Testing
NVLAP LAB CODE 600222-0

MEASUREMENT REPORT

FCC PART 15.247

Report No.: S20221129093613
Issue Date: 03-31-2023

Applicant:	SBOT Technologies LLC
Address:	230 W 39th St, 8th FL, New York United States 10018
FCC ID:	2A3Q4-JRD-4035
Product:	Caper Cart M3 RFID
Model No.:	JRD-4035
FCC Classification:	FCC Part 15 Spread Spectrum Transmitter (DSS)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01v05r02
Result:	Pass
Item Receipt Date:	Feb 08, 2023
Test Date:	Mar 13 ~ Mar 23, 2023

Compiled By: Amos Xia
(Amos Xia)
Senior Test Engineer

Approved By: Line Chen
(Line Chen)
Engineer Manager

The test results relate only to the samples tested.
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2014. Test results reported herein relate only to the item(s) tested.
The test report shall not be reproduced except in full without the written approval of Fangguang Inspection & Testing Co., Ltd. Wuxi Branch
The test report must not be used by the client to claim product certifications, approval, or endorsement by NVLAP, NIST or any agency of U.S. Government.

Revision History

Report No.	Version	Description	Issue Date
S20221129093613	Rev. 01	/	03-31-2023

CONTENTS

Description Page

§2.1033 General Information 6

1. INTRODUCTION 7

1.1. Scope 7
1.2. FANGGUANG Test Location 7

2. PRODUCT INFORMATION 8

2.1. Equipment Description 8
2.2. Product Specification Subjective to this Standard 8
2.3. Operation Frequency / Channel List 9
2.4. Device Capabilities 9
2.5. Description of Test Software 11
2.6. Test Configuration 11
2.7. EMI Suppression Device(s)/Modifications 11
2.8. Labeling Requirements 11
2.9. Calculation with all conversion and correction factors used 12

3. DESCRIPTION of TEST 13

3.1. Evaluation Procedure 13
3.2. AC Line Conducted Emissions 13
3.3. Radiated Emissions 14

4. ANTENNA REQUIREMENTS 15

5. TEST EQUIPMENT CALIBRATION DATE 16

6. MEASUREMENT UNCERTAINTY 17

7. TEST RESULT 18

7.1. Summary 18
7.2. 20dB Bandwidth Measurement 19
7.2.1. Test Limit 19
7.2.2. Test Procedure used 19
7.2.3. Test Setting 19
7.2.4. Test Setup 19
7.2.5. Test Result 20
7.3. Output Power Measurement 22
7.3.1. Test Limit 22
7.3.2. Test Procedure Used 22

7.3.3. Test Setting 22
7.3.4. Test Setup 22
7.3.5. Test Result 23
7.4. Carrier Frequency Separation Measurement 25
7.4.1. Test Limit 25
7.4.2. Test Procedure Used 25
7.4.3. Test Setting 25
7.4.4. Test Setup 26
7.4.5. Test Result 27
7.5. Number of Hopping Channels Measurement 28
7.5.1. Test Limit 28
7.5.2. Test Procedure Used 28
7.5.3. Test Settitng 28
7.5.4. Test Setup 28
7.5.5. Test Result 29
7.6. Time of Occupancy Measurement 30
7.6.1. Test Limit 30
7.6.2. Test Procedure Used 30
7.6.3. Test Settitng 30
7.6.4. Test Setup 31
7.6.5. Test Result 32
7.7. Band-edge Compliance Measurement 33
7.7.1. Test Limit 33
7.7.2. Test Procedure Used 33
7.7.3. Test Setting 33
7.7.4. Test Setup 34
7.7.5. Test Result 35
7.8. Conducted Spurious Emissions Measurement 38
7.8.1. Test Limit 38
7.8.2. Test Procedure Used 38
7.8.3. Test Setting 38
7.8.4. Test Setup 39
7.8.5. Test Result 40
7.9. Radiated Spurious Emission Measurement 46
7.9.1. Test Limit 46
7.9.2. Test Procedure Used 46
7.9.3. Test Setting 47
7.9.4. Test Setup 49

7.9.5. Test Result 50
7.10. AC Conducted Emissions Measurement 55
7.10.1. Test Limit 55
7.10.2. Test Setup 55
7.10.3. Test Result 55
8. CONCLUSION 56

§2.1033 General Information

Applicant:	SBOT Technologies LLC
Applicant Address:	230 W 39th St, 8th FL, New York United States 10018
Manufacturer:	SBOT Technologies LLC
Manufacturer Address:	230 W 39th St, 8th FL, New York United States 10018
Test Site:	Fangguang Inspection & Testing Co., Ltd.
LAB ID:	CN5037
Test Site Address:	G9 Building, China Sensor Network International Innovation Park No.200, Linghu Avenue Wuxi, Jiangsu 214000 China
FCC Rule Part(s):	Part 15 Subpart C (15.247)
FCC ID:	2A3Q4-JRD-4035
Test Device Serial No.:	S/N.:CAM3RFDV01.03.99.000009JR22900023 ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	FCC Part 15 Spread Spectrum Transmitter (DSS)

1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2. FANGGUANG Test Location

These measurement tests were performed at the Fangguang Inspection and testing Co.,LTD located at 200 Linghu Avenue, Xinwu District, Wuxi City. The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014.

2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	Caper Cart M3 RFID
Model Name:	JRD-4035
Trade Mark:	/
Input Voltage Range:	DC 5V

2.2. Product Specification Subjective to this Standard

Operating Frequency:	902.25~927.75MHz
Channel Number:	52
Type of modulation:	FHSS
Antenna Type:	Dielectric Antenna
Antenna Gain:	1dBi

The equipment under test (EUT) is the **Caper Cart M3 RFID**. The test data contained in this report pertains only to the emissions due to the EUT's RFID transmitter.

- 15.247(h): The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

2.3. Operation Frequency / Channel List

Channel	Frequency	Channel	Frequency	Channel	Frequency
00	902.25 MHz	01	902.75 MHz	02	903.25 MHz
03	903.75 MHz	04	904.25 MHz	05	904.75 MHz
06	905.25 MHz	07	905.75 MHz	08	906.25 MHz
09	906.75 MHz	10	907.25 MHz	11	907.75 MHz
12	908.25 MHz	13	908.75 MHz	14	909.25 MHz
15	909.75MHz	16	910.25 MHz	17	910.75 MHz
18	911.25 MHz	19	911.75 MHz	20	912.25 MHz
21	912.75 MHz	22	913.25 MHz	23	913.75 MHz
24	914.25 MHz	25	914.75 MHz	26	915.25 MHz
27	915.75 MHz	28	916.25 MHz	29	916.75 MHz
30	917.25 MHz	31	917.75 MHz	32	918.25 MHz
33	918.75 MHz	34	919.25 MHz	35	919.75 MHz
36	920.25 MHz	37	920.75 MHz	38	921.25 MHz
39	921.75 MHz	40	922.25 MHz	41	922.75 MHz
42	923.25 MHz	43	923.75 MHz	44	924.25 MHz
45	924.75 MHz	46	925.25 MHz	47	925.75 MHz
48	926.25 MHz	49	926.75 MHz	50	927.25 MHz
51	927.75 MHz	-	-	-	-

2.4. Device Capabilities

This device contains the following capabilities:RFID

Note: The maximum achievable duty cycle was determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are are as follows:

Test Channel	Duty Cycle
902.25	66.73%
914.75	66.80%
927.75	66.73%

RFID_Ant1_902.25


RFID_Ant1_914.75


RFID_Ant1_927.75


2.5. Description of Test Software

The test utility software used during testing was “Ampak RFTestTool”, the version was v 7.0, and the emission setting value is the software default value.

