

Report No.: SEWM2205000047RG06
 Rev.: 01
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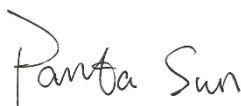
TEST REPORT

Application No.: SEWM2205000047RG
Applicant: Heimgard Technologies AS
Address of Applicant: Postbox 1618 VIKA, 0119 Oslo, Norway
Manufacturer: Heimgard Technologies AS
Address of Manufacturer: Postbox 1618 VIKA, 0119 Oslo, Norway
EUT Description: Hybrid Router 4G
Model No.: C4DM-ADAE-C0S0CCLEH-HCv1
Trade Mark: Heimgard, Heimgard Technologies
FCC ID: 2A62BHYBRIDROUTER4G
Standards: FCC 47 CFR Part 2, Subpart J
 FCC 47 CFR Part 15, Subpart C
Date of Receipt: 2022/05/27
Date of Test: 2022/06/10 to 2022/06/25
Date of Issue: 2022/07/04

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:



Panta Sun
 Wireless Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2022/07/04		Original

Prepared By		 <hr/> (Tizy Song) / Test Engineer
Checked By		 <hr/> (Well Wei) / Reviewer



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Wireless Laboratory

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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 2013 Section 6.2	Clause 4.2	PASS
Conducted Output Power	15.247 (b)(3)	ANSI C63.10 2013 Section 11.9.2.3	Clause 4.4	PASS
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
Power Spectral Density	15.247 (e)	ANSI C63.10 2013 Section 11.10.2	Clause 4.6	PASS
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 2013 Section 11.11	Clause 4.7	PASS
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 2013 Section 11.11	Clause 4.8	PASS
Radiated Spurious Emissions	15.205/15.209	ANSI C63.10 2013 Section 11.12	Clause 4.9	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.205/15.209	ANSI C63.10 2013 Section 11.12	Clause 4.10	PASS



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3 General Information

3.1 Details of Client

Applicant:	Heimgard Technologies AS
Address of Applicant:	Postbox 1618 VIKA, 0119 Oslo, Norway
Manufacturer:	Heimgard Technologies AS
Address of Manufacturer:	Postbox 1618 VIKA, 0119 Oslo, Norway

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.
Address:	South of No. 6 Plant, No. 1, Runsheng Road, Suzhou Industrial Park, Suzhou Area, China (Jiangsu) Pilot Free Trade Zone
Post code:	215000
Test engineer:	Lves Cheng, Tizy Song

3.3 Test Facility

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

- A2LA (Certificate No. 6336.01)**
 SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01.
- Innovation, Science and Economic Development Canada**
 SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory.
 CAB identifier: CN0120.
 IC#: 27594.
- FCC –Designation Number: CN1312**
 SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory.
 Designation Number: CN1312.
 Test Firm Registration Number: 717327



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3.4 General Description of EUT

EUT Description:	Hybrid Router 4G
Model No.:	C4DM-ADAE-C0S0CCLEH-HCv1
Trade Mark:	Heimgard, Heimgard Technologies
Hardware Version:	C0S0CCLEH-HCv1
Software Version:	Version V23
Operation Frequency:	2400MHz~2483.5MHz
Modulation Type:	O-QPSK
Number of Channel:	16
Rates Type*:	<input checked="" type="checkbox"/> Provided by client
	250kbps
Antenna Type:	<input type="checkbox"/> External, <input checked="" type="checkbox"/> Integrated
Antenna Gain*:	<input checked="" type="checkbox"/> Provided by client
	1.0dBi(ANT4);
RF Cable:	1.0dB
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Operation Frequency of each channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2405MHz	4	2425MHz	8	2445MHz	12	2465MHz
1	2410MHz	5	2430MHz	9	2450MHz	13	2470MHz
2	2415MHz	6	2435MHz	10	2455MHz	14	2475MHz
3	2420MHz	7	2440MHz	11	2460MHz	15	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)	2405MHz
The Middle channel(CH7)	2440MHz
The Highest channel(CH15)	2480MHz



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3.5 Test Environment

Environment Parameter	101.0 kPa Selected Values During Tests	
Relative Humidity	44-46 % RH Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	22-23	12
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)
<p>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.</p> <p>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.</p>	
<p>The antenna is integrated and no consideration of replacement. The best case gain of the antenna is 1.0dBi(ANT4)(Provided by client)*;</p> <p><i>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.</i></p> <p><i>Remark:</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.</p>	



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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: 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:	<ol style="list-style-type: none"> 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. 		



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



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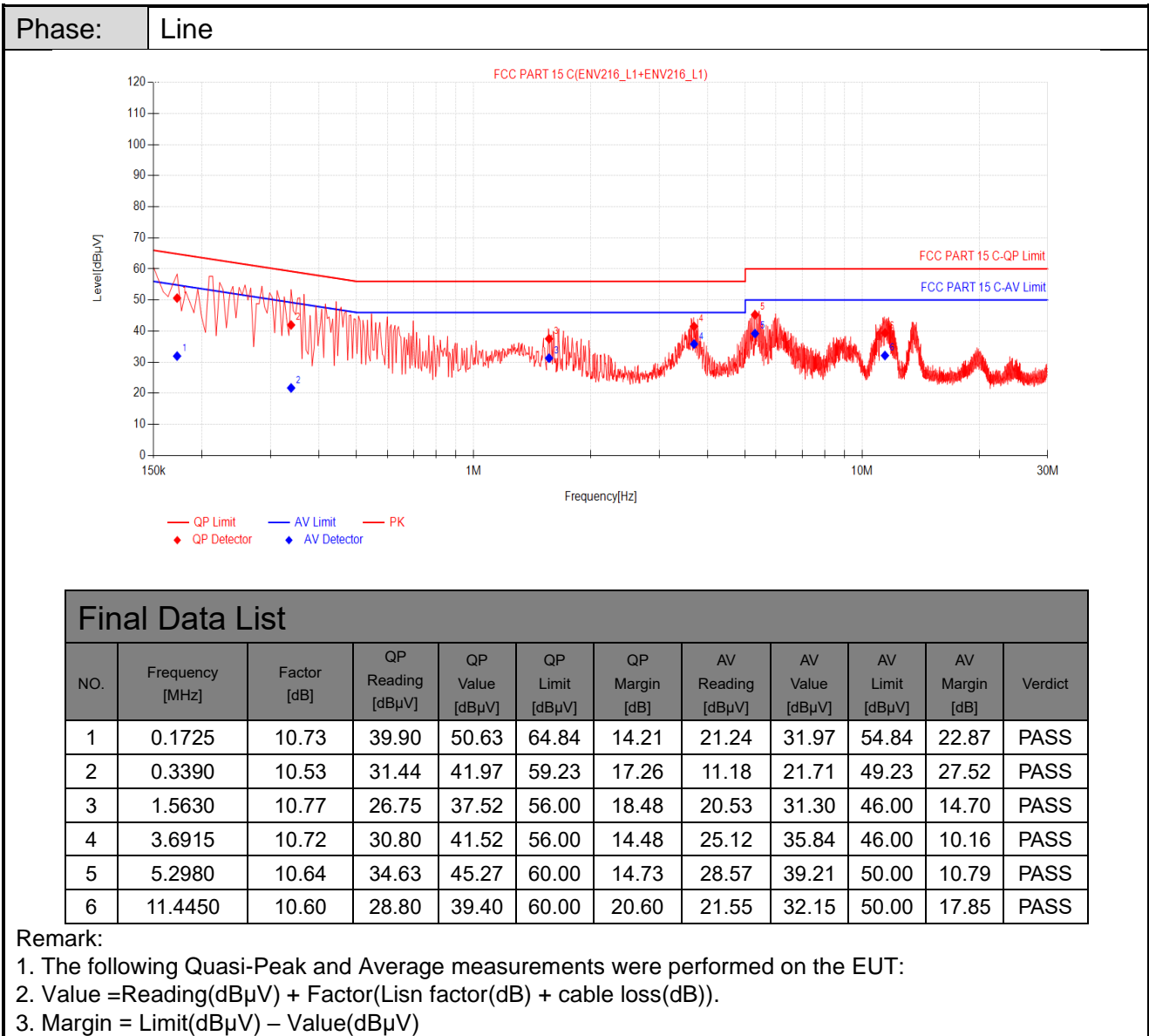
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Measurement Data

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.

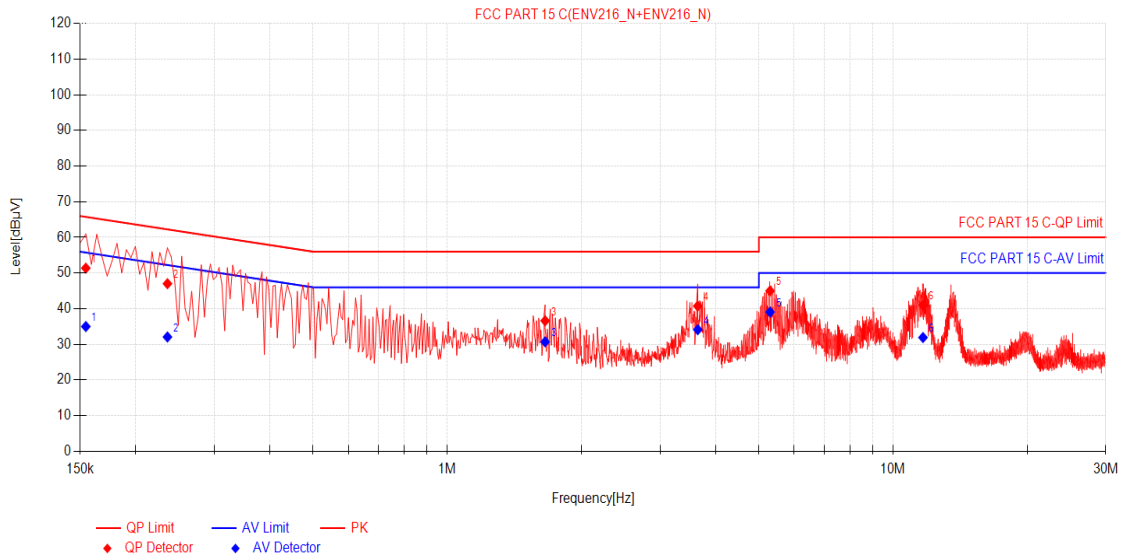


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Phase: Neutral



Final 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	0.1545	10.72	40.66	51.38	65.75	14.37	24.27	34.99	55.75	20.76	PASS
2	0.2355	10.71	36.31	47.02	62.25	15.23	21.36	32.07	52.25	20.18	PASS
3	1.6575	10.77	25.85	36.62	56.00	19.38	19.93	30.70	46.00	15.30	PASS
4	3.6465	10.69	30.05	40.74	56.00	15.26	23.43	34.12	46.00	11.88	PASS
5	5.2980	10.62	34.37	44.99	60.00	15.01	28.45	39.07	50.00	10.93	PASS
6	11.6745	10.65	30.35	41.00	60.00	19.00	21.26	31.91	50.00	18.09	PASS

