

CFR 47 FCC PART 15 SUBPART C
CERTIFICATION TEST REPORT

For

Vivint Door and Window Sensor (Long Range)

MODEL NUMBER: DW03

FCC ID: 2AAAS-DW03

REPORT NUMBER: 4791771880-1-RF-2

ISSUE DATE: May 13, 2025

Prepared for

Vivint, Inc.
3401 N. Ashton Blvd. Lehi Utah 84043 United States

Prepared by

UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch
Room 101, Building 2, No.4, Information Road, Songshan Lake, Dongguan,
Guangdong, China

Tel: +86 769 22038881
Fax: +86 769 33244054
Website: www.ul.com

Revision History

Rev.	Issue Date	Revisions	Revised By
V0	May 13, 2025	Initial Issue	

Summary of Test Results			
Clause	Test Items	FCC/ISED Rules	Test Results
1	6dB Bandwidth and 99% Occupied Bandwidth	FCC Part 15.247 (a) (2)	Pass
2	Peak Conducted Output Power	FCC Part 15.247 (b) (3)	Pass
3	Power Spectral Density	FCC Part 15.247 (e)	Pass
4	Conducted Bandedge and Spurious Emission	FCC Part 15.247 (d)	Pass
5	Radiated Bandedge and Spurious Emission	FCC Part 15.247 (d) FCC Part 15.209 FCC Part 15.205	Pass
6	AC Power Line Conducted Emission	FCC Part 15.207	N/A (Note 3)
7	Antenna Requirement	FCC Part 15.203	Pass
<p>Note:</p> <p>1.This test report is only published to and used by the applicant, and it is not for evidence purpose in China.</p> <p>2. The measurement result for the sample received is <Pass> according to < CFR 47 FCC PART 15 SUBPART C >when < Simple Acceptance > decision rule is applied.</p> <p>3. The EUT is powered by battery and cannot be charged.</p>			

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	6
2. TEST METHODOLOGY	7
3. FACILITIES AND ACCREDITATION	7
4. CALIBRATION AND UNCERTAINTY	8
4.1. MEASURING INSTRUMENT CALIBRATION	8
4.2. MEASUREMENT UNCERTAINTY.....	8
5. EQUIPMENT UNDER TEST	9
5.1. DESCRIPTION OF EUT	9
5.2. CHANNEL LIST	10
5.3. MAXIMUM OUTPUT POWER	10
5.4. TEST CHANNEL CONFIGURATION.....	10
5.5. THE WORSE CASE POWER SETTING PARAMETER.....	10
5.6. DESCRIPTION OF AVAILABLE ANTENNAS.....	10
5.7. DESCRIPTION OF TEST SETUP	11
6. MEASURING INSTRUMENT AND SOFTWARE USED	12
7. ANTENNA PORT TEST RESULTS.....	14
7.1. ON TIME AND DUTY CYCLE.....	14
7.2. 6 dB DTS BANDWIDTH AND 99 % OCCUPIED BANDWIDTH	15
7.3. CONDUCTED OUTPUT POWER.....	17
7.4. POWER SPECTRAL DENSITY.....	18
7.5. CONDUCTED BANDEGE AND SPURIOUS EMISSIONS	20
8. RADIATED TEST RESULTS.....	22
8.1. SPURIOUS EMISSIONS (1 GHz ~ 10 GHz).....	28
8.2. SPURIOUS EMISSIONS (30 MHz ~ 1 GHz).....	32
8.3. SPURIOUS EMISSIONS BELOW 30 MHz	34
9. ANTENNA REQUIREMENTS.....	37
10. Appendix.....	38
10.1. Appendix A: DTS Bandwidth.....	38
10.1.1. Test Result.....	38
10.1.2. Test Graphs	39
10.2. Appendix B: Occupied Channel Bandwidth.....	40
10.2.1. Test Result.....	40
10.2.2. Test Graphs	41

10.3.	<i>Appendix C: Maximum conducted output power</i>	42
10.3.1.	Test Result.....	42
10.4.	<i>Appendix D: Maximum power spectral density</i>	43
10.4.1.	Test Result.....	43
10.4.2.	Test Graphs	44
10.5.	<i>Appendix E: Band edge measurements</i>	45
10.5.1.	Test Result.....	45
10.5.2.	Test Graphs	46
10.6.	<i>Appendix F: Conducted Spurious Emission</i>	47
10.6.1.	Test Result.....	47
10.6.2.	Test Graphs	48
10.7.	<i>Appendix G: Duty Cycle</i>	50
10.7.1.	Test Result.....	50
10.7.2.	Test Graphs	51

1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Vivint, Inc.
Address: 3401 N. Ashton Blvd. Lehi Utah 84043 United States

Manufacturer Information

Company Name: Vivint, Inc.
Address: 3401 N. Ashton Blvd. Lehi Utah 84043 United States

EUT Information

EUT Name: Vivint Door and Window Sensor (Long Range)
Model: DW03
Sample Received Date: April 30, 2025
Sample Status: Normal
Sample ID: 8431413
Date of Tested: May 6, 2025~ May 13, 2025

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 FCC PART 15 SUBPART C	PASS

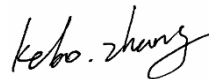
Prepared By:



Fanny Huang

Engineer Project Associate

Checked By:



Kebo Zhang

Senior Project Engineer

Approved By:



Stephen Guo

Operations Manager

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with KDB 558074 D01 15.247 Meas Guidance v05r02, 414788 D01 Radiated Test Site v01r01, CFR 47 FCC Part 2, CFR 47 FCC Part 15, ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	<p>A2LA (Certificate No.: 4102.01) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA.</p> <p>FCC (FCC Designation No.: CN1187) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.</p> <p>ISED (Company No.: 21320) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with ISED. The Company Number is 21320 and the test lab Conformity Assessment Body Identifier (CABID) is CN0046.</p>
---------------------------	--

Note 1:

All tests measurement facilities use to collect the measurement data are located at Room 101, Building 2, No.4, Information Road, Songshan Lake, Dongguan, Guangdong, China.

Note 2:

The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

Note 3:

For below 30 MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30 MHz had been correlated to measurements performed on an OFS.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognize national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Conduction emission	3.62 dB
Radiated Emission (Included Fundamental Emission) (9 kHz ~ 30 MHz)	2.2 dB
Radiated Emission (Included Fundamental Emission) (30 MHz ~ 1 GHz)	4.00 dB
Radiated Emission (Included Fundamental Emission) (1 GHz to 26 GHz)	5.78 dB (1 GHz ~ 18 GHz)
	5.23 dB (18 GHz ~ 26 GHz)
Duty Cycle	±0.028%
DTS and 99% Occupied Bandwidth	±0.0196%
Maximum Conducted Output Power	±0.686 dB
Maximum Power Spectral Density Level	±0.743 dB
Conducted Band-edge Compliance	±1.328 dB
Conducted Unwanted Emissions In Non-restricted Frequency Bands	±0.746 dB (9 kHz ~ 1 GHz)
	±1.328dB (1 GHz ~ 26 GHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name	Vivint Door and Window Sensor (Long Range)
Model	DW03
Battery	DC 3 V*2
Protocol	ZWAVE
Transmit Frequency Range	902 MHz ~ 928 MHz
Modulation	OQPSK

Note: There are two batteries in the EUT and they are connected in parallel. So the normal test Voltage is DC 3V.

5.2. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	912	2	920	/	/

5.3. MAXIMUM OUTPUT POWER

Test Mode	Frequency (MHz)	Channel Number	Maximum Peak Output Power (dBm)
OQPSK	902 - 928	2	14.01

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
OQPSK	CH 1(Low Channel), CH 2(High Channel)	912 MHz, 920 MHz

5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter			
Test Software Version		sscom5.12.1	
Test Mode	Transmit Antenna Number	Test Software Setting Value	
		LCH	HCH
OQPSK	1	default	default

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency (MHz)	Antenna Type	MAX Antenna Gain (dBi)
1	902 - 928	Metal Antenna	1.44

Test Mode	Transmit and Receive Mode	Description
OQPSK	<input checked="" type="checkbox"/> 1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.

Note: 1. The value of the antenna gain was declared by customer.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	P/N
1	PC	Lenovo	E42-80	/
2	Dongle	/	/	/

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
/	/	/	/	/	/

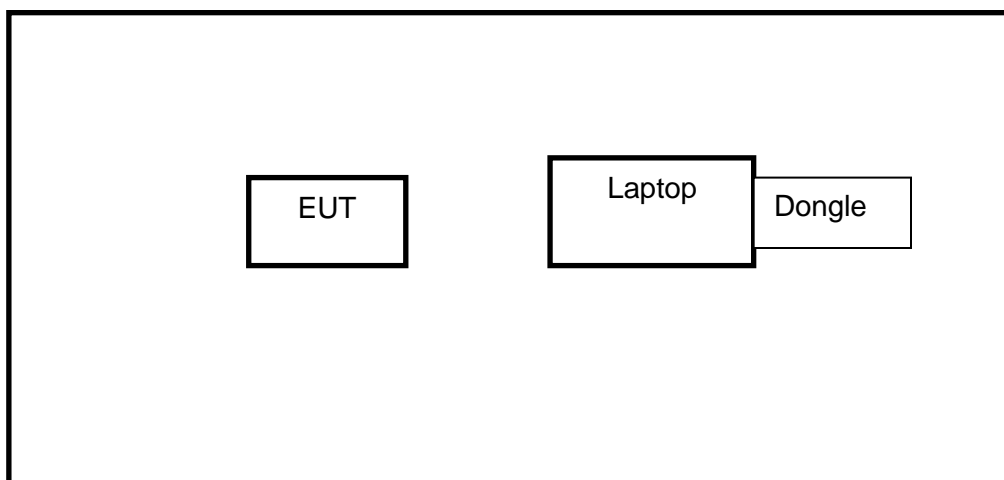
ACCESSORIES

Item	Accessory	Brand Name	Model Name	Description
/	/		/	/

TEST SETUP

The EUT can work in engineering mode with a software through a Laptop controlled by dongle.

