TEST REPORT

Application No.:	XEWA2310000073RG
Applicant:	Harman International Industries Incorporated
Address of Applicant:	30001, Cabot Drive, Novi, MI 48377, USA
Manufacturer:	Harman International Industries Incorporated
Address of Manufacturer:	30001, Cabot Drive, Novi, MI 48377, USA
EUT Description:	Toyota La-DCM
Model No.:	TYT25_LT_AA
Trade Mark:	HARMAN
FCC ID:	2AHPN-TYT25-LT-AA
Standards:	FCC 47 CFR Part 2, Subpart J FCC 47 CFR Part 15, Subpart C
Date of Receipt:	2023/11/01
Date of Test:	2023/11/22 to 2024/01/08
Date of Issue:	2024/01/10
Test Result :	**PASS ***

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

Authorized Signature:

Linus Chen
Wireless Laboratory Manager

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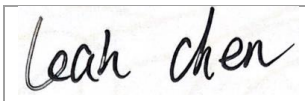
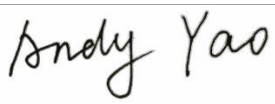
1 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2024/01/10		Original

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

2 Test Summary

Test Item	FCC Rule No.	Test Method	Test Result	Result	Test Lab*
Antenna Requirement	15.203/15.247(b)	--	Clause 4.1	PASS	--
AC Power Line Conducted Emission	15.207	ANSI C63.10-2013 Section 6.2	Clause 4.2	PASS	A
Duty cycle	--	ANSI C63.10-2013 Section 11.6	Clause 4.3	For Report Purpose	B
Conducted Output Power	15.247 (b)(3)	ANSI C63.10-2013 Section11.9.1.3	Clause 4.4	PASS	B
DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	15.247 (a)(2)	ANSI C63.10-2013 Section 11.8 Option 2 / 6.9.3	Clause 4.5	PASS	B
Power Spectral Density	15.247 (e)	ANSI C63.10-2013 Section 11.10.2	Clause 4.6	PASS	B
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10-2013 Section 11.11	Clause 4.7	PASS	B
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10-2013 Section 11.11	Clause 4.8	PASS	B
Radiated Spurious Emissions	15.205/15.209	ANSI C63.10-2013 Section 11.12	Clause 4.9	PASS	A
Restricted bands around fundamental frequency (Radiated Emission)	15.205/15.209	ANSI C63.10-2013 Section 11.12	Clause 4.10	PASS	A

Remark*:
Lab A SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd.
Lab B Compliance Certification Services (Kunshan) Inc.

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Contents

3 General Information

3.1 Details of Client

Applicant:	Harman International Industries Incorporated
Address of Applicant:	30001, Cabot Drive, Novi, MI 48377, USA
Manufacturer:	Harman International Industries Incorporated
Address of Manufacturer:	30001, Cabot Drive, Novi, MI 48377, USA

3.2 Test Location

Lab A:	
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:	Jacky Xue
Lab B:	
Company:	Compliance Certification Services (Kunshan) Inc.
Address:	No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.
Contact Information:	Tel: +86 512 5735 5888 Fax: +86 512 5737 0818
Test engineer:	Hans Han

3.3 Test Facility

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

Lab A:
•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
Lab B:
• A2LA Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01. **• FCC** Compliance Certification Services (Kunshan) Inc. has been recognized as an accredited testing laboratory. Designation Number: CN1172. **• ISED** Compliance Certification Services (Kunshan) Inc.has been recognized by Innovation, Science and Econamic Development Canada (ISED) as an accredited testing laboratory. Company Number: 2324E **• VCCI** The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.:R-20134, R-11600, C-11707, T-11499, G-10216 respectively.

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3.4 General Description of EUT

EUT Description:	Toyota La-DCM	
Model No.:	TYT25_LT_AA	
Trade Mark:	HARMAN	
Hardware Version:	0.0.3	
Software Version:	TYTLLADCM_R04.5D	
Power Supply:	12V	
IMEI:	RF Conducted	356590670015700
	RSE & AC power line	356590670015866
Operation Frequency:	2400MHz~2483.5MHz fc = 2402 MHz + N * 2 MHz, where: -fc = “Operating Frequency” in MHz, -N = “Channel Number” with the range from 0 to 39.	
Bluetooth version:	Bluetooth V5.0	
Modulation Type:	GFSK	
Number of Channel:	40	
Rates Type*:	☒Provided by client	
	1M PHY	
Antenna Type:	☐ External, ☒ Integrated	
Antenna Gain:	2.92 dBi(Ant2)	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.	
RF Cable:	1.0dB	

Note: *Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information , SGS is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.
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.

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
The Lowest channel(CH0)	2402MHz
The Middle channel(CH19)	2440MHz
The Highest channel(CH39)	2480MHz

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3.5 Test Environment

Environment Parameter	96.0~101.0 kPa Selected Values During Tests	
Relative Humidity	40-60 % RH Ambient	
Value	**Temperature(℃)**	**Voltage(V)**
NTNV	22~25	12
Remark: NV: Normal Voltage NT: Normal Temperature		

3.6 Description of Support Units

The EUT has been tested as an independent unit.

4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(b)

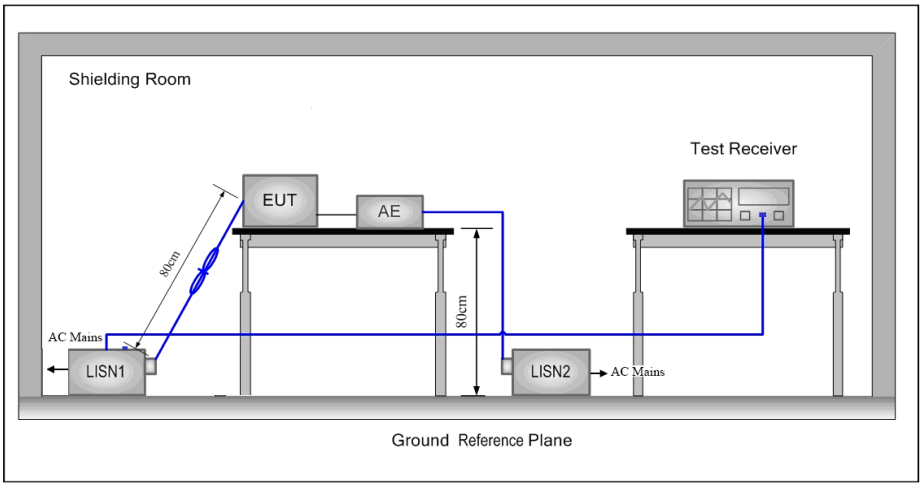
15.203 requirement:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer 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) requireent:
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 Integrated Antenna and no consideration of replacement.
The best case gain of the antenna is 2.92 dBi(Ant2).*

**Note:*
The antenna gain are derived from the gain information report provided by the manufacturer.
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.

4.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10-2013 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 C63.10-2013 on conducted measurement.		

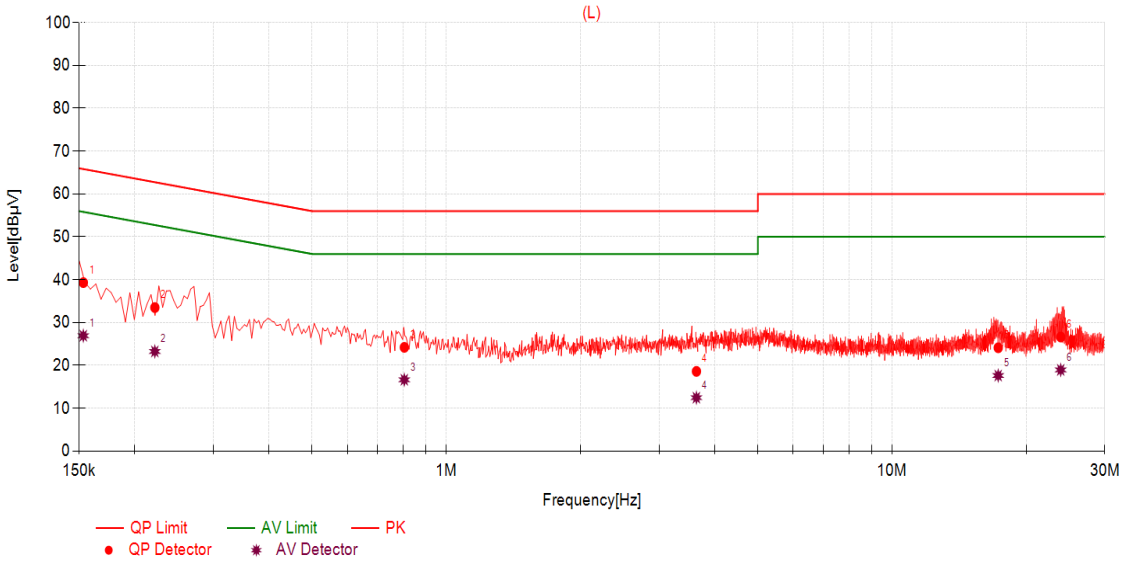
Test Setup:	
Test Mode:	Transmitting with GFSK modulation. DC Supply+ Transmitting mode. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass

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.

Phase:	Line

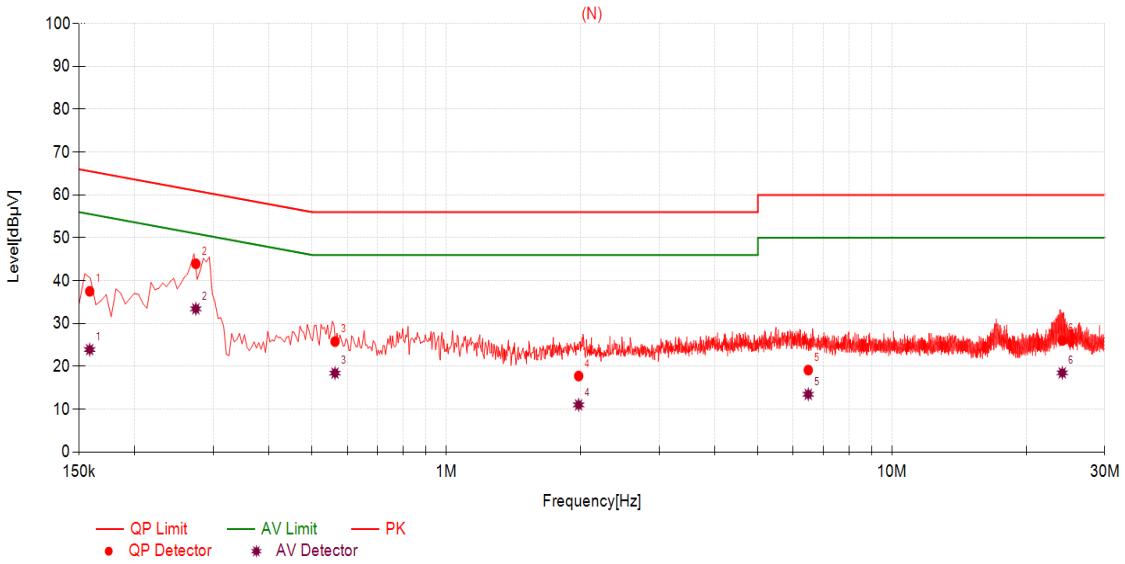


Data List

NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.1533	9.86	29.47	39.33	65.82	26.49	17.07	26.93	55.82	28.89	PASS
2	0.2218	9.86	23.65	33.51	62.75	29.24	13.40	23.26	52.75	29.49	PASS
3	0.8049	9.91	14.31	24.22	56.00	31.78	6.74	16.65	46.00	29.35	PASS
4	3.6398	9.86	8.75	18.61	56.00	37.39	2.61	12.47	46.00	33.53	PASS
5	17.3052	10.25	13.88	24.13	60.00	35.87	7.38	17.63	50.00	32.37	PASS
6	23.9051	10.28	16.35	26.63	60.00	33.37	8.67	18.95	50.00	31.05	PASS

Remark:
1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Value =Reading[dBµV] + Factor(Lisn factor[dB] + cable loss[dB]).
3. Margin = Limit[dBµV] – Value[dBµV]

Phase:	Neutral



Data List

NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.1584	9.78	27.75	37.53	65.55	28.02	14.14	23.92	55.55	31.63	PASS
2	0.2741	9.80	34.16	43.96	60.99	17.03	23.64	33.44	50.99	17.55	PASS
3	0.5626	9.86	15.94	25.80	56.00	30.20	8.58	18.44	46.00	27.56	PASS
4	1.9808	9.85	7.91	17.76	56.00	38.24	1.18	11.03	46.00	34.97	PASS
5	6.4860	10.05	9.09	19.14	60.00	40.86	3.44	13.49	50.00	36.51	PASS
6	24.0962	10.27	15.79	26.06	60.00	33.94	8.23	18.50	50.00	31.50	PASS

Remark:
1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Value =Reading[dBµV] + Factor(Lisn factor[dB] + cable loss[dB]).
3. Margin = Limit[dBµV] – Value[dBµV]