Remark:

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



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4.3 Duty Cycle

The detailed test data see: **Appendix**



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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 :2013 Section11.9.2.3
Test Setup:	<p>* Test with power meter (Detector function: Peak)</p>
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
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 :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	



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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: 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	



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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: 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	



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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 :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:

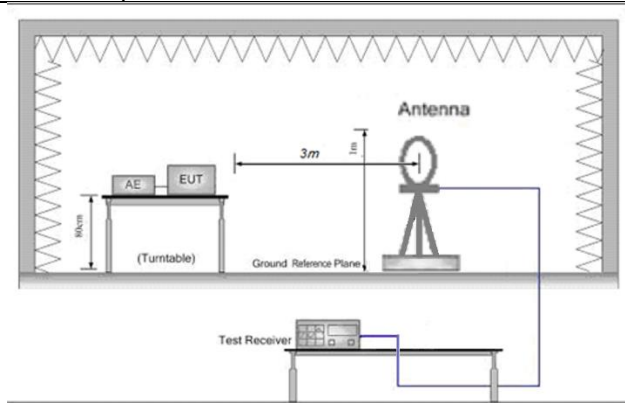


Figure 1. Below 30MHz

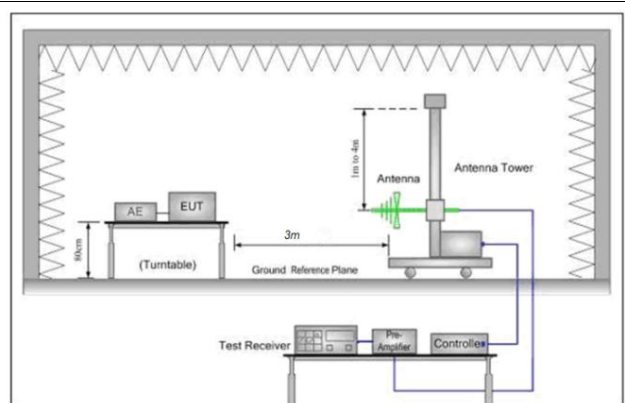


Figure 2. 30MHz to 1GHz



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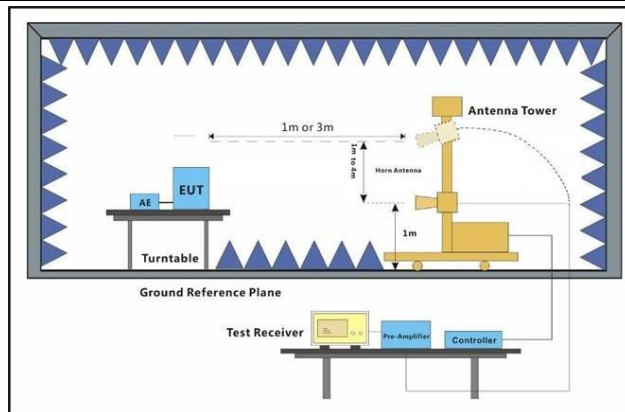


Figure 3. Above 1 GHz

<p>Test Procedure:</p>	<ol style="list-style-type: none"> 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 $20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}$.
<p>Test Configuration:</p>	<p>Measurements Below 1000MHz</p> <ul style="list-style-type: none"> RBW = 120 kHz VBW = 300 kHz Detector = Peak Trace mode = max hold



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	<p>Peak Measurements Above 1000 MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW ≥ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold <p>Average Measurements Above 1000MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW ≥ [3 *RBW] • Detector = RMS (power averaging), if span / (# of points in sweep) ≤ (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak. • Sweep time = auto • Perform a trace average of at least 100 traces. <p>Level = Reading Level(dBμV) + Factor(dB): Factor = AF(dB/m) + (Cable Factor(dB) - Preamplifier Gain(dB)) AF = Antenna Factor(dB/m) Margin = Limit(dBμV/m) – Level(dBμV/m)</p>
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, the worst case is the lowest channel. 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	



4.10 Restricted 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:

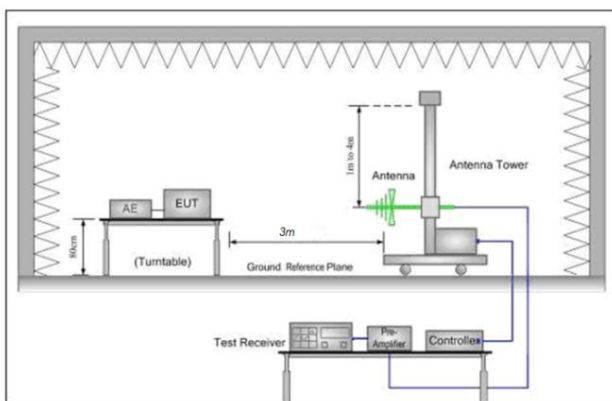


Figure 1. 30MHz to 1GHz

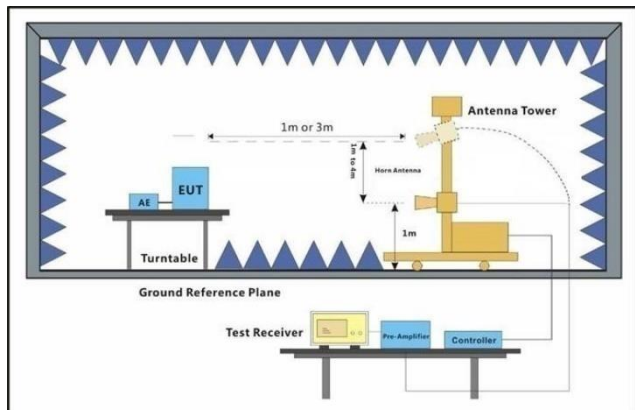


Figure 2. Above 1 GHz

Test Procedure:

- 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 Bandwidth with Maximum Hold Mode.
- 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



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	<p>bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel</p> <p>h. Test the EUT in the lowest channel , the Highest channel</p> <p>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.</p> <p>j. Repeat above procedures until all frequencies measured was complete.</p>
Test Configuration:	<p>Measurements Below 1000MHz</p> <ul style="list-style-type: none"> • RBW = 120 kHz • VBW = 300 kHz • Detector = Peak • Trace mode = max hold <p>Peak Measurements Above 1000 MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW ≥ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold <p>Average Measurements Above 1000MHz</p> <ul style="list-style-type: none"> • RBW = 1 MHz • VBW ≥ [3 *RBW] • Detector = RMS (power averaging), if span / (# of points in sweep) ≤ (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak. • Sweep time = auto • Perform a trace average of at least 100 traces. <p>Level = Reading Level(dBμV) + Factor(dB): Factor = AF(dB/m) + Cable Factor(dB) AF = Antenna Factor(dB/m) Margin = Limit(dBμV/m) – Level(dBμV/m)</p>
Exploratory Test Mode:	<p>Transmitting with GFSK modulation. Charge + Transmitting mode.</p>
Final Test Mode:	<p>Transmitting with GFSK modulation. Pretest the EUT at Charge + Transmitting mode. Only the worst case is recorded in the report.</p>
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	Total RF power, conducted	±0.54dB
2	RF power density, conducted	±1.03dB
3	Spurious emissions, conducted	±0.54dB
4	Radio Frequency	±1.0%
5	Duty Cycle	±0.37%
6	Occupied Bandwidth	±1.0%
7	Conduction Emission	± 2.90dB (150kHz to 30MHz)
8	Radiated Emission	± 3.13dB (9k -30MHz)
		± 4.80dB (30M -1GHz)
		± 4.80dB (1GHz to 18GHz)
		± 4.80dB (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 Equipment					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Shielding Room	Brilliant-emc	N/A	SUWI-04-01-06	2021/05/08	2024/05/07
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-07	2022/02/16	2023/02/15
Signal Analyzer	ROHDE&SCHWARZ	FSV3030	SUWI-01-02-02	2022/05/17	2023/05/16
Measurement Software	Tonscend	JS1120-3 Test System V3.1.55	SUWI-02-09-09	NCR	NCR
DC Power Supply	HYELEC	HY3005B	SUWI-01-18-01	2022/02/15	2023/02/14
Power meter	Anritsu	ML2495A	SUWI-01-31-01	2021/12/04	2022/12/03
Pulse power sensor	Anritsu	MA2411b	SUWI-01-32-01	2021/12/04	2022/12/03

CE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Shielding Room	Brilliant-emc	N/A	SUWI-04-03-01	2021/05/08	2024/05/07
Artificial network	ROHDE&SCHWARZ	ENV216	SUWI-01-19-01	2022/02/19	2023/02/18
Artificial network	ROHDE&SCHWARZ	ENV216	SUWI-01-19-02	2022/02/19	2023/02/18
Measurement Software	Tonscend	JS32-CE V4.0.0.2	SUWI-02-09-05	NCR	NCR
Test receiver	ROHDE&SCHWARZ	ESR7	SUWI-01-10-01	2022/02/19	2023/02/18
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-06	2022/02/16	2023/02/15



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RSE Test Equipment					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Semi-Anechoic Chamber	Brilliant-emc	N/A	SUWI-04-02-01	2021/05/08	2024/05/07
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-05	2022/02/16	2023/02/15
Signal Analyzer	ROHDE&SCHWARZ	FSW43	SUWI-01-02-04	2022/05/28	2023/05/27
Signal Analyzer	KEYSIGHT	N9020A	SUWI-01-02-05	2021/12/04	2022/12/03
Test receiver	ROHDE&SCHWARZ	ESR7	SUWI-01-10-01	2022/02/19	2023/02/18
DC Power Supply	HYELEC	HY3005B	SUWI-01-18-01	2022/02/15	2023/02/14
Receiving antenna	SCHWRZBECK MESS- ELEKTRONIK	VULB 9163	SUWI-01-11-01	2021/05/16	2023/05/15
Receiving antenna	SCHWRZBECK MESS- ELEKTRONIK	BBHA 9120D	SUWI-01-11-02	2021/05/16	2023/05/15
Receiving antenna	SCHWRZBECK MESS- ELEKTRONIK	BBHA 9170	SUWI-01-11-03	2021/05/14	2023/05/13
Amplifier	Tonscend	TAP9K3G40	SUWI-01-14-01	2022/02/14	2023/02/13
Amplifier	Tonscend	TAP01018050	SUWI-01-14-02	2022/02/14	2023/02/13
Amplifier	Tonscend	TAP18040048	SUWI-01-14-03	2022/02/19	2023/02/18
Active Loop Antenna	SCHWRZBECK MESS- ELEKTRONIK	FMZB 1519B	SUWI-01-21-01	2021/06/10	2023/06/09
Measurement Software	Tonscend	JS32-RE V4.0.0.0	SUWI-02-09-04	NCR	NCR
Measurement Software	Tonscend	JS32-RSE V4.0.0.1	SUWI-02-09-06	NCR	NCR



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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
ZIGB	Ant4	2405	0.55	2404.72	2405.27	≥0.5	PASS
		2440	0.55	2439.72	2440.27	≥0.5	PASS
		2480	0.55	2479.72	2480.27	≥0.5	PASS