SETUP DIAGRAM FOR TESTS



6. MEASURING INSTRUMENT AND SOFTWARE USED

R&S TS 8997 Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Power sensor, Power Meter	R&S	OSP120	100921	Dec.27,2024	Dec.26,2025
Vector Signal Generator	R&S	SMBV100A	261637	Sep.28, 2024	Sep.27, 2025
Signal Generator	R&S	SMB100A	178553	Sep.28, 2024	Sep.27, 2025
Signal Analyzer	R&S	FSV40	101118	Sep.28, 2024	Sep.27, 2025
Software					
Description	Manufacturer		Name	Version	
For R&S TS 8997 Test System	Rohde & Schwarz		EMC 32	10.60.10	
Tonsend RF Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Wireless Connectivity Tester	R&S	CMW270	1201.0002N75-102	Sep.13, 2024	Sep.12, 2025
PXA Signal Analyzer	Keysight	N9030A	MY55410512	Sep.28, 2024	Sep.27, 2025
MXG Vector Signal Generator	Keysight	N5182B	MY56200284	Sep.28, 2024	Sep.27, 2025
MXG Vector Signal Generator	Keysight	N5172B	MY56200301	Sep.28, 2024	Sep.27, 2025
DC power supply	Keysight	E3642A	MY55159130	Sep.28, 2024	Sep.27, 2025
Temperature & Humidity Chamber	SANMOOD	SG-80-CC-2	2088	Sep.28, 2024	Sep.27, 2025
Attenuator	Aglient	8495B	2814a12853	Sep.28, 2024	Sep.27, 2025
RF Control Unit	Tonscend	JS0806-2	23B80620666	Dec.27,2024	Dec.26,2025
Software					
Description	Manufacturer	Name		Version	
Tonsend SRD Test System	Tonsend	JS1120-3 RF Test System		V3.2.22	

Radiated Emissions					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Sep.28, 2024	Sep.27, 2025
Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	June 28, 2024	June.27 2027
Preamplifier	HP	8447D	2944A09099	Sep.28, 2024	Sep.27, 2025
EMI Measurement Receiver	R&S	ESR26	101377	Sep.28, 2024	Sep.27, 2025
Horn Antenna	TDK	HRN-0118	130940	Dec.10, 2024	Dec.11, 2027
Preamplifier	TDK	PA-02-0118	TRS-305-00067	Sep.28, 2024	Sep.27, 2025
Horn Antenna	Schwarzbeck	BBHA9170	697	Jun 30, 2024	Jun 29, 2027
Preamplifier	TDK	PA-02-2	TRS-307-00003	Sep.28, 2024	Sep.27, 2025
Preamplifier	TDK	PA-02-3	TRS-308-00002	Sep.28, 2024	Sep.27, 2025
Loop antenna	Schwarzbeck	1519B	00008	Dec.09, 2024	Dec.08, 2027

Other Instrument					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
Temperature humidity probe	OMEGA	ITHX-SD-5	18470007	Oct.8, 2024	Oct.7, 2025
Barometer	Yiyi	Baro	N/A	Oct.10, 2024	Oct.9, 2025
Attenuator	Agilent	8495B	2814a12853	Sep.28, 2024	Sep.27, 2025

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

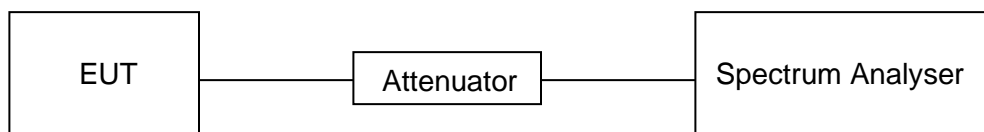
LIMITS

None; for reporting purposes only.

PROCEDURE

Refer to ANSI C63.10-2013 clause 11.6 Zero – Span Spectrum Analyzer method.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.1 °C	Relative Humidity	52 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 3 V

TEST DATE / ENGINEER

Test Date	May 8, 2025	Test By	Walker Yuan
-----------	-------------	---------	-------------

RESULTS

Please refer to appendix G.

7.2. 6 dB DTS BANDWIDTH AND 99 % OCCUPIED BANDWIDTH

LIMITS

CFR 47FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247(a)(2)	6 dB Bandwidth	≥ 500 kHz	902-928
ISED RSS-Gen Clause 6.7	99 % Occupied Bandwidth	None; for reporting purposes only.	902-928

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.8 for DTS bandwidth and clause 6.9 for Occupied Bandwidth.

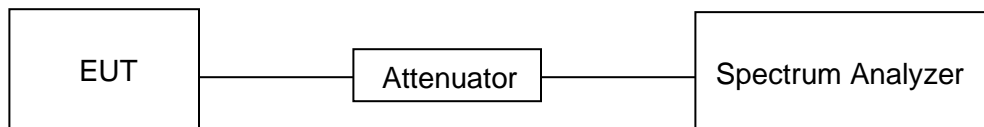
Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Frequency Span	For 6 dB Bandwidth: Enough to capture all products of the modulation carrier emission For 99 % Occupied Bandwidth: Between 1.5 times and 5.0 times the OBW
Detector	Peak
RBW	For 6 dB Bandwidth: 100 kHz For 99 % Occupied Bandwidth: 1 % to 5 % of the occupied bandwidth
VBW	For 6 dB Bandwidth: $\geq 3 \times$ RBW For 99 % Occupied Bandwidth: $\geq 3 \times$ RBW
Trace	Max hold
Sweep	Auto couple

a) Use the 99 % power bandwidth function of the instrument, allow the trace to stabilize and report the measured bandwidth.

b) Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.1 °C	Relative Humidity	52 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 3 V

TEST DATE / ENGINEER

Test Date	May 8, 2025	Test By	Walker Yuan
-----------	-------------	---------	-------------

RESULTS

Please refer to appendix A & B.

7.3. CONDUCTED OUTPUT POWER

LIMITS

CFR 47 FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247(b)(3)	Peak Output Power	1 watt or 30 dBm	902-928

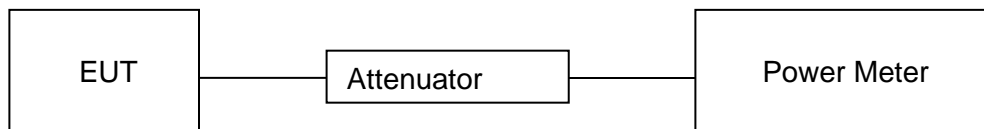
TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 1.9.1.3.

Connect the EUT to a low loss RF cable from the antenna port to the power sensor (video bandwidth is greater than the occupied bandwidth).

Measure peak emission level, the indicated level is the peak output power, after any corrections for external attenuators and cables.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.1 °C	Relative Humidity	52 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 3 V

TEST DATE / ENGINEER

Test Date	May 8, 2025	Test By	Walker Yuan
-----------	-------------	---------	-------------

RESULTS

Please refer to appendix C.

7.4. POWER SPECTRAL DENSITY

LIMITS

CFR 47 FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC §15.247 (e)	Power Spectral Density	Shall not be greater than 8 dBm in any 3 kHz band	902-928

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.10.2.

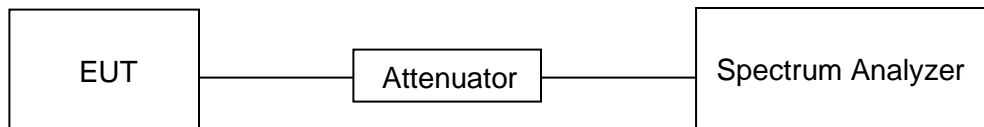
Connect the EUT to the spectrum analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	peak
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
VBW	$\geq 3 \times \text{RBW}$
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.1 °C	Relative Humidity	52 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 3 V

TEST DATE / ENGINEER

Test Date	May 8, 2025	Test By	Walker Yuan
-----------	-------------	---------	-------------

RESULTS

Please refer to appendix D.

7.5. CONDUCTED BANDEGE AND SPURIOUS EMISSIONS

LIMITS

CFR 47 FCC Part15 (15.247) Subpart C		
Section	Test Item	Limit
CFR 47 FCC §15.247 (d)	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.11 and 11.13.

Connect the EUT to the spectrum analyser and use the following settings for reference level measurement:

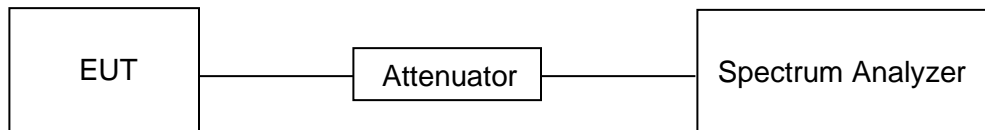
Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100 kHz
VBW	$\geq 3 \times \text{RBW}$
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum PSD level.

Change the settings for emission level measurement:

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100 kHz
VBW	$\geq 3 \times \text{RBW}$
measurement points	$\geq \text{span}/\text{RBW}$
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum PSD level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11.

TEST SETUP**TEST ENVIRONMENT**

Temperature	24.1 °C	Relative Humidity	52 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 3 V

TEST DATE / ENGINEER

Test Date	May 8, 2025	Test By	Walker Yuan
-----------	-------------	---------	-------------

RESULTS

Please refer to appendix E&F.

8. RADIATED TEST RESULTS

LIMITS

Please refer to CFR 47 FCC §15.205 and §15.209.

Radiation Disturbance Test Limit for FCC (Class B) (9 kHz-1 GHz)

Emissions radiated outside of the specified frequency bands above 30 MHz			
Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m	
		Quasi-Peak	
30 - 88	100	40	
88 - 216	150	43.5	
216 - 960	200	46	
Above 960	500	54	
Above 1000	500	Peak	Average
		74	54

FCC Emissions radiated outside of the specified frequency bands below 30 MHz		
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

FCC Restricted bands of operation refer to FCC §15.205 (a):

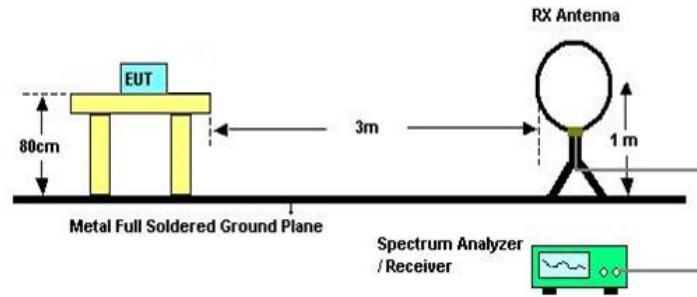
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