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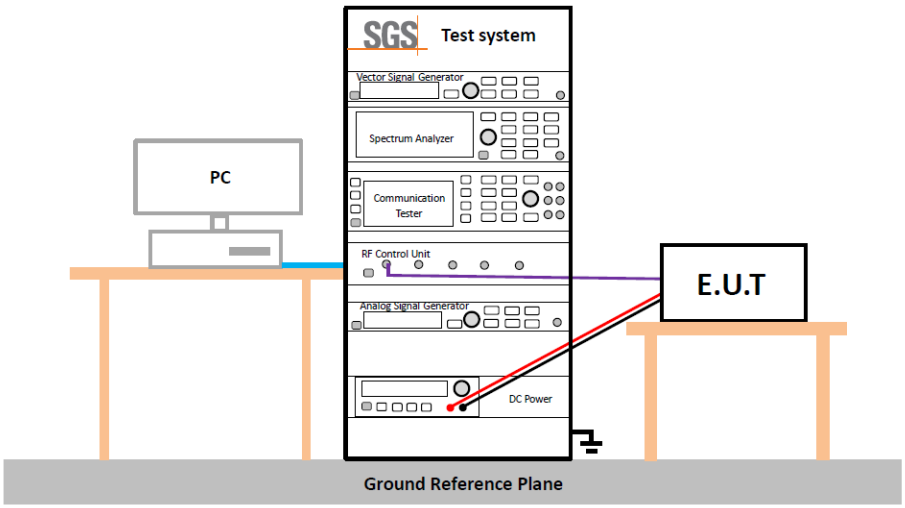
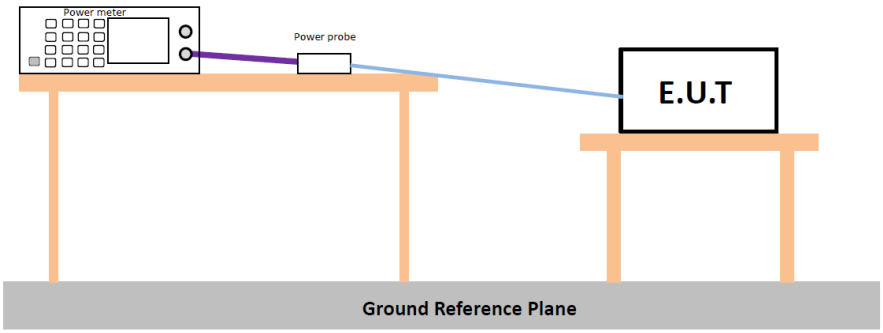
4.3 Duty Cycle

Test Requirement:	ANSI C63.10-2013 Section 11.6
Test Method:	ANSI C63.10-2013 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**	

4.4 Conducted Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)
Test Method:	ANSI C63.10-2013 Section 11.9.1.3
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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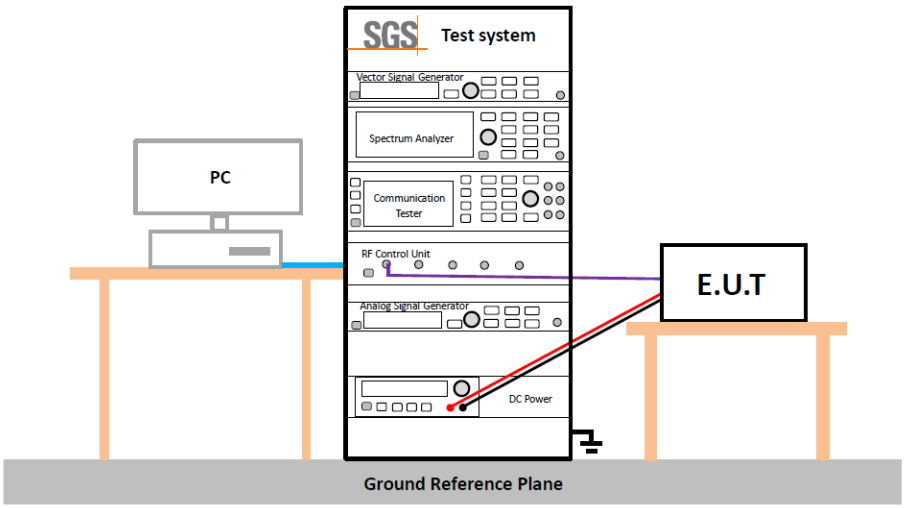
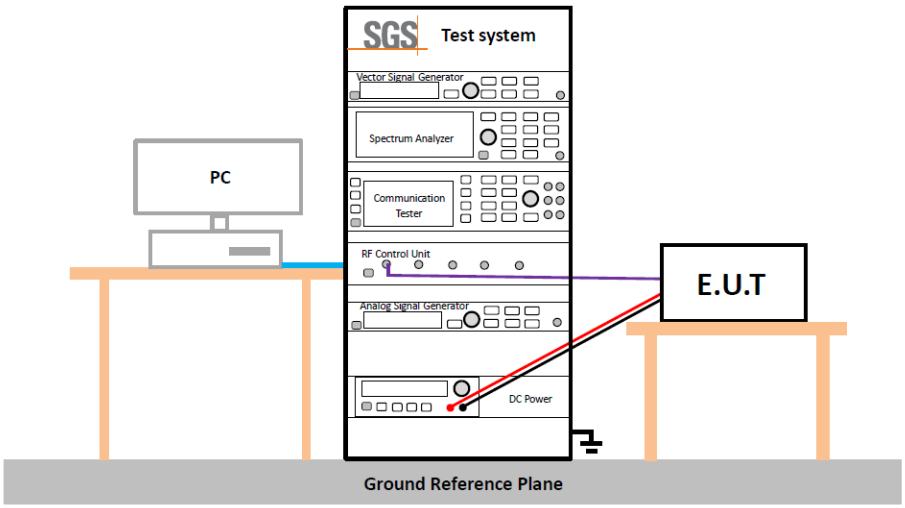
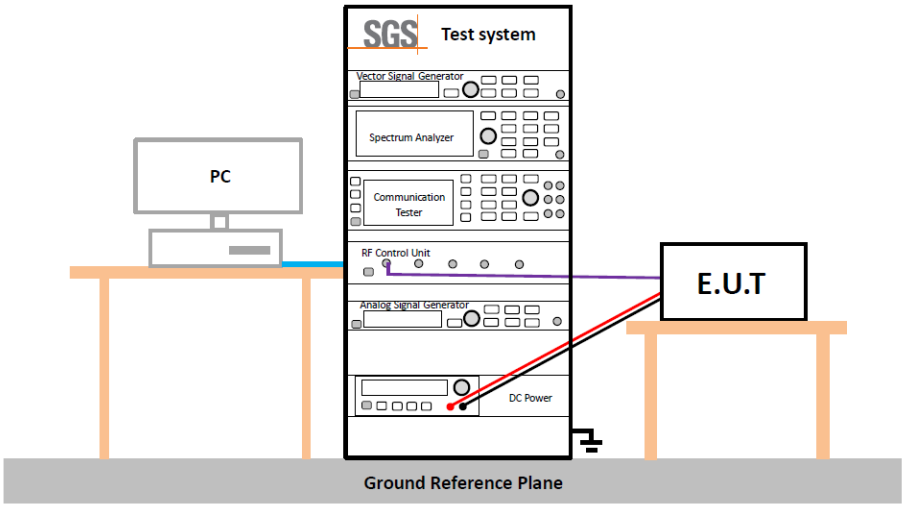
4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10-2013 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**	

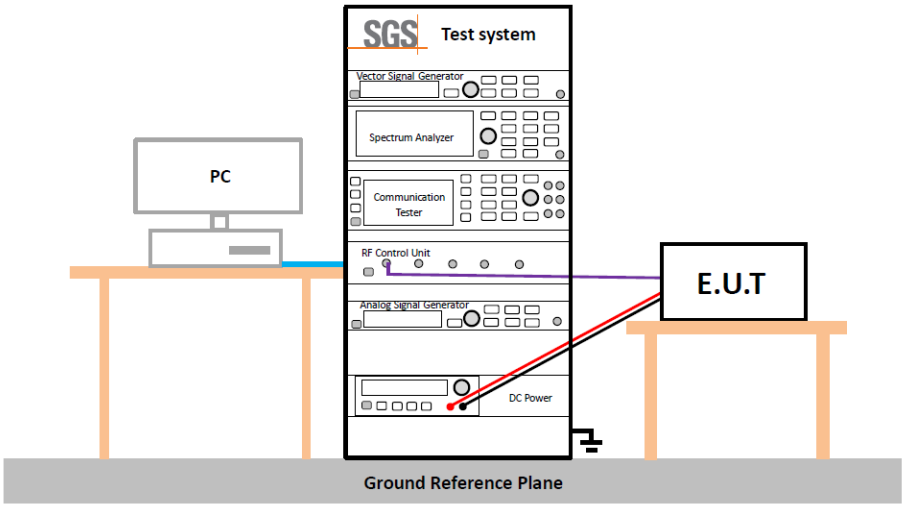
4.6 Power Spectral Density

Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10-2013 Section 11.10.2
Test Setup:	
Test Instruments:	Refer to section 6 for details
Test Mode:	Transmitting with GFSK modulation.
Limit:	≤8.00dBm/3kHz
Test Results:	Pass
The detailed test data see: **Appendix**	

4.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10-2013 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**	

4.8 RF Conducted Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10-2013 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**	

4.9 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10-2013 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:

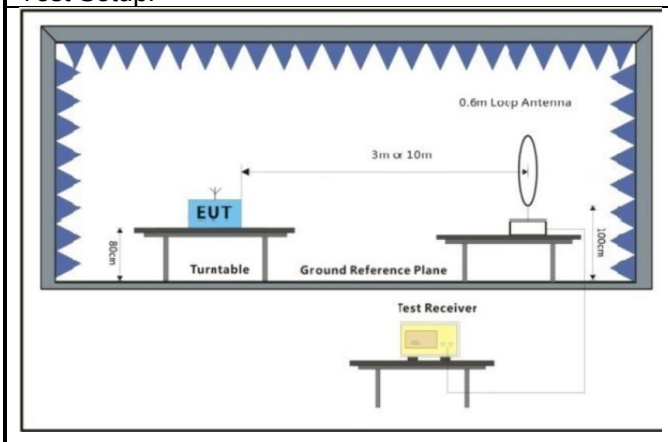


Figure 1. Below 30MHz

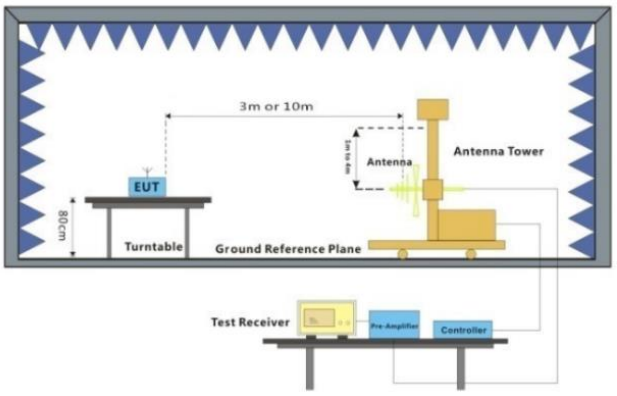


Figure 2. 30MHz to 1GHz

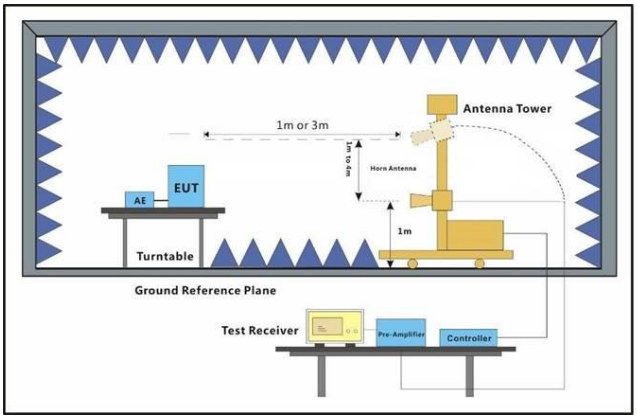


Figure 3. Above 1 GHz

Test Procedure:	a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation (Distance from antenna to EUT is 1m for measurements >18GHz). c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters(for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. Test the EUT in the lowest channel, the middle channel ,the Highest channel. h. 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. i. Repeat above procedures until all frequencies measured was complete. j. 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 k. 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. l. At a measurement distance of 1 meter the limit line was increased by 20*LOG(3/1) = 9.54 dB.
Test Configuration:	Measurements below 30MHz • RBW = 10 kHz • VBW = 30 kHz

	• 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 ≥ 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. DC Supply+ Transmitting mode.
Final Test Mode:	Transmitting with GFSK modulation. Pretest the EUT at DC Supply+ 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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4.10Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10-2013 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:

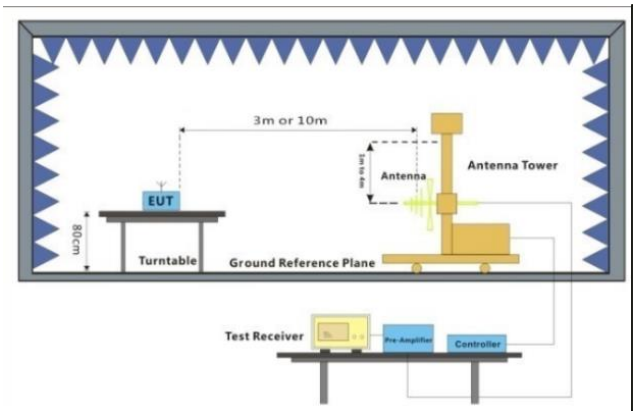

Figure 1. 30MHz to 1GHz

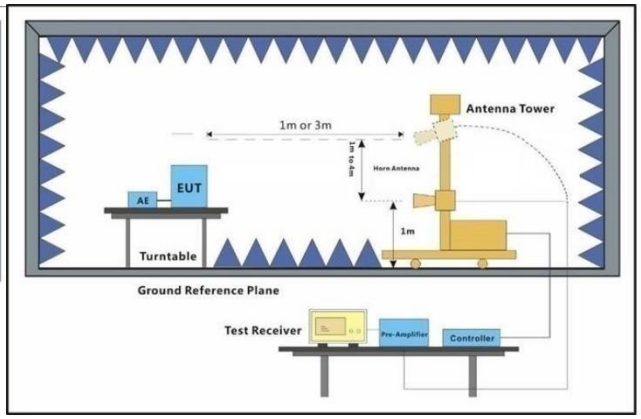

Figure 2. Above 1 GHz

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

	Bandwidth with Maximum Hold Mode. g. 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. DC Supply+ Transmitting mode.
Final Test Mode:	Transmitting with GFSK modulation. Pretest the EUT at DC Supply+ 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**	

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

Lab A:

No.	Item	Measurement Uncertainty
1	Conduction Emission	± 3.0dB (150kHz to 30MHz)
2	Radiated Emission	± 4.6dB (9KHz to 30MHz)
		± 4.9dB (30MHz to 1GHz)
		± 4.9dB (1GHz to 6GHz)
		± 4.7dB (6GHz to 18GHz)
		± 5.26dB (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.		

Lab B:

No.	Item	Measurement Uncertainty
1	Radio Frequency	8.4×10^{-8} GHz
2	Timeout	2s
3	Duty Cycle	0.37%
4	Occupied Bandwidth	3%
5	RF Conducted Power	0.6dB
6	RF Power Density	2.9dB
7	Conducted Spurious Emissions	0.75dB
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.		

6 Equipment List

Lab A:

CE Test System					
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	XAW01-03-07	2023/08/30	2024/08/29
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-02	2023/06/30	2024/06/29

Remark: NCR=No Calibration Requirement

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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
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-07	2023/08/30	2024/08/29
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

Remark: NCR=No Calibration Requirement

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Lab B:

RF Test Equipment					
Test Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy/mm/dd)**	**Cal.Due date (yyyy/mm/dd)**
Spectrum Analyzer	Keysight	N9020A	KUS1911E004-2	2023/08/24	2024/08/23
Spectrum Analyzer	Keysight	N9020A	KUS2001M001-2	2023/08/24	2024/08/23
Spectrum Analyzer	Keysight	N9030B	KSEM021-1	2023/02/03	2024/02/02
Signal Generator	R&S	SMBV100B	KSEM032	2023/03/16	2024/03/15
Signal Generator	R&S	SMW200A	KSEM020-1	2023/08/24	2024/08/23
Signal Generator	Agilent	N5182A	KUS2001M001-1	2023/08/24	2024/08/23
Radio Communication Test Station	Anritsu	MT8000A	KSEM001-1	2023/08/24	2024/08/23
Radio Communication Analyzer	Anritsu	MT8821C	KSEM002-1	2023/03/16	2024/03/15
Universal Radio Communication Tester	R&S	CMW500	KUS1911E004-1	2023/08/24	2024/08/23
Switcher	CCSRF	FY562	KUS2001M001-3	2023/08/24	2024/08/23
AC Power Source	EXTECH	6605	KS301178	NCR	NCR
DC Power Supply	Aglient	E3632A	KS301180	NCR	NCR
Conducted Test Cable	Thermax	RF01-RF04	CZ301111-CZ301120	2023/02/03	2024/02/02
Temp. / Humidity Chamber	TERCHY	MHK-120AK	KS301190	2023/08/24	2024/08/23
Temperature & Humidity Recorder	Renke Control	RS-WS-N01-6J	KSEM024-5	2023/03/22	2024/03/21
Software	BST	TST-PASS	/	NCR	NCR

Remark: NCR=No Calibration Requirement

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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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Duty Cycle

Test Result

Ant2							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
1M	SISO	2402	0.418	0.625	66.88	1.75	0.00
		2440	0.418	0.625	66.88	1.75	0.03
		2480	0.418	0.625	66.88	1.75	0.00

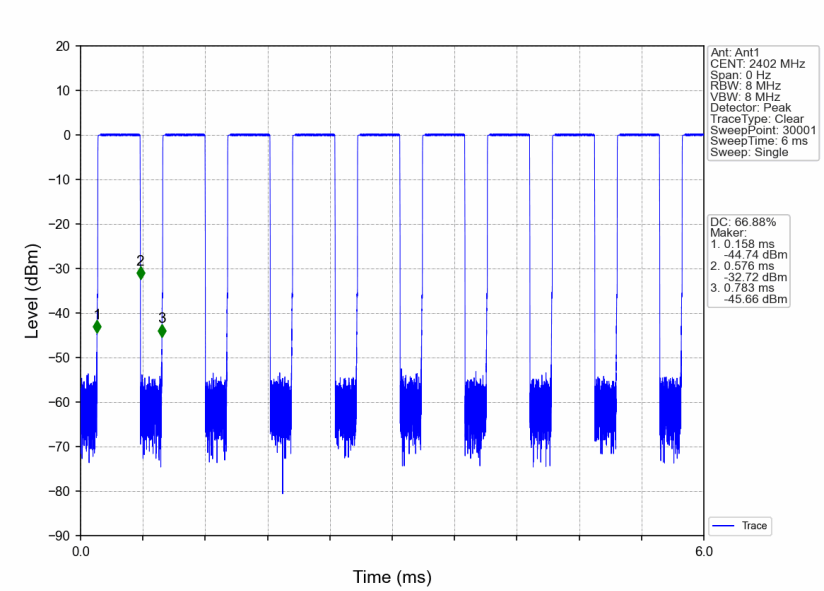
Note:

Radiated Emission Average VBW = 1 / T

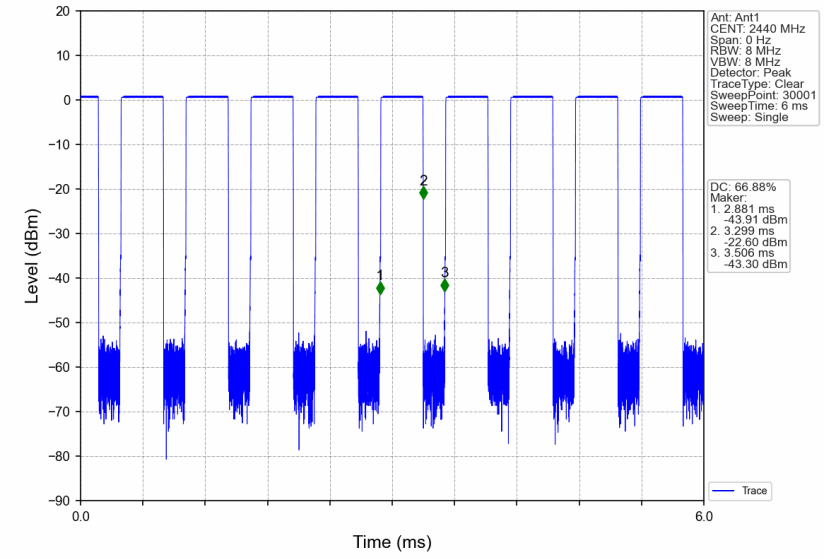
TestMode	T[ms]	Period[ms]	Duty Cycle[%]	1/T[kHz]	VBW Setting
BLE_1M	0.418	0.625	66.88	2.39234	2.7KHz

Test Graphs

1M_LCH_2402MHz_Ant2_NTNV



1M_MCH_2440MHz_Ant2_NTNV



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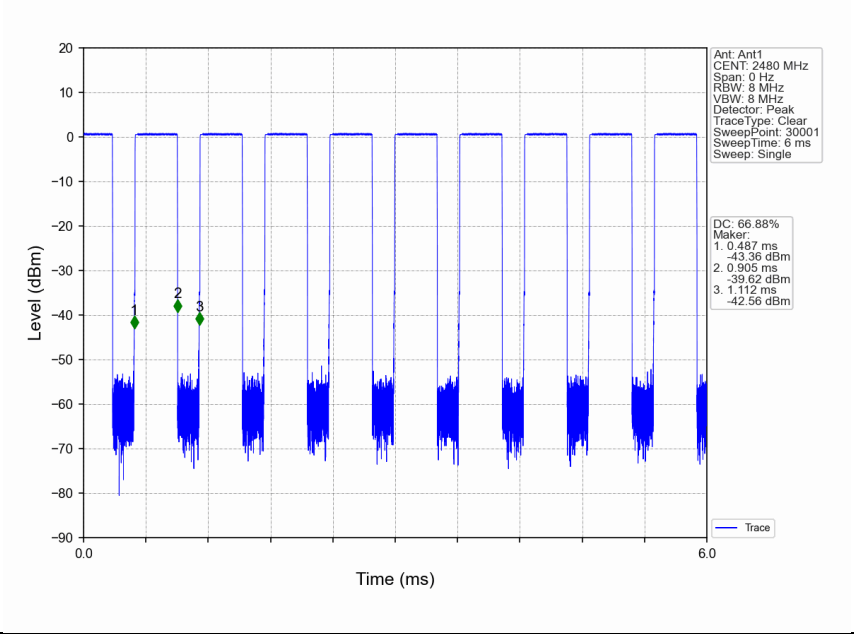
1M_HCH_2480MHz_Ant2_NTNV



Occupied Channel Bandwidth

Test Result

Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)		Verdict
				Result	Limit	
1M	SISO	2402	2	1.066	/	Pass
		2440	2	1.067	/	Pass
		2480	2	1.062	/	Pass

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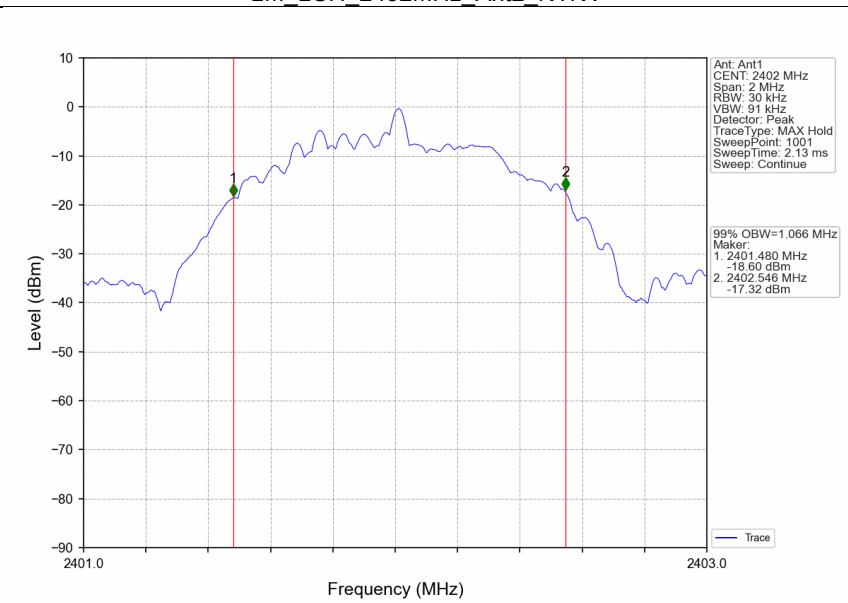
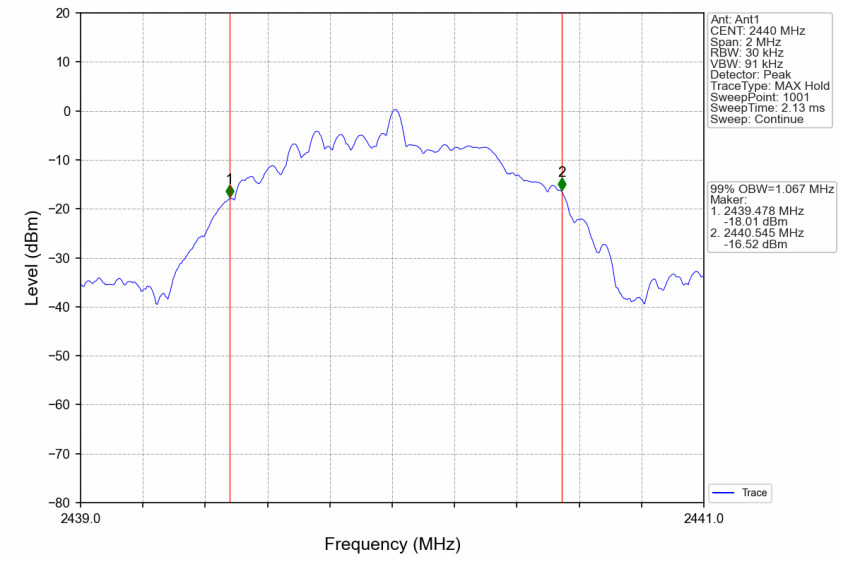
Test Graphs

