

FCC Part 15 EMI TEST REPORT

of

E.U.T. : RFID READER
MODEL : WBR800
FCC ID. : WXAWBR800
Frequency Range : 2402MHz~2480MHz

for

APPLICANT : GIGA-TMS INC.
ADDRESS : 9F-2, NO. 31, Lane 169, Kang-Ning St., Hsi-Chih,
New Taipei City22180, Taiwan

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN
NO. 34. LIN 5, DINGFU VIL., LINKOU DIST.,
NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.
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Report Number : 13-07-RBF-028-01

TEST REPORT CERTIFICATION

Applicant : GIGA-TMS INC.
9F-2, NO. 31, Lane 169, Kang-Ning St., Hsi-Chih, New Taipei City 22180, Taiwan

Manufacturer : GIGA-TEK INC.
NO. 47, Xianghe Rd., Tanzi Dist., Taichung City 42741, Taiwan

Description of EUT

- a) Type of EUT : RFID READER
- b) Trade Name : PROMAG, GIGATEK, Prox Data
- c) Model No. : WBR800
- d) Power Supply : DC 3.7V
- f) Frequency Range : 2402MHz~2480MHz;

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 C63.4, 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
Conducted Emission	Pass
Band Edge Requirement	Pass

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1 GENERAL INFORMATION

1.1 Product Description

- a) Type of EUT : RFID READER
- b) Trade Name : PROMAG, GIGATEK, Prox Data
- c) Model No. : WBR800
- d) Power Supply : DC 3.7V
- e) Frequency Range : 2402MHz~2480MHz

1.2 Characteristics of Device

RFID READER working on 2.4GHz and 13.56MHz frequency band.

1.3 Test Methodology

Both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.4 (2003). Other required measurements were illustrated in separate sections of this test report for details.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at No.34, Lin 5, Dingfu Vil., Linkou Dist., New Taipei City, Taiwan 24442, R.O.C.

This site has been fully described in a report submitted to your office, and accepted in a letter dated Jan. 11, 2011.

2 PROVISIONS APPLICABLE

2.1 Definition

Unintentional radiator:

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

Class B Digital Device :

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

Intentional radiator:

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

2.2 Requirement for Compliance

(1) Conducted Emission Requirement

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 30MHz shall not exceed the limits in the following table, as measured using a 50MH/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 band edges.

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

(2) Radiated Emission Requirement

For unintentional device, according to §15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency MHz	Distance Meters	Radiated dB μ V/m	Radiated μ V/m
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
Above 960	3	54.0	500

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

For intentional radiator device, per §15.249(a), the field strength of emissions shall comply with the following :

Frequency MHz	Distance Meters	Fundamental		Harmonic	
		dB μ V/m	mV/m	dB μ V/m	μ V/m
902 - 928	3	94	50	54	500
2400 - 2483.5	3	94	50	54	500
5725 - 5875	3	94	50	54	500
24000 - 24250	3	108	250	68	2500

In accordance with §15.249(e), limits shown in above table are based on average limits for frequencies above 1000 MHz, and frequencies below 1000 MHz are based on quasi peak. However, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20 dB.

(3) Spurious in Out Band Requirement

For intentional device, according to §15.249 (d), emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits in §15.209.

(4) Antenna Requirement

For intentional device, 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.

2.3 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	4.5-5.25
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			

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

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.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio / TV technician for help.

3. SYSTEM TEST CONFIGURATION

3.1 Justification

For both radiated and conducted emissions, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation.

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

3.2 Devices for Tested System

Device	Manufacturer	Model / FCC ID	Description
* RFID READER	GIGA-TEK INC.	WBR800 / WXA WBR800	1.2m Shielded USB Cable
Notebook PC	DELL	PP25L	1.8m Unshielded AC Adaptor Power Cord

Remark “*” means equipment under test.

4 RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

For intentional radiators, according to §15.249 (a), the fundamental field strength shall not exceed 94 dBuV/m and the harmonics shall not exceed 54 dBuV/m. For out band emission except for harmonics shall be comply with §15.209 or at least attenuated by 50 dB below the level of the fundamental.

4.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. 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.

Figure 1 : Frequencies measured below 1 GHz configuration

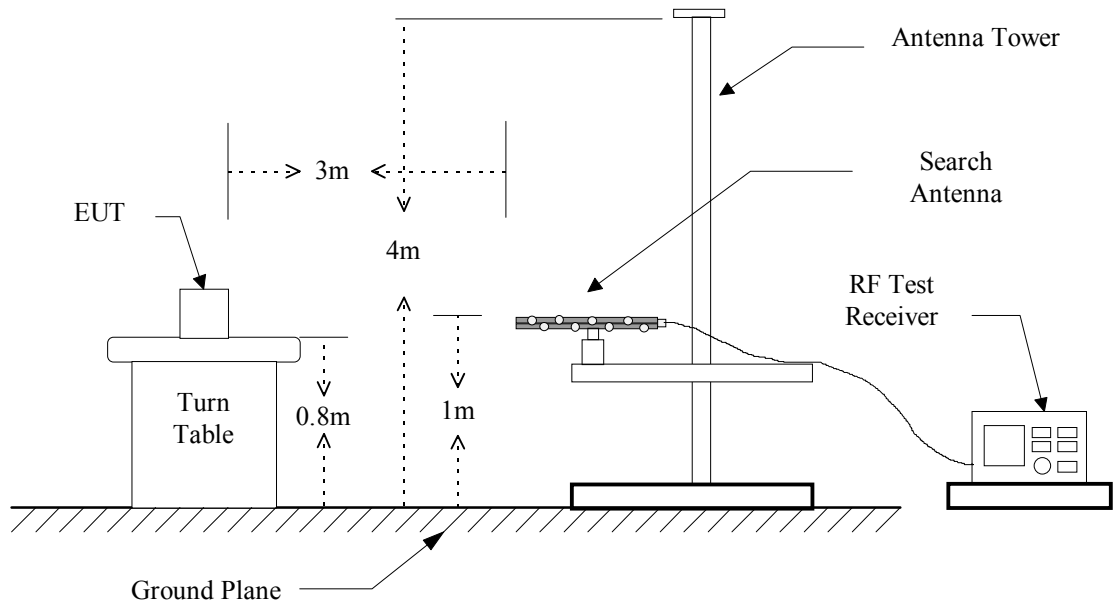
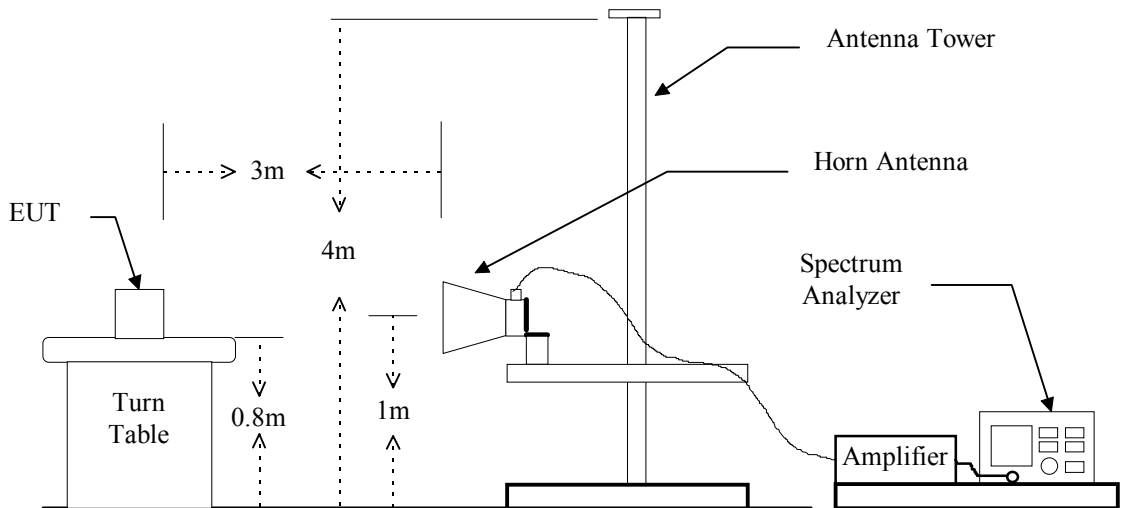