2.6. Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.7. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.8. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not

practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

RSP-100 Issue 11 Section 3

The manufacturer, importer or distributor shall meet the labelling requirements set out in this section for every unit:

(i) prior to marketing in Canada, for products manufactured in Canada

(ii) prior to importation into Canada, for imported products

For information regarding the e-labelling option, see Notice 2014-DRS1003. The label for the certified product represents the manufacturer's or importer's compliance with Innovation, Science and Economic Development Canada's (ISED) regulatory requirements.

Please see attachment for IC label and label location.

2.9. Calculation with all conversion and correction factors used

For AC Line Conducted Emissions Test:

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

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

For Radiated Emissions Below 1GHz Test:

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

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

For Radiated Emissions Above 1GHz Test:

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

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

3. DESCRIPTION of TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the “Filing were used in the measurement of the EUT.

Deviation from measurement procedure…….....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 9'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions were used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. The turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beamwidth of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

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.”

- Use a Integral Antenna coupling to the intentional radiator**.**

5. TEST EQUIPMENT CALIBRATION DATE

Radiated Emission

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Loop Antenna	Schwarzbeck	FMZB 1519B	FWXGJC-2018-015	3 year	2024/08/13
Bi-Log Antenna	R&S	HL562E	FWXGJC-2016-267-06	1 year	2024/03/10
Broadband Horn Antenna	R&S	HF907	FWXGJC-2016-267-07	1 year	2024/03/02
Broadband Horn Antenna	Schwarzbeck	BBHA9170	FWXGJC-2018-016	1 year	2024/06/04
EMI Receiver	R&S	ESR26	FWXGJC-2016-267-01	1 year	2023/11/08
Pre-Amplifier	R&S	SCU-18D	FWXGJC-2016-267-05	1 year	2023/11/17
Pre-Amplifier	R&S	EMC184055 SE	FWXGJC-2018-018	3 year	2025/04/13
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-386	1 year	2023/11/21
Anechoic Chamber	Aimuke	EMCCT-3	FWXGJC-2016-270	1 year	2023/04/07

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Keysight	N9010B	FWXGJC-2018-010	1 year	2023/04/13
RF Control Unit	Toncend	JS0806-2	FWXGJC-2018-013	1 year	2023/06/30
Signal Generator	Keysight	N5182B	FWXGJC-2018-011	1 year	2023/04/13
Signal Generator	Keysight	N5171B	FWXGJC-2018-012	1 year	2023/04/13
Comprehensive measuring instrument	R&S	CMW270	FWXGJC-2018-023	1 year	2024/03/05
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-385	1 year	2023/11/21

Test Software	Manufacturer	Version	Asset No.	Function
EMI Test Software	tonscend	/	/	/

6. 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
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.05dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 30MHz-1GHz: 3.06dB 1GHz-12.75GHz: 4.13dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 30MHz-1GHz: 1.00 dB 1GHz-26.5GHz: 1.30 dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.60dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.80dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.20MHz

7. TEST RESULT

7.1. Summary

FCC Part Section(s)	IC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(1)	RSS-247 [5.1]	20dB Bandwidth	N/A	Conducted	PASS	Section 7.2
15.247(b)(1)	RSS-247 [5.4(b)]	Peak Transmitter Output Power	<0.125 Watt if > 75 non- overlapping channels used		PASS	Section 7.3
15.247(a)(1)	RSS-247 [5.1]	Channel Separation	> 2/3 of 20 dB BW for systems with Output Power < 125mW		PASS	Section 7.4
15.247(a)(1)(iii)	RSS-247 [5.1]	Number of Channels	> 15 Channels		PASS	Section 7.5
15.247(a)(1)(iii)	RSS-247 [5.1]	Time of Occupancy	< 0.4 sec in 31.6 sec period		PASS	Section 7.6
15.247(d)	RSS-247 [5.5]	Band Edge / out-of-Band Emissions	Conducted ≥ 20dBc		PASS	Section 7.7 Section 7.8
15.205, 15.209	RSS-247 [5.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	PASS	Section 7.9 Section 7.10
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	N/A	Section 7.11

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) All modes of operation and data rates were investigated. 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) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

7.2. 20dB Bandwidth Measurement

7.2.1. Test Limit

N/A

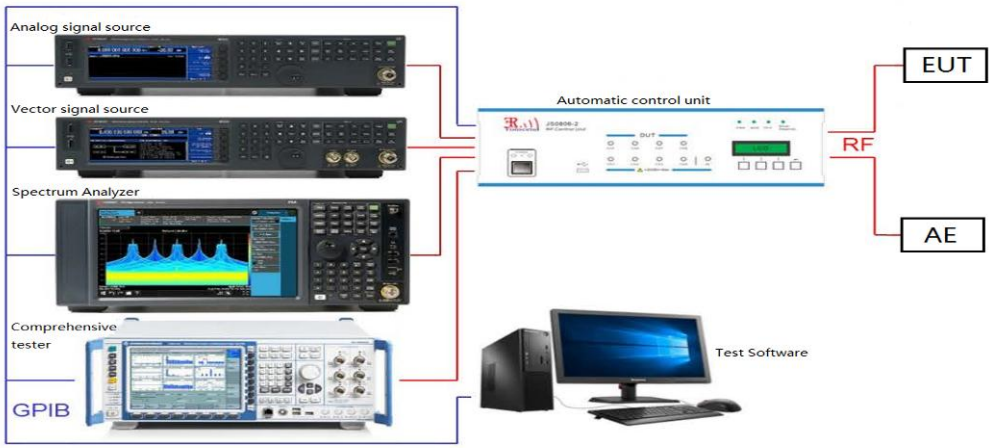
7.2.2. Test Procedure used

ANSI C63.10-2013 - Section 6.9.2

7.2.3. 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.

7.2.4. Test Setup



7.2.5. Test Result

Test Mode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	99% BW (MHz)	Verdict
RFID	Ant1	902.25	0.182	902.163	902.345	0.19349	PASS
		914.75	0.182	914.663	914.845	0.19378	PASS
		927.75	0.183	927.662	927.845	0.19214	PASS

RFID_Ant1_902.25

RFID_Ant1_914.75

RFID_Ant1_927.75

7.3. Output Power Measurement

7.3.1. Test Limit

The maximum out power permissible output power is 0.125 Watt for all other frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels.

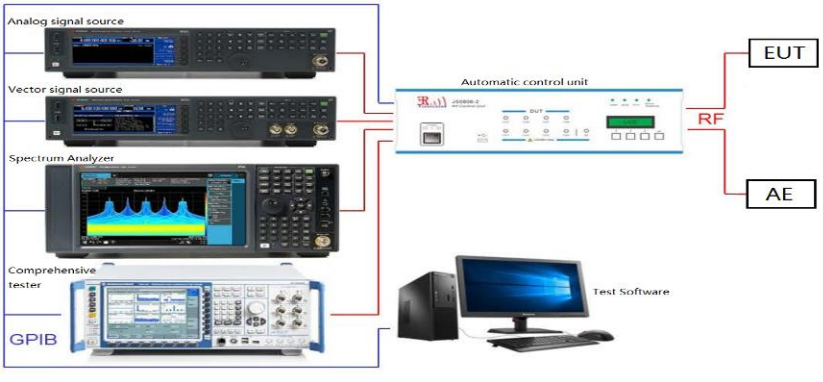
7.3.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.5

7.3.3. 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)

7.3.4. Test Setup



7.3.5. Test Result

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
RFID	Ant1	902.25	14.83	≤30	PASS
		914.75	13.05	≤30	PASS
		927.75	12.86	≤30	PASS

RFID_Ant1_902.25

RFID_Ant1_914.75

RFID_Ant1_927.75

7.4. Carrier Frequency Separation Measurement

7.4.1. Test Limit

For BDR Mode, the minimum permissible channel separation for this system is the value of the 20dB BW. For EDR Mode, the minimum permissible channel separation for this system is 2/3 the value of the 20dB BW.

