



Report No.: FR4N1311A

FCC RADIO TEST REPORT

FCC ID : 2AP4W-BELLEP

Equipment : mPERS
Brand Name : Belle
Model Name : Belle X2
Marketing Name : Belle X2

Applicant : Freeus, LLC

1069 Stewart Dr, Suites 3-6 Ogden, Utah 84404, United States

Manufacturer : Freeus, LLC

1069 Stewart Dr, Suites 3-6 Ogden, Utah 84404, United States

Standard : FCC Part 15 Subpart C §15.247

The product was received on Jan. 03, 2025 and testing was performed from Jan. 16, 2025 to Feb. 05, 2025. 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.

Lunis Wu

Approved by: Louis Wu

Sporton 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

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Report No.	Version	Description	Issue Date
FR4N1311A	01	Initial issue of report	Feb. 27, 2025

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Summary of Test Result

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Report Clause	i lest items		Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049 99% Occupied Bandwidth		Pass	-
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	-
3.6	15.207	AC Conducted Emission	Pass	-
3.7	15.203	Antenna Requirement	Pass	-

Conformity Assessment Condition:

- 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: Keven Cheng Report Producer: Lucy Wu

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1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature					
General Specs	General Specs LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n and GNSS.				
Sample 1	Black				
Sample 2	Golden				
Antenna Type	PIFA Antenna				

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Antenna information				
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	-2.26		

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, 03CH11-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.

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Test Configuration of Equipment Under Test 2

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	
	0	2402	21	2444	
	1	2404	22	2446	
	2	2406	23	2448	
	3	2408	24	2450	
	4	2410	25	2452	
	5	2412	26	2454	
	6	2414	27	2456	
	7 8 9 5 MHz 10 11	2416	28	2458	
		2418	29	2460	
		9	2420	30	2462
2400-2483.5 MHz		2422	31	2464	
		2424	32	2466	
	12	2426	33	2468	
	13	2428	34	2470	
	14 15	2430	35	2472	
		2432	36	2474	
	16	2434	37	2476	
	17	2436	38	2478	
	18	2438	39	2480	
	19	2440	-	-	
	20	2442	-	-	

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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 adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst case emissions were reported in this report.

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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.

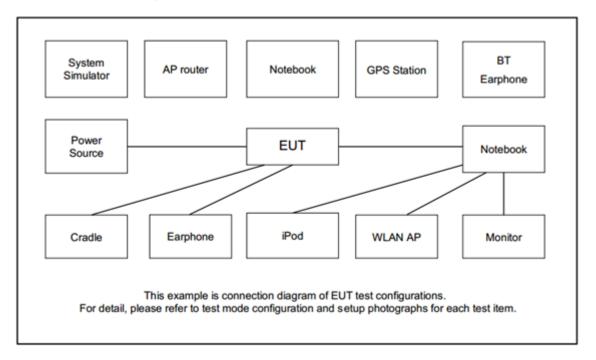
	Summary table of Test Cases					
Test Item	Data Rate / Modulation					
	Bluetooth – LE / GFSK					
	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps					
Conducted	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps					
Test Cases	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps					
Test Cases	Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps					
	Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps					
	Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps					
AC Conducted	Made 4. Blueteeth I.E. Link J. Charging Cradle with adentar for Comple 4					
Emission	Mode 1: Bluetooth-LE Link + Charging Cradle with adapter for Sample 1					

Remark:

- For radiation spurious emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power.
- The detailed Radiated test modes are shown in Appendix C.

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2.3 Connection Diagram of Test System



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2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	ASUS	RT-AC52	MSQ-RTAC4A00	N/A	Unshielded,1.8m
2.	Notebook	Dell	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2m DC O/P: Shielded, 1.8m

2.5 EUT Operation Test Setup

The RF test items, utility "EspRFTestTool_v3.6" 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.

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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.

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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.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
=
$$4.2 + 10 = 14.2$$
 (dB)

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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.

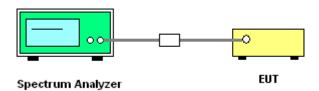
3.1.3 Test Procedures

- 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.

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- 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.
- 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) ≥ 3 * 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.

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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.

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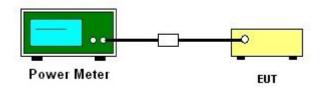
3.2.2 Measuring Instruments

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.

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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.

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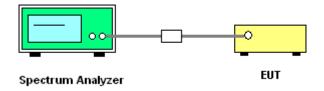
3.3.2 Measuring Instruments

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.
- 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.

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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.

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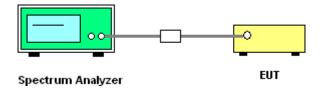
3.4.2 Measuring Instruments

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.

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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 transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required 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.

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Frequency	Field Strength	Measurement Distance		
(MHz)	(microvolts/meter)	(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.

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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.

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- 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 ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW = 3 MHz for f ≥ 1 GHz for peak measurement.

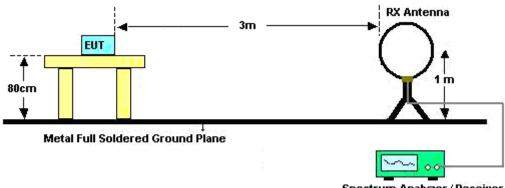
For average measurement:

- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW ≥ 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.

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3.5.4 Test Setup

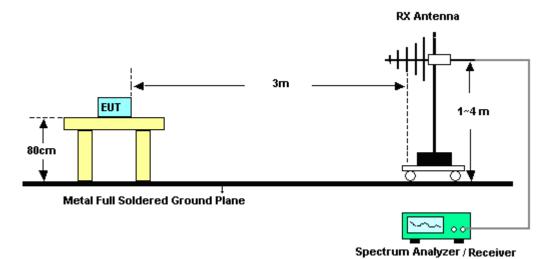
For radiated test below 30MHz



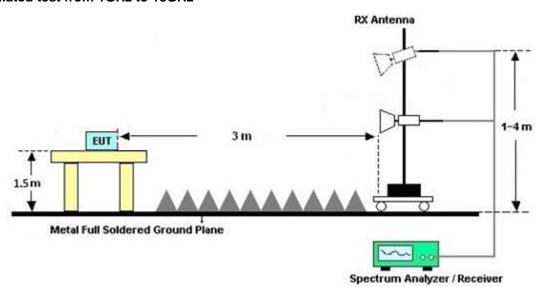
Spectrum Analyzer / Receiver

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For radiated test from 30MHz to 1GHz

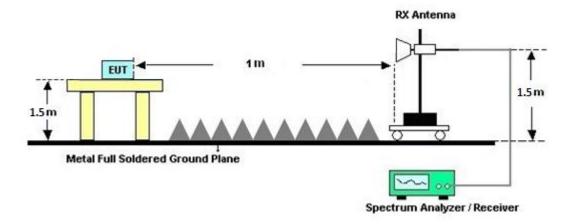


For radiated test from 1GHz to 18GHz



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For radiated test above 18GHz



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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.

3.5.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix C.

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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.

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Eroquonov of omission (MHz)	Conducted limit (dBµV)				
Frequency of emission (MHz)	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

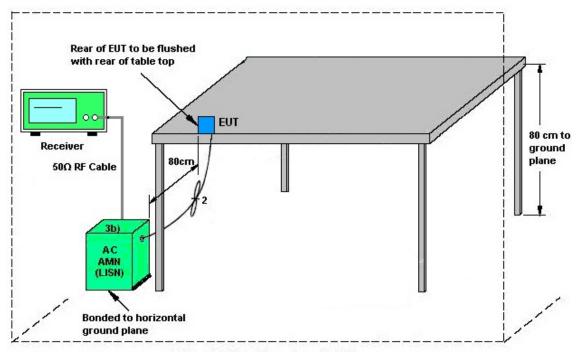
Please refer to the measuring equipment list in this test report.

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.
- 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.

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3.6.4 Test Setup



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AMN = Artificial mains network (LISN)

AE = Associated equipment

EUT = Equipment under test

ISN = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

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3.7 Antenna Requirements

3.7.1 Standard Applicable

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

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3.7.2 Antenna Anti-Replacement Construction

Antenna permanently attached.

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4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	41912 & 05	30MHz~1GHz	Feb. 04, 2024	Jan. 21, 2024~ Jan. 25, 2024	Feb. 03, 2025	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Aug. 29, 2024	Jan. 21, 2024~ Jan. 25, 2024	Aug. 28, 2025	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-01620	1GHz~18GHz	Aug. 28, 2024	Jan. 21, 2024~ Jan. 25, 2024	Aug. 27, 2025	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	1223	18GHz~40GHz	Jun. 24, 2024	Jan. 21, 2024~ Jan. 25, 2024	Jun. 23, 2025	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 07, 2024	Jan. 21, 2024~ Jan. 25, 2024	Dec. 06, 2025	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Mar. 25, 2024	Jan. 21, 2024~ Jan. 25, 2024	Mar. 24, 2025	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-30 3	17100018000 55007	1GHz~18GHz	Jun. 13, 2024	Jan. 21, 2024~ Jan. 25, 2024	Jun. 12, 2025	Radiation (03CH11-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz~40GHz	May 27, 2024	Jan. 21, 2024~ Jan. 25, 2024	May 26, 2025	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz~44GHz	Oct. 14, 2024	Jan. 21, 2024~ Jan. 25, 2024	Oct. 13, 2025	Radiation (03CH11-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY55420170	20MHz~8.4GHz	Jul. 19, 2024	Jan. 21, 2024~ Jan. 25, 2024	Jul. 18, 2025	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Jan. 21, 2024~ Jan. 25, 2024	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Jan. 21, 2024~ Jan. 25, 2024	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Jan. 21, 2024~ Jan. 25, 2024	N/A	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-001053	N/A	N/A	Jan. 21, 2024~ Jan. 25, 2024	N/A	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	804013/2	30M~40G	May 23, 2024	Jan. 21, 2024~ Jan. 25, 2024	May 22, 2025	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz~40GHz	Mar. 06, 2024	Jan. 21, 2024~ Jan. 25, 2024	Mar. 05, 2025	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	9K~30M	Mar. 06, 2024	Jan. 21, 2024~ Jan. 25, 2024	Mar. 05, 2025	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	30M~40G	Mar. 06, 2024	Jan. 21, 2024~ Jan. 25, 2024	Mar. 05, 2025	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 0SS	SN3	3GHz High Pass Filter	Sep. 10, 2024	Jan. 21, 2024~ Jan. 25, 2024	Sep. 09, 2025	Radiation (03CH11-HY)
Filter	Wainwright	WLK4-1000-15 30-8000-40SS	SN11	1.53GHz Low Pass Filter	Sep. 10, 2024	Jan. 21, 2024~ Jan. 25, 2024	Sep. 09, 2025	Radiation (03CH11-HY)
Attenuator	HONOVA	5910 SMA-50-005	0028	N/A	Sep. 10, 2024	Jan. 21, 2024~ Jan. 25, 2024	Sep. 09, 2025	Radiation (03CH11-HY)

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Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 01, 2024	Jan. 16, 2025~ Feb. 04, 2025	Oct. 30, 2025	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	17I00015SNO 35 (NO:109)	10MHz~6GHz	Jan. 04, 2025	Jan. 16, 2025~ Feb. 04, 2025	Jan. 03, 2026	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 23, 2024	Jan. 16, 2025~ Feb. 04, 2025	Aug. 22, 2025	Conducted (TH05-HY)
Switch Control Mainframe	Burgeon	ETF-058	EC1300484 (BOX3)	N/A	May 20, 2024	Jan. 16, 2025~ Feb. 04, 2025	May 19, 2025	Conducted (TH05-HY)
Software	Sporton	BTWIFI_Final_ version_24051 3	N/A	Conducted Other Test Item	N/A	Jan. 16, 2025~ Feb. 04, 2025	N/A	Conducted (TH05-HY)
AC Power Source	ACPOWER	AFC-11003G	F317040033	N/A	N/A	Feb. 05, 2025	N/A	Conduction (CO07-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Feb. 05, 2025	N/A	Conduction (CO07-HY)
Pulse Limiter	SCHWARZBE CK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Oct. 23, 2024	Feb. 05, 2025	Oct. 22, 2025	Conduction (CO07-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	Mar. 14, 2024	Feb. 05, 2025	Mar. 13, 2025	Conduction (CO07-HY)
Two-Line V-Network	TESEQ	NNB 51	45051	N/A	Mar. 10, 2024	Feb. 05, 2025	Mar. 09, 2025	Conduction (CO07-HY)
Four-Line V-Network	TESEQ	NNB 52	36122	N/A	Mar. 07, 2024	Feb. 05, 2025	Mar. 06, 2025	Conduction (CO07-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102317	9kHz~3.6GHz	Sep. 23, 2024	Feb. 05, 2025	Sep. 22, 2025	Conduction (CO07-HY)

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5 Measurement Uncertainty

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

Measuring Uncertainty for a Level of Confidence	2.7.40
of 95% (U = 2Uc(y))	3.7 dB

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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence	6.4 dB
of 95% (U = 2Uc(y))	0.4 UB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence	E 4 AD
of 95% (U = 2Uc(y))	5.1 dB

Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence	5.3 dB
of 95% (U = 2Uc(y))	5.3 UD

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence	5.3 dB
of 95% (U = 2Uc(y))	3.3 ub

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Appendix A. Test Result of Conducted Test Items

Test Engineer:	Shiming Liu and Willy Chang	Temperature:	21~25	°C
Test Date:	2025/1/16~2025/2/4	Relative Humidity:	51~54	%

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	1Mbps	1	0	2402	1.018	0.639	0.50	Pass
BLE	1Mbps	1	19	2440	1.018	0.637	0.50	Pass
BLE	1Mbps	1	39	2480	1.019	0.638	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	1Mbps	1	0	2402	3.10	30.00	-2.26	0.84	36.00	Pass
BLE	1Mbps	1	19	2440	3.30	30.00	-2.26	1.04	36.00	Pass
BLE	1Mbps	1	39	2480	3.40	30.00	-2.26	1.14	36.00	Pass