Figure 2 : Frequencies measured above 1 GHz configuration



4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

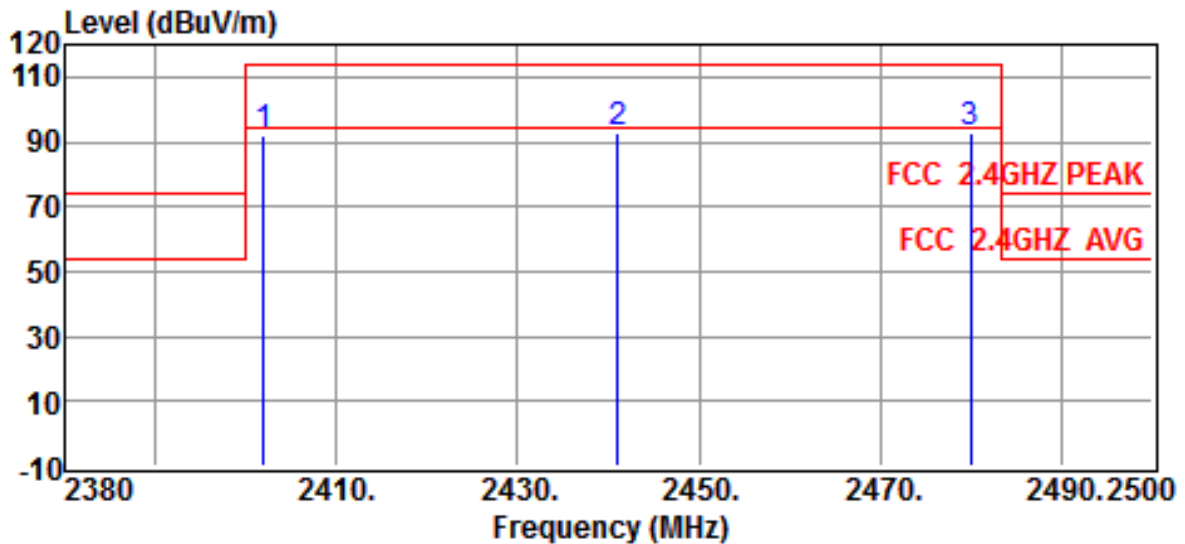
Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Test Receiver	Rohde & Schwarz	ESVS30	2013/05/06	2014/05/05
EMI Test Receiver	Rohde & Schwarz	ESL	2013/07/29	2014/07/28
Bi-Log Antenna	ETC	MCTD 2756	2013/01/17	2014/01/17
Log-periodic Antenna	EMCO	3146	2012/10/17	2013/10/16
Double Ridged Guide Horn Antenna	EMCO	3116	2012/11/23	2013/11/22
Biconical Antenna	EMCO	3110	2012/10/17	2013/10/16
Double Ridged Antenna	EMCO	3115	2013/04/29	2014/04/28
Amplifier	HP	8449B	2013/01/09	2014/01/08
Amplifier	HP	83051A	2013/05/06	2014/05/05
Amplifier	HP	8447D	2013/05/03	2014/05/02
EMI Test Receiver	Rohde & Schwarz	ESU 40	2012/09/17	2013/09/16

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10Hz

4.4 Radiated Emission Data

4.4.1 RF Portion

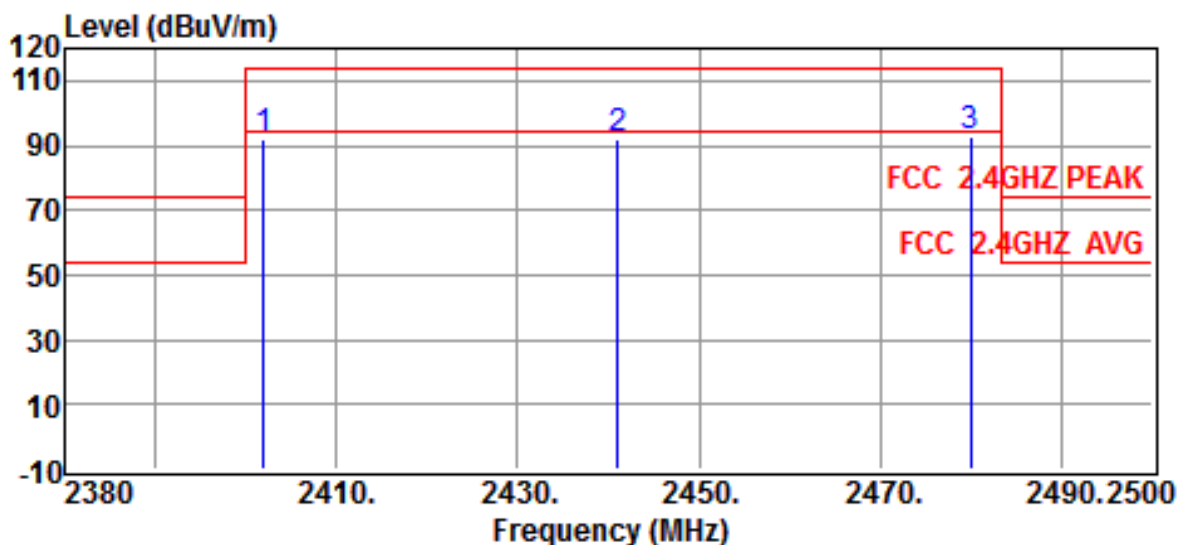


Site	:Chamber #2	Date	:2013-08-20
Limit	:FCC 2.4GHZ PEAK	Ant. Pol.	:HORIZONTAL
EUT	:RFID READER	Temp.	:25°C
Power Rating	:battery	Humi.	:60%
Model	:WBR800	Engineer.	:Jiapeng
Test Mode	:TX on Channel low, middle and high; Fundamental		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2402.0000	98.1	-5.8	92.3	114.0	-21.7	Peak
2441.0000	98.7	-5.6	93.1	114.0	-20.9	Peak
2480.0000	98.4	-5.4	93.0	114.0	-21.0	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit – Result
4. Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
5. Output Power calculation:
 $E=0.045V/m, d=3m, Gain=2dBi$
 $P_t=(0.045*3)^2/(30*2)=0.00030375(W)$



