

Report No.: XEWM2309000451RG04

Rev.: 01

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TEST REPORT

Application No.: XEWM2309000451RG

Applicant: Guangdong OPPO Mobile Telecommunications Corp., Ltd.

Address of Applicant: NO.18 Haibin Road, Wusha Village, Chang'an Town, Dongguan City, Guangdong, China

Manufacturer: Guangdong OPPO Mobile Telecommunications Corp., Ltd.

Address of Manufacturer: NO.18 Haibin Road, Wusha Village, Chang'an Town, Dongguan City, Guangdong, China

EUT Description: Mobile Phone

Model No.: CPH2599

Trade Mark: OPPO

FCC ID: R9C-CPH2599

Standards: FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart C

Date of Receipt: 2023/09/08

Date of Test: 2023/09/11 to 2023/09/29

Date of Issue: 2023/10/20

Test Result :	PASS *
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Peter Tan
Regulatory Technical Manager



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Wireless Laboratory

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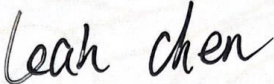
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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023/10/20		Original

Prepared By	 (Leah Chen) / Test Engineer
Checked By	 (Andy Yao) / Reviewer



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2 Test Summary

Test Item	FCC Rule No.	Test Method	Test Result	Result
Antenna Requirement	15.203/15.247(b)	--	Clause 4.1	PASS
AC Power Line Conducted Emission	15.207	ANSI C63.10-2020 Section 6.2	Clause 4.2	PASS
Duty cycle	--	ANSI C63.10-2020 Section 11.6	Clause 4.3	For Report Purpose
Conducted Output Power	15.247 (b)(3)	ANSI C63.10-2020 Section 11.9.1.2	Clause 4.4	PASS
DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	15.247 (a)(2)	ANSI C63.10-2020 Section 11.8 Option 2 / 6.9.3	Clause 4.5	PASS
Power Spectral Density	15.247 (e)	ANSI C63.10-2020 Section 11.10.2	Clause 4.6	PASS
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10-2020 Section 11.11	Clause 4.7	PASS
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10-2020 Section 11.11	Clause 4.8	PASS
Radiated Spurious Emissions	15.205/15.209	ANSI C63.10-2020 Section 11.12	Clause 4.9	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.205/15.209	ANSI C63.10-2020 Section 11.12	Clause 4.10	PASS



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3 General Information

3.1 Details of Client

Applicant:	Guangdong OPPO Mobile Telecommunications Corp., Ltd.
Address of Applicant:	NO.18 Haibin Road, Wusha Village, Chang'an Town, Dongguan City, Guangdong, China
Manufacturer:	Guangdong OPPO Mobile Telecommunications Corp., Ltd.
Address of Manufacturer:	NO.18 Haibin Road, Wusha Village, Chang'an Town, Dongguan City, Guangdong, China

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd.
Address:	1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi China
Post code:	710086
Test engineer:	Qiang Zhang, Jacky Xue

3.3 Test Facility

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

•A2LA (Certificate No. 4854.01)

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0095.

IC#: 25613.

• FCC –Designation Number: CN1337

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized as an accredited testing laboratory.

Designation Number: CN1337.

Test Firm Registration Number: 917410



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3.4 General Description of EUT

EUT Description:	Mobile Phone	
Model No.:	CPH2599	
Trade Mark:	OPPO	
Hardware Version:	11	
Software Version:	ColosOS 14.0	
Power Supply:	Li-ion polymer Battery(3.89V)	
IMEI:	RF Conducted	865055060031471
	RSE & AC power line	865055060029756
Operation Frequency:	2400MHz~2483.5MHz $f_c = 2402 \text{ MHz} + N * 2 \text{ MHz}$, where: -fc = "Operating Frequency" in MHz, -N = "Channel Number" with the range from 0 to 39.	
Bluetooth version:	Bluetooth V5.3	
Modulation Type:	GFSK	
Number of Channel:	40	
Rates Type*:	☒ Provided by client	
	1M PHY	2M PHY
Antenna Type:	Fixed Internal Antenna	
Antenna Gain:	0dBi(Ant9)	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.	
RF Cable:	1.2dB	
Remark:	As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.	

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

Remark:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
BLE 1M:	
The Lowest channel(CH0)	2402MHz
The Middle channel(CH19)	2440MHz
The Highest channel(CH39)	2480MHz
BLE 2M:	
The Lowest channel(CH1)	2404MHz
The Middle channel(CH19)	2440MHz
The Highest channel(CH38)	2478MHz



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3.5 Test Environment

Environment Parameter	96~101 kPa Selected Values During Tests	
Relative Humidity	40-60 % RH Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	22~25	3.89
Remark: NV: Normal Voltage NT: Normal Temperature		

3.6 Description of Support Units

The EUT has been tested as an independent unit.



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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(b)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The antenna is Fixed Internal Antenna and no consideration of replacement. The best case gain of the antenna is 0dBi(Ant9). * <i>*Note:</i> <i>The antenna gain are derived from the gain information report provided by the manufacturer.</i> <i>Remark:</i> <i>As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.</i>	



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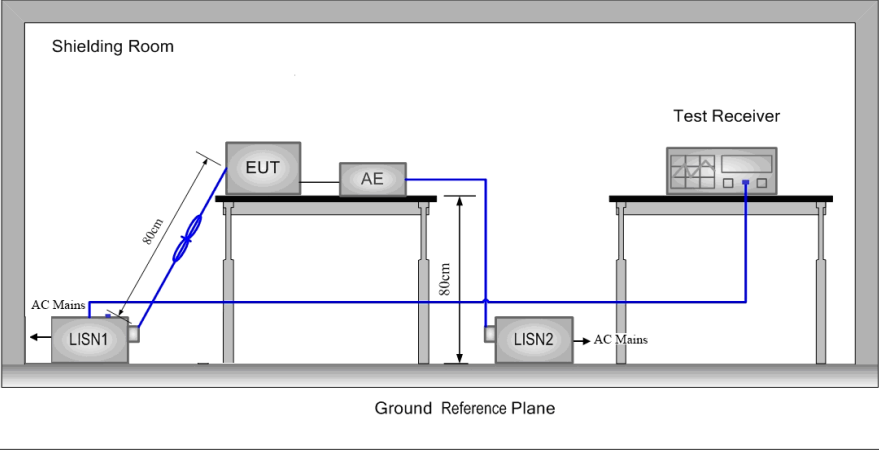
4.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10-2020 Section 6.2		
Test Frequency Range:	150kHz to 30MHz		
Receiver Setup:	RBW = 9kHz, VBW = 30kHz		
Limit:	Frequency range(MHz)	Limit (dBuV)	
		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.			
Test Procedure:	1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane. 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10-2020 on conducted measurement.		

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Test Setup:	
Test Mode:	Transmitting with GFSK modulation. Charge +Transmitting mode.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass

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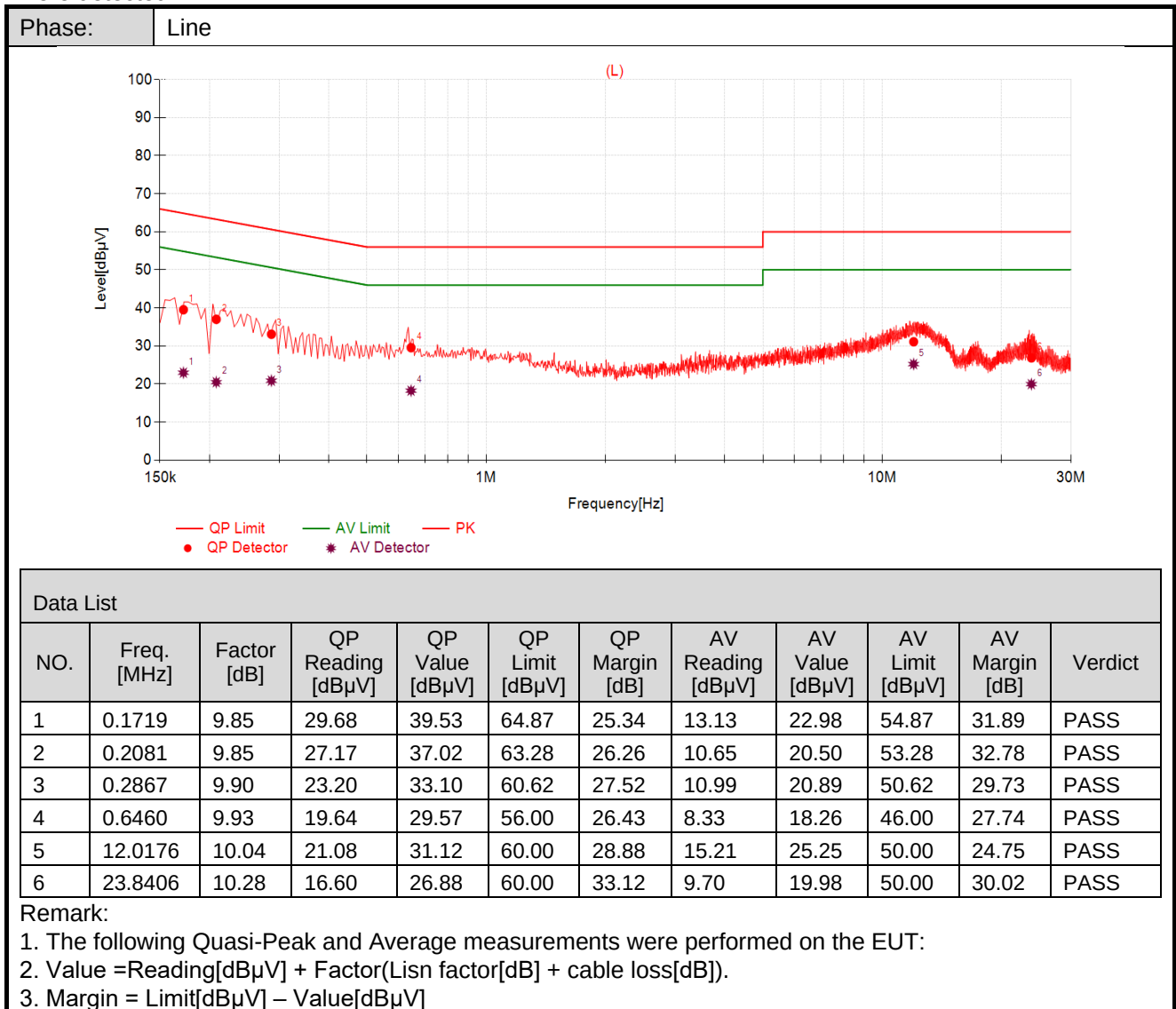
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Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

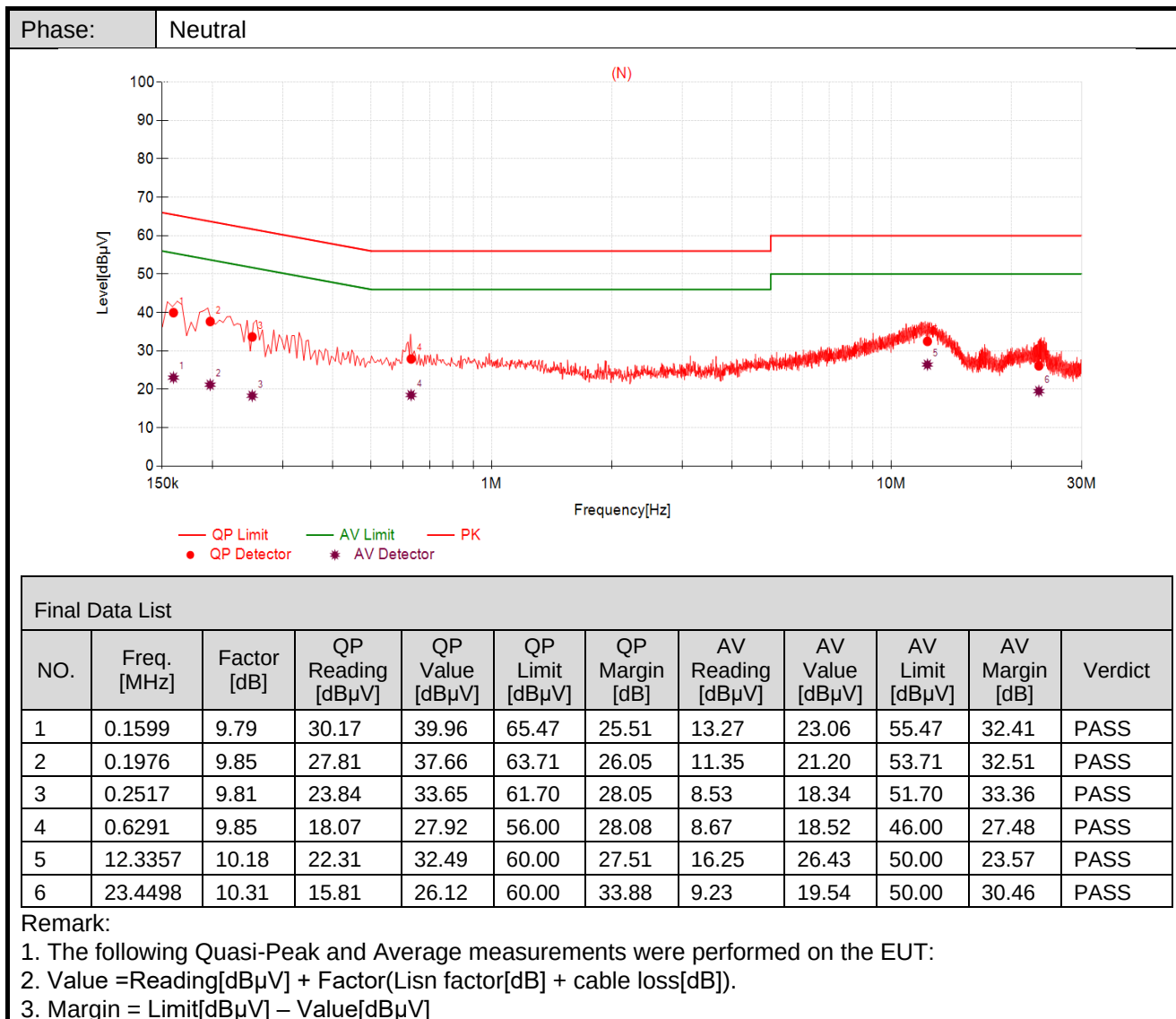
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.



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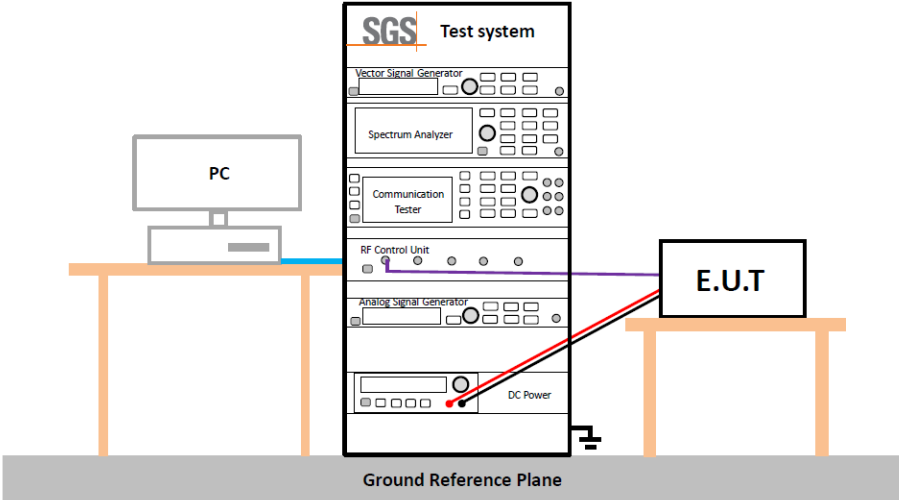


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4.3 Duty Cycle

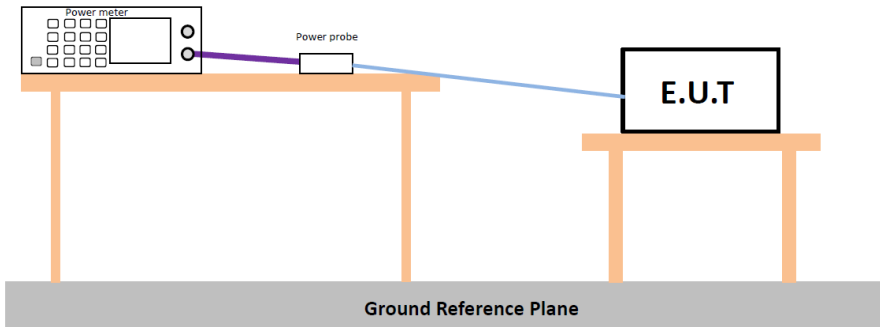
Test Requirement:	ANSI C63.10-2020 Section 11.6
Test Method:	ANSI C63.10-2020 Section 11.6
Test Setup:	
Instruments Used:	Refer to section 6 for details
Test Mode:	Transmitting with GFSK modulation.
Limit:	No restriction limits
Test Results:	For Report Purpose
The detailed test data see: Appendix	

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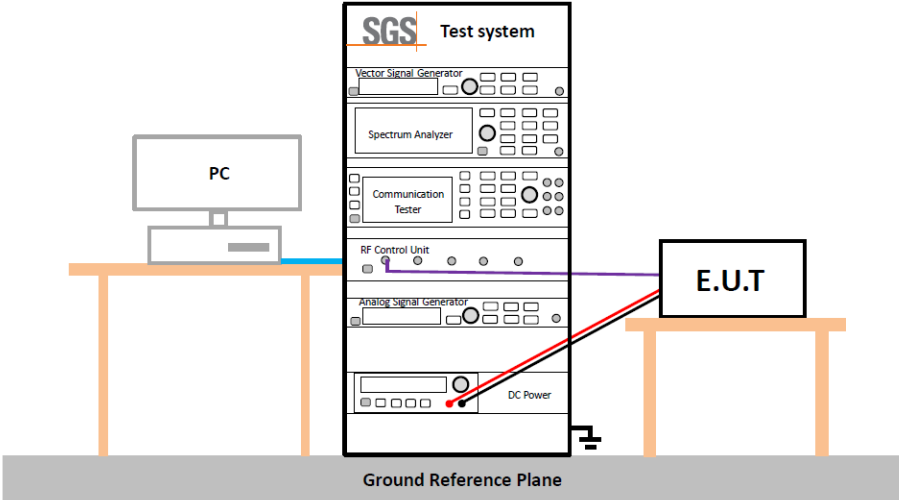
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4.4 Conducted Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)
Test Method:	ANSI C63.10-2020 Section 11.9.1.2
Test Setup:	 * Test with power meter (Detector function: Peak)
Test Instruments:	Refer to section 6 for details
Test Mode:	Transmitting with GFSK modulation.
Limit:	30dBm
Test Results:	Pass
The detailed test data see: Appendix	

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4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

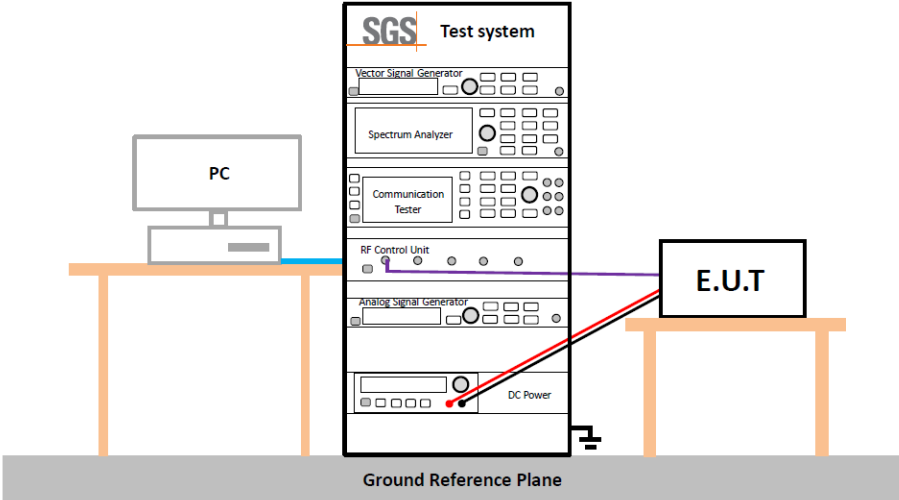
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10-2020 Section 11.8 Option 2 / 6.9.3
Test Setup:	
Instruments Used:	Refer to section 6 for details
Test Mode:	Transmitting with GFSK modulation.
Limit:	≥ 500 kHz for DTS Bandwidth
Test Results:	Pass
The detailed test data see: Appendix	