TEST RESULTS DATA Peak Power Density

Mod.	Data Rate	N⊤x	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	1Mbps	1	0	2402	3.95	-11.46	-2.26	8.00	Pass
BLE	1Mbps	1	19	2440	4.39	-11.03	-2.26	8.00	Pass
BLE	1Mbps	1	39	2480	5.09	-10.39	-2.26	8.00	Pass

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

Report Number : FR4N1311A

TEST RESULTS DATA 6dB and 99% Occupied Bandwidth

Mod.	Data Rate	N⊤x	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	2Mbps	1	0	2402	2.020	1.113	0.50	Pass
BLE	2Mbps	1	19	2440	2.018	1.113	0.50	Pass
BLE	2Mbps	1	39	2480	2.017	1.111	0.50	Pass

TEST RESULTS DATA Average Power Table

Averag	C I	OWE	Table	
				-

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power DG Limit (dBi) (dBm)	DG	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	3.30	30.00	-2.26	1.04	36.00	Pass
BLE	2Mbps	1	19	2440	3.50	30.00	-2.26	1.24	36.00	Pass
BLE	2Mbps	1	39	2480	3.60	30.00	-2.26	1.34	36.00	Pass

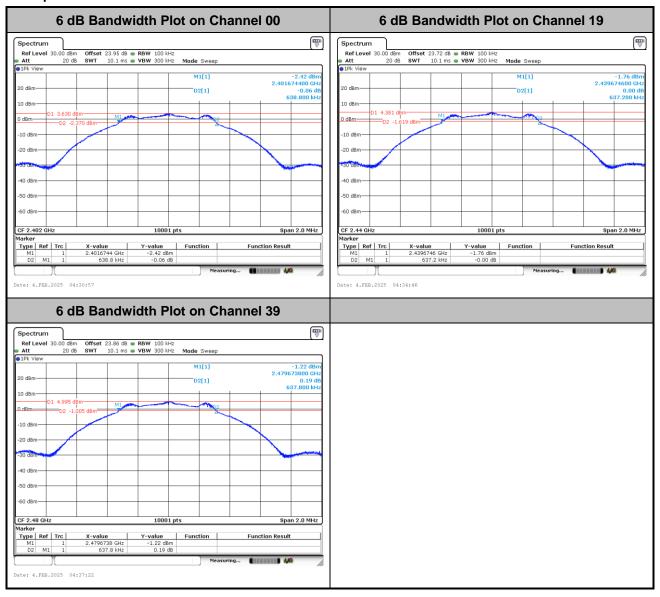
TEST RESULTS DATA Peak Power Density

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	2Mbps	1	0	2402	4.10	-13.28	-2.26	8.00	Pass
BLE	2Mbps	1	19	2440	4.51	-12.89	-2.26	8.00	Pass
BLE	2Mbps	1	39	2480	5.18	-12.25	-2.26	8.00	Pass

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

6dB Bandwidth

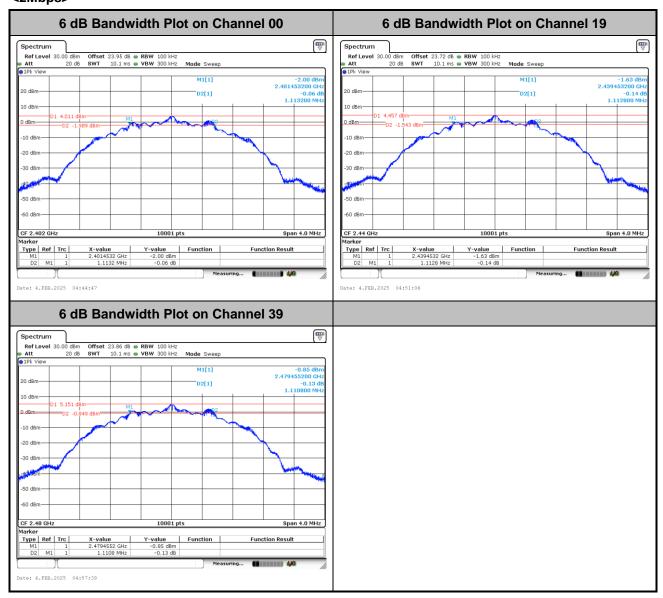
<1Mbps>



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<2Mbps>

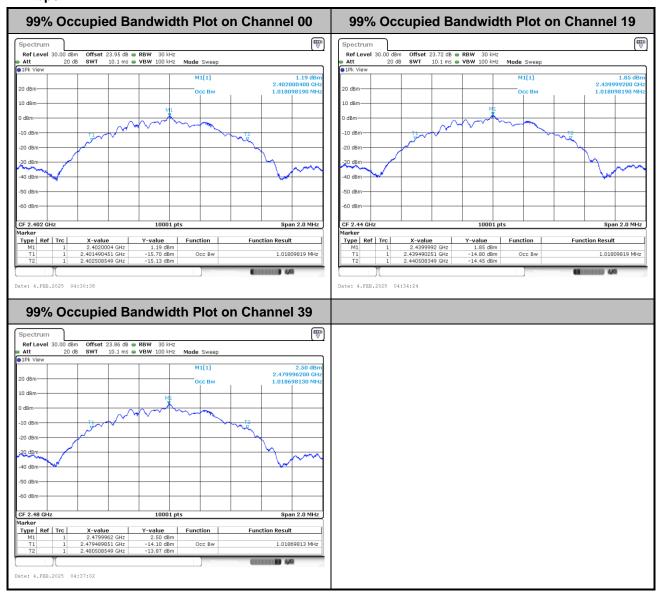


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99% Occupied Bandwidth

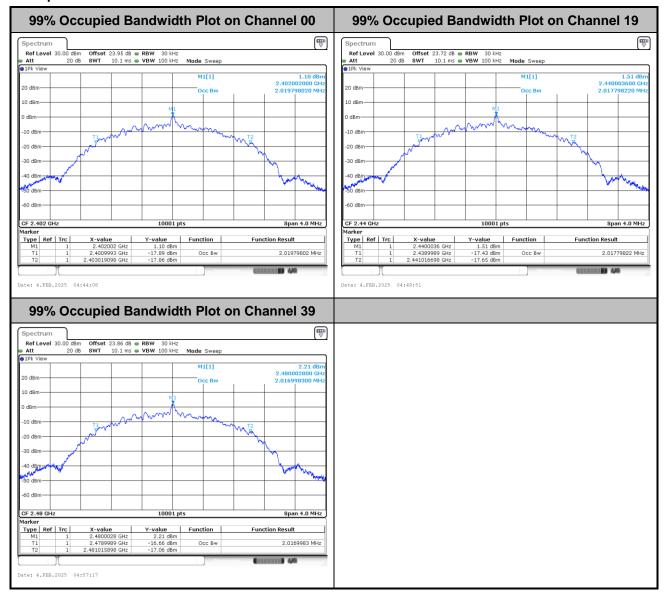
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<2Mbps>

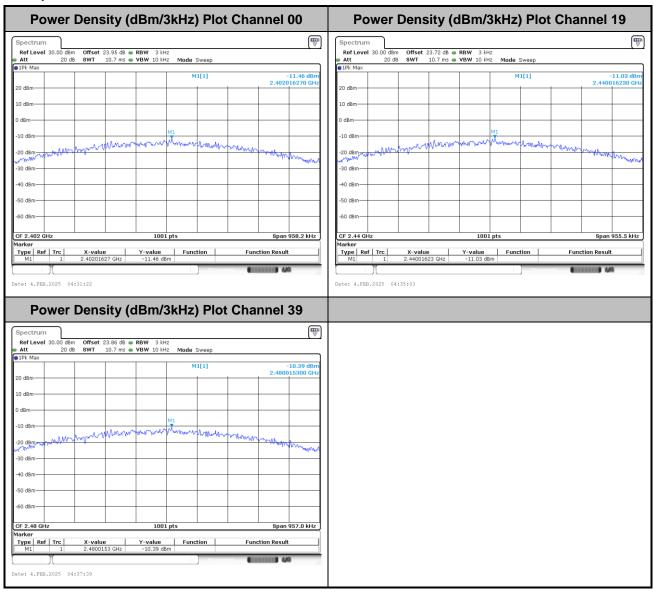


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Power Spectral Density (dBm/3kHz)

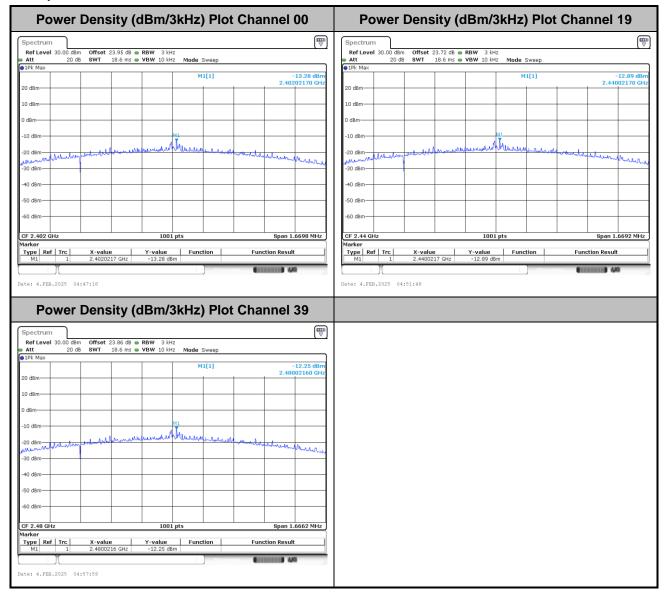
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<2Mbps>

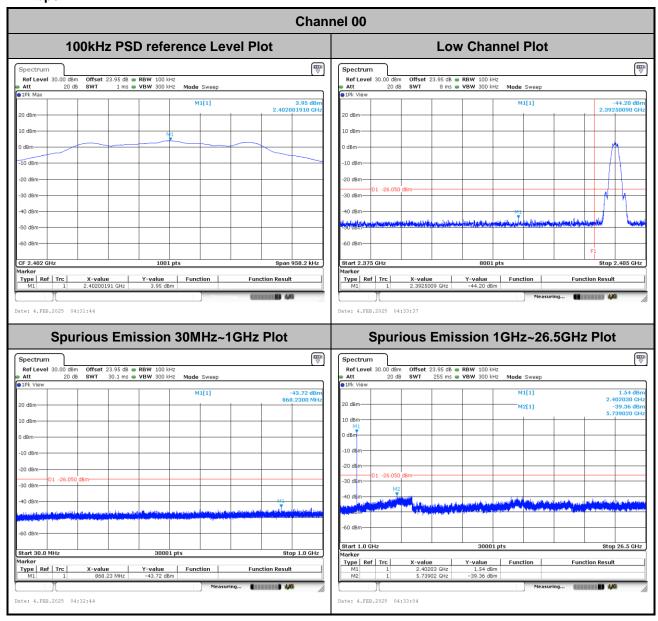


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Band Edge and Conducted Spurious Emission

<1Mbps>



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Function

Function Result

Date: 4.FEB.2025 04:36:07

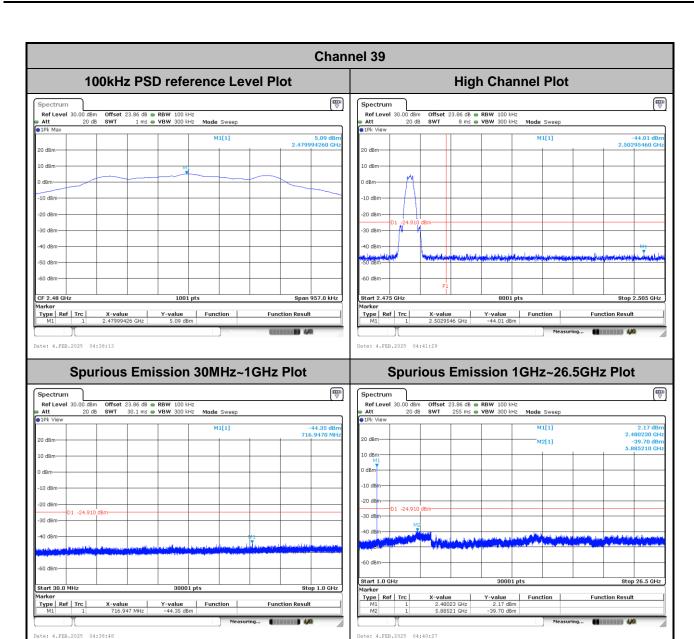
Channel 19 100kHz PSD reference Level Plot **Mid Channel Plot** 4.39 dBm 2.440000950 GHz -10 dBm 30 dBn 40 dBm CF 2.44 GHz Marker Span 955.5 kHz Type Ref Trc Function Function Result Spurious Emission 30MHz~1GHz Plot Spurious Emission 1GHz~26.5GHz Plot Spectrum Ref Level 30.00 db Ref Level 30.00 Offset 23.72 dB • RBW 100 kHz SWT 30.1 ms • VBW 300 kHz Mode Sweep 10 dBm 10 dBm -10 di -20 dBm 30 dBm 60 dBm Start 1.0 GHz Stop 1.0 GHz X-value 2.44028 GHz 6.40369 GHz Y-value : 3.51 dBm : -39.93 dBm Type Ref Trc Function **Function Result**