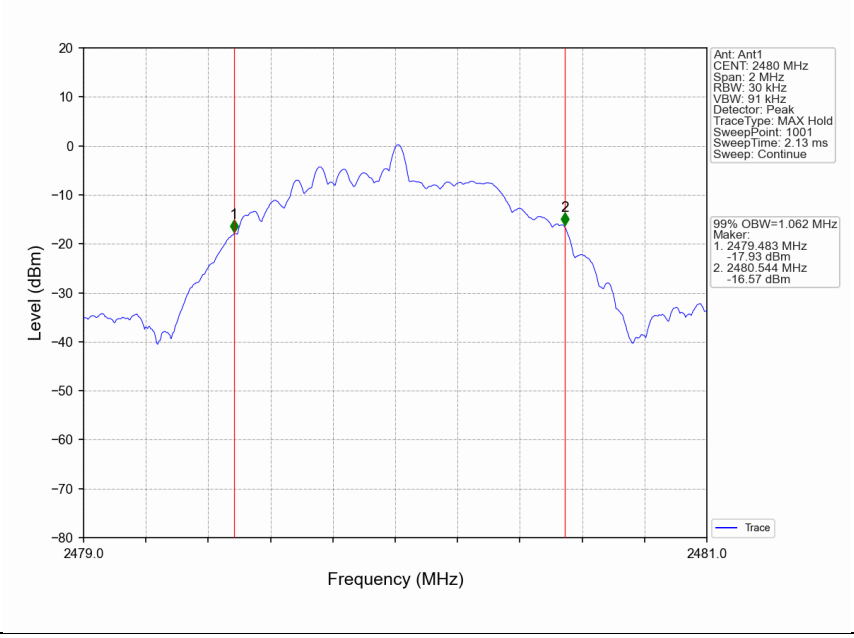
1M_LCH_2402MHz_Ant2_NTNV



1M_MCH_2440MHz_Ant2_NTNV



1M_HCH_2480MHz_Ant2_NTNV



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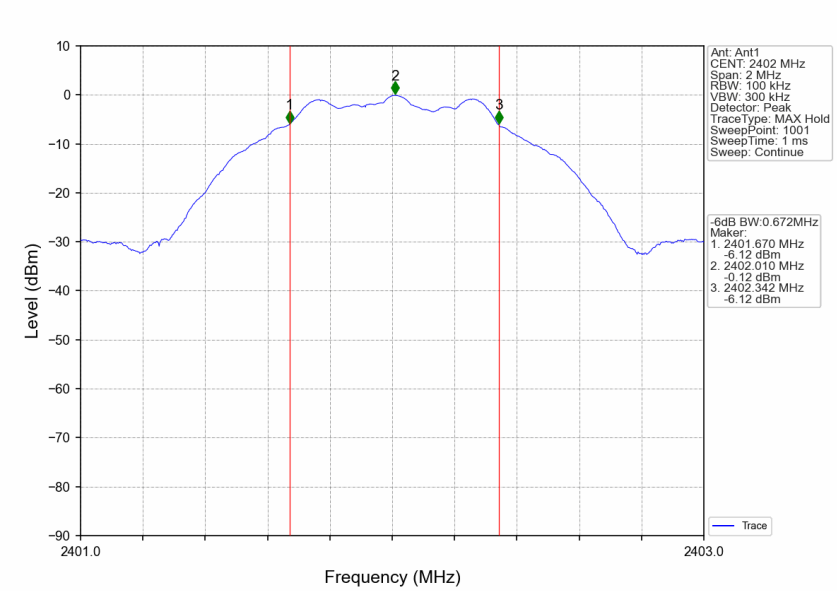
6dB Bandwidth

Test Result

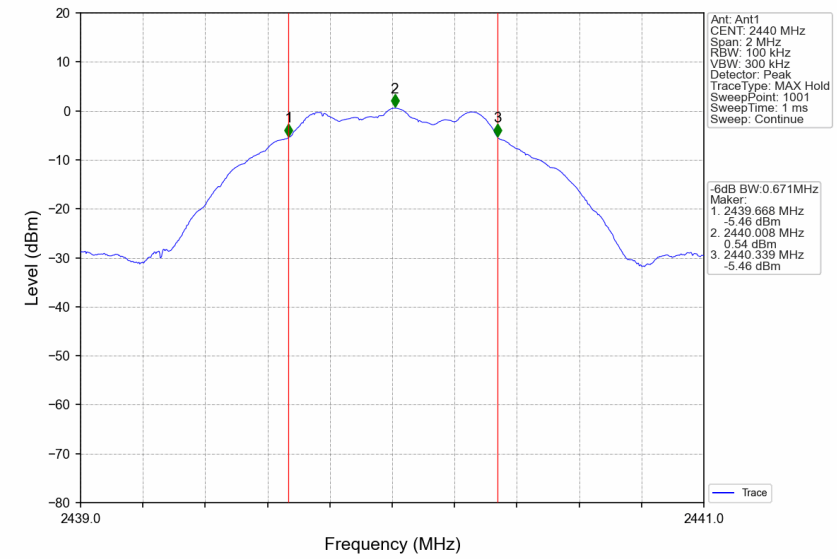
Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
1M	SISO	2402	2	0.672	>=0.5	Pass
		2440	2	0.671	>=0.5	Pass
		2480	2	0.666	>=0.5	Pass

Test Graphs

1M_LCH_2402MHz_Ant2_NTNV



1M_MCH_2440MHz_Ant2_NTNV



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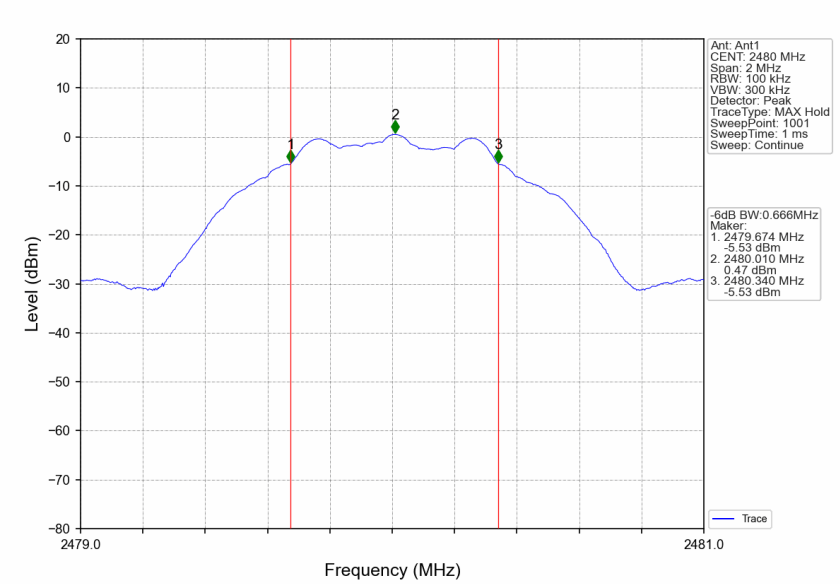
1M_HCH_2480MHz_Ant2_NTNV



Maximum conducted output power

Test Result

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT2	Limit	
1M	SISO	2402	0.14	<=30	Pass
		2440	0.80	<=30	Pass
		2480	0.70	<=30	Pass
Note1: Antenna Gain: Ant2: 2.92dBi;					

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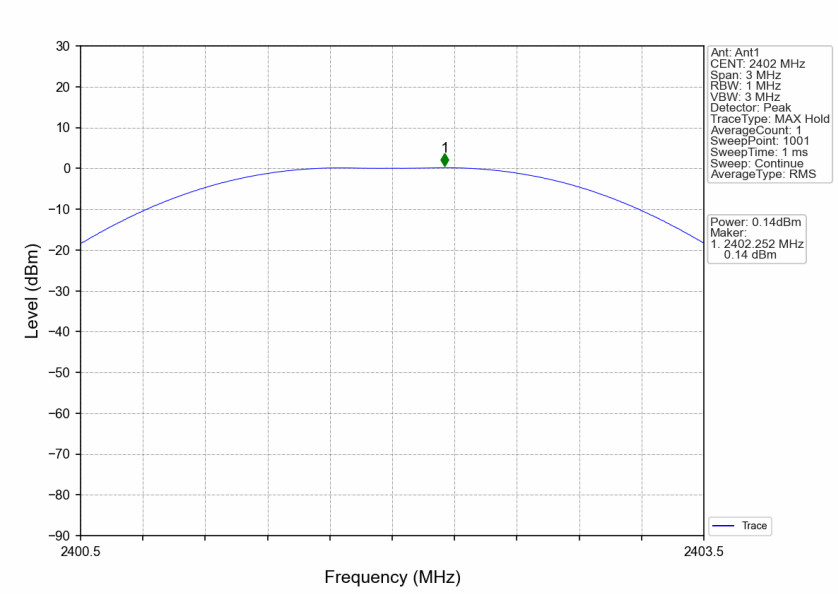
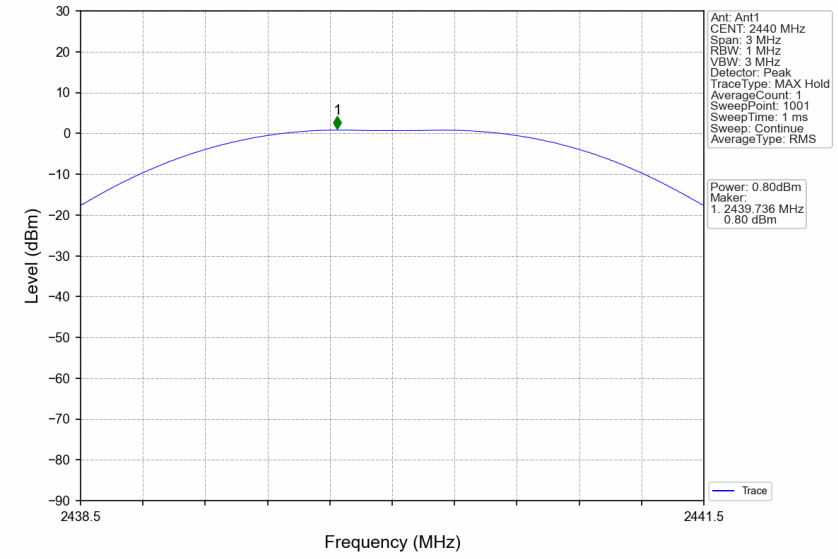
Test Graphs

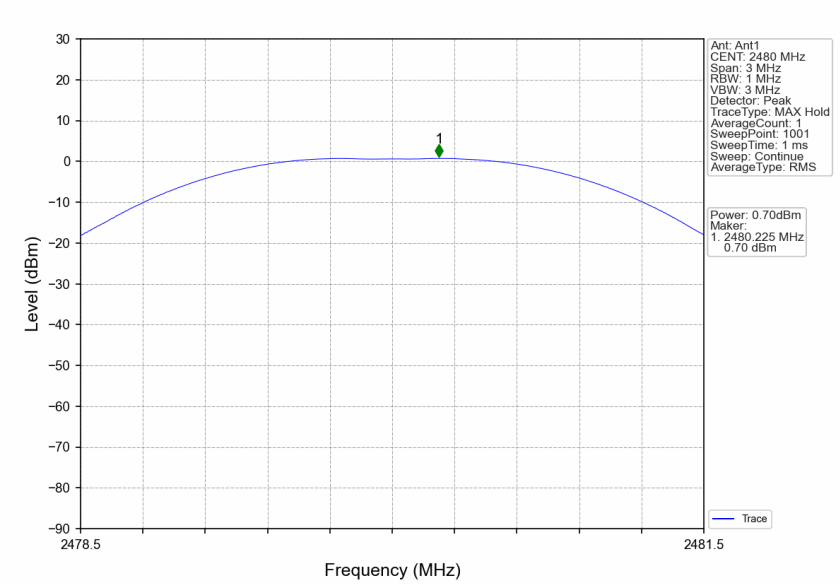
1M_LCH_2402MHz_Ant2_NTNV



1M_MCH_2440MHz_Ant2_NTNV



1M_HCH_2480MHz_Ant2_NTNV



Maximum power spectral density

Test Result

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			ANT2	Limit	
1M	SISO	2402	-14.20	<=8	Pass
		2440	-13.49	<=8	Pass
		2480	-13.86	<=8	Pass
Note1: Antenna Gain: Ant2: 2.92dBi;					