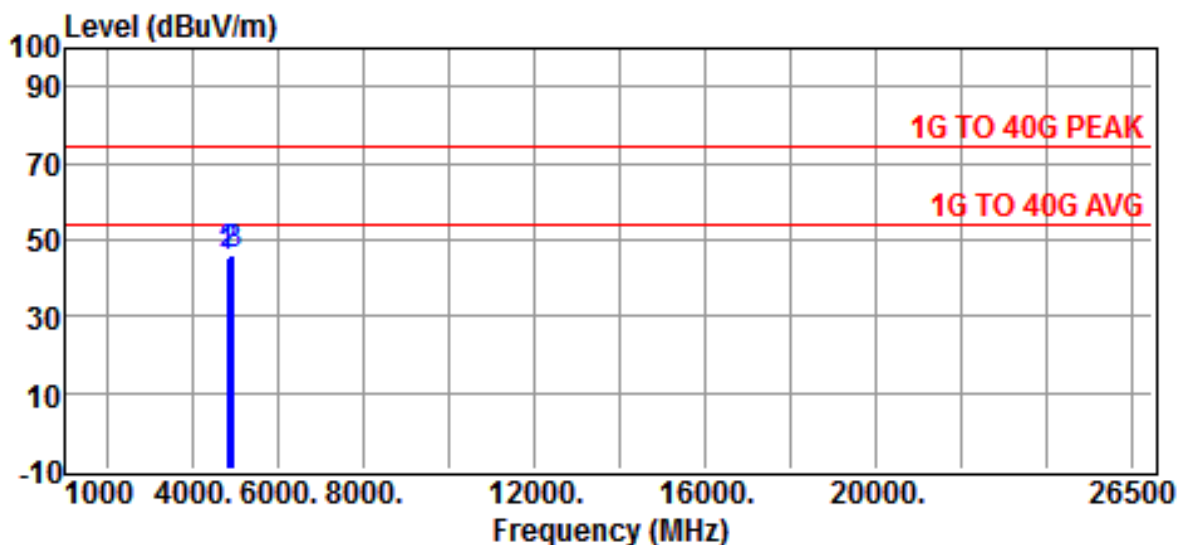
Site :Chamber #2 Date :2013-08-20
 Limit :FCC 2.4GHZ PEAK Ant. Pol. :VERTICAL
 EUT :RFID READER Temp. :25°C
 Power Rating :battery Humi. :60%
 Model :WBR800 Engineer. :Jiapeng
 Test Mode :TX on Channel low, middle and high; Fundamental

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2402.0000	98.0	-5.8	92.2	114.0	-21.8	Peak
2441.0000	97.3	-5.6	91.7	114.0	-22.3	Peak
2480.0000	97.9	-5.4	92.5	114.0	-21.5	Peak

Note :

Note :

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

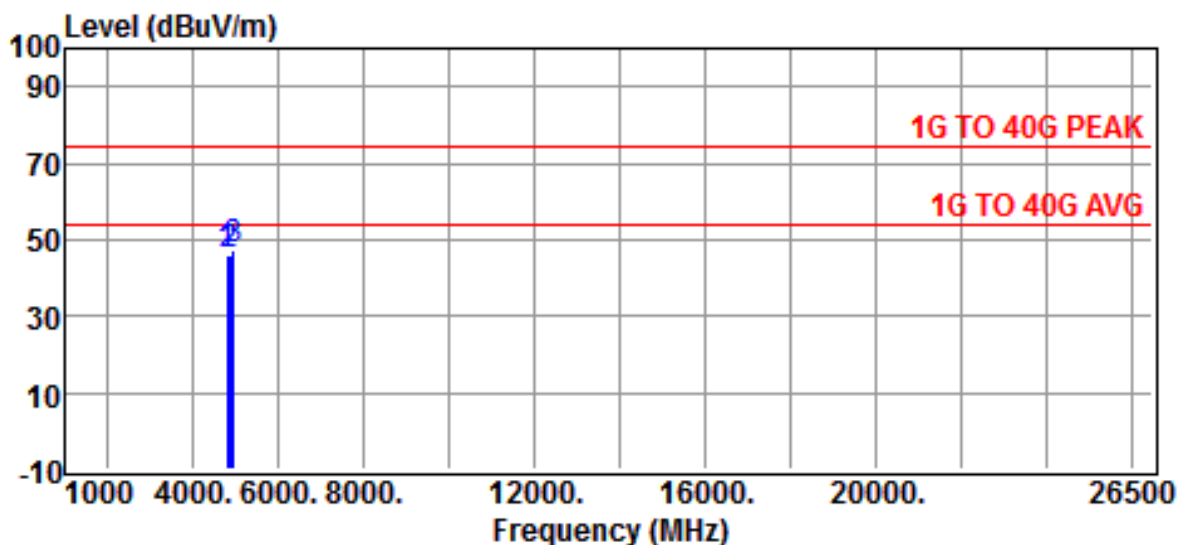


Site	:Chamber #2	Date	:2013-08-20
Limit	:1G TO 40G PEAK	Ant. Pol.	:HORIZONTAL
EUT	:RFID READER	Temp.	:25°C
Power Rating	:battery	Humi.	:60%
Model	:WBR800	Engineer.	:Jiapeng
Test Mode	:TX on Channel low, middle and high; Harmonics		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
4804.0000	43.9	1.3	45.2	74.0	-28.8	Peak
4882.0000	44.5	1.4	45.9	74.0	-28.1	Peak
4960.0000	44.5	1.6	46.1	74.0	-27.9	Peak

Note :

