FCC TEST REPORT
for
Shenzhen PowerMagic Communication Co., Ltd.

RFID Reader
Model No.: PM-R200

Prepared for	:	Shenzhen PowerMagic Communication Co., Ltd.
Address	:	Rm920, 9th Floor, R/D Building Complex, Tsinghua Hi-Tech Park, North District, Hi-Tech & Industrial Estate, Nanshan, Shenzhen Tel: (86) 755-26030005 Fax: (86) 755-26030005
Prepared By	:	Anbotek Compliance Laboratory Limited
Address	:	2/F, Langfeng Building, Kefa Road North, Hi-tech Industrial Park, Nanshan District, Shenzhen 518057, China Tel: (86) 755-26014771 Fax: (86) 755-26014720

Report Number	:	200903707F
Date of Test	:	Apr. 01~16, 2009
Date of Report	:	Apr. 17, 2009

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TEST REPORT

Applicant	:	Shenzhen PowerMagic Communication Co., Ltd.
Manufacturer	:	Shenzhen PowerMagic Communication Co., Ltd.
EUT	:	RFID Reader
Model No.	:	PM-R200
Serial No.	:	N/A
Rating	:	DC 12V via Adapter
Trade Mark	:	PowerMagic

Measurement Procedure Used:

FCC Part15 Subpart C, Paragraph 15.207&15.247: 2007

The device described above is tested by Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Anbotek Compliance Laboratory Limited

Date of Test : Apr. 01~16, 2009

Prepared by :

(Engineer)

Reviewer :

(Project Manager)

Approved & Authorized Signer :

(Manager)

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	RFID Reader
Model Number	:	PM-R200
Test Power Supply	:	AC 120V, 60Hz
Frequency	:	2404 ~ 2476MHz
Antenna Gain	:	33dBi
Input Line	:	Non-shielded, Detachable, <3.0m
Applicant	:	Shenzhen PowerMagic Communication Co., Ltd.
Address	:	Rm920, 9th Floor, R/D Building Complex, Tsinghua Hi-Tech Park, North District, Hi-Tech & Industrial Estate, Nanshan, Shenzhen
Manufacturer	:	Shenzhen PowerMagic Communication Co., Ltd.
Address	:	Rm920, 9th Floor, R/D Building Complex, Tsinghua Hi-Tech Park, North District, Hi-Tech & Industrial Estate, Nanshan, Shenzhen
Date of receiver	:	Mar. 25, 2009
Date of Test		Apr. 01~16, 2009

1.2. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS - LAB Code: L3503
Anbotek Compliance Laboratory Limited., Laboratory has been assessed and in compliance with CNAS/CL01: 2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

FCC-Registration No.: 607248
Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 607248, November 12, 2008.

IC-Registration No.: 8058A
Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A, November 12, 2008.

Test Location
All Emissions tests were performed:
Anbotek Compliance Laboratory Limited at 2/F, Langfeng Building, Kefa Road North, Hi-tech Industrial Park, Nanshan District, Shenzhen 518057, China

