FCC Part 15
EMI TEST REPORT

E.U.T. : RFID Reader Module
Model : EWTJ680G-I
FCC ID : 2AGMLEWTJ680GI

for

APPLICANT : East Wind Technologies, Inc.
ADDRESS : 7F-3, No. 390, Section 1, Fu-Hsin South Road, Taipei, Taiwan

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN
NO. 34. LIN 5. DINGFU, LINKOU DIST.,
NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.
Tel:(02)26023052 Fax:(02)26010910
http://www.etc.org.tw ; e-mail : emc@etc.org.tw

Report Number : 18-09-RBF-003-04

TEST REPORT CERTIFICATION

Applicant	:	East Wind Technologies, Inc. 7F-3, No. 390, Section 1, Fu-Hsin South Road, Taipei, Taiwan
Manufacture	:	East Wind Technologies, Inc. 7F-3, No. 390, Section 1, Fu-Hsin South Road, Taipei, Taiwan

Description of Device	:	
a) Type of EUT	:	RFID Reader Module
b) Trade Name	:	EWT
c) Model No.	:	EWTJ680G-I
d) Power Supply	:	5Vdc

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.10-2013, and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note: 1. The result of the testing report relate only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

Summary of Tests

Test	Results
Radiated Emission	**Pass**
Frequency Stability	**Pass**
Conducted Emission	**N/A**
Operation Bandwidth	**Pass**

Date Test Item Received	:	Sep.06, 2018
Date Test Campaign Completed	:	Sep.20, 2018
Date of Issue	:	Oct.05, 2018

Test Engineer : Brian Huang
(Brian Huang, Engineer)

Approve & Authorized Signer : Vincent Chang
Vincent Chang, Supervisor
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

Table of Contents Page

1. GENERAL INFORMATION

1.1 Product Description

a) Type of EUT : RFID Reader Module
b) Trade Name : EWT
c) Model No. : EWTJ680G-I
d) Power Supply : 5Vdc

1.2 Characteristics of Device:

The product is a RFID Reader Module.

- Support ISO 14443A/B, ISO 15693, FeliCa Lite-S (RCS966)
- Support ISO-DEP(ISO 14443-4)
- 13.56 MHz (±20PPM)
- 5V (±0.5V)
- 110mA (±10mA)
- Detect Distance: 5.5cm (±0.5cm, ISO 14443A (MF1 IC S50))
- Interface: UART, SPI
- RF cable max. Length: 5m
- Storage Temperature: -40℃~95℃
- Operating Temperature: -30℃~85℃
- Operating humidity: 90% non-condensing
- Baud Rate: 19,200bps

1.3 Test Methodology

Both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.10-2013. Other required measurements were illustrated in separate sections of this test report for details.

Measurement Software

Software	Version	Note
e3	Version 6.100618f	Radiated Emission Test
e3	Version 6.100421	Conducted Emission Test

1.4 Test Facility

Location of the Test site: No.34, Lin 5, Dingfu Vil., Linkou Dist., New Taipei City, Taiwan 24442, R.O.C.
Designation Number: TW2628.

2. DEFINITION AND LIMITS

2.1 Definition

Intentional radiator:
A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
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	2655-2900	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	3360-4400	Above 38.6
13.36-13.41			

Remark "**" : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.3 Limitation

(1) Conducted Emission Limits:

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency MHz	**Quasi Peak dB μ V**	**Average dB μ V**
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

- Decreases with the logarithm of the frequency

(2) Radiated Emission Limits:

According to 15.225, the requirement of radiated emission is:

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

According to § 15.209 Radiated emission limits, general requirements.
(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequencies (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
30 – 88	100 **	3
88 – 216	150 **	3
216 – 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

(3) Frequency Stability Limit:

According to 15.225, the requirement of frequency stability is:

(e) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performe using a new battery.

(4) Operation Bandwidth Limit:

According to 15.215(c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

3 SYSTEM TEST CONFIGURATION

3.1 Justification

All measurement were intentional to maximum the emissions from EUT by varying the connection cables (if applicable), therefore, the test result is sure to meet the applicable requirement.

