RF MEASUREMENT REPORT

FCC ID:	2APPT-322
Applicant:	Airthings ASA
Product:	AT-322
Model No.:	322
Brand Name:	Airthings
FCC Classification:	FCC Part 15 Spread Spectrum Transmitter (DSS)
FCC Rule Part(s):	Part15 Subpart C (Section 15.247)
Result:	Complies
Received Date:	2023-04-25
Test Date:	2023-05-03 ~ 2023-05-18

Reviewed By: Sunny Sun

Approved By: Robin Wu

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

The test results relate only to the samples tested.
The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.
The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2304RSU057-U2	V01	Initial Report	2023-05-20	Valid

CONTENTS

Description Page

1. General Information 6

1.1. Applicant 6

1.2. Manufacturer 6

1.3. Testing Facility 6

1.4. Product Information 7

1.5. Radio Specification under Test 7

1.6. Working Frequencies 8

2. Test Configuration 9

2.1. Test Mode 9

2.2. Test System Connection Diagram 9

2.3. Test Software 9

2.4. Applied Standards 10

2.5. Test Environment Condition 10

3. Antenna Requirement 11

4. Measuring Instrument 12

5. Decision Rules and Measurement Uncertainty 13

5.1. Decision Rules 13

5.2. Measurement Uncertainty 13

6. Test Result 14

6.1. Summary 14

6.2. 20dB Bandwidth Measurement 15

6.2.1. Test Limit 15

6.2.2. Test Procedure 15

6.2.3. Test Setting 15

6.2.4. Test Setup 15

6.2.5. Test Result 15

6.3. Output Power Measurement 16

6.3.1. Test Limit 16

6.3.2. Test Procedure 16

6.3.3. Test Setting 16

6.3.4. Test Setup 16

6.3.5. Test Result 16

6.4. Carrier Frequency Separation Measurement 17

6.4.1. Test Limit 17

6.4.2. Test Procedure 17

6.4.3. Test Setting 17

6.4.4. Test Setup 17
6.4.5. Test Result 17
6.5. Number of Hopping Channels Measurement 18
6.5.1. Test Limit 18
6.5.2. Test Procedure 18
6.5.3. Test Settitng 18
6.5.4. Test Setup 18
6.5.5. Test Result 18
6.6. Time of Occupancy Measurement 19
6.6.1. Test Limit 19
6.6.2. Test Procedure 19
6.6.3. Test Settitng 19
6.6.4. Test Setup 19
6.6.5. Test Result 19
6.7. Band-edge Compliance Measurement 20
6.7.1. Test Limit 20
6.7.2. Test Procedure 20
6.7.3. Test Setting 20
6.7.4. Test Setup 20
6.7.5. Test Result 20
6.8. Conducted Spurious Emissions Measurement 21
6.8.1. Test Limit 21
6.8.2. Test Procedure 21
6.8.3. Test Setting 21
6.8.4. Test Setup 21
6.8.5. Test Result 22
6.9. Radiated Spurious Emission Measurement 23
6.9.1. Test Limit 23
6.9.2. Test Procedure 23
6.9.3. Test Setting 23
6.9.4. Test Setup 25
6.9.5. Test Result 26
6.10. Radiated Restricted Band Edge Measurement 27
6.10.1. Test Limit 27
6.10.2. Test Procedure 28
6.10.3. Test Setting 28
6.10.4. Test Setup 29
6.10.5. Test Result 29
6.11. AC Conducted Emissions Measurement 30

6.11.1. Test Limit 30
6.11.2. Test Setup 30
6.11.3. Test Result 30
Appendix A - Test Result 31
A.1 Duty Cycle Test Result 31
A.2 20dB Bandwidth Test Result 32
A.3 Output Power Test Result 33
A.4 Carrier Frequency Separation Test Result 34
A.5 Number of Hopping Channels Test Result 35
A.6 Time of Occupancy Test Result 36
A.7 Band-edge Compliance Test Result 37
A.8 Conducted Spurious Emissions Test Result 38
A.9 Radiated Spurious Emission Test Result 39
A.10 Radiated Restricted Band Edge Test Result 42
Appendix B - Test Setup Photograph 46
Appendix C - EUT Photograph 47

1. General Information

1.1. Applicant

Airthings ASA

Wergelandsveien 7, 0167 Oslo, Norway

1.2. Manufacturer

4Mod Technology

4 rue de la Cornouaille, 44300 Nantes, France

1.3. Testing Facility

☒	**Test Site – MRT Suzhou Laboratory**				
	Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China **Laboratory Location (Suzhou - SIP)** 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China				
	Laboratory Accreditations				
	A2LA: 3628.01		CNAS: L10551		
	FCC: CN1166		ISED: CN0001		
	VCCI:	☐R-20025	☐G-20034	☐C-20020	☐T-20020
		☐R-20141	☐G-20134	☐C-20103	☐T-20104
☐	**Test Site – MRT Shenzhen Laboratory**				
	Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China				
	Laboratory Accreditations				
	A2LA: 3628.02		CNAS: L10551		
	FCC: CN1284		ISED: CN0105		
☐	**Test Site – MRT Taiwan Laboratory**				
	Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)				
	Laboratory Accreditations				
	TAF: L3261-190725				
	FCC: 291082, TW3261		ISED: TW3261		

1.4. Product Information

Product	AT-322
Model No.	322
EUT Identification No.	CERT_C9_6 for Conducted measurement CERT_C9_5 for Radiated
Bluetooth Specification	v5.1 Single Mode (BLE)
SmartLink Specification	905.6 ~ 926MHz
Sidewalk Specification	902.2 ~ 915.8MHz
Antenna Information	Refer to 1.5.
Operating Temp.	0 ~ 45°C
Working Voltage	2x AA batteries giving max 3.6V
Note: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification under Test

Frequency Range	905.6 ~ 926 MHz
Channel Number	52
Type of modulation	FHSS
Antenna Type	Fixed Internal Antenna
Antenna Gain	1.48 dBi

1.6. Working Frequencies

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	905.6 MHz	2	906.0 MHz	3	906.4 MHz
4	906.8 MHz	5	907.2 MHz	6	907.6 MHz
7	908.0 MHz	8	908.4 MHz	9	908.8 MHz
10	909.2 MHz	11	909.6 MHz	12	910.0 MHz
13	910.4 MHz	14	910.8 MHz	15	911.2 MHz
16	911.6 MHz	17	912.0 MHz	18	912.4 MHz
19	912.8 MHz	20	913.2 MHz	21	913.6 MHz
22	914.0 MHz	23	914.4 MHz	24	914.8 MHz
25	915.2 MHz	26	915.6 MHz	27	916.0 MHz
28	916.4 MHz	29	916.8 MHz	30	917.2 MHz
31	917.6 MHz	32	918.0 MHz	33	918.4 MHz
34	918.8 MHz	35	919.2 MHz	36	919.6 MHz
37	920.0 MHz	38	920.4 MHz	39	920.8 MHz
40	921.2 MHz	41	921.6 MHz	42	922.0 MHz
43	922.4 MHz	44	922.8 MHz	45	923.2 MHz
46	923.6 MHz	47	924.0 MHz	48	924.4 MHz
49	924.8 MHz	50	925.2 MHz	51	925.6 MHz
52	926.0 MHz	-	-	-	-

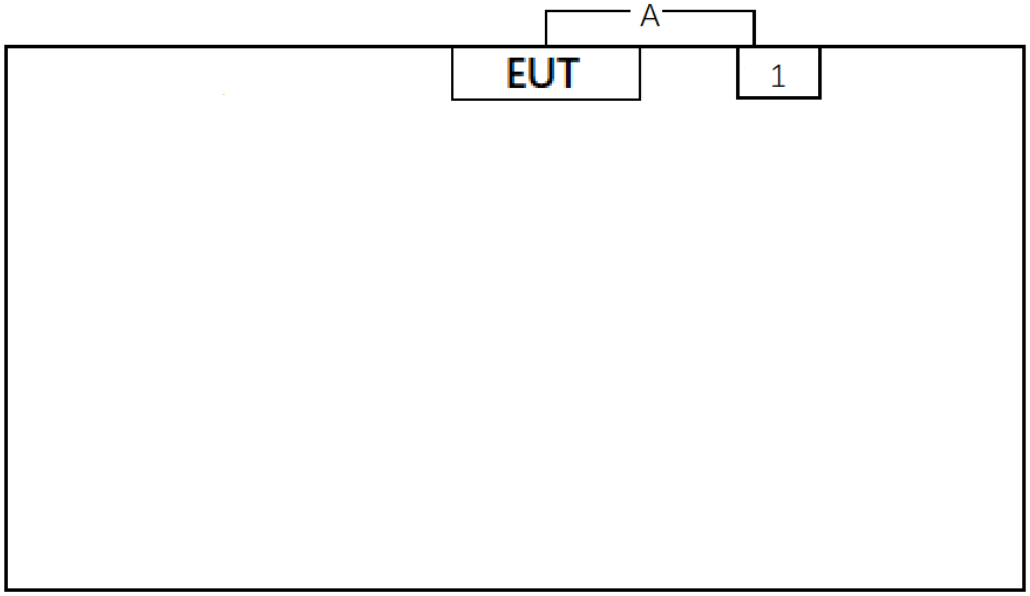
2. Test Configuration

2.1. Test Mode

Mode 1: Transmit by SmartLink

2.2. Test System Connection Diagram

The device was tested per the guidance ANSI C63.10: 2013 was used to reference the appropriate EUT setup for radiated emissions testing.

Connection Diagram – Radiated Emission testing			
			
Cable Type		Cable Spec.	Length
A	Serial Cable	Shielding	1.5m
Product		Manufacturer	Model No.
1	Notebook	DELL	DELL Inspiron 5359

2.3. Test Software

The test utility software used during testing was “IPOP”, and the version was 4.1.

2.4. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15.247
- KDB 558074 D01v05r02
- ANSI C63.10-2013

2.5. Test Environment Condition

Ambient Temperature	15 ~ 35 °C
Relative Humidity	20 ~ 75 %RH

3. Antenna Requirement

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antenna of the device is **permanently attached.**

Conclusion:

The unit complies with the requirement of §15.203.

4. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2023-12-28	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2023-08-22	WZ-AC1
Preamplifier	Agilent	83017A	MRTSUE06076	1 year	2024-05-07	WZ-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2023-06-21	WZ-AC1
Anechoic Chamber	TDK	WZ-AC1	MRTSUE06212	1 year	2024-04-20	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE06403	1 year	2023-06-06	WZ-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06607	1 year	2023-12-28	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11039	1 year	2023-11-01	WZ-AC1
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2023-09-29	WZ-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2023-06-04	WZ-SR5
Thermohygrometer	testo	608-H1	MRTSUE06402	1 year	2023-06-06	WZ-SR5
Shielding Room	HUAMING	WZ-SR5	MRTSUE06442	N/A	N/A	WZ-SR5
Attenuator	MVE	MVE2213	MRTSUE11093	1 year	2023-06-09	WZ-SR5
Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2024-02-29	WZ-SR5

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802	2.03C	RE Antenna & Turntable

5. Decision Rules and Measurement Uncertainty

5.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2.

(Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.2. Measurement Uncertainty

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement
The maximum measurement uncertainty is evaluated as: 9kHz~150kHz: 3.58dB 150kHz~30MHz: 3.20dB
Radiated Disturbance
The maximum measurement uncertainty is evaluated as: Coaxial: 9kHz~30MHz: 2.59dB Coplanar: 9kHz~30MHz: 2.60dB Horizontal: 30MHz~200MHz: 3.85dB 200MHz~1GHz: 4.36dB 1GHz~10GHz: 4.98dB Vertical: 30MHz~200MHz: 4.06dB 200MHz~1GHz: 5.28dB 1GHz~10GHz: 4.91dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.30dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.30dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 3.20%

6. Test Result

6.1. Summary

FCC Section(s)	Test Description	Test Condition	Verdict
15.247(a)(1)(i)	20dB Bandwidth	Conducted	Pass
15.247(b)(2)	Peak Transmitter Output Power		Pass
15.247(a)(1)	Channel Separation		Pass
15.247(a)(1)(i)	Number of Channels		Pass
15.247(a)(1)(i)	Time of Occupancy		Pass
15.247(d)	Band Edge / Out- of-Band Emissions		Pass
15.205, 15.209	General Field Strength (Restricted Bands and Radiated Emission)	Radiated	Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	N/A

Notes:

1. The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
2. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
3. “N/A” means that this item is not applicable, and the detail information refer to relevant section.

6.2. 20dB Bandwidth Measurement

6.2.1. Test Limit

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

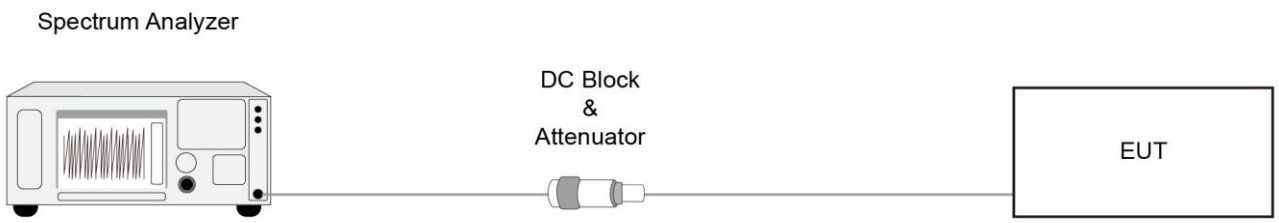
6.2.2. Test Procedure

ANSI C63.10-2013 - Section 6.9.2 (20dB Bandwidth)

6.2.3. Test Setting

1. Set RBW = 1% to 5% of the 20dB bandwidth
2. VBW = approximately three times RBW
3. Span = approximately 2 to 5 times the 20dB bandwidth, centered on a hopping channel
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize
8. 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 20 dB relative to the maximum level measured in the fundamental emission.

6.2.4. Test Setup



6.2.5. Test Result

Refer to Appendix A.2.

6.3. Output Power Measurement

6.3.1. Test Limit

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels

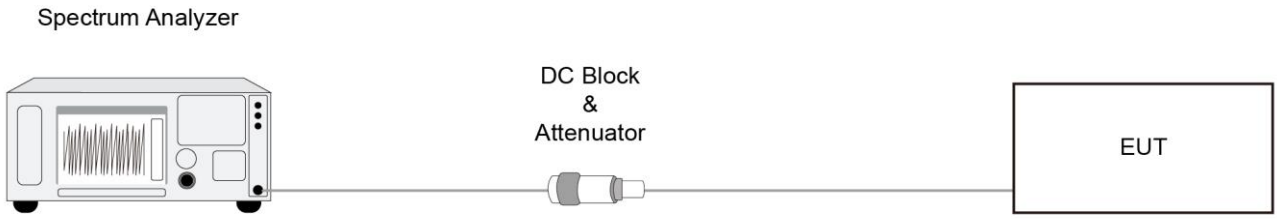
6.3.2. Test Procedure

ANSI C63.10-2013 - Section 7.8.5

6.3.3. Test Setting

1. Set RBW ≥ the 20 dB bandwidth of the emission being measured.
2. VBW ≥ RBW
3. Span = approximately five times the 20dB bandwidth, centered on a hopping channel
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (don't forget added the external attenuation and cable loss)

6.3.4. Test Setup



6.3.5. Test Result

Refer to Appendix A.3.

6.4. Carrier Frequency Separation Measurement

6.4.1. Test Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

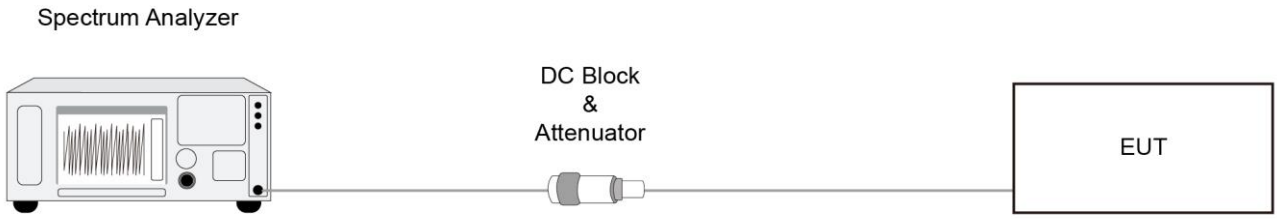
6.4.2. Test Procedure

ANSI C63.10-2013 - Section 7.8.2.

6.4.3.Test Setting

1. Span = wide enough to capture the peaks of two adjacent channels.
2. Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3. VBW ≥ RBW
4. Sweep time = Auto couple
5. Detector = Peak
6. Trace mode = Max hold
7. Allowed the trace to stabilize
8. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

6.4.4. Test Setup



6.4.5. Test Result

Refer to Appendix A.4.

6.5. Number of Hopping Channels Measurement

6.5.1. Test Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.

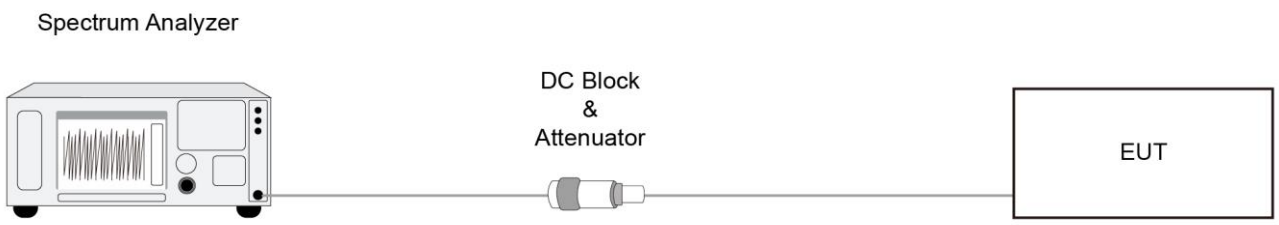
6.5.2. Test Procedure

ANSI C63.10-2013 - Section 7.8.3.

6.5.3. Test Settitng

1. Span = the frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. VBW ≥ RBW
4. Sweep time = Auto couple
5. Detector = Peak
6. Trace mode = Max hold
7. Allow the trace to stabilize

6.5.4. Test Setup



6.5.5. Test Result

Refer to Appendix A.5.

6.6. Time of Occupancy Measurement

6.6.1. Test Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

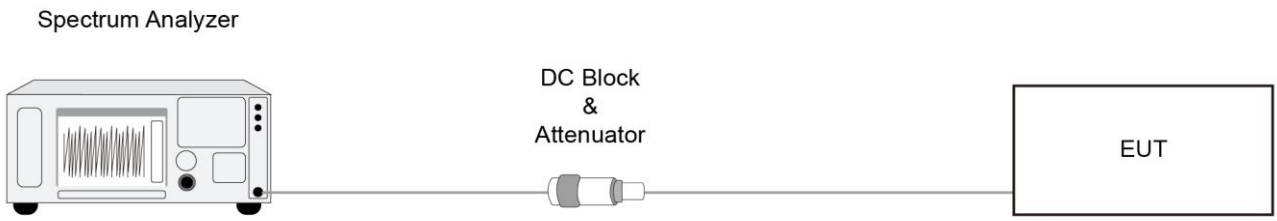
6.6.2. Test Procedure

ANSI C63.10-2013 - Section 7.8.4.

6.6.3. Test Settitng

1. Span = zero span, centered on a hopping channel.
2. RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
3. VBW ≥ RBW
4. Sweep time = as necessary to capture the entire dwell time per hopping channel
5. Detector = Peak
6. Trace mode = max hold
7. Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time. An oscilloscope may be used instead of a spectrum analyzer. The EUT shall show compliance with the appropriate regulatory limit for the number of hopping channels. A plot of the data shall be included in the test report.

6.6.4. Test Setup



6.6.5. Test Result

Refer to Appendix A.6.

6.7. Band-edge Compliance Measurement

6.7.1. Test Limit

The maximum permissible emission level is 20dBc. Any emissions were lying outside of the emission bandwidth and in authorized band edges to a field strength limit specified in Section 15.209 of the Title 47 CFR.