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FAX: 886-3-327-0855

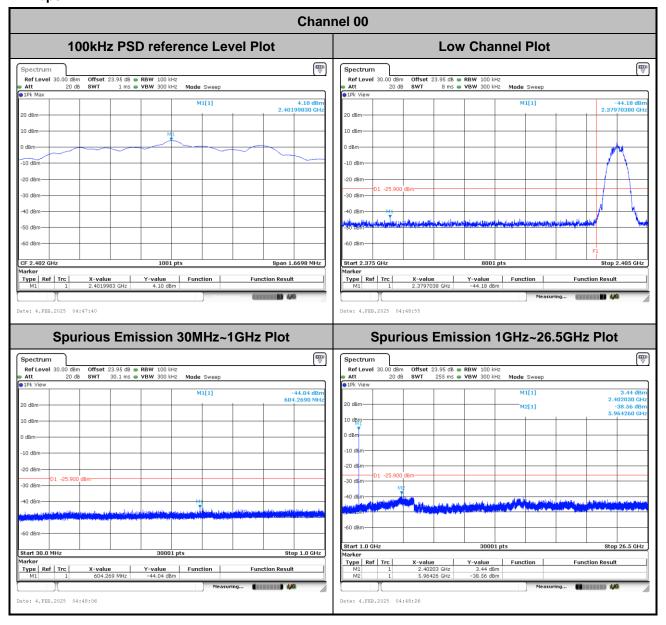
Date: 4.FEB.2025 04:35:47



Report No.: FR4N1311A

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<2Mbps>



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Channel 19 100kHz PSD reference Level Plot **Mid Channel Plot** 4.51 dBm 2.43999830 GHz -10 dBm 30 dBn 40 dBm CF 2.44 GHz Marker Span 1.6692 MHz Type Ref Trc Function Function Result Spurious Emission 30MHz~1GHz Plot Spurious Emission 1GHz~26.5GHz Plot Spectrum Ref Level 30.00 db Ref Level 30.00 Offset 23.72 dB • RBW 100 kHz SWT 30.1 ms • VBW 300 kHz Mode Sweep 10 dBm -10 di -20 dBn 30 dBm 60 dBm Start 1.0 GHz Stop 1.0 GHz Y-value : 0.45 dBm : -39.74 dBm X-value 2.44028 GHz 5.98041 GHz Type Ref Trc Function **Function Result** Function Function Result

Date: 4.FEB.2025 04:56:24

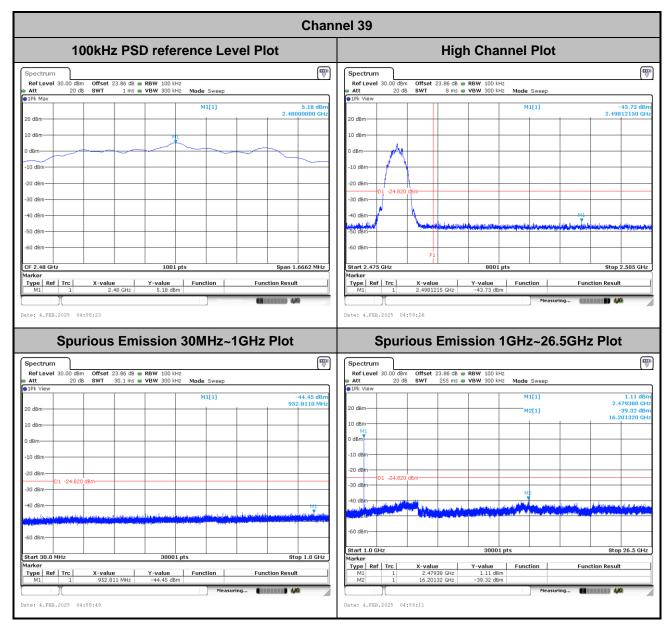
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FAX: 886-3-327-0855

Date: 4.FEB.2025 04:54:08

Report No.: FR4N1311A



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Appendix B. AC Conducted Emission Test Results

Test Engineer :	Lauis Chung	Temperature :	19.2~22.3°C
	Louis Chung	Relative Humidity :	45.4~52.1%

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Report No.: FR4N1311A

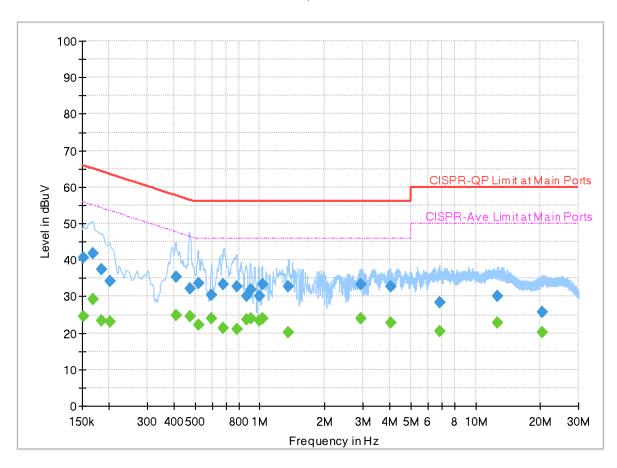
EUT Information

Report NO: 4N1311

Test Voltage: 120Vac/60Hz

Phase: Line

Full Spectrum



Final Result

Frequency	QuasiPeak	CAverage	Limit	Margin	Line	PE	Corr.
(MHz)	(dBuV)	(dBuV)	(dBuV)	(dB)			(dB)
0.151823	-	24.65	55.90	31.25	L1	FLO	19.9
0.151823	40.65		65.90	25.25	L1	FLO	19.9
0.167280	-	29.12	55.09	25.97	L1	FLO	19.9
0.167280	41.72		65.09	23.37	L1	FLO	19.9
0.184830		23.40	54.27	30.87	L1	FLO	19.9
0.184830	37.33		64.27	26.94	L1	FLO	19.9
0.202740	-	23.14	53.50	30.36	L1	FLO	19.9
0.202740	34.08		63.50	29.42	L1	FLO	19.9
0.408660	-	24.90	47.68	22.78	L1	FLO	19.9
0.408660	35.43		57.68	22.25	L1	FLO	19.9
0.472200		24.47	46.48	22.01	L1	FLO	19.9
0.472200	32.15		56.48	24.33	L1	FLO	19.9
0.519450		22.19	46.00	23.81	L1	FLO	19.9
0.519450	33.72		56.00	22.28	L1	FLO	19.9
0.595320	-	23.88	46.00	22.12	L1	FLO	19.9
0.595320	30.53		56.00	25.47	L1	FLO	19.9
0.676500	-	21.24	46.00	24.76	L1	FLO	19.9
0.676500	33.29		56.00	22.71	L1	FLO	19.9
0.784500		21.09	46.00	24.91	L1	FLO	19.9

0.784500	32.64		56.00	23.36	L1	FLO	19.9
0.864240		23.69	46.00	22.31	L1	FLO	19.9
0.864240	30.22		56.00	25.78	L1	FLO	19.9
0.902940		24.03	46.00	21.97	L1	FLO	19.9
0.902940	31.80		56.00	24.20	L1	FLO	19.9
0.989250	-	23.46	46.00	22.54	L1	FLO	19.9
0.989250	30.03		56.00	25.97	L1	FLO	19.9
1.026420		23.99	46.00	22.01	L1	FLO	19.9
1.026420	33.37		56.00	22.63	L1	FLO	19.9
1.358340		20.24	46.00	25.76	L1	FLO	20.0
1.358340	32.77		56.00	23.23	L1	FLO	20.0
2.950710		24.06	46.00	21.94	L1	FLO	20.0
2.950710	33.36		56.00	22.64	L1	FLO	20.0
4.017570		22.69	46.00	23.31	L1	FLO	20.0
4.017570	32.76		56.00	23.24	L1	FLO	20.0
6.807390		20.36	50.00	29.64	L1	FLO	20.1
6.807390	28.48		60.00	31.52	L1	FLO	20.1
12.665580		22.78	50.00	27.22	L1	FLO	20.1
12.665580	30.03		60.00	29.97	L1	FLO	20.1
20.414850		20.14	50.00	29.86	L1	FLO	20.1
20.414850	25.85		60.00	34.15	L1	FLO	20.1

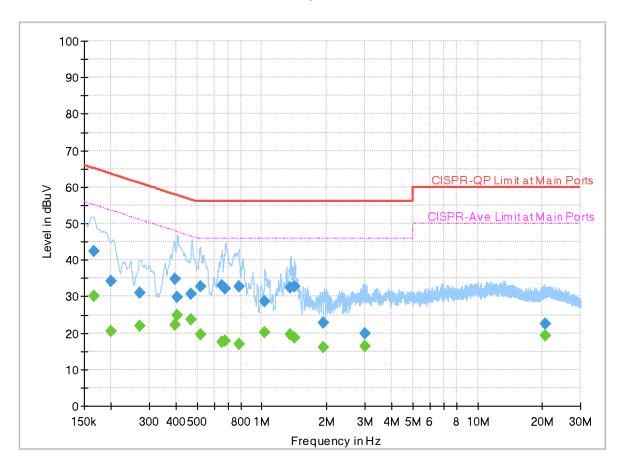
Report No.: FR4N1311A

EUT Information

Report NO: 4N1311

Test Voltage : 120Vac/60Hz Phase : Neutral

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	PE	Corr. (dB)
0.166920	-	30.20	55.11	24.91	N	FLO	19.9
0.166920	42.46		65.11	22.65	N	FLO	19.9
0.200310		20.40	53.60	33.20	N	FLO	19.9
0.200310	34.29		63.60	29.31	N	FLO	19.9
0.272400		22.05	51.04	28.99	N	FLO	19.9
0.272400	31.05		61.04	29.99	N	FLO	19.9
0.395250		22.08	47.95	25.87	N	FLO	19.9
0.395250	34.79		57.95	23.16	N	FLO	19.9
0.402000	-	24.87	47.81	22.94	N	FLO	19.9
0.402000	29.85		57.81	27.96	N	FLO	19.9
0.470760		23.80	46.50	22.70	N	FLO	19.9
0.470760	30.84		56.50	25.66	N	FLO	19.9
0.516660		19.56	46.00	26.44	N	FLO	19.9
0.516660	32.61		56.00	23.39	N	FLO	19.9
0.655530	-	17.69	46.00	28.31	N	FLO	19.9
0.655530	33.09	-	56.00	22.91	N	FLO	19.9
0.676500		17.75	46.00	28.25	N	FLO	19.9
0.676500	32.17		56.00	23.83	N	FLO	19.9
0.783060		16.88	46.00	29.12	N	FLO	19.9

0.783060	32.86		56.00	23.14	N	FLO	19.9
1.031370		20.16	46.00	25.84	N	FLO	20.0
1.031370	28.57		56.00	27.43	N	FLO	20.0
1.356000		19.57	46.00	26.43	N	FLO	20.0
1.356000	32.52		56.00	23.48	N	FLO	20.0
1.419720		18.57	46.00	27.43	N	FLO	20.0
1.419720	32.64		56.00	23.36	N	FLO	20.0
1.934250		16.13	46.00	29.87	N	FLO	20.0
1.934250	22.71		56.00	33.29	N	FLO	20.0
3.016410		16.43	46.00	29.57	N	FLO	20.0
3.016410	19.88		56.00	36.12	N	FLO	20.0
20.583600		19.17	50.00	30.83	N	FLO	20.2
20.583600	22.40		60.00	37.60	N	FLO	20.2

Appendix C. Radiated Spurious Emission Test Data

Test Engineer :	Daniel Lee, Fu Cehn and Troye Hsieh	Temperature :	19.4~20.5°C
rest Engineer .		Relative Humidity :	52.2~66.5%

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Note symbol

-L	Low channel location
-R	High channel location

C1. Radiated Spurious Emission Test Modes

<Sample 1>

Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	RU	Remark
Mode 23	2400-2483.5	1	Bluetooth-LE_GSFK	39	2480	2Mbps	-	-
Mode 25	2400-2483.5	1	Bluetooth-LE_GSFK	39	2480	2Mbps	-	SHF
Mode 26	2400-2483.5	1	Bluetooth-LE_GSFK	39	2480	2Mbps	-	LF

<Sample 2>

Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	RU	Remark
Mode 1	2400-2483.5	1	Bluetooth-LE_GSFK	00	2402	1Mbps	-	-
Mode 2	2400-2483.5	1	Bluetooth-LE_GSFK	19	2440	1Mbps	-	-
Mode 3	2400-2483.5	1	Bluetooth-LE_GSFK	39	2480	1Mbps	-	-
Mode 4	2400-2483.5	1	Bluetooth-LE_GSFK	00	2402	2Mbps	-	-
Mode 5	2400-2483.5	1	Bluetooth-LE_GSFK	19	2440	2Mbps	-	-
Mode 6	2400-2483.5	1	Bluetooth-LE_GSFK	39	2480	2Mbps	-	-
Mode 7	2400-2483.5	1	Bluetooth-LE_GSFK	39	2480	2Mbps	-	SHF
Mode 8	2400-2483.5	1	Bluetooth-LE_GSFK	39	2480	2Mbps	-	LF

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C2. Summary of each worse mode

<Sample 1>

Mode	Modulation	Ch.	Freq.	Level	Limit	Margin	Pol.	Peak	Result	RU	Remark
wode	Modulation	CII.	(MHz)	(dBuV/m)	(dBuV/m)	(dB)	POI.	Avg.	Result	KU	Nemark
23	Bluetooth-LE_GSFK	39	2484.72	43.60	54.00	-10.40	Н	Avg.	Pass	-	Band Edge
23	Bluetooth-LE_GSFK	39	7440.00	42.54	74.00	-31.46	V	Peak	Pass	-	Harmonic
25	SHF	39	24678.00	39.91	74.00	-34.09	Н	Peak	Pass	-	SHF
26	LF	39	30.00	33.06	40.00	-6.94	Н	Peak	Pass	-	LF