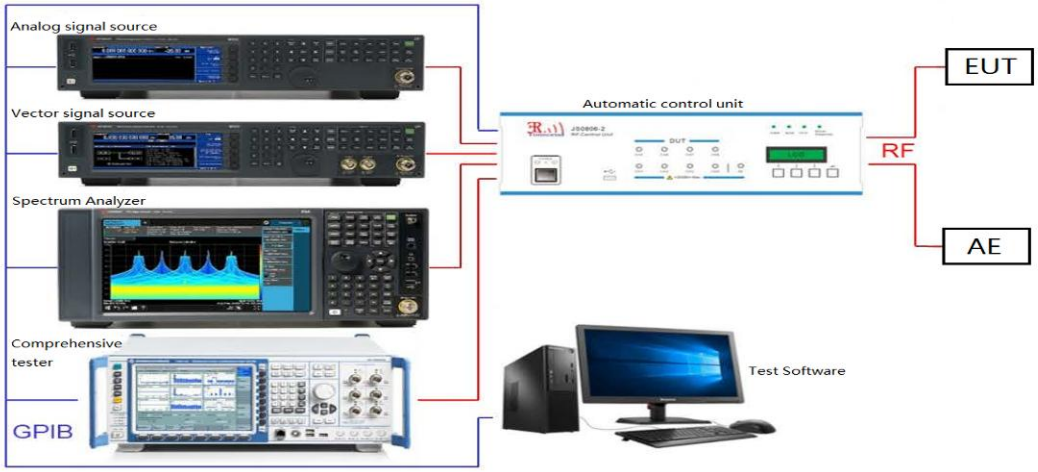
7.4.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.2

7.4.3. 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.

7.4.4. Test Setup



7.4.5. Test Result

Test Mode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
RFID	Ant1	Hop	0.5	≥0.182	PASS

RFID_Ant1_Hop

7.5. Number of Hopping Channels Measurement

7.5.1. Test Limit

This frequency hopping system must employ a minimum of 15 hopping channels.

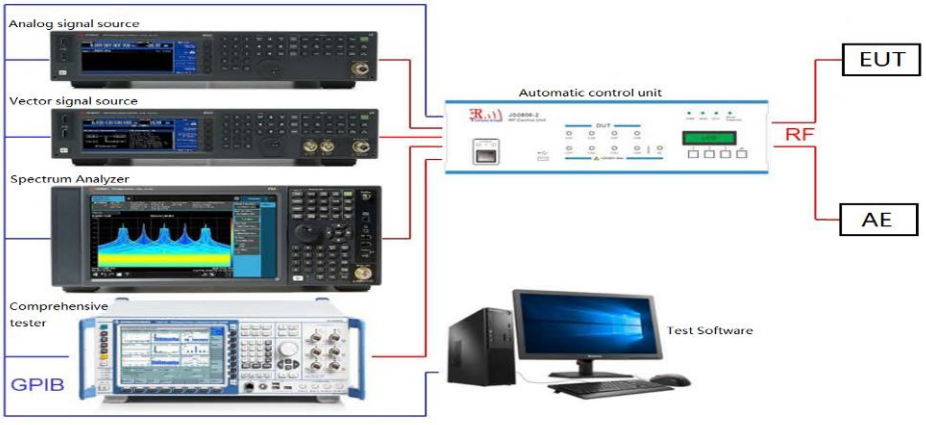
7.5.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.3

7.5.3. 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

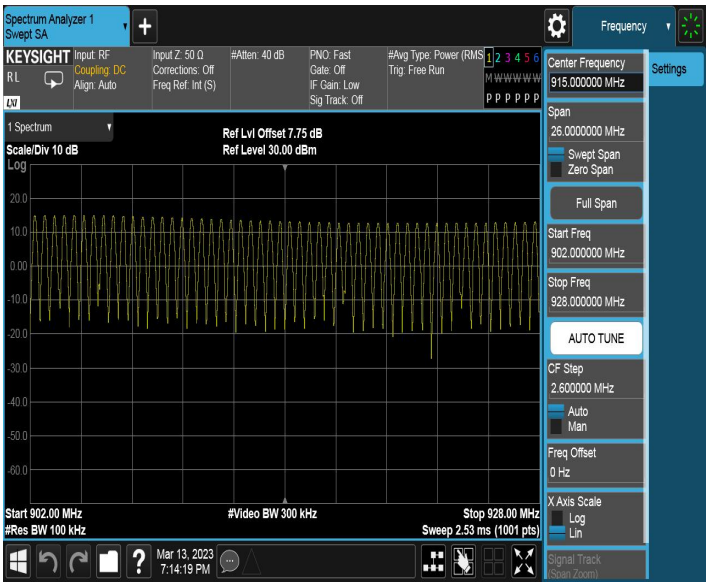
7.5.4. Test Setup



7.5.5. Test Result

Test Mode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
RFID	Ant1	Hop	52	>=15	PASS

RFID_Ant1_Hop



7.6. Time of Occupancy Measurement

7.6.1. Test Limit

The maximum permissible time of occupancy is 400ms within a period of 400ms multiplied by the number of hopping channels employed.

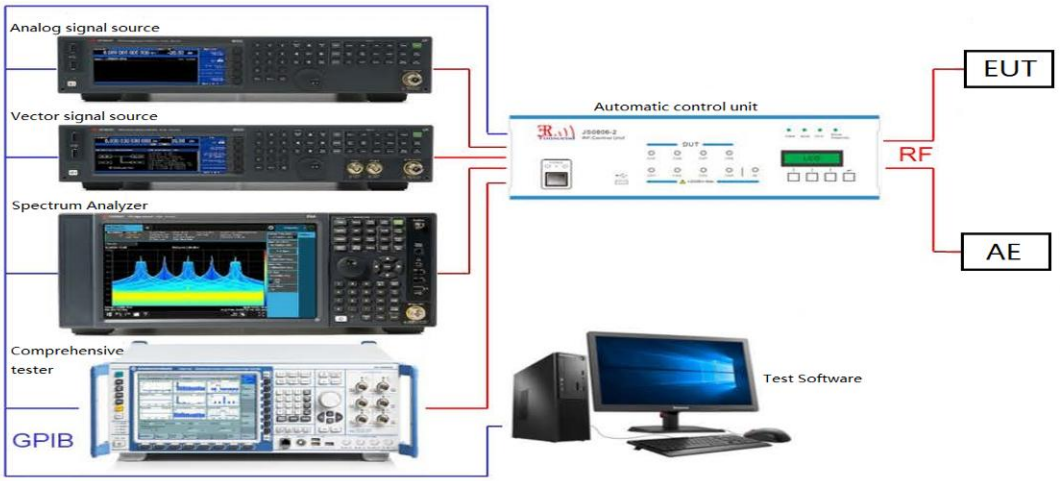
7.6.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.4

7.6.3. 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.