3.2 Devices for Tested System

Device	Manufacture	Model / FCC ID.	Description
RFID Reader Module*	East Wind Technologies, Inc.	EWTJ680G-I	---
Notebook PC	Lenovo	R400	

Remark "*" means equipment under test.

4. RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

According to 15.225, the requirement of radiated emission is:

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

4.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below 30 MHz and 30 MHz~1000MHz respectively.
2. For radiated emission measurements, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on an open test site.
3. For radiated emission measurements, set the spectrum analyzer on a 100 kHz resolution bandwidth for each frequency measured in step 2.
4. For emission frequencies measured in 30 MHz~1000MHz, the search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.
8. For emission frequencies measured below 30 MHz, the search antenna is to be set in horizontal and vertical polarized orientation respectively. Rotate the loop antenna when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna rotation again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

Figure 1 : Frequencies measured below 30 MHz configuration

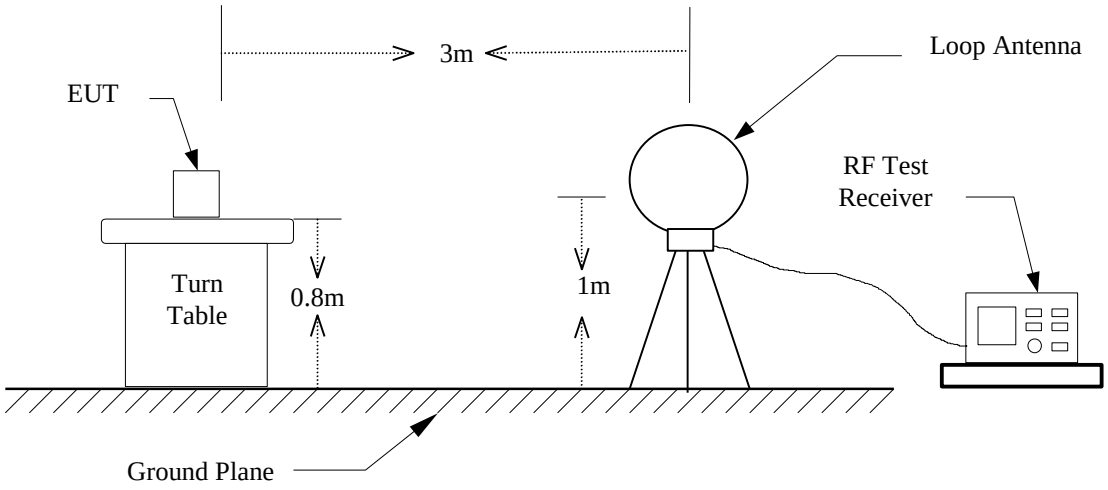
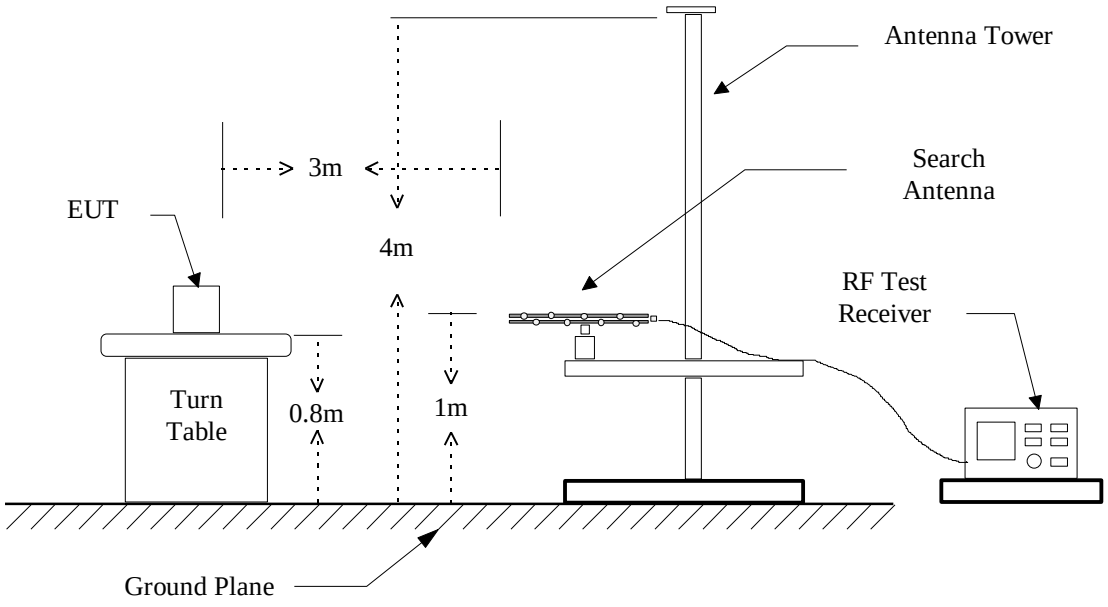