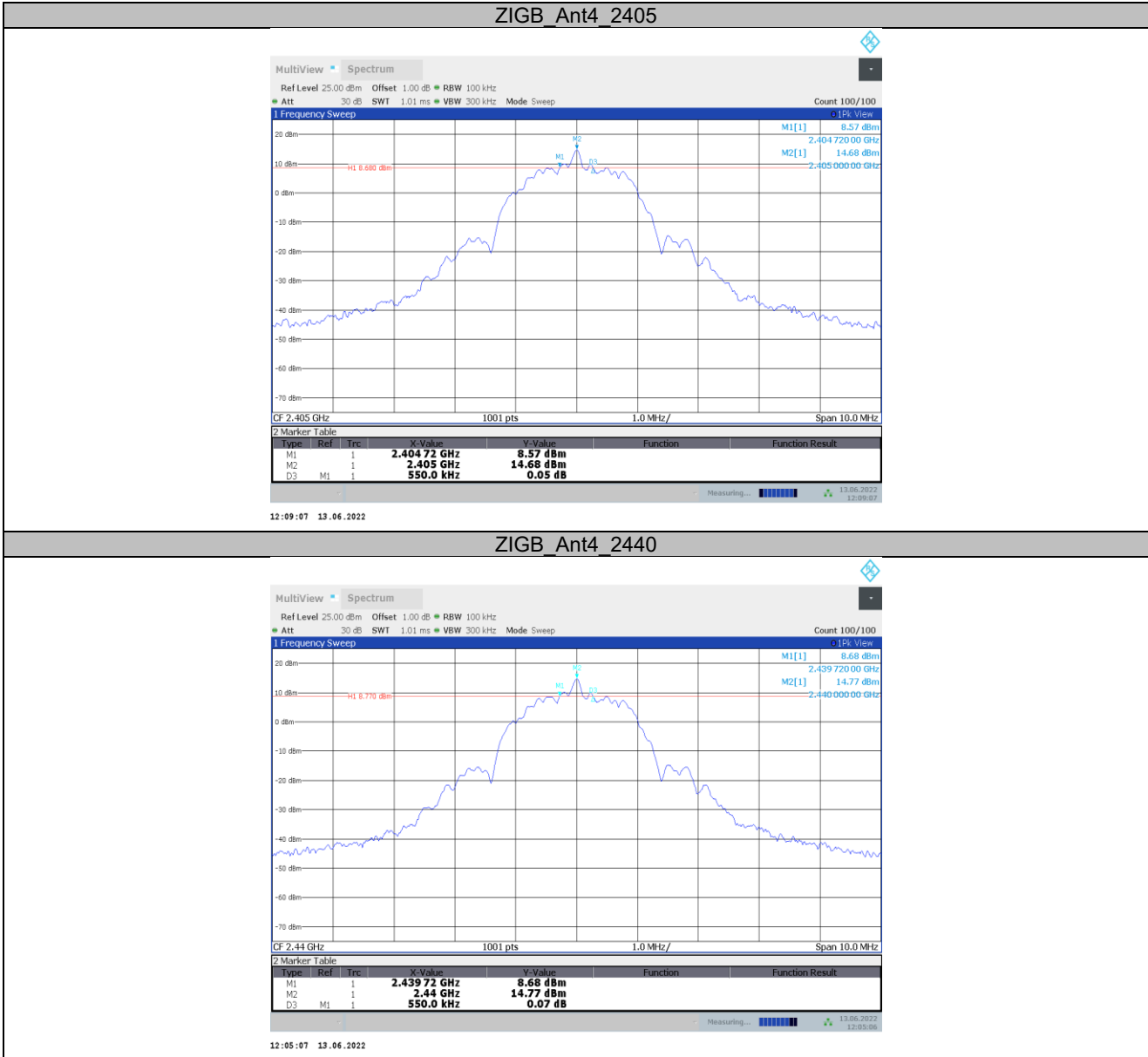
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Test Graphs

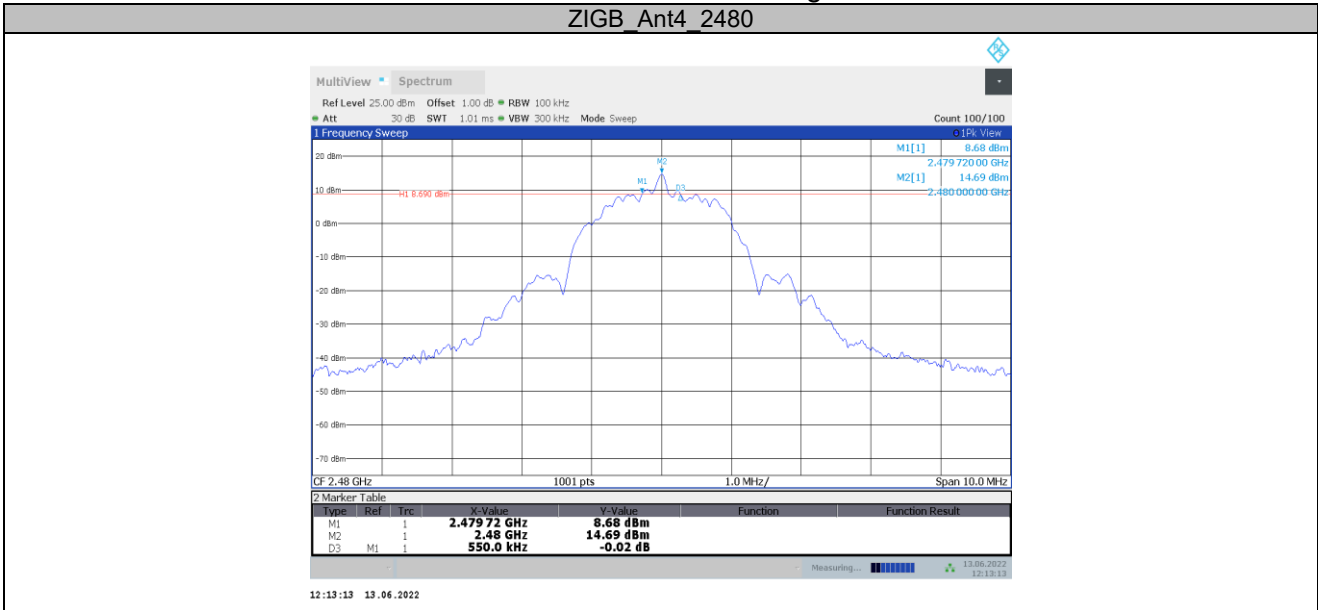


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Occupied Channel Bandwidth Test Result

TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
ZIGB	Ant4	2405	2.211	2403.859	2406.069	---	---
		2440	2.216	2438.857	2441.073	---	---
		2480	2.223	2478.853	2481.076	---	---



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Test Graphs

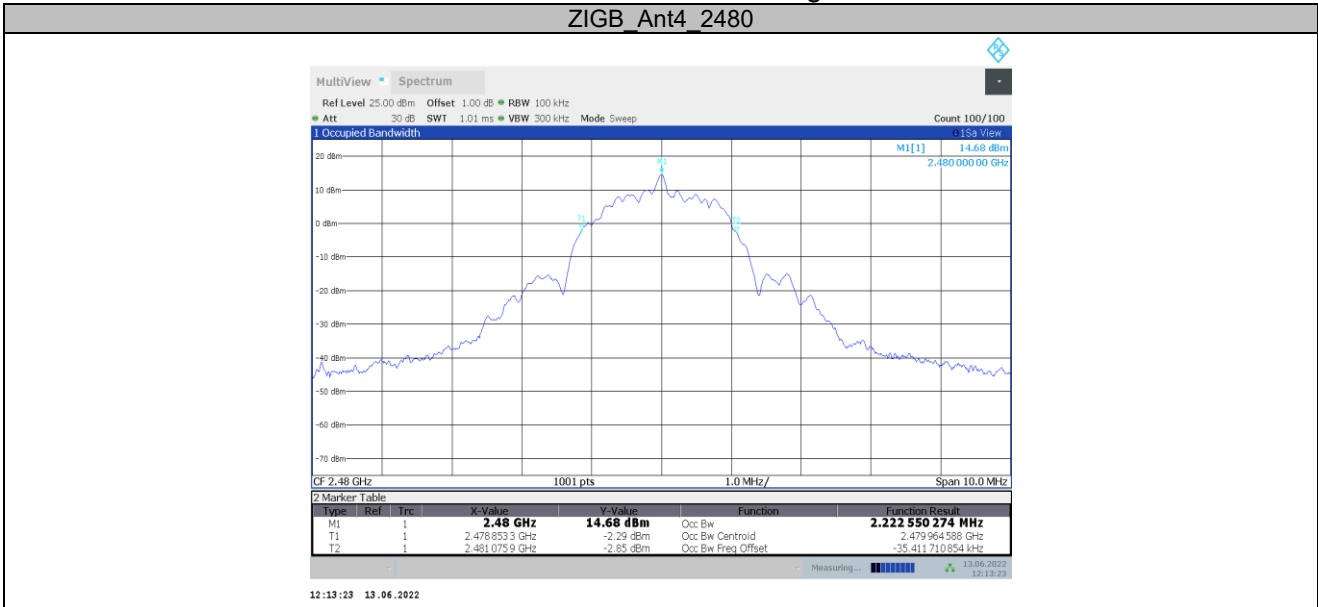


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ZIGB_Ant4_2480



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Report No.: SEWM2205000047RG06

Rev.: 01

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**Maximum peak power
Test Result**

TestMode	Antenna	Frequency[MHz]	peak power[dBm]	Limit[dBm]	Verdict
ZIGB	Ant4	2405	13.86	≤30	PASS
		2440	13.79	≤30	PASS
		2480	13.75	≤30	PASS



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Report No.: SEWM2205000047RG06

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**Maximum power spectral density
Test Result**

TestMode	Antenna	Frequency[MHz]	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
ZIGB	Ant4	2405	0.37	≤8.00	PASS
		2440	0.49	≤8.00	PASS
		2480	0.46	≤8.00	PASS