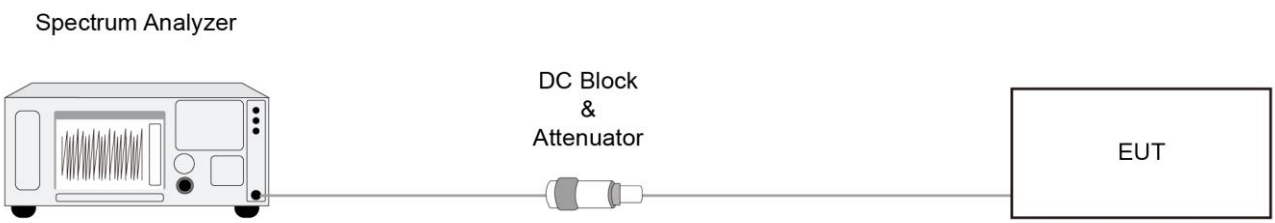
6.7.2. Test Procedure

ANSI C63.10-2013 - Section 6.10.4.

6.7.3. Test Setting

1. Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize
8. Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission.

6.7.4. Test Setup



6.7.5. Test Result

Refer to Appendix A.7.

6.8. Conducted Spurious Emissions Measurement

6.8.1. Test Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

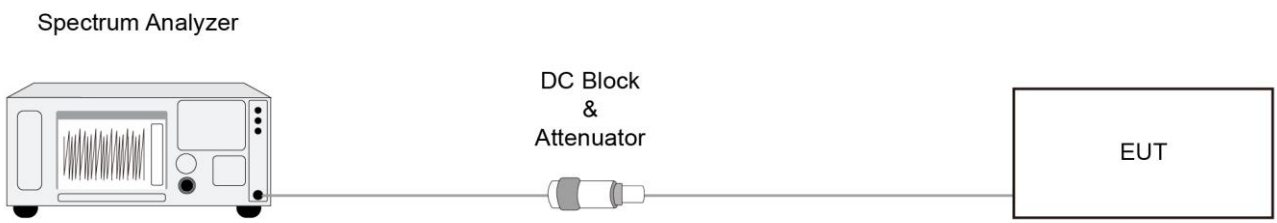
6.8.2. Test Procedure

ANSI C63.10-2013 - Section 7.8.8.

6.8.3. Test Setting

1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize
8. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this section.

6.8.4. Test Setup



6.8.5. Test Result

Refer to Appendix A.8.

6.9. Radiated Spurious Emission Measurement

6.9.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.9.2. Test Procedure

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 Section 6.5 (Standard test method above 30MHz to 1GHz)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

6.9.3. Test Setting

Table 1 - RBW as a function of frequency

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Quasi-Peak Measurements below 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = as specified in Table 1
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

Peak Measurements above 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

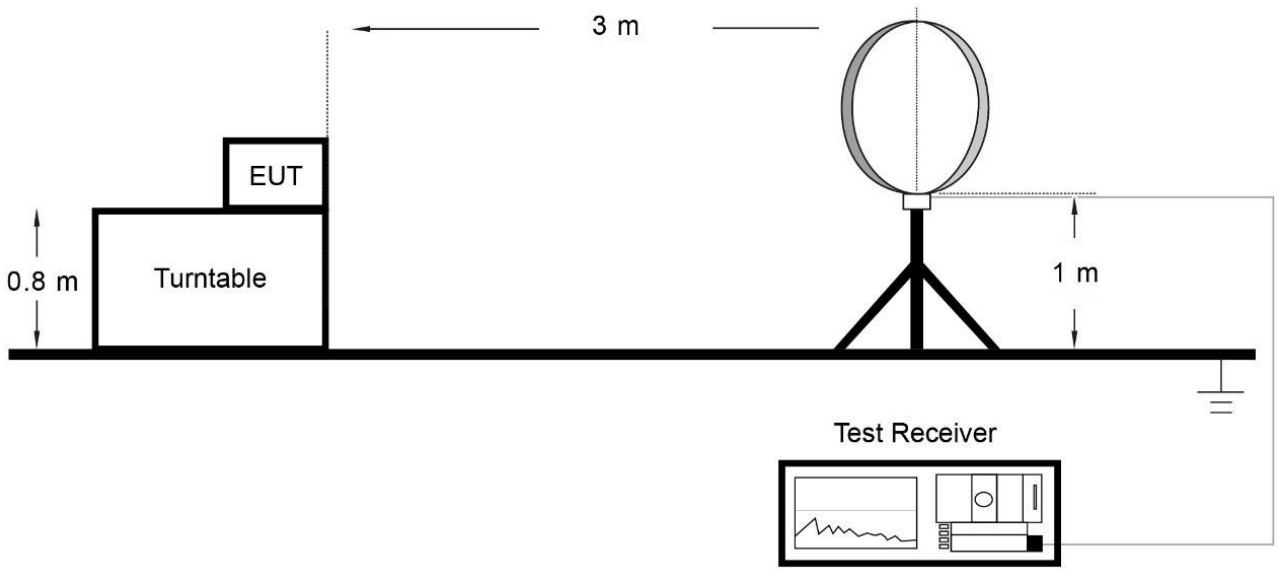
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.

If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.

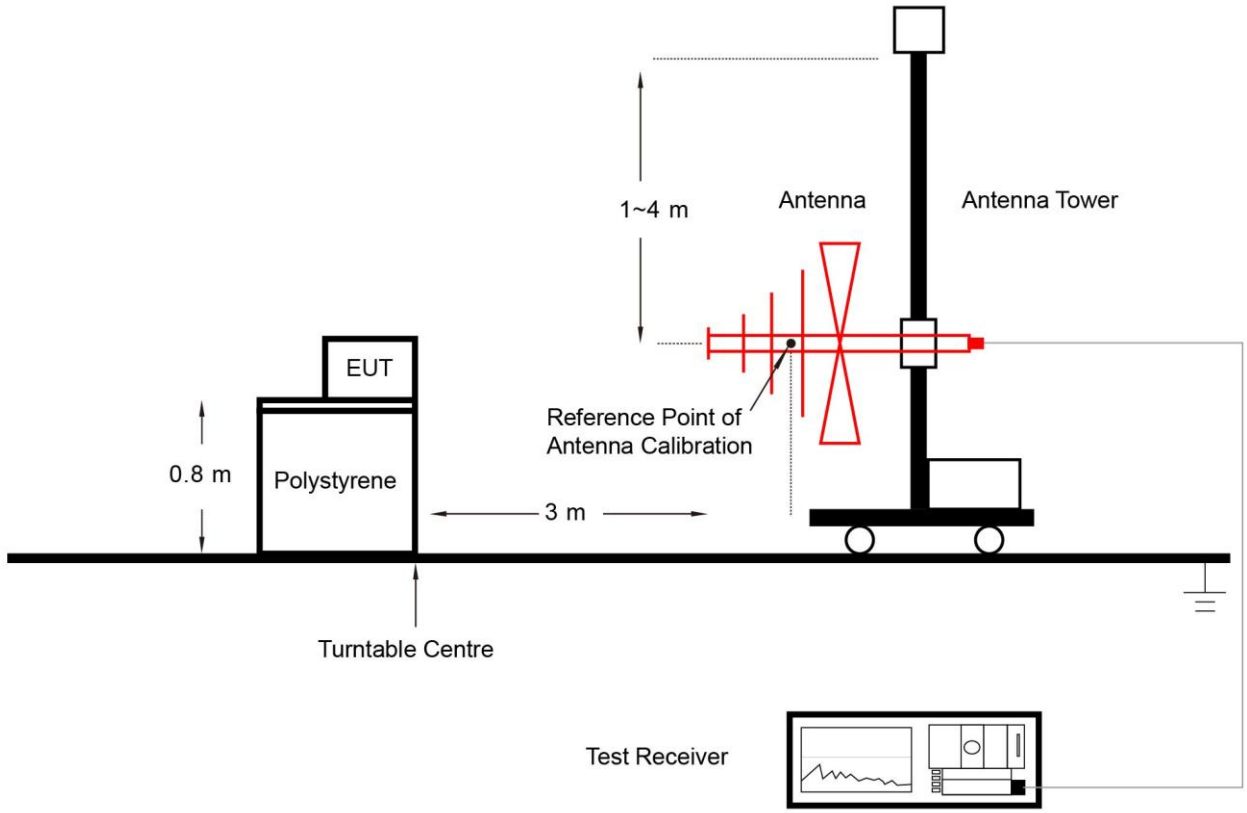
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