Note: ¹Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

²Above 38.6c

TEST SETUP AND PROCEDURE

Below 30 MHz

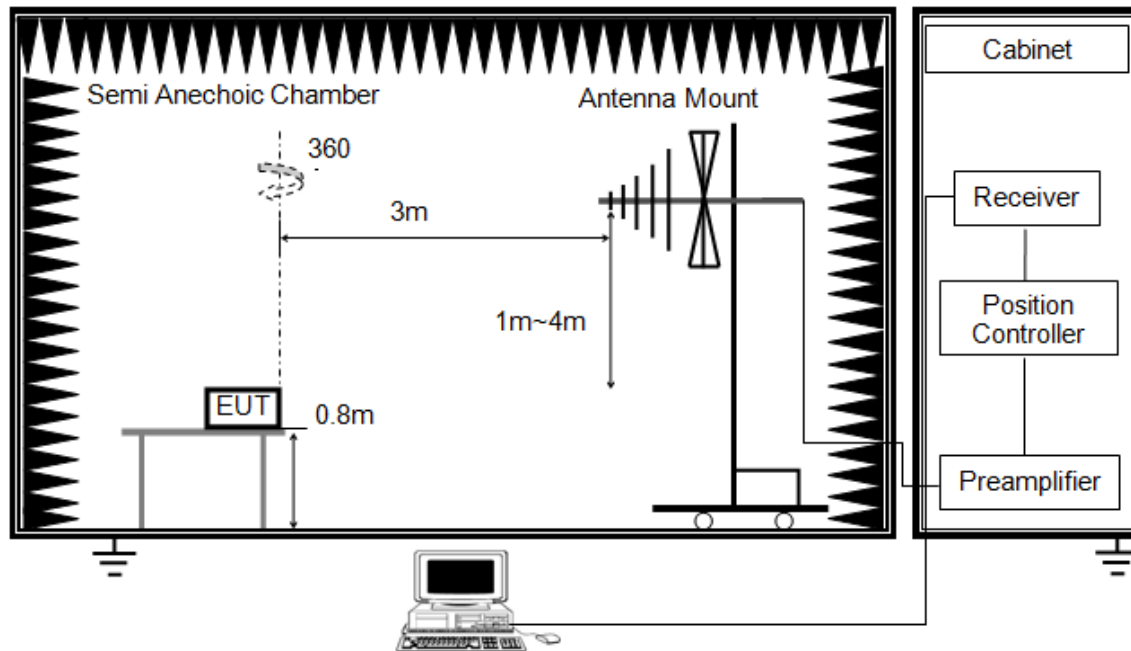


The setting of the spectrum analyser

RBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
VBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
Sweep	Auto
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.4.
2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both Horizontal, Face-on and Face-off polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80 cm above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a 1 m height antenna tower.
5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
6. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak and average detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak and average detector and reported.
7. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field site based on KDB 414788.
8. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω . For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to $Y-51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

Below 1 GHz and above 30 MHz

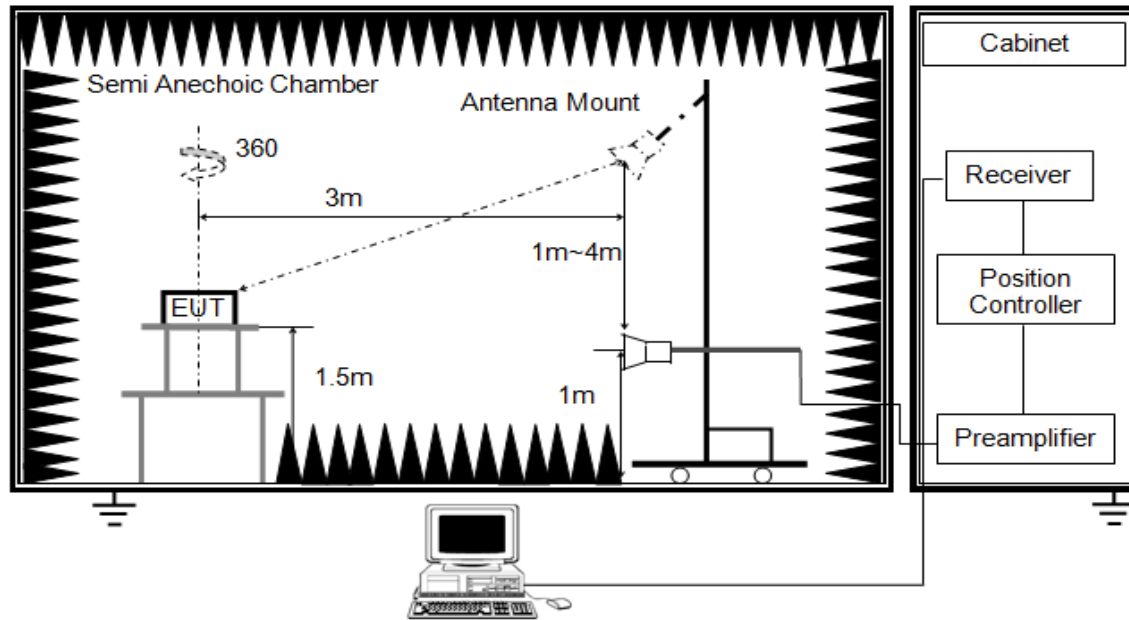


The setting of the spectrum analyser

RBW	120 kHz
VBW	300 kHz
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.5.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80 cm above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

Above 1GHz

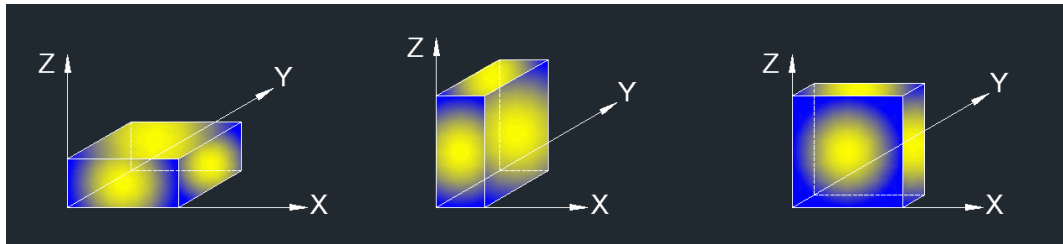


The setting of the spectrum analyser

RBW	1 MHz
VBW	PEAK: 3 MHz AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.6.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 1.5 m above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For measurement above 1 GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.
6. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 7.1.ON TIME AND DUTY CYCLE.

X axis, Y axis, Z axis positions:



Note 1: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

Note 2: For the radiated restricted bandedge, a pre-scan was performed, and the result was 20 dB lower than the limit line, the test data was not shown in the report.

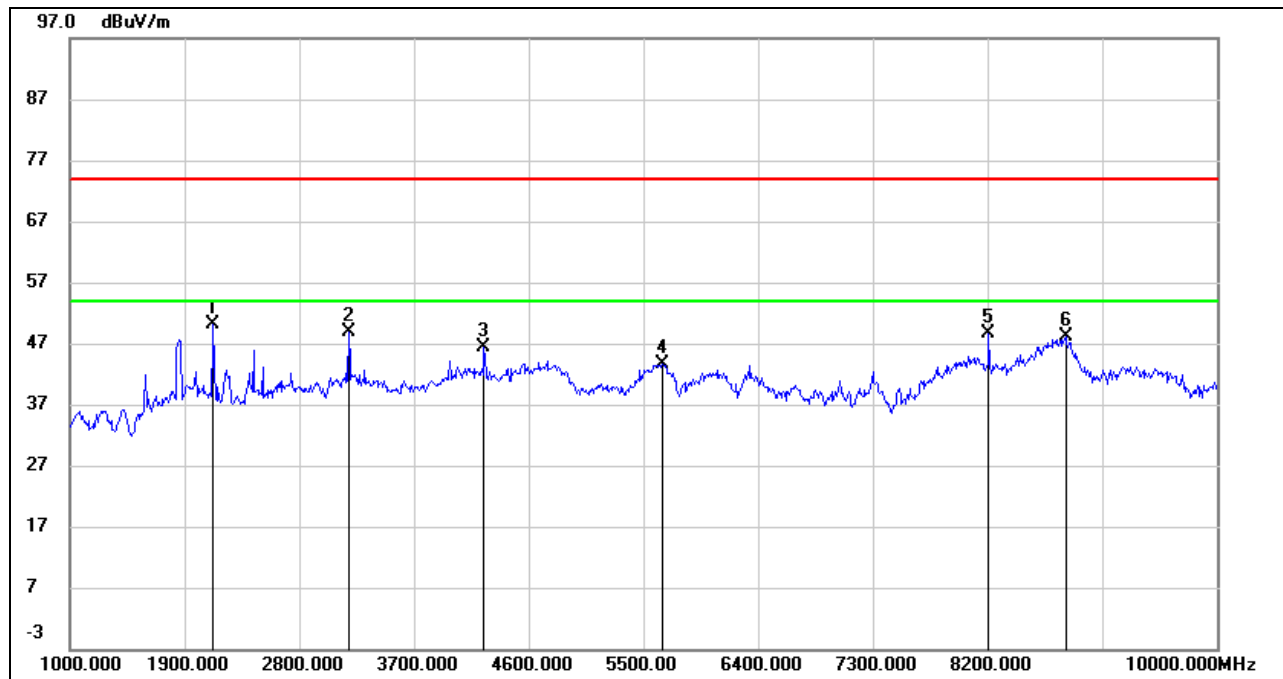
TEST ENVIRONMENT

Temperature	24.6 °C	Relative Humidity	62 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 3 V

RESULTS

8.1. SPURIOUS EMISSIONS (1 GHz ~ 10 GHz)

HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



No.	Frequency	Reading	Correct	Result	Limit for Peak	Margin for Peak	Limit for AVG	Margin for AVG	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV/m)	(dB)	
1	2125.000	56.33	-6.25	50.08	74.00	-23.92	54.00	-3.92	peak
2	3187.000	52.41	-3.41	49.00	74.00	-25.00	54.00	-5.00	peak
3	4249.000	47.21	-0.85	46.36	74.00	-27.64	54.00	-7.64	peak
4	5644.000	42.26	1.36	43.62	74.00	-30.38	54.00	-10.38	peak
5	8209.000	43.34	5.19	48.53	74.00	-25.47	54.00	-5.47	peak
6	8812.000	40.71	7.35	48.06	74.00	-25.94	54.00	-5.94	peak

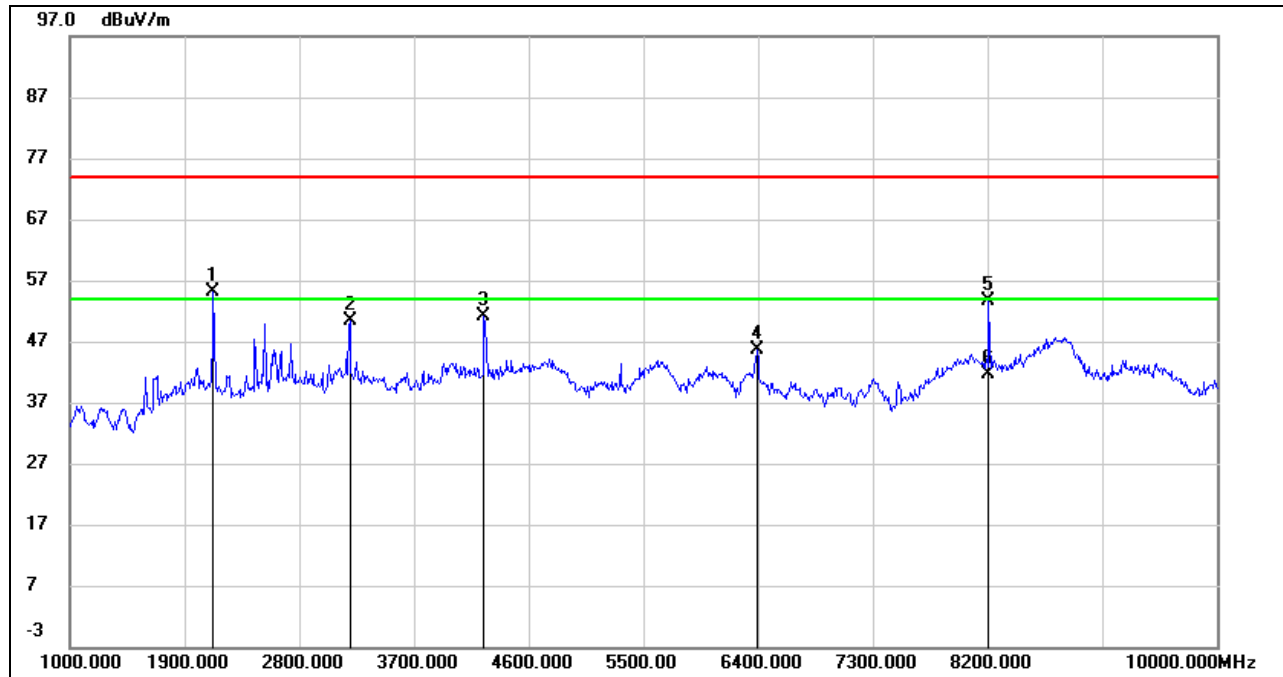
Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit. The measured result complies with AV limit, which is 54 dBuV/m.