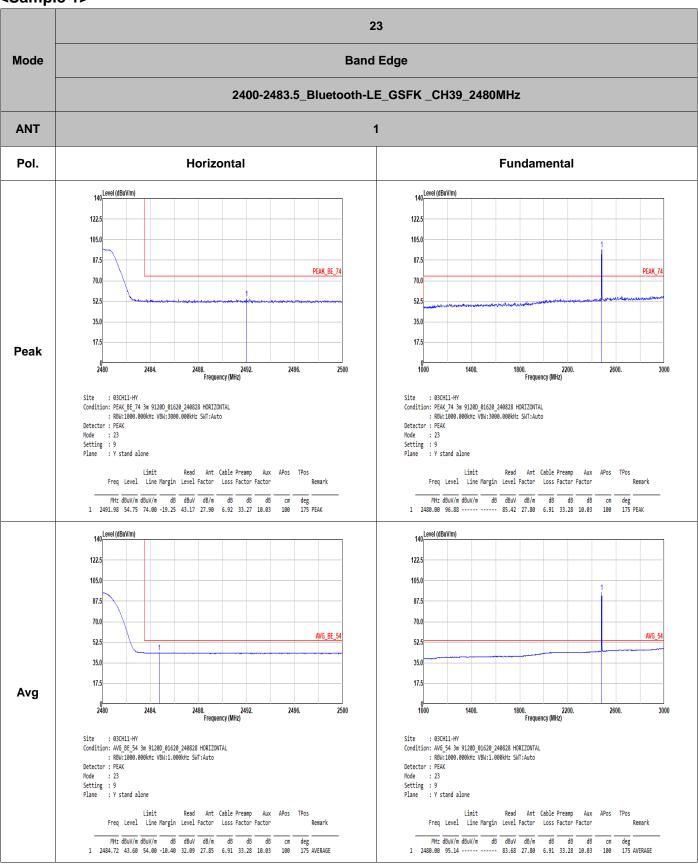
<Sample 2>

Mode	Modulation	Ch.	Freq.	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	RU	Remark
	Bluetooth-LE_GSFK	00	2381.76	42.36	54.00	-11.64	Н	Avg.	Pass	-	Band Edge
1	Bluetooth-LE_GSFK	00	4804.00	40.87	74.00	-33.13	V	Peak	Pass	-	Harmonic
0	Bluetooth-LE_GSFK	19	2495.02	43.12	54.00	-10.88	V	Avg.	Pass		Band Edge
2	Bluetooth-LE_GSFK	19	7320.00	44.06	74.00	-29.94	Н	Peak	Pass		Harmonic
3	Bluetooth-LE_GSFK	39	2483.70	43.40	54.00	-10.60	Н	Avg.	Pass	•	Band Edge
3	Bluetooth-LE_GSFK	39	7440.00	43.00	74.00	-31.00	V	Peak	Pass	•	Harmonic
4	Bluetooth-LE_GSFK	00	2385.62	42.72	54.00	-11.28	V	Avg.	Pass	•	Band Edge
4	Bluetooth-LE_GSFK	00	4804.00	40.77	74.00	-33.23	Н	Peak	Pass	•	Harmonic
F	Bluetooth-LE_GSFK	19	2496.88	43.50	54.00	-10.50	Н	Avg.	Pass	-	Band Edge
5	Bluetooth-LE_GSFK	19	7320.00	44.80	74.00	-29.20	Н	Peak	Pass	•	Harmonic
	Bluetooth-LE_GSFK	39	2483.84	43.67	54.00	-10.33	Н	Avg.	Pass	•	Band Edge
6	Bluetooth-LE_GSFK	39	7440.00	44.11	74.00	-29.89	V	Peak	Pass	-	Harmonic
7	SHF	39	24474.82	39.69	74.00	-34.31	V	Peak	Pass	-	SHF
8	LF	39	30.00	33.03	40.00	-6.97	V	Peak	Pass	-	LF

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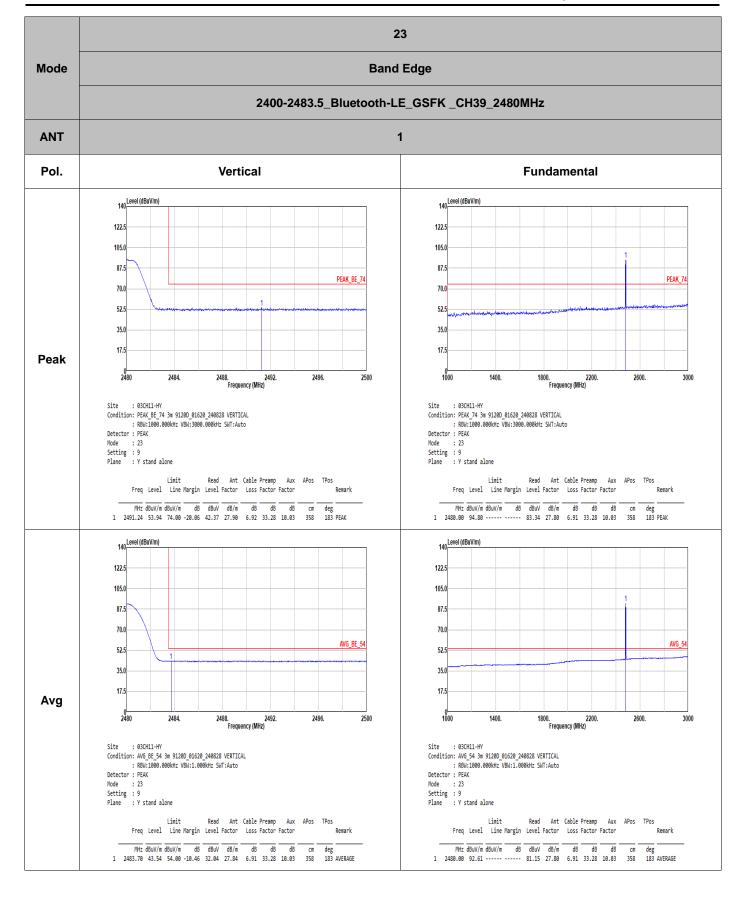


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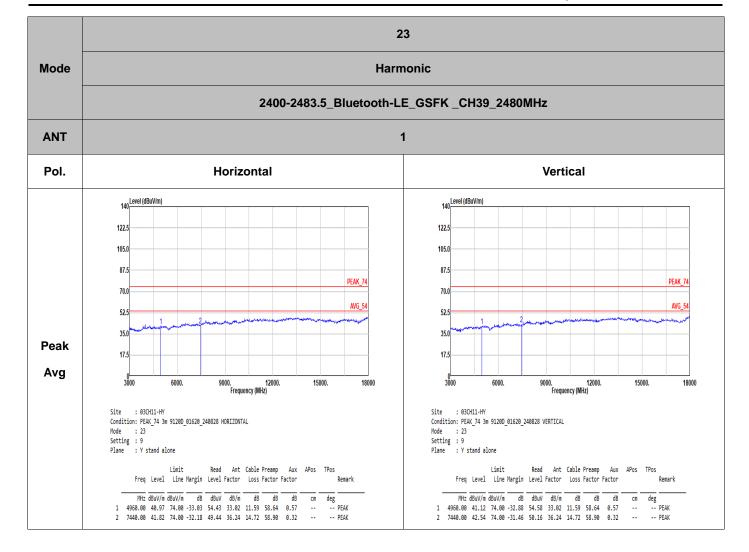


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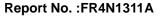




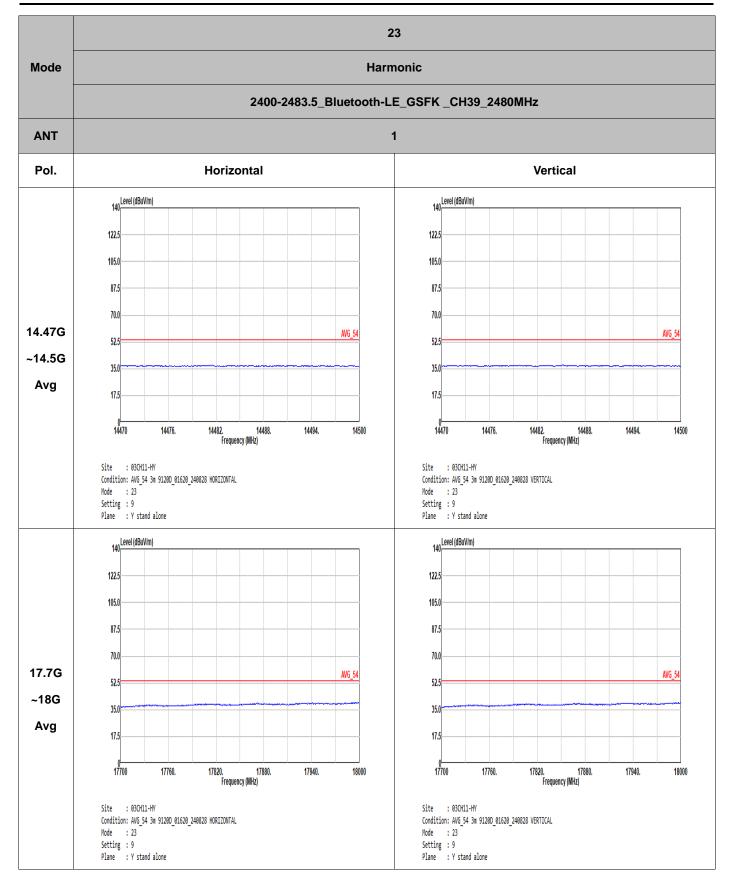
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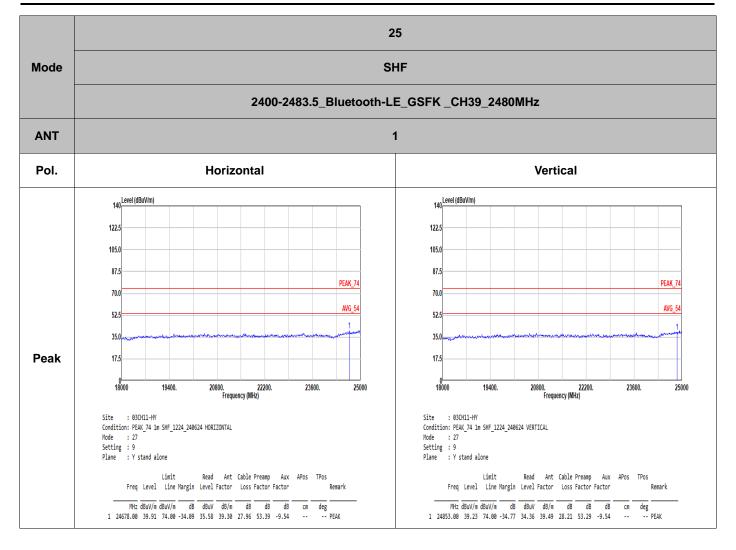






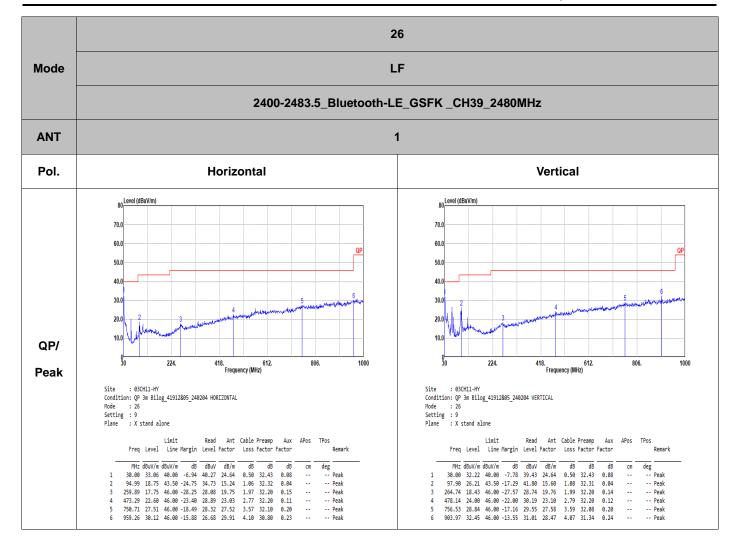
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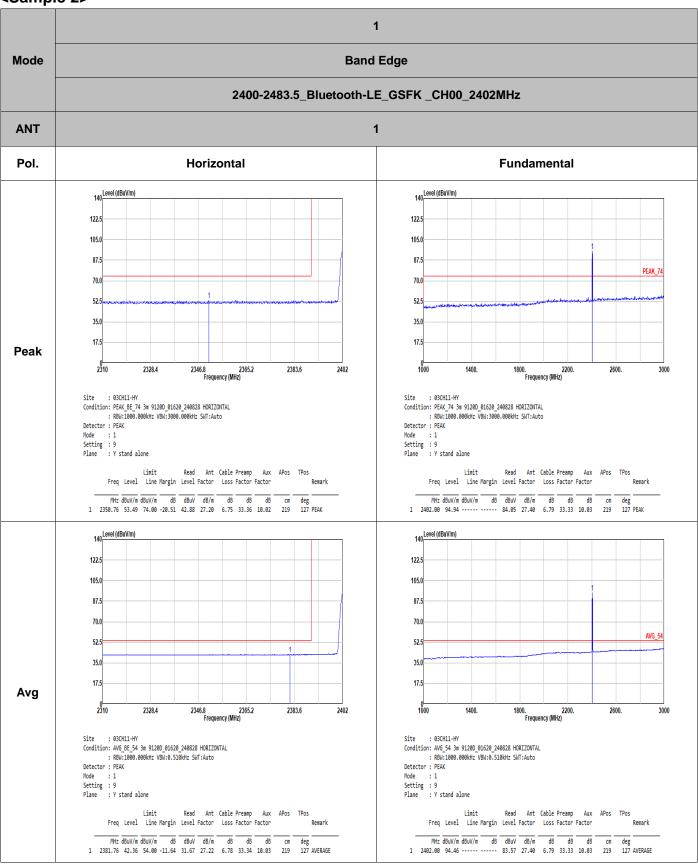
Report No. :FR4N1311A