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

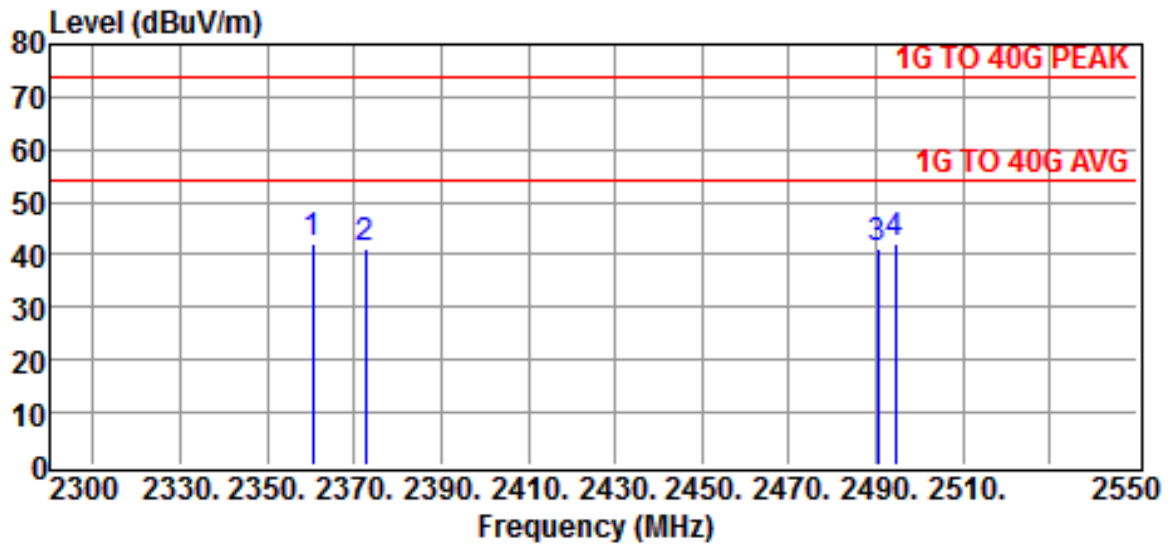


Site	:Chamber #2	Date	:2013-08-20
Limit	:1G TO 40G PEAK	Ant. Pol.	:VERTICAL
EUT	:RFID READER	Temp.	:25°C
Power Rating	:battery	Humi.	:60%
Model	:WBR800	Engineer.	:Jiapeng
Test Mode	:TX on Channel low, middle and high; Harmonics		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
4804.0000	44.5	1.3	45.8	74.0	-28.2	Peak
4882.0000	44.7	1.4	46.1	74.0	-27.9	Peak
4960.0000	45.7	1.6	47.3	74.0	-26.7	Peak

Note :

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

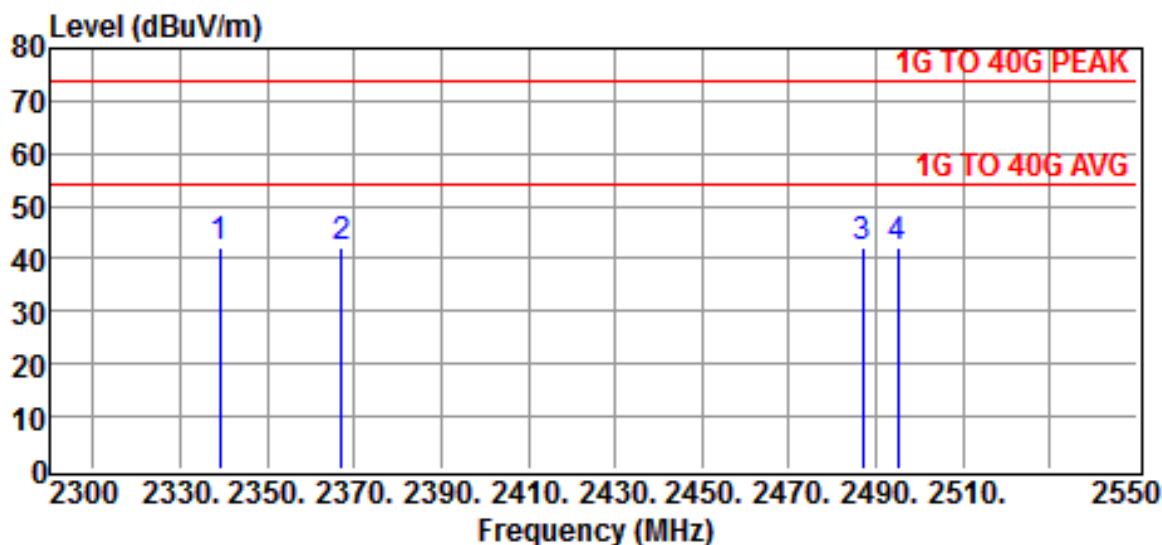


Site	:Chamber #2	Date	:2013-08-20
Limit	:1G TO 40G PEAK	Ant. Pol.	:HORIZONTAL
EUT	:RFID READER	Temp.	:25°C
Power Rating	:battery	Humi.	:60%
Model	:WBR800	Engineer.	:Jiapeng
Test Mode	:Channel Low & High - Restricted Bands		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2360.5000	48.2	-5.9	42.3	74.0	-31.7	Peak
2372.5000	47.2	-5.8	41.4	74.0	-32.6	Peak
2490.5000	46.6	-5.4	41.2	74.0	-32.8	Peak
2494.5000	47.6	-5.4	42.2	74.0	-31.8	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result
4. 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 :2013-08-20
 Limit :1G TO 40G PEAK Ant. Pol. :VERTICAL
 EUT :RFID READER Temp. :25°C
 Power Rating :battery Humi. :60%
 Model :WBR800 Engineer. :Jiapeng
 Test Mode : Channel Low & High - Restricted Bands

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2339.0000	47.9	-5.9	42.0	74.0	-32.0	Peak
2367.0000	48.1	-5.9	42.2	74.0	-31.8	Peak
2487.0000	47.4	-5.4	42.0	74.0	-32.0	Peak
2495.0000	47.4	-5.4	42.0	74.0	-32.0	Peak

Note :