1.3. Measurement Uncertainty

Radiation Uncertainty	:	Ur = ± 4.26dB
Conduction Uncertainty	:	Uc = ± 2.66dB

2. MEASURING DEVICE AND TEST EQUIPMENT

Equipment	Manufacturer	Model #	Serial #	Data of Cal.	Due Data
EMI Test Receiver	Rohde & Schwarz	ESCI	100119	Mar.03, 2009	Mar.02, 2010
EMI Test Receiver	Rohde & Schwarz	ESPI	1101604	Jun.21, 2008	Jun.20, 2009
EMI Test Receiver	Rohde & Schwarz	ESIB26	100249	Sep.22, 2008	Sep.21, 2009
Spectrum Analyzer	Agilent	E7405A	MY45114970	Jun.21, 2008	Jun.20, 2009
Signal Generator	Rohde & Schwarz	SMR27	100124	Jul.06, 2008	Jul.25, 2010
Signal Generator	Rohde & Schwarz	SML03	102319	Aug.01, 2008	Aug.01, 2010
AC Power Source	All Power Electronic Co.	APW-1100N	890869	N/A	N/A
Absorbing Clamp	Rohde & Schwarz	MDS21	100218	Apr.30, 2007	Apr.29, 2009
Power Meter	Rohde & Schwarz	NRVD	101287	Jul.19, 2007	Jul.18, 2009
Coaxial Cable	N/A	N/A	N/A	May.31, 2008	May.30, 2009
Coaxial Cable	N/A	N/A	N/A	May.31, 2008	May.30, 2009
Coaxial Cable	N/A	N/A	N/A	May.31, 2008	May.30, 2009
Universal radio Communication tester	Rohde & Schwarz	CMU200	101724	Sep.08, 2007	Sep.07, 2009
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	N/A	N/A	N/A
BiConilog Antenna	ETS-LINDGREN	3142C	00042670	Mar.03, 2009	Mar.02, 2010
BiConilog Antenna	ETS-LINDGREN	3142C	00042673	Mar.03, 2009	Mar.02, 2010
Double-ridged Waveguide horn	ETS-LINDGREN	3117	00035926	Dec.30, 2007	Dec.29, 2009
Double-ridged Waveguide horn	ETS-LINDGREN	3117	00041545	Dec.30, 2007	Dec.29, 2009
Pre-amplifier	CD	PAM0203	804203	Jun.21, 2008	Jun.20, 2009
RF Switch	CD	RSU-M3	706543	Jun.21, 2008	Jun.20, 2009
Thermo-/Hygrometer	N/A	TH01	N/A	May.03, 2008	Mar.03, 2010
Shielding Room	Zhong Yu Electron	GB-88	N/A	N/A	N/A
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	N/A	Apr.28, 2007	Apr.27, 2009

3. Technical Test

3.1. Summary of Test Results

The EUT has been tested according to the following specifications:

Standard	Test Type	Result	Notes
FCC Part 15, Paragraph 15.203, 15.247(b)(4)	Antenna Requirement	PASS	Complies
FCC Part 15, Paragraph 15.107, 15.207	Conducted Test	PASS	Complies
FCC Part 15, Paragraph 15.247(b)(1)	Peak Output Power	PASS	Complies
FCC Part 15, Paragraph 15.247(a)	20dB Bandwidth	PASS	Complies
FCC Part 15, Paragraph 15.247(c)	100kHz Bandwidth of Frequency Band Edges	PASS	Complies
FCC Part 15, Paragraph 15.209(a)(f)	Spurious Emission	PASS	Complies
FCC Part 15, Paragraph 15.247(a)(1)	Frequency Separation	PASS	Complies
FCC Part 15, Paragraph 15.247(a)(1)(iii)	Number of Hopping Frequency	PASS	Complies
FCC Part 15, Paragraph 15.247(a)(1)(iii)	Time of Occupancy	PASS	Complies
FCC Part 15, Paragraph 15.247(c)	Peak Power Density	PASS	N/A

* The digital circuit porting of the EUT has been tested and verified to comply with FCC Part 15, Subpart B., Class B Digital Devices and the associated Radio Receiver has also been tested and found to comply with FCC Part 15, Subpart B – Radio Receivers.

3.2. Antenna Requirement

A. Regulation

FCC section 15.203, An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219 or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

B. Result

The internal antenna used in this product is a monopole antenna and integrated on PCB and it is considered to meet antenna requirement of FCC.