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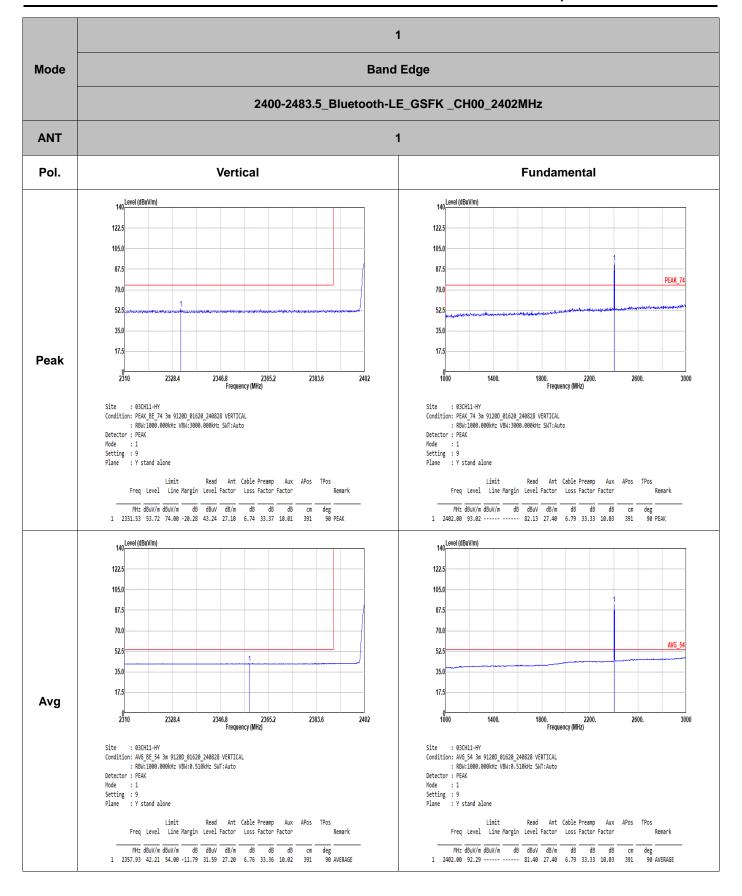


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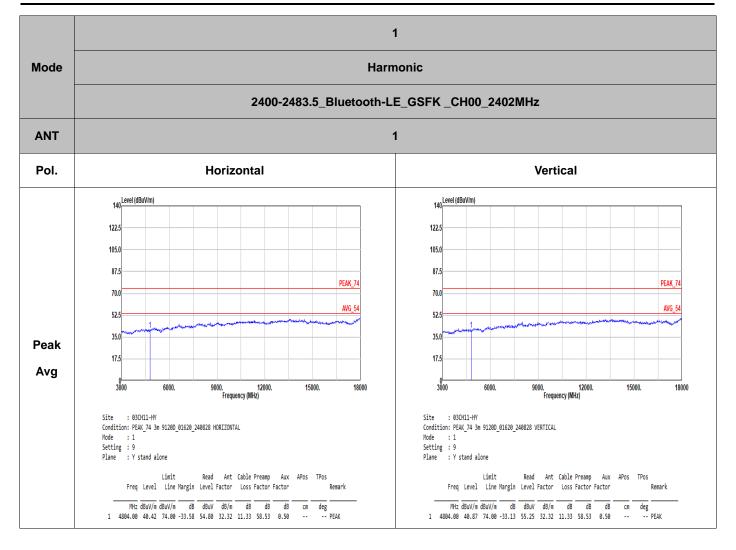


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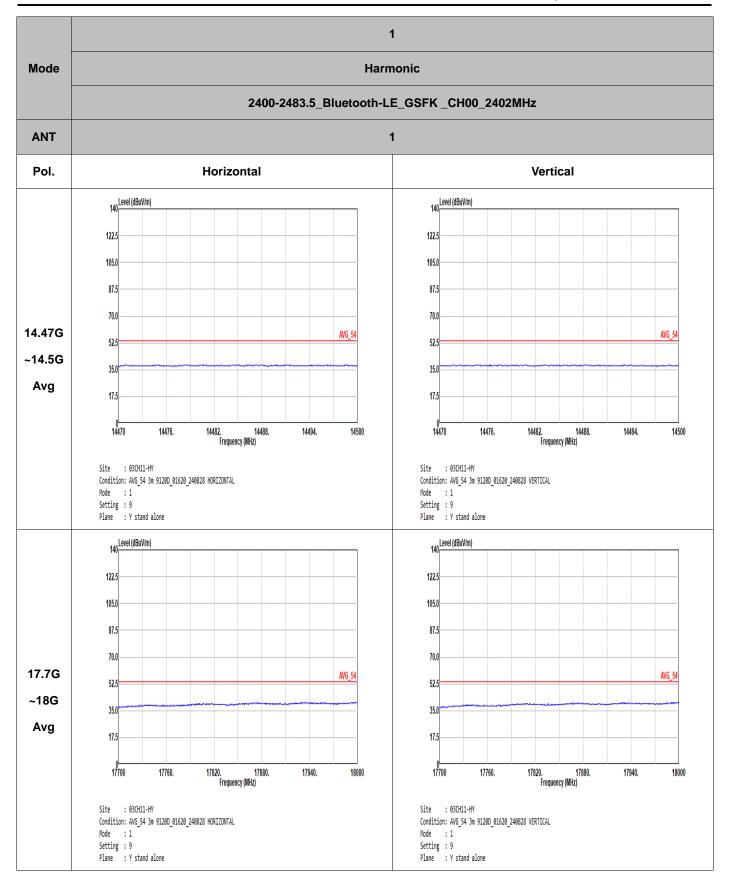