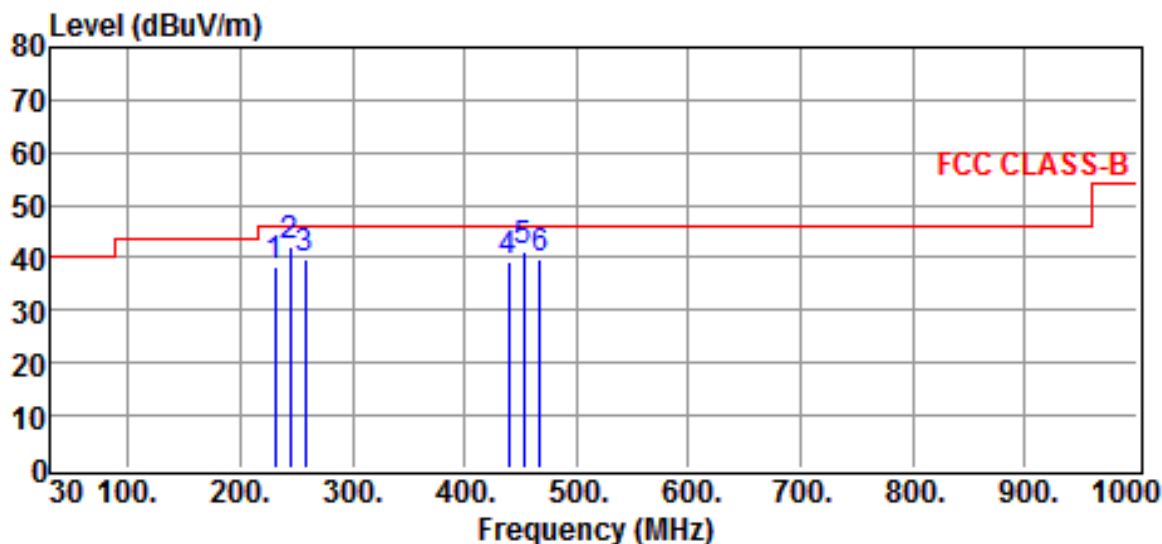
1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result
4. Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.

4.4.2 Other Emissions

a) Emission frequencies below 1 GHz

Operation Mode : Charging & TX Other Emissions

Test Date : Aug 20, 2013 Temperature : 25 °C Humidity : 60 %

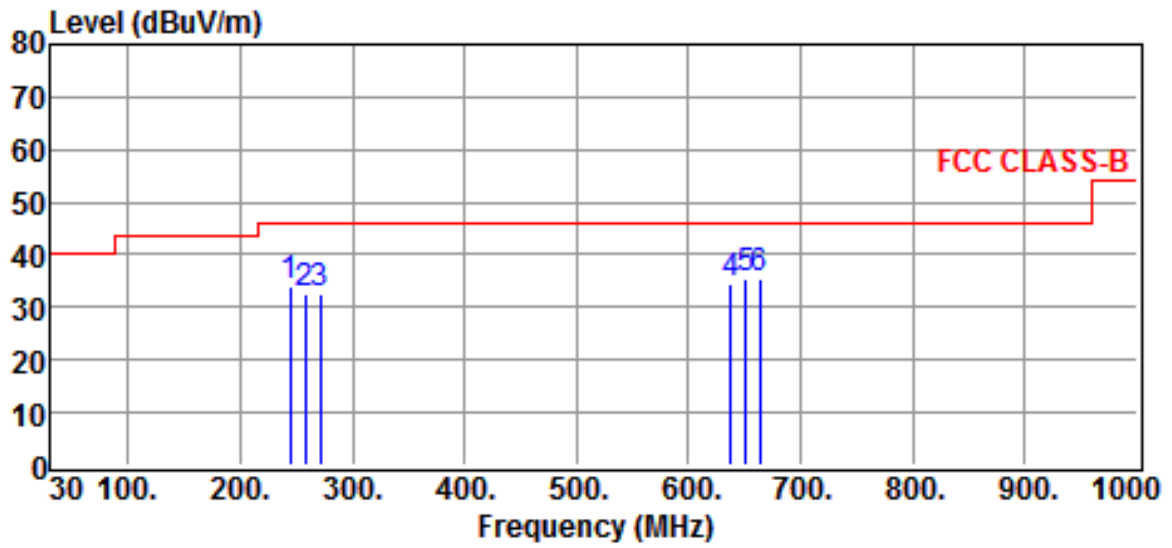


Site	:Open Site	Date	:2013-08-20
Limit	:FCC CLASS-B	Ant. Pol.	:HORIZONTAL
EUT	:RFID READER	Temp.	:25°C
Power Rating	:Power From PC	Humi.	:60%
Model	:WBR800	Engineer.	:Jiapeng
Test Mode	:Charging		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
231.0800	19.7	18.8	38.5	46.0	-7.5	QP
244.3600	22.5	19.7	42.2	46.0	-3.8	QP
258.1800	19.2	20.7	39.9	46.0	-6.1	QP
439.3000	19.3	20.1	39.4	46.0	-6.6	QP
453.3000	20.9	20.5	41.4	46.0	-4.6	QP
467.3000	18.9	20.8	39.7	46.0	-6.3	QP

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

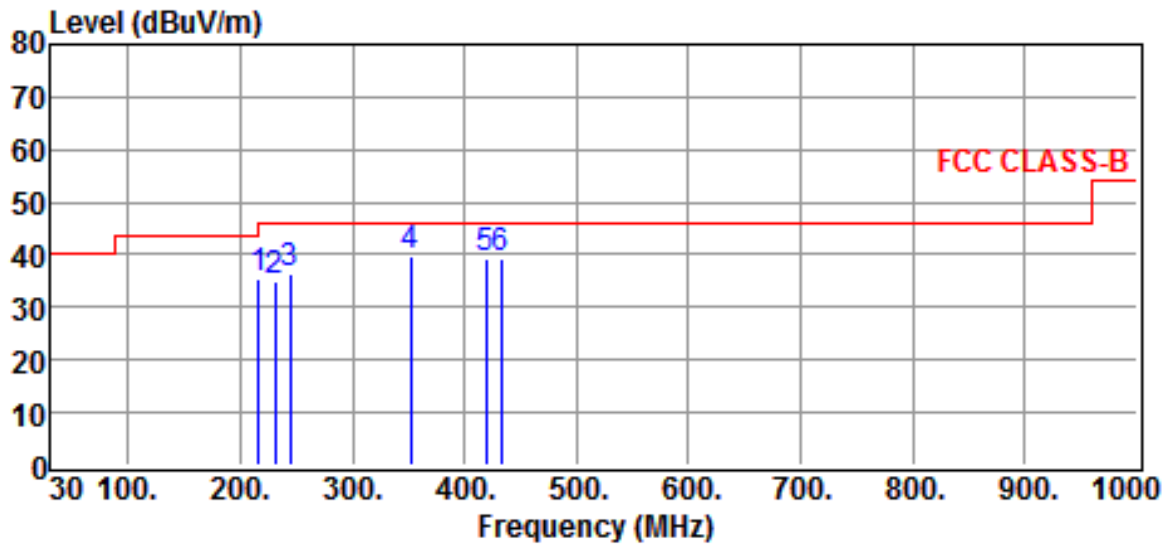


Site	:Open Site	Date	:2013-08-20
Limit	:FCC CLASS-B	Ant. Pol.	:VERTICAL
EUT	:RFID READER	Temp.	:25°C
Power Rating	:Power From PC	Humi.	:60%
Model	:WBR800	Engineer.	:Jiapeng
Test Mode	:Charging		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
244.3600	14.5	19.7	34.2	46.0	-11.8	QP
258.1800	11.7	20.7	32.4	46.0	-13.6	QP
271.4600	10.1	22.3	32.4	46.0	-13.6	QP
637.4000	10.7	24.0	34.7	46.0	-11.3	QP
651.4000	11.3	24.3	35.6	46.0	-10.4	QP
663.3000	11.1	24.5	35.6	46.0	-10.4	QP