4. Conducted Power Line Test

4.1 Test Equipment

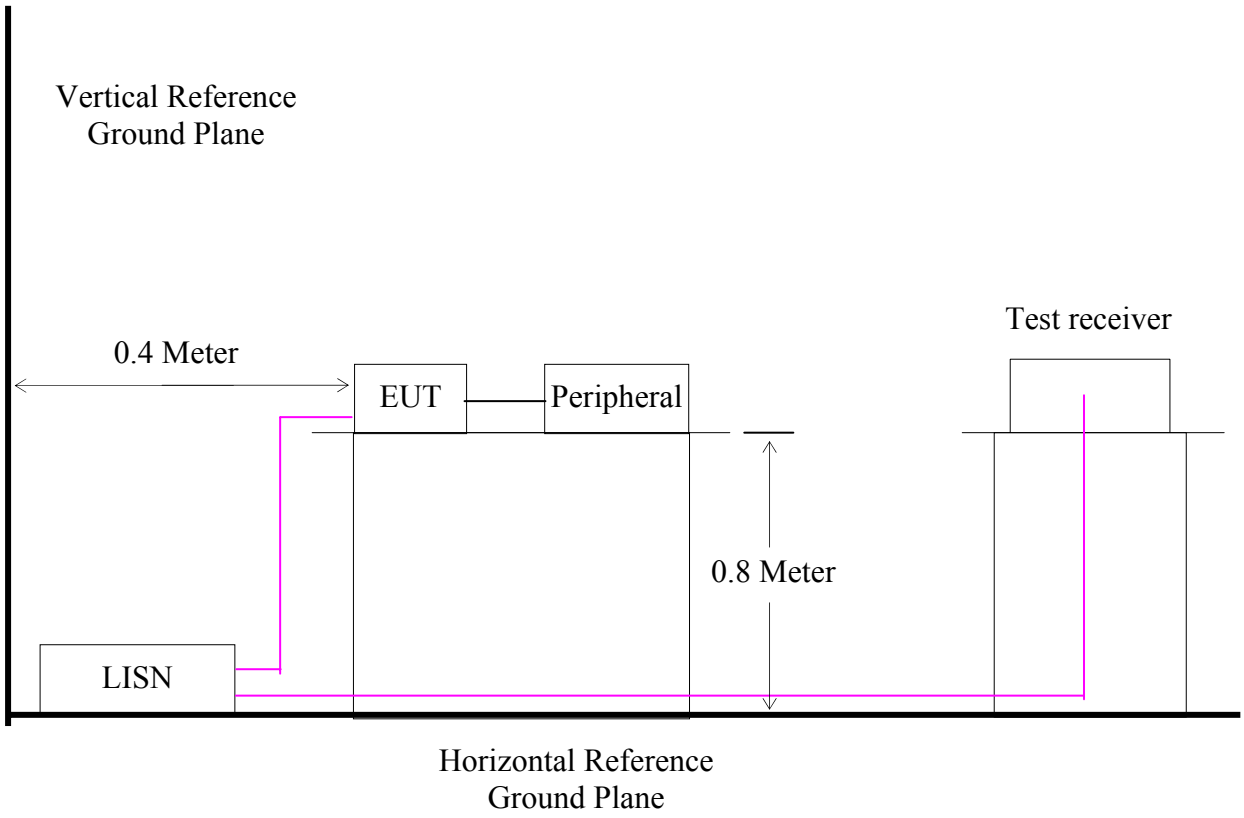
Please refer to Section 2 this report

4.2 Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm/50µH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50µH coupling impedance with 50ohm termination.

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4:2003 on conducted measurement. Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

4.3 Test Setup



For the actual test configuration, Please refer to the related items – Photos of Testing.

4.4 Configuration of the EUT

The EUT was configured according to ANSI C63.4-2003. EUT was used AC source. The operation frequency is from 2404MHz~2476MHz. Enable the signal transmitted from the EUT. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

Note:

1) Operating Modes: Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements. The EUT operates in normal FHSS.
2) Special Test Software & Hardware: Special firmware and hardware provided by the Applicant are installed to allow the EUT to operates in FHSS at each channel frequency continuously. For example, the transmitter will be operated at each of lowest, middle and highest frequencies individually continuously during testing.
3) Transmitter Test Antenna: The EUT is tested with the antenna fitted in a manner typical of normal intended use as an integral / non-integral antenna equipment as describe with the test results.
4) Frequency(ies) Tested: 2404MHz, 2440MHz and 2476MHz were pre-tested, The worst case one, was chosen for conducted emission test.
5) Above 1GHz, the 2404MHz, 2440MHz and 2476MHz were tested individually.
6) Normal Test Modulation: FHSS
7) Modulating Signal Source: External