6.9.4. Test Setup

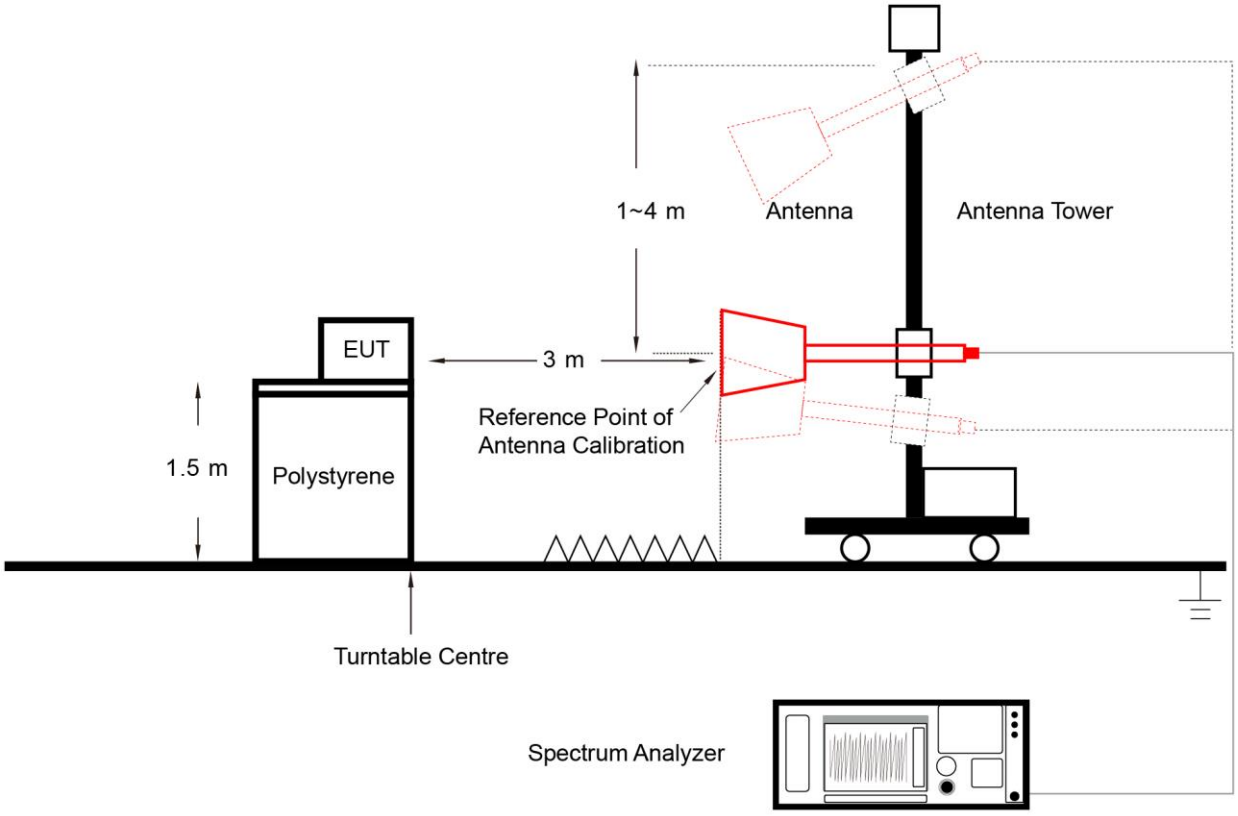
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



6.9.5. Test Result

Refer to Appendix A.9.

6.10. Radiated Restricted Band Edge Measurement

6.10.1. Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (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 - 156.525	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	--	--	--

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.10.2. Test Procedure

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

6.10.3. Test Setting

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. RBW = 1MHz

3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.

   If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.

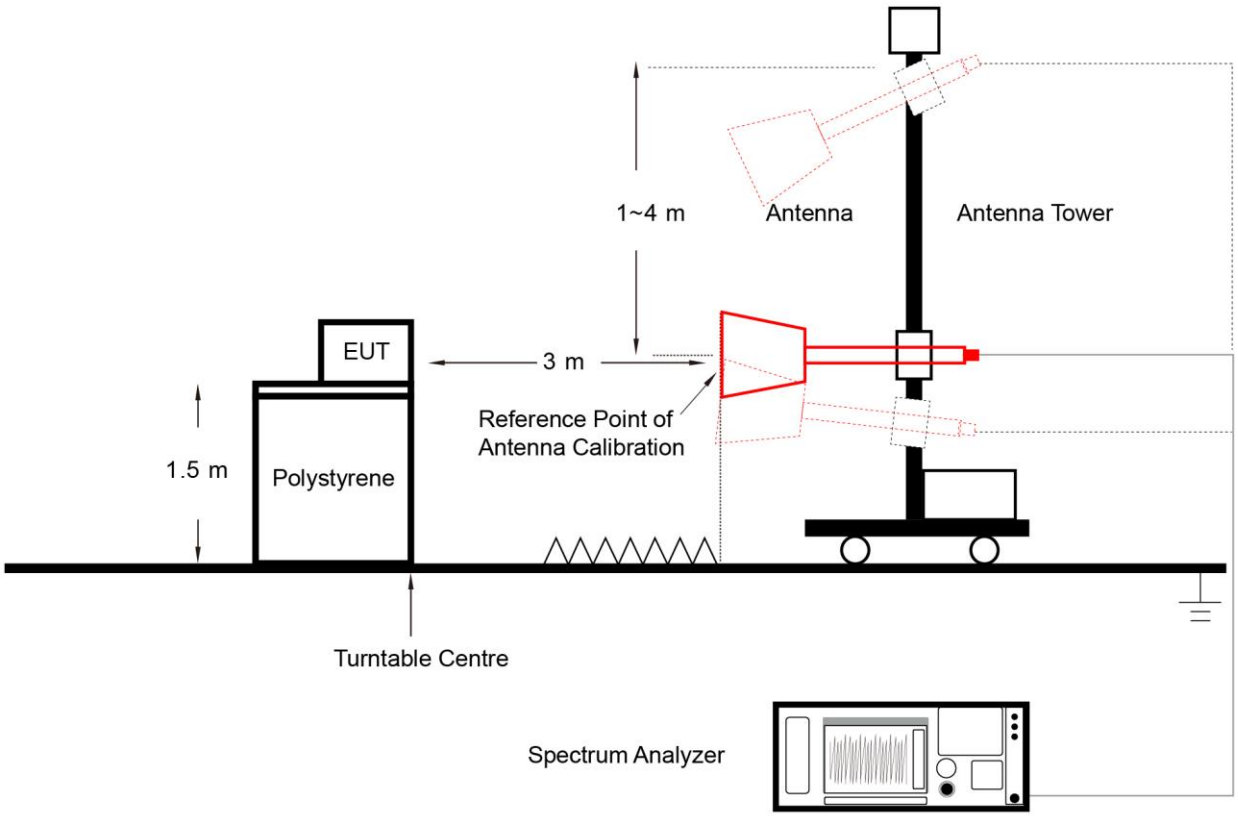
4. Detector = Peak

5. Sweep time = auto

6. Trace mode = max hold

7. Trace was allowed to stabilize

6.10.4. Test Setup



6.10.5. Test Result

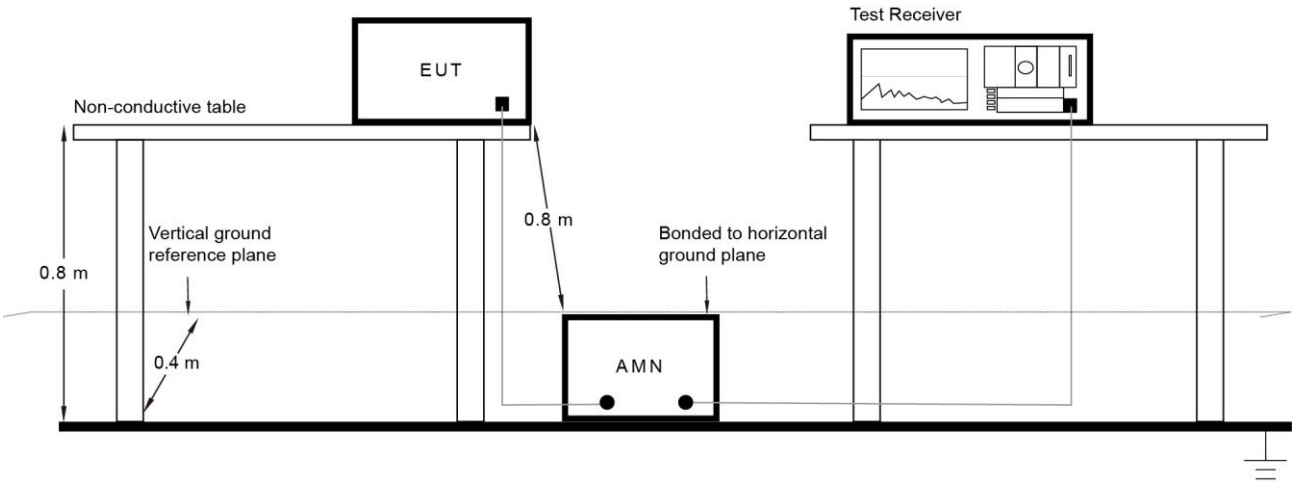
Refer to Appendix A.10.

6.11. AC Conducted Emissions Measurement

6.11.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBμV)	Average (dBμV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50
Note 1: The lower limit shall apply at the transition frequencies. Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.		

6.11.2. Test Setup



6.11.3. Test Result

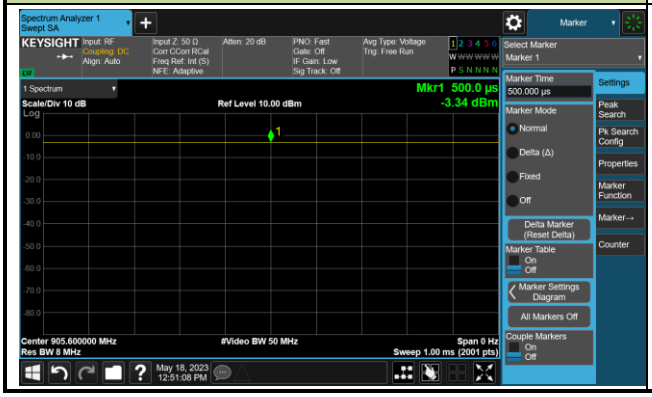
The device powered by battery, so this item was not applicable.