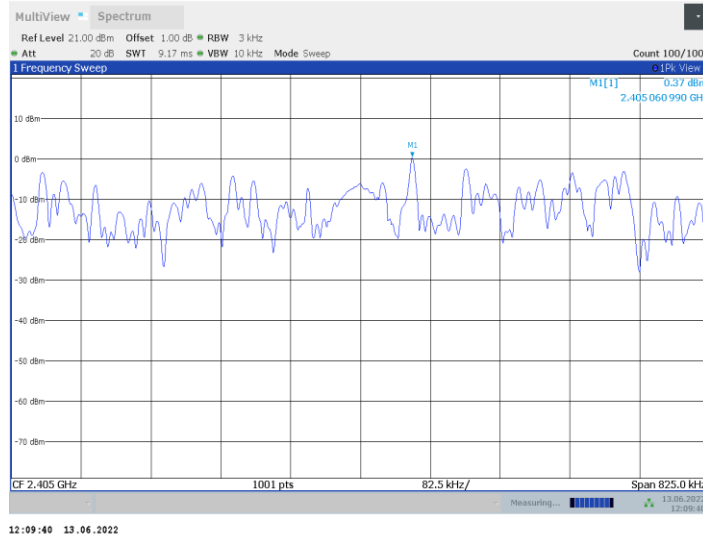
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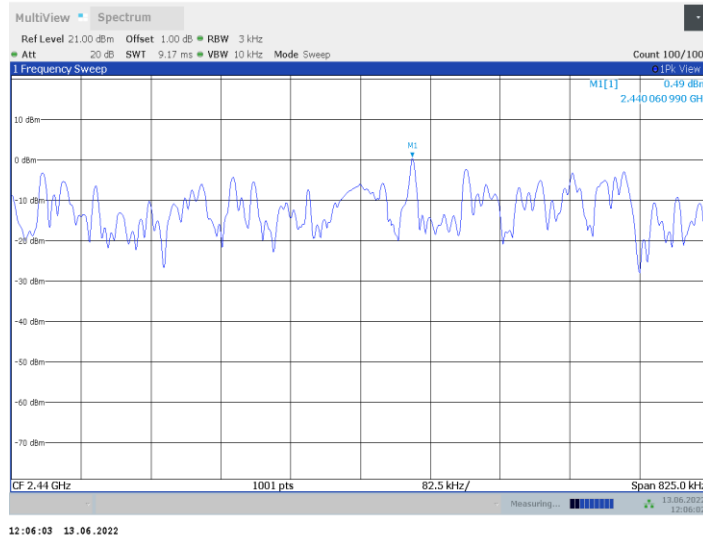
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Test Graphs

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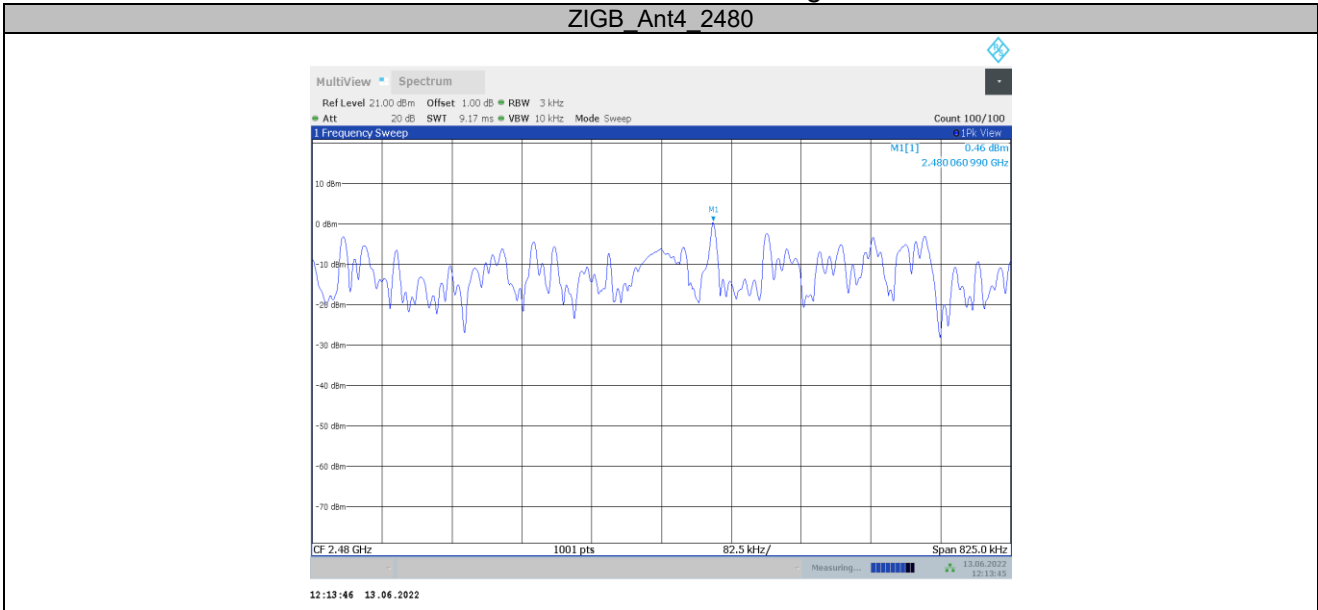


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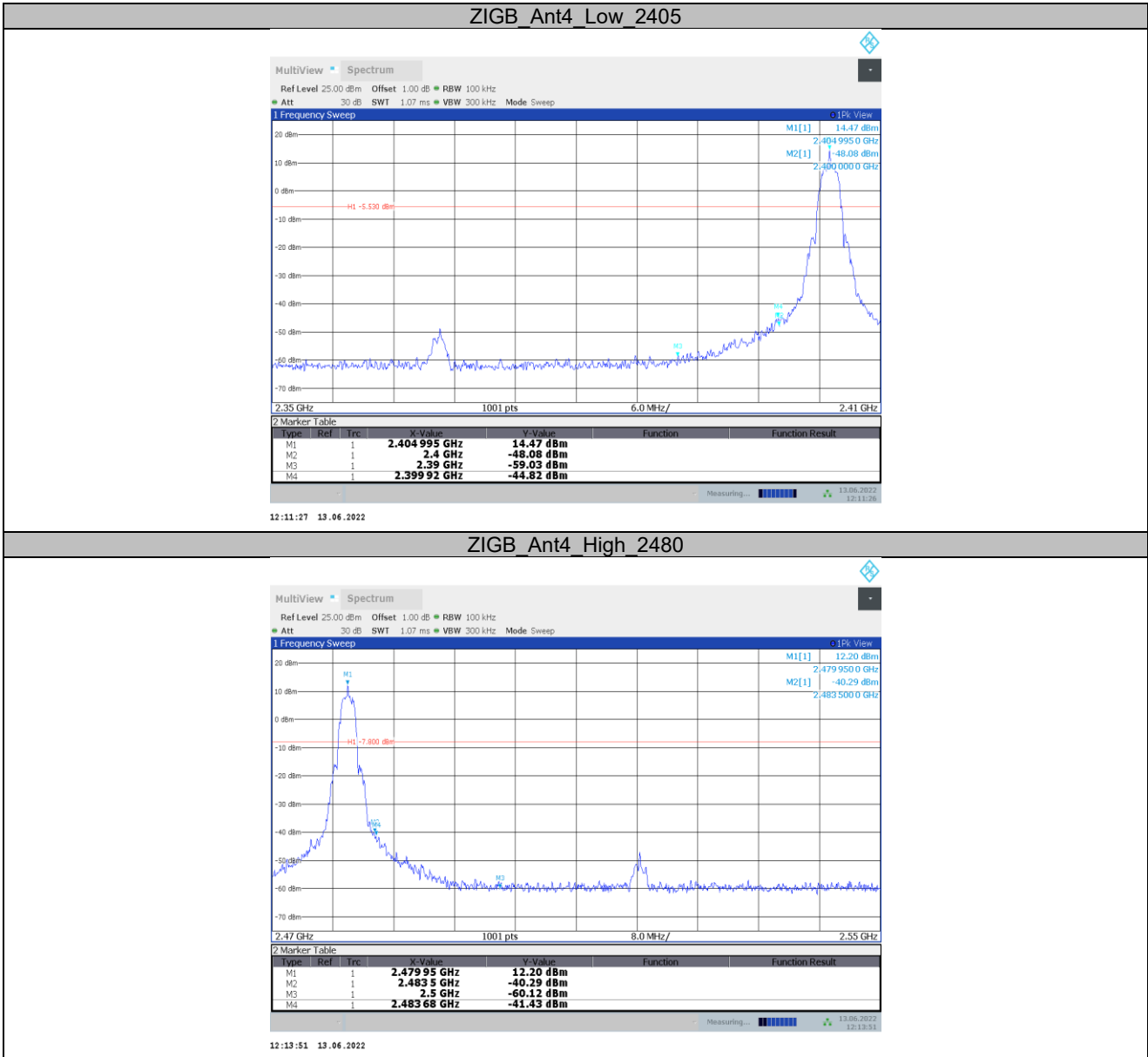
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Band edge measurements Test Graphs