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4.6 Power Spectral Density

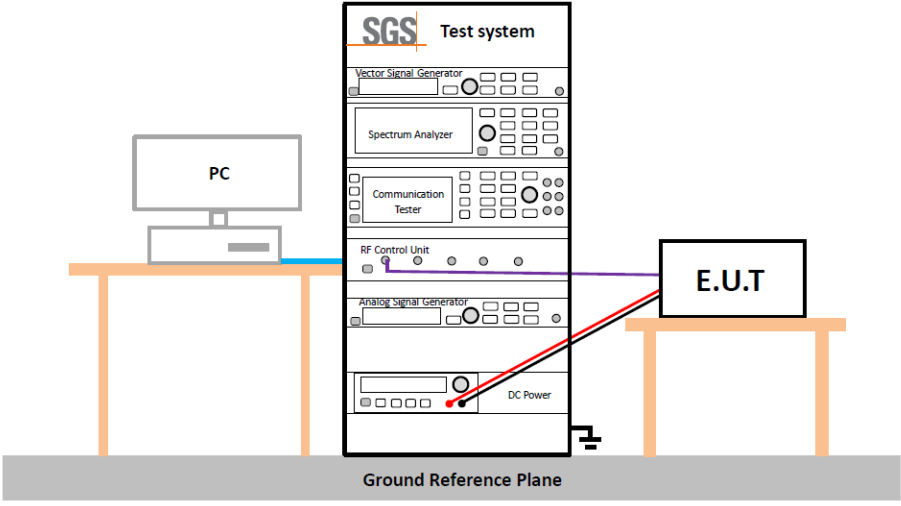
Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10-2020 Section 11.10.2
Test Setup:	
Test Instruments:	Refer to section 6 for details
Test Mode:	Transmitting with GFSK modulation.
Limit:	$\leq 8.00\text{dBm}/3\text{kHz}$
Test Results:	Pass
The detailed test data see: Appendix	

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4.7 Band-edge for RF Conducted Emissions

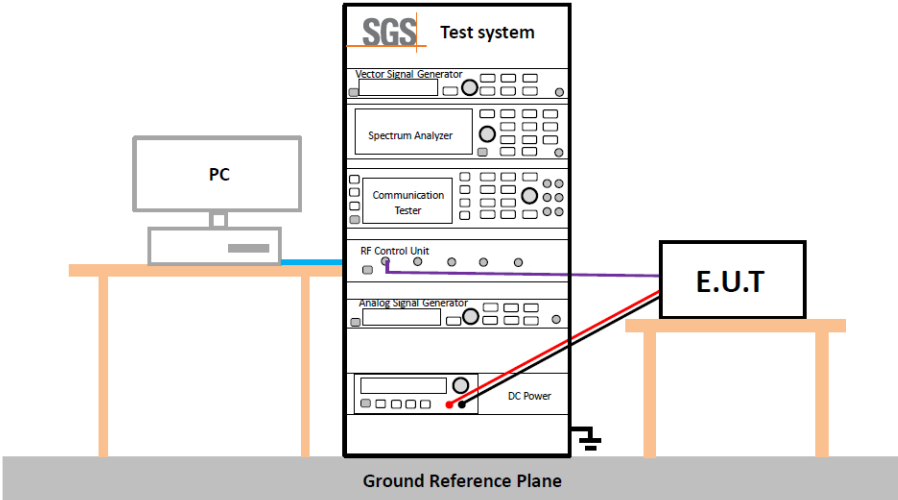
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10-2020 Section 11.11
Test Setup:	
Instruments Used:	Refer to section 6 for details
Test Mode:	Transmitting with GFSK modulation.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test Results:	Pass
The detailed test data see: Appendix	

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4.8 RF Conducted Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10-2020 Section 11.11
Test Setup:	
Instruments Used:	Refer to section 6 for details
Test Mode:	Transmitting with GFSK modulation.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test Results:	Pass
The detailed test data see: Appendix	

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4.9 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10-2020 Section 11.12				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Test Frequency:	9kHz ~ 25GHz				
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					

Test Setup:

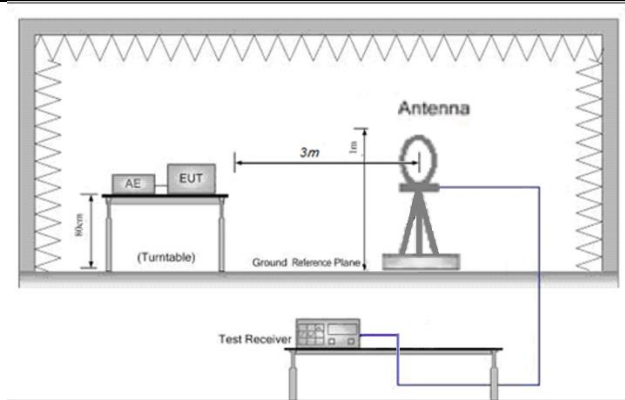


Figure 1. Below 30MHz

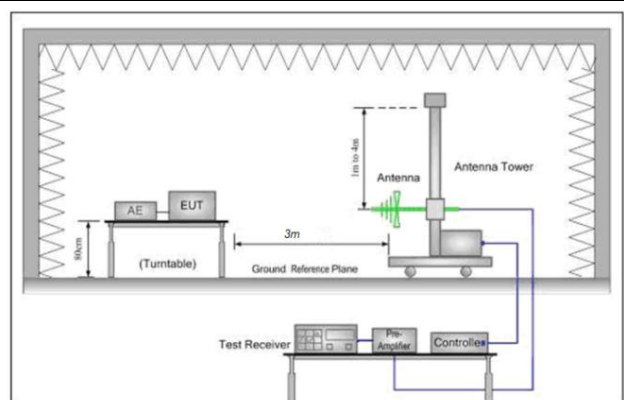


Figure 2. 30MHz to 1GHz

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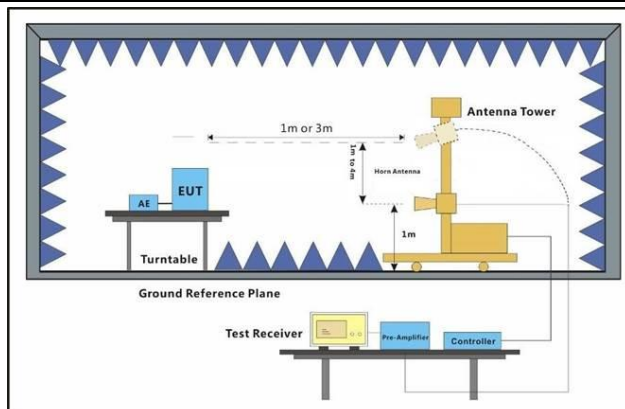


Figure 3. Above 1 GHz

Test Procedure:	- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. - For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation (Distance from antenna to EUT is 1m for measurements >18GHz). - The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. - The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. - For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. - The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. - Test the EUT in the lowest channel, the middle channel, the Highest channel. - The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case. - Repeat above procedures until all frequencies measured was complete. - The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported - The disturbance above 18GHz was very low, and the harmonics were the highest point could be found when testing, so only the harmonics had been displayed. - At a measurement distance of 1 meter the limit line was increased by $20 \cdot \log(3/1) = 9.54 \text{ dB}$.
Test Configuration:	Measurements below 30MHz - RBW = 10 kHz - VBW = 30 kHz

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	• Detector = Peak & Average & Quasi-peak • Trace mode = max hold Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW $\geq$ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz • RBW = 1 MHz • 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.
Exploratory Test Mode:	Transmitting with GFSK modulation. Charge + Transmitting mode.
Final Test Mode:	Transmitting with GFSK modulation. Pretest the EUT at Charge + Transmitting mode, For below 1GHz part, through pre-scan all channels, but only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details
Test Results:	Pass
The detailed test data see: Appendix	



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4.10 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10-2020 Section 11.12		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m)	Remark
	30MHz-88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
	960MHz-1GHz	54.0	Quasi-peak
	Above 1GHz	54.0	Average Value
		74.0	Peak Value

Test Setup:

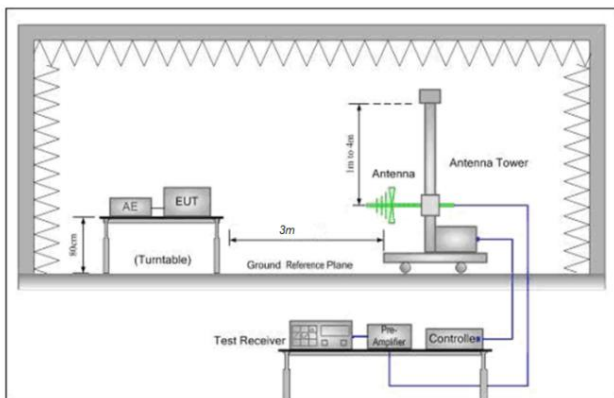


Figure 1. 30MHz to 1GHz

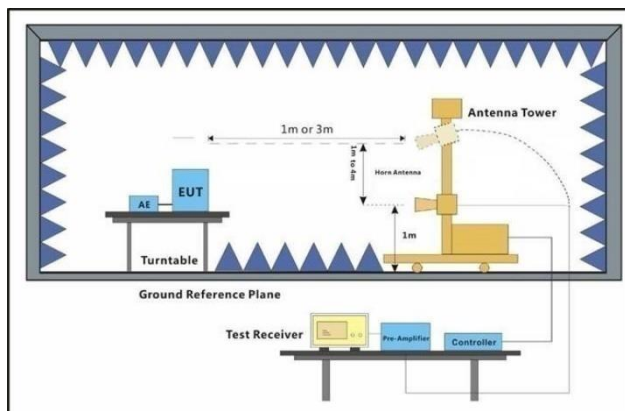


Figure 2. Above 1 GHz

Test Procedure:

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified

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	Bandwidth with Maximum Hold Mode. g. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel h. Test the EUT in the lowest channel , the Highest channel i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode,And found the X axis positioning which it is worse case. j. Repeat above procedures until all frequencies measured was complete.
Test Configuration:	Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW ≥ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz • RBW = 1 MHz • 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.
Exploratory Test Mode:	Transmitting with GFSK modulation. Charge + Transmitting mode.
Final Test Mode:	Transmitting with GFSK modulation. Pretest the EUT at Charge + Transmitting mode. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details
Test Results:	Pass
The detailed test data see: Appendix	



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5 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$ GHz
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 0.2\%$
4	RF conducted power	± 0.21 dB
5	RF power density	± 2.84 dB
6	Conducted Spurious emissions	± 0.75 dB
7	Conduction Emission	± 3.0 dB (150kHz to 30MHz)
8	Radiated Emission	± 4.6 dB (9kHz to 30MHz)
		± 4.9 dB (30MHz to 1GHz)
		± 4.9 dB (1GHz to 6GHz)
		± 4.7 dB (6GHz to 18GHz)
		± 5.26 dB (Above 18GHz)
Remark: The U _{lab} (lab Uncertainty) is less than U _{cispr/ETSI} (CISPR/ETSI Uncertainty), so the test results – compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit; – non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.		



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6 Equipment List

RF Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
MXA signal analyzer	Agilent	N9020A	XAW01-06-07	2023/02/16	2024/02/15
MXG vector signal Generator	Agilent	N5182B	XAW01-07-16	2023/02/16	2024/02/15
Measurement Software	Tonscend	JS1120-3 (3.2.18)	XAW02-14-01	NCR	NCR
RF control unit	Tonscend	JS0806-2	XAW03-37-01	NCR	NCR
Power Meter	Anritsu	ML2495A	XAW01-25-03	2023/08/30	2024/08/29
Power Supply	Agilent	66311B	XAW01-17-01	2023/02/16	2024/02/15
Temperature and humidity meter	MingGao	T809	XAW01-01-16	2023/09/04	2024/09/03

CE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	XAW04-03-01	N/A	N/A
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2023/08/30	2024/08/29
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2023/06/30	2024/06/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2023/08/30	2024/08/29
Measurement Software	Tonscend	TS+ V4.0.0.0	XAW02-07-01	NCR	NCR
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-02	2023/02/16	2024/02/15
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-02	2023/06/30	2024/06/29



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RSE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2021/09/09	2024/09/08
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2023/02/16	2024/02/15
Spectrum Analyzer	ROHDE& SCHWARZ	FSV3044	XAW01-13-05	2023/05/15	2024/05/14
Test receiver	ROHDE& SCHWARZ	ESR	XAW01-08-01	2023/08/30	2024/08/29
Receiving antenna (30MHz-3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2022/07/28	2024/07/27
Receiving antenna (1GHz~18GHz)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2022/07/28	2024/07/27
Receiving antenna (15GHz~40GHz)	Schwarzbeck	BBHA 9170	XAW01-09-03	2022/07/23	2024/07/22
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP9K3G32	XAW01-41-01	2023/05/15	2024/05/14
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2023/08/30	2024/08/29
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2023/08/30	2024/08/29
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2023/08/30	2024/08/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2023/09/04	2024/09/03
Measurement Software	Tonscend	TS+ V4.0.0.0	XAW02-05-01	NCR	NCR
Loop Antenna	Schwarzbeck	FMZB 1519B	XAW01-48-02	2022/05/26	2024/05/25



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7 Photographs - Setup Photos

Refer to Appendix A.2 WLAN Setup Photos.



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Appendix



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DTS Bandwidth Test Result

TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant9	2402	0.664	2401.672	2402.336	0.5	PASS
		2440	0.700	2439.652	2440.352	0.5	PASS
		2480	0.704	2479.652	2480.356	0.5	PASS
BLE_2M	Ant9	2404	1.236	2403.344	2404.580	0.5	PASS
		2440	1.132	2439.460	2440.592	0.5	PASS
		2478	1.136	2477.440	2478.576	0.5	PASS



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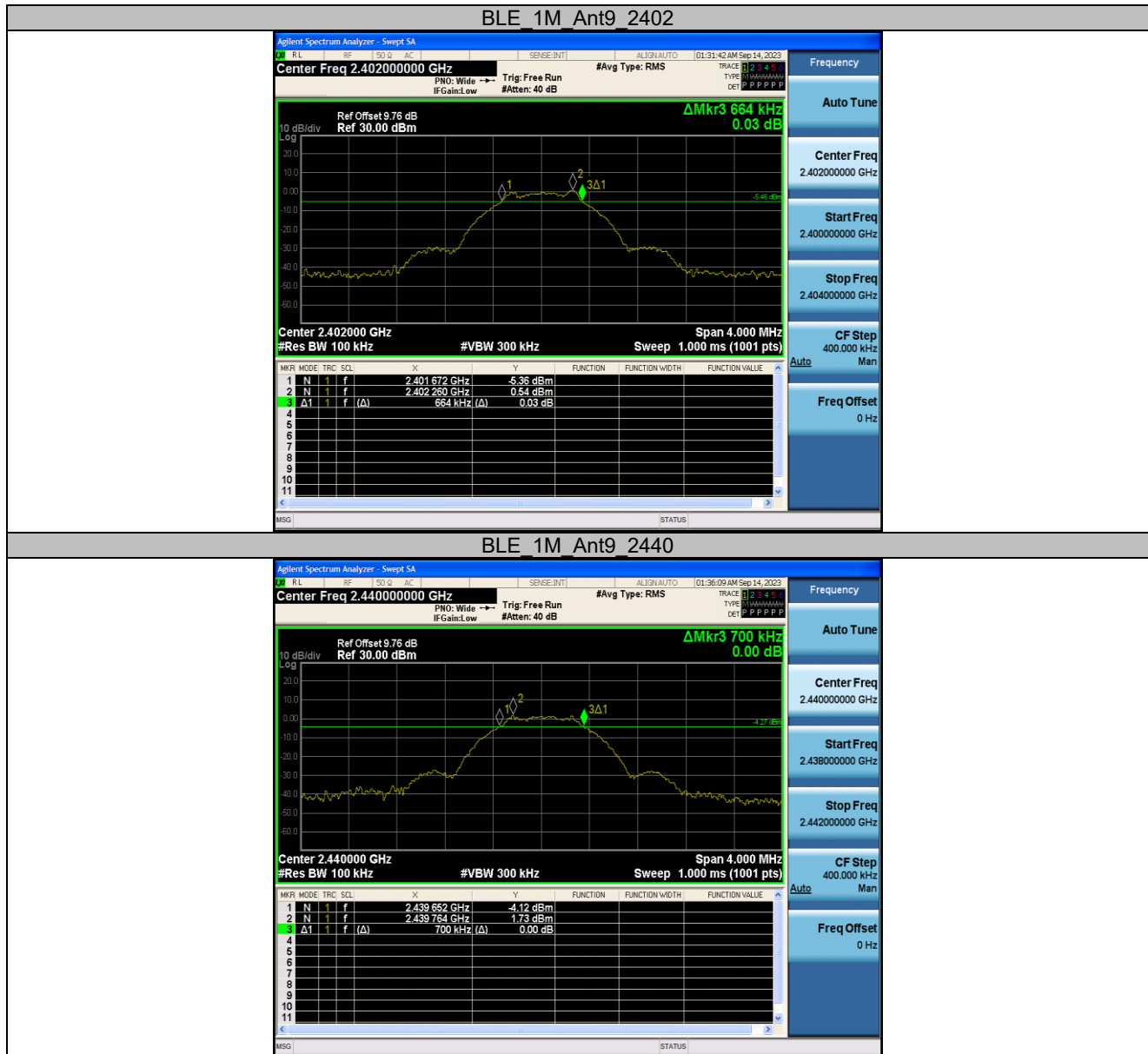
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Test Graphs



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BLE 1M Ant9 2480



BLE 2M Ant9 2404



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BLE 2M Ant9 2440



BLE 2M Ant9 2478



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99% Occupied Bandwidth Test Result

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
BLE_1M	Ant9	2402	1.0406	2401.4906	2402.5312	For Report Purpose
		2440	1.0261	2439.4953	2440.5214	
		2480	1.0357	2479.4900	2480.5257	
BLE_2M	Ant9	2404	2.0651	2402.9899	2405.0550	
		2440	2.0579	2438.9953	2441.0532	
		2478	2.0582	2476.9971	2479.0553	