3. Peak: Peak detector.

4. Only the worst data was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency	Reading	Correct	Result	Limit for Peak	Margin for Peak	Limit for AVG	Margin for AVG	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV/m)	(dB)	
1*	2125.000	61.36	-6.25	55.11	/	/	/	/	peak
2	3196.000	53.64	-3.38	50.26	74.00	-23.74	54.00	-3.74	peak
3	4249.000	51.96	-0.85	51.11	74.00	-22.89	54.00	-2.89	peak
4	6391.000	44.00	1.66	45.66	74.00	-28.34	54.00	-8.34	peak
5	8209.000	48.45	5.19	53.64	74.00	-20.36	/	/	peak
6	8209.000	36.50	5.19	41.69	/	/	54.00	-12.31	AVG

Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit. The measured result complies with AV limit, which is 54 dBuV/m.

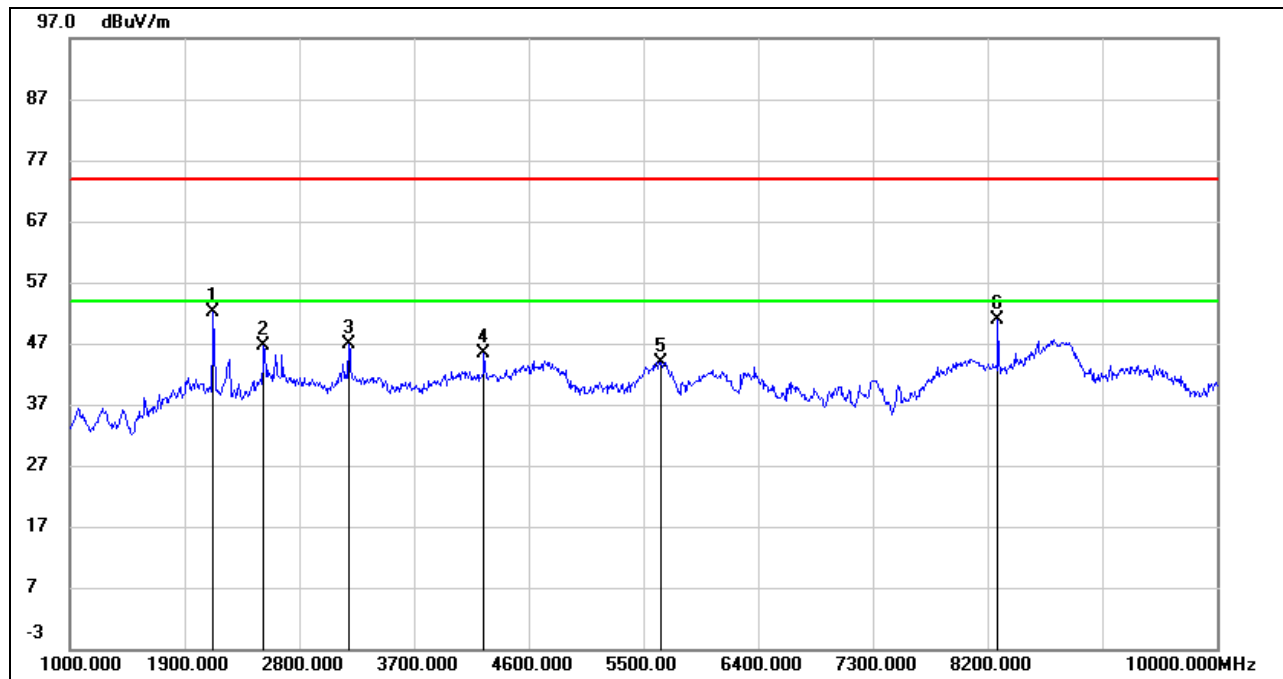
3. Peak: Peak detector.

4. AVG: VBW=1/Ton where: ton is transmit duration.

5. For transmit duration, please refer to clause 7.1.

6. Only the worst data was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

7.*-indicates frequency is out of the restricted bands and the limit is referring to 15.247 (d) and RSS-247 clause 5.5. We had already performed the conducted non-restricted bands test, please refer to clause 7.5.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)


No.	Frequency	Reading	Correct	Result	Limit for Peak	Margin for Peak	Limit for AVG	Margin for AVG	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV/m)	(dB)	
1	2125.000	58.43	-6.25	52.18	74.00	-21.82	54.00	-1.82	peak
2	2521.000	51.69	-5.16	46.53	74.00	-27.47	54.00	-7.47	peak
3	3187.000	50.28	-3.41	46.87	74.00	-27.13	54.00	-7.13	peak
4	4249.000	46.26	-0.85	45.41	74.00	-28.59	54.00	-8.59	peak
5	5635.000	42.44	1.47	43.91	74.00	-30.09	54.00	-10.09	peak
6	8281.000	45.35	5.56	50.91	74.00	-23.09	54.00	-3.09	peak

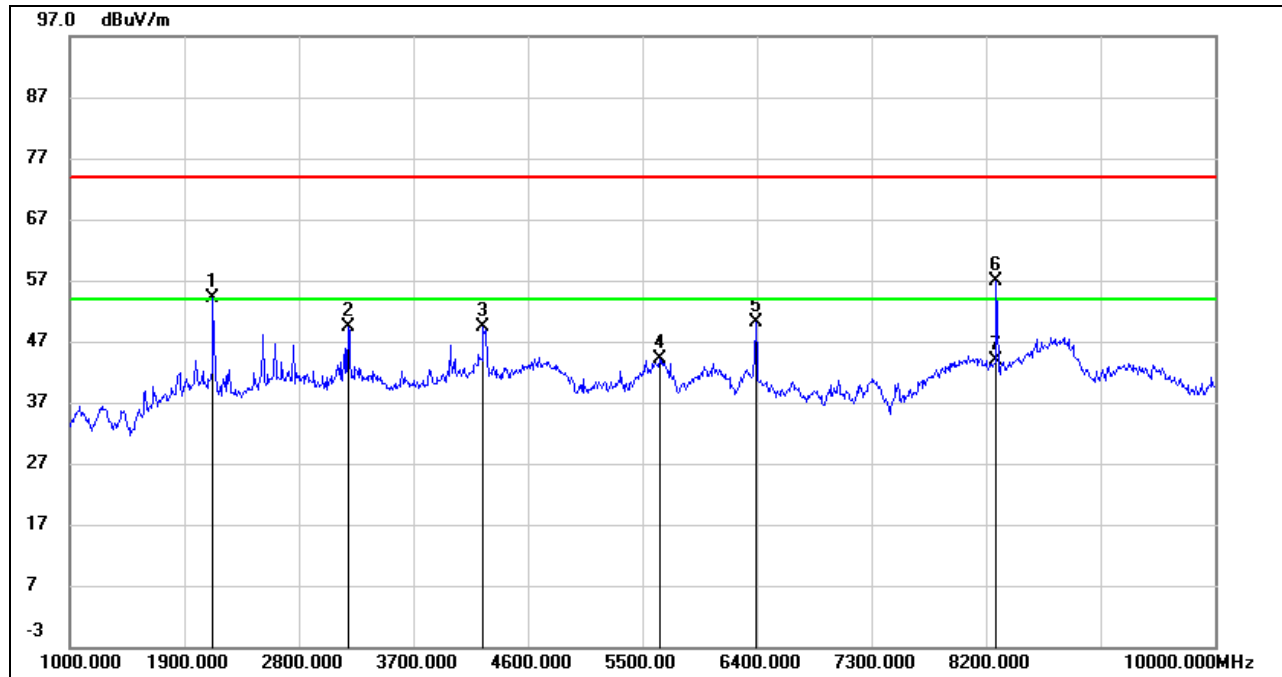
Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit. The measured result complies with AV limit, which is 54 dBuV/m.

3. Peak: Peak detector.

4. Only the worst data was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)



No.	Frequency	Reading	Correct	Result	Limit for Peak	Margin for Peak	Limit for AVG	Margin for AVG	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV/m)	(dB)	
1*	2125.000	60.27	-6.25	54.02	/	/	/	/	peak
2	3187.000	52.80	-3.41	49.39	74.00	-24.61	54.00	-4.61	peak
3	4249.000	50.14	-0.85	49.29	74.00	-24.71	54.00	-4.71	peak
4	5635.000	42.78	1.47	44.25	74.00	-29.75	54.00	-9.75	peak
5	6391.000	48.51	1.66	50.17	74.00	-23.83	54.00	-3.83	peak
6	8281.000	51.29	5.56	56.85	74.00	-17.15	/	/	peak
7	8281.000	38.32	5.56	43.88	/	/	54.00	-10.12	AVG

Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit. The measured result complies with AV limit, which is 54 dBuV/m.