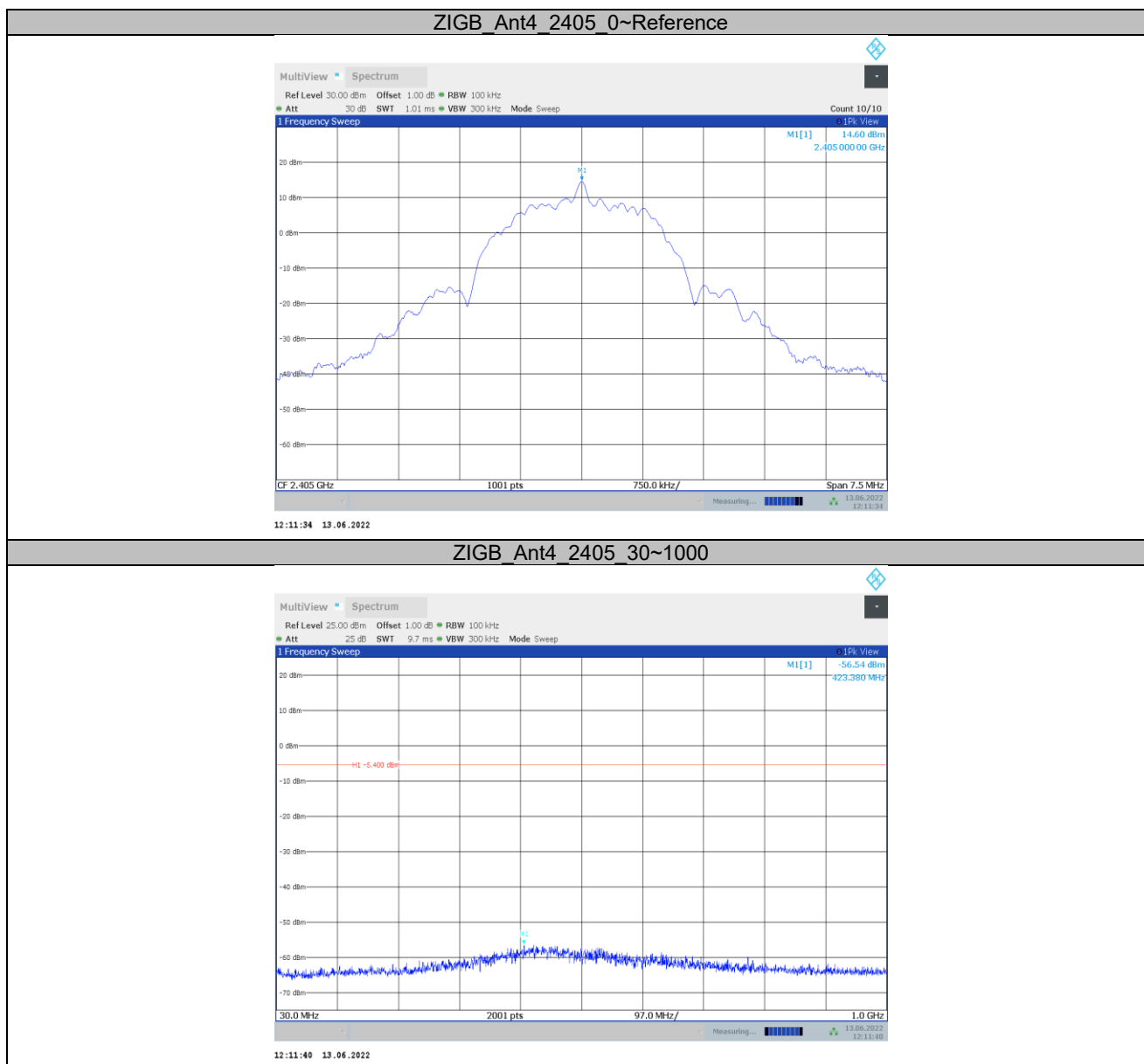


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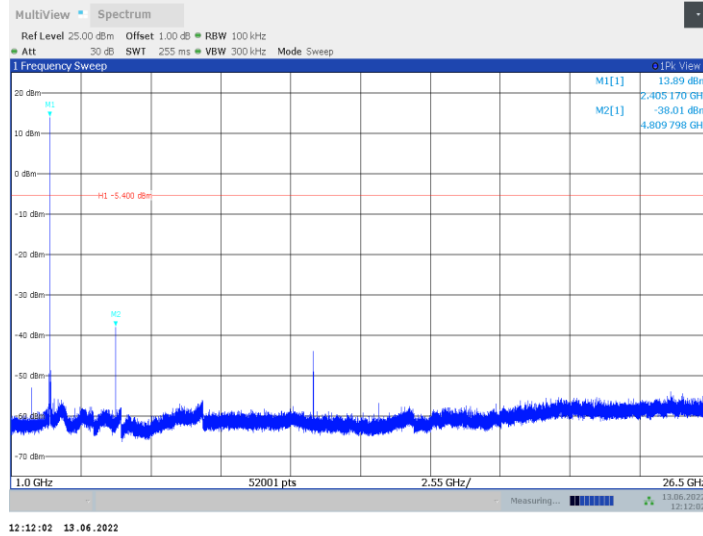
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Conducted Spurious Emission Test Graphs

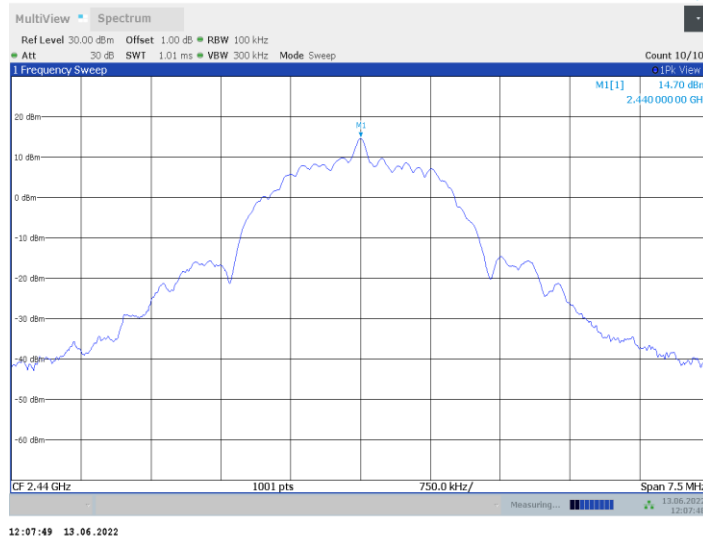


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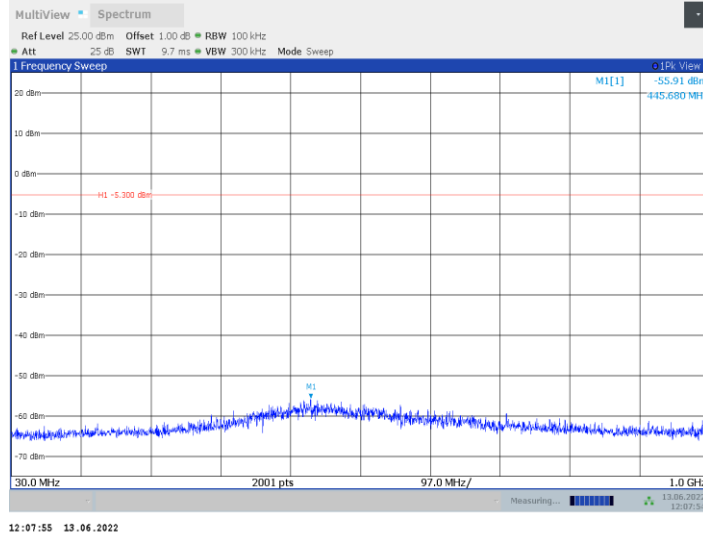
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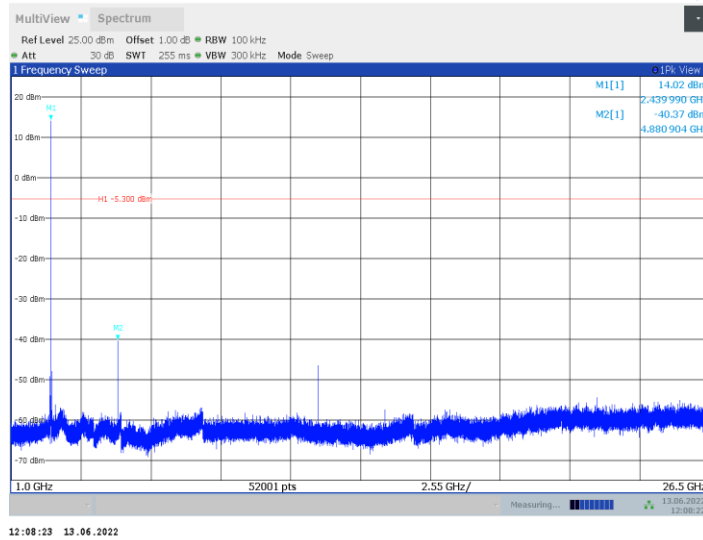
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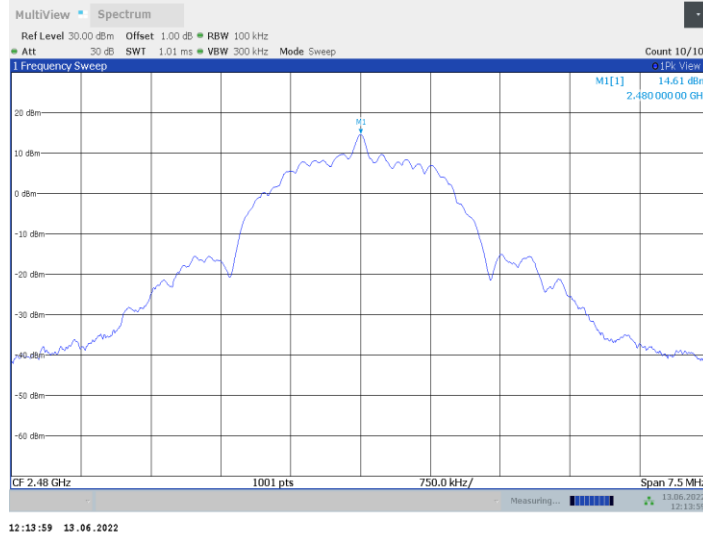


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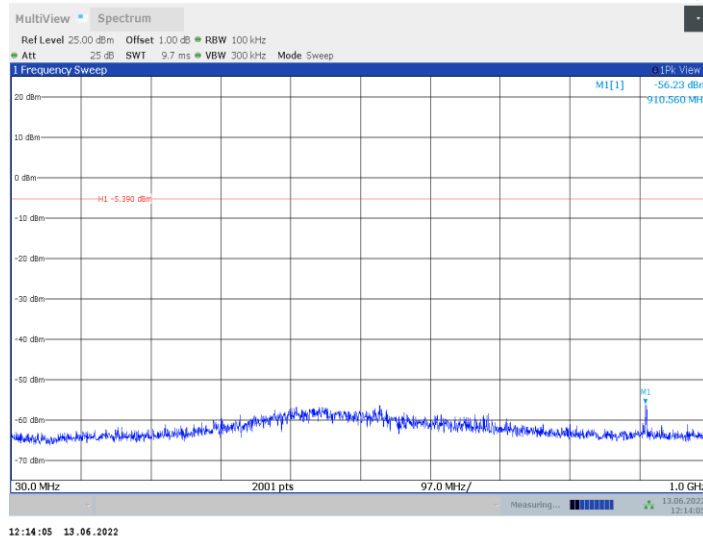
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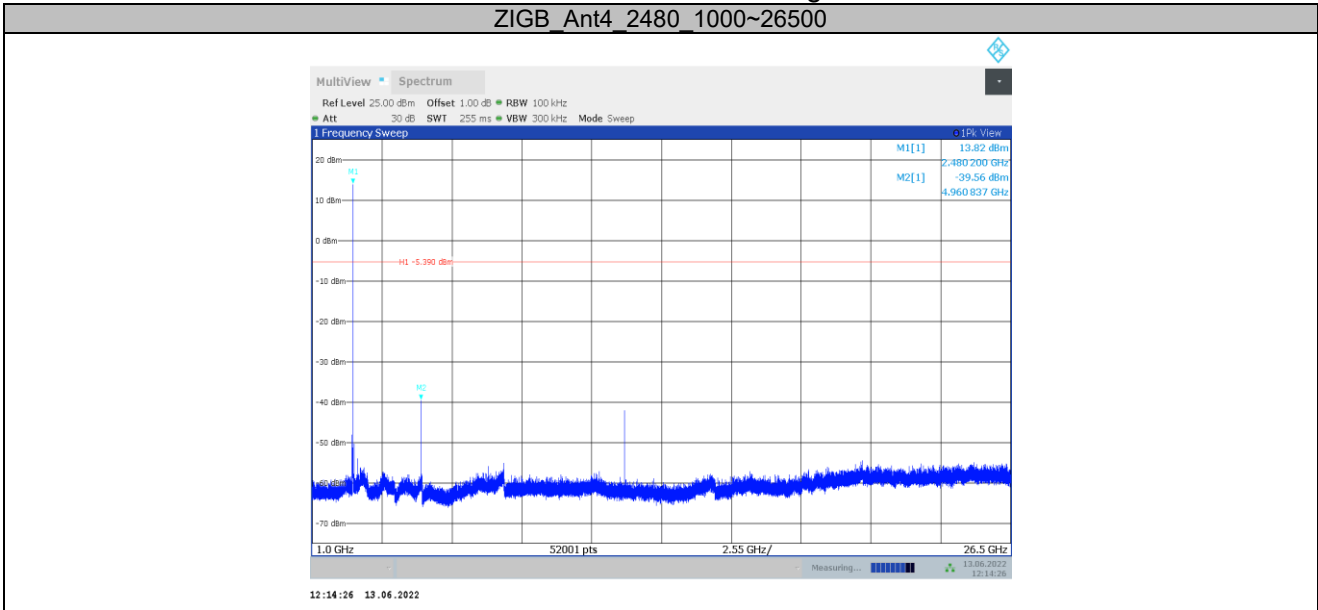