Appendix A - Test Result

A.1 Duty Cycle Test Result

Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2023-05-18		

Channel No.	Duty Cycle
01	100%

905.6MHz	
	

A.2 20dB Bandwidth Test Result

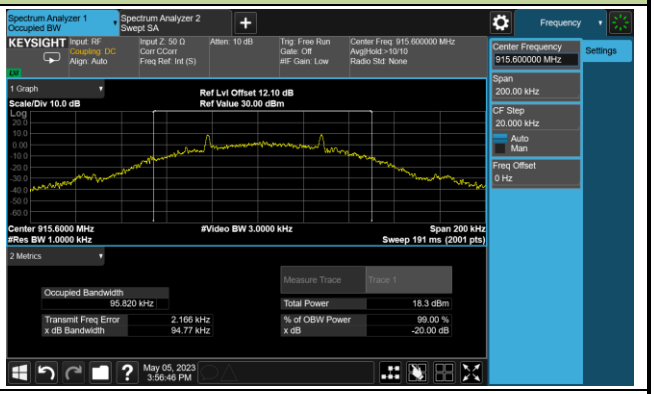
Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2023-05-05		

Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)
01	905.6	92.77	≤ 500
26	915.6	94.77	≤ 500
52	926.0	94.58	≤ 500

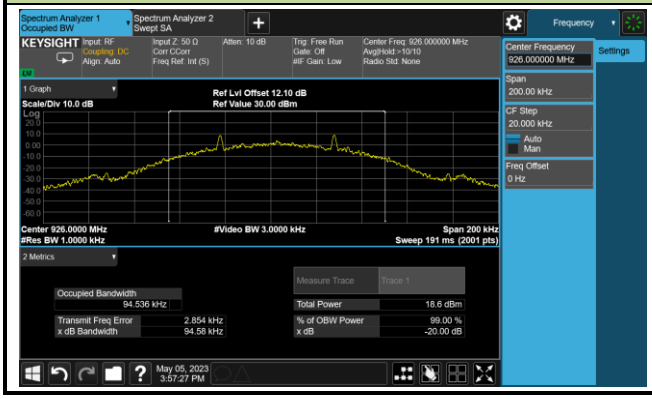
20dB Bandwidth

Channel 01 (905.6MHz)

Channel 26 (915.6MHz)



Channel 52 (926.0MHz)



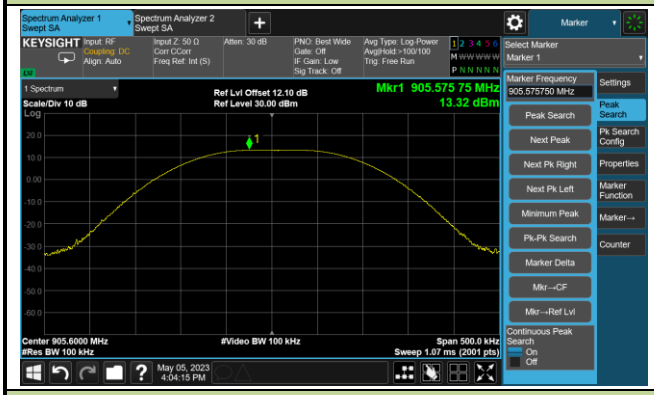
A.3 Output Power Test Result

Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2023-05-05		

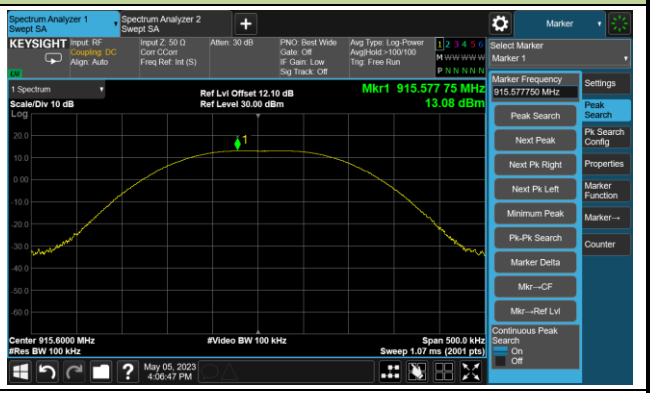
Channel No.	Frequency (MHz)	Output Power (dBm)	Power Limit (dBm)
01	905.6	13.32	≤ 30.00
26	915.6	13.08	≤ 30.00
52	926.0	12.71	≤ 30.00

Output Power

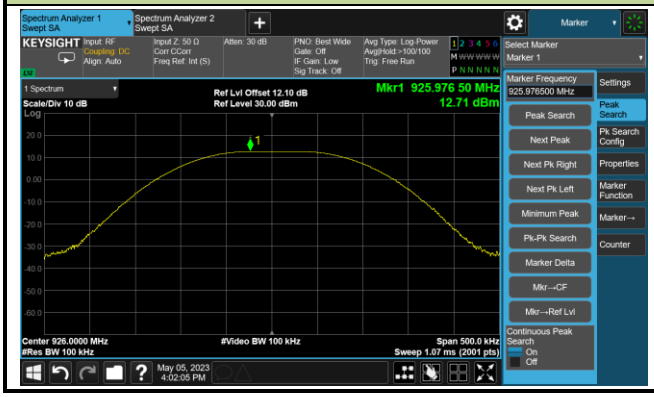
Channel 01 (905.6MHz)



Channel 26 (915.6MHz)



Channel 52 (926.0MHz)



A.4 Carrier Frequency Separation Test Result

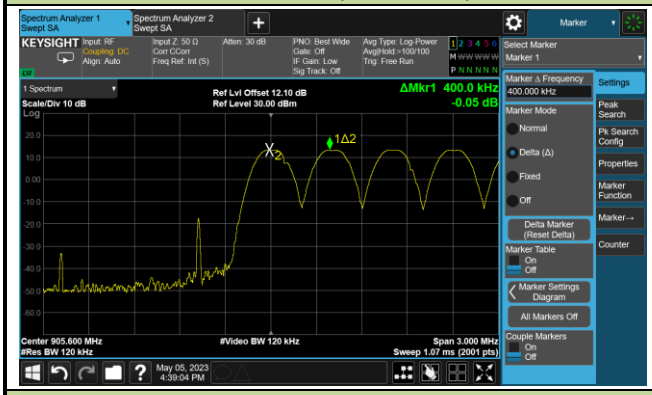
Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2023-05-05		

Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
01	905.6	400	≥ 92.77	Pass
26	915.6	400	≥ 94.77	Pass
52	926.0	400	≥ 94.58	Pass

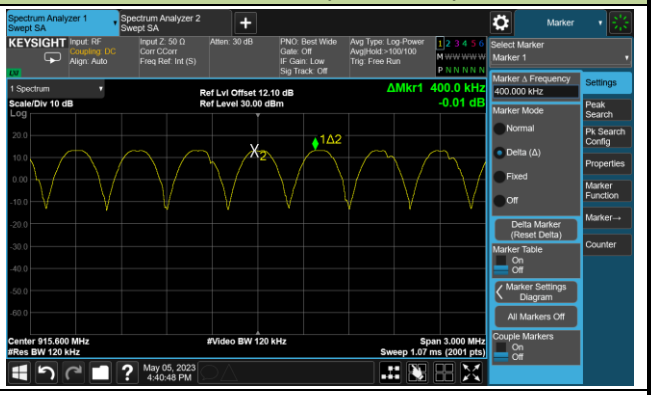
Note: The limit is the value of the 20dB BW.

Carrier Frequency Separation

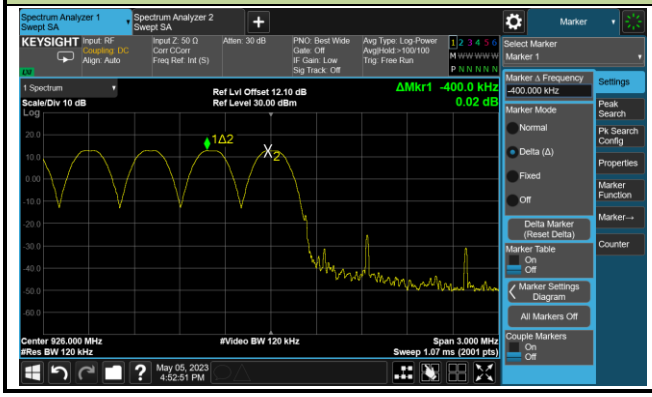
Channel 01 (905.6MHz)



Channel 26 (915.6MHz)



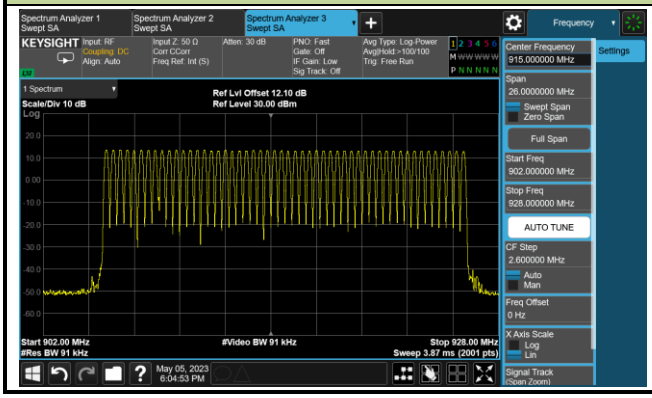
Channel 52 (926.0MHz)



A.5 Number of Hopping Channels Test Result

Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2023-05-05		

Channel Numbers	Frequency (MHz)	Limit (Hopping Channels)	Result
52	905.6~926.0	≥ 50	Pass

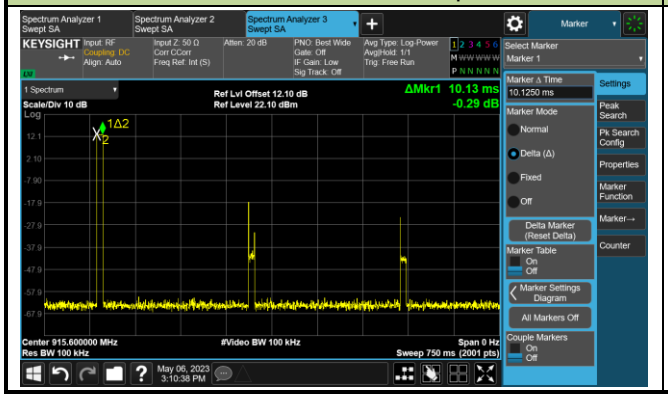
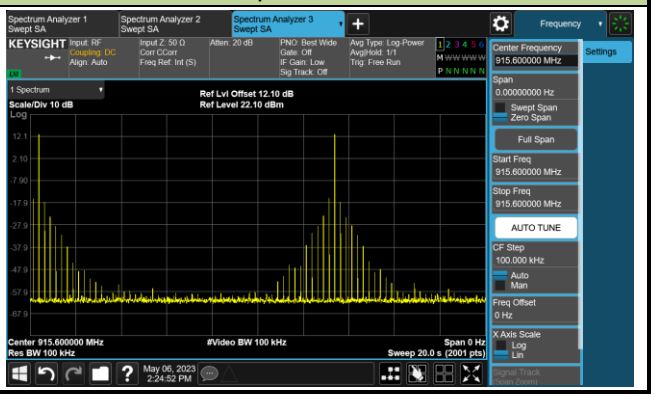
Number of Hopping Channels	
902.0~928.0MHz	
	