* Associated Antenna Descriptions: The antenna used in this product is embedded antenna

4.5 EUT Operating Condition

Operating condition is according to ANSI C63.4 - 2003

4.5.1 Setup the EUT and simulator as shown as Section 4.3.
4.5.2 Turn on the power of all equipment.
4.5.3 Let the EUT work in test mode (On) and measure it.

4.6 Conducted Power Line Emission Limits

FCC Part 15 Paragraph 15.207		
Frequency Range	Limits (dBμV)	
	Class A QP/AV	Class B QP/AV
0.15 ~ 0.50	79/66	66 ~ 56 / 56 ~ 46*
0.50 ~ 5.00	73/60	56/46
5.00 ~ 30.00	73/60	60/50

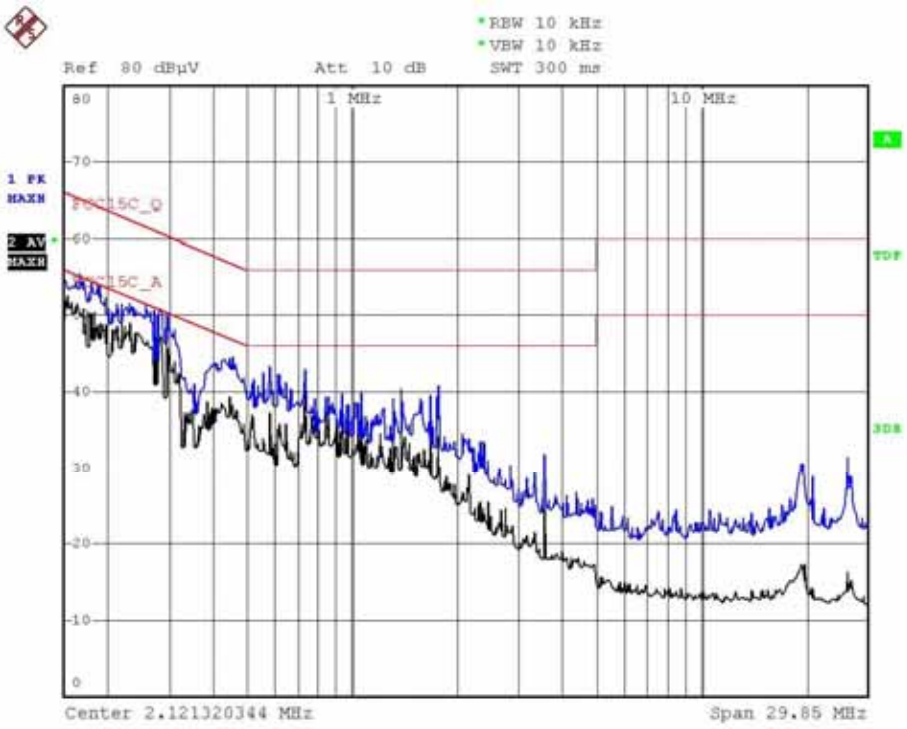
Notes: 1. *Decreasing linearly with logarithm of frequency.
2. In the above table, the tighter limit applies at the band edges.

4.7 Conducted Power Line Test Result

Please refer to the following pages.