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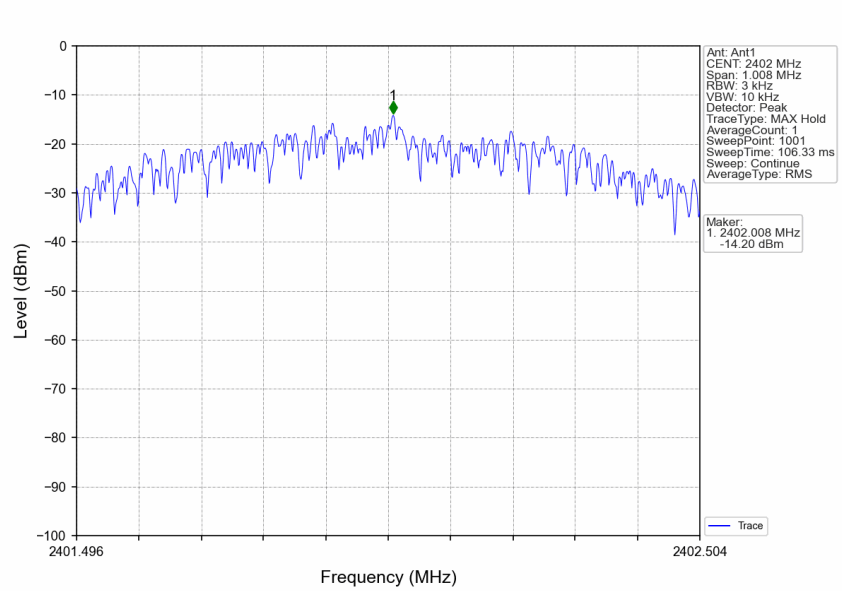
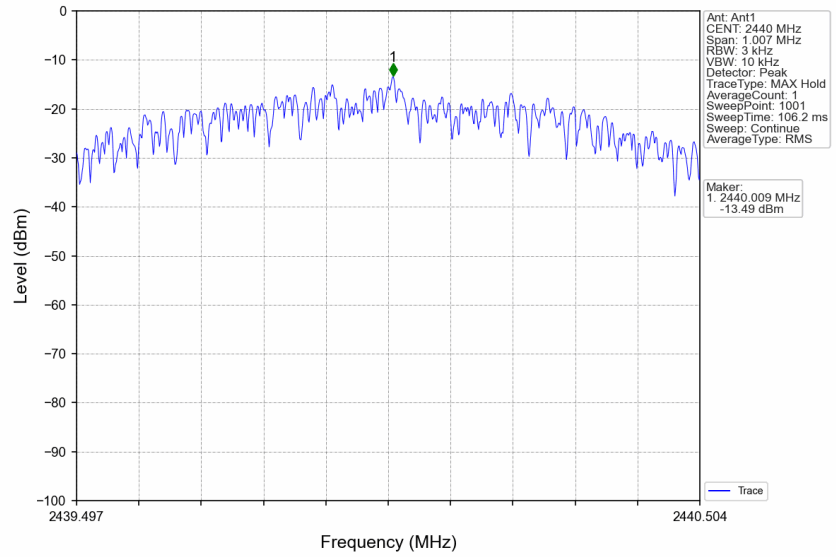
Test Graphs

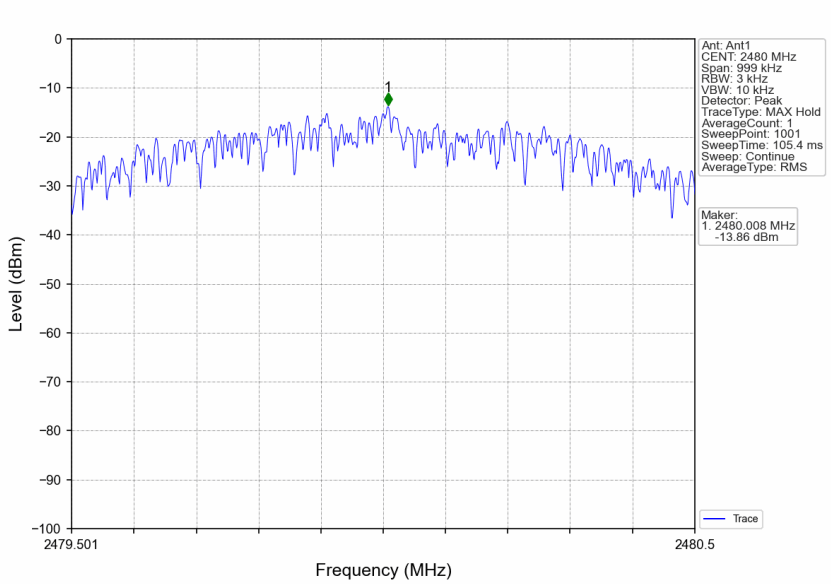
1M_LCH_2402MHz_Ant2_NTNV



1M_MCH_2440MHz_Ant2_NTNV



1M_HCH_2480MHz_Ant2_NTNV



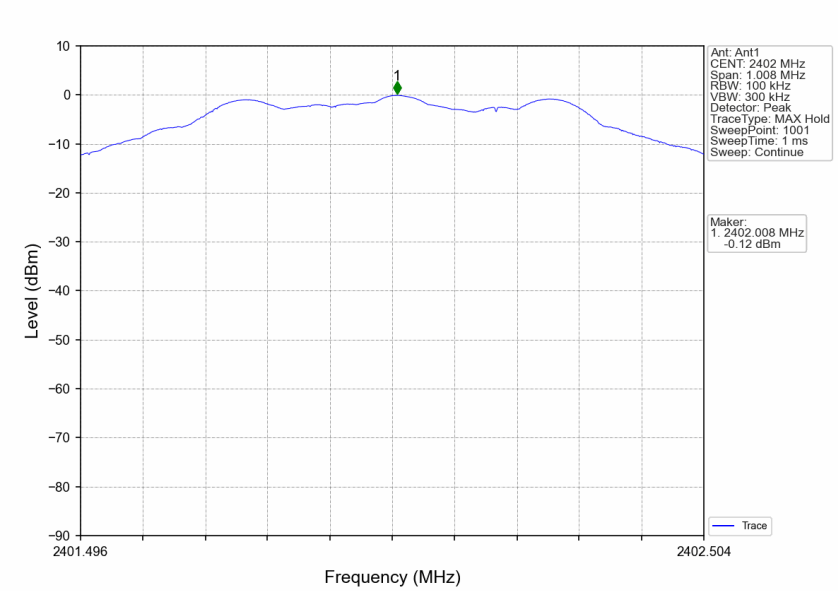
Unwanted Emissions In Non-restricted Frequency Bands

Test Result

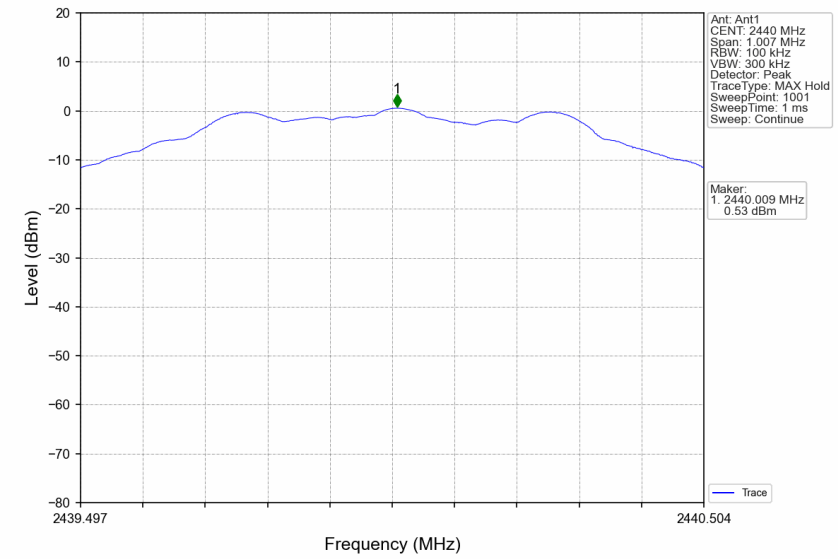
Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
1M	SISO	2402	2	-0.12
		2440	2	**0.53**
		2480	2	0.47
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.				

Test Graphs

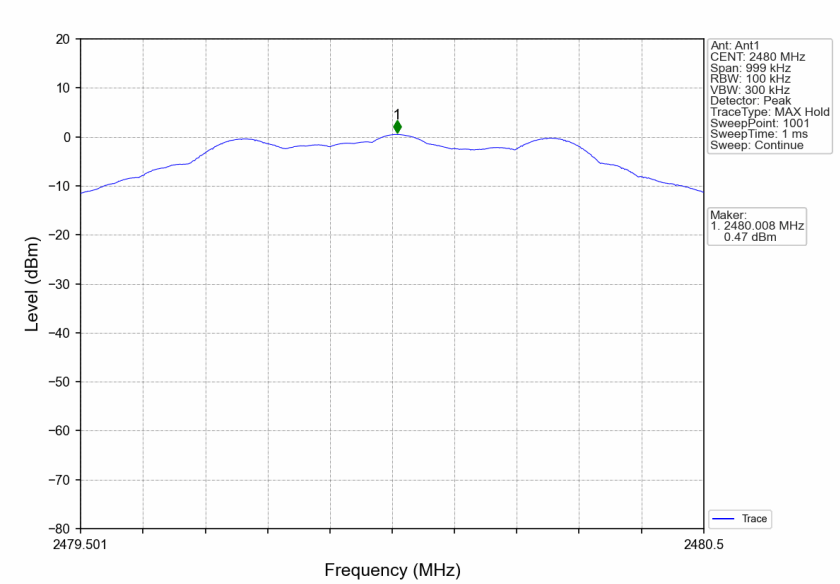
1M_LCH_2402MHz_Ant2_NTNV



1M_MCH_2440MHz_Ant2_NTNV



1M_HCH_2480MHz_Ant2_NTNV



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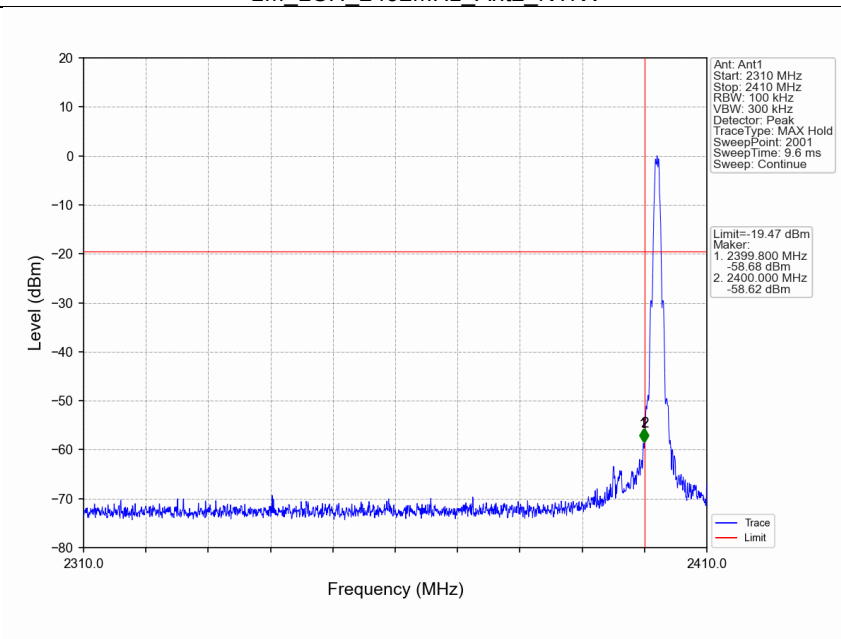
Conducted Spurious Emission

Test Graphs

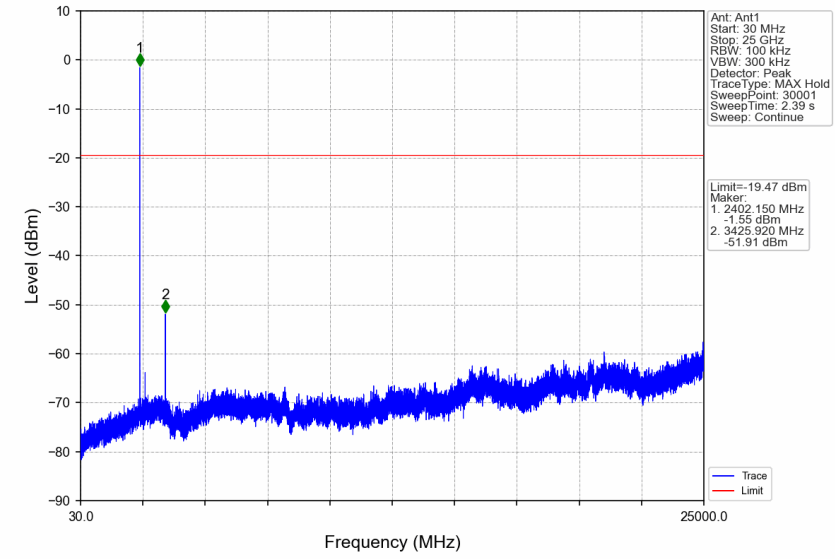
Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
1M	SISO	2402	2	0.53	-19.47	Pass
		2440	2	0.53	-19.47	Pass
		2480	2	0.53	-19.47	Pass
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.						