7.6.4. Test Setup



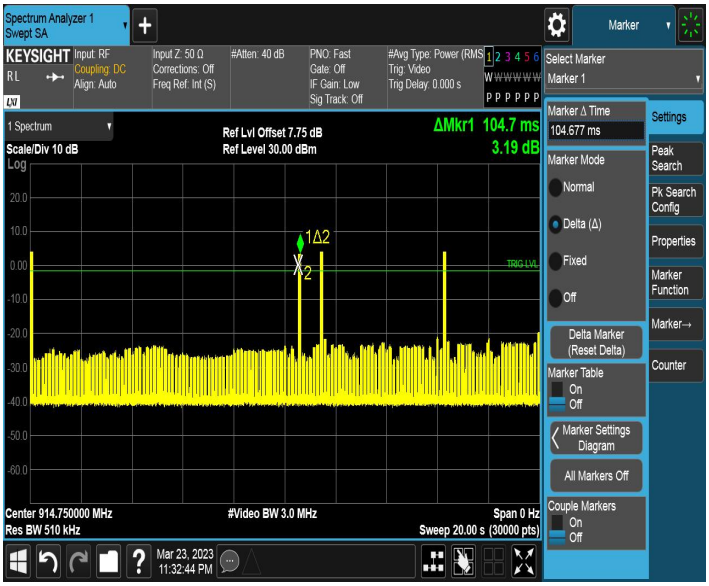
7.6.5. Test Result

Test Mode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Dutycycle	Result[s]	Limit[ms]	Verdict
RFID	Ant1	Hop	104.7	4	60.24%	252.29	<=400	PASS

Dutycycle: 8.56/(16.15-1.941)*100%=60.24

Result: BurstWidth* TotalHops* Dutycycle=104.7*4*60.24%=252.29

RFID_Ant1_Hop



7.7. Band-edge Compliance Measurement

7.7.1. 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.

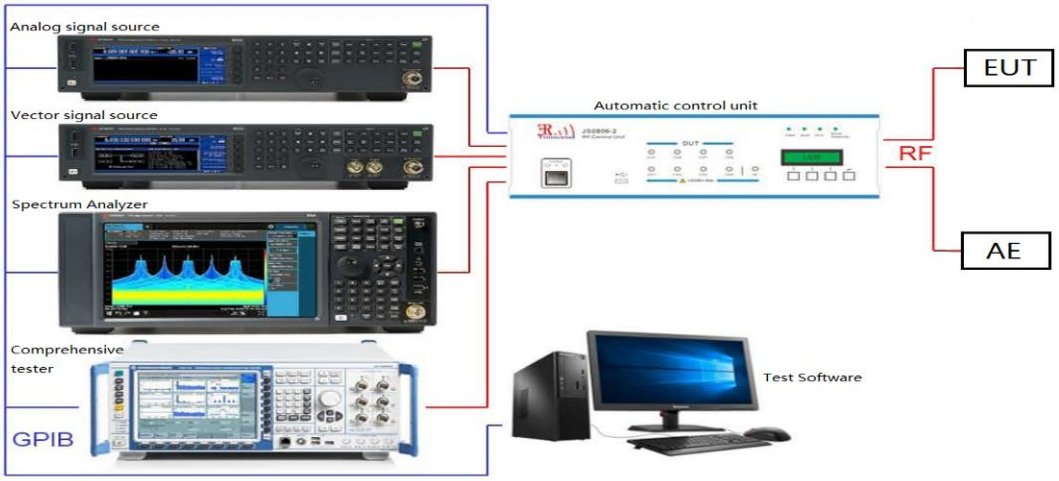
7.7.2. Test Procedure Used

ANSI C63.10-2013 - Section 6.10.4

7.7.3. Test Setting

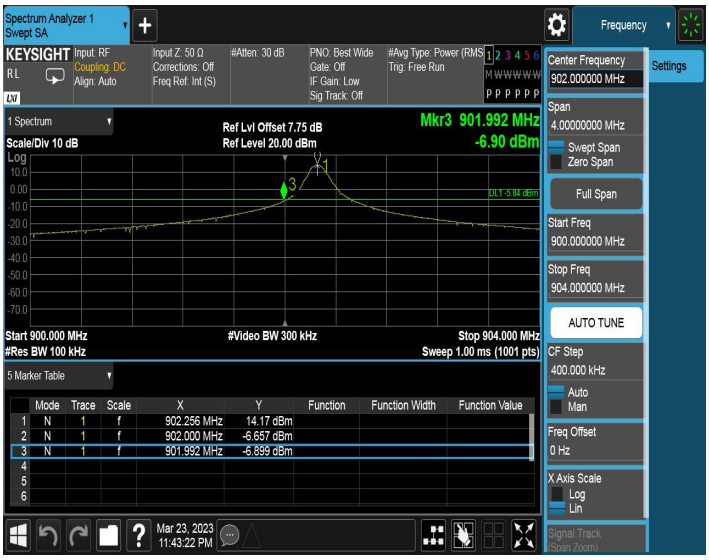
1. Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = 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, than use the marker-to-peak function to move the marker to the peak of the in-band emission.

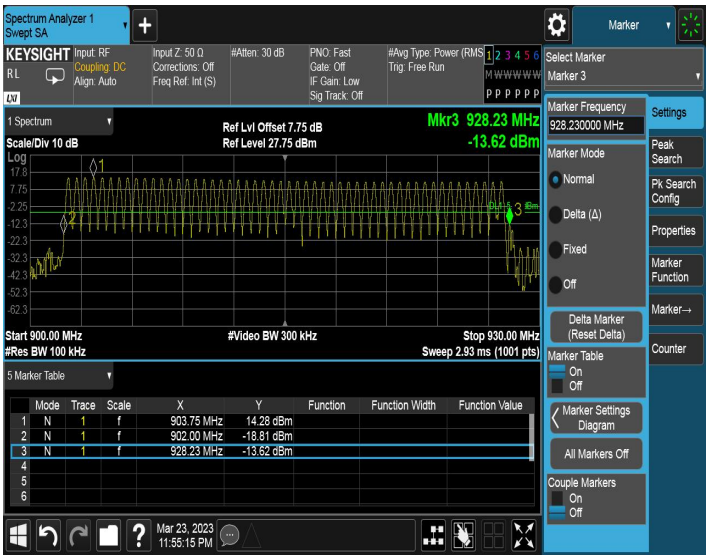
7.7.4. Test Setup



7.7.5. Test Result

Test Mode	Antenna	Ch Name	Channel	Ref Level [dBm]	Result [dBm]	Limit [dBm]	Verdict
RFID	Ant1	0	902.25	14.17	-6.657	≤-5.84	PASS
		51	927.75	11.96	-9.446	≤-8.04	PASS
		Hopping	902.25	14.28	-18.81	≤-5.72	PASS
			927.75		-13.62		

RFID_Ant1_Low_902.25

RFID_Ant1_High_927.75


RFID_Ant1_Hopping


7.8. Conducted Spurious Emissions Measurement

7.8.1. 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.