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Report No.: SEWM2205000047RG06

Rev.: 01

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Duty Cycle Test Result

TestMode	Antenna	Frequency[MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Limit	Verdict
ZIGB	Ant4	2405	0.33	0.55	60.00	---	---



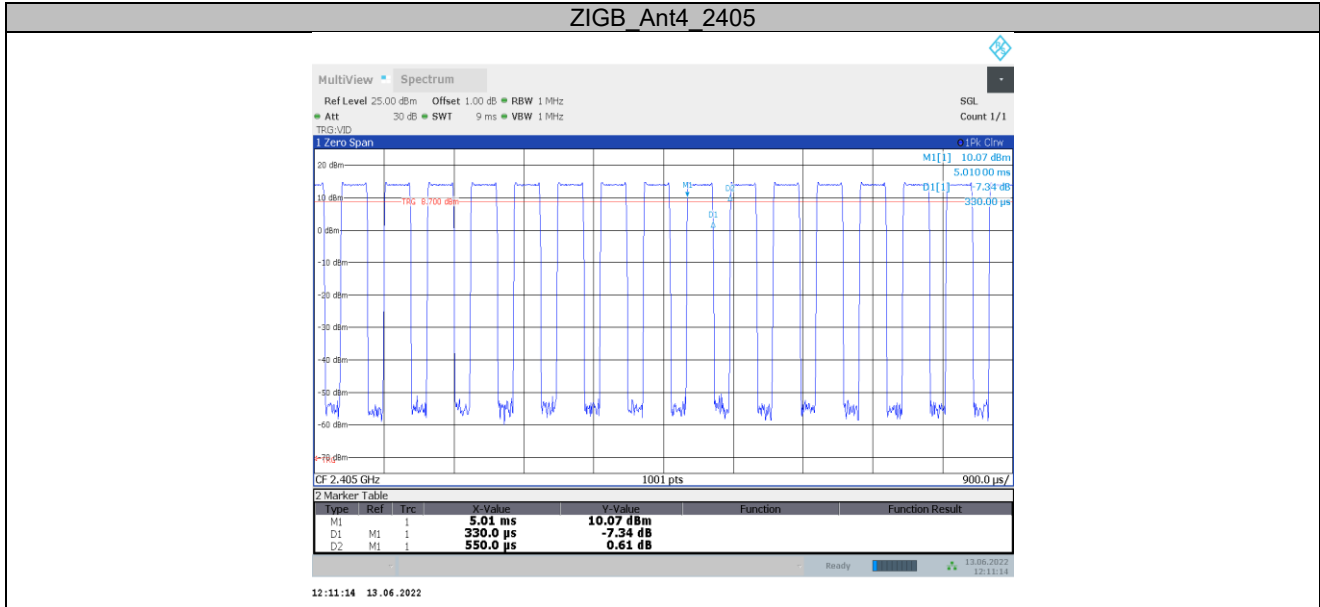
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 Wireless Laboratory

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Test Graphs



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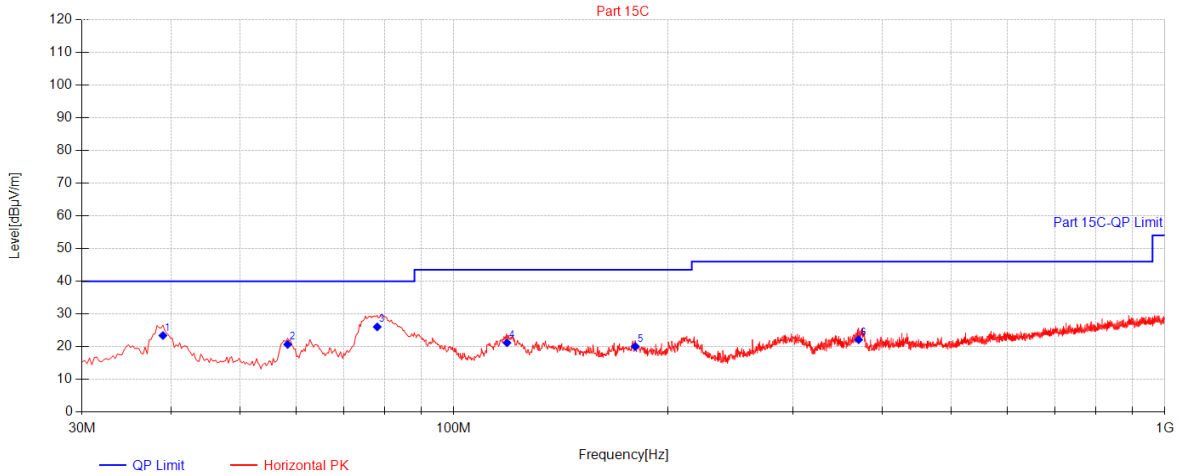
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Radiated Spurious Emissions

Radiated emission below 1GHz

Worst case Mode: Zigbee_ Channel 0



Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	38.9725	45.75	-22.38	23.37	40.00	16.63	136	126	Horizontal
2	58.3725	44.13	-23.48	20.65	40.00	19.35	251	135	Horizontal
3	78.015	52.23	-26.21	26.02	40.00	13.98	189	156	Horizontal
4	118.755	45.19	-24.05	21.14	43.50	22.36	291	318	Horizontal
5	179.865	40.59	-20.55	20.04	43.50	23.46	178	2	Horizontal
6	370.7125	42.03	-19.92	22.11	46.00	23.89	166	316	Horizontal

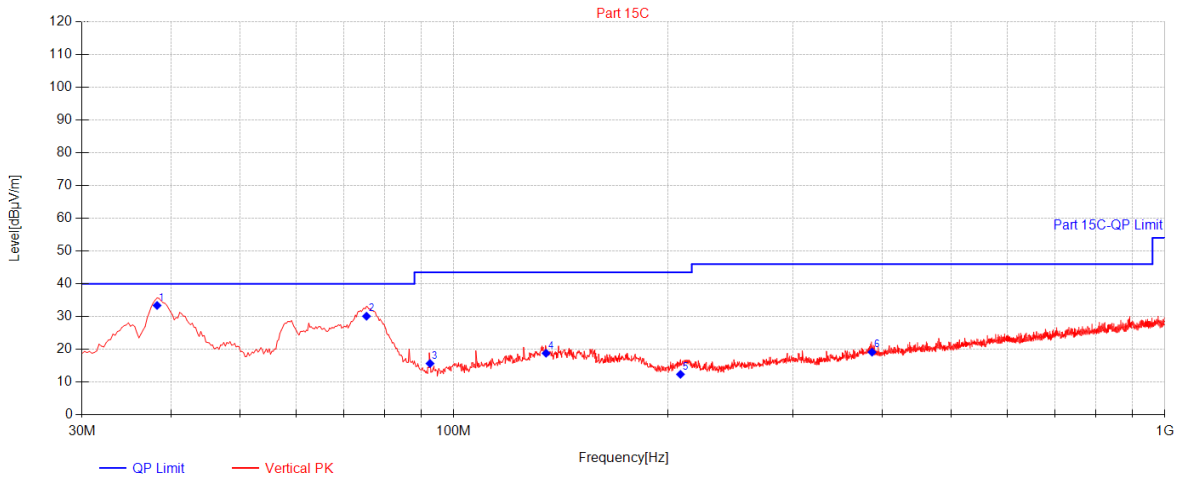


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Final Data List

NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	38.245	55.89	-22.51	33.38	40.00	6.62	203	358	Vertical
2	75.3475	56.13	-26.04	30.09	40.00	9.91	234	284	Vertical
3	92.565	42.28	-26.64	15.64	43.50	27.86	166	54	Vertical
4	134.76	41.23	-22.46	18.77	43.50	24.73	294	351	Vertical
5	208.2375	37.19	-24.86	12.33	43.50	31.17	175	141	Vertical
6	387.2025	38.03	-18.92	19.11	46.00	26.89	213	81	Vertical



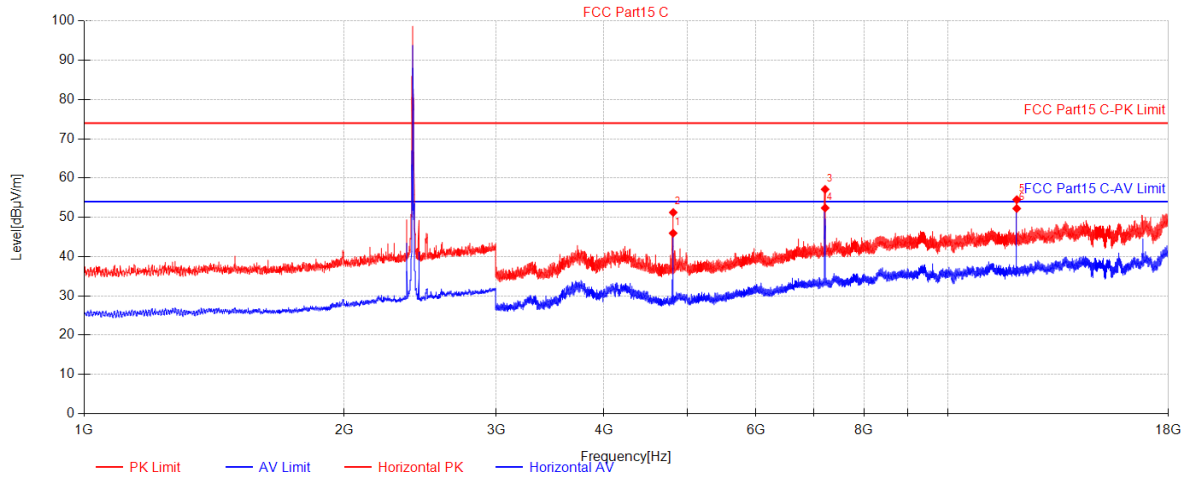
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Transmitter emission Above 1GHz

Zigbee_Channel 0



Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4809.5	59.15	-13.19	45.96	54.00	8.04	168	210	Horizontal
2	4811	64.43	-13.19	51.24	74.00	22.76	194	190	Horizontal
3	7213.5	64.00	-6.87	57.13	74.00	16.87	172	105	Horizontal
4	7214	59.25	-6.87	52.38	54.00	1.62	230	127	Horizontal
5	12025	53.07	1.43	54.50	74.00	19.50	266	1	Horizontal
6	12025.5	50.81	1.43	52.24	54.00	1.76	133	12	Horizontal