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

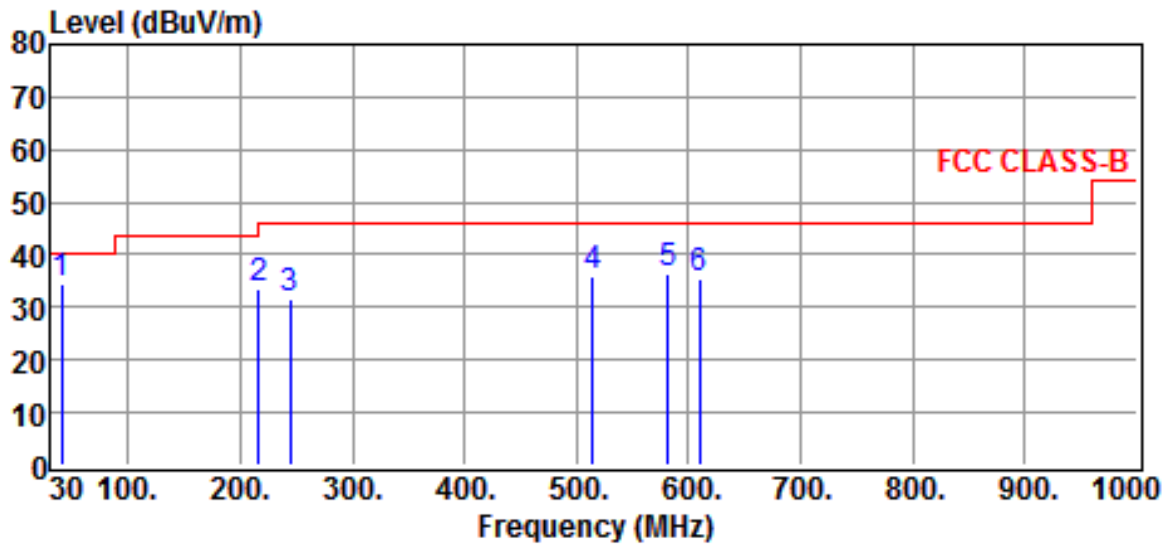


Site	:Open Site	Date	:2013-08-20
Limit	:FCC CLASS-B	Ant. Pol.	:HORIZONTAL
EUT	:RFID READER	Temp.	:25
Power Rating	:battery	Humi.	:60
Model	:WBR800	Engineer.	:Jiapeng
Test Mode	:TX Other Emissions		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
216.9900	16.9	18.4	35.3	46.0	-10.7	QP
231.0800	16.0	18.8	34.8	46.0	-11.2	QP
244.3600	16.5	19.7	36.2	46.0	-9.8	QP
351.8000	22.0	17.8	39.8	46.0	-6.2	QP
419.7000	19.6	19.6	39.2	46.0	-6.8	QP
433.0000	19.5	20.0	39.5	46.0	-6.5	QP

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result



Site	:Open Site	Date	:2013-08-20
Limit	:FCC CLASS-B	Ant. Pol.	:VERTICAL
EUT	:RFID READER	Temp.	:25
Power Rating	:battery	Humi.	:60
Model	:WBR800	Engineer.	:Jiapeng
Test Mode	:TX Other Emissions		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
40.3000	21.3	13.1	34.4	40.0	-5.6	QP
216.9900	15.2	18.4	33.6	46.0	-12.4	QP
244.3600	12.1	19.7	31.8	46.0	-14.2	QP
514.9000	14.2	21.8	36.0	46.0	-10.0	QP
582.1000	13.6	22.8	36.4	46.0	-9.6	QP
610.1000	12.2	23.4	35.6	46.0	-10.4	QP

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit - Result

b) Emission frequencies above 1 GHz

Radiated emission frequencies above 1 GHz to 26.5 GHz were too low to be measured with a pre-amplifier of 35 dB.

4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

$$\mathbf{Result = Reading + Corrected Factor}$$

where Corrected Factor

$$= \text{Antenna FACTOR} + \text{Cable Loss} + \text{High Pass Filter Loss} - \text{Amplifier Gain}$$

4.6 Photos of Radiation Measuring Setup

Test Mode: Charging



Test Mode: TX Other Emissions



5 CONDUCTED EMISSION MEASUREMENT

5.1 Standard Applicable

According to §15.207(a), 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 50 μ H/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.

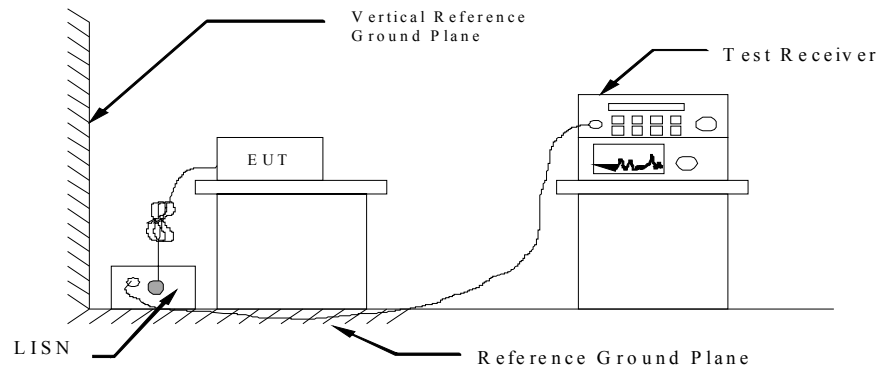
Frequency MHz	Quasi Peak dB μ V	Average dB μ V
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