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Test Graphs

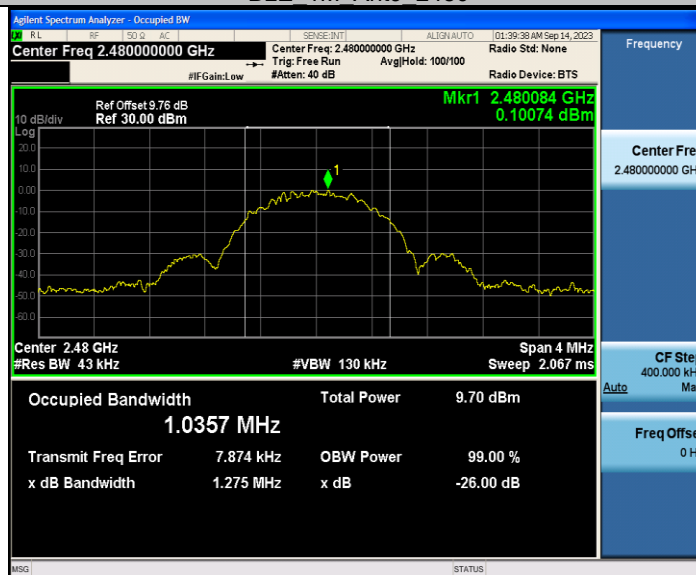


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BLE 1M Ant9 2480



BLE 2M Ant9 2404



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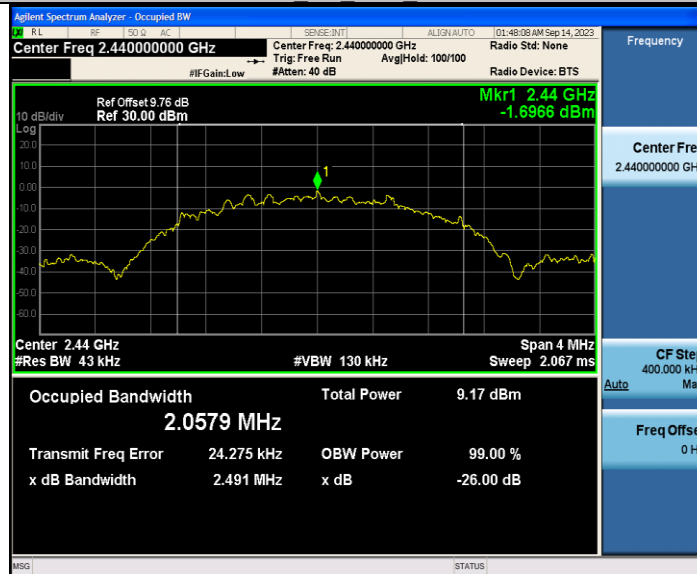
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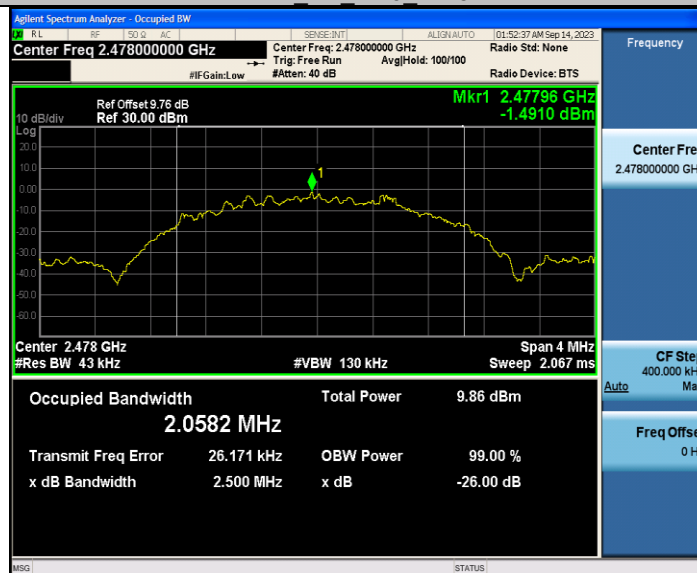
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BLE 2M Ant9 2440



BLE 2M Ant9 2478



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Maximum conducted output power Test Result Peak

TestMode	Antenna	Frequency[MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	Verdict
BLE_1M	Ant9	2402	1.32	≤30	PASS
		2440	2.57	≤30	PASS
		2480	2.18	≤30	PASS
BLE_2M	Ant9	2404	1.61	≤30	PASS
		2440	2.61	≤30	PASS
		2478	2.25	≤30	PASS



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**power spectral density
Test Result**

TestMode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant9	2402	-15.37	≤8.00	PASS
		2440	-13.46	≤8.00	PASS
		2480	-12.86	≤8.00	PASS
BLE_2M	Ant9	2404	-17.25	≤8.00	PASS
		2440	-15.62	≤8.00	PASS
		2478	-15.04	≤8.00	PASS



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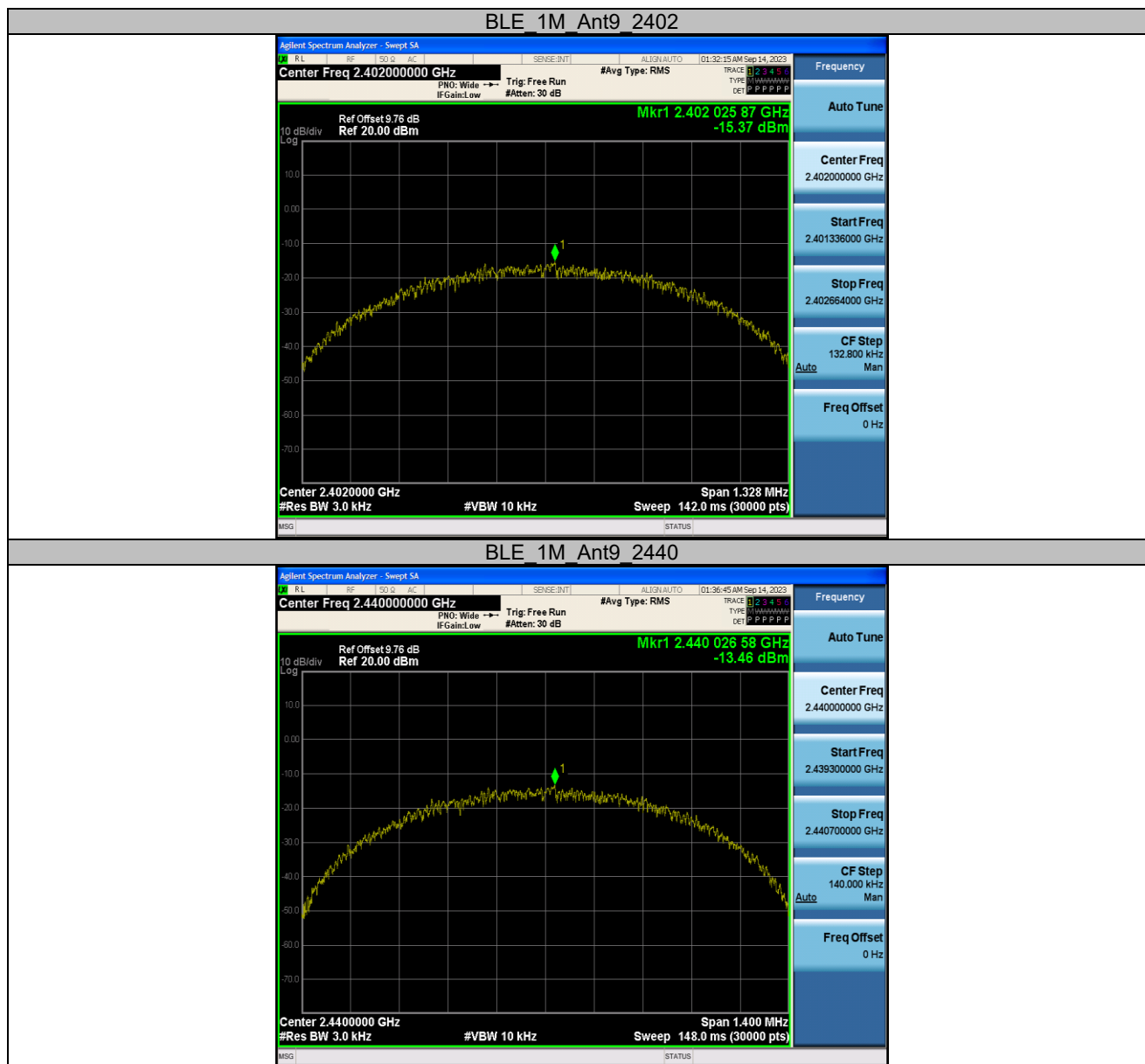
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Test Graphs



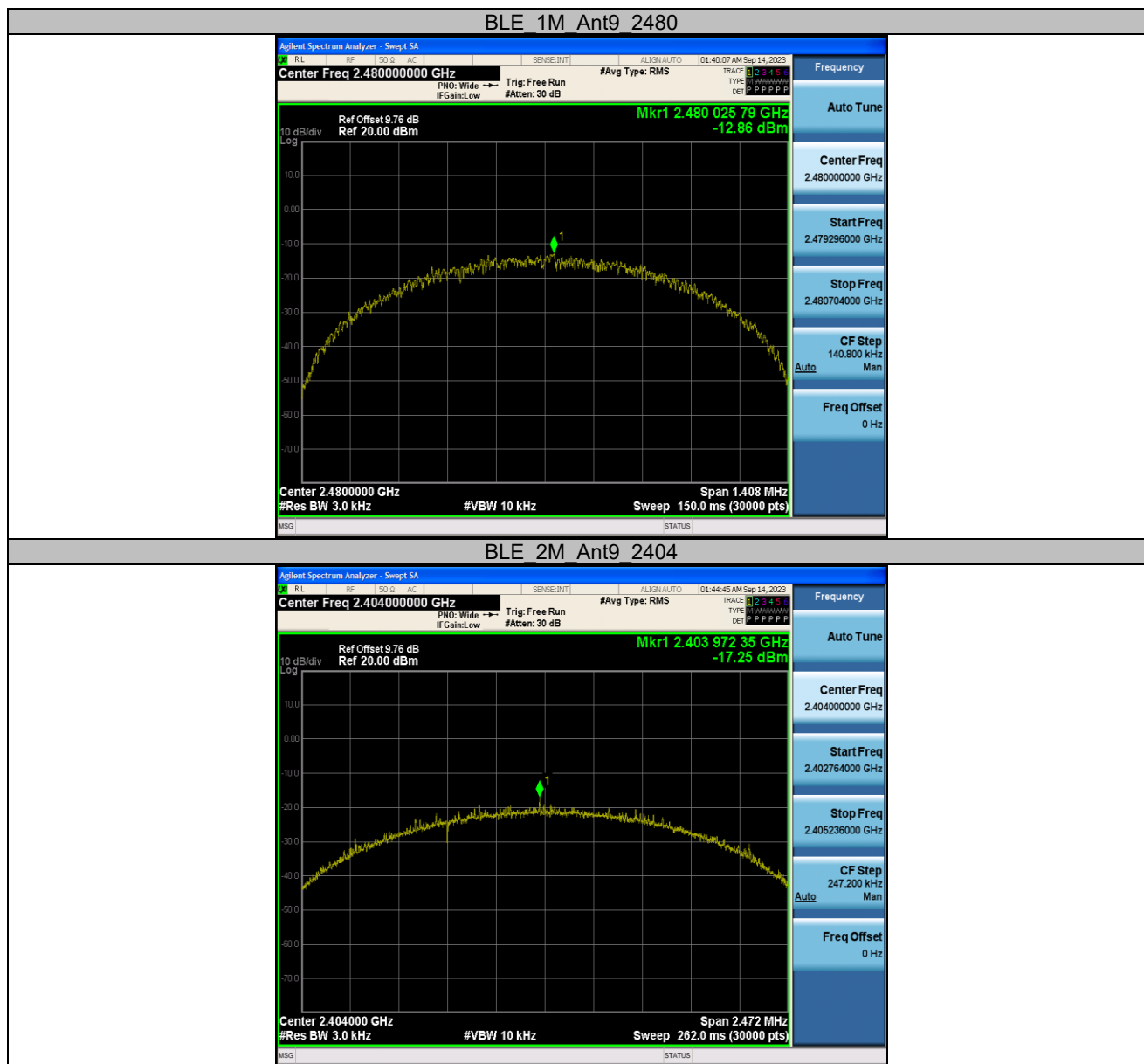
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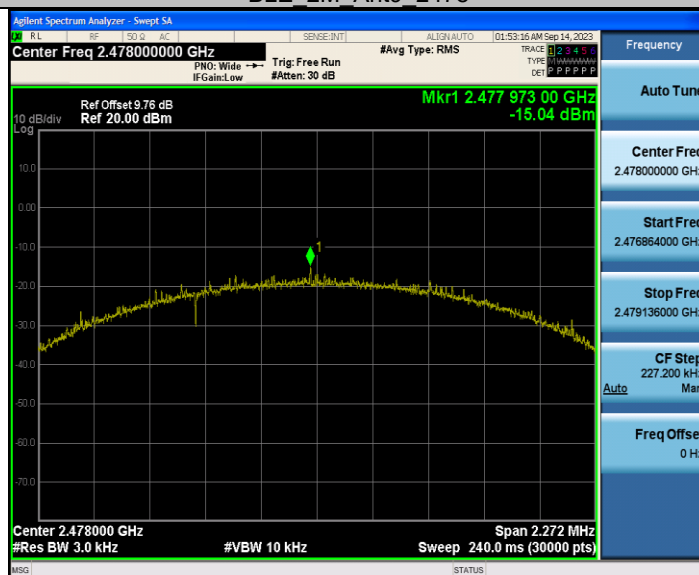
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BLE 2M Ant9 2440



BLE 2M Ant9 2478



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Band edge measurements

Test Result

TestMode	Antenna	Channel	Frequency[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant9	Low	2402	-0.45	-50.23	≤ -20.45	PASS
		High	2480	3.11	-46.44	≤ -16.9	PASS
BLE_2M	Ant9	Low	2404	-1.94	-49.62	≤ -21.94	PASS
		High	2478	1.94	-49.82	≤ -18.06	PASS



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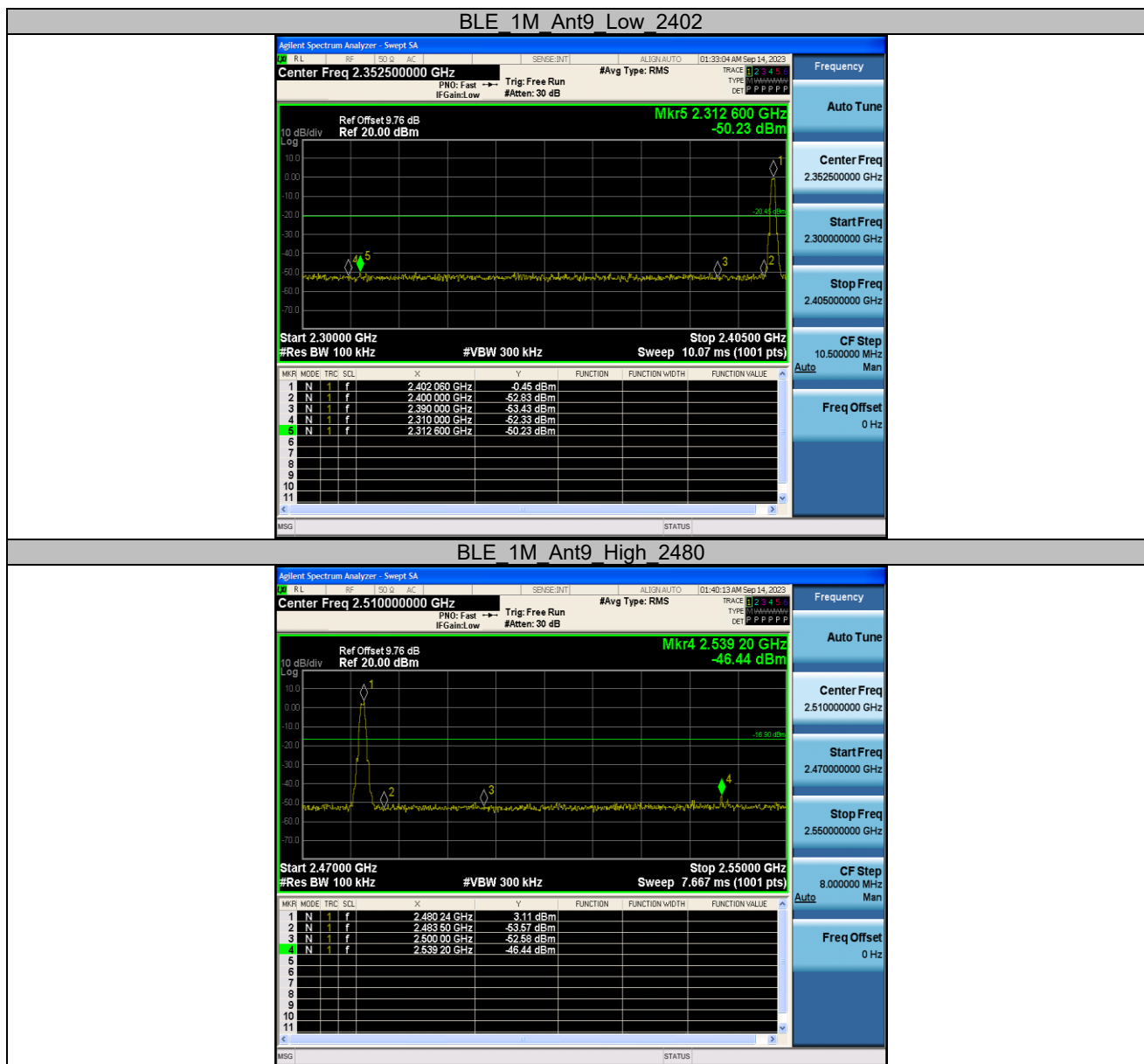
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Test Graphs



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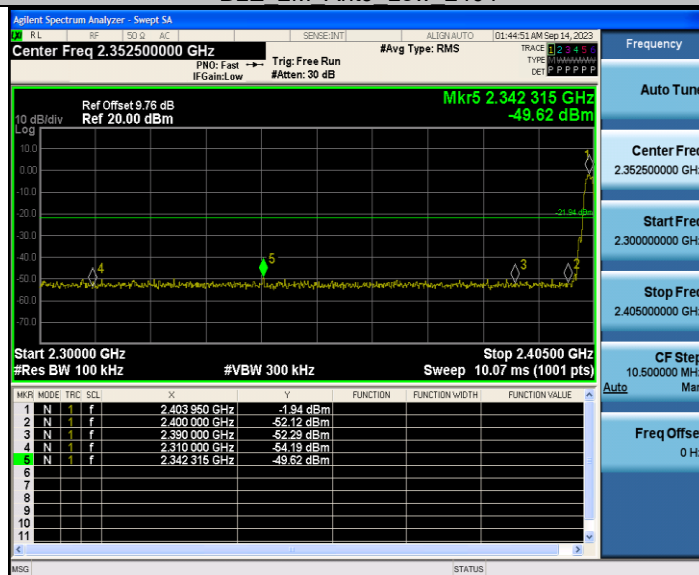
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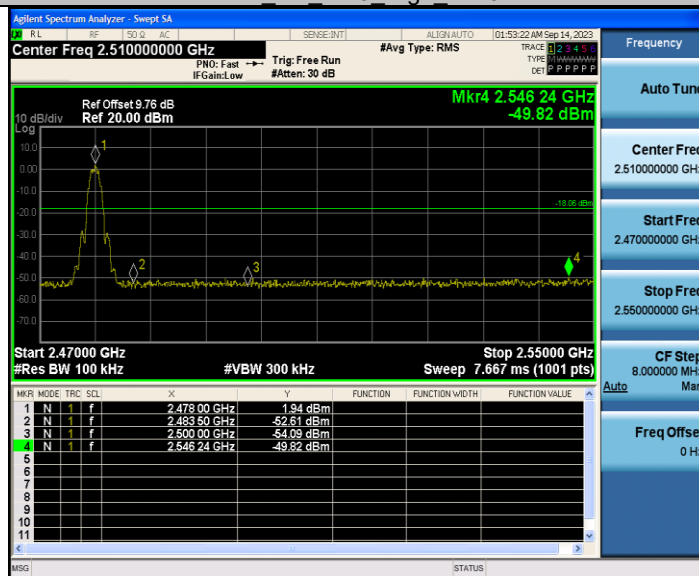
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BLE 2M Ant9 Low 2404



BLE 2M Ant9 High 2478



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Conducted Spurious Emission Test Result

TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant9	2402	Reference	-0.69	-0.69	---	PASS
			30~1000	-0.69	-60.36	≤-20.69	PASS
			1000~26500	-0.69	-45.26	≤-20.69	PASS
		2440	Reference	1.24	1.24	---	PASS
			30~1000	1.24	-60.13	≤-18.76	PASS
			1000~26500	1.24	-45.66	≤-18.76	PASS
		2480	Reference	1.56	1.56	---	PASS
			30~1000	1.56	-59.84	≤-18.44	PASS
			1000~26500	1.56	-45.24	≤-18.44	PASS
BLE_2M	Ant9	2404	Reference	-0.42	-0.42	---	PASS
			30~1000	-0.42	-59	≤-20.42	PASS
			1000~26500	-0.42	-45.32	≤-20.42	PASS
		2440	Reference	-1.41	-1.41	---	PASS
			30~1000	-1.41	-60.04	≤-21.41	PASS
			1000~26500	-1.41	-44.85	≤-21.41	PASS
		2478	Reference	-0.01	-0.01	---	PASS
			30~1000	-0.01	-59.09	≤-20.01	PASS
			1000~26500	-0.01	-42.07	≤-20.01	PASS



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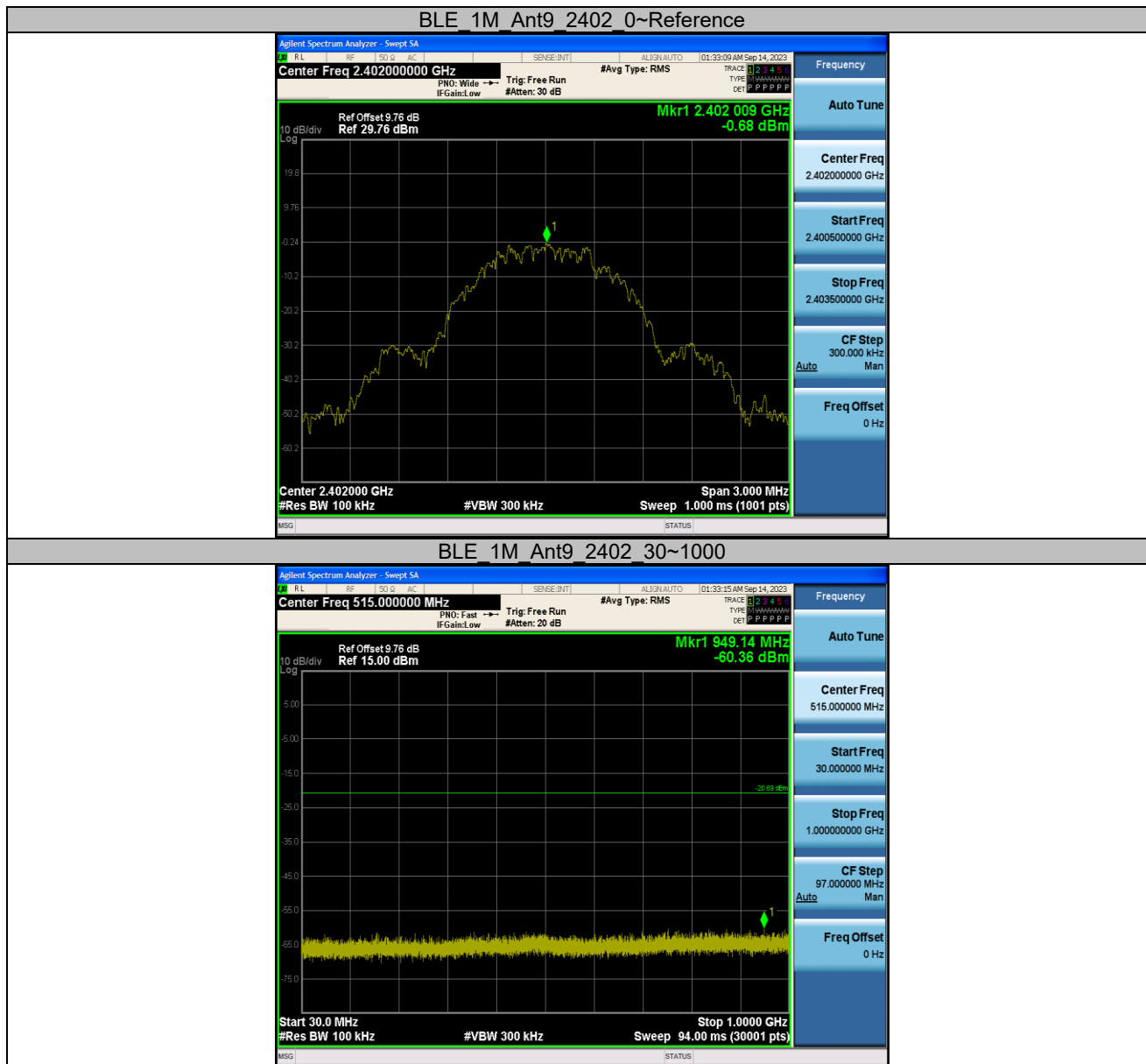
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Test Graphs



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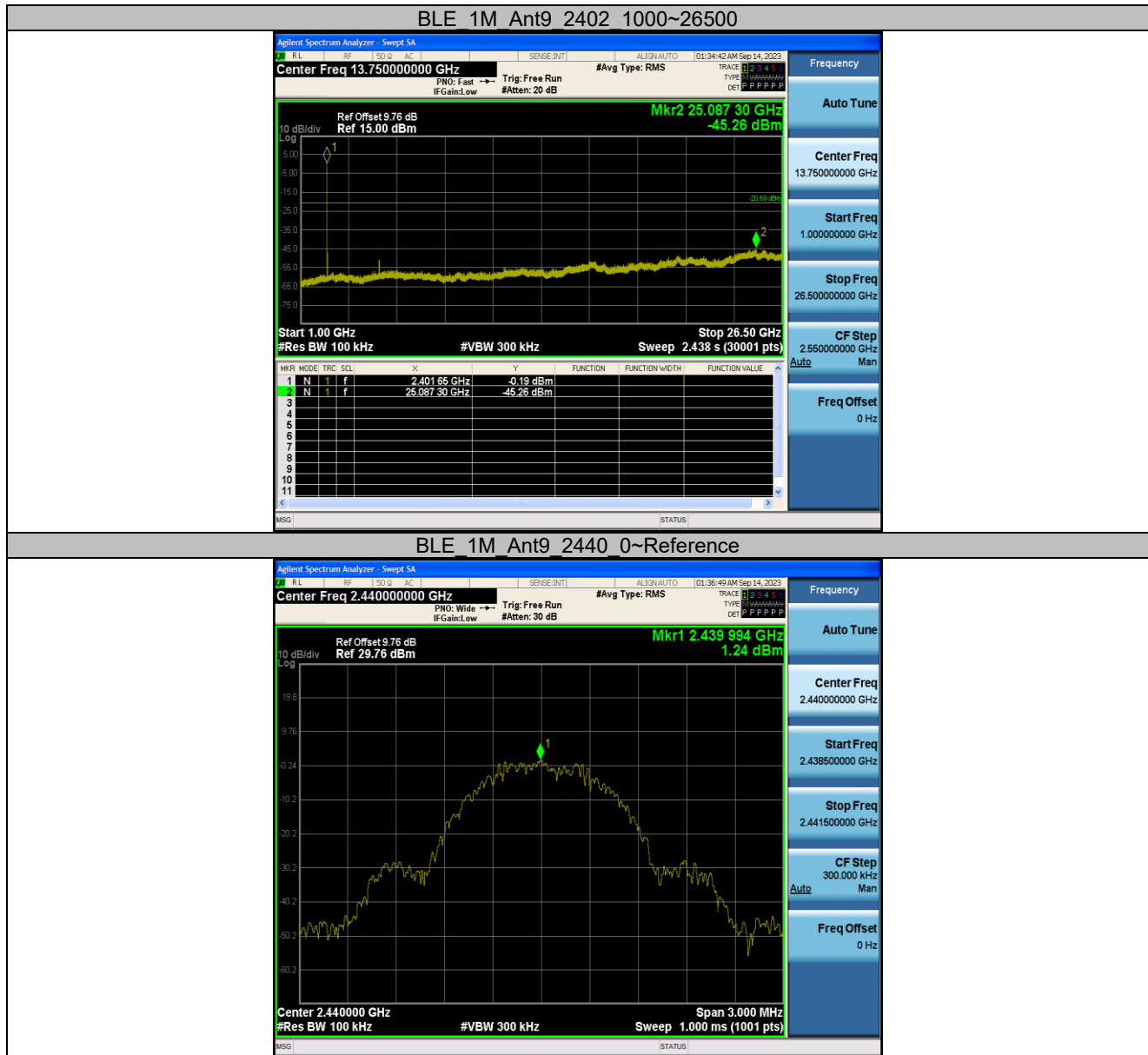
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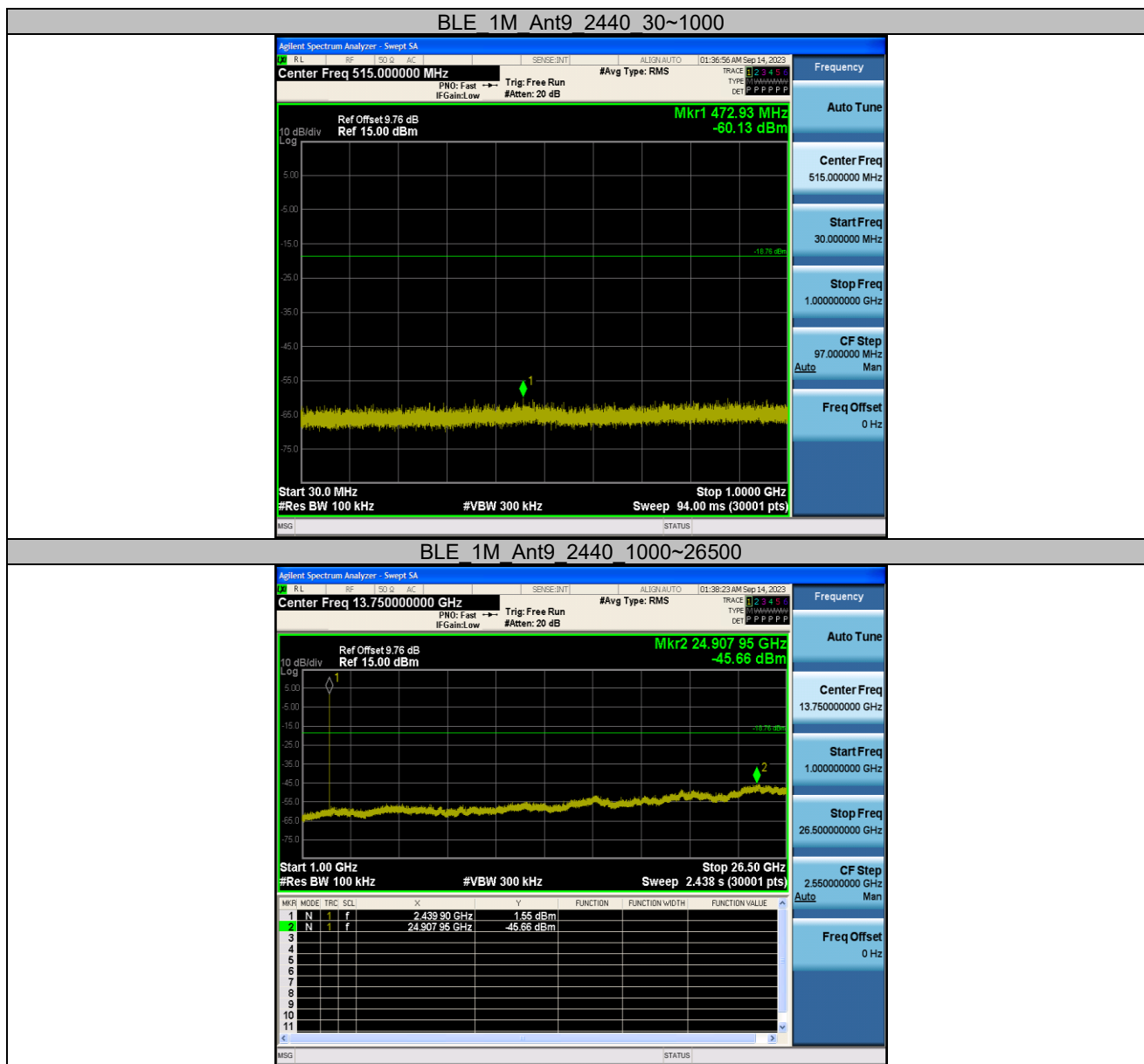
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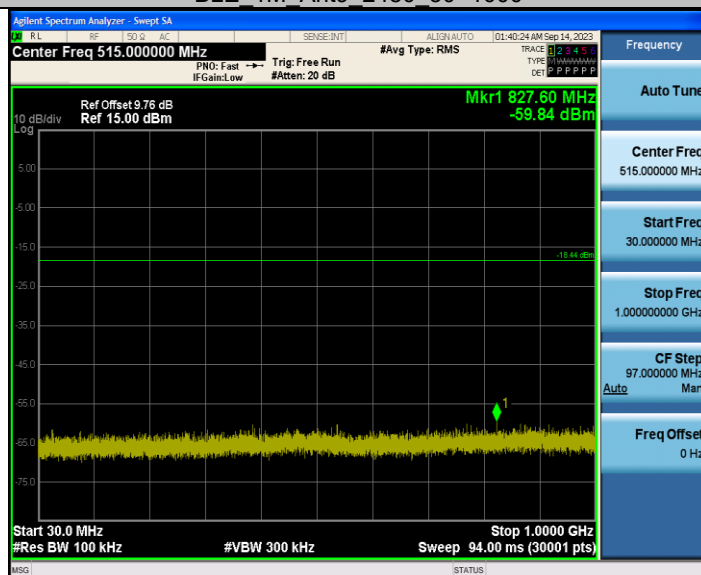
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BLE 1M Ant9 2480 0~Reference



BLE 1M Ant9 2480 30~1000



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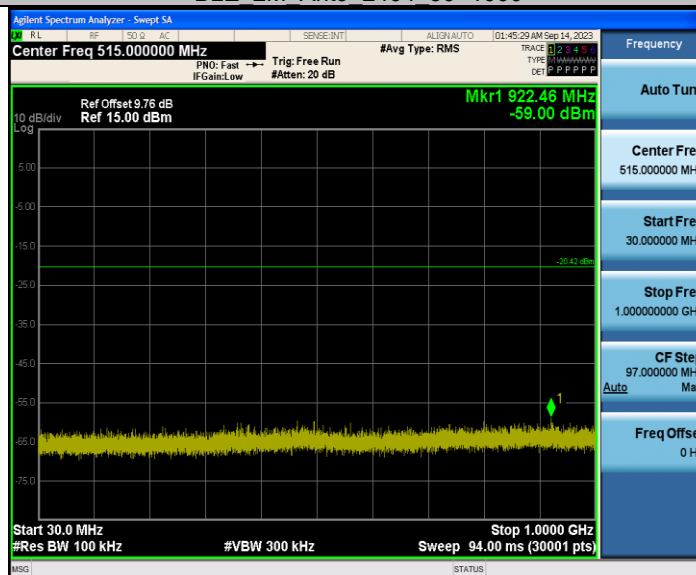


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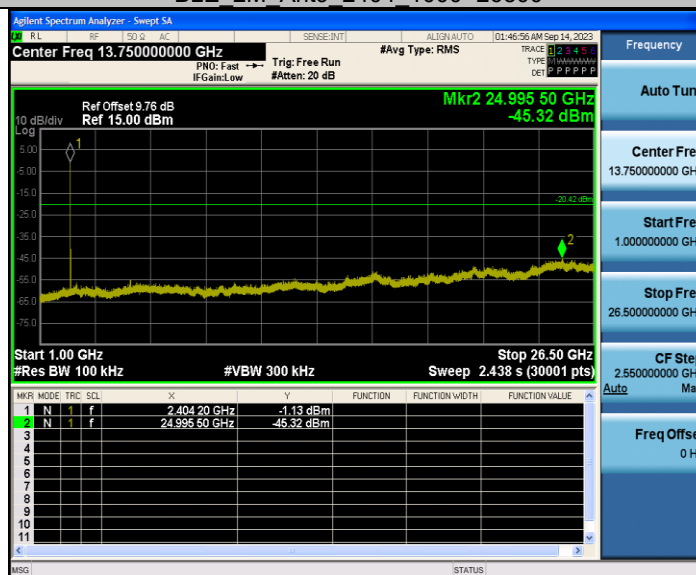
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BLE 2M Ant9 2404 30~1000



BLE 2M Ant9 2404 1000~26500



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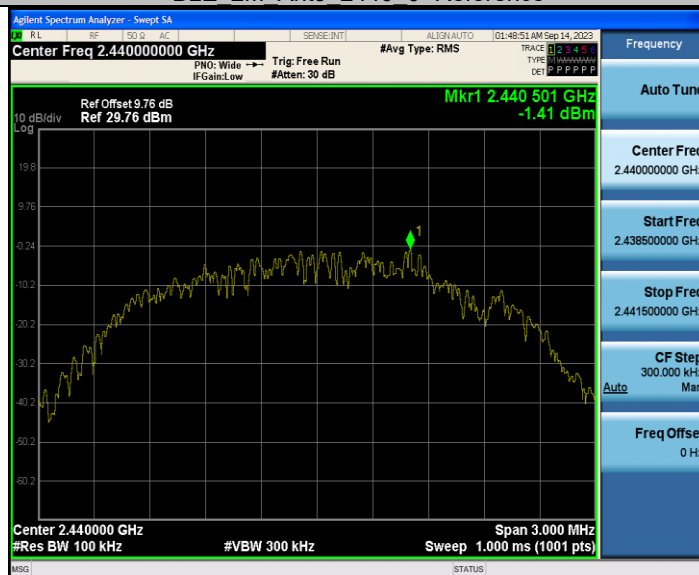
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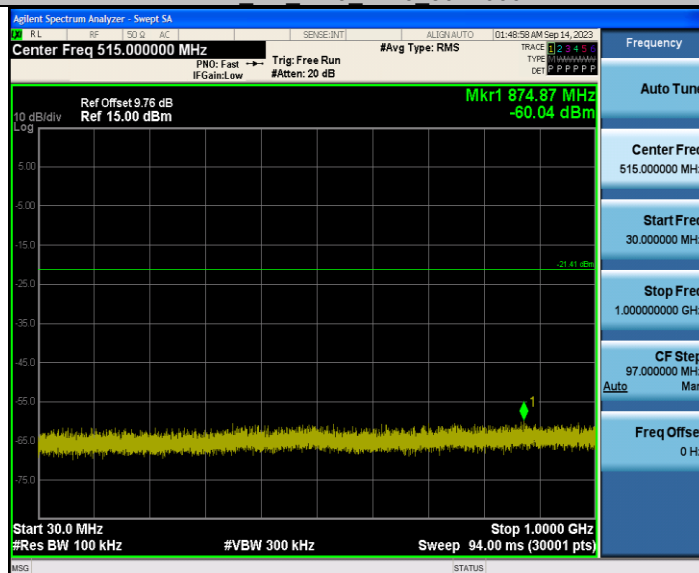
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BLE 2M Ant9 2440 0~Reference