3. Peak: Peak detector.

4. AVG: VBW=1/Ton where: ton is transmit duration.

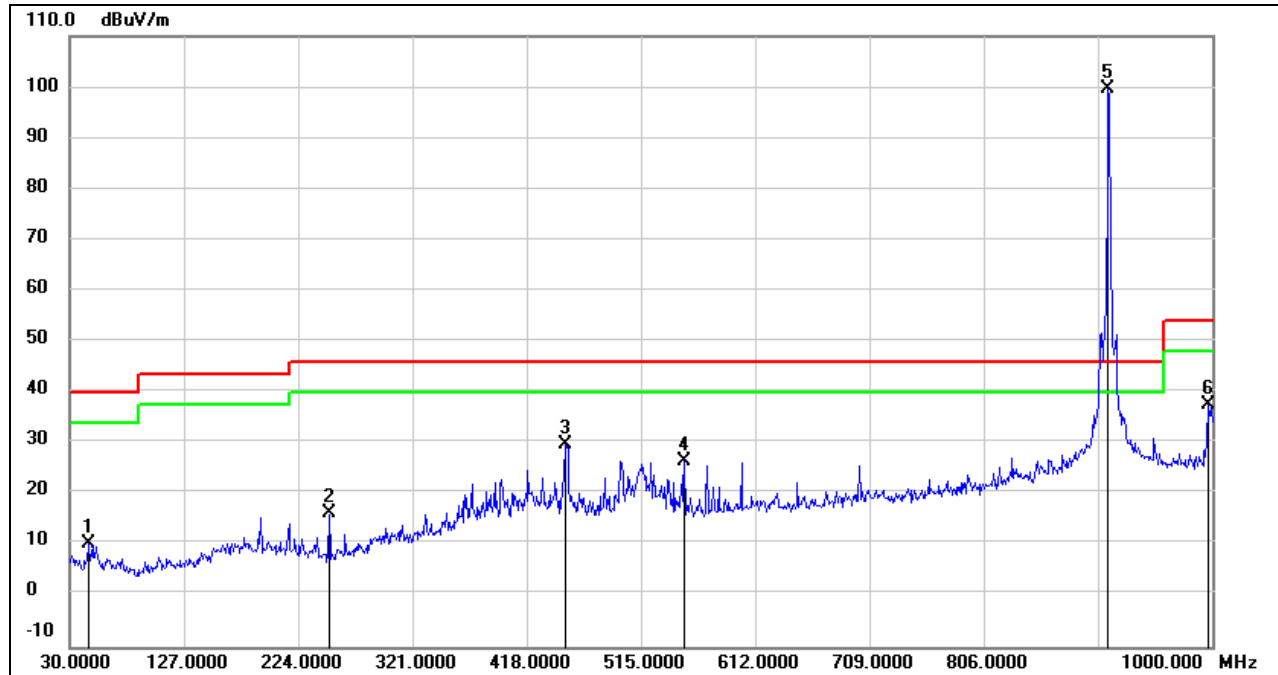
5. For transmit duration, please refer to clause 7.1.

6. Only the worst data was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

7. *-indicates frequency is out of the restricted bands and the limit is referring to 15.247 (d) and RSS-247 clause 5.5. We had already performed the conducted non-restricted bands test, please refer to clause 7.5.

8.2. SPURIOUS EMISSIONS (30 MHz ~ 1 GHz)

SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	45.5200	25.25	-14.94	10.31	40.00	-29.69	QP
2	250.1900	30.66	-14.56	16.10	46.00	-29.90	QP
3	450.9800	37.76	-8.13	29.63	46.00	-16.37	QP
4	551.8600	33.54	-6.98	26.56	46.00	-19.44	QP
5	911.7300	100.13	-0.54	99.59	/	/	fundamental
6	996.1200	37.82	-0.18	37.64	54.00	-16.36	QP

Note: 1. Result Level = Read Level + Correct Factor.

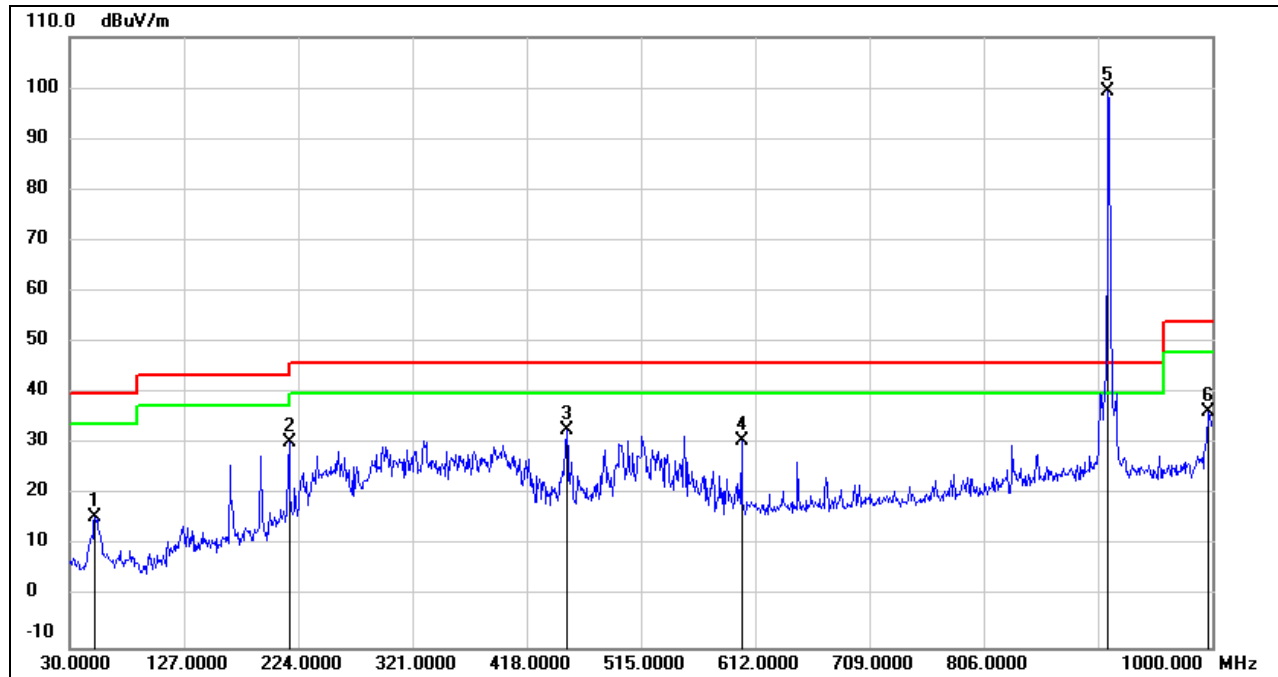
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto

4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.

5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	51.3400	30.86	-15.07	15.79	40.00	-24.21	QP
2	216.2400	43.17	-12.95	30.22	46.00	-15.78	QP
3	451.9500	40.89	-8.13	32.76	46.00	-13.24	QP
4	600.3600	36.42	-5.74	30.68	46.00	-15.32	QP
5	911.7300	99.81	-0.54	99.27	/	/	fundamental
6	996.1200	36.46	-0.18	36.28	54.00	-17.72	QP

Note: 1. Result Level = Read Level + Correct Factor.

2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto

4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.

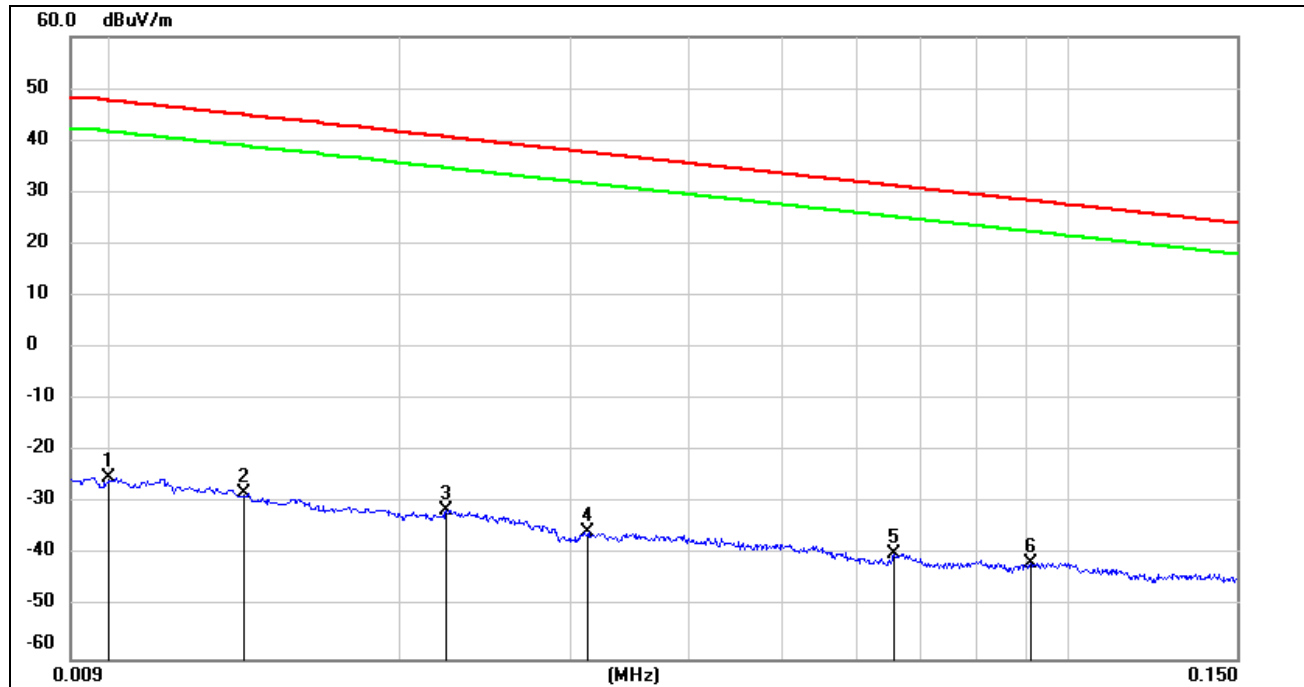
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

Note: All the modes and channels have been tested, only the worst data was recorded in the report.

8.3. SPURIOUS EMISSIONS BELOW 30 MHz

SPURIOUS EMISSIONS (LOW CHANNEL, LOOP ANTENNA FACE ON TO THE EUT, WORST-CASE CONFIGURATION)

