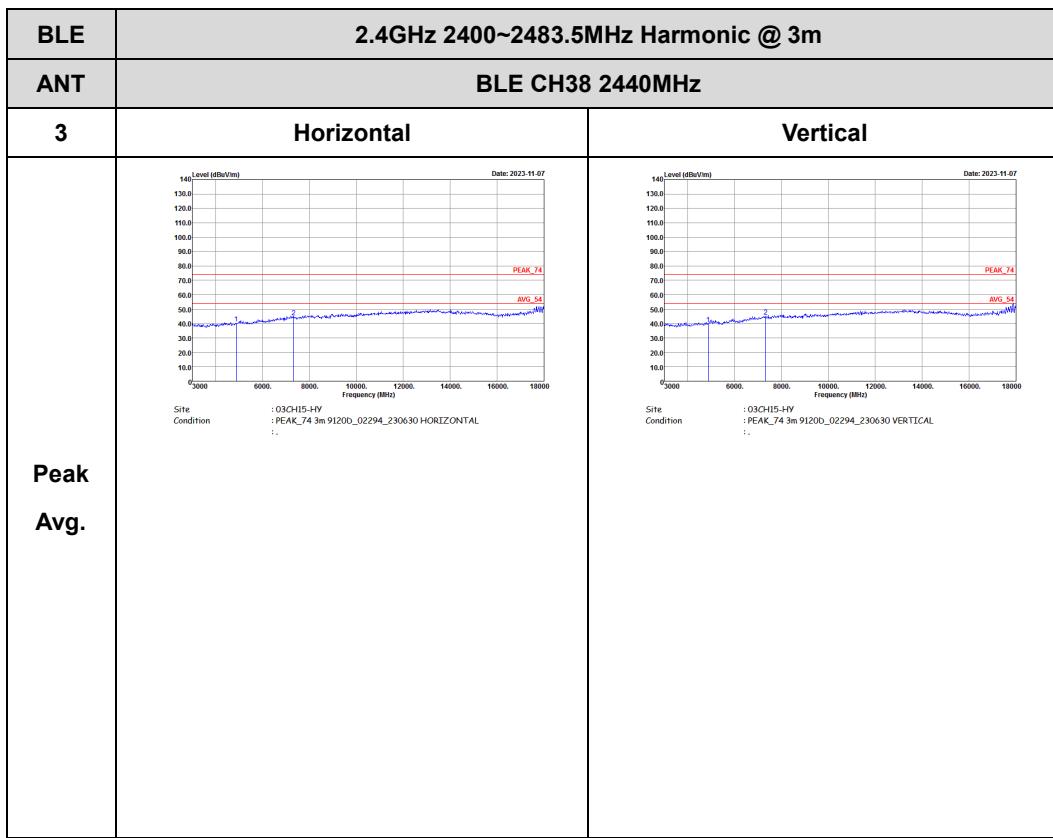


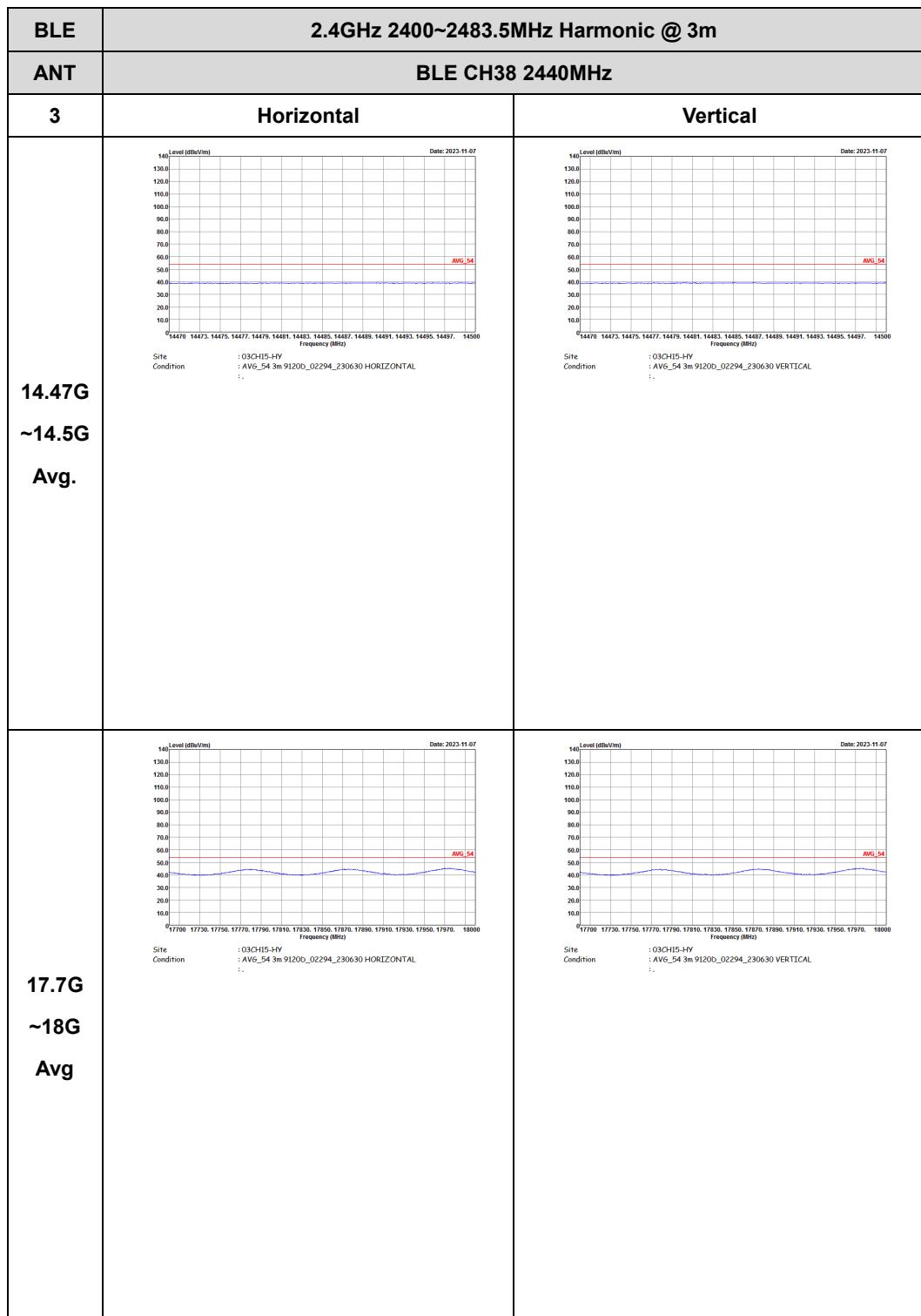