BLE 2M Ant9 2440 30~1000



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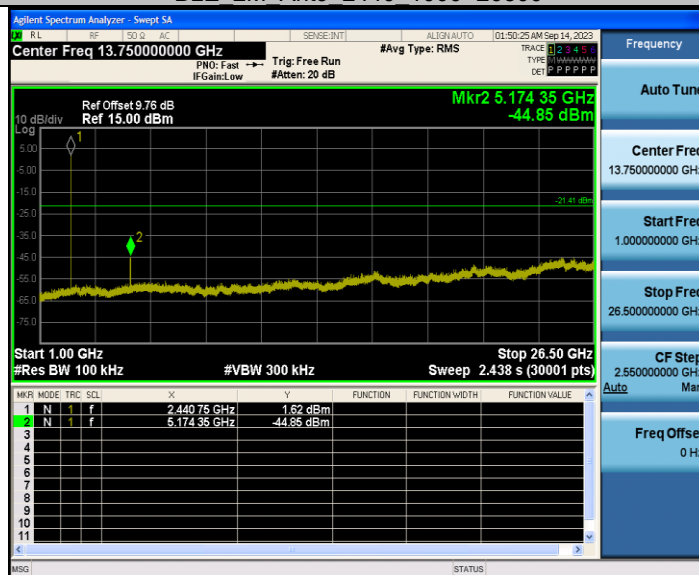
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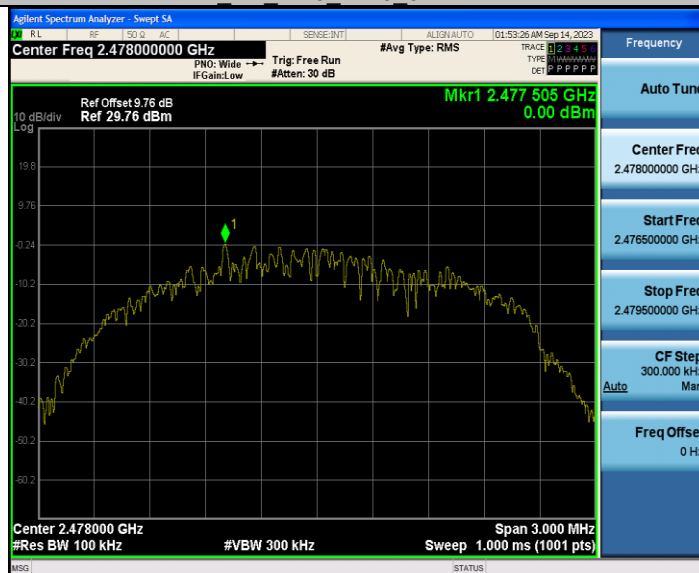
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BLE 2M Ant9 2440 1000~26500



BLE 2M Ant9 2478 0~Reference



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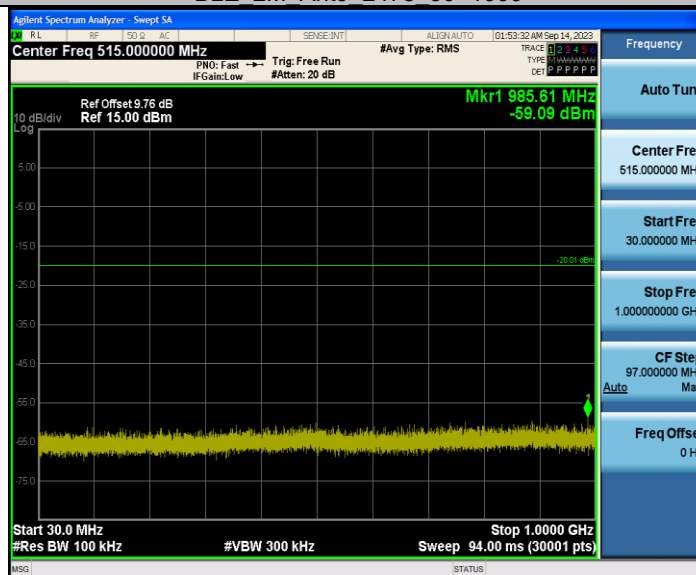
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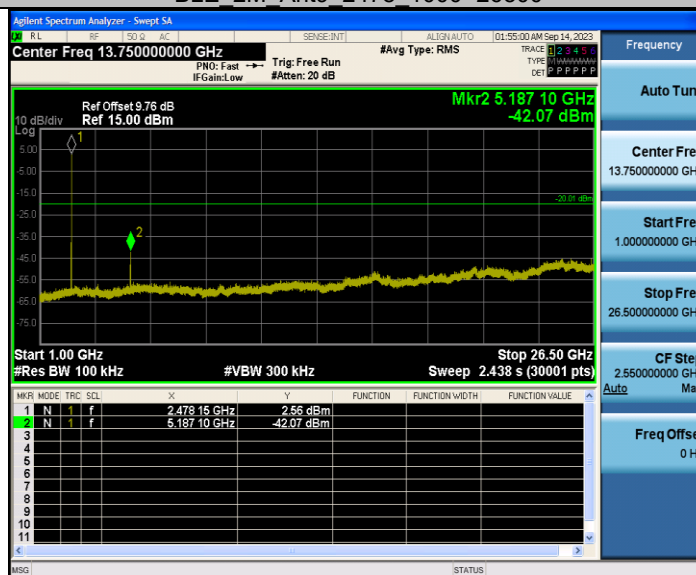
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BLE 2M Ant9 2478 30~1000



BLE 2M Ant9 2478 1000~26500



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Duty Cycle Test Result

TestMode	Antenna	Frequency[MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]
BLE_1M	Ant9	2402	2.13	2.50	85.20	0.70
		2440	2.12	2.50	84.80	0.72
		2480	2.12	2.50	84.80	0.72
BLE_2M	Ant9	2404	1.07	1.87	57.22	2.42
		2440	1.08	1.88	57.45	2.41
		2478	1.07	1.87	57.22	2.42

Note:

Radiated Emission Average VBW = 1 / T

TestMode	T[ms]	Period[ms]	Duty Cycle[%]	1/T[kHz]	VBW Setting
BLE_1M	2.13	2.50	85.20	0.46948	1KHz
BLE_2M	1.07	0.87	57.22	0.93458	1KHz



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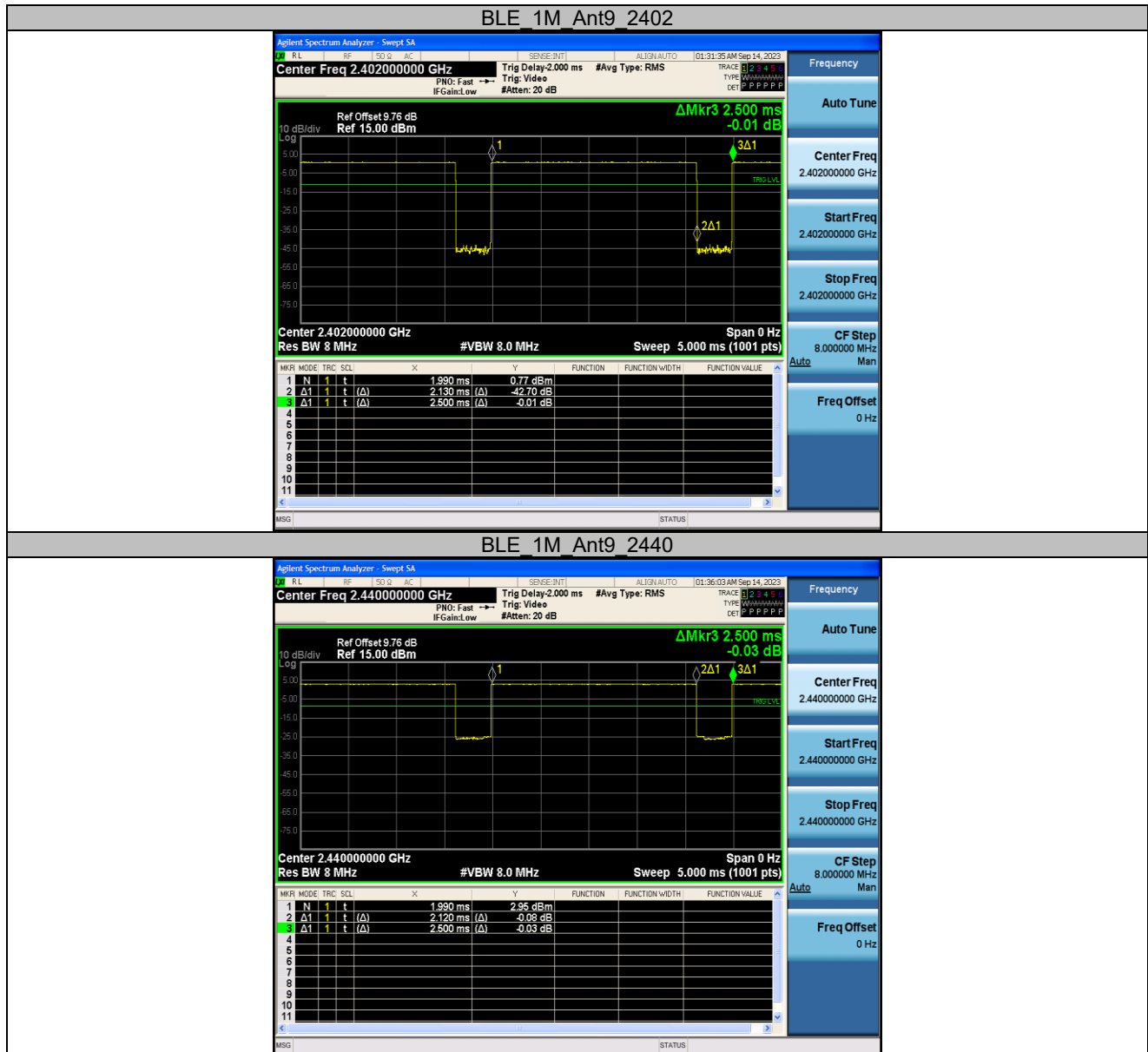
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Test Graphs

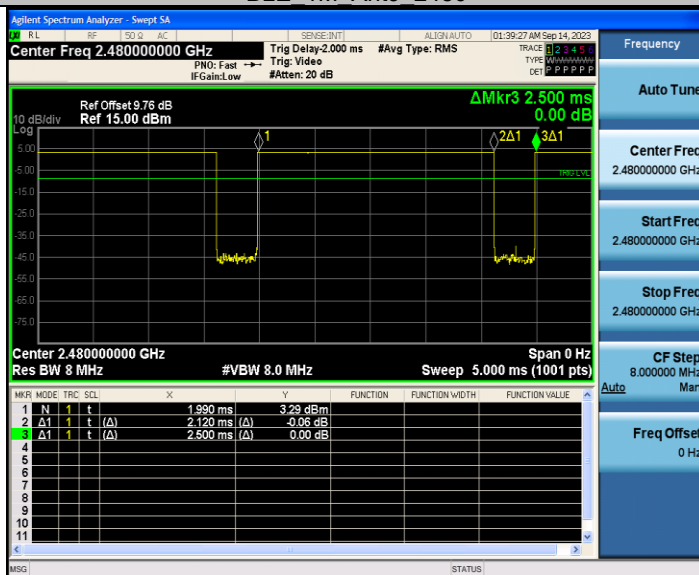


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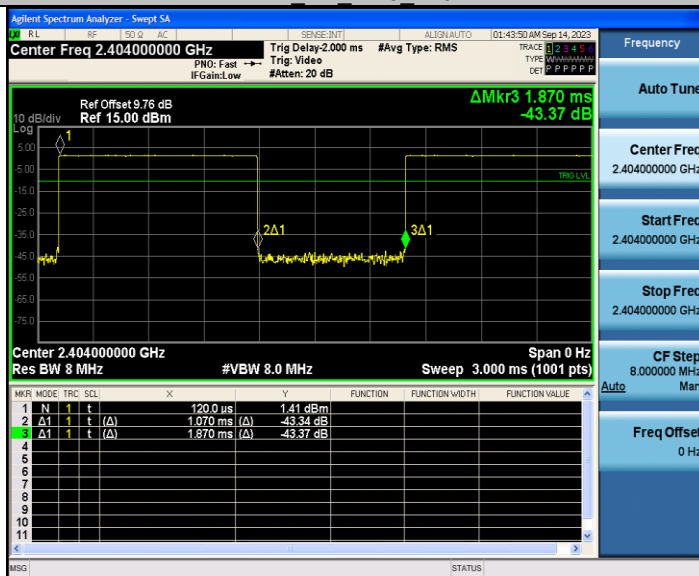
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BLE 1M Ant9 2480



BLE 2M Ant9 2404

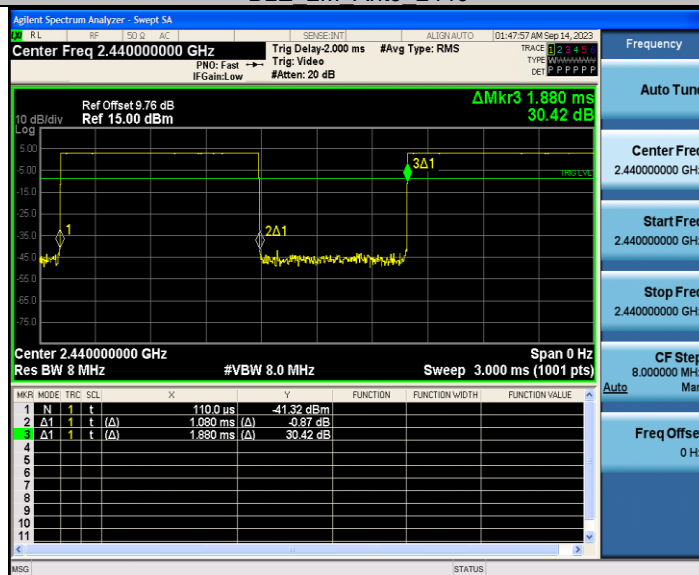


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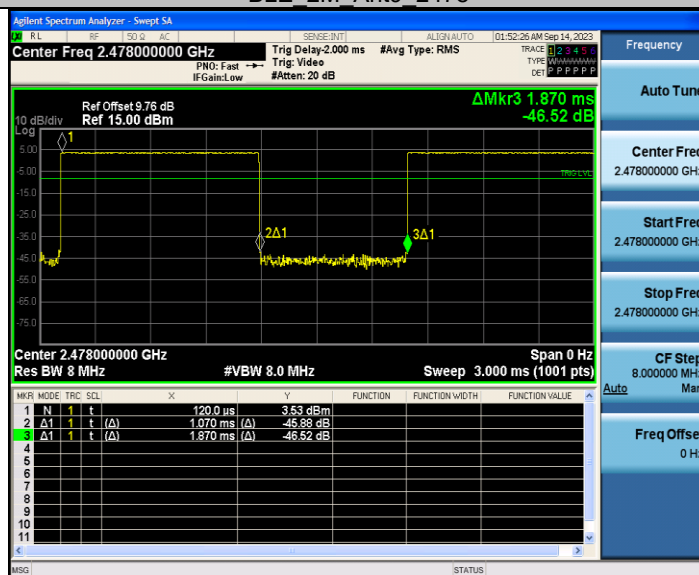
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BLE 2M Ant9 2440



BLE 2M Ant9 2478



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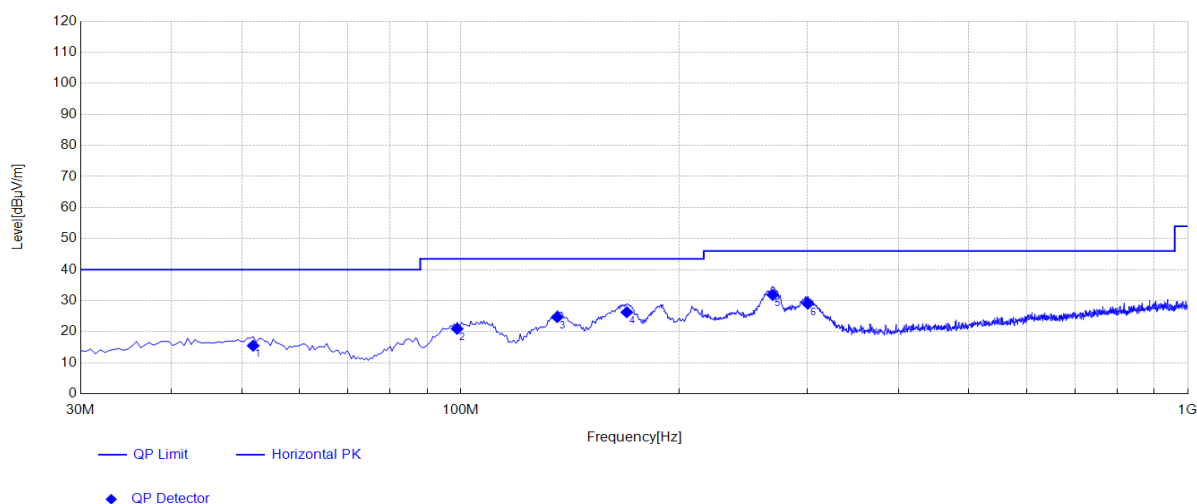
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Radiated Spurious Emissions

Radiated emission below 1GHz

Worst case Mode: BLE-2M_Channel 1

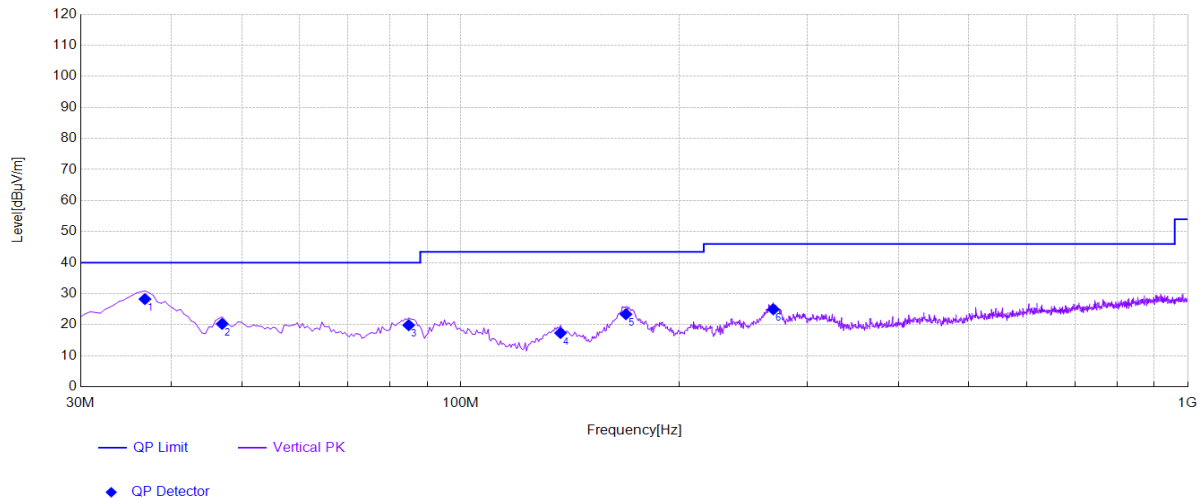


Data List								
NO.	Freq. [MHz]	AF[dB/m]	Factor [dB]	QP Reading[dBμV]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Polarity
1	51.8359	14.13	-27.75	29.14	15.52	40.00	24.48	Horizontal
2	98.9045	11.48	-27.17	36.64	20.95	43.50	22.55	Horizontal
3	135.7829	7.63	-26.54	43.63	24.72	43.50	18.78	Horizontal
4	169.2646	8.82	-26.51	43.98	26.29	43.50	17.21	Horizontal
5	268.7394	12.55	-26.08	45.39	31.86	46.00	14.14	Horizontal
6	300.2801	13.22	-25.90	41.71	29.03	46.00	16.97	Horizontal

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Data List								
NO.	Freq. [MHz]	AF[dB/m]	Factor [dB]	QP Reading[dBμV]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Polarity
1	36.7934	12.04	-27.99	44.22	28.27	40.00	11.73	Vertical
2	46.9835	14.30	-27.78	33.76	20.28	40.00	19.72	Vertical
3	84.8324	8.82	-27.41	38.45	19.86	40.00	20.14	Vertical
4	137.2386	7.58	-26.50	36.27	17.35	43.50	26.15	Vertical
5	168.7794	8.88	-26.50	41.03	23.41	43.50	20.09	Vertical
6	269.2246	12.57	-26.07	38.47	24.97	46.00	21.03	Vertical

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier gain. The basic equation with a sample calculation is as follows:

Value = Reading(dBμV) + AF(dB/m) + Factor(dB):

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier gain(dB)

Margin = Limit(dBμV/m) – Value(dBμV/m)

- 2) All channels have been tested, but only the worst case data displayed in this report.