Figure 2 : Frequencies measured above 30 MHz configuration



4.3 Test Data

4.3.1 Fundamental, harmonics and spurious emissions below 30MHz

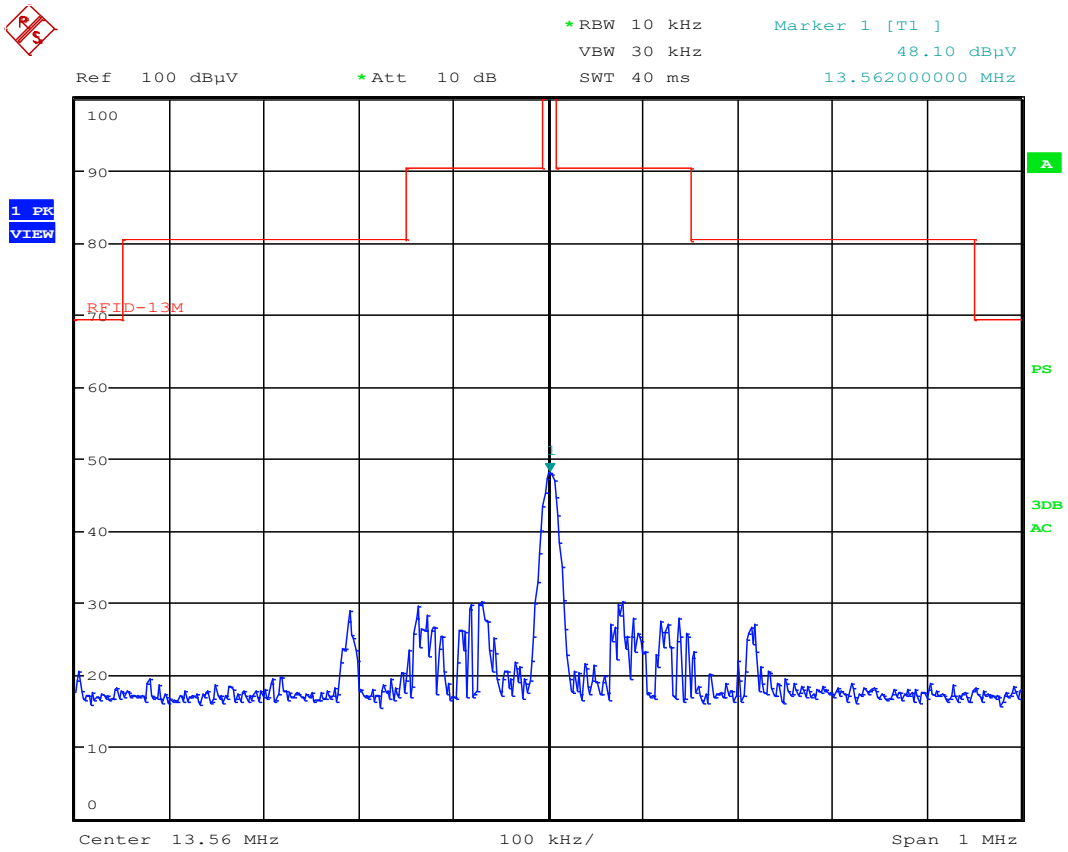
Operation Mode : Transmitting

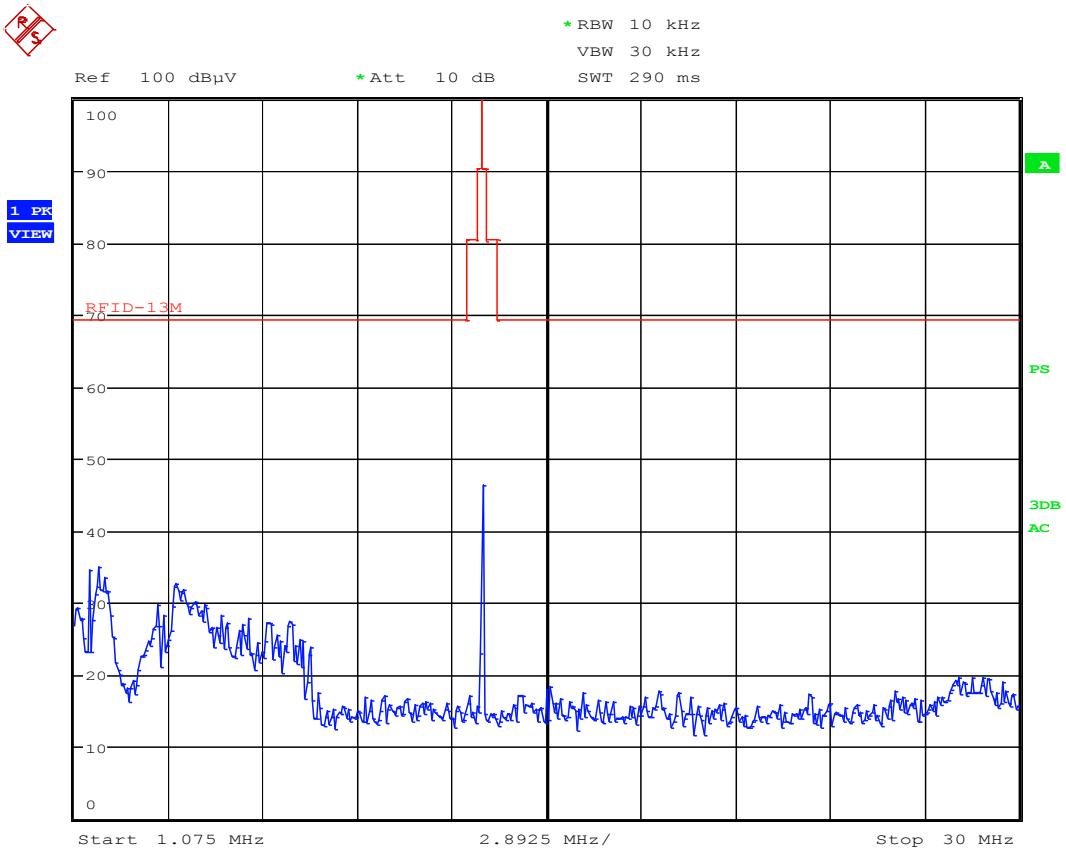
Test Date: Sep.19, 2018 Temperature : 25 ℃ Humidity : 52 %

Frequency (MHz)	Antenna Pol (H/V)	Meter Reading (dBμV)	Corrected Factor (dB)	Amplifier (dB)	Result @3m (dBμV/m)	Result @30m (dBμV/m)	Limit @30m (dBμV/m)
13.562	V	48.10	34.90	28.30	54.70	14.70	84.00
27.123	V	34.8	28.3	28.9	-11.1	29.5	29.5