2.4GHz 2400~2483.5MHz

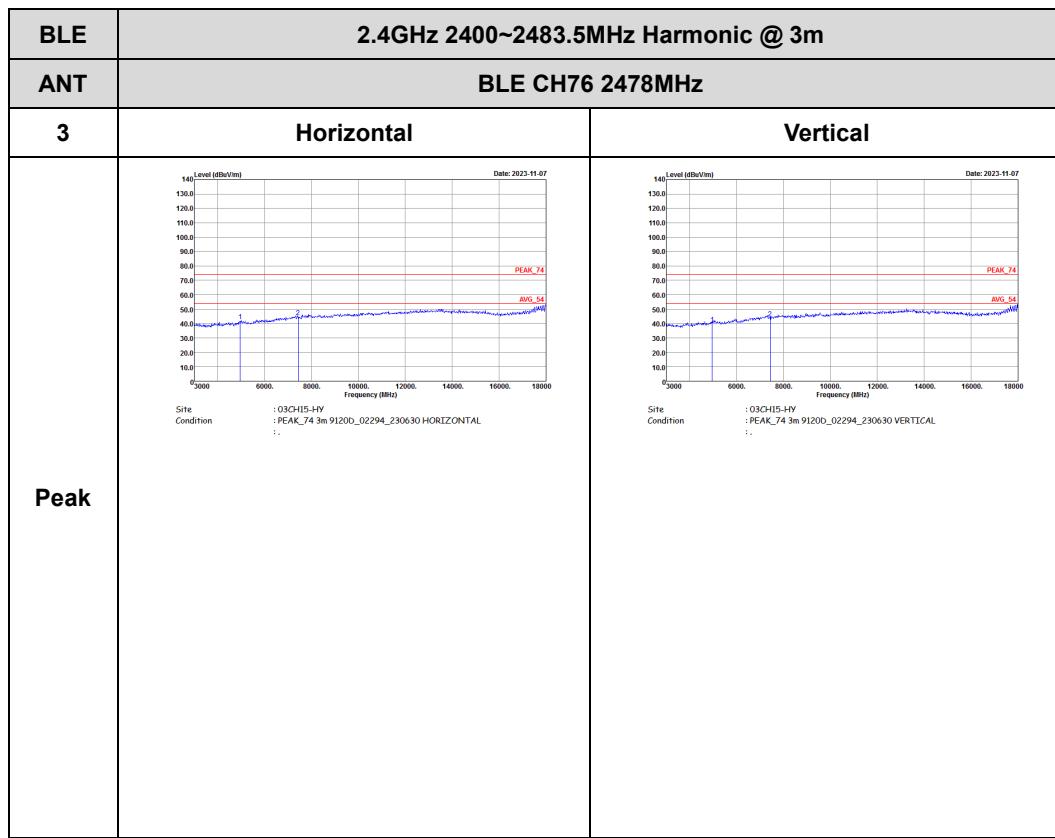
BLE (Harmonic @ 3m)