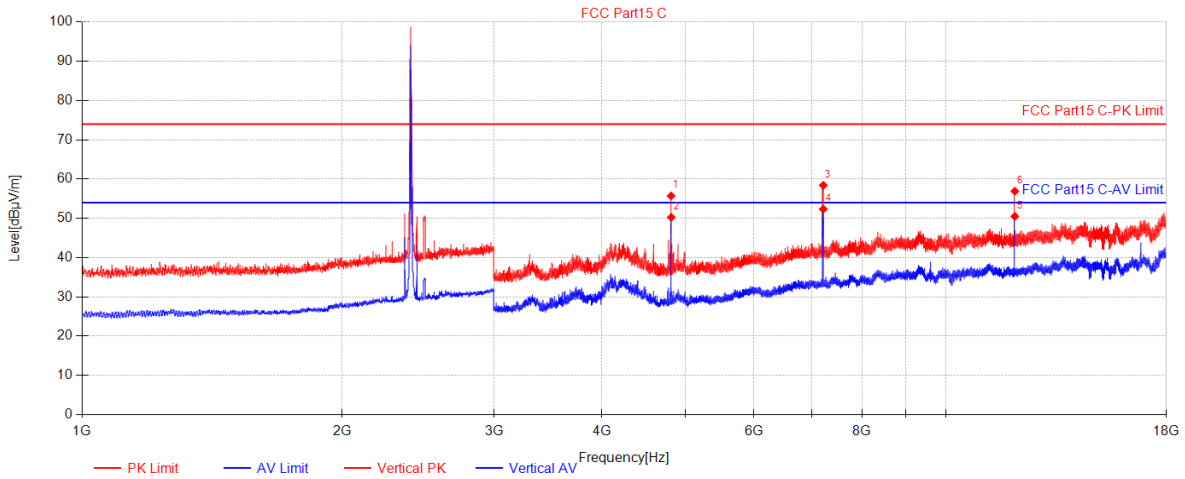


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Zigbee_Channel 0



Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4809	68.91	-13.19	55.72	74.00	18.28	168	209	Vertical
2	4811.5	63.45	-13.19	50.26	54.00	3.74	194	232	Vertical
3	7216.5	65.30	-6.88	58.42	74.00	15.58	172	84	Vertical
4	7217	59.24	-6.89	52.35	54.00	1.65	230	84	Vertical
5	12025.5	49.06	1.43	50.49	54.00	3.51	255	188	Vertical
6	12027.5	55.47	1.44	56.91	74.00	17.09	166	190	Vertical

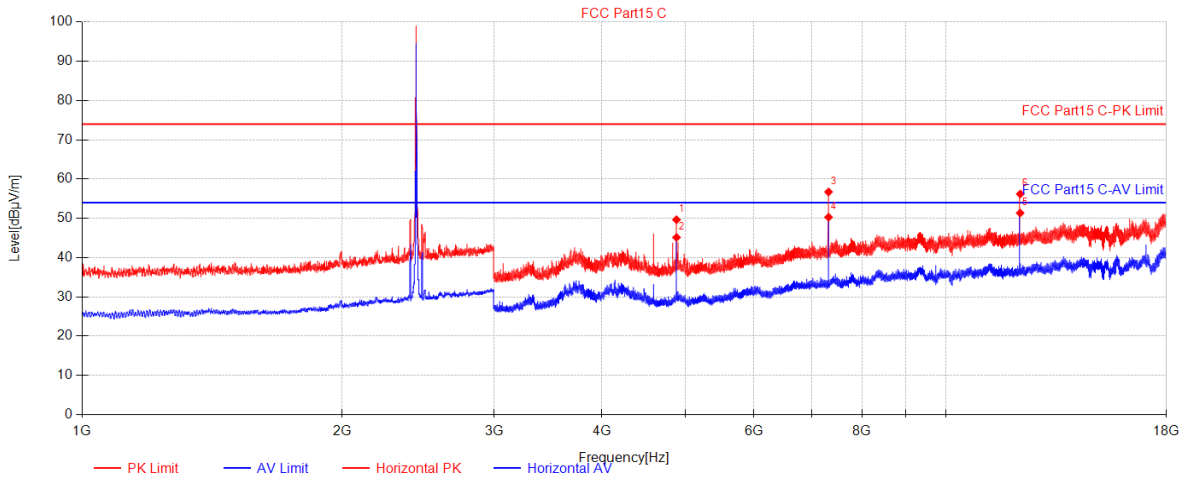


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Zigbee_Channel 7



Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4879	62.64	-12.99	49.65	74.00	24.35	196	211	Horizontal
2	4879.5	58.13	-12.99	45.14	54.00	8.86	225	211	Horizontal
3	7318.5	63.87	-7.15	56.72	74.00	17.28	236	105	Horizontal
4	7319	57.44	-7.15	50.29	54.00	3.71	148	125	Horizontal
5	12200.5	49.70	1.64	51.34	54.00	2.66	172	0	Horizontal
6	12202.5	54.56	1.64	56.20	74.00	17.80	201	318	Horizontal

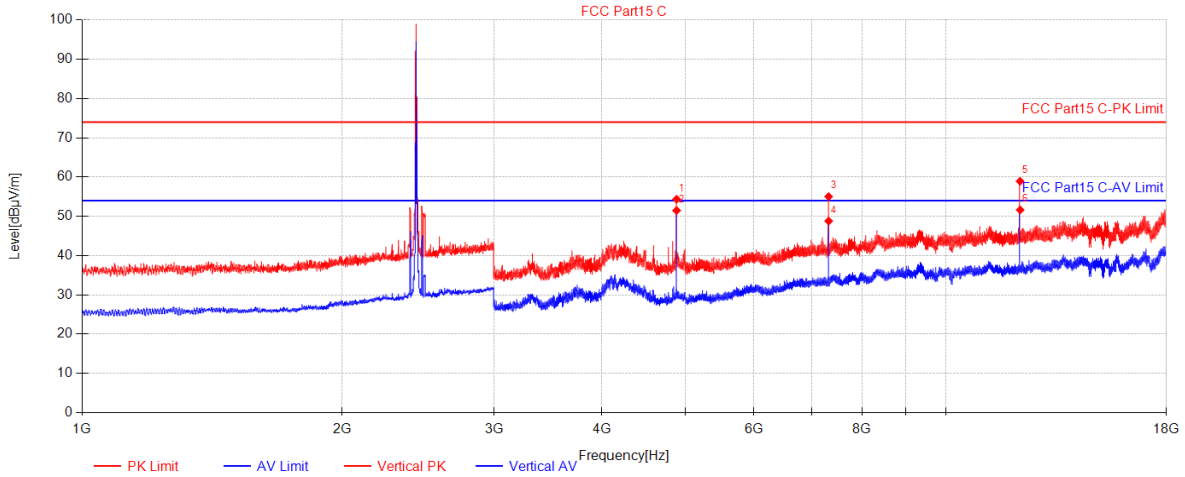


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Zigbee_Channel 7



Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4880	67.35	-12.99	54.36	74.00	19.64	169	271	Vertical
2	4880.5	64.48	-12.99	51.49	54.00	2.51	198	272	Vertical
3	7320	62.18	-7.15	55.03	74.00	18.97	175	155	Vertical
4	7320.5	55.95	-7.15	48.80	54.00	5.20	152	40	Vertical
5	12197	57.30	1.64	58.94	74.00	15.06	255	208	Vertical
6	12200.5	50.00	1.64	51.64	54.00	2.36	230	313	Vertical

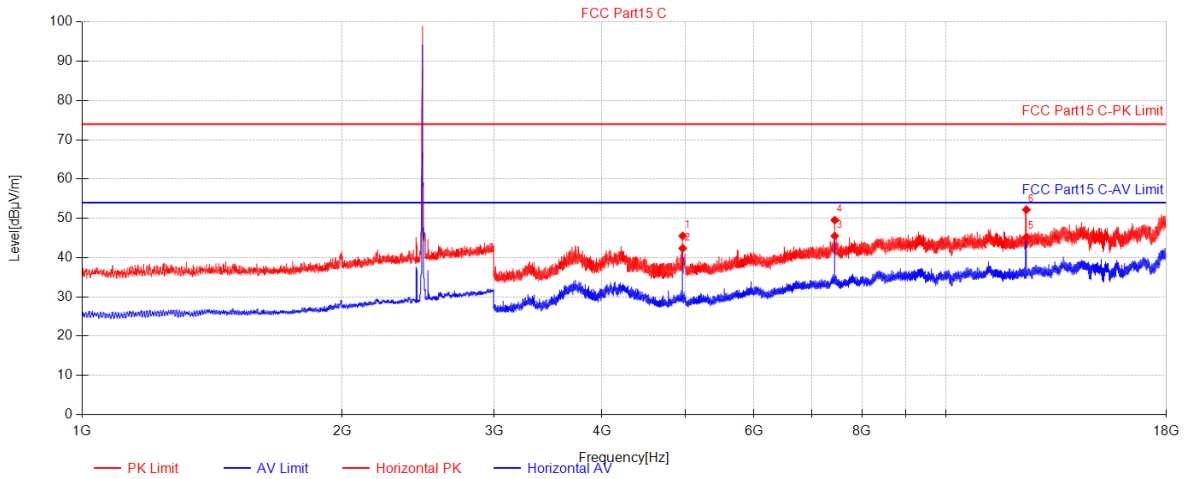


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Zigbee_Channel 15



Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4960	58.34	-12.83	45.51	74.00	28.49	185	169	Horizontal
2	4960.5	55.19	-12.83	42.36	54.00	11.64	194	169	Horizontal
3	7440.5	52.33	-6.83	45.50	54.00	8.50	172	189	Horizontal
4	7441.5	56.37	-6.83	49.54	74.00	24.46	231	104	Horizontal
5	12400.5	43.67	1.51	45.18	54.00	8.82	166	0	Horizontal
6	12402.5	50.67	1.53	52.20	74.00	21.80	201	140	Horizontal