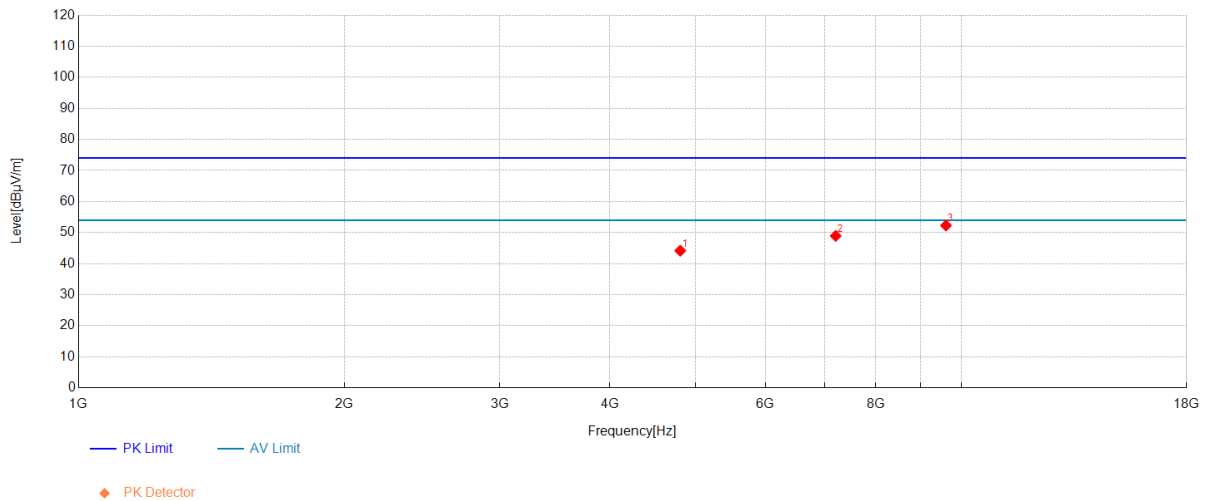
Report No.: XEWM2309000451RG04

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Transmitter emission Above 1GHz

BLE-1M_Channel 0



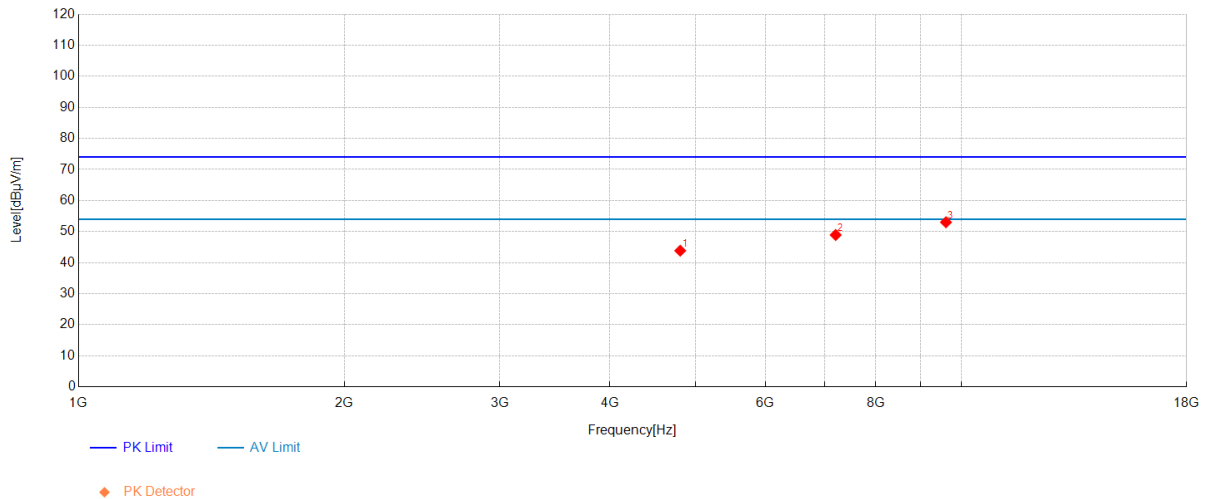
Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4804	59.48	32.43	-47.74	44.17	74.00	29.83	Horizontal
2	7206	56.57	37.11	-44.74	48.94	74.00	25.06	Horizontal
3	9608	54.25	39.14	-41.10	52.29	74.00	21.71	Horizontal

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BLE-1M_Channel 0



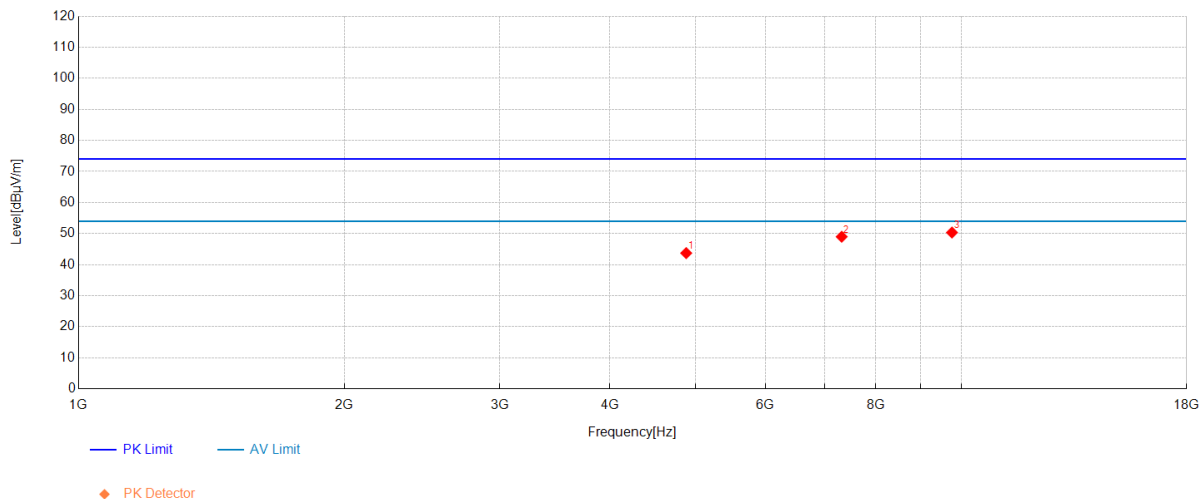
Data List								
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1	4804	59.17	32.43	-47.74	43.86	74.00	30.14	Vertical
2	7206	56.55	37.11	-44.74	48.92	74.00	25.08	Vertical
3	9608	54.97	39.14	-41.10	53.01	74.00	20.99	Vertical

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BLE-1M_Channel 19



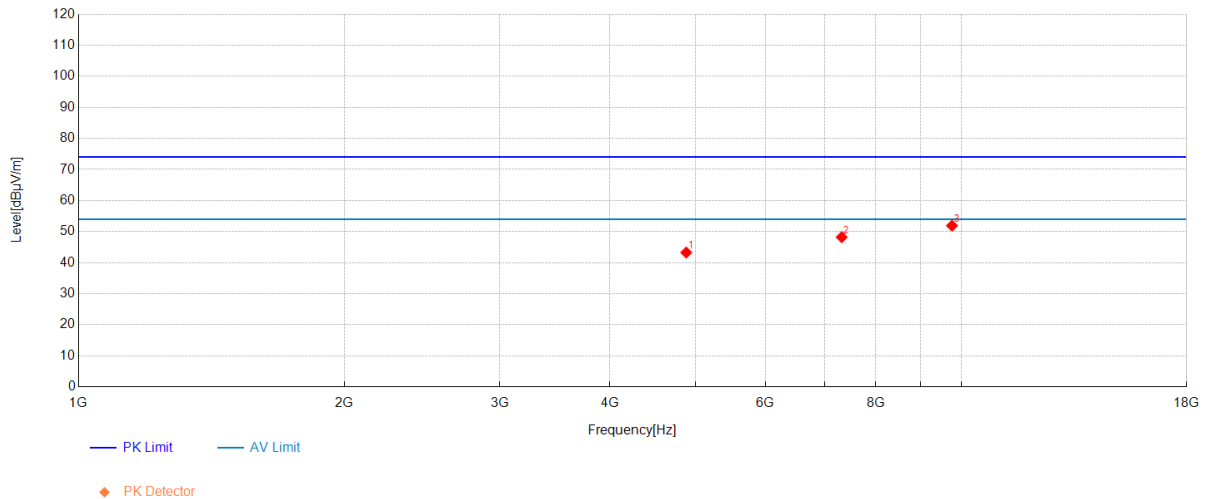
Data List								
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1	4880	58.32	32.98	-47.58	43.72	74.00	30.28	Horizontal
2	7320	56.85	37.02	-44.88	48.99	74.00	25.01	Horizontal
3	9760	52.70	38.82	-41.17	50.35	74.00	23.65	Horizontal

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BLE-1M_Channel 19



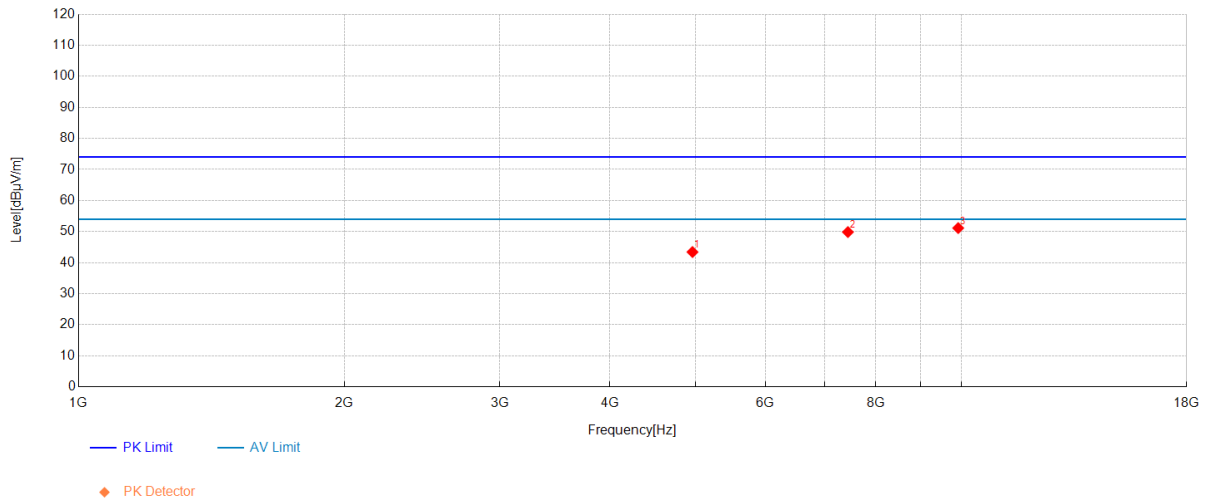
Data List								
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1	4880	57.86	32.98	-47.58	43.26	74.00	30.74	Vertical
2	7320	56.06	37.02	-44.88	48.20	74.00	25.80	Vertical
3	9760	54.26	38.82	-41.17	51.91	74.00	22.09	Vertical

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BLE-1M_Channel 39



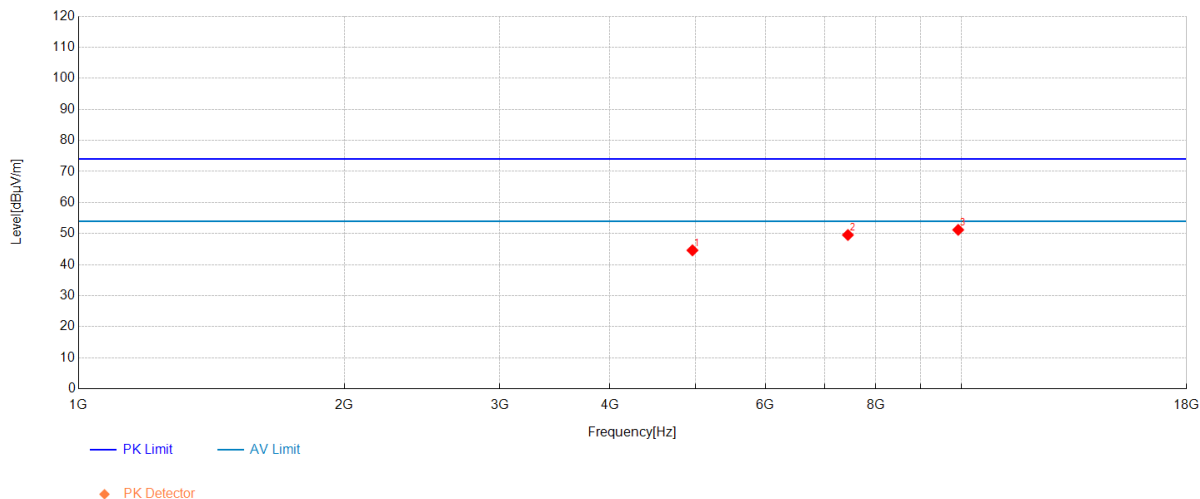
Data List								
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1	4960	57.36	33.18	-47.11	43.43	74.00	30.57	Horizontal
2	7440	56.80	36.72	-43.66	49.86	74.00	24.14	Horizontal
3	9920	53.36	38.98	-41.20	51.14	74.00	22.86	Horizontal

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BLE-1M_Channel 39



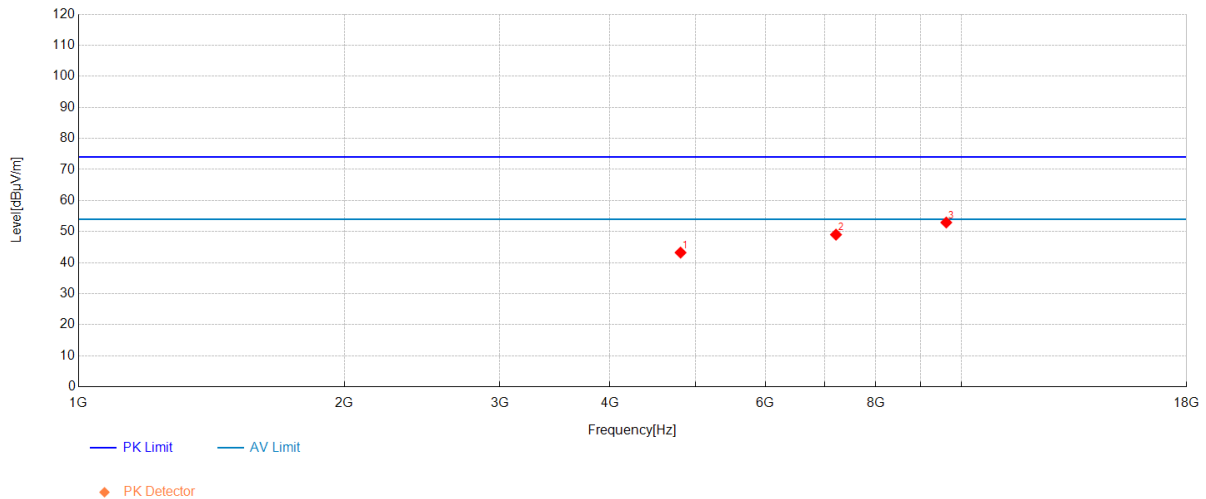
Data List								
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1	4960	58.55	33.18	-47.11	44.62	74.00	29.38	Vertical
2	7440	56.49	36.72	-43.66	49.55	74.00	24.45	Vertical
3	9920	53.42	38.98	-41.20	51.20	74.00	22.80	Vertical

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BLE-2M_Channel 1



Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4808	58.50	32.47	-47.73	43.24	74.00	30.76	Horizontal
2	7212	56.68	37.12	-44.79	49.01	74.00	24.99	Horizontal
3	9616	54.96	39.07	-41.10	52.93	74.00	21.07	Horizontal



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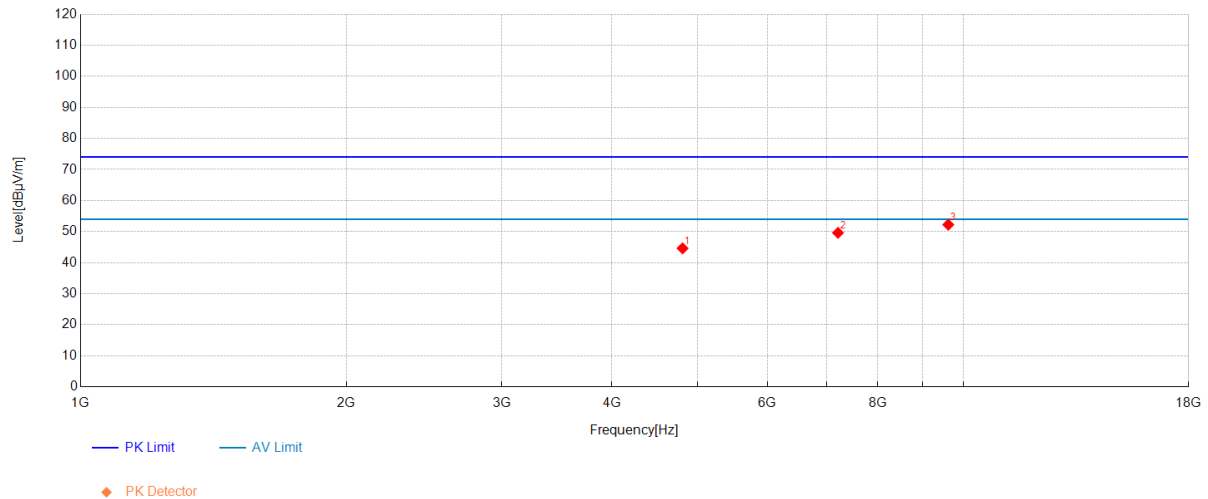
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BLE-2M_Channel 1



Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4808	59.87	32.47	-47.73	44.61	74.00	29.39	Vertical
2	7212	57.28	37.12	-44.79	49.61	74.00	24.39	Vertical
3	9616	54.25	39.07	-41.10	52.22	74.00	21.78	Vertical



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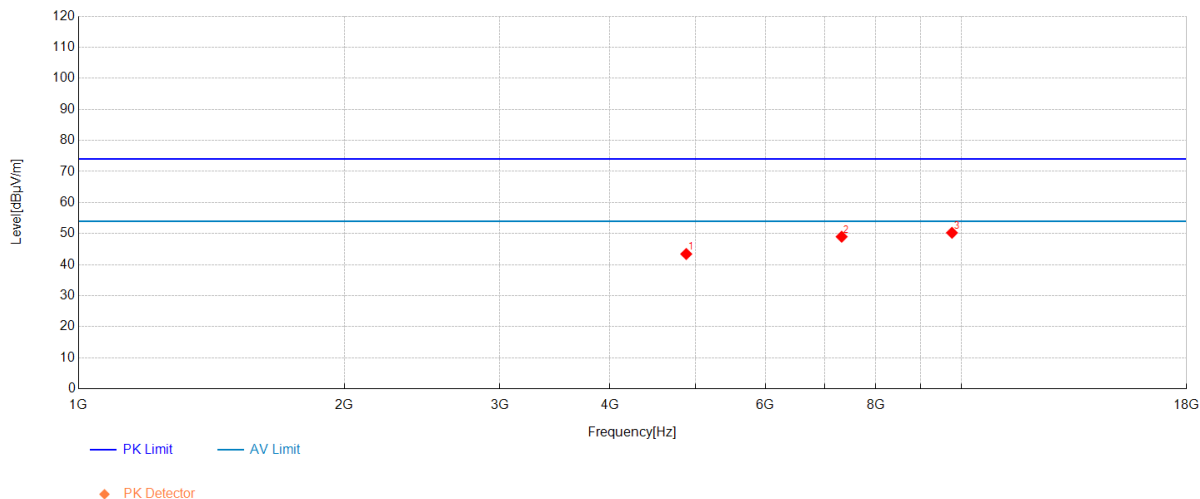
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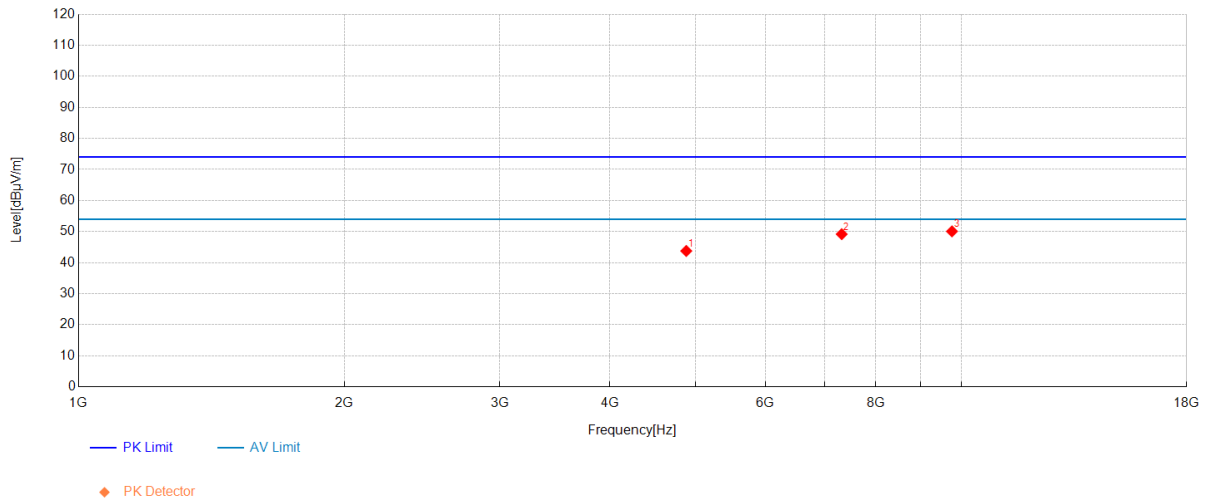
Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4880	58.04	32.98	-47.58	43.44	74.00	30.56	Horizontal
2	7320	56.86	37.02	-44.88	49.00	74.00	25.00	Horizontal
3	9760	52.61	38.82	-41.17	50.26	74.00	23.74	Horizontal