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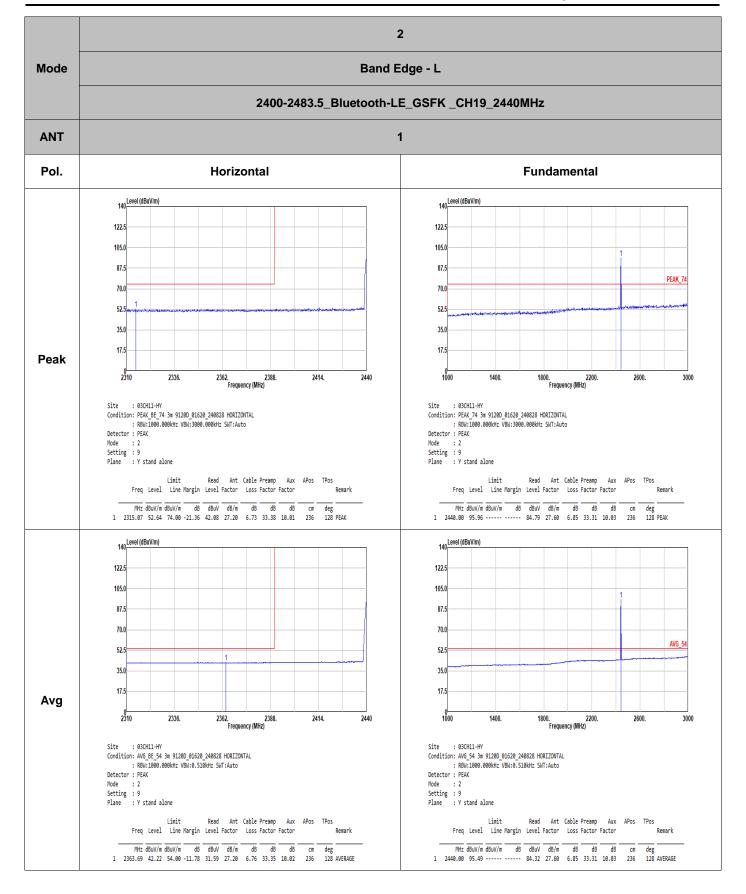
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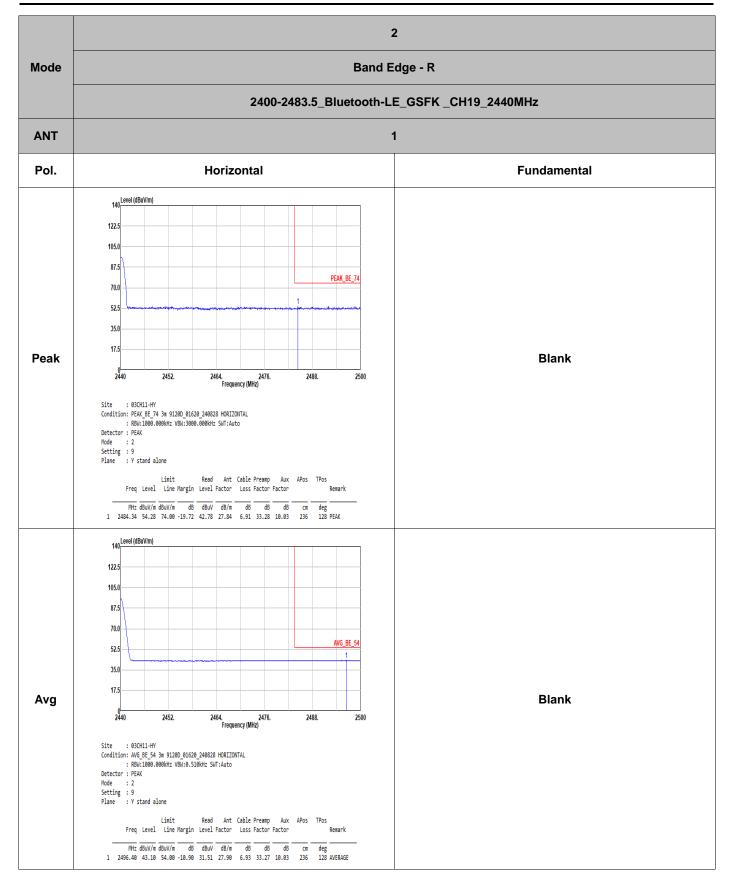
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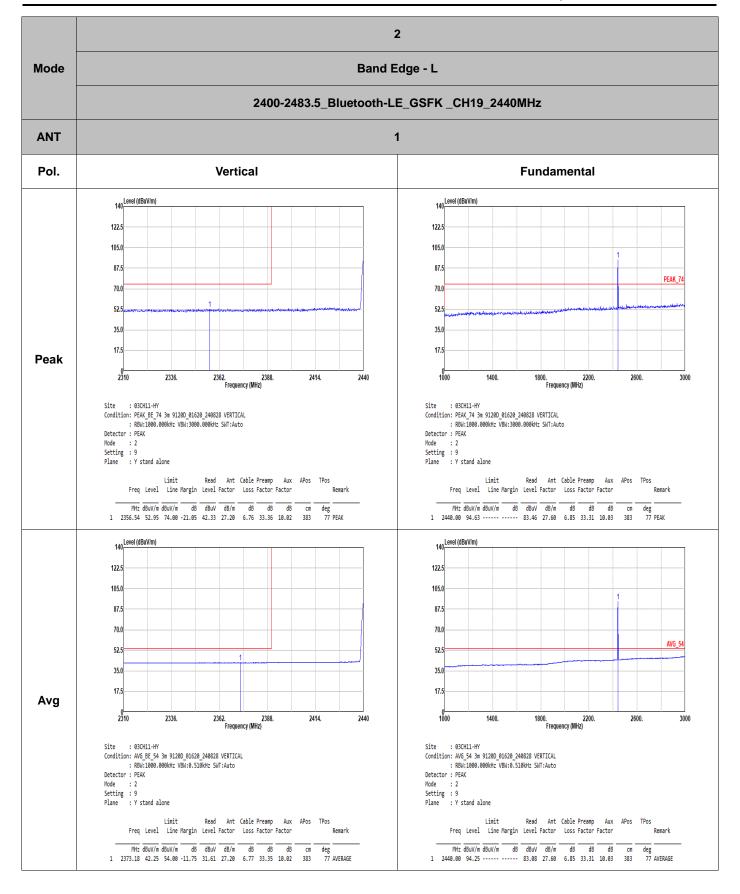
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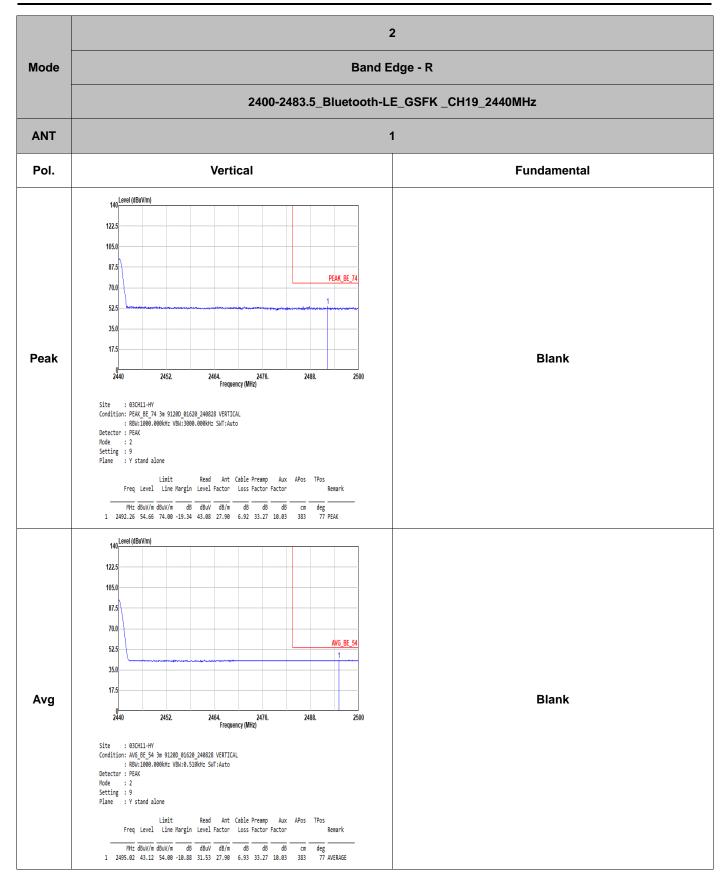
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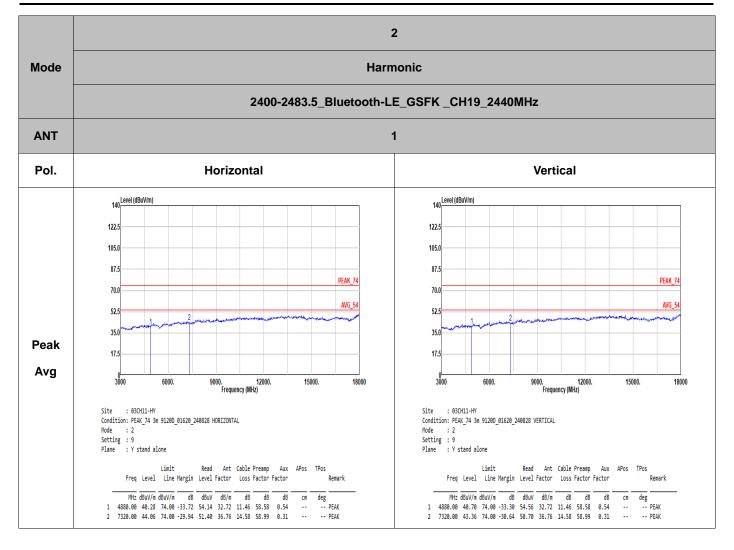
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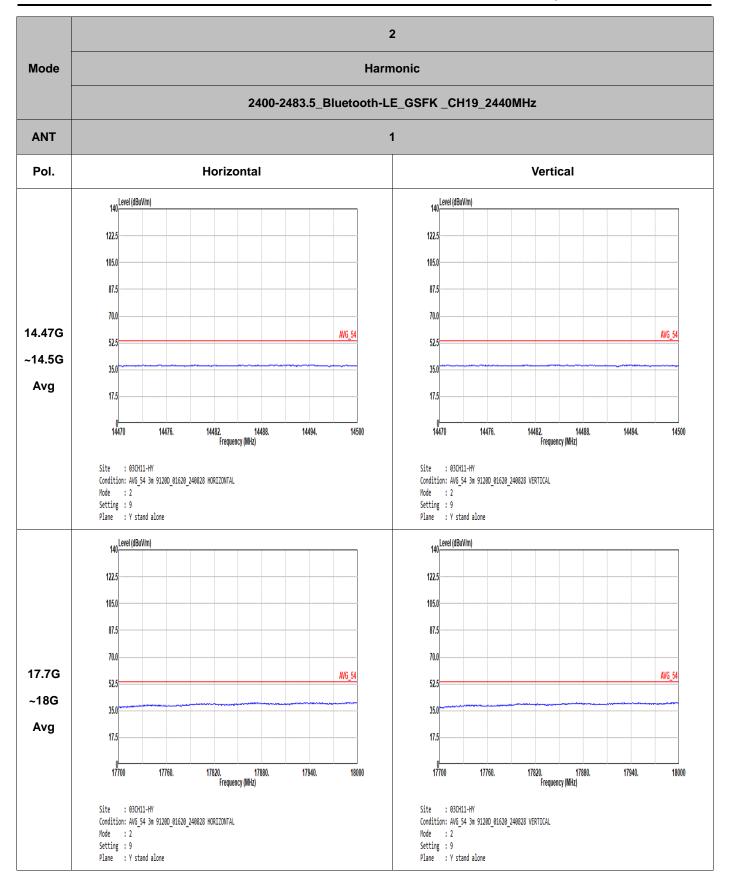
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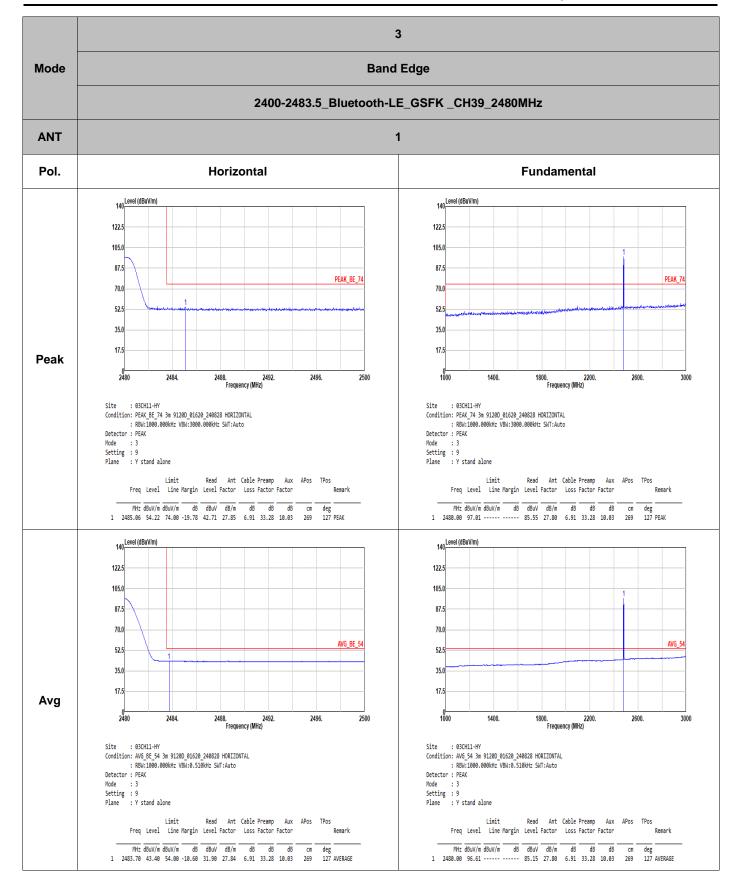
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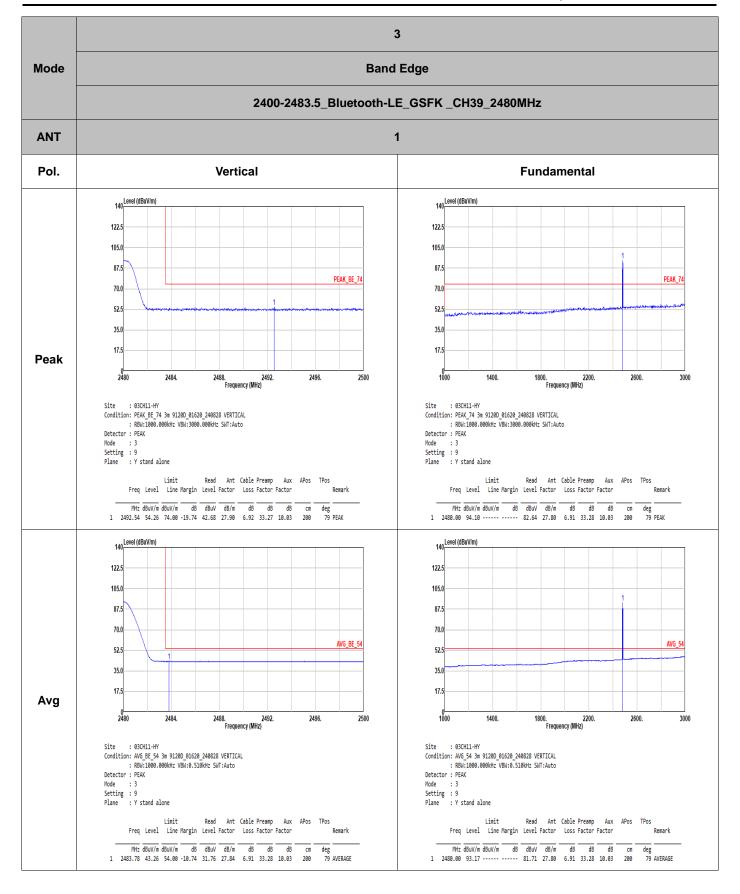
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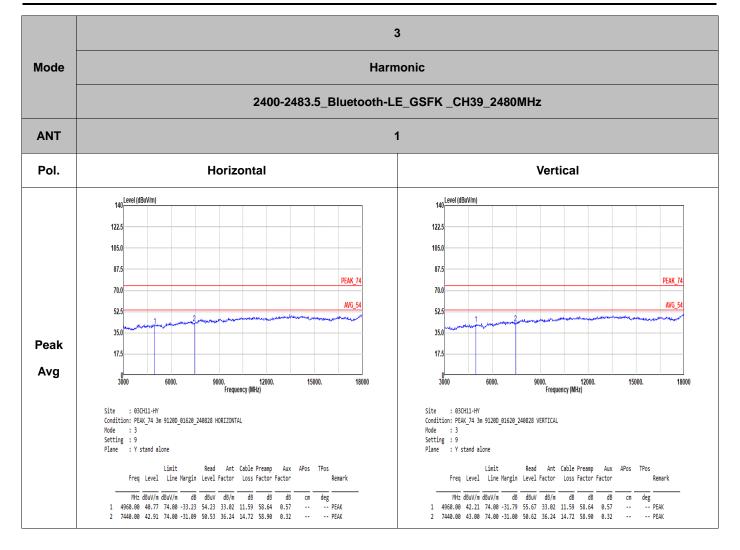
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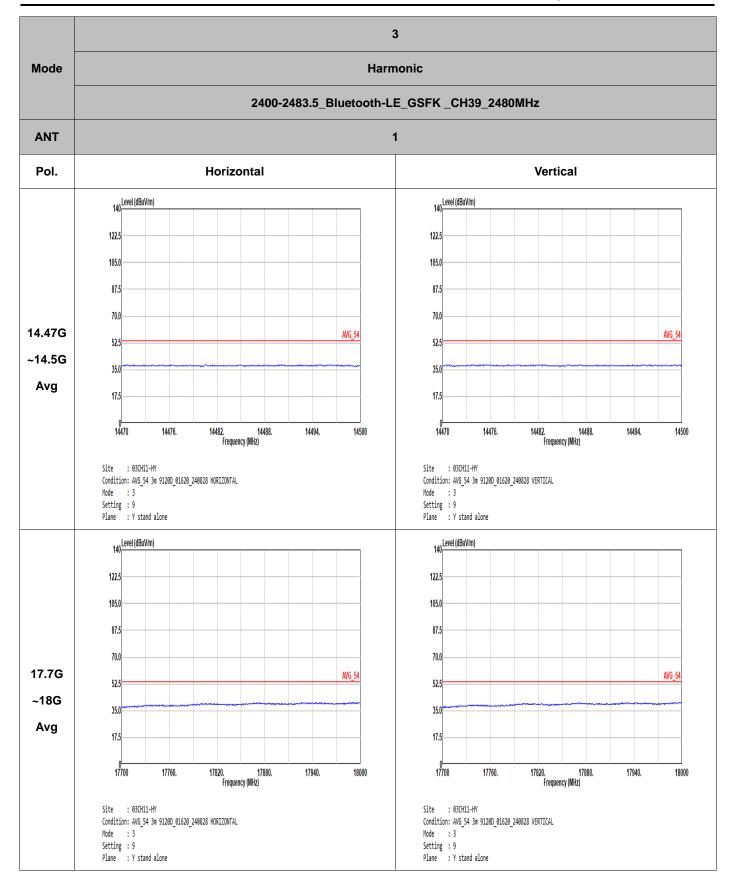
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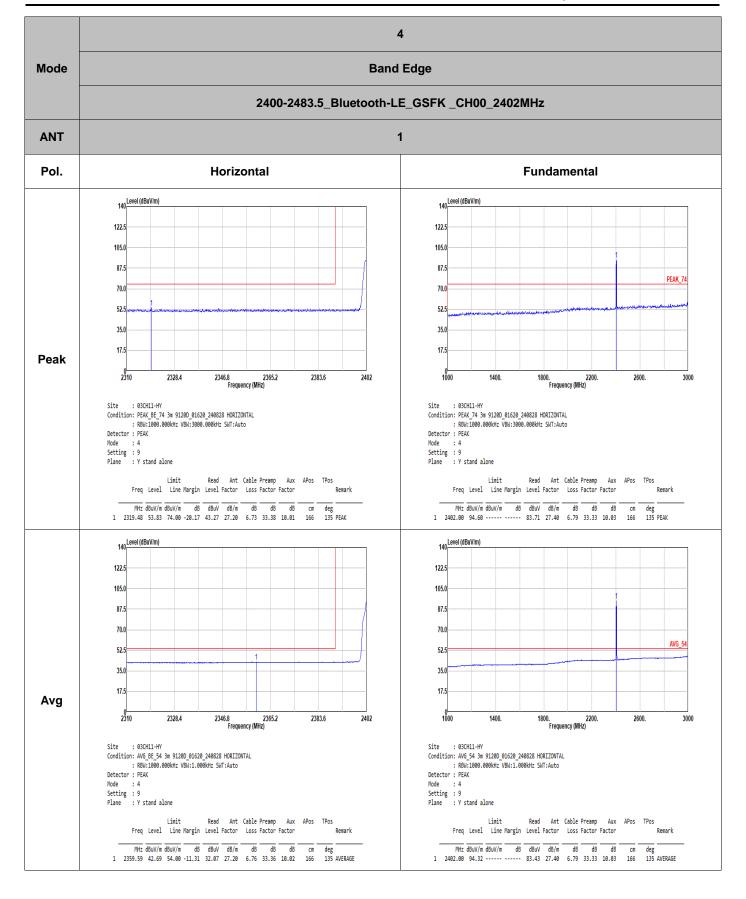