Test Graphs

1M_LCH_2402MHz_Ant2_NTNV



1M_LCH_2402MHz_Ant2_NTNV



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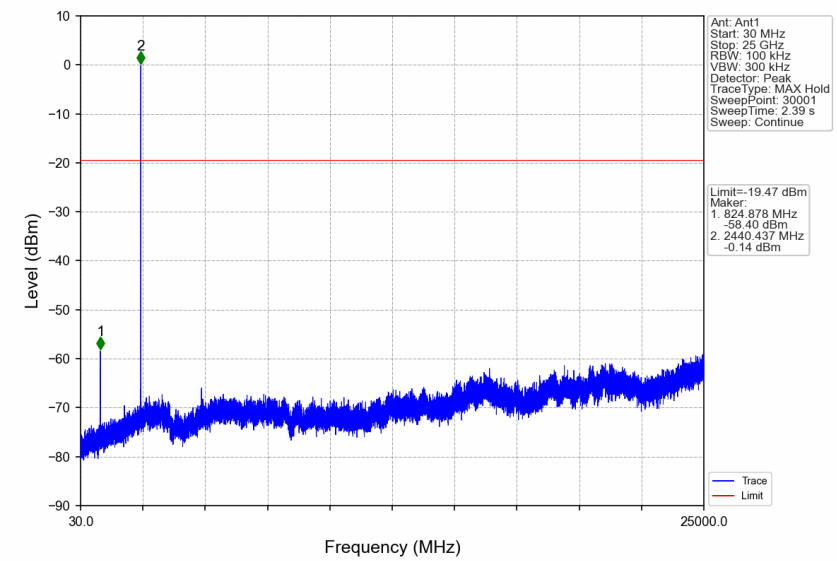
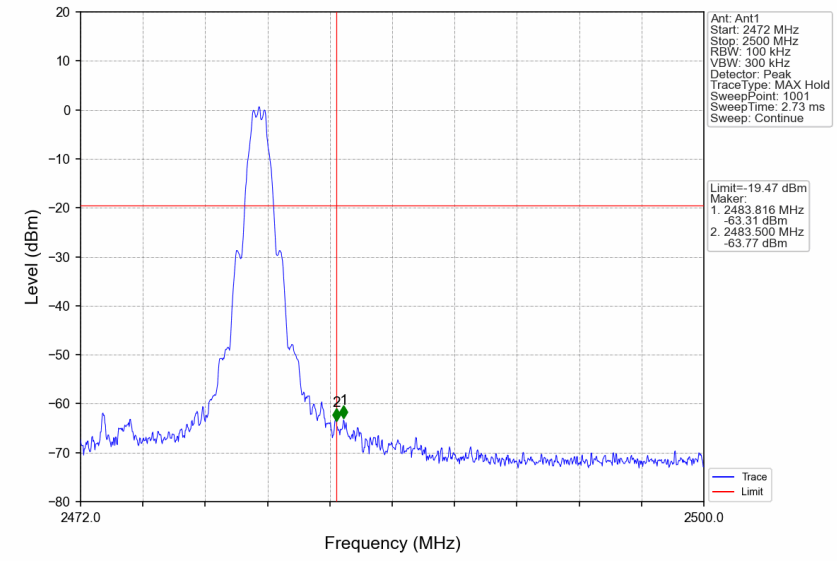
1M_MCH_2440MHz_Ant2_NTNV



1M_HCH_2480MHz_Ant2_NTNV



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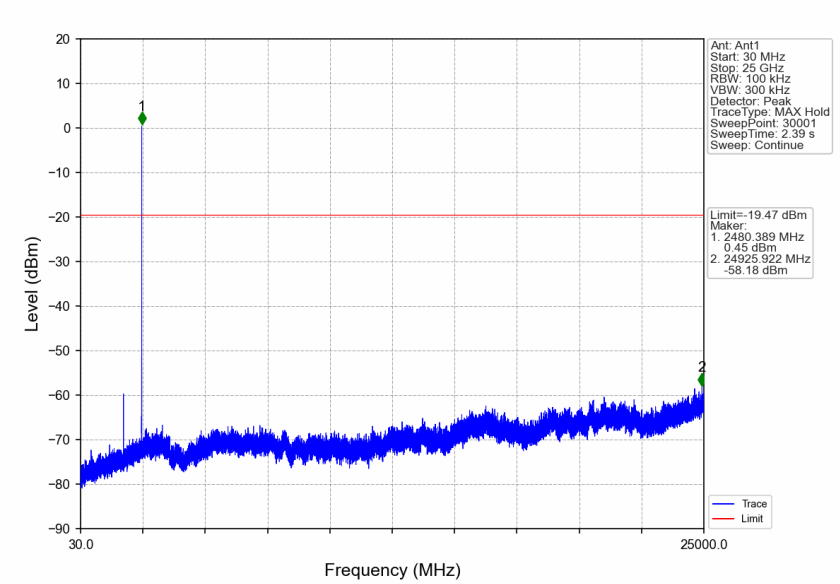
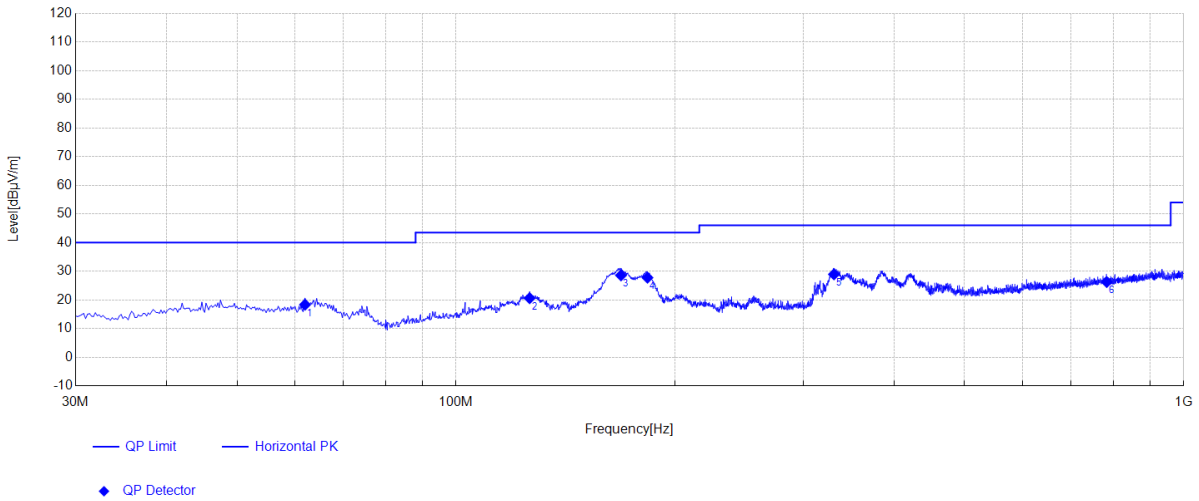
1M_HCH_2480MHz_Ant2_NTNV



Radiated Spurious Emissions

Radiated emission below 1GHz

Worst case Mode: BLE 1M_Channel 39



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	62.0164	12.00	-27.16	33.48	18.32	40.00	21.68	Horizontal
2	126.2432	8.80	-26.66	38.44	20.58	43.50	22.92	Horizontal
3	168.5437	8.85	-26.21	45.92	28.56	43.50	14.94	Horizontal
4	183.2907	9.23	-26.28	44.79	27.74	43.50	15.76	Horizontal
5	330.7602	14.12	-25.55	40.35	28.92	46.00	17.08	Horizontal
6	784.0348	20.64	-23.28	28.87	26.23	46.00	19.77	Horizontal

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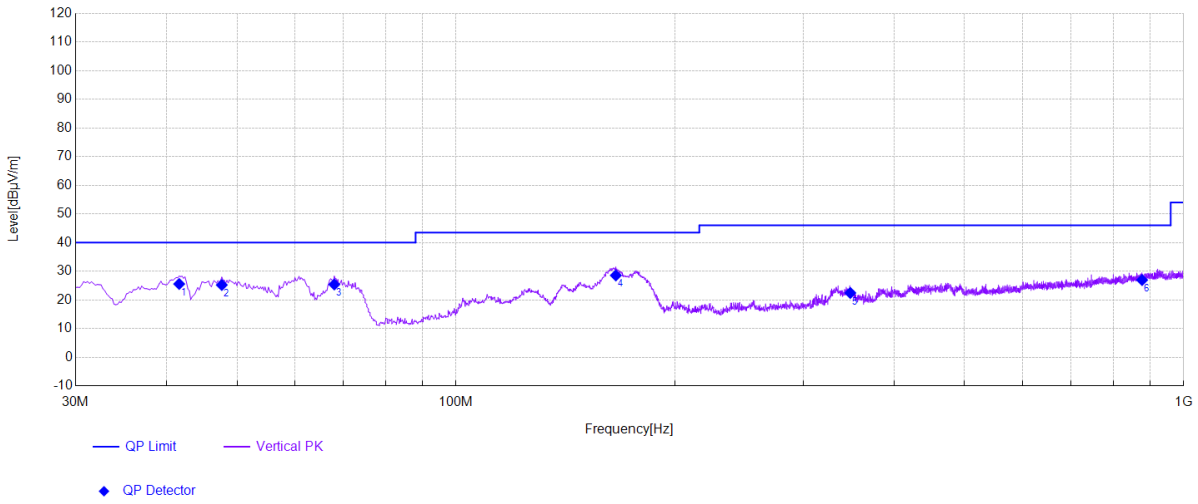

Data List								
NO.	Freq. [MHz]	AF[dB/m]	Factor [dB]	QP Reading[dBµV]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Polarity
1	41.6423	13.46	-27.64	39.73	25.55	40.00	14.45	Vertical
2	47.6575	13.97	-27.54	38.77	25.20	40.00	14.80	Vertical
3	68.0316	10.49	-26.88	41.77	25.38	40.00	14.62	Vertical
4	165.8272	8.87	-26.26	45.93	28.54	43.50	14.96	Vertical
5	348.2236	14.89	-25.29	32.82	22.42	46.00	23.58	Vertical
6	876.7854	21.76	-23.19	28.36	26.93	46.00	19.07	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.

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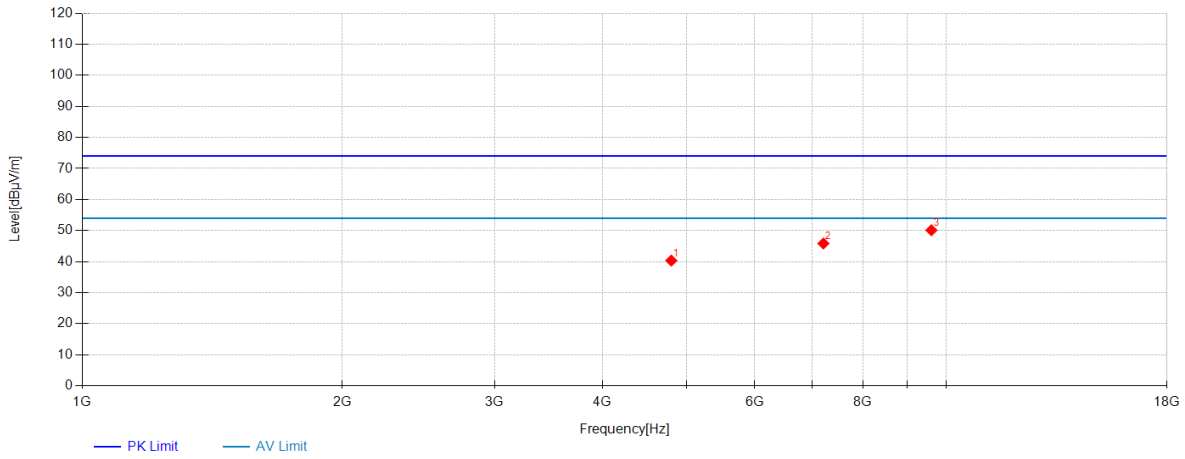
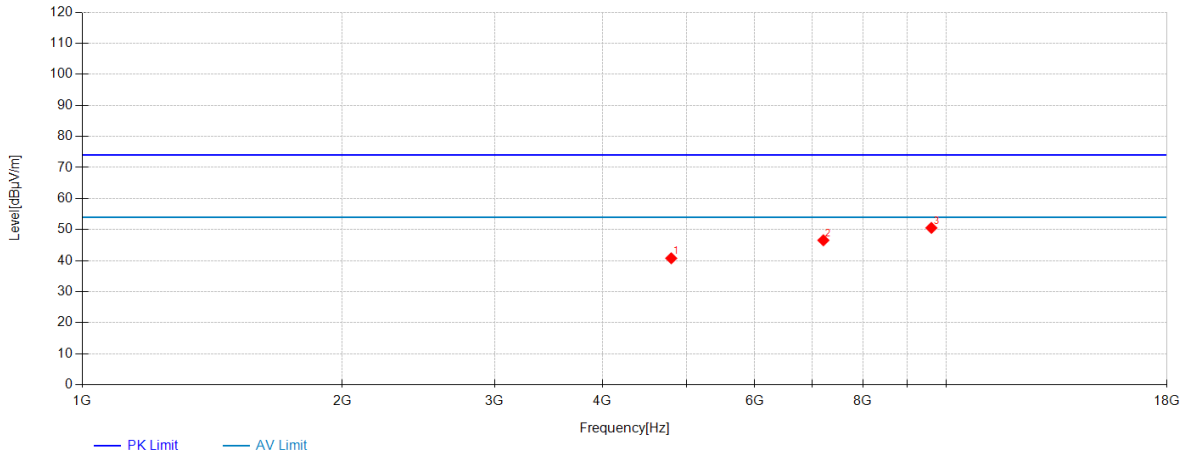
Transmitter emission Above 1GHz