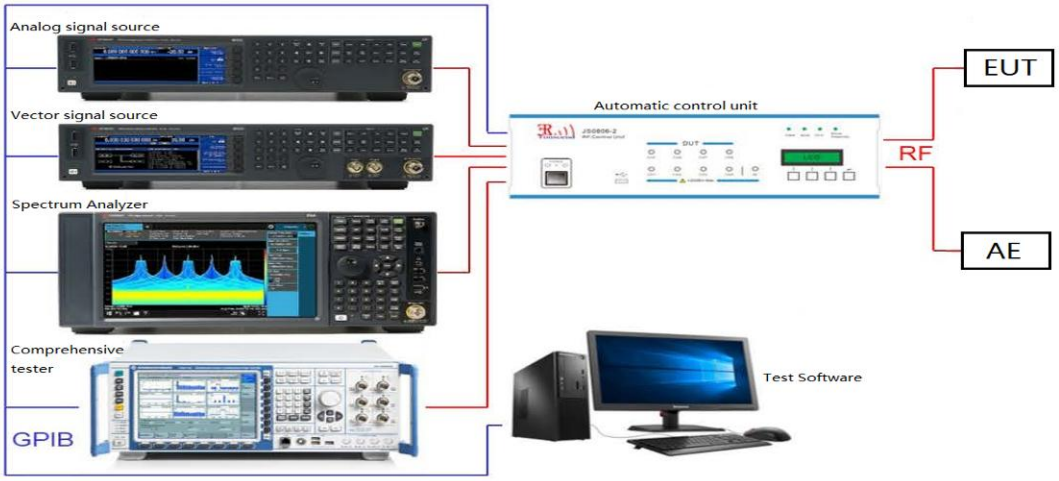
7.8.2. Test Procedure Used

ANSI C63.10-2013 - Section 7.8.8

7.8.3. Test Setting

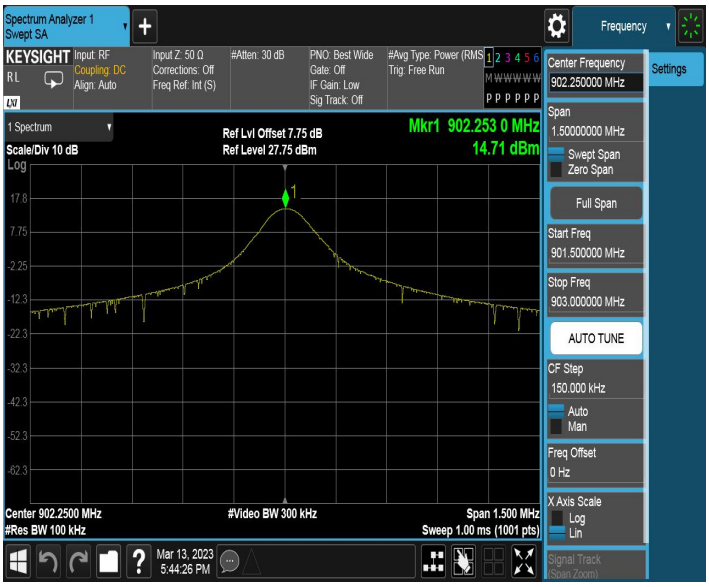
1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
2. RBW = 100 KHz
3. VBW ≥ RBW
4. Detector = 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.

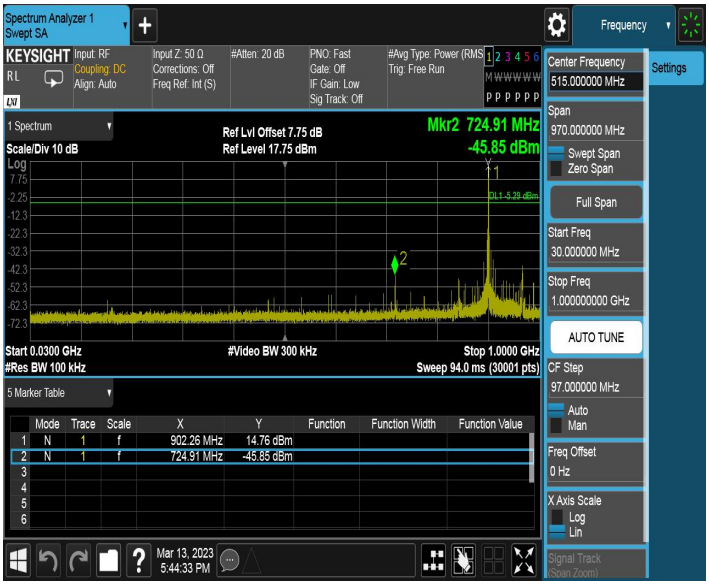
7.8.4. Test Setup



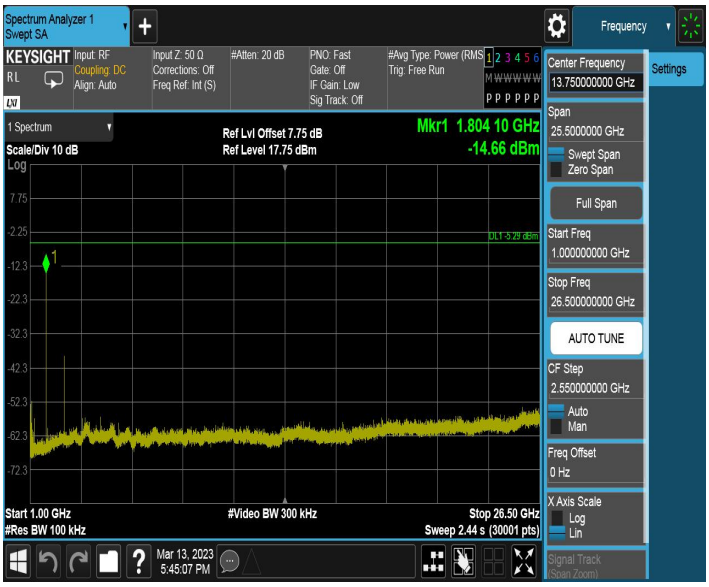
7.8.5. Test Result

Test Mode	Antenna	Channel	Freq Range [MHz]	Ref Level [dBm]	Result [dBm]	Limit [dBm]	Verdict
RFID	Ant1	902.25	Reference	14.71	14.71	---	PASS
			30~1000	14.71	-45.85	≤-5.29	PASS
			1000~26500	14.71	-14.66	≤-5.29	PASS
		914.75	Reference	13.05	13.05	---	PASS
			30~1000	13.05	-45.16	≤-6.95	PASS
			1000~26500	13.05	-16.3	≤-6.95	PASS
		927.75	Reference	12.81	12.81	---	PASS
			30~1000	12.81	-45.4	≤-7.19	PASS
			1000~26500	12.81	-13.57	≤-7.19	PASS