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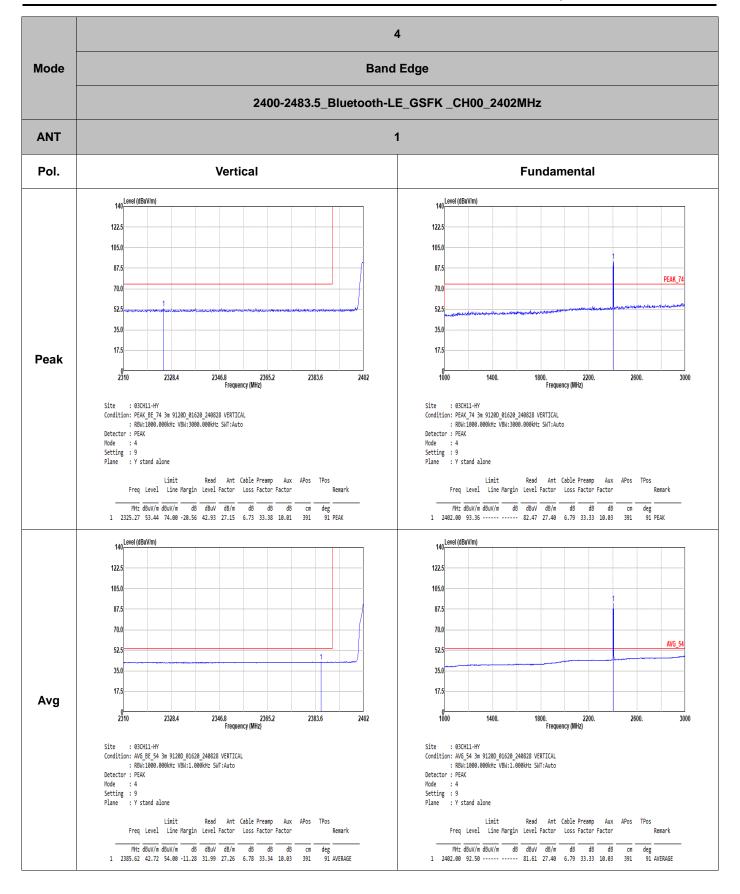
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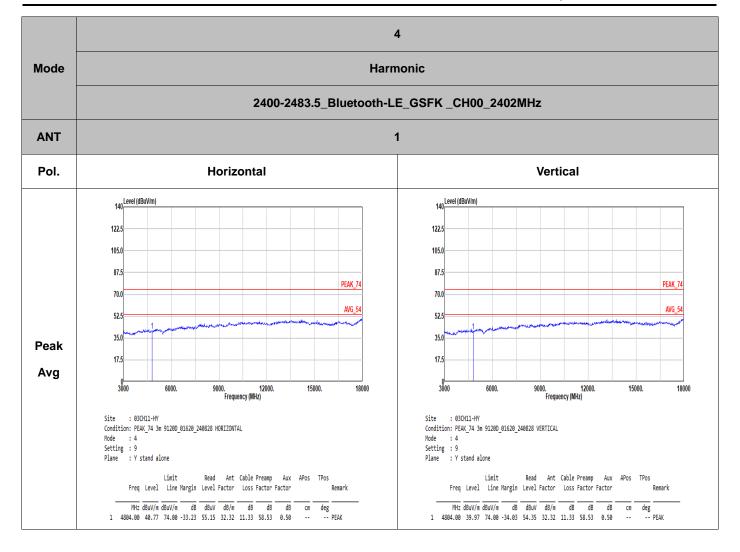
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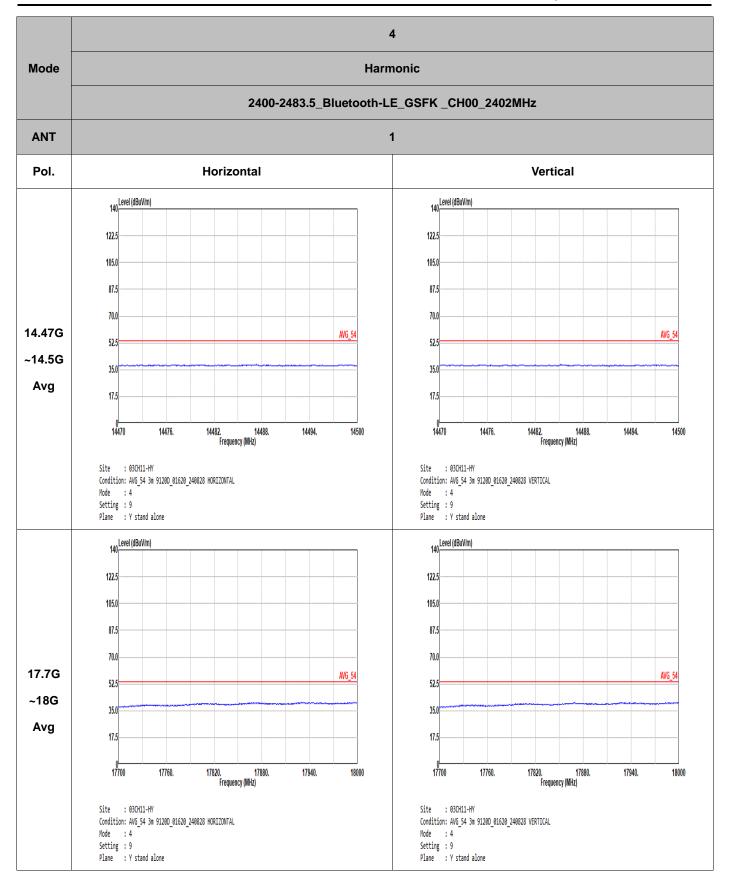
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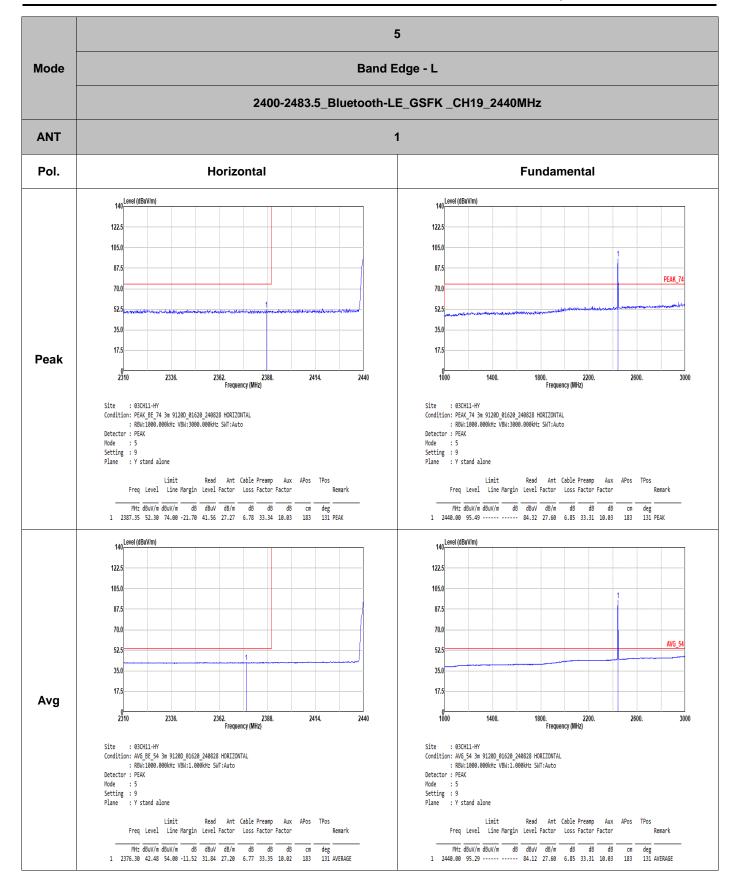
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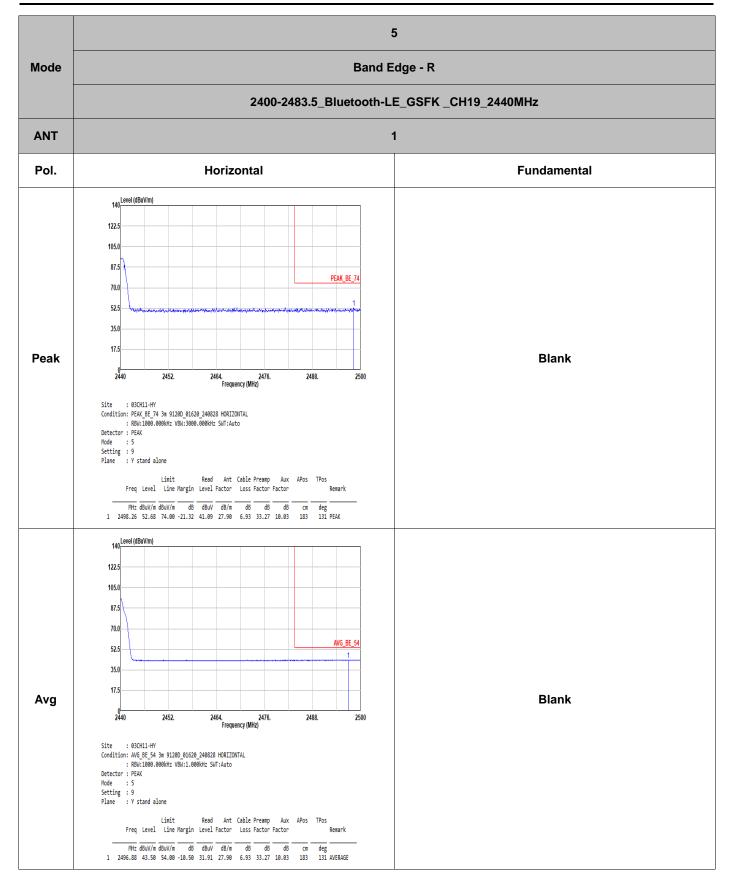
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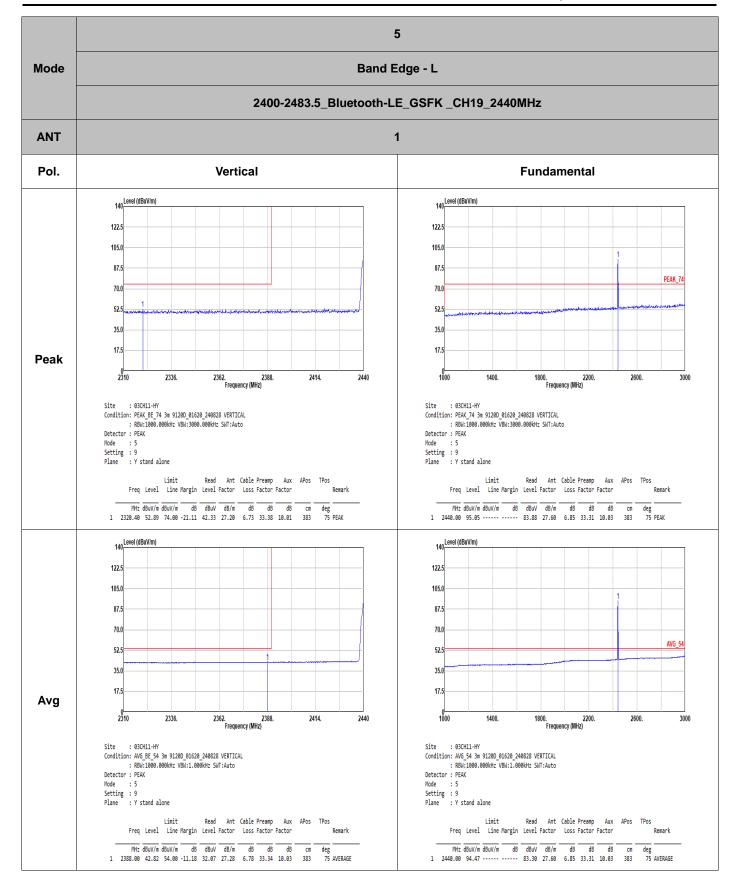
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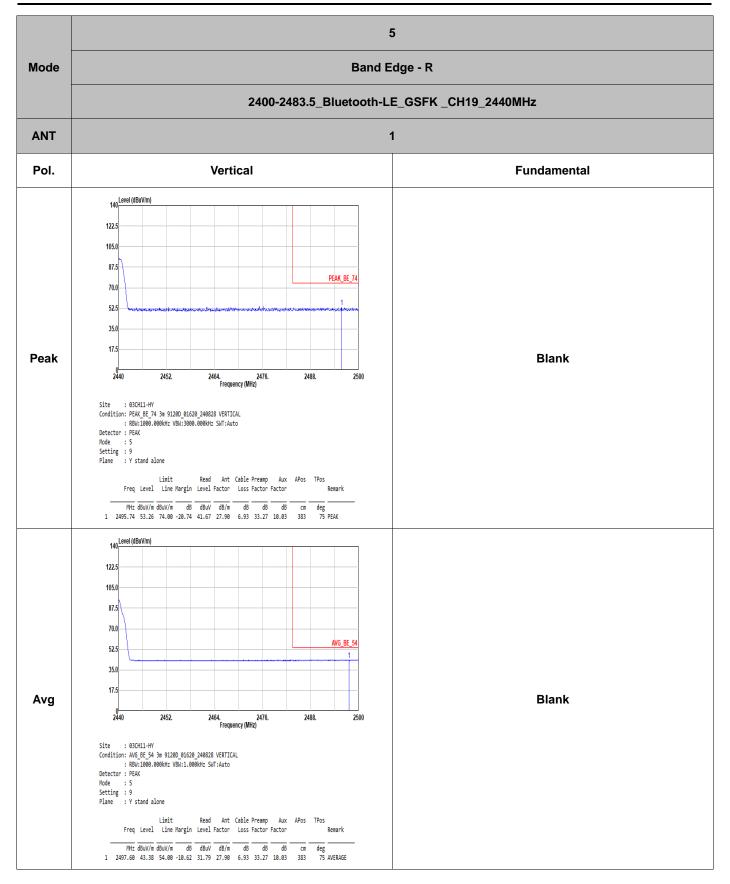
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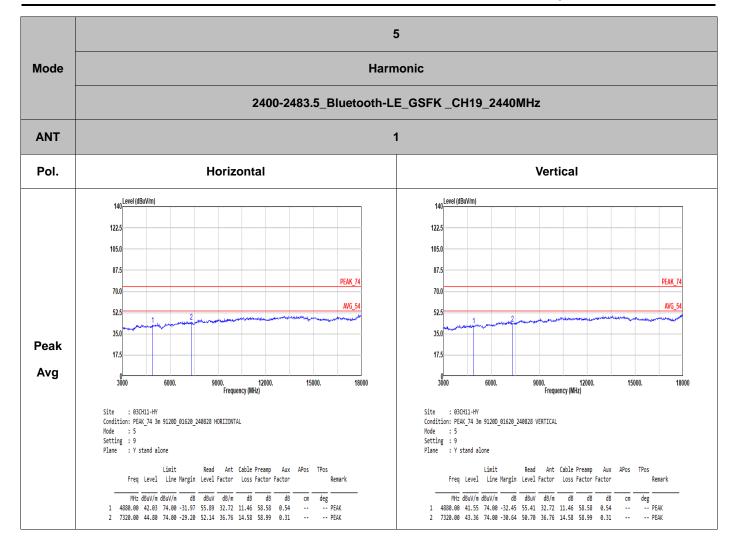
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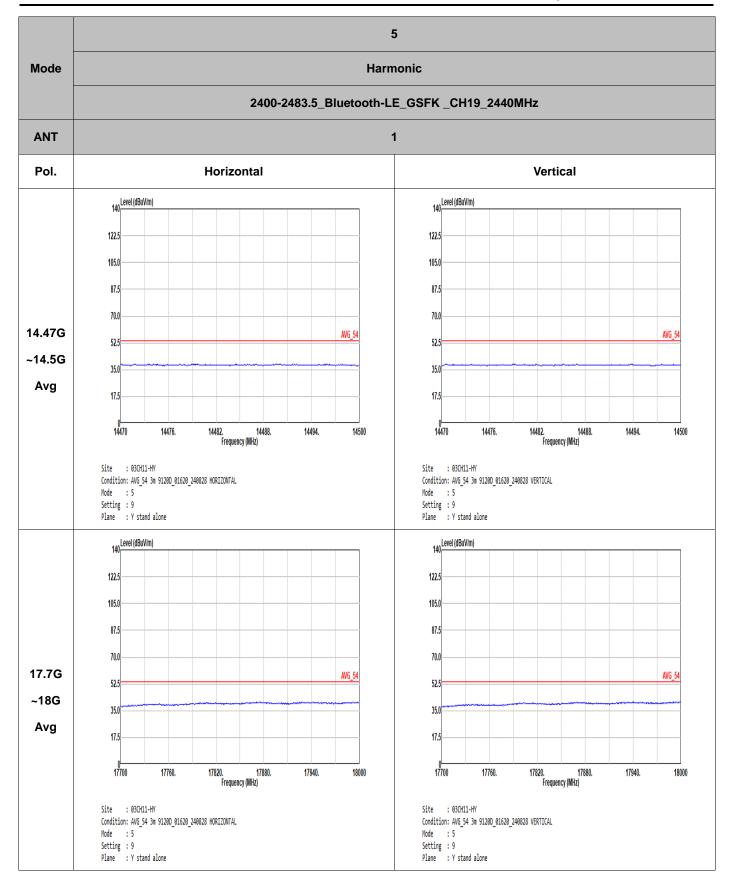
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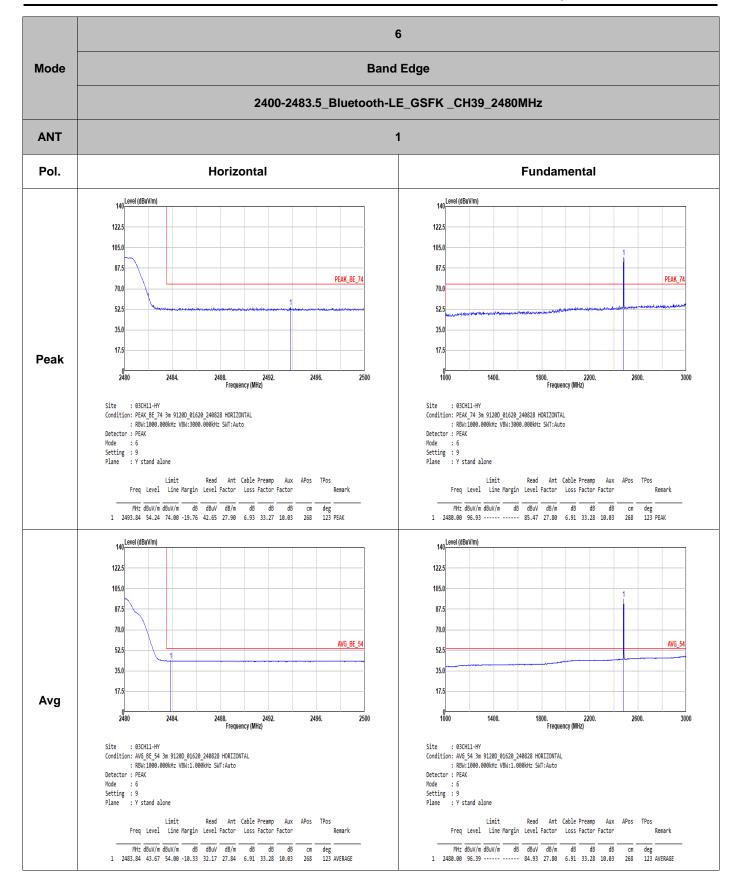