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	52.51	30.78	-42.95	40.34	74.00	33.66	Horizontal
2	7206	48.00	36.56	-38.71	45.85	74.00	28.15	Horizontal
3	9608	47.97	37.85	-35.70	50.12	74.00	23.88	Horizontal

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	52.94	30.78	-42.95	40.77	74.00	33.23	Vertical
2	7206	48.71	36.56	-38.71	46.56	74.00	27.44	Vertical
3	9608	48.40	37.85	-35.70	50.55	74.00	23.45	Vertical

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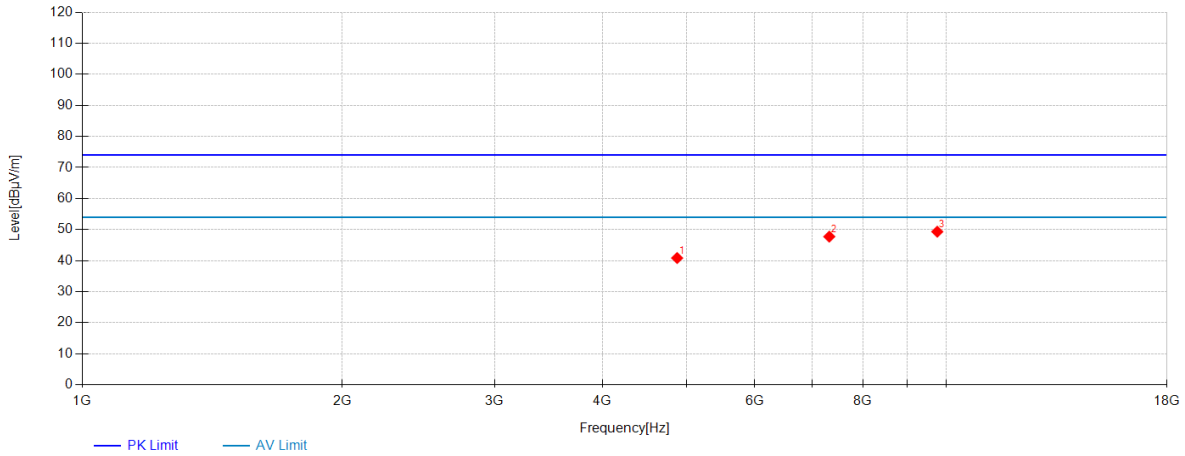
BLE 1M_Channel 19



Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	4880	52.96	30.78	-42.89	40.85	74.00	33.15	Horizontal
2	7320	50.06	36.44	-38.76	47.74	74.00	26.26	Horizontal
3	9760	46.95	38.34	-35.97	49.32	74.00	24.68	Horizontal

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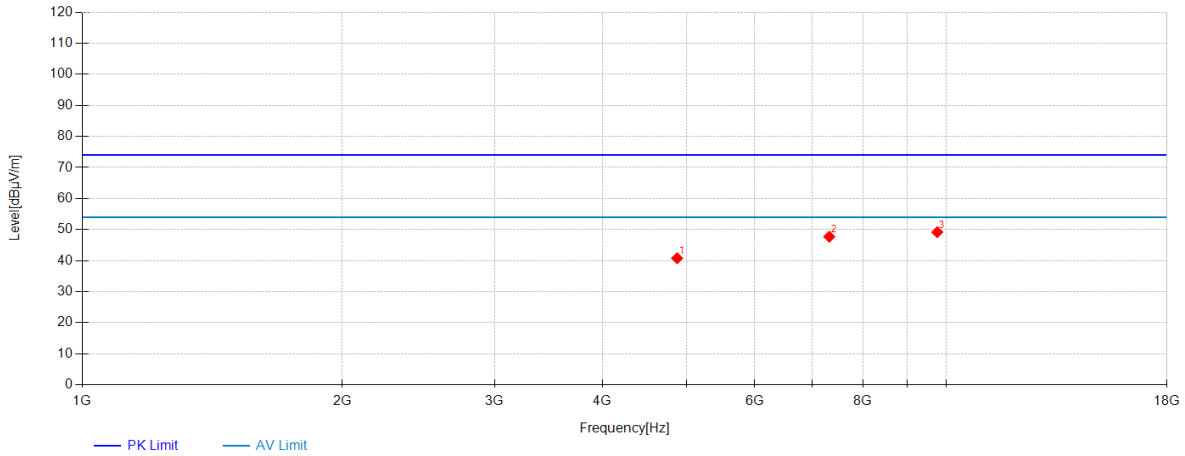
BLE 1M_Channel 19



Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	4880	52.89	30.78	-42.89	40.78	74.00	33.22	Vertical
2	7320	50.04	36.44	-38.76	47.72	74.00	26.28	Vertical
3	9760	46.80	38.34	-35.97	49.17	74.00	24.83	Vertical

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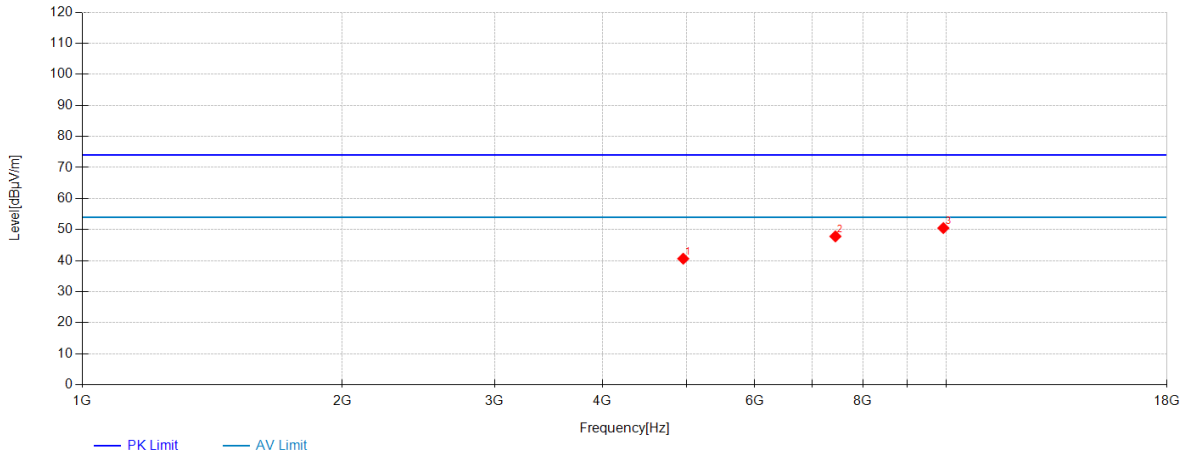
BLE 1M_Channel 39



Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	4960	52.37	31.04	-42.78	40.63	74.00	33.37	Horizontal
2	7440	49.32	36.78	-38.28	47.82	74.00	26.18	Horizontal
3	9920	47.37	38.62	-35.49	50.50	74.00	23.50	Horizontal

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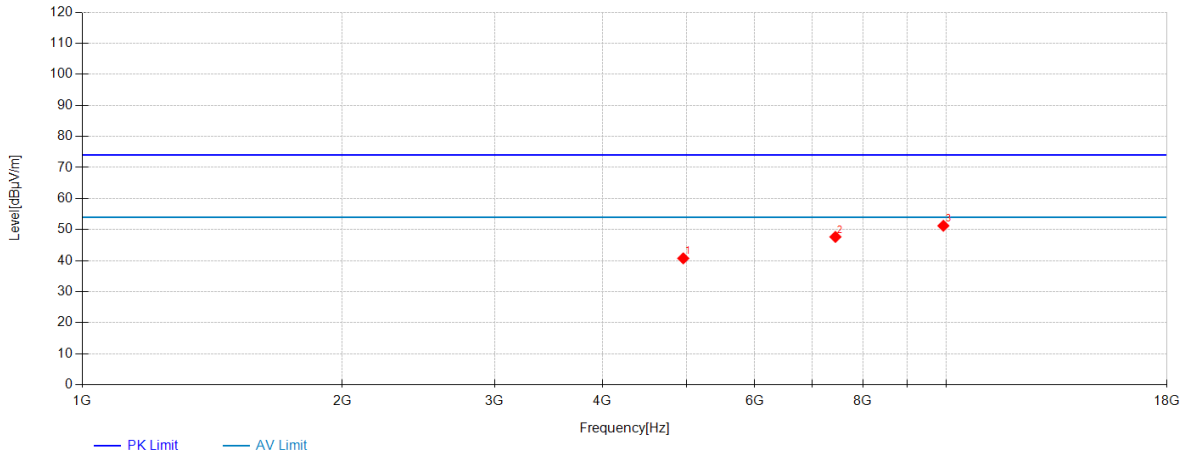
BLE 1M_Channel 39



Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	4960	52.49	31.04	-42.78	40.75	74.00	33.25	Vertical
2	7440	49.14	36.78	-38.28	47.64	74.00	26.36	Vertical
3	9920	48.10	38.62	-35.49	51.23	74.00	22.77	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) All channels have been tested, but only the worst case data displayed in this report.
3) Both peak and average measured complies with the limit line, so test result is "PASS"

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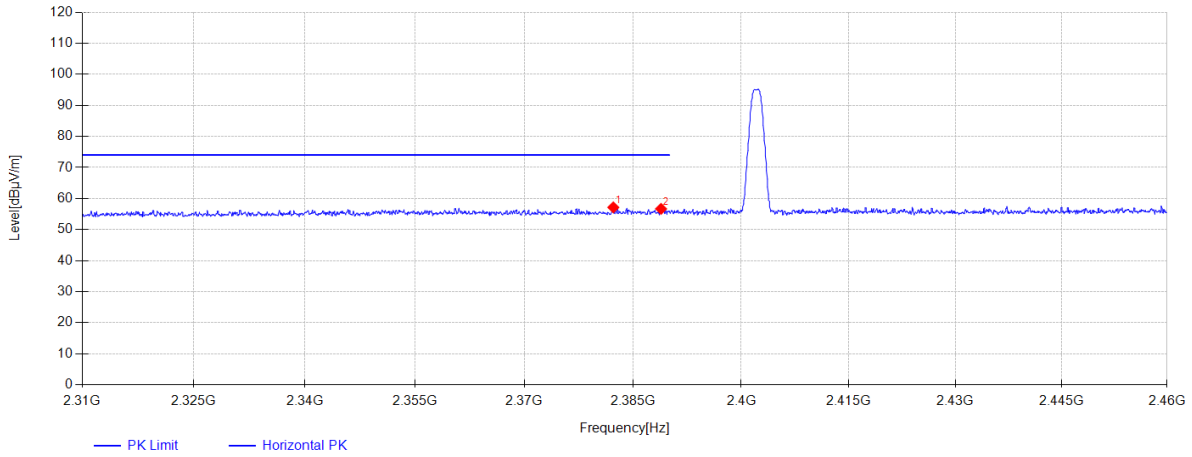
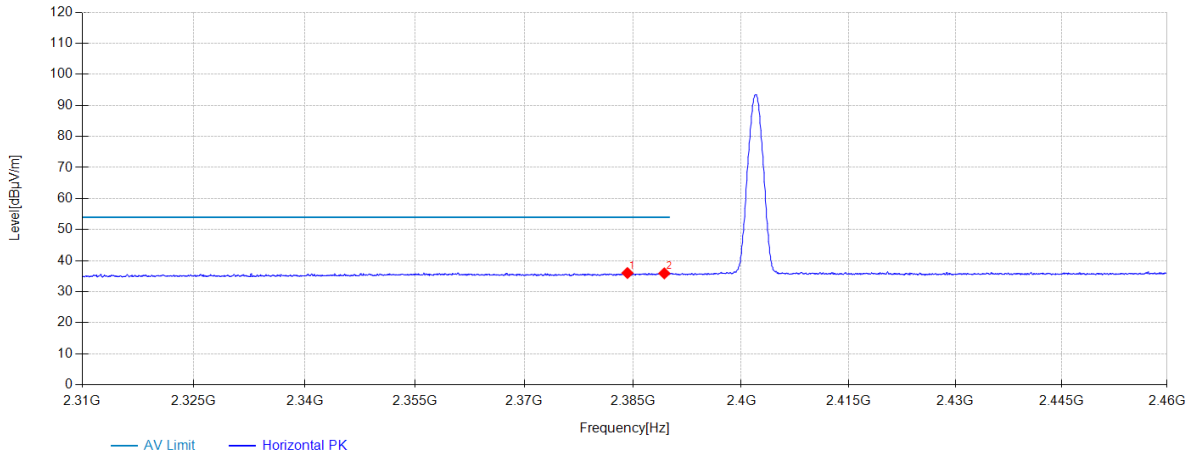
Restricted bands around fundamental frequency