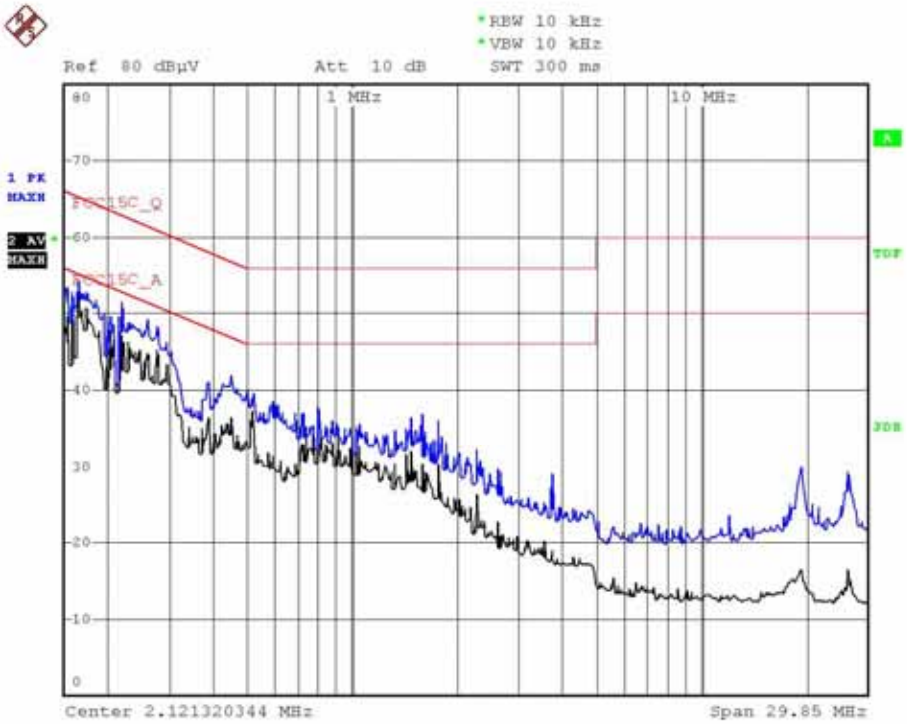
Conducted disturbance

EUT: RFID Reader M/N: PM-R200
Op Cond: Play
Test Spec: L
Comment: AC 120V, 60Hz
Data: 2009-04-15



Conducted disturbance

EUT: RFID Reader M/N: PM-R200
Op Cond: On
Test Spec: N
Comment: AC 120V, 60Hz
Data: 2009-04-15



5. FCC Part 15.247 Requirements for FHSS Systems

5.1 Test Equipment

Please refer to Section 2 this report

5.2 Test Procedure

Refer to FCC 15.247(a)(2), ANSI C63.4: 2003

20 dB Bandwidth:

a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
c. Set the spectrum analyzer as RBW = 100 kHz, VBW = 100 kHz, Span = 2 MHz, Sweep = 100ms.
d. Mark the peak frequency and -20dB (upper and lower) frequency.
e. Repeat until all the rest channels are investigated.

Peak Power:

The transmitter output is connected to the test receiver. The test receiver is set to the peak power detection. The power is equal to the reading level on test receiver plus cable loss at the EUT RF output terminal.

100kHz Bandwidth of Band Edges Measurement:

a. The transmitter output was connected to the spectrum analyzer via a low lose cable.
b. Set both RBW and VBW of spectrum analyzer to 100kHz with suitable frequency span including 100kHz bandwidth from band edge.
c. The band edges was measured and recorded.

Peak Power Spectral Density:

a. The transmitter output is connect to a test receiver, The spectrum analyzer's resolution bandwidth was set at 3kHz RBW and 30kHz VBW as that of the fundamental frequency. Set the sweep time=100ms.
b. The power spectral density was measured and recorded.
c. The sweep time is allowed to be longer than span/3kHz for a full response of the mixer in the spectrum analyzer.

Frequency Separation:

a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
c. Set the spectrum analyzer as RBW = 100kHz, VBW = 100kHz, Span = 5MHz, Sweep = 100ms.
d. Set center frequency spectrum analyzer = middle of hopping channel.