A.6 Time of Occupancy Test Result

Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2023-05-06		

Channel No.	Frequency (MHz)	Transmit Time Per Hop (ms)	Observation Period (s)	Number of Hops in Observation Period	Time of Occupancy (ms)	Limit (ms)	Result
01~52	905.6~926.0	10.13	20	2	20.26	≤ 400	Pass

Note: Time of Occupancy (ms) = Transmit Time Per Hop (ms) * Number of Hops in Observation Period

Transmit Time Per Hop	Number of Hops in Observation Period
	

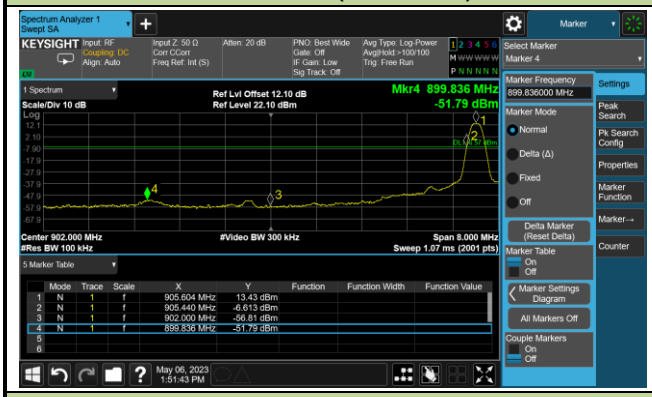
A.7 Band-edge Compliance Test Result

Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2023-05-06~2023-05-11		

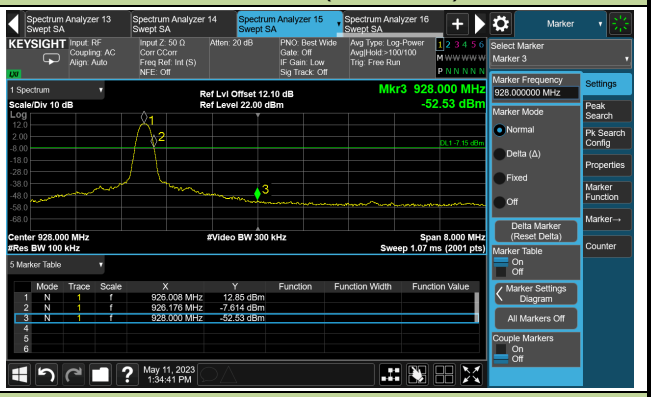
Channel No.	Frequency (MHz)	Limit	Result
01	905.6	20dBc	Pass
52	926.0	20dBc	Pass

Band-edge Compliance

Channel 01 (905.6MHz)

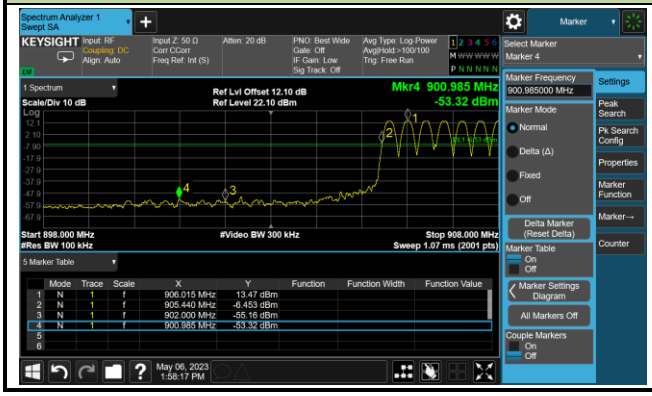


Channel 52 (926.0MHz)

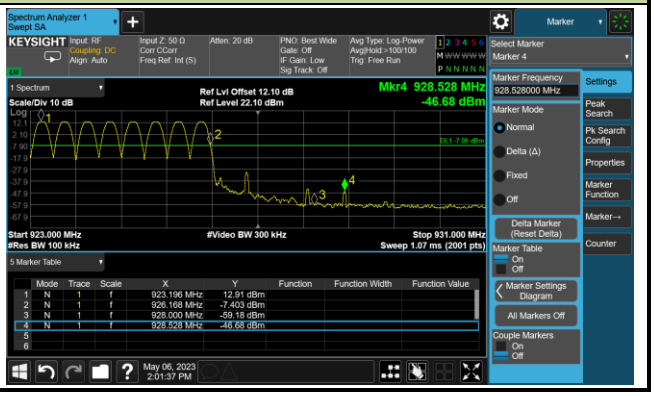


Operation Frequency Range of 20dB Bandwidth within Hopping Mode

Channel 01 (905.6MHz)



Channel 52 (926.0MHz)



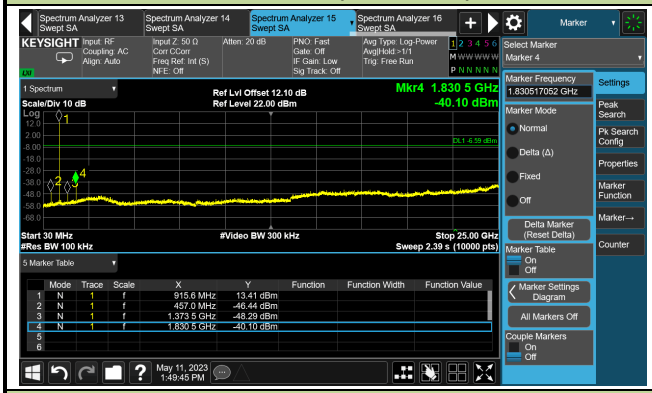
A.8 Conducted Spurious Emissions Test Result

Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2023-05-11		

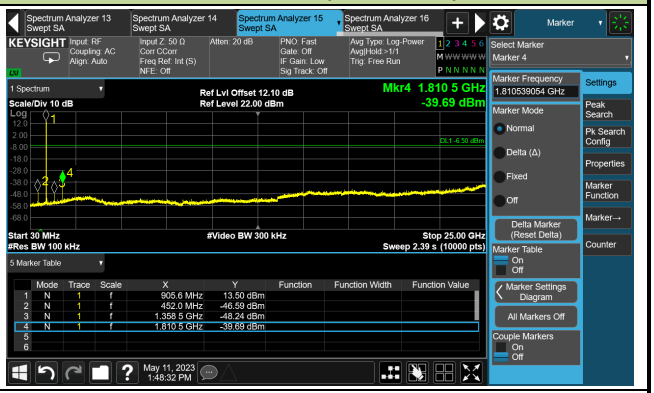
Channel No.	Frequency (MHz)	Limit (MHz)	Result
01	905.6	20dBc	Pass
26	915.6	20dBc	Pass
52	926.0	20dBc	Pass

Conducted Spurious Emissions

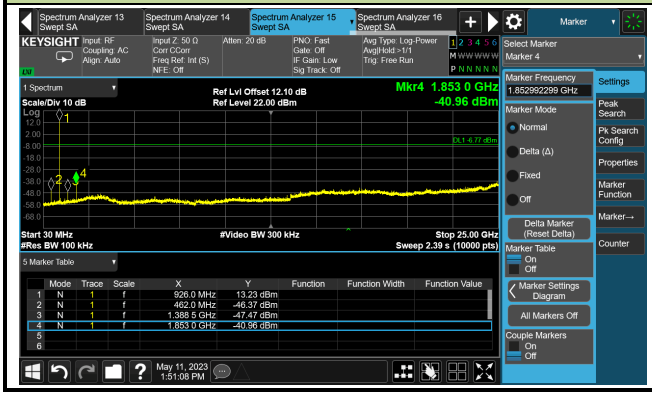
Channel 01 (905.6MHz)



Channel 26 (915.6MHz)



Channel 52 (926.0MHz)



A.9 Radiated Spurious Emission Test Result

Test Site	WZ-AC1	Test Engineer	Charles Zhang
Test Date	2023-05-03		
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-10GHz, there is not show in the report.		

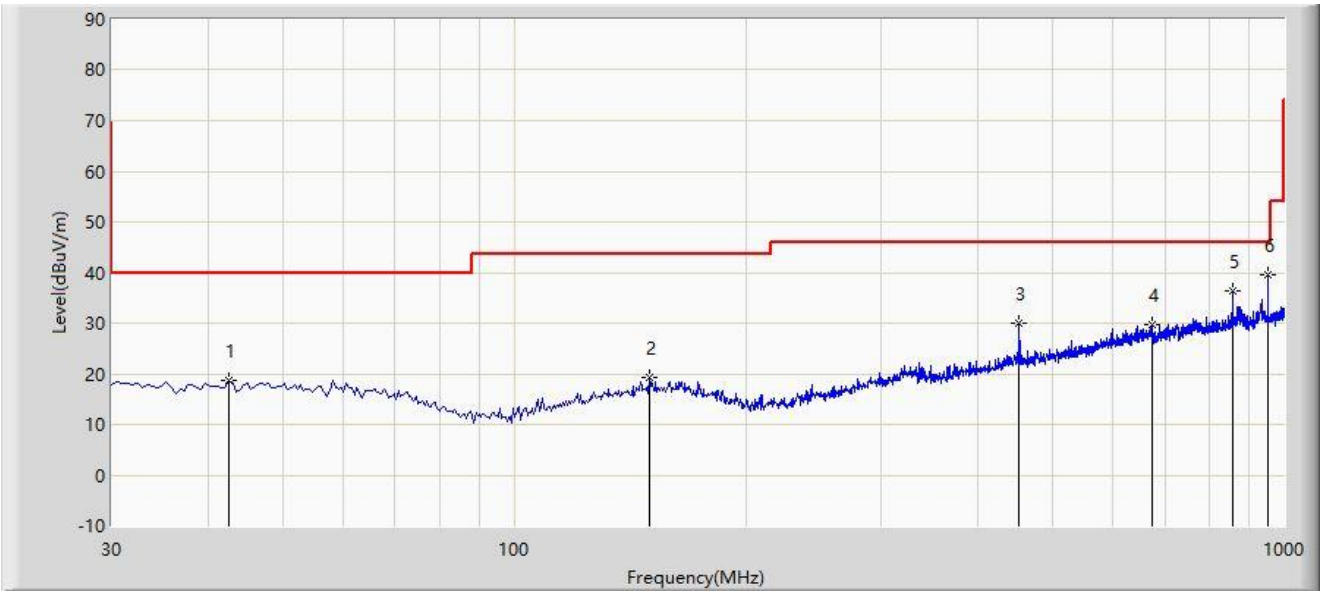
Test Channel	Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
01	2717.0	43.2	-2.6	40.6	74.0	-33.4	Peak	Horizontal
	8148.5	41.2	8.7	49.9	74.0	-24.1	Peak	Horizontal
	9058.0	40.4	10.5	50.9	74.0	-23.1	Peak	Horizontal
	1357.0	47.7	-5.8	41.9	74.0	-32.1	Peak	Vertical
	2717.0	45.7	-2.6	43.1	74.0	-30.9	Peak	Vertical
	8148.5	41.0	8.7	49.7	74.0	-24.3	Peak	Vertical
26	2751.0	42.2	-2.5	39.7	74.0	-34.3	Peak	Horizontal
	8242.0	42.1	8.5	50.6	74.0	-23.4	Peak	Horizontal
	9160.0	39.2	11.2	50.4	74.0	-23.6	Peak	Horizontal
	1374.0	48.3	-5.7	42.6	74.0	-31.4	Peak	Vertical
	2751.0	44.7	-2.5	42.2	74.0	-31.8	Peak	Vertical
	8242.0	42.6	8.5	51.1	74.0	-22.9	Peak	Vertical
	8242.0	40.2	8.5	48.7	54.0	-5.3	Average	Vertical
52	1391.0	44.2	-5.7	38.5	74.0	-35.5	Peak	Horizontal
	2776.5	44.1	-2.4	41.7	74.0	-32.3	Peak	Horizontal
	8335.0	43.7	8.3	52.0	54.0	-2.0	Average	Horizontal
	8335.5	44.2	8.3	52.5	74.0	-21.5	Peak	Horizontal
	1391.0	48.5	-5.7	42.8	74.0	-31.2	Peak	Vertical
	2776.5	44.6	-2.4	42.2	74.0	-31.8	Peak	Vertical
	8335.0	41.6	8.3	49.9	54.0	-4.1	Average	Vertical
	8335.5	42.9	8.3	51.2	74.0	-22.8	Peak	Vertical