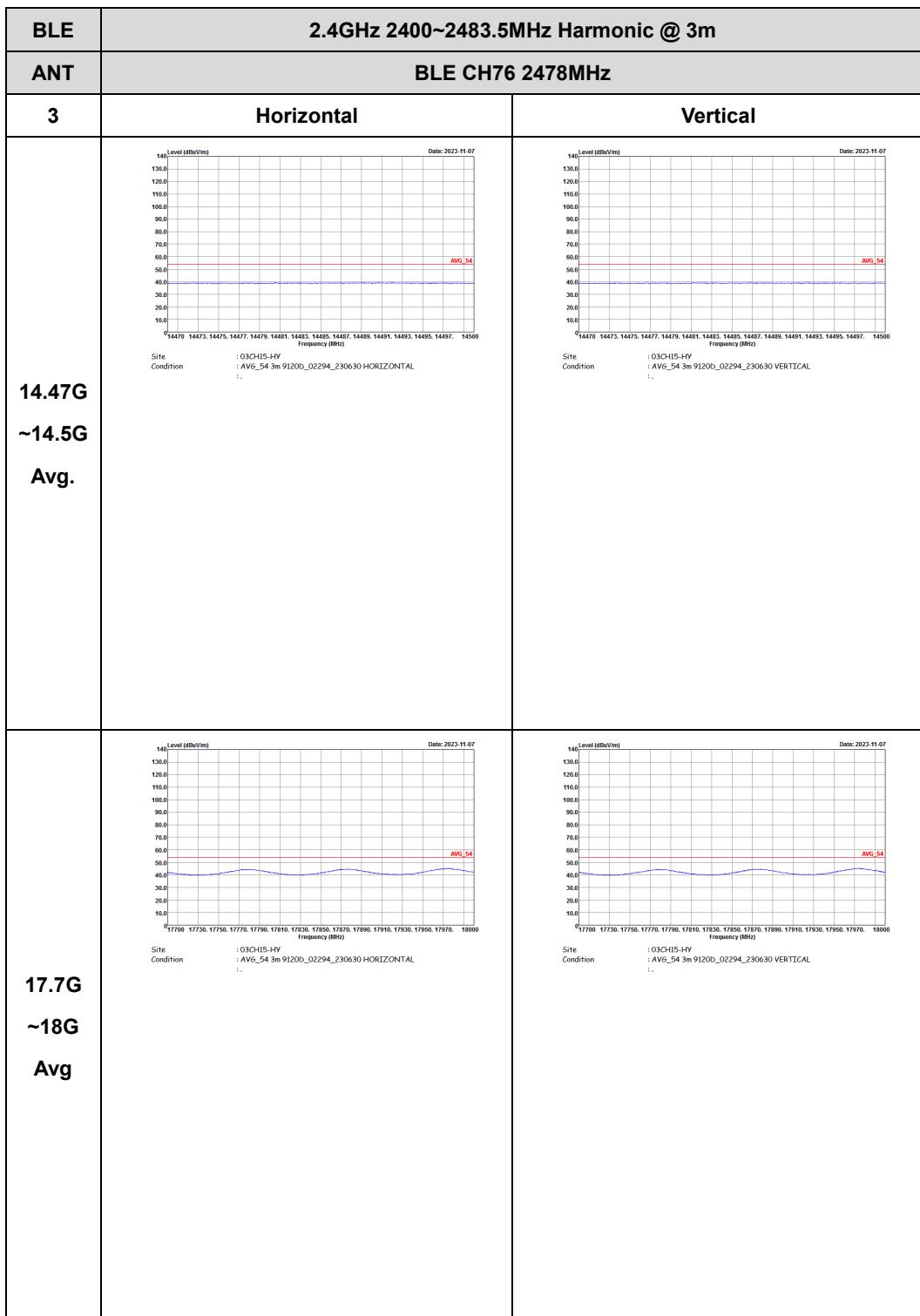






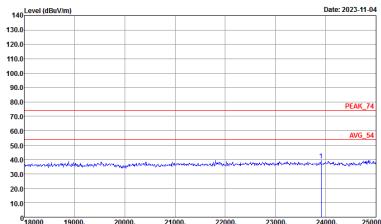
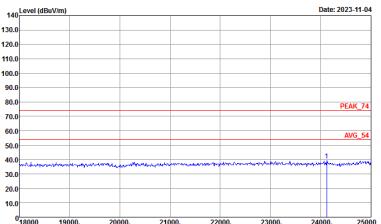








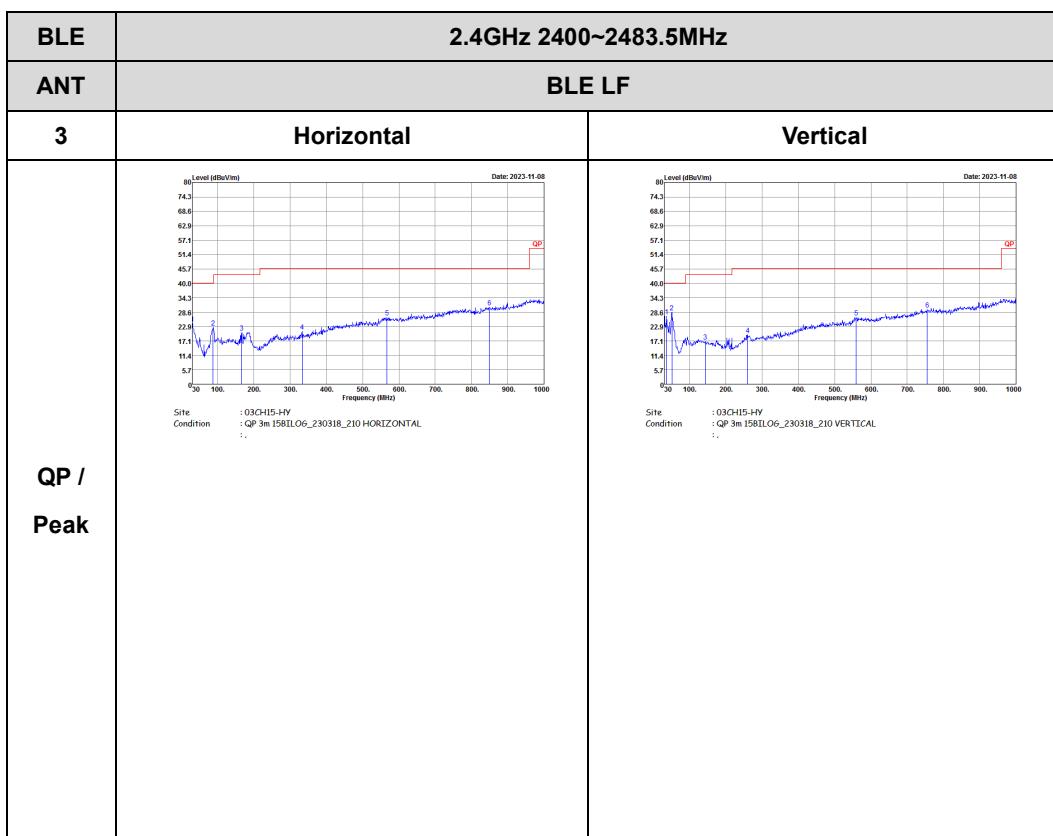
Emission after 18GHz
2.4GHz BLE (SHF @ 1m)

BLE	2.4GHz 2400~2483.5MHz	
ANT	BLE SHF	
3	Horizontal	Vertical
Peak Avg.	 <p>Level (dBmV/m) Date: 2023-11-04 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 18000 19000. 20000. 21000. 22000. 23000. 24000. 25000 Frequency (MHz) PEAK_74 AVG_54 1</p> <p>Site : 03CH15-HY Condition : PEAK_74 Im SHF_00993_221123 HORIZONTAL ...</p>	 <p>Level (dBmV/m) Date: 2023-11-04 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 18000 19000. 20000. 21000. 22000. 23000. 24000. 25000 Frequency (MHz) PEAK_74 AVG_54 1</p> <p>Site : 03CH15-HY Condition : PEAK_74 Im SHF_00993_221123 VERTICAL ...</p>



Emission below 1GHz

2.4GHz BLE (LF)





2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