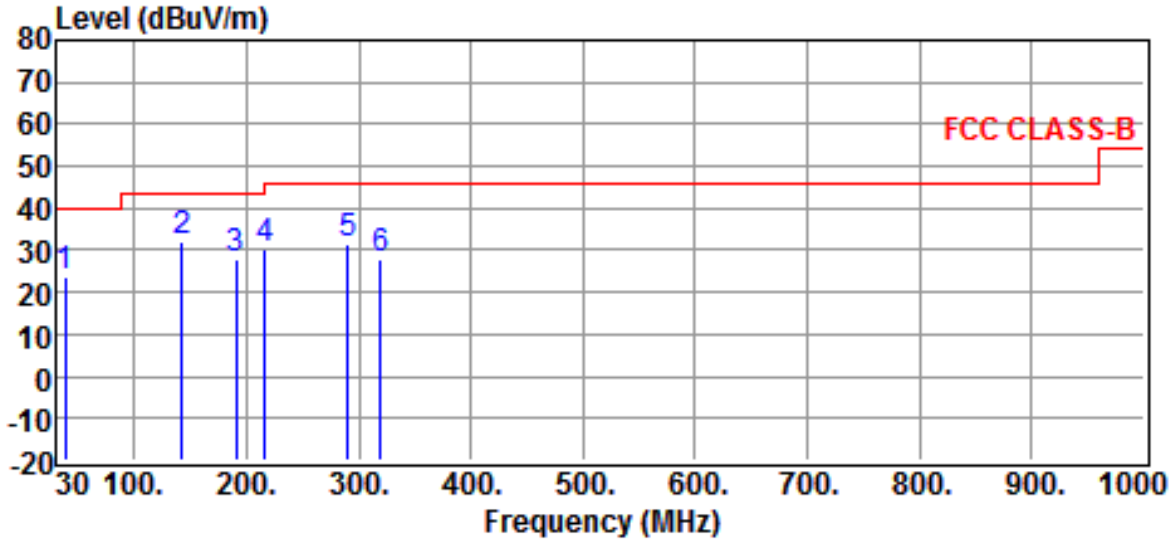
Note :

1. *Result = Reading + C. Factor - Amplifier*
2. *If the result of peak value is under the limit of Quasi-Peak, the Quasi-Peak value doesn't need to be measured.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *With a distant extrapolation of 40log(30m/3m) on the offset level of receiver during the test.*




*RBW 10 kHz
VBW 30 kHz
Ref 100 dBµV
*Att 10 dB
SWT 290 ms
100
90
80
70
60
50
40
30
20
10
0
RFID-13M
1 PK
VIEW
A
PS
3DB
AC
Start 1.075 MHz
2.8925 MHz/
Stop 30 MHz