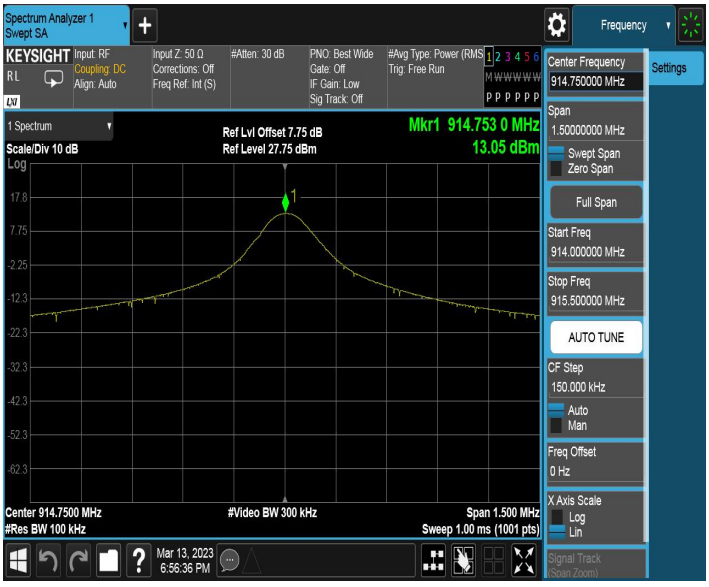
RFID_Ant1_902.25_0~Reference


RFID_Ant1_902.25_30~1000


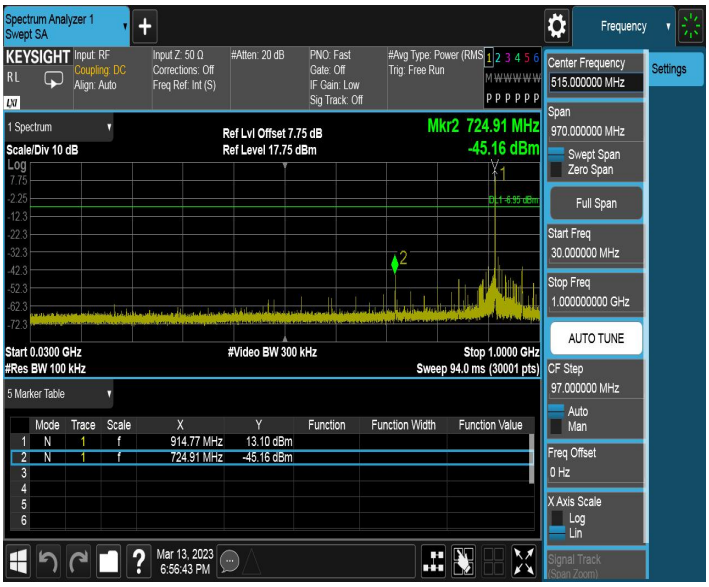
RFID_Ant1_902.25_1000~26500



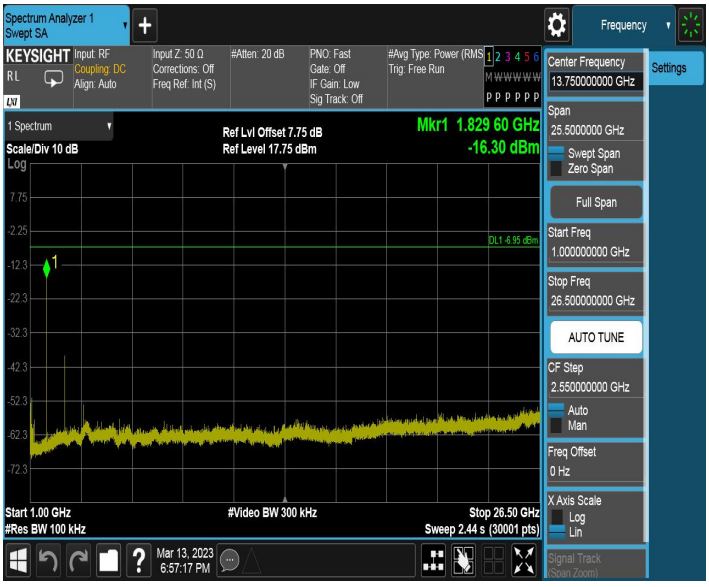
RFID_Ant1_914.75_0~Reference



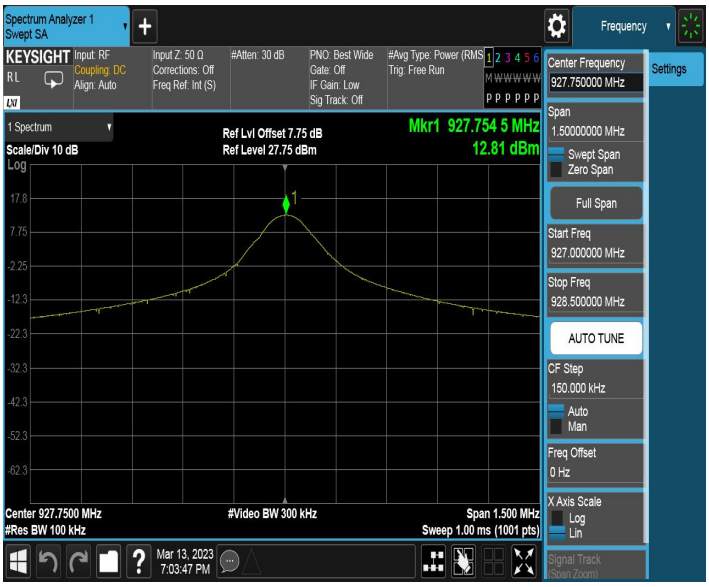
RFID_Ant1_914.75_30~1000



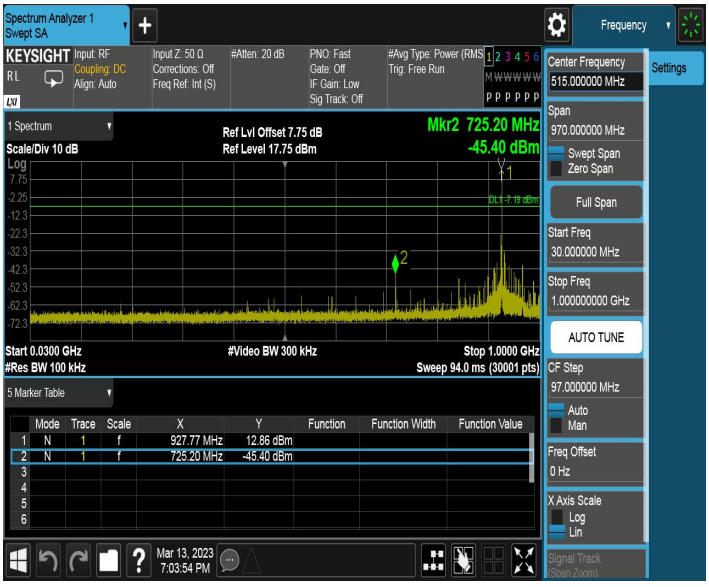
RFID_Ant1_914.75_1000~26500

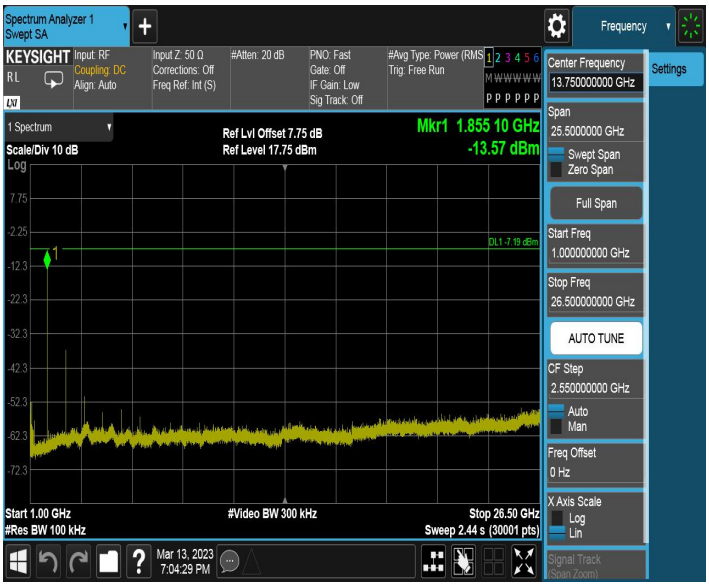


RFID_Ant1_927.75_0~Reference



RFID_Ant1_927.75_30~1000



RFID_Ant1_927.75_1000~26500


7.9. Radiated Spurious Emission Measurement

7.9.1. 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

7.9.2. Test Procedure Used

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)

7.9.3. Test Setting

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

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

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)

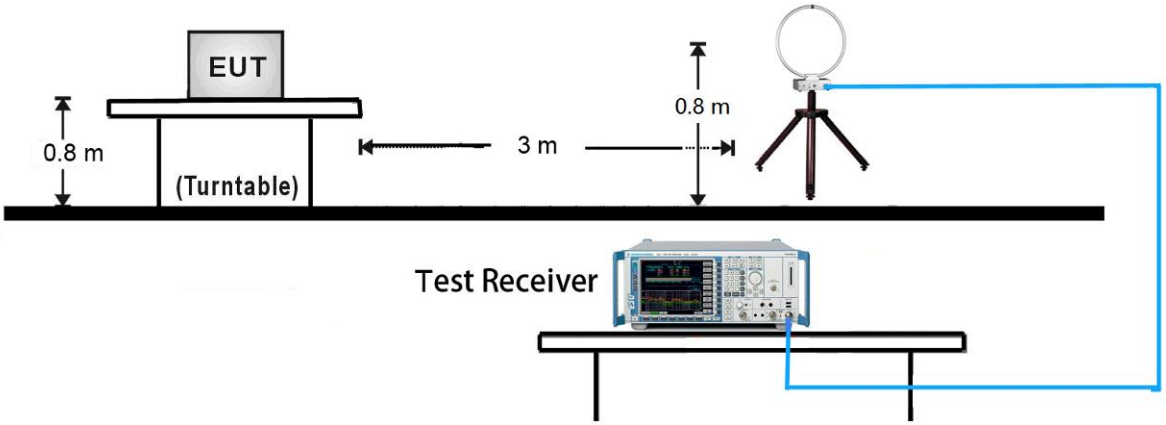
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.
   If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.
4. Detector = Peak
5. Sweep time = auto