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

Factor ((dB/m) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

The Result of Radiated Emission below 1GHz:

Site: WZ-AC1	Test Date: 2023-05-06
Limit: FCC_Part15.209_RSE(3m)	Engineer: Charles Zhang
Probe: VULB 9168_25-2000MHz	Polarity: Horizontal
EUT: AT-322	Power: By Battery
Test Mode: Transmit at 905.6MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		42.610	18.723	0.373	-21.277	40.000	18.350	PK
2		149.795	19.247	1.257	-24.253	43.500	17.990	PK
3		452.920	30.107	7.794	-15.893	46.000	22.313	PK
4		672.625	29.658	3.313	-16.342	46.000	26.345	PK
5		857.895	36.474	7.506	-9.526	46.000	28.968	PK
6	*	953.925	39.621	9.939	-6.379	46.000	29.682	PK

Note 1: " * ", means this data is the worst emission level.

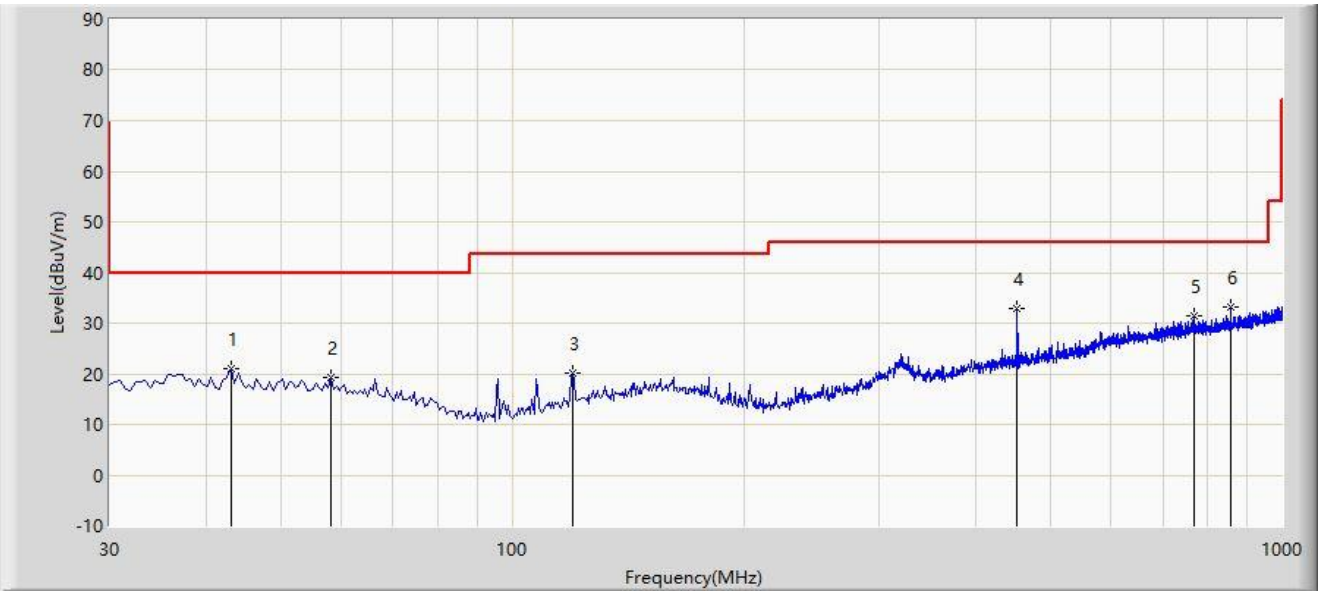
Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: Quasi-Peak measurement was not performed when peak measure level was lower than the quasi-peak limit.

Note 5: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

Site: WZ-AC1	Test Date: 2023-05-06
Limit: FCC_Part15.209_RSE(3m)	Engineer: Charles Zhang
Probe: VULB 9168_25-2000MHz	Polarity: Vertical
EUT: AT-322	Power: By Battery
Test Mode: Transmit at 905.6MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		43.095	20.947	2.586	-19.053	40.000	18.361	PK
2		58.130	19.388	1.763	-20.612	40.000	17.625	PK
3		119.725	20.109	4.357	-23.391	43.500	15.753	PK
4		452.920	32.931	10.618	-13.069	46.000	22.313	PK
5		768.170	31.365	3.145	-14.635	46.000	28.220	PK
6	*	857.895	33.091	4.123	-12.909	46.000	28.968	PK

Note 1: " * ", means this data is the worst emission level.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

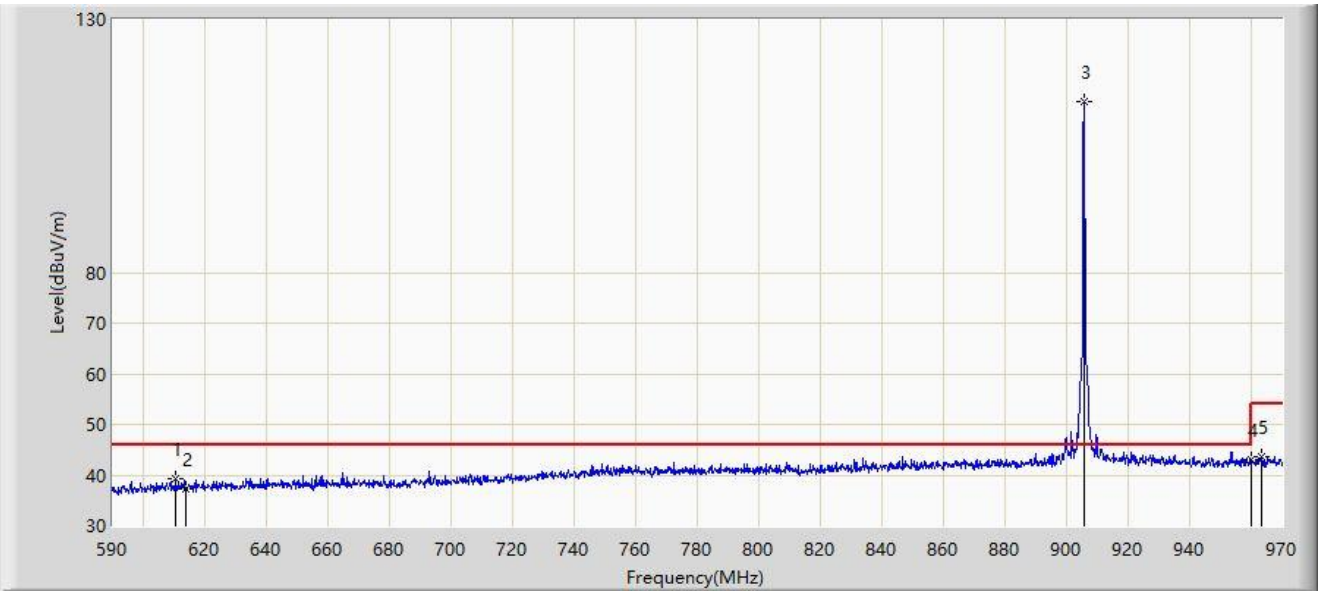
Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: Quasi-Peak measurement was not performed when peak measure level was lower than the quasi-peak limit.