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	2382.2611	48.00	27.47	-18.32	57.15	74.00	16.85	Horizontal
2	2388.8644	47.41	27.44	-18.17	56.68	74.00	17.32	Horizontal

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	2384.2121	26.84	27.46	-18.28	36.02	54.00	17.98	Horizontal
2	2389.3147	26.64	27.44	-18.17	35.91	54.00	18.09	Horizontal

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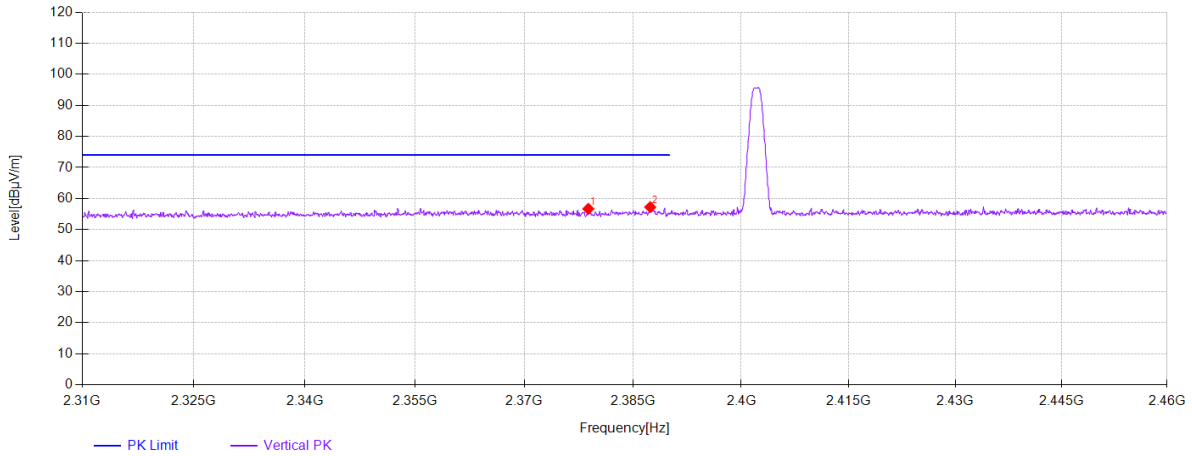
BLE 1M_Channel 0



Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	2378.8094	47.59	27.48	-18.38	56.69	74.00	17.31	Vertical
2	2387.3637	48.00	27.45	-18.21	57.24	74.00	16.76	Vertical

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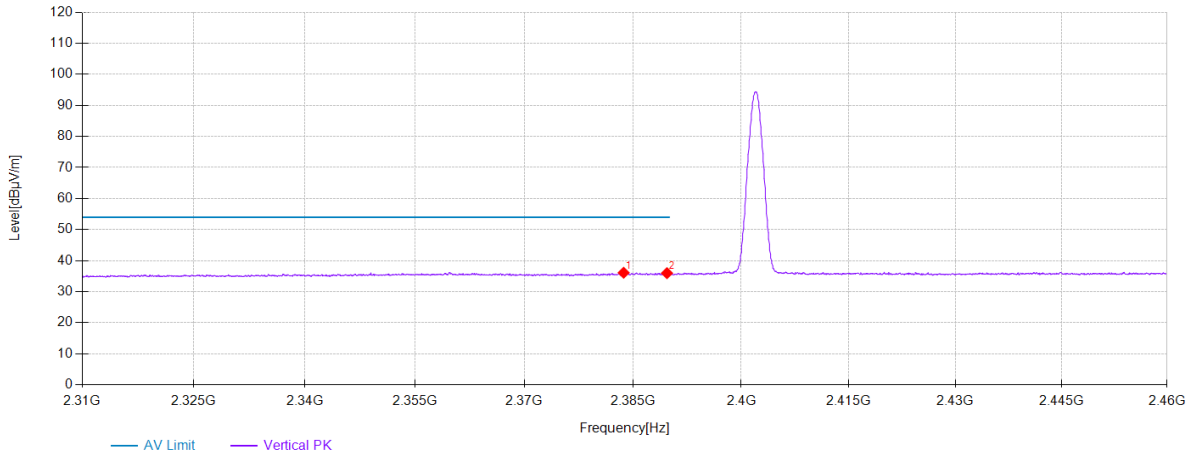
BLE 1M_Channel 0



Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	2383.6868	26.93	27.47	-18.29	36.11	54.00	17.89	Vertical
2	2389.6898	26.70	27.44	-18.16	35.98	54.00	18.02	Vertical

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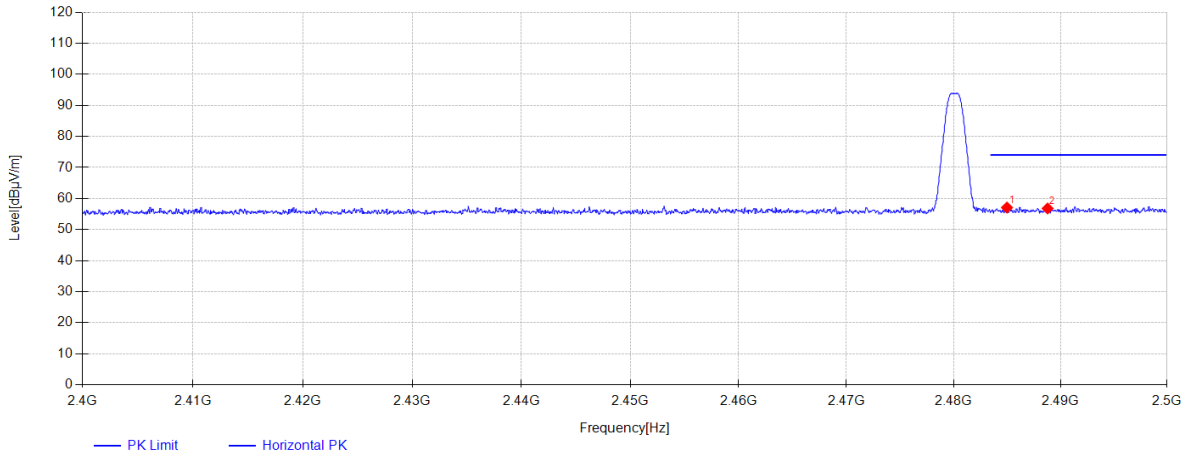
BLE 1M_Channel 39



Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	2484.9925	47.53	27.74	-18.18	57.09	74.00	16.91	Horizontal
2	2488.7944	47.20	27.76	-18.16	56.80	74.00	17.20	Horizontal

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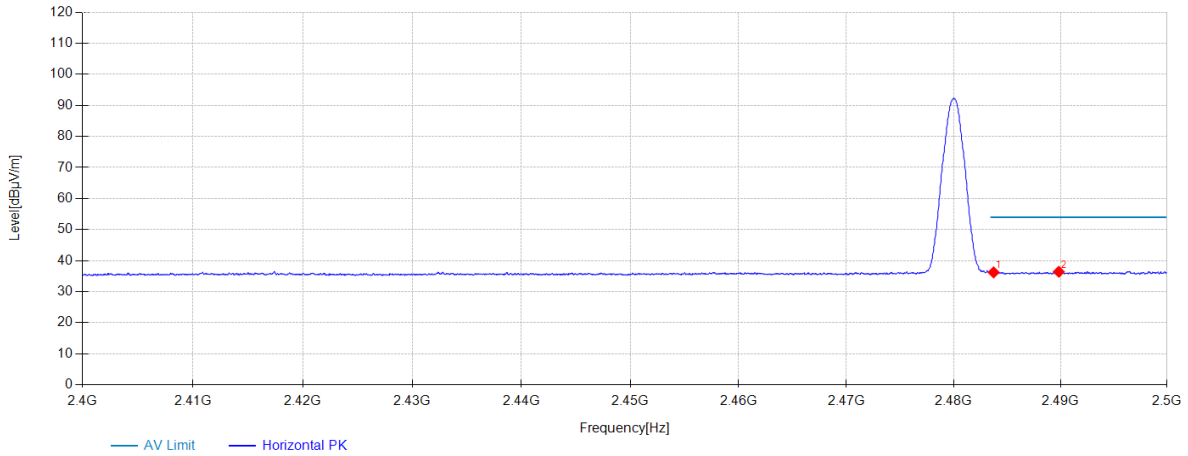

Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	2483.7419	26.69	27.73	-18.19	36.23	54.00	17.77	Horizontal
2	2489.8449	26.82	27.76	-18.16	36.42	54.00	17.58	Horizontal

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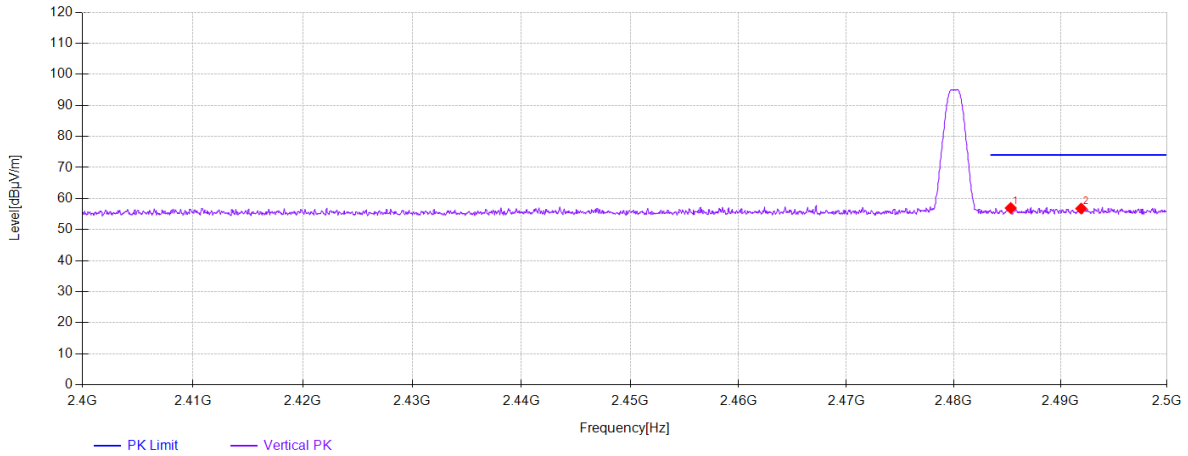

Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	2485.3427	47.39	27.74	-18.18	56.95	74.00	17.05	Vertical
2	2491.946	47.19	27.77	-18.18	56.78	74.00	17.22	Vertical

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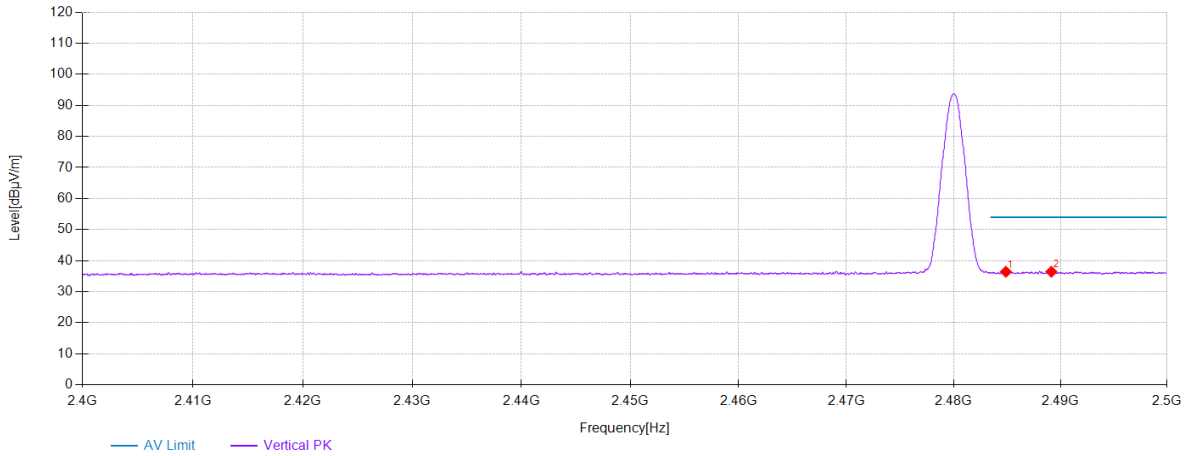

Data List								
NO.	Frequency [MHz]	Reading [dBµV]	AF[dB/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Polarity
1	2484.8924	26.86	27.74	-18.18	36.42	54.00	17.58	Vertical
2	2489.1446	26.84	27.76	-18.16	36.44	54.00	17.56	Vertical

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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