6. Trace mode = max hold

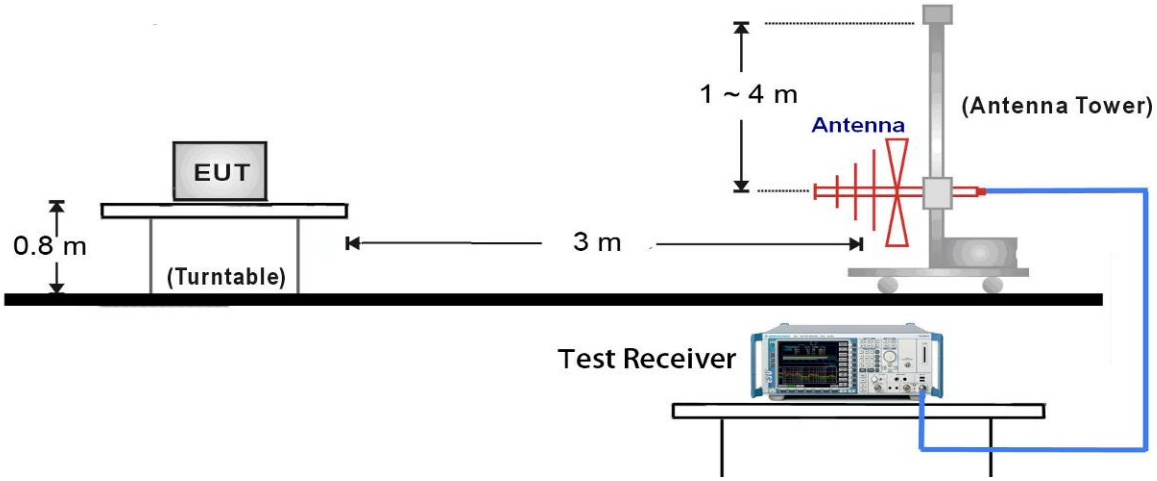
7. Trace was allowed to stabilize

7.9.4. Test Setup

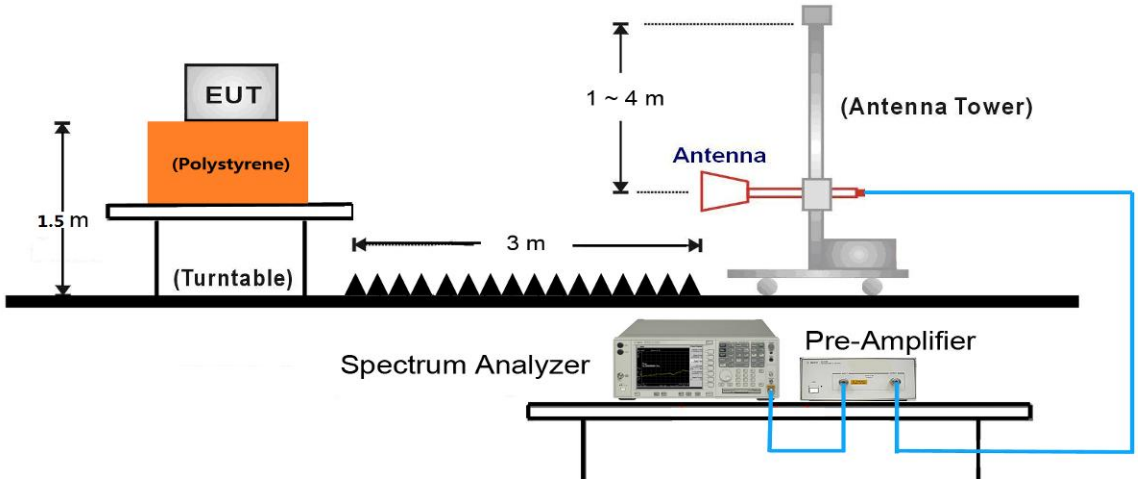
9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:



1GHz ~ 25GHz Test Setup:



7.9.5. Test Result

Test Mode:	RFID - Ant 1	Test Date:	2023-03-13
Test Channel:	00	Test Engineer:	Amos Xia
Remark:	Average measurement was not performed if peak level lower than average limit. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Frequency (MHz)	Level (dBμV)	Factor (dB)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1804.6667	60.86	-4.13	74.00	13.14	Peak	Horizontal
1804.6667	51.92	-4.13	54.00	2.08	AV	Horizontal
2705.6667	47.41	-0.90	74.00	26.59	Peak	Horizontal
2841.6667	39.79	-0.64	74.00	34.21	Peak	Horizontal
3000.3333	45.65	-0.35	74.00	28.35	Peak	Horizontal
1804.6667	60.89	-4.13	74.00	13.11	Peak	Vertical
1804.6667	51.97	-4.13	54.00	2.03	AV	Vertical
2705.6667	45.03	-0.90	74.00	28.97	Peak	Vertical
2847.3333	40.97	-0.63	74.00	33.03	Peak	Vertical
2994.6667	50.06	-0.36	74.00	23.94	Peak	Vertical

Test Mode:	RFID - Ant 1	Test Date:	2023-03-13
Test Channel:	25	Test Engineer:	Amos Xia
Remark:	Average measurement was not performed if peak level lower than average limit. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Frequency (MHz)	Level (dBμV)	Factor (dB)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1827.3333	59.57	-4.07	74.00	14.43	Peak	Horizontal
1827.3333	51.89	-4.07	54.00	2.11	AV	Horizontal
2739.6667	50.06	-0.83	74.00	23.94	Peak	Horizontal
2847.3333	39.95	-0.63	74.00	34.05	Peak	Horizontal
2994.6667	45.40	-0.36	74.00	28.60	Peak	Horizontal
1827.3333	59.35	-4.07	74.00	14.65	Peak	Vertical
1827.3333	51.75	-4.07	54.00	2.25	AV	Vertical
2739.6667	48.49	-0.83	74.00	25.51	Peak	Vertical
2847.3333	42.33	-0.63	74.00	31.67	Peak	Vertical
2994.6667	51.91	-0.36	74.00	22.09	Peak	Vertical

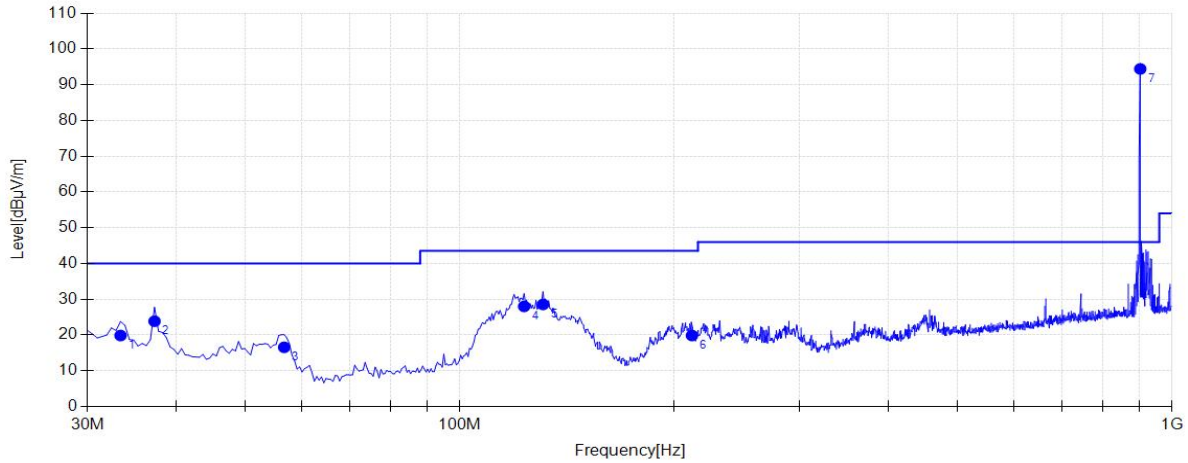
Test Mode:	RFID - Ant 1	Test Date:	2023-03-13
Test Channel:	51	Test Engineer:	Amos Xia
Remark:	Average measurement was not performed if peak level lower than average limit. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Frequency (MHz)	Level (dBμV)	Factor (dB)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1855.6667	57.92	-3.99	74.00	16.08	Peak	Horizontal
1855.6667	51.24	-3.99	54.00	2.76	AV	Horizontal
2779.3333	56.31	-0.76	74.00	17.69	Peak	Horizontal
2853.0000	39.48	-0.62	74.00	34.52	Peak	Horizontal
2994.6667	44.84	-0.36	74.00	29.16	Peak	Horizontal
1855.6667	57.37	-3.99	74.00	16.63	Peak	Vertical
1855.6667	51.05	-3.99	54.00	2.95	AV	Vertical
2779.3333	53.52	-0.76	74.00	20.48	Peak	Vertical
2841.6667	41.56	-0.64	74.00	32.44	Peak	Vertical
2994.6667	50.60	-0.36	74.00	23.40	Peak	Vertical