Note 5: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

A.10 Radiated Restricted Band Edge Test Result

Site: WZ-AC1	Test Date: 2023-05-03
Limit: FCC_Part15.209_RSE(3m)	Engineer: Charles Zhang
Probe: VULB 9168_25-2000MHz	Polarity: Horizontal
EUT: AT-322	Power: By Battery
Test Mode: Transmit at 905.6MHz	



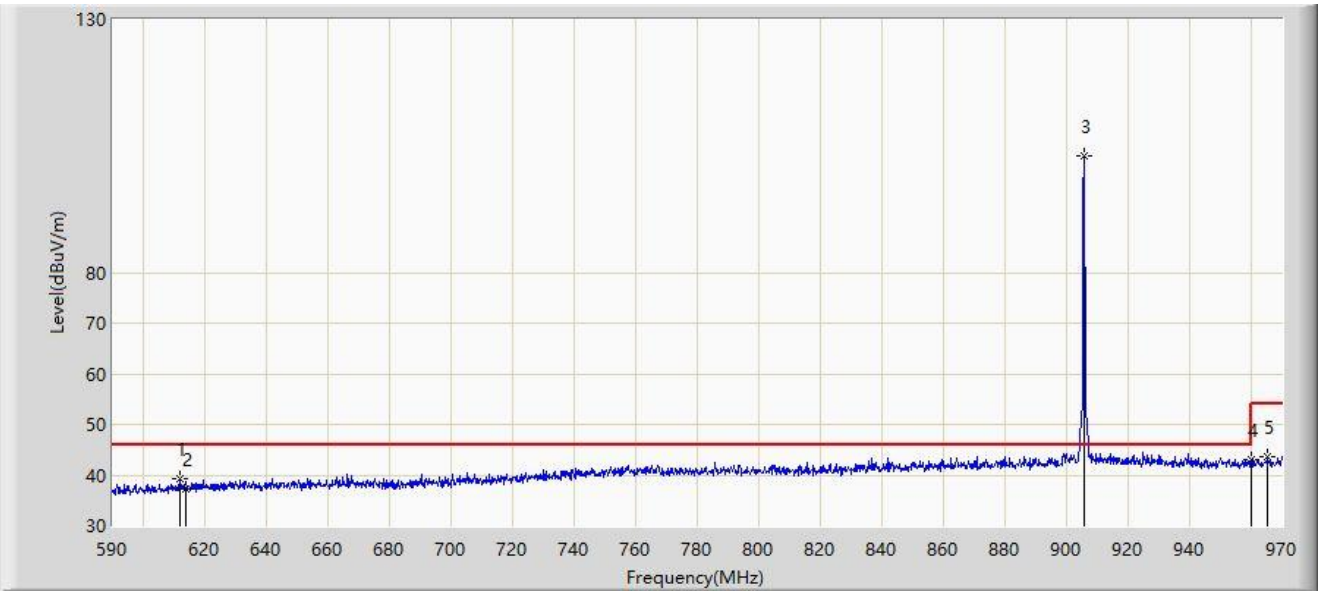
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		610.710	39.337	13.631	-6.663	46.000	25.706	PK
2		614.000	37.372	11.640	-8.628	46.000	25.732	PK
3	*	905.590	113.913	84.383	N/A	N/A	29.529	PK
4		960.000	43.043	13.264	-2.957	46.000	29.779	PK
5		963.160	43.591	13.753	-10.409	54.000	29.837	PK

Note 1: " * ", means this data is the worst emission level.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: WZ-AC1	Test Date: 2023-05-03
Limit: FCC_Part15.209_RSE(3m)	Engineer: Charles Zhang
Probe: VULB 9168_25-2000MHz	Polarity: Vertical
EUT: AT-322	Power: By Battery
Test Mode: Transmit at 905.6MHz	



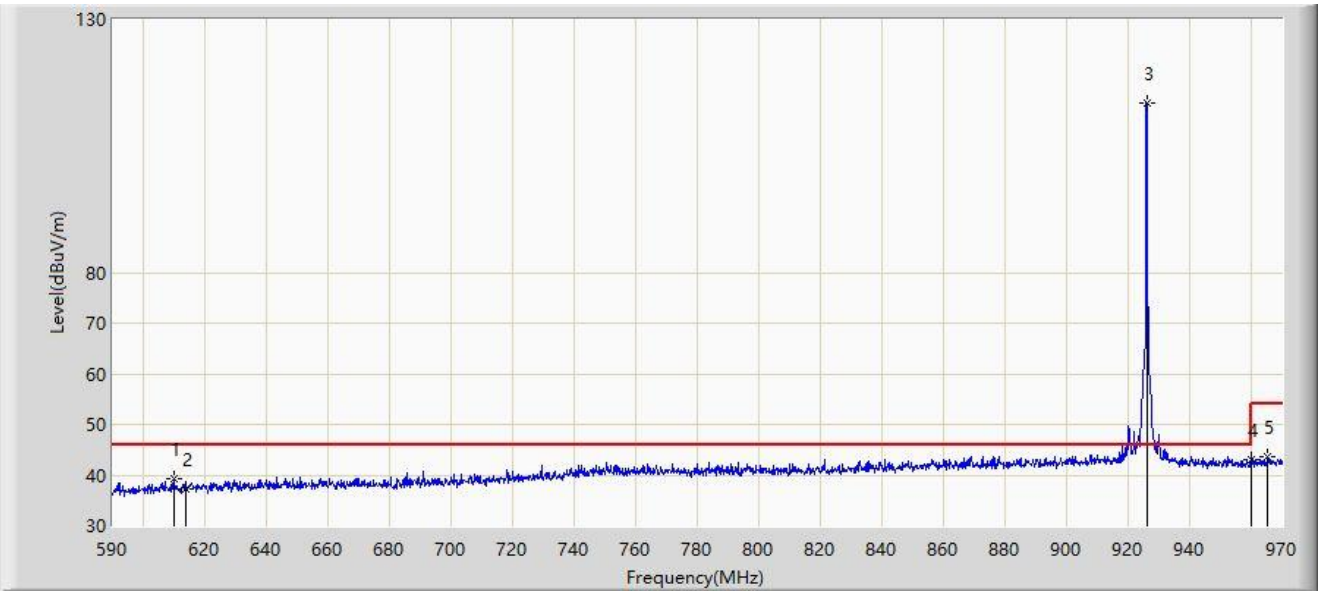
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		611.850	39.405	13.678	-6.595	46.000	25.727	PK
2		614.000	37.239	11.507	-8.761	46.000	25.732	PK
3	*	905.590	103.177	73.647	N/A	N/A	29.529	PK
4		960.000	42.903	13.124	-3.097	46.000	29.779	PK
5		965.440	43.494	13.612	-10.506	54.000	29.882	PK

Note 1: " * ", means this data is the worst emission level.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: WZ-AC1	Test Date: 2023-05-03
Limit: FCC_Part15.209_RSE(3m)	Engineer: Charles Zhang
Probe: VULB 9168_25-2000MHz	Polarity: Horizontal
EUT: AT-322	Power: By Battery
Test Mode: Transmit at 926.0MHz	



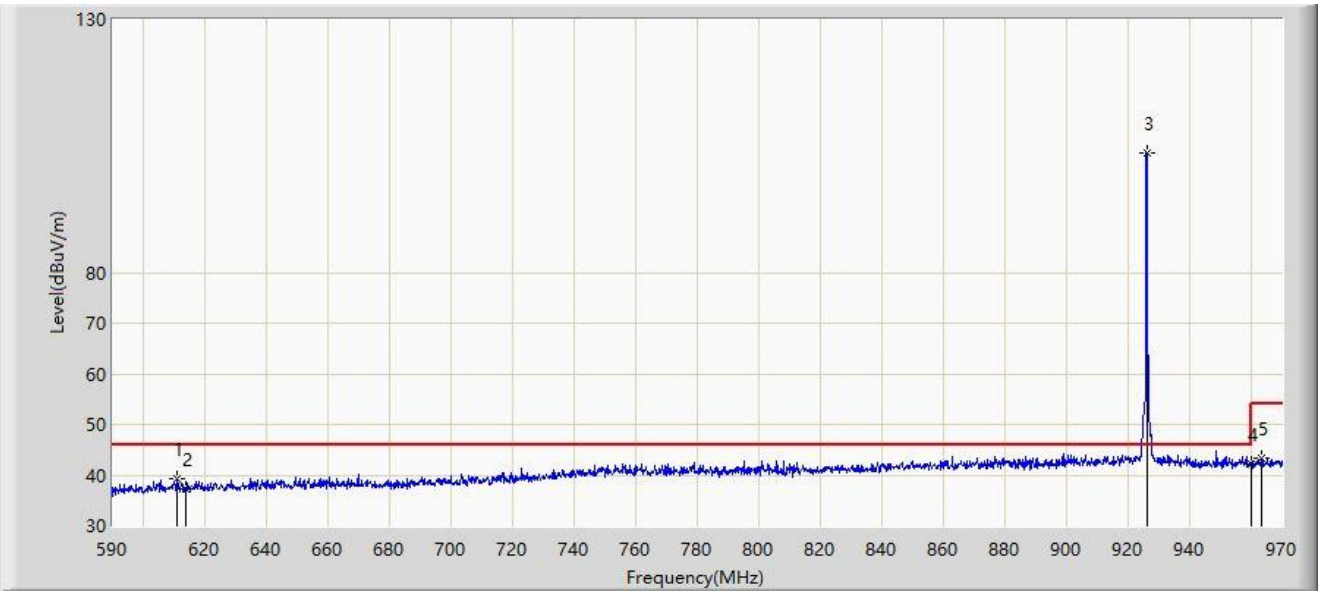
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		609.950	39.304	13.608	-6.696	46.000	25.696	PK
2		614.000	37.285	11.553	-8.715	46.000	25.732	PK
3	*	926.110	113.570	83.621	N/A	N/A	29.949	PK
4		960.000	43.138	13.359	-2.862	46.000	29.779	PK
5		965.440	43.729	13.847	-10.271	54.000	29.882	PK

Note 1: " * ", means this data is the worst emission level.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: WZ-AC1	Test Date: 2023-05-03
Limit: FCC_Part15.209_RSE(3m)	Engineer: Charles Zhang
Probe: VULB 9168_25-2000MHz	Polarity: Vertical
EUT: AT-322	Power: By Battery
Test Mode: Transmit at 926.0MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		610.900	39.205	13.496	-6.795	46.000	25.709	PK
2		614.000	37.220	11.488	-8.780	46.000	25.732	PK
3	*	926.110	103.620	73.671	N/A	N/A	29.949	PK
4		960.000	42.259	12.480	-3.741	46.000	29.779	PK
5		963.350	43.377	13.535	-10.623	54.000	29.842	PK

Note 1: " * ", means this data is the worst emission level.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Appendix B - Test Setup Photograph

Refer to “2304RSU057-UT” file.

Appendix C - EUT Photograph

Refer to “ 2304RSU057-UE” file.

The End