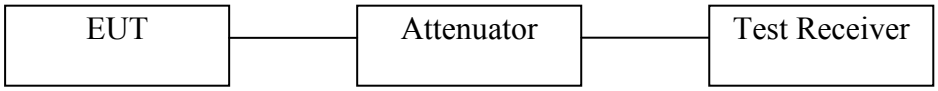
Number of Hopping Frequency:

a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
c. Set spectrum analyzer Start = 2400MHz, Stop = 2483.5MHz, RBW = 100kHz, VBW = 300kHz, Sweep = 10ms.
d. Max hold, view and count how many channel in the band.

Time of Occupancy (Dwell Time):

a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
c. Set center frequency of spectrum analyzer = operating frequency, RBW = 100kHz, VBW = 300kHz, Sweep = 2ms.
d. Repeat above procedures until all frequency measured were complete.

5.3 Test Setup



5.4 Configuration of the EUT

Same as section 4.4 of this report.

5.5 EUT Operating Condition

Same as section 4.5 of this report.

5.6 Limit

20 dB Bandwidth: For frequency hopping systems operating in the 2400MHz~2483.5MHz no limit for 20dB bandwidth

Peak Power: For frequency hopping systems operating in the 2400~2483.5MHz band employing at least 75 hopping channel, and all frequency hopping systems in the 5725~5850MHz band: 1Watt. For all other frequency hopping systems in the 2400~2483.5MHz band: 0.125Watts.

(Note: 1. According to FCC Part15 Subpart C, Paragraph 15.247(c), we provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.)

100kHz Bandwidth of Band Edges Measurement: According to §15.247(c), in any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

Peak Power Spectral Density: According to §15.247(d), for direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

Frequency separation: According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 20dBbandwidth of the hopping channel, whichever is greater.

Number of Hopping Frequency: According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400~2483.5MHz bands shall use at least 15hopping frequencies.

Time of Occupancy (Dwell Time): According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400~2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4s within period of 0.4 seconds multiplied by the number of hopping channel employed.