* Decreases with the logarithm of the frequency

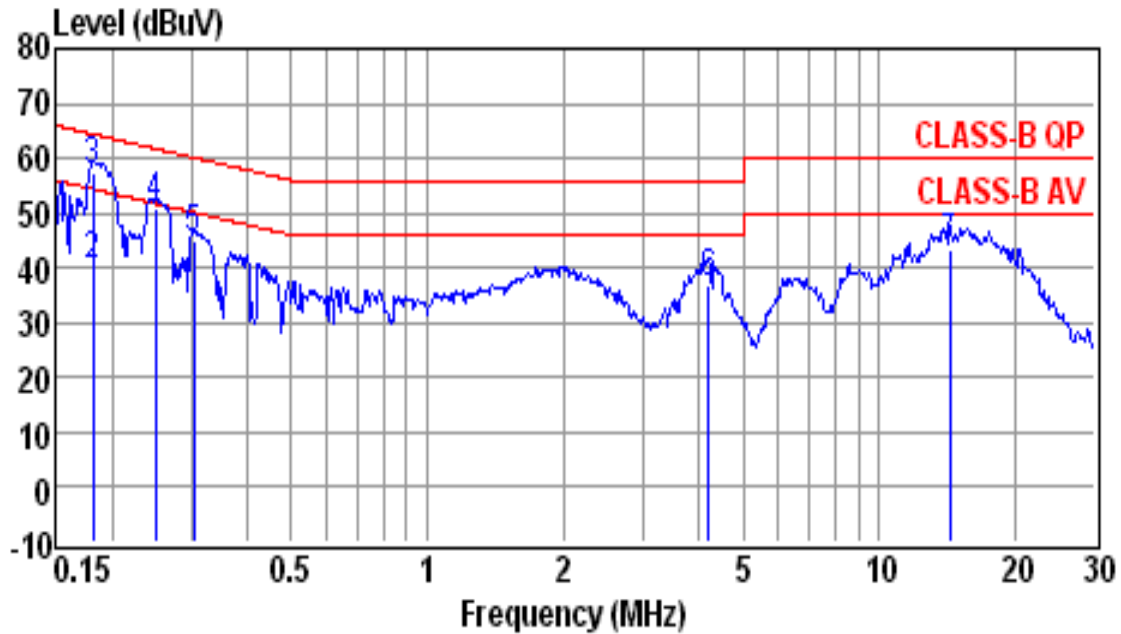
5.2 Measurement Procedure

1. Setup the configuration per figure 5.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 6 or 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then records the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 5: Conducted emissions measurement configuration



5.3 Conducted Emission Data

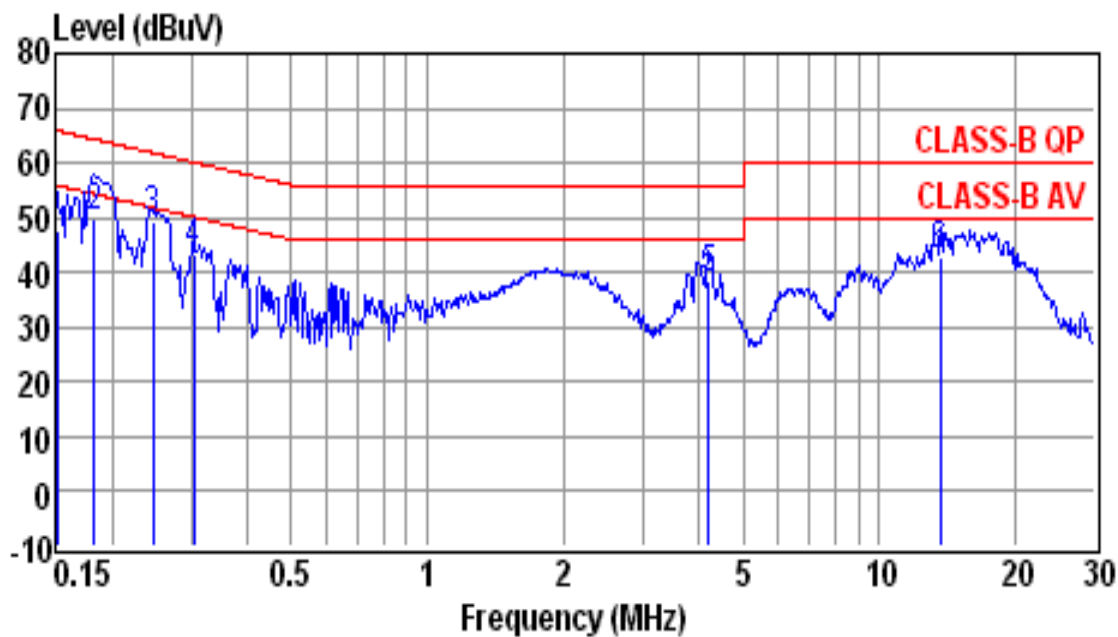


Site : conducted #1 Date : 08-20-2013
 Condition : CLASS-B QP LISN : NEUTRAL
 Tem / Hum : 25 °C / 60% Test Mode : Charging
 EUT : RFID READER Power Rating: Power From PC
 Memo : Memo :

Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
0.1500	38.6	10.3	48.9	66.0	-17.1	QP
0.1815	29.6	10.3	39.9	54.4	-14.5	Average
0.1815	47.1	10.3	57.4	64.4	-7.0	QP
0.2495	40.5	10.3	50.8	61.8	-11.0	QP
0.3035	34.7	10.3	45.0	60.1	-15.1	QP
4.2020	26.4	10.5	36.9	56.0	-19.1	QP
14.3640	32.9	10.7	43.6	60.0	-16.4	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss



Site : conducted #1 Date : 08-20-2013
 Condition : CLASS-B QP LISN : LINE
 Tem / Hum : 25 °C / 60% Test Mode : Charging
 EUT : RFID READER Power Rating: Power From PC
 Memo : Memo :

Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
0.1516	37.1	10.3	47.4	65.9	-18.5	QP
0.1835	39.8	10.3	50.1	64.3	-14.2	QP
0.2468	39.2	10.3	49.5	61.9	-12.4	QP
0.3035	32.9	10.3	43.2	60.1	-16.9	QP
4.2020	27.8	10.5	38.3	56.0	-17.7	QP
13.6950	32.0	10.8	42.8	60.0	-17.2	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss

5.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

$$\mathbf{RESULT = READING + LISN FACTOR}$$

Assume a receiver reading of 22.5 dB μ V is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dB μ V.

$$\text{RESULT} = 22.5 + 0.1 = 22.6 \text{ dB}\mu\text{V}$$

$$\begin{aligned} \text{Level in } \mu\text{V} &= \text{Common Antilogarithm}[(22.6 \text{ dB}\mu\text{V})/20] \\ &= 13.48 \mu\text{V} \end{aligned}$$

5.5 Conducted Measurement Equipment

The following test equipments are used during the conducted test.

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESCI	2013/07/15	2014/07/14
LISN	EMCO	3825/2	2012/11/02	2013/11/02
LISN	Rohde & Schwarz	ESH2-Z5	2012/08/23	2013/08/23

5.6 Photos of Conduction Measuring Setup



6 ANTENNA REQUIREMENT

6.1 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.

6.2 Antenna Construction

The antenna is integrated on the device. No consideration of replacement. Please refer to the construction Photo for details.

7 BAND EDGES MEASUREMENT

7.1 Standard Applicable

According to 15.249(d), out band emission except for harmonics shall be comply with §15.209 or at least attenuated by 50 dB below the level of the fundamental.

7.2 Measurement Procedure

A) 50 dB attenuation method

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 its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
4. Repeat above procedures until all measured frequencies were complete.