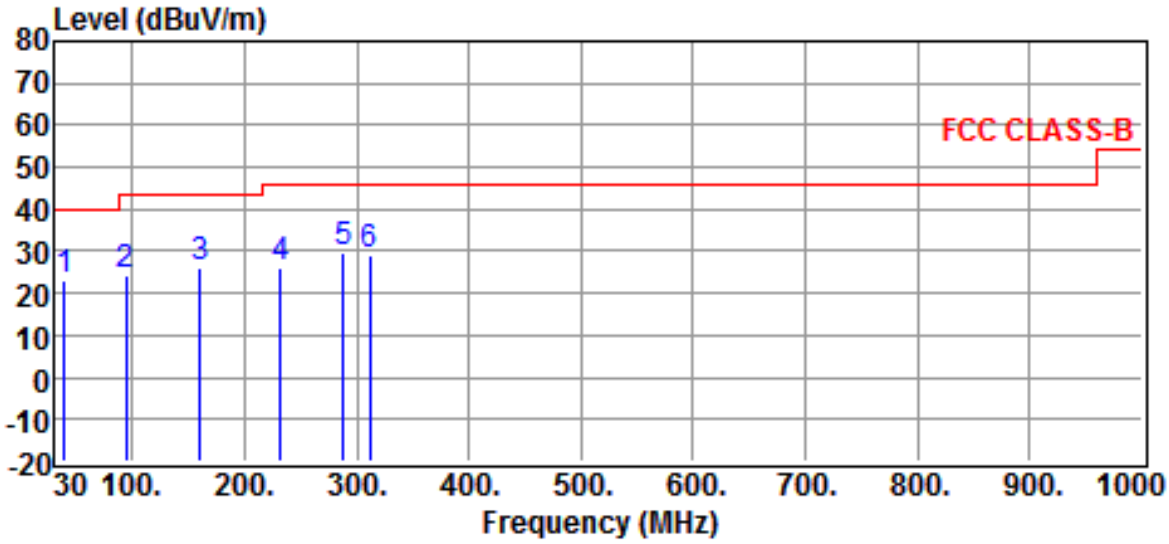
4.3.2 30MHz – 1GHz



Site	:Chamber #2	Date	:2018-09-19
Limit	:FCC CLASS-B	Ant. Pol.	:HORIZONTAL
EUT	: RFID Reader Module	Model	:EWTJ680G-I
Power Rating	:DC 5V From PC	Temp.	:26˚C
Engineer	: Brian Huang	Humi.	:53 %
Test Mode	:Operation Mode		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
38.7300	29.48	-5.74	23.74	40.00	-16.26	QP
142.5200	39.15	-7.18	31.97	43.50	-11.53	QP
191.0200	36.99	-8.96	28.03	43.50	-15.47	QP
216.2400	36.94	-6.74	30.20	46.00	-15.80	QP
289.9600	34.97	-3.42	31.55	46.00	-14.45	QP
319.0600	30.44	-2.80	27.64	46.00	-18.36	QP

Note :
1. Result = Reading + Corrected Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.



Site	:Chamber #2	Date	:2018-09-19
Limit	:FCC CLASS-B	Ant. Pol.	:VERTICAL
EUT	: RFID Reader Module	Model	:EWTJ680G-I
Power Rating	:DC 5V From PC	Temp.	:26˚C
Engineer	: Brian Huang	Humi.	:53 %
Test Mode	:Operation Mode		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
39.7000	29.58	-6.25	23.33	40.00	-16.67	QP
94.0200	35.22	-10.64	24.58	43.50	-18.92	QP
159.9800	33.83	-7.58	26.25	43.50	-17.25	QP
231.7600	33.24	-6.86	26.38	46.00	-19.62	QP
288.0200	33.25	-3.53	29.72	46.00	-16.28	QP
311.3000	31.68	-2.85	28.83	46.00	-17.17	QP

Note :
1. Result = Reading + Corrected Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.

4.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Result = Reading + Corrected Factor

where

Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

4.5 Radiated Test Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Loop Antenna	EMCO	6512	2017/10/13	2018/10/12
EMI Test Receiver	Rohde & Schwarz	ESCI	2018/09/19	2019/09/18
Spectrum Analyzer	Rohde & Schwarz	FSP 40	2017/11/02	2018/11/01
Bi-Log Antenna	ETC	MCTD 2786	2017/10/26	2018/10/25
Log-periodic Antenna	EMCO	3146	2018/08/10	2019/08/09
Amplifier	HP	8447D	2017/12/08	2018/12/07

4.8 Measuring Instrument Setup

Explanation of measuring instrument setup in frequency band measured is as following :

Frequency Band	Instrument	Detector	IF Bandwidth
9 kHz ~ 150 kHz	EMI Test Receiver	QP	200 Hz
	EMI Test Receiver	PK/AV	200 Hz
150 kHz ~ 30 MHz	EMI Test Receiver	QP	9 kHz
	EMI Test Receiver	PK/AV	9 kHz
30 ~ 1000 MHz	EMI Test Receiver	QP	120 kHz
	Spectrum Analyzer	PK	RBW: 100 kHz VBW: 100 kHz

NOTE:

The radiated emission tests of frequency below 30MHz were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open area test 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 based on KDB 414788.

5 FREQUENCY STABILITY MEASUREMENT

5.1 Provisions Applicable

According to sec. 15.225(e) the frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.2 Measurement Procedure

A) Frequency stability versus environmental temperature

1. Setup the configuration per figure 3 for frequencies measured at an environmental chamber set for a temperature of 20℃.

2. Turn on EUT and set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.

3. Set the temperature of chamber to 50℃. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.

4. Repeat step 2 with a 10℃ decreased per stage until the lowest temperature -20℃ is measured, record all measurement frequencies.