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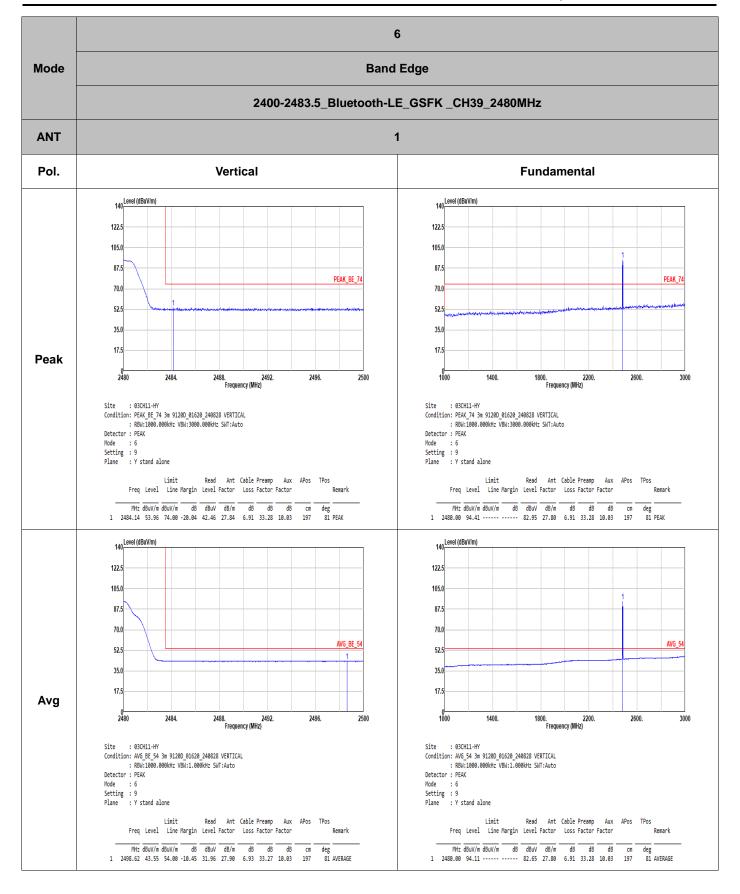
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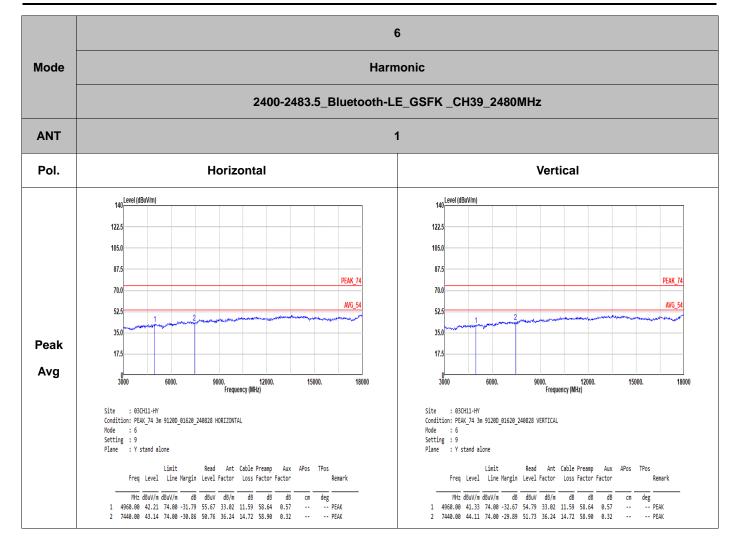
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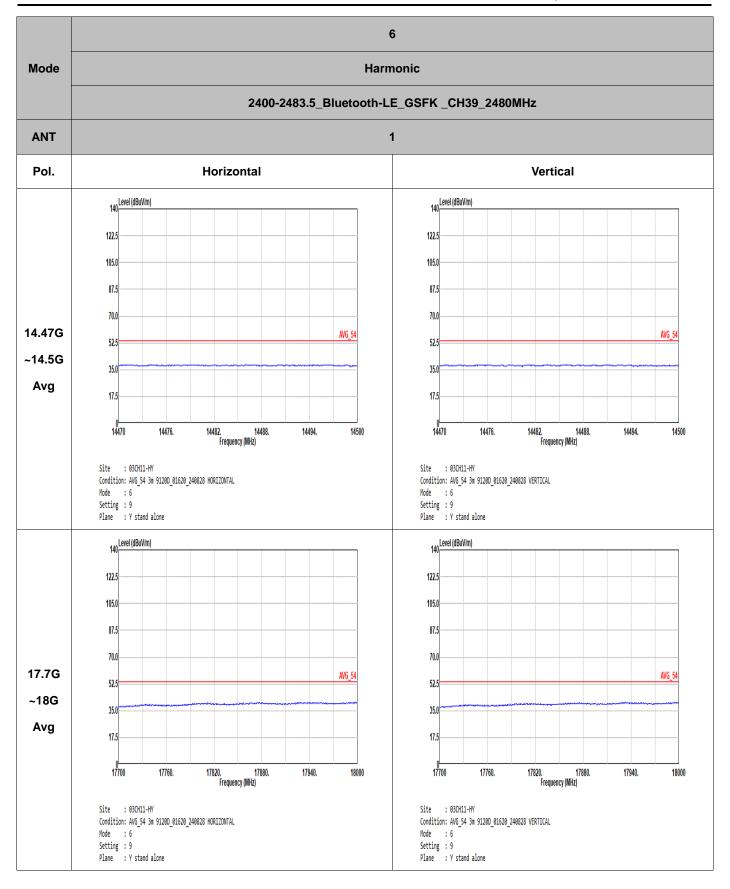
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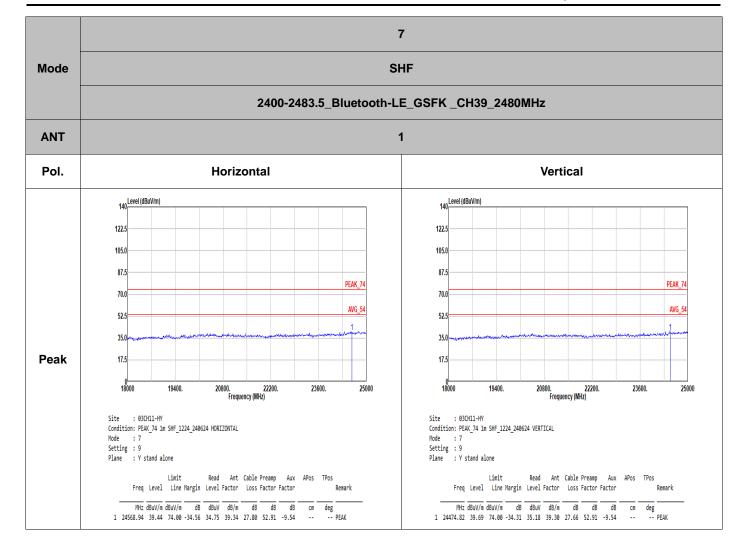
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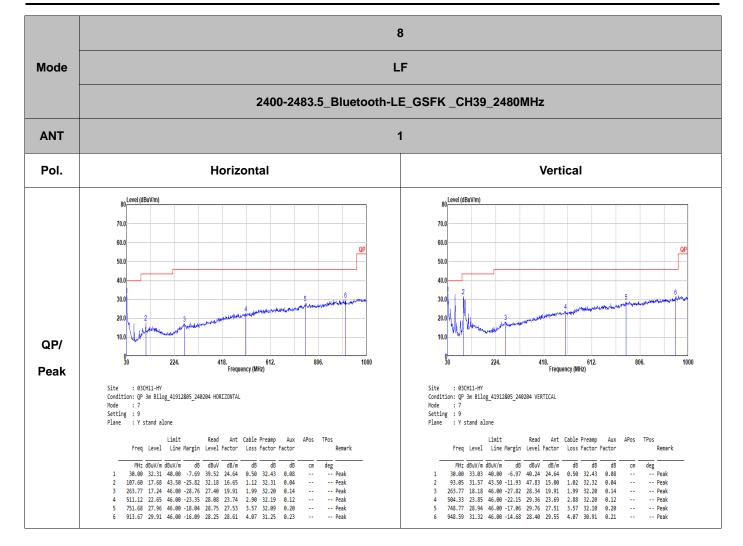
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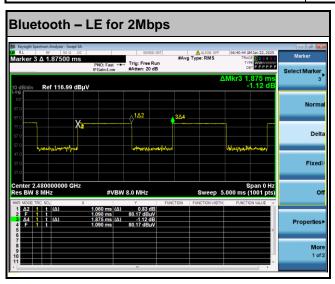
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Appendix D. Duty Cycle Plots

<Sample 1>

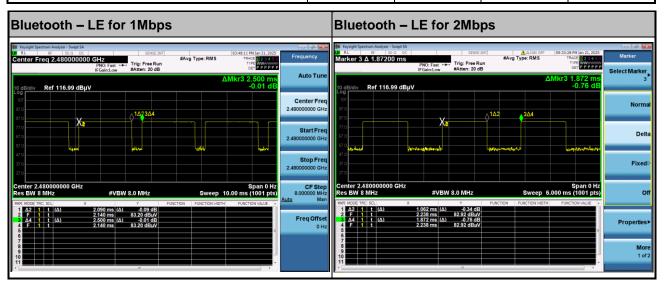
Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth –LE for 2Mbps	56.53	1060	0.943	1KHz

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<Sample 2>

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth –LE for 1Mbps	83.60	2090	0.478	0.51KHz
Bluetooth –LE for 2Mbps	56.73	1062	0.942	1KHz



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