The Worst Case of Radiated Emission below 1GHz:

EUT:	Caper Cart M3 RFID	Polarity:	Horizontal
Model:	JRD-4035	SN:	N/A
Mode:	Transmit by RFID at Channel 00	Voltage:	DC 5V
Environment:	Temp: 22℃; Humi:54%	Engineer:	Amos Xia

Test Graph

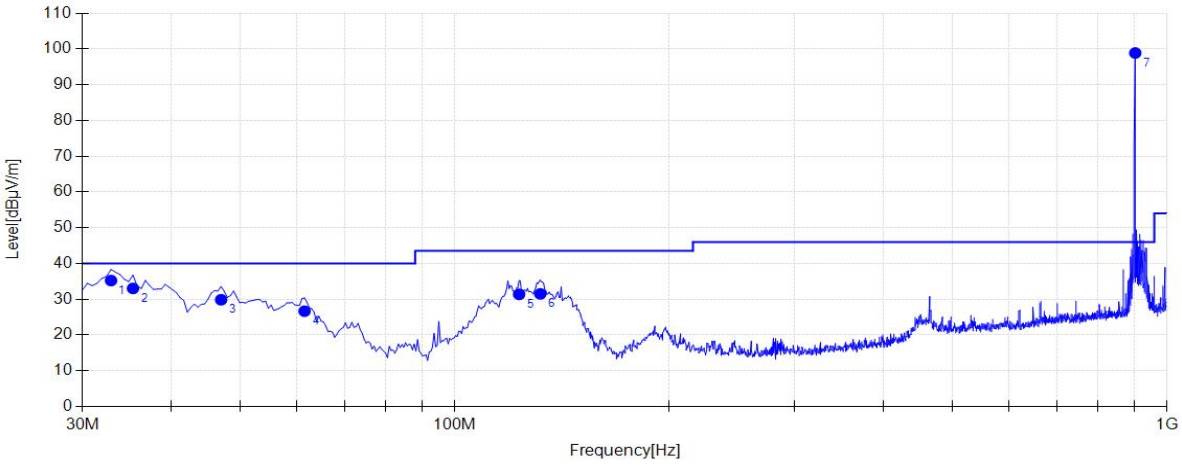


Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	33.3950	17.99	19.84	40.00	20.16	100	299	Horizontal
2	37.2750	16.02	23.84	40.00	16.16	100	196	Horizontal
3	56.6750	7.71	16.55	40.00	23.45	100	92	Horizontal
4	123.120	11.59	28.00	43.50	15.50	100	23	Horizontal
5	130.880	11.47	28.54	43.50	14.96	100	3	Horizontal
6	211.875	10.15	19.85	43.50	23.65	100	133	Horizontal

Note 1: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

EUT:	Caper Cart M3 RFID	Polarity:	Vertical
Model:	JRD-4035	SN:	N/A
Mode:	Transmit by RFID at Channel 00	Voltage:	DC 5V
Environment:	Temp: 22℃; Humi:54%	Engineer:	Amos Xia

Test Graph



Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	32.9100	18.24	35.22	40.00	4.78	100	124	Vertical
2	35.3350	17.01	33.02	40.00	6.98	100	20	Vertical
3	46.9750	11.07	29.85	40.00	10.15	100	172	Vertical
4	61.5250	7.08	26.65	40.00	13.35	100	6	Vertical
5	123.120	11.59	31.36	43.50	12.14	100	117	Vertical
6	187.140	10.36	17.56	43.50	25.94	200	117	Vertical

Note 1: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

7.10. AC Conducted Emissions Measurement

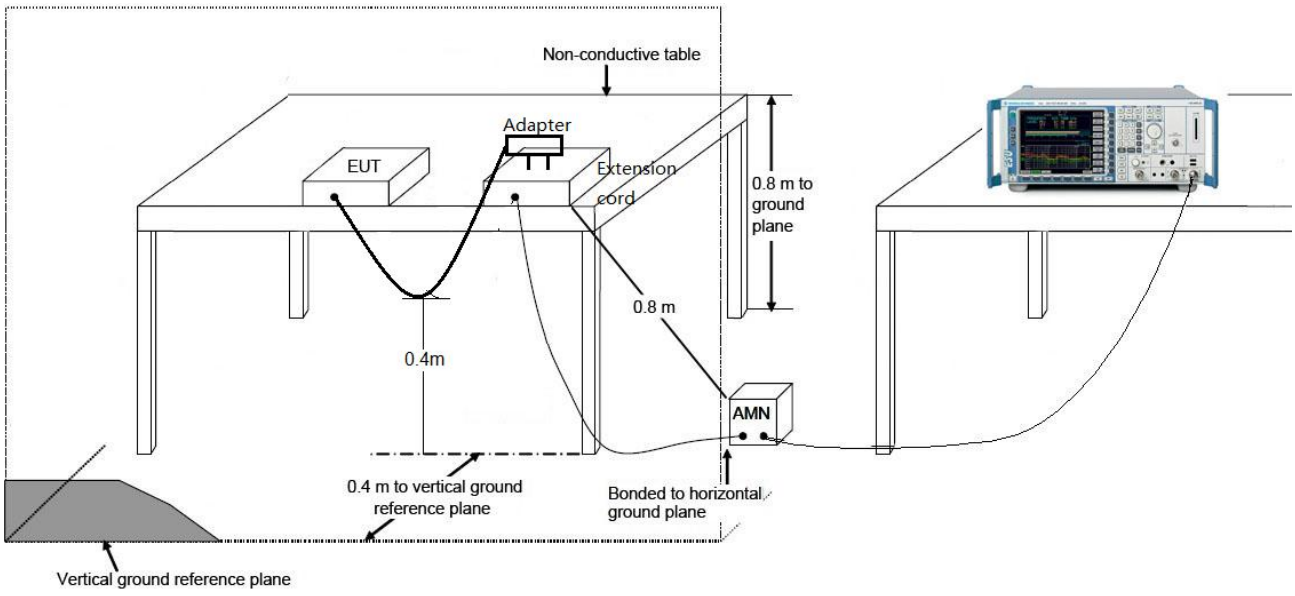
7.10.1. Test Limit

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.

7.10.2. Test Setup



7.10.3. Test Result

DC power supply, Not applicable.

8. CONCLUSION

The data collected relate only the item(s) tested and show that the **Caper Cart M3 RFID** is in compliance with Part 15C of the FCC Rules.

The End