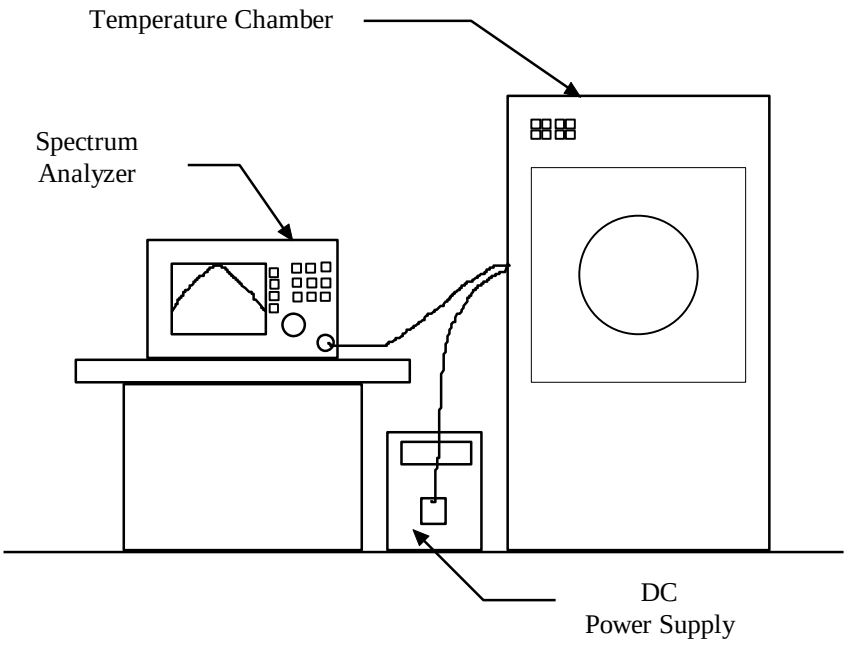
B) Frequency stability versus input voltage

1. Setup the configuration per figure 3 for frequencies measured at an environmental chamber set for a temperature of 20℃.

2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.

3. The EUT is powered with the DC Power Supply, supplied it with 85% and 115% voltage, and measured the EUT operating frequency.

Figure 3 : Frequency stability measurement configuration



5.3 Measurement Instrument

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2017/11/02	2018/11/01
Temperature Chamber	ESPEC	EFL-3	2018/07/26	2019/07/25

5.4 Measurement Data

A1. Frequency stability versus enviroment tempture

Test Date: Sep.19, 2018 Temperature : 22 ℃ Humidity : 52 %

Reference Frequency : 13.56 MHz		Limit：0.01%							
Enviroment	Power	Frequency measured with time elapsed							
Tempture	Supplied	Startup		2 minute		5 minute		10 minute	
(℃)	(Vdc)	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
50	12	13.5606	0.00442	13.5610	0.00737	13.5597	-0.00221	13.5606	0.00442
40		13.5609	0.00664	13.5591	-0.00664	13.5609	0.00664	13.5609	0.00664
30		13.5604	0.00295	13.5592	-0.00590	13.5608	0.00590	13.5604	0.00295
20		13.5592	-0.00590	13.5593	-0.00516	13.5597	-0.00221	13.5592	-0.00590
10		13.5594	-0.00442	13.5609	0.00664	13.5607	0.00516	13.5594	-0.00442
0		13.5590	-0.00737	13.5591	-0.00664	13.5598	-0.00147	13.5590	-0.00737
-10		13.5610	0.00737	13.5600	0.00000	13.5597	-0.00221	13.5610	0.00737
-20		13.5591	-0.00664	13.5602	0.00147	13.5609	0.00664	13.5591	-0.00664

A2. Frequency stability versus input voltage (±15%)

Reference Frequency : 13.56 MHz		Limit：0.01%							
Enviroment	Power	Frequency measured with time elapsed							
Tempture	Supplied	Startup		2 minute		5 minute		10 minute	
(℃)	(Vdc)	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
20	13.8	13.5607	0.00516	13.5604	0.00295	13.5608	0.00590	13.5607	0.00516
20	10.2	13.5610	0.00737	13.5605	0.00369	13.5596	-0.00295	13.5610	0.00737

6. CONDUCTED EMISSION MEASUREMENT

6.1 Description

This EUT is excused from investigation of conducted emission, for it is powered by DC battery only. According to §15.207 (d), measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

7 ANTENNA REQUIREMENT

7.1 Standard Applicable

According to §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.

7.2 Antenna Construction

The antenna is permanently attached to the main PCB, no consideration of replacement.