9 kHz~ 150 kHz



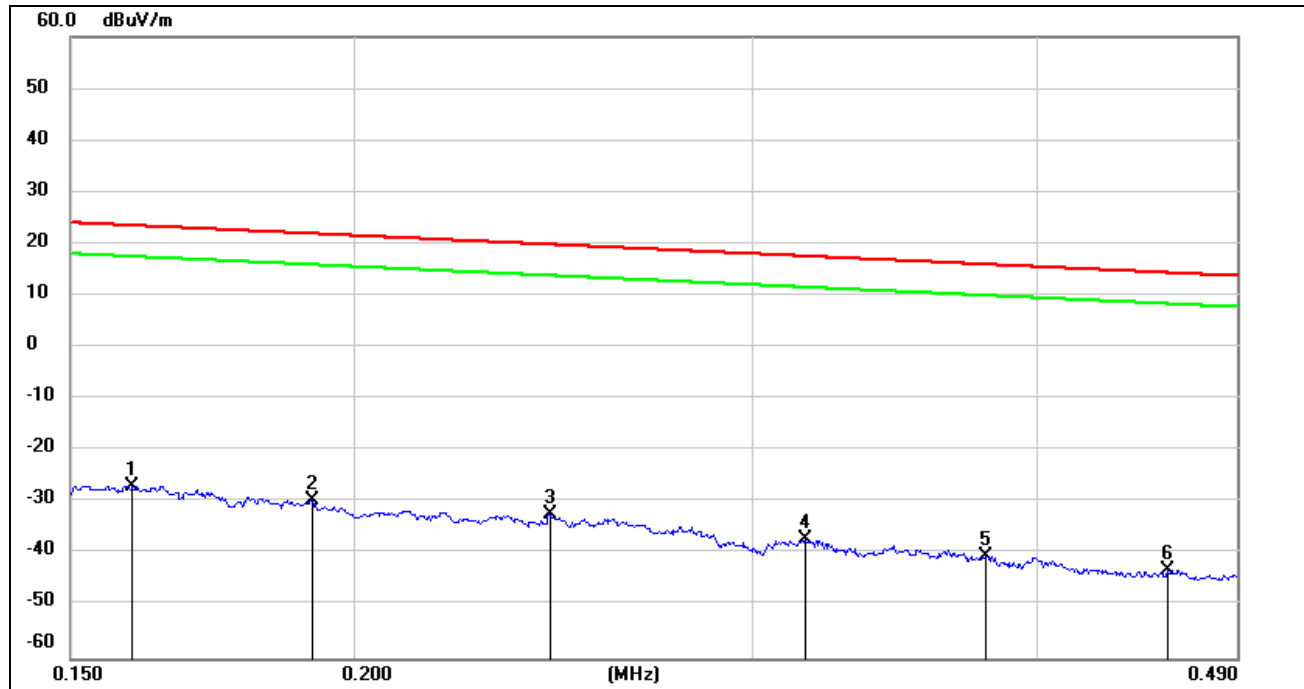
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.0100	76.22	-101.40	-25.18	47.60	-72.78	peak
2	0.0137	73.36	-101.38	-28.02	44.87	-72.89	peak
3	0.0223	70.07	-101.35	-31.28	40.63	-71.91	peak
4	0.0313	65.70	-101.39	-35.69	37.69	-73.38	peak
5	0.0656	61.86	-101.55	-39.69	31.26	-70.95	peak
6	0.0912	60.22	-101.73	-41.51	28.40	-69.91	peak

Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

150 kHz ~ 490 kHz



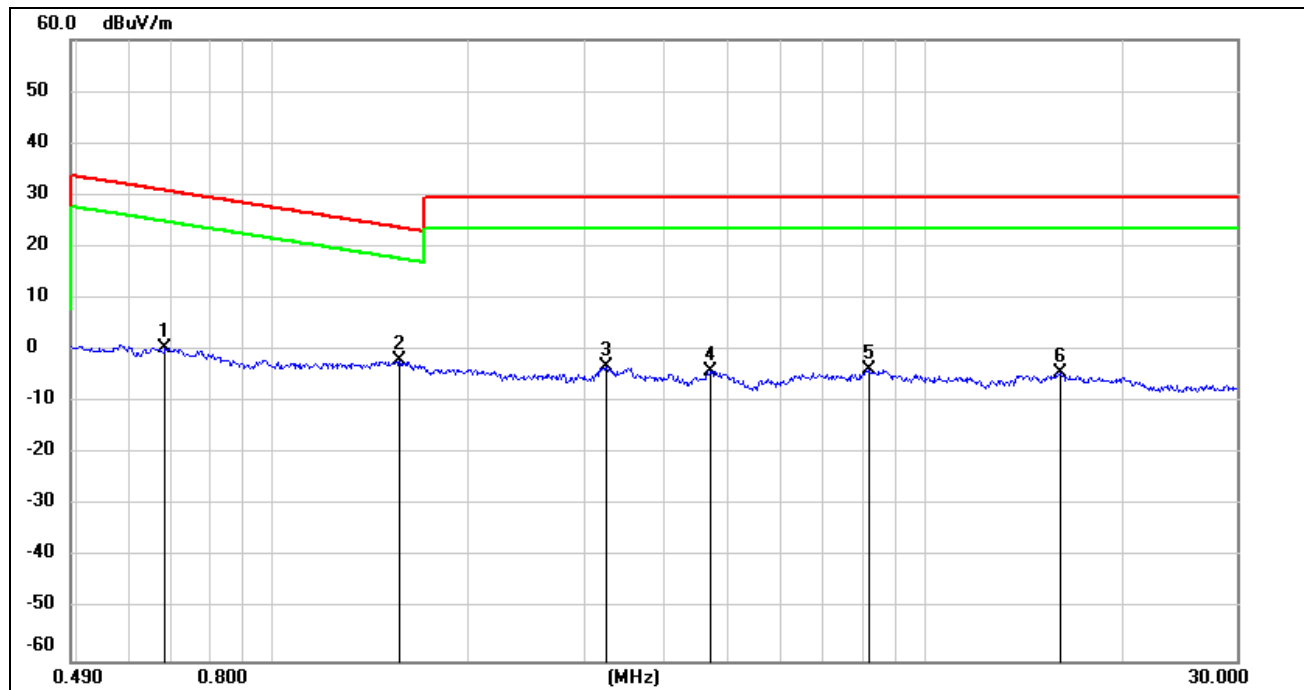
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.1597	74.85	-101.65	-26.80	23.54	-50.34	peak
2	0.1917	72.04	-101.70	-29.66	21.95	-51.61	peak
3	0.2442	69.53	-101.79	-32.26	19.85	-52.11	peak
4	0.3163	64.70	-101.87	-37.17	17.60	-54.77	peak
5	0.3800	61.52	-101.94	-40.42	16.01	-56.43	peak
6	0.4566	59.04	-102.02	-42.98	14.41	-57.39	peak

Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

490 kHz ~ 30 MHz



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.6834	62.71	-62.11	0.60	30.91	-30.31	peak
2	1.5625	59.96	-62.02	-2.06	23.73	-25.79	peak
3	3.2389	58.34	-61.53	-3.19	29.54	-32.73	peak
4	4.6905	57.32	-61.44	-4.12	29.54	-33.66	peak
5	8.1920	57.17	-61.05	-3.88	29.54	-33.42	peak
6	16.1598	56.61	-60.97	-4.36	29.54	-33.90	peak

Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

Note: All the modes and channels have been tested, only the worst data was recorded in the report.

9. ANTENNA REQUIREMENTS

APPLICABLE REQUIREMENTS

Please refer to FCC §15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Please refer to FCC §15.247(b)(4)

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.

RESULTS

Complies

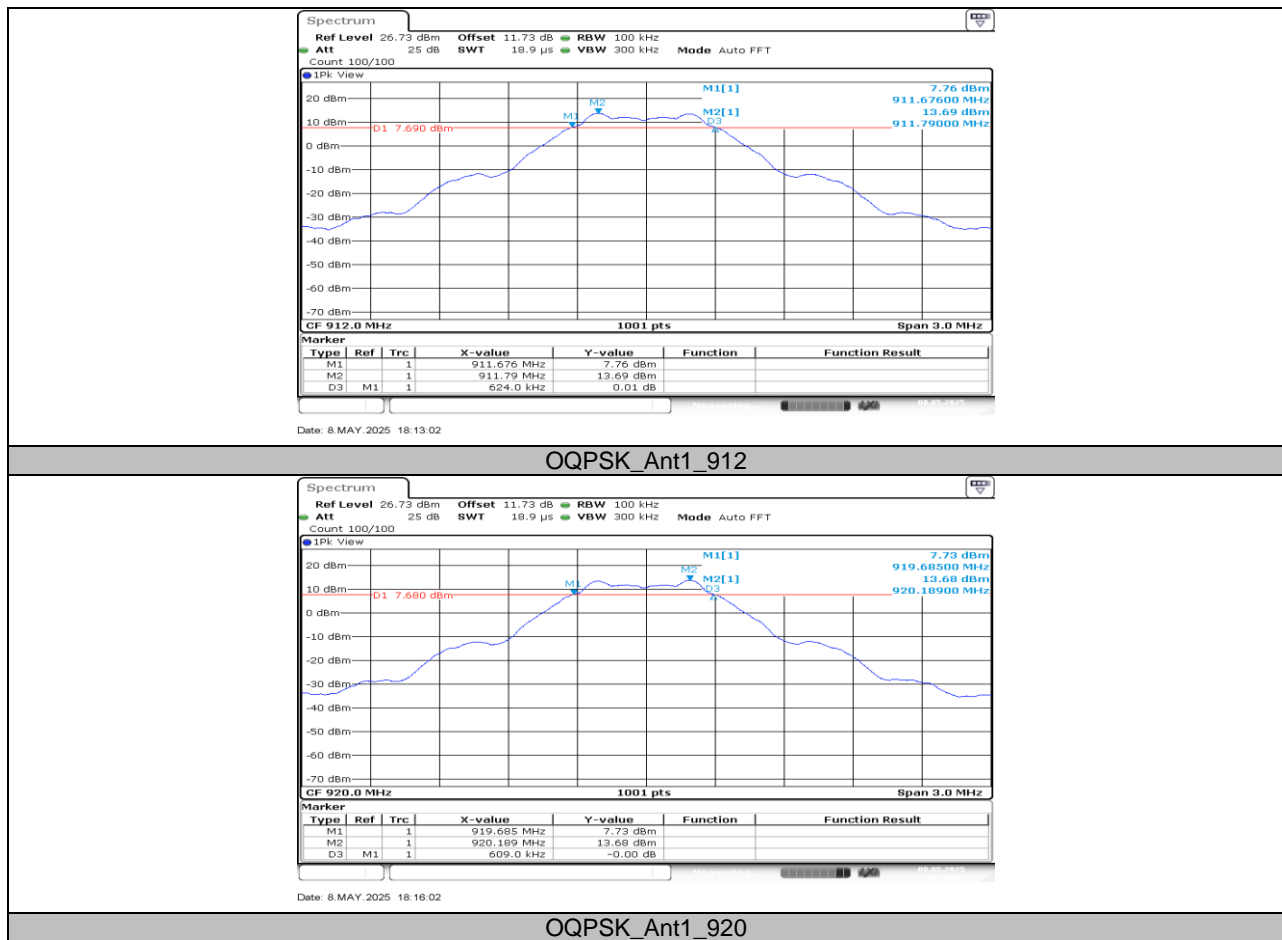
10. Appendix

10.1. Appendix A: DTS Bandwidth

10.1.1. Test Result

TestMode	Antenna	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
OQPSK	Ant1	912	0.62	911.68	912.30	≥ 0.5	PASS
		920	0.61	919.69	920.29	≥ 0.5	PASS