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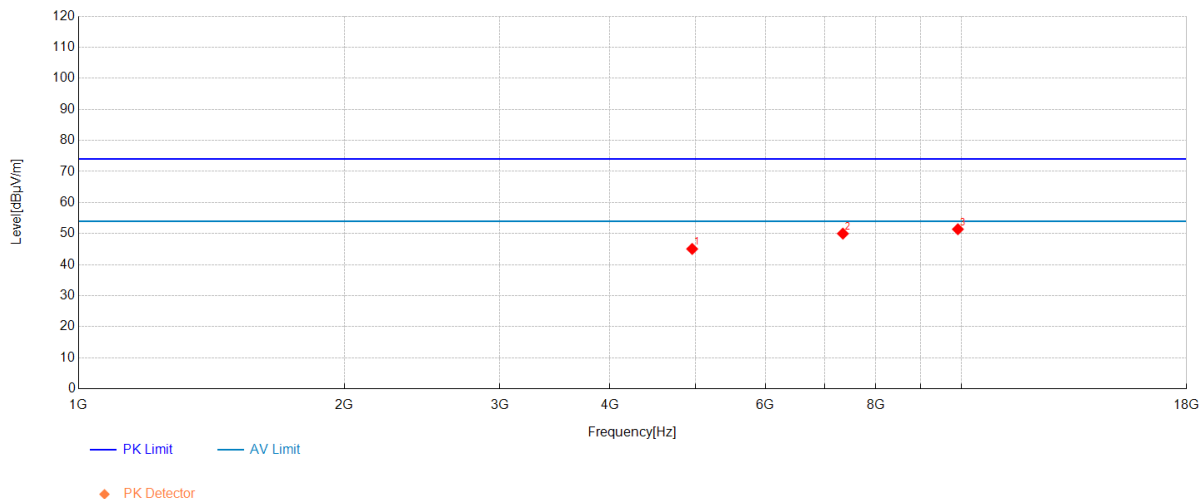
Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4880	58.36	32.98	-47.58	43.76	74.00	30.24	Vertical
2	7320	57.03	37.02	-44.88	49.17	74.00	24.83	Vertical
3	9760	52.43	38.82	-41.17	50.08	74.00	23.92	Vertical

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BLE-2M_Channel 38



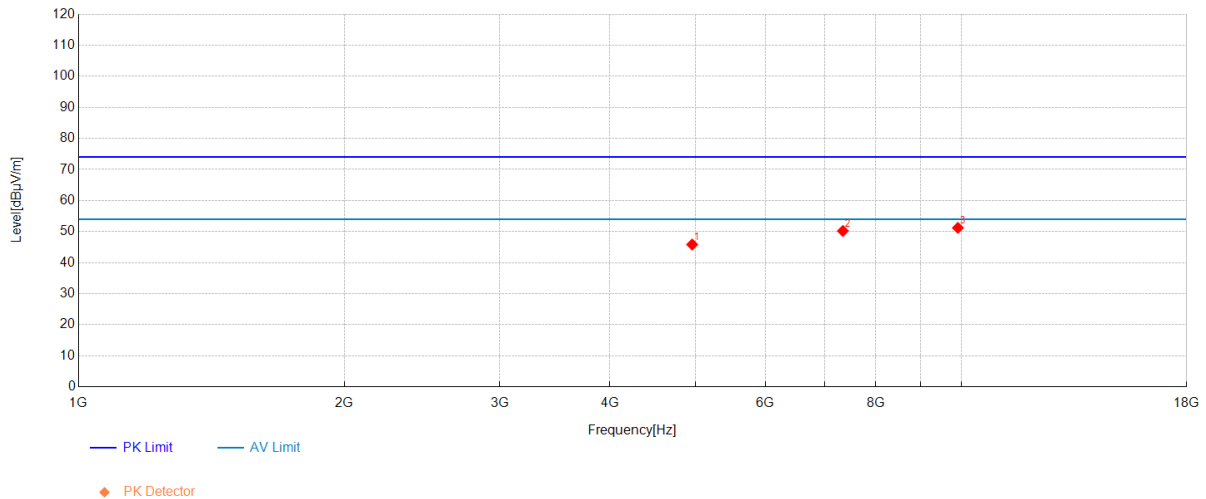
Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4956	59.00	33.19	-47.13	45.06	74.00	28.94	Horizontal
2	7343	57.19	36.93	-44.13	49.99	74.00	24.01	Horizontal
3	9912	53.59	39.03	-41.21	51.41	74.00	22.59	Horizontal

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Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4956	59.78	33.19	-47.13	45.84	74.00	28.16	Vertical
2	7343	57.41	36.93	-44.13	50.21	74.00	23.79	Vertical
3	9912	53.38	39.03	-41.21	51.20	74.00	22.80	Vertical

Remark:

- The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier gain. The basic equation with a sample calculation is as follows:
Level = Reading(dBμV) + AF(dB/m) + Factor(dB):
AF = Antenna Factor(dB/m)
Factor = Cable Factor(dB) - Preamplifier gain(dB)
Margin = Limit(dBμV/m) – Level(dBμV/m)
- All channels have been tested, but only the worst case data displayed in this report.
- Both peak and average measured complies with the limit line, so test result is "PASS"



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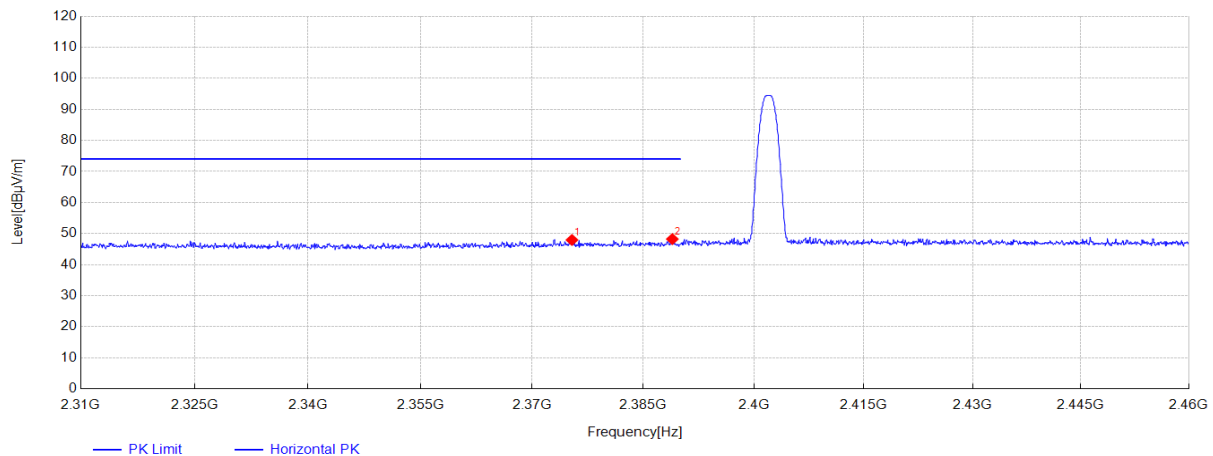
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Restricted bands around fundamental frequency

BLE-1M_Channel 0



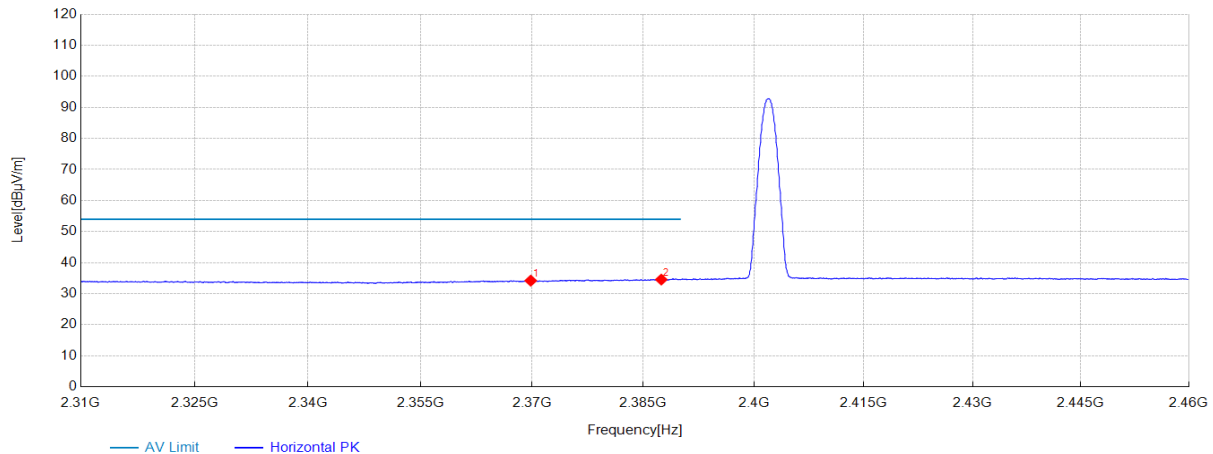
Data List								
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1	2375.3577	38.18	27.85	-18.08	47.95	74.00	26.05	Horizontal
2	2388.9395	38.16	27.82	-17.75	48.23	74.00	25.77	Horizontal

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BLE-1M_Channel 0



Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2369.8049	24.56	27.86	-18.21	34.21	54.00	19.79	Horizontal
2	2387.4387	24.50	27.83	-17.78	34.55	54.00	19.45	Horizontal

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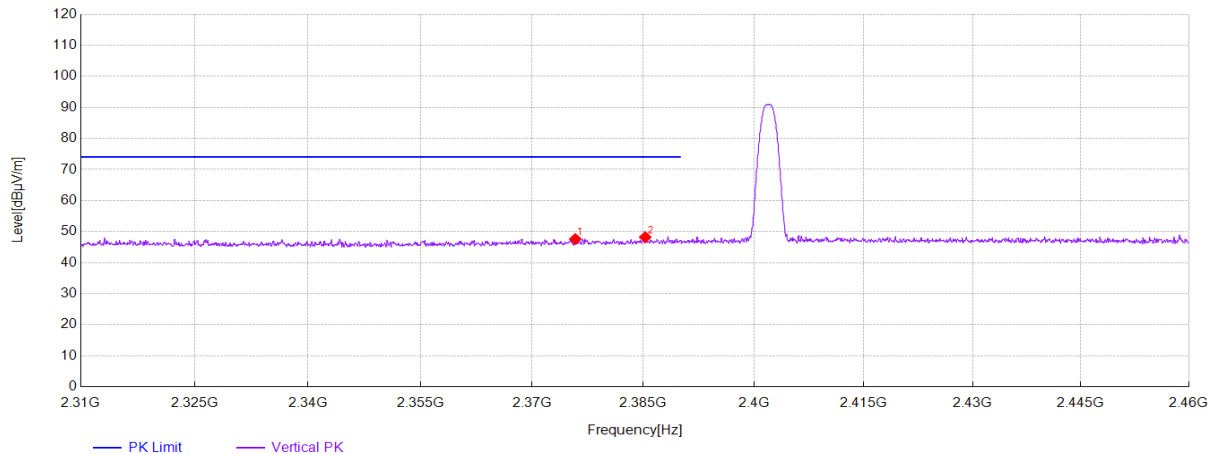
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BLE-1M_Channel 0



Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2375.8079	37.84	27.85	-18.07	47.62	74.00	26.38	Vertical
2	2385.2626	38.21	27.83	-17.84	48.20	74.00	25.80	Vertical



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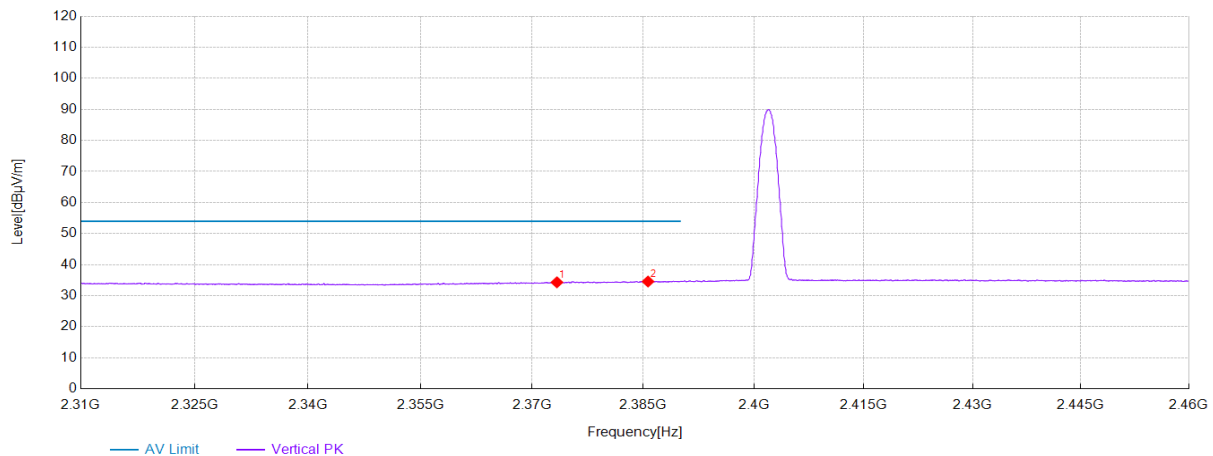
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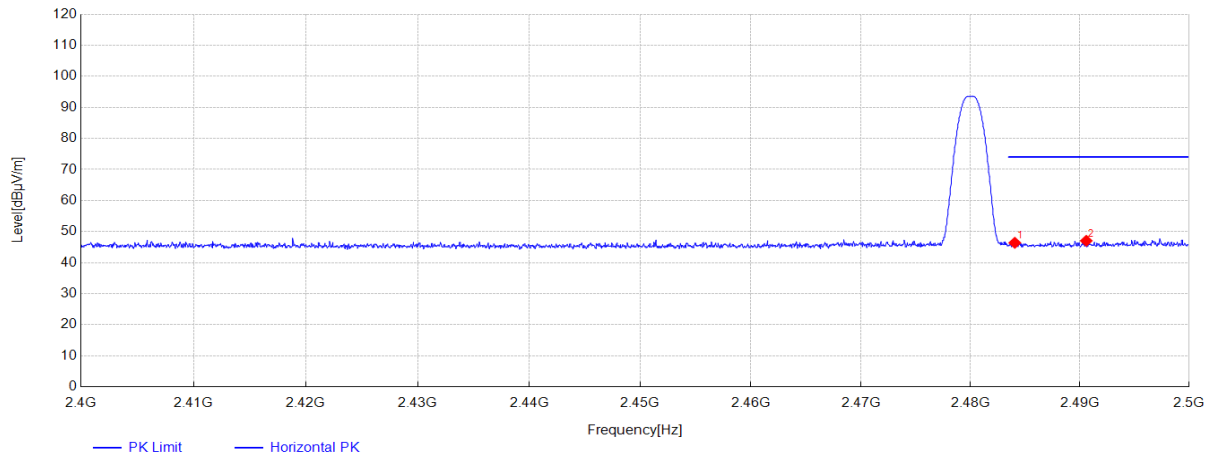
Data List								
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1	2373.3317	24.60	27.85	-18.13	34.32	54.00	19.68	Vertical
2	2385.6378	24.57	27.83	-17.83	34.57	54.00	19.43	Vertical

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Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	2484.042	37.52	27.97	-19.10	46.39	74.00	27.61	Horizontal
2	2490.5953	38.15	27.98	-19.09	47.04	74.00	26.96	Horizontal



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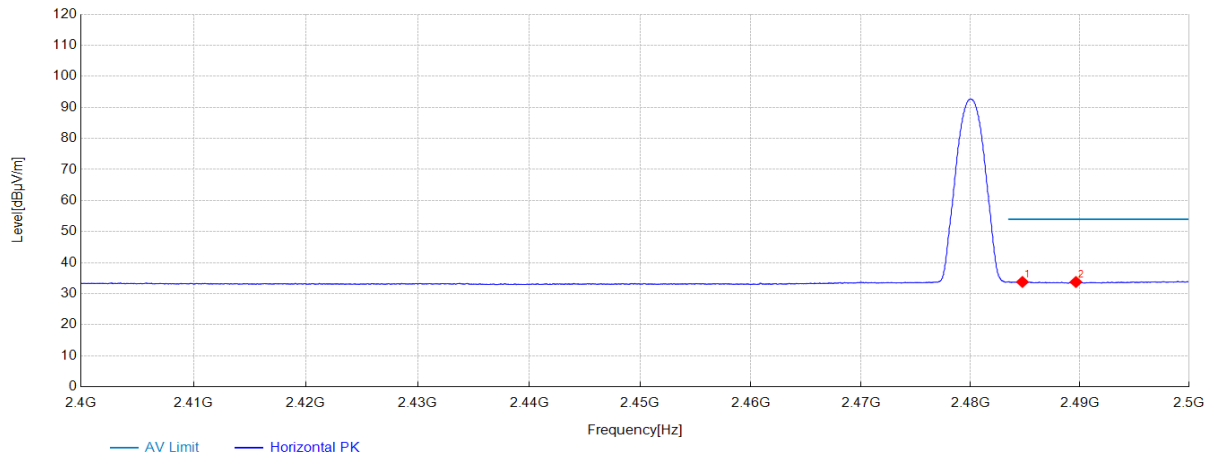
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BLE-1M_Channel 39



Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2484.7424	24.92	27.97	-19.10	33.79	54.00	20.21	Horizontal
2	2489.6448	24.89	27.98	-19.10	33.77	54.00	20.23	Horizontal