Please see photos submitted in Exhibit B.

8 OPERATION BANDWIDTH REQUIREMENT

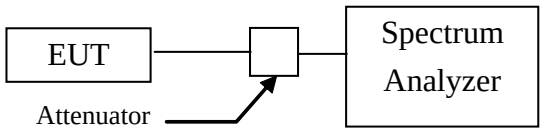
8.1 Standard Applicable

According to §15.215(c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value. The settings of spectrum analyzer is as followings.
   1) Set RBW = 10 kHz.
   2) Set the video bandwidth (VBW) ≥ RBW.
   3) Detector = Peak.
   4) Trace mode = max hold.
   5) Sweep = auto couple.
   6) Allow the trace to stabilize.
   7) 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.
3. Repeat above procedures until all frequencies measured were complete.

Figure 4: Emission bandwidth measurement configuration.



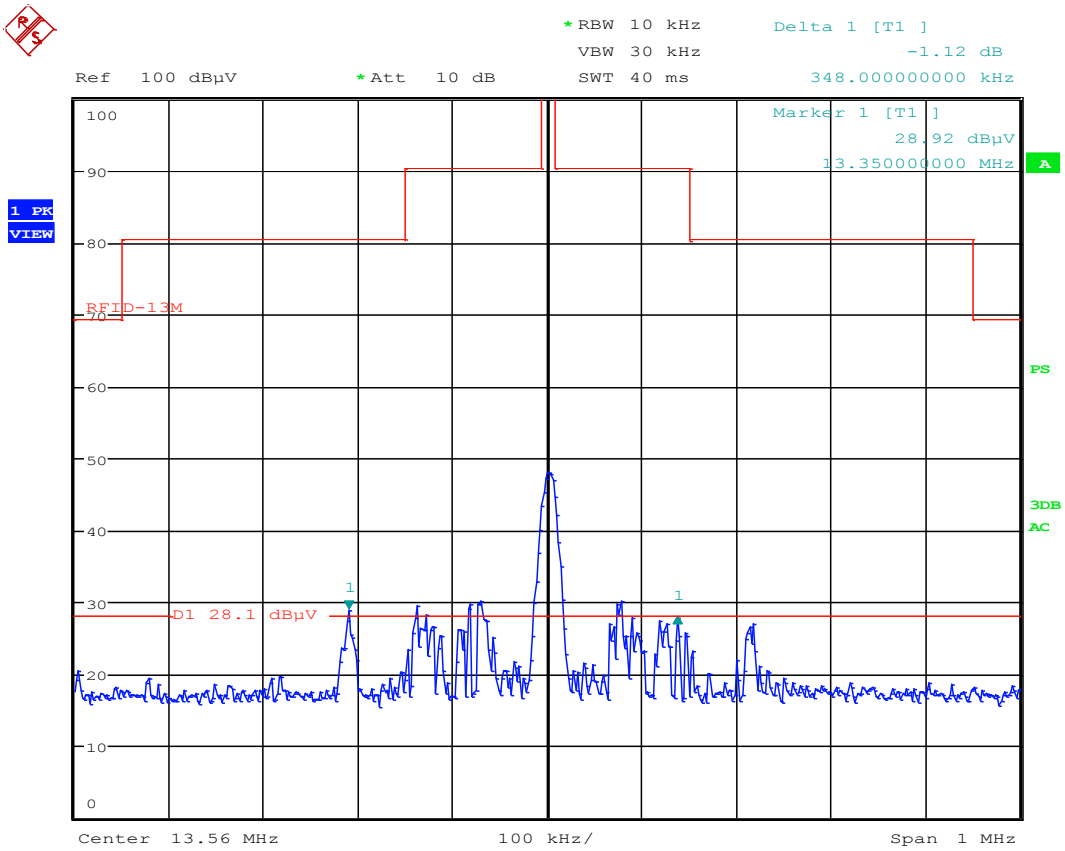
8.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2017/11/02	2018/11/01

8.4 Measurement Data

Test Date : Sep.19, 2018 Temperature : 22 ℃ Humidity : 52 %

a) 20 dB Emission Bandwidth is 348 kHz



The 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section 15.225.