10.1.2. Test Graphs

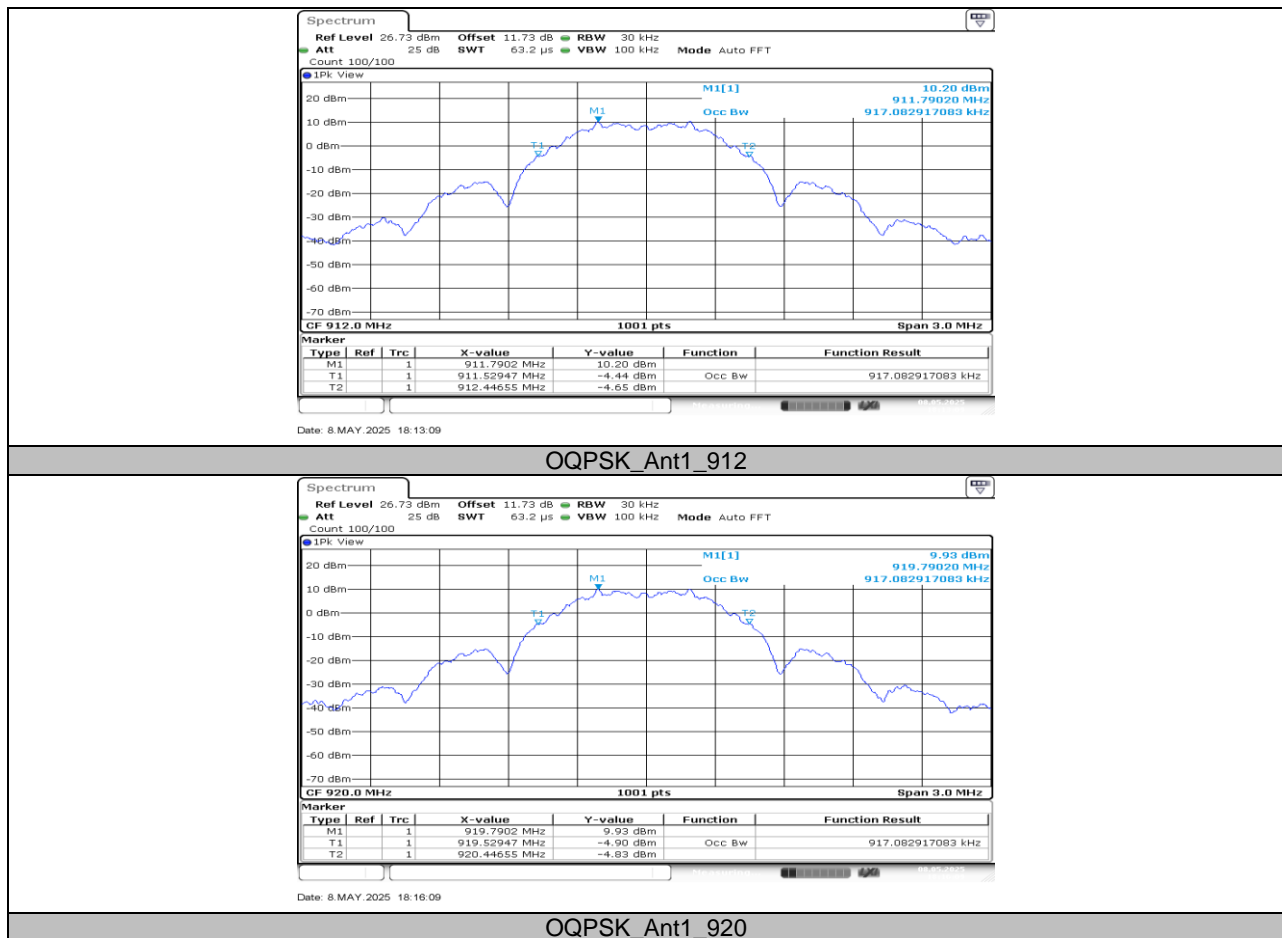


10.2. Appendix B: Occupied Channel Bandwidth

10.2.1. Test Result

TestMode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
OQPSK	Ant1	912	0.917	911.5295	912.4466	PASS
		920	0.917	919.5295	920.4466	PASS

10.2.2. Test Graphs



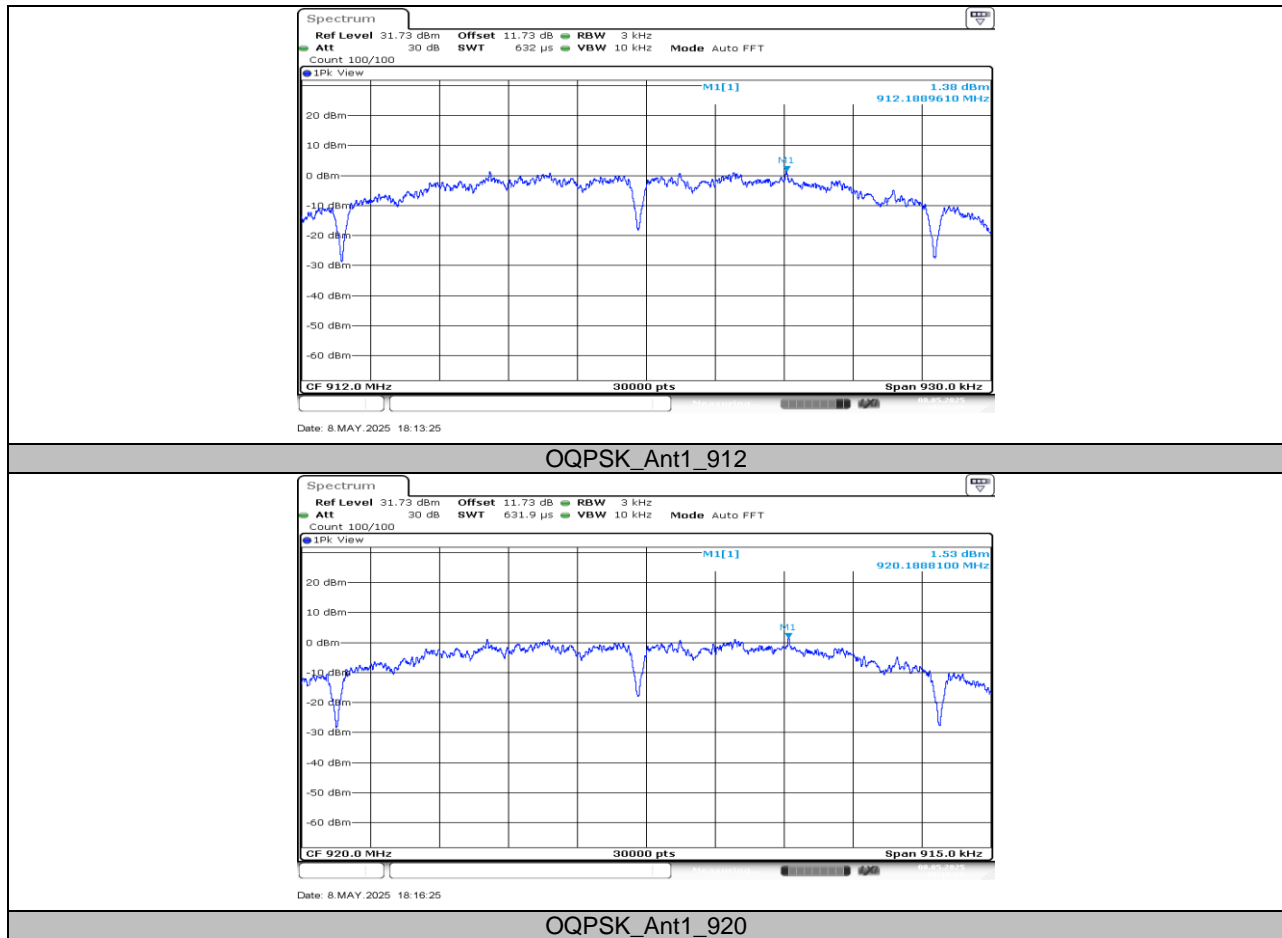
10.3. Appendix C: Maximum conducted output power**10.3.1. Test Result**

Test Mode	Antenna	Frequency[MHz]	Result[dBm]	Limit[dBm]	Verdict
OQPSK	Ant1	912	14.01	≤30	PASS
		920	13.92	≤30	PASS

10.4. Appendix D: Maximum power spectral density**10.4.1. Test Result**

TestMode	Antenna	Freq(MHz)	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
OQPSK	Ant1	912	1.38	≤8.00	PASS
		920	1.53	≤8.00	PASS

10.4.2. Test Graphs

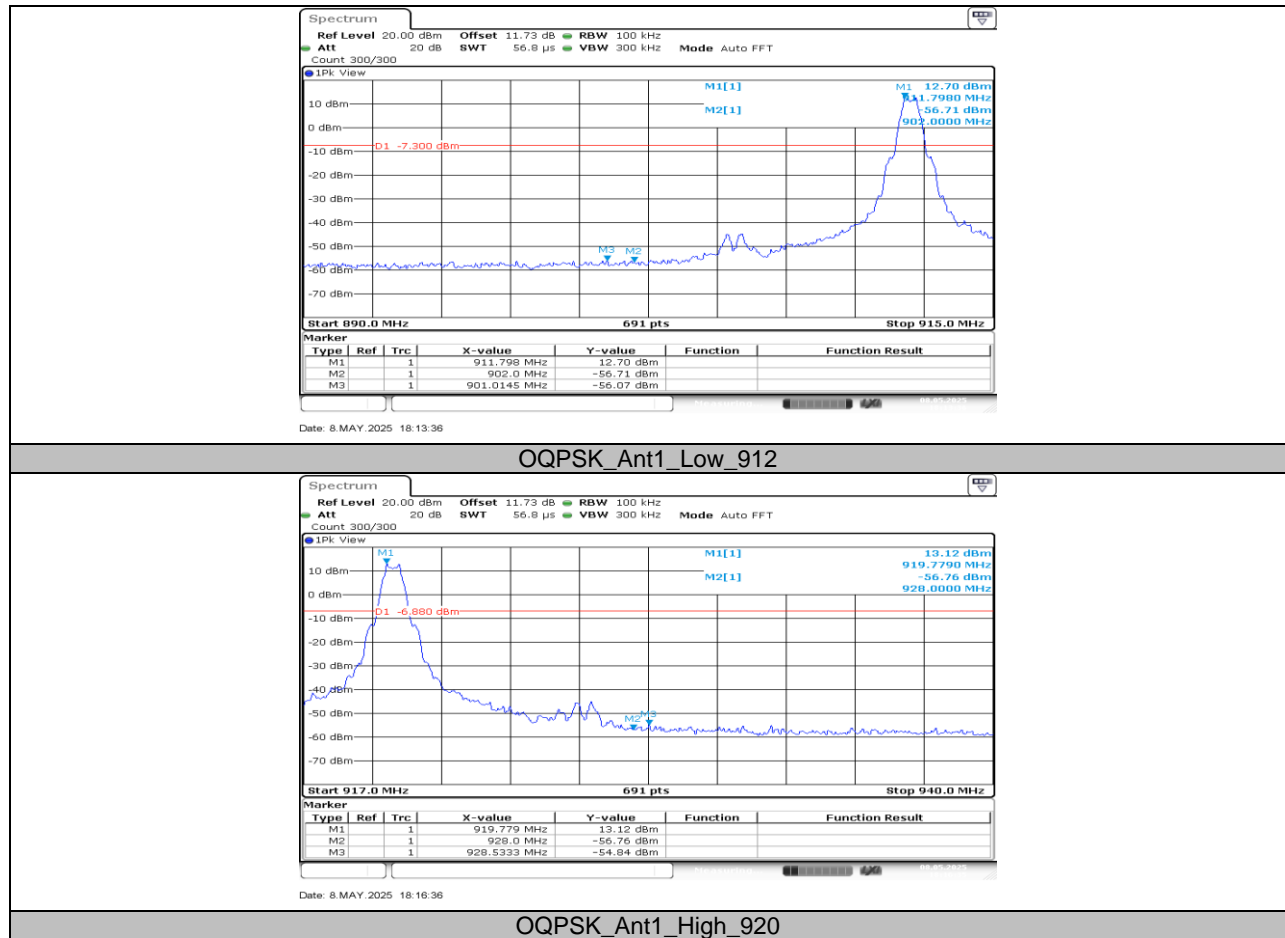


10.5. Appendix E: Band edge measurements

10.5.1. Test Result

TestMode	Antenna	ChName	Freq (MHz)	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
OQPSK	Ant1	Low	912	12.70	-56.07	≤ -7.3	PASS
		High	920	13.12	-54.84	≤ -6.88	PASS