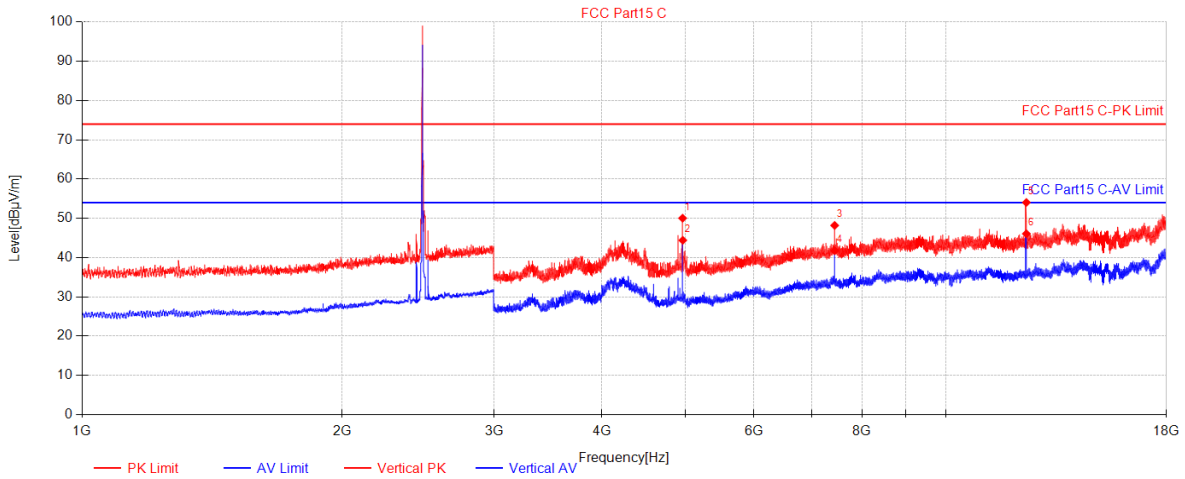


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Zigbee_Channel 15



Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4959	62.87	-12.83	50.04	74.00	23.96	145	253	Vertical
2	4961.5	57.23	-12.83	44.40	54.00	9.60	196	122	Vertical
3	7438.5	55.03	-6.84	48.19	74.00	25.81	188	190	Vertical
4	7440.5	48.59	-6.83	41.76	54.00	12.24	163	148	Vertical
5	12403	52.51	1.53	54.04	74.00	19.96	271	23	Vertical
6	12403	44.54	1.53	46.07	54.00	7.93	144	231	Vertical

Remark:

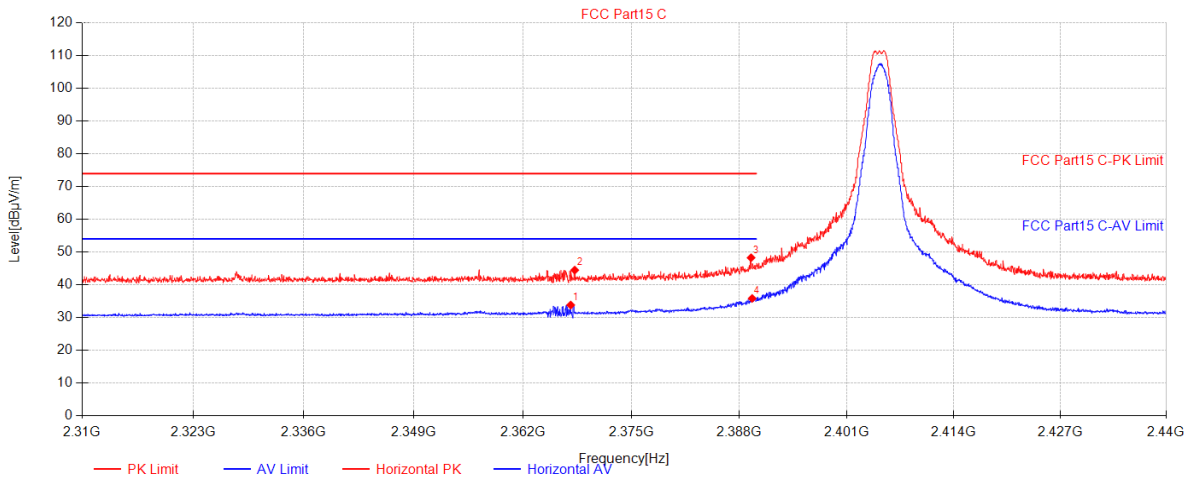
Level = Reading Level(dBµV) + Factor(dB):
 Factor = AF(dB/m) + (Cable Factor(dB) - Preamplifier Gain(dB))
 AF = Antenna Factor(dB/m)
 Margin = Limit(dBµV/m) – Level(dBµV/m)



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Restricted bands around fundamental frequency

Zigbee_Channel 0



Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2367.72	30.73	3.08	33.81	54.00	20.19	255	163	Horizontal
2	2368.1967	41.40	3.08	44.48	74.00	29.52	255	163	Horizontal
3	2389.3867	45.19	3.07	48.26	74.00	25.74	255	163	Horizontal
4	2389.5167	32.75	3.07	35.82	54.00	18.18	255	163	Horizontal



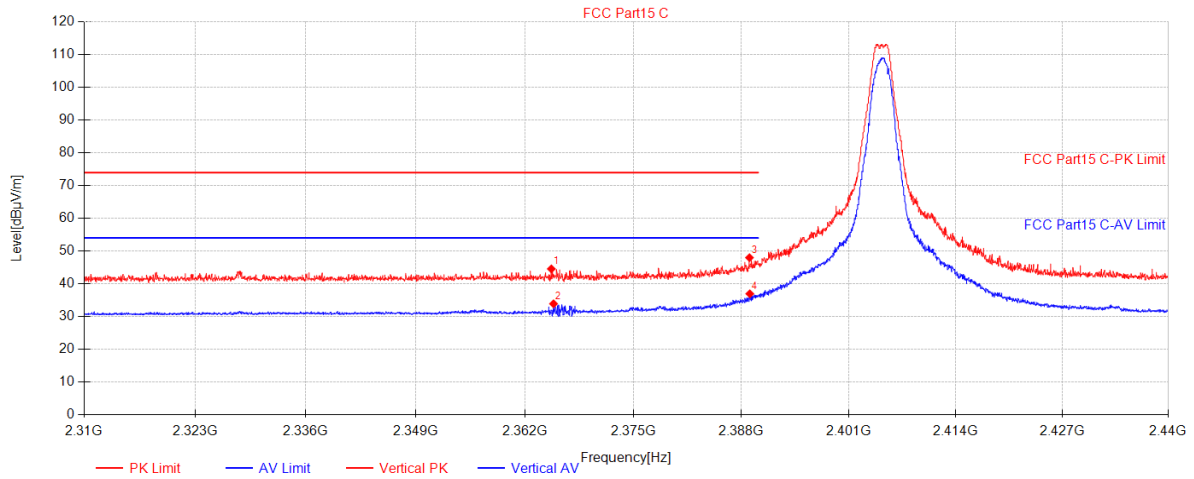
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Zigbee_Channel 0



Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2365.1633	41.47	3.08	44.55	74.00	29.45	198	224	Vertical
2	2365.4233	30.81	3.08	33.89	54.00	20.11	198	224	Vertical
3	2388.9533	44.92	3.07	47.99	74.00	26.01	198	224	Vertical
4	2388.9967	33.87	3.07	36.94	54.00	17.06	198	224	Vertical

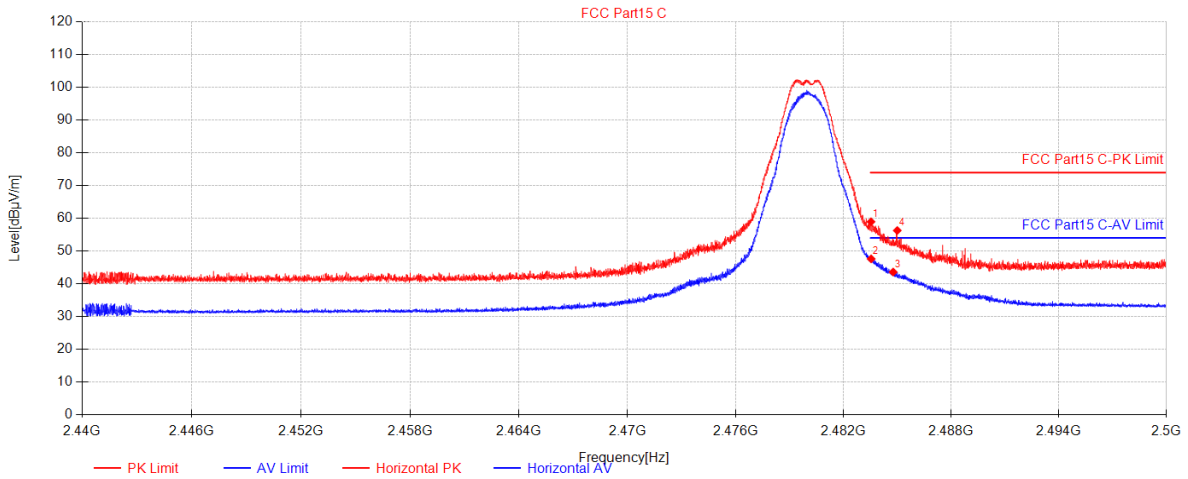


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Zigbee_Channel 15



Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2483.5225	55.35	3.60	58.95	74.00	15.05	196	35	Horizontal
2	2483.53	44.02	3.60	47.62	54.00	6.38	196	35	Horizontal
3	2484.76	39.99	3.60	43.59	54.00	10.41	196	35	Horizontal
4	2484.985	52.67	3.61	56.28	74.00	17.72	196	35	Horizontal

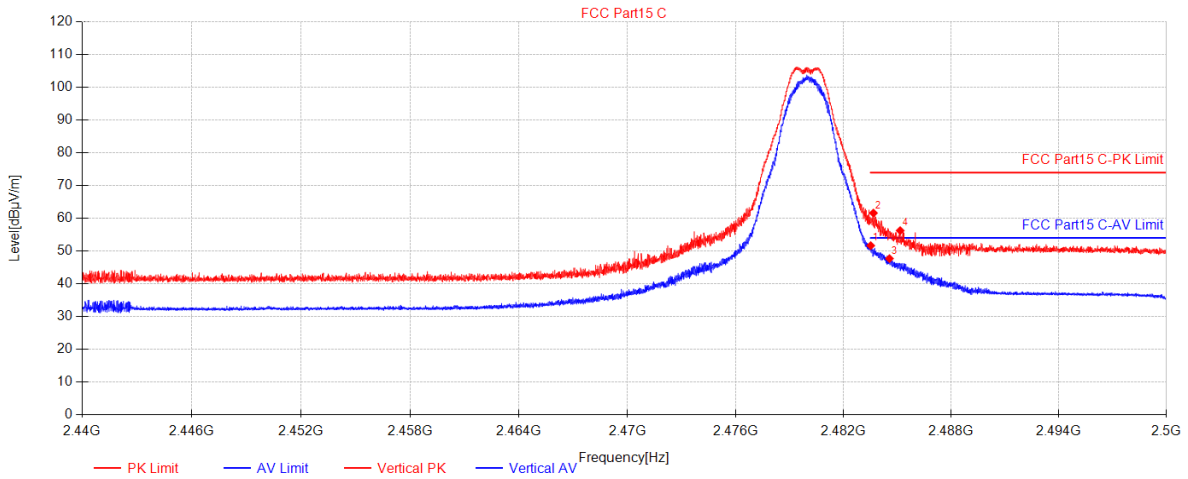


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1	2483.5075	48.06	3.60	51.66	54.00	2.34	132	172	Vertical
2	2483.6575	58.01	3.60	61.61	74.00	12.39	132	172	Vertical
3	2484.55	44.12	3.60	47.72	54.00	6.28	132	172	Vertical
4	2485.15	52.64	3.61	56.25	74.00	17.75	132	172	Vertical

Remark:

Level = Reading Level(dBµV) + Factor(dB):

Factor = AF(dB/m) + Cable Factor(dB)

AF = Antenna Factor(dB/m)

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

---End of Report---



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