B) Radiated Emission method

1. Following the measurement procedures in section 4.2 with the EUT set to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
2. Measure the highest amplitude appearing on spectral displayed.
3. Repeat above procedures until all measured frequencies were complete.

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10Hz

7.3 Measurement Equipment

A) 50 dB attenuation method

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESU 40	2012/09/17	2013/09/17

B) Radiated Emission method

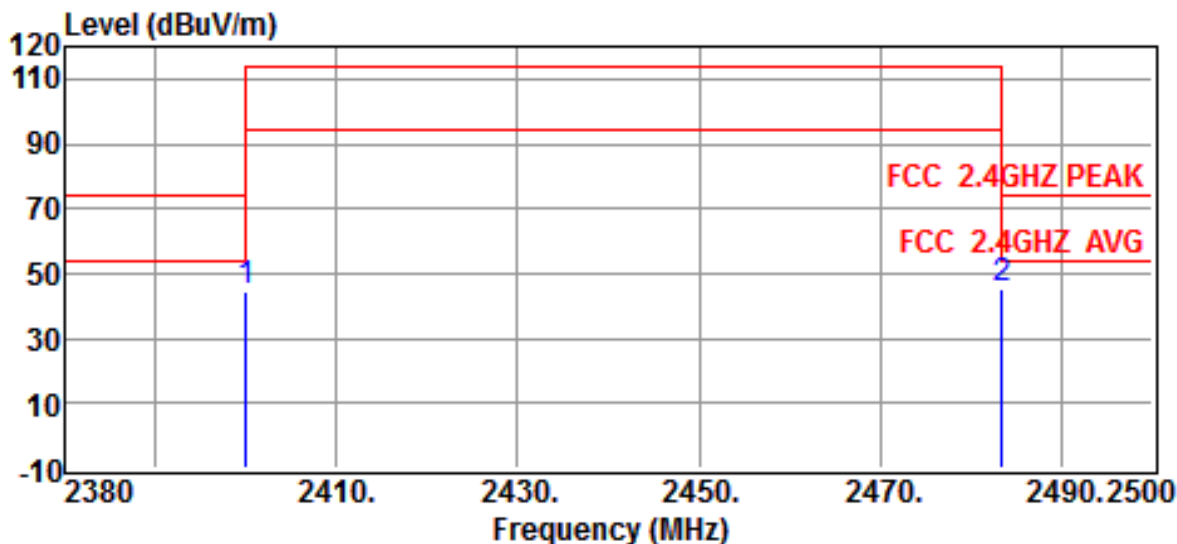
Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Test Receiver	Rohde & Schwarz	ESVS30	2013/05/06	2014/05/05
EMI Test Receiver	Rohde & Schwarz	ESL	2013/07/29	2014/07/28
Bi-Log Antenna	ETC	MCTD 2756	2013/01/17	2014/01/17
Log-periodic Antenna	EMCO	3146	2012/10/17	2013/10/16
Double Ridged Guide Horn Antenna	EMCO	3116	2012/11/23	2013/11/22
Biconical Antenna	EMCO	3110	2012/10/17	2013/10/16
Double Ridged Antenna	EMCO	3115	2013/04/29	2014/04/28
Amplifier	HP	8449B	2013/01/09	2014/01/08
Amplifier	HP	83051A	2013/05/06	2014/05/05
Amplifier	HP	8447D	2013/05/03	2014/05/02
EMI Test Receiver	Rohde & Schwarz	ESU 40	2012/09/17	2013/09/16

7.4 Measurement Data

Test Result: (Radiated Emission method)

The radiated emission test results of the lower and the upper band edges were comply with §15.209. Please refer to the following pages for test results.

Radiated Emission Test Results of the Band Edges

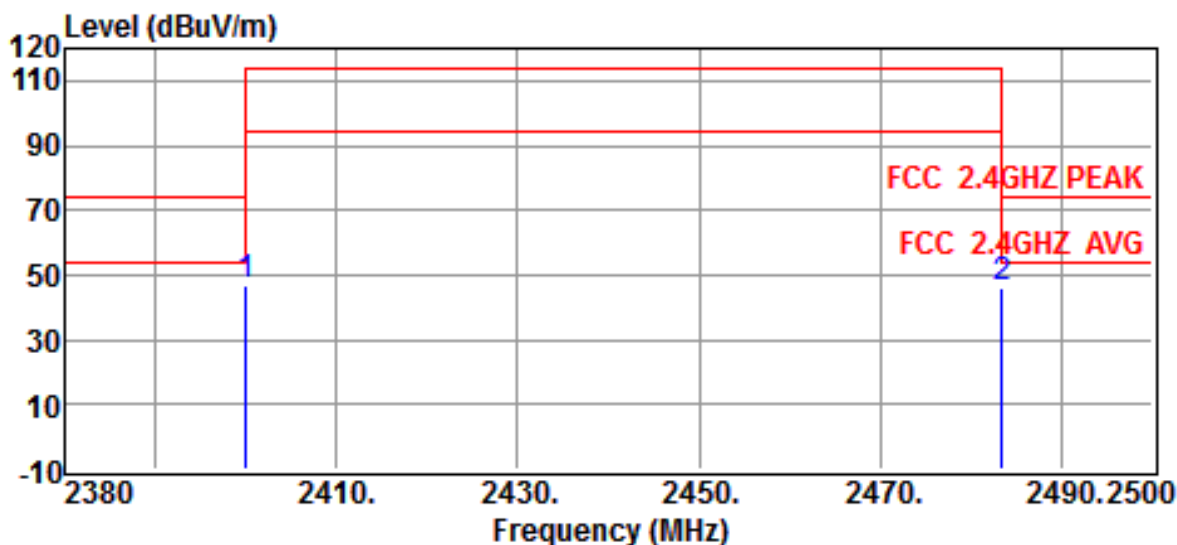


Site	:Chamber #2	Date	:2013-08-20
Limit	:FCC 2.4GHZ PEAK	Ant. Pol.	:HORIZONTAL
EUT	:RFID READER	Temp.	:25 °C
Power Rating	:battery	Humi.	:60%
Model	:WBR800	Engineer.	:Jiapeng
Test Mode	: Band edge		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2400.0000	50.2	-5.8	44.4	74.0	-29.6	Peak
2483.5000	51.0	-5.4	45.6	74.0	-28.4	Peak

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
3. The margin value=Limit – Result
4. 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	:2013-08-20
Limit	:FCC 2.4GHZ PEAK	Ant. Pol.	:VERTICAL
EUT	:RFID READER	Temp.	:25 °C
Power Rating	:battery	Humi.	:60%
Model	:WBR800	Engineer.	:Jiapeng
Test Mode	: Band edge		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
2400.0000	52.4	-5.8	46.6	74.0	-27.4	Peak
2483.5000	51.1	-5.4	45.7	74.0	-28.3	Peak

Note :

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