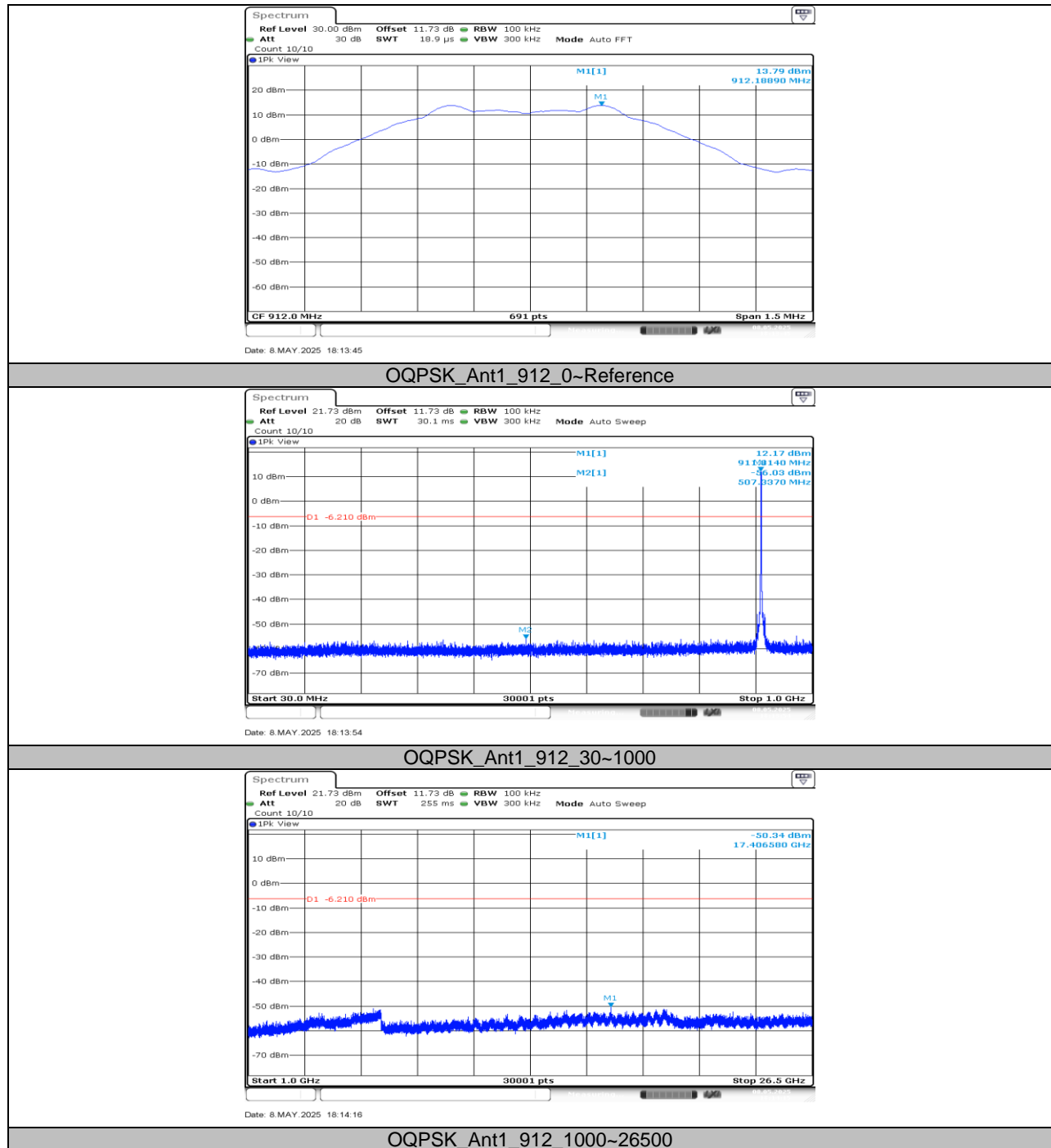
10.5.2. Test Graphs

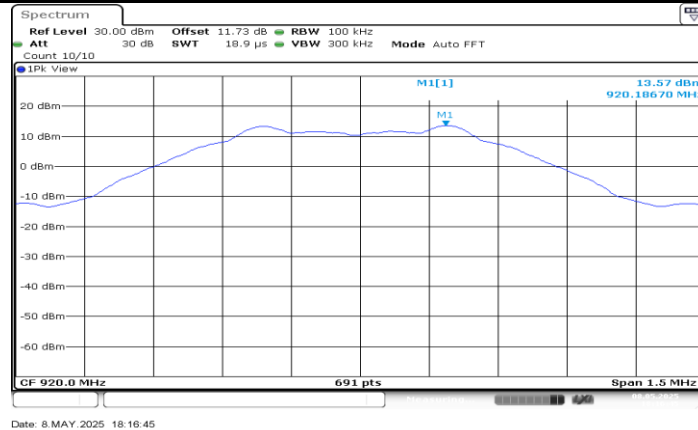


10.6. Appendix F: Conducted Spurious Emission**10.6.1. Test Result**

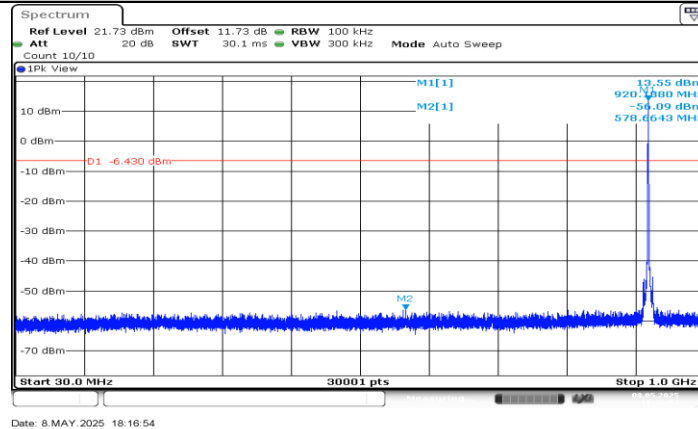
TestMode	Antenna	Freq(MHz)	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
OQPSK	Ant1	912	Reference	13.79	13.79	---	PASS
			30~1000	13.79	-56.03	≤-6.21	PASS
			1000~26500	13.79	-50.34	≤-6.21	PASS
		920	Reference	13.57	13.57	---	PASS
			30~1000	13.57	-56.09	≤-6.43	PASS
			1000~26500	13.57	-49.26	≤-6.43	PASS

10.6.2. Test Graphs

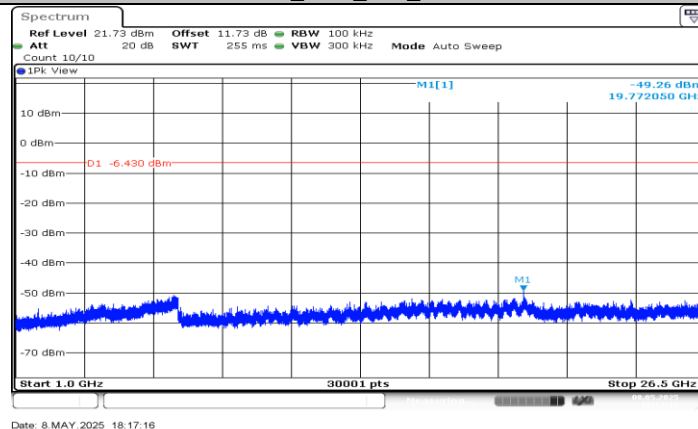




OQPSK_Ant1_920_0~Reference



OQPSK_Ant1_920_30~1000



OQPSK_Ant1_920_1000~26500

10.7. Appendix G: Duty Cycle**10.7.1. Test Result**

Test Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)	Final setting For VBW (kHz)
OQPSK	100	100	1.0000	100.00	0.00	0.01	0.01

Note:

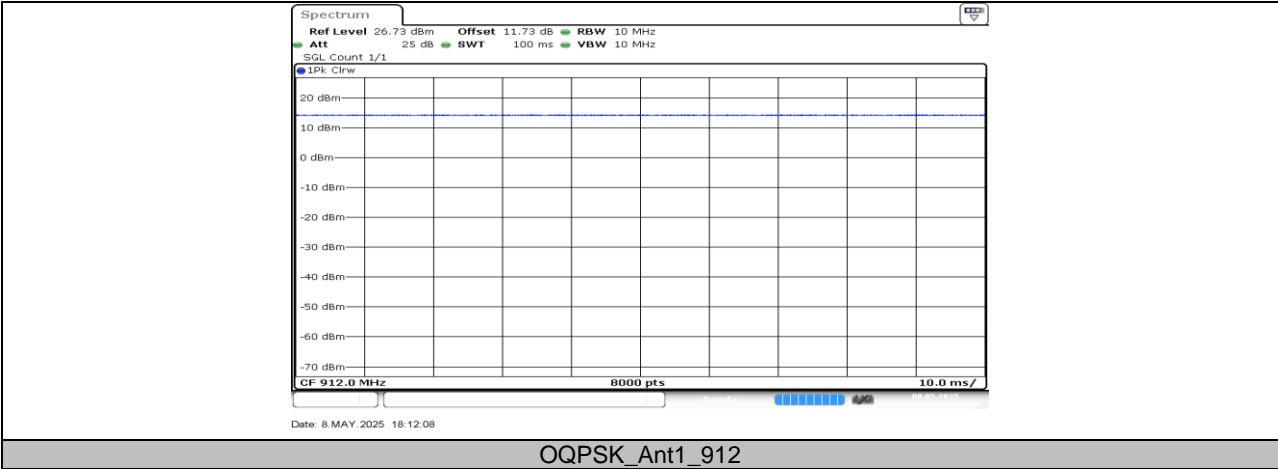
Duty Cycle Correction Factor= $10\log(1/x)$.

Where: x is Duty Cycle (Linear)

Where: T is On Time

If that calculated VBW is not available on the analyzer then the next higher value should be used.

10.7.2. Test Graphs



END OF REPORT