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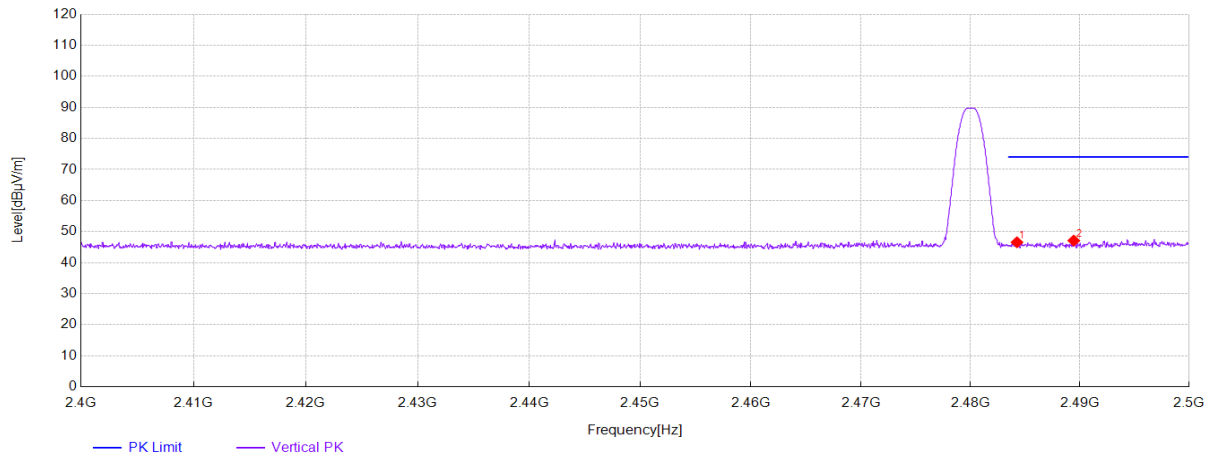
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Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2484.2421	37.69	27.97	-19.10	46.56	74.00	27.44	Vertical
2	2489.4447	38.22	27.98	-19.10	47.10	74.00	26.90	Vertical



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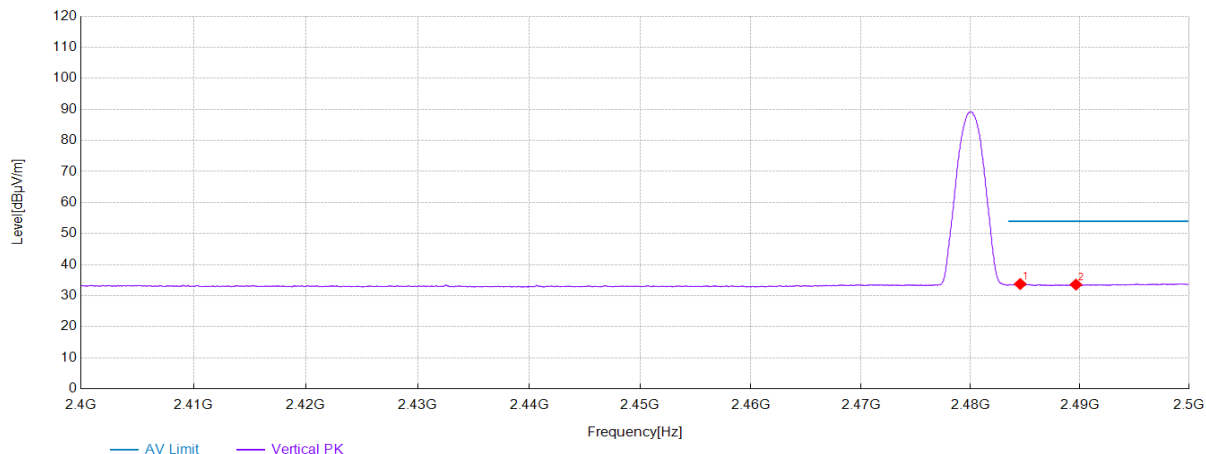
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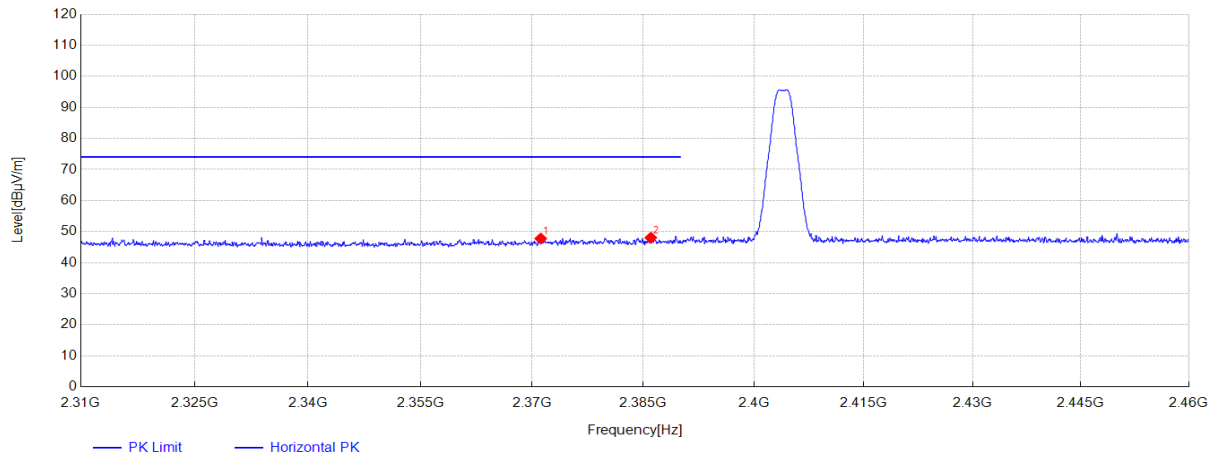
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1	2484.5423	24.90	27.97	-19.10	33.77	54.00	20.23	Vertical
2	2489.6448	24.70	27.98	-19.10	33.58	54.00	20.42	Vertical

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Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2371.1556	38.09	27.86	-18.18	47.77	74.00	26.23	Horizontal
2	2386.013	38.02	27.83	-17.82	48.03	74.00	25.97	Horizontal



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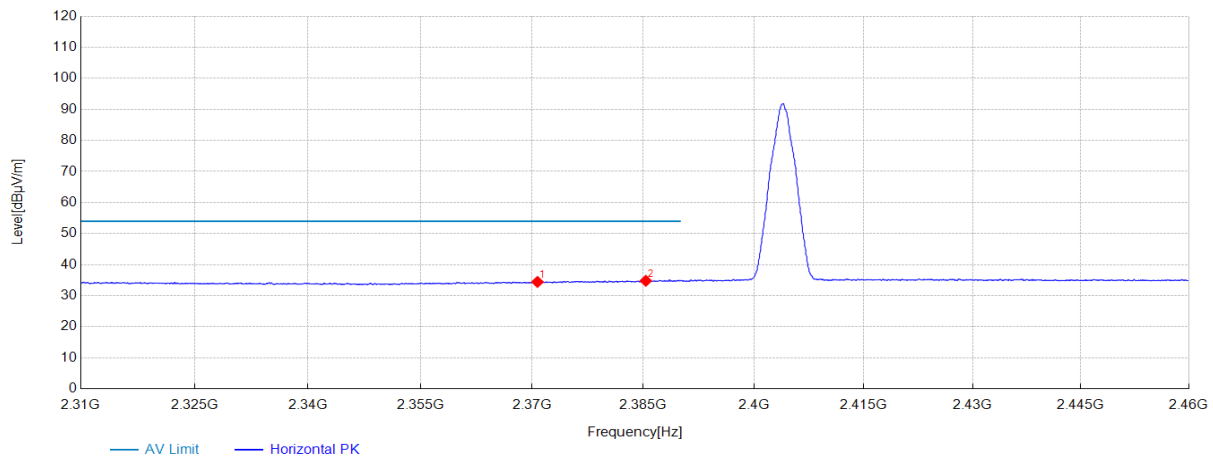
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Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2370.7054	24.77	27.86	-18.19	34.44	54.00	19.56	Horizontal
2	2385.3377	24.80	27.83	-17.83	34.80	54.00	19.20	Horizontal



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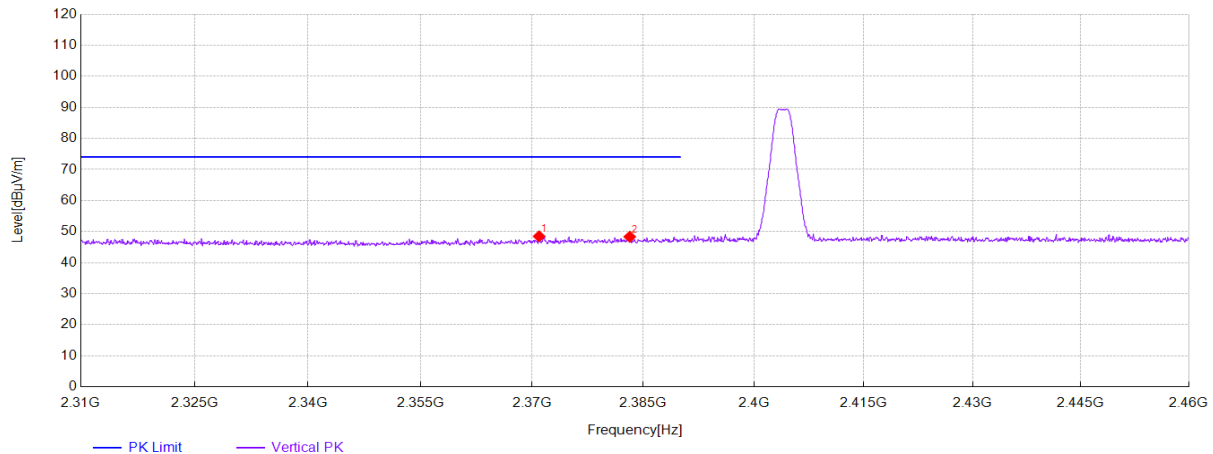
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Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2370.9305	38.81	27.86	-18.18	48.49	74.00	25.51	Vertical
2	2383.1616	38.39	27.83	-17.89	48.33	74.00	25.67	Vertical



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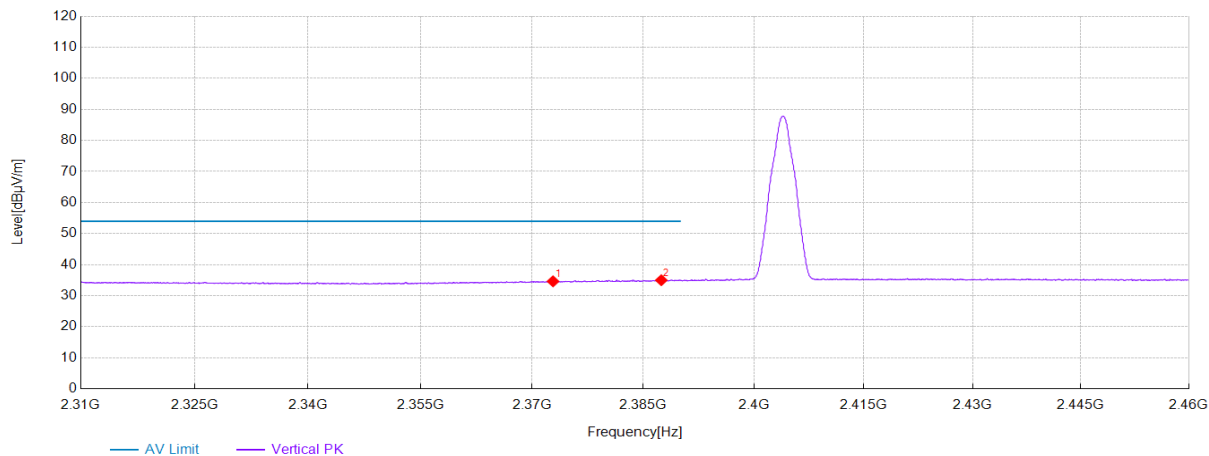
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Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2372.8064	24.92	27.85	-18.14	34.63	54.00	19.37	Vertical
2	2387.4387	24.94	27.83	-17.78	34.99	54.00	19.01	Vertical



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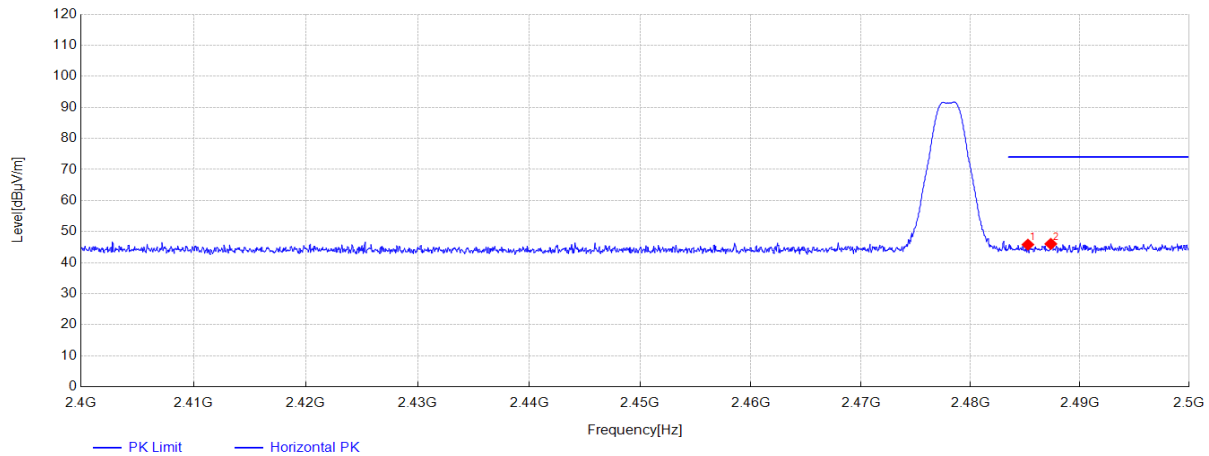
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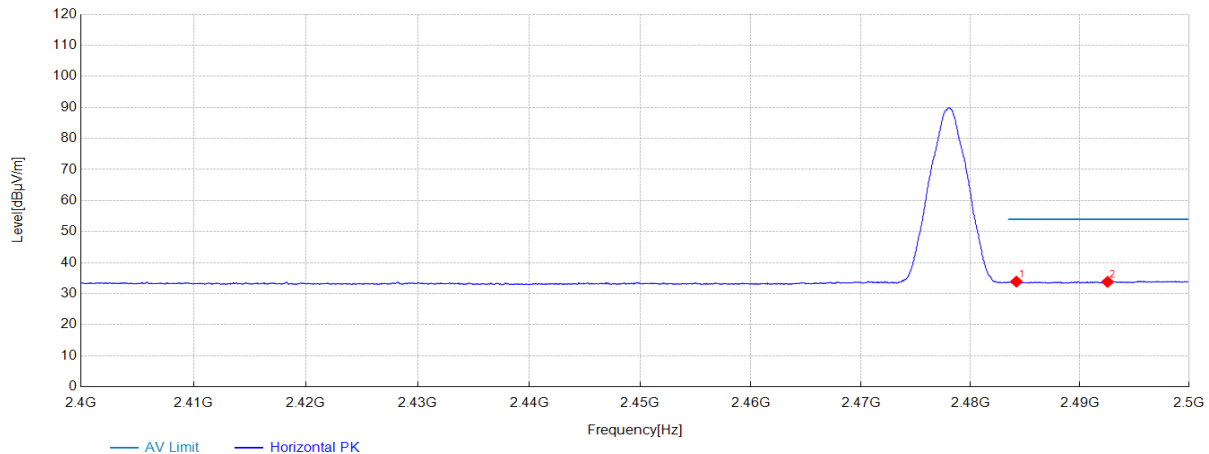
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1	2485.2426	36.94	27.97	-19.10	45.81	74.00	28.19	Horizontal
2	2487.3437	37.17	27.97	-19.10	46.04	74.00	27.96	Horizontal

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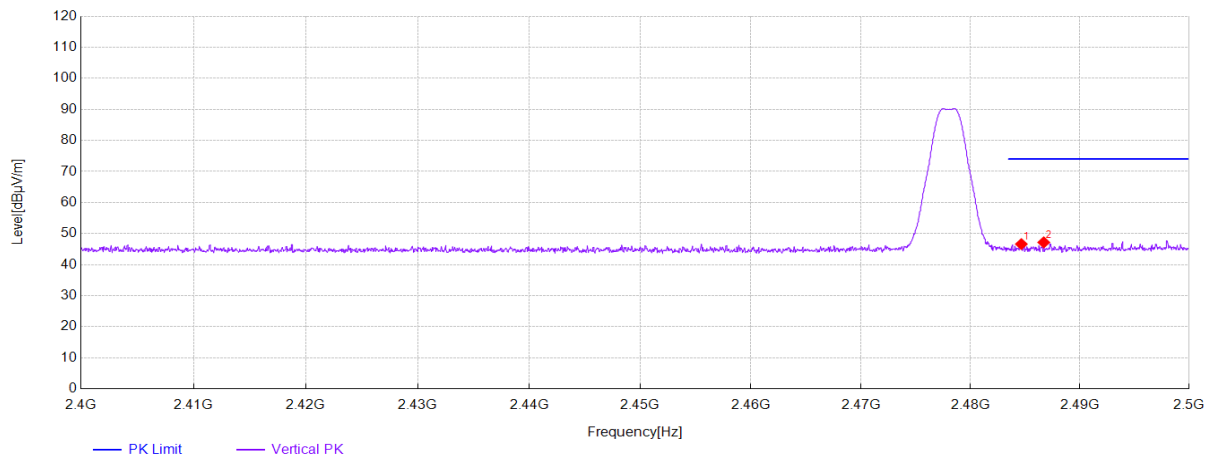
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1	2484.1921	25.04	27.97	-19.10	33.91	54.00	20.09	Horizontal
2	2492.5463	24.88	27.99	-19.05	33.82	54.00	20.18	Horizontal

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Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2484.6423	37.75	27.97	-19.10	46.62	74.00	27.38	Vertical
2	2486.6933	38.31	27.97	-19.10	47.18	74.00	26.82	Vertical



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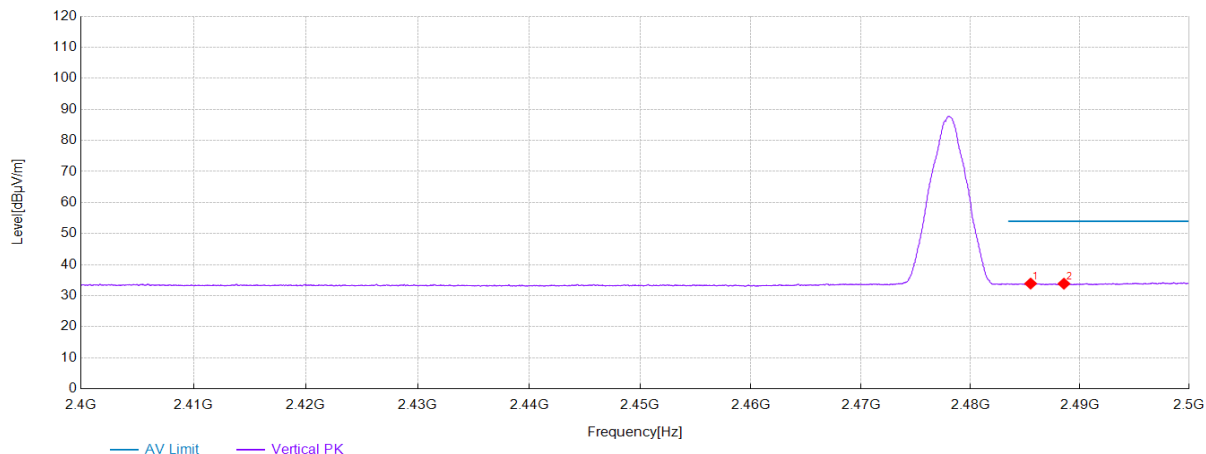
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Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2485.4927	25.05	27.97	-19.10	33.92	54.00	20.08	Vertical
2	2488.5443	25.00	27.98	-19.10	33.88	54.00	20.12	Vertical

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier gain. The basic equation with a sample calculation is as follows:

Level = Reading(dBμV) + AF(dB/m) + Factor(dB):

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier gain(dB)

Margin = Limit(dBμV/m) – Level(dBμV/m)

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

---End of Report---



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