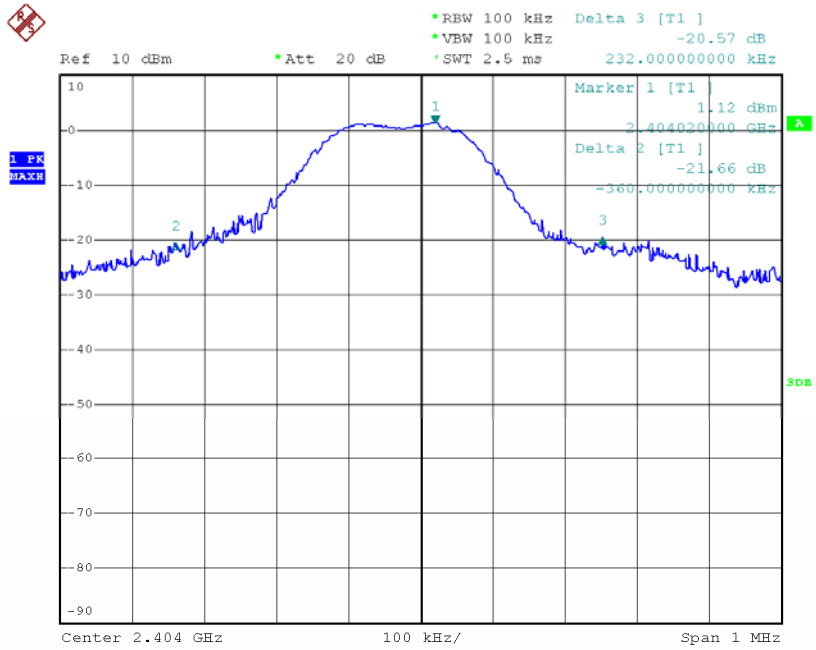
5.7 Test Result

A. 20dB Bandwidth

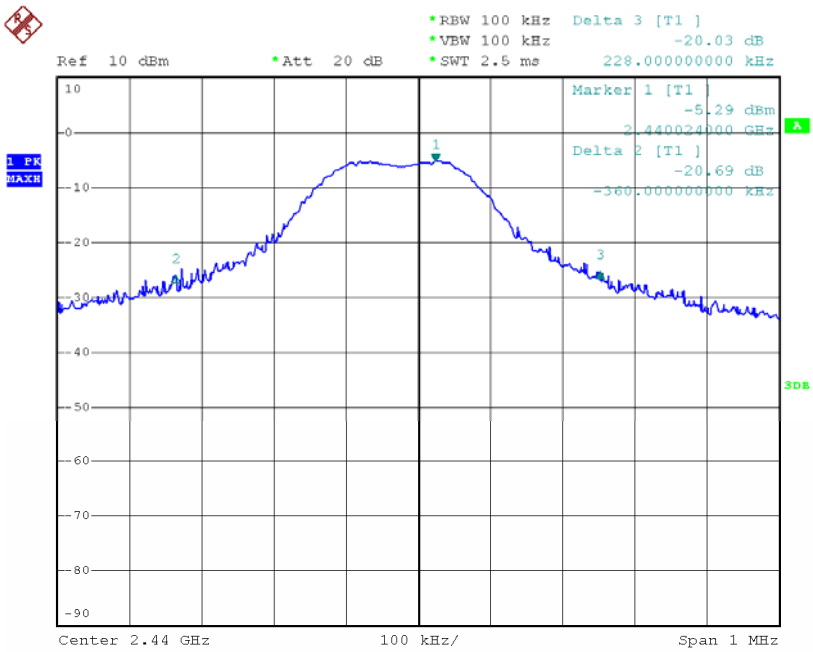
Product	:	RFID Reader	Test Mode	:	CH Low ~ CH High
Test Item	:	20dB BW	Temperature	:	24℃
Test Voltage	:	DC 12V	Humidity	:	55%RH
Test Result	:	PASS			

Channel	Frequency (MHz)	20dB Down BW (kHz)
Low	2404	592
Mid	2440	588
High	2476	606

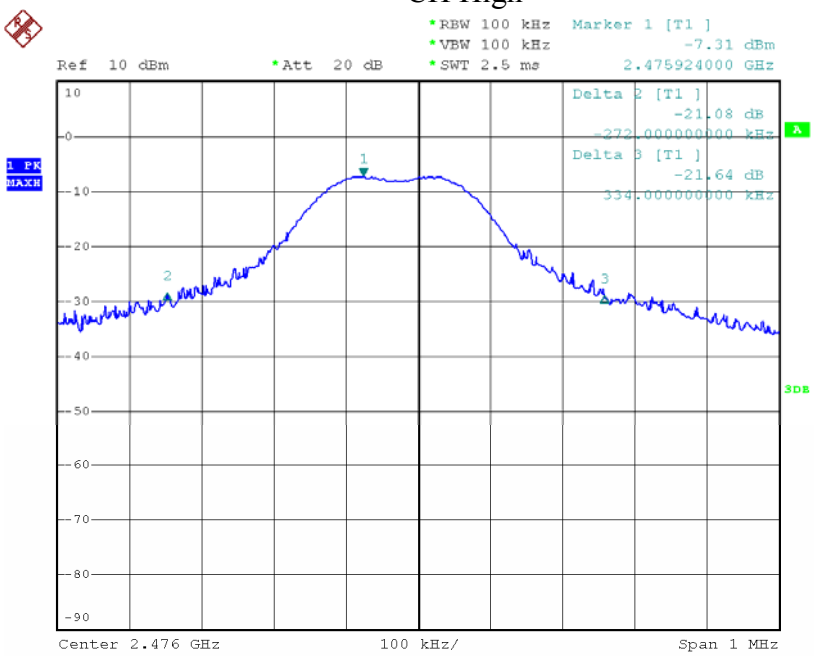
CH Low


RBW 100 kHz
VBW 100 kHz
SWT 2.5 ms
Delta 3 [T1]
-20.57 dB
232.000000000 kHz
Ref 10 dBm
Att 20 dB
Marker 1 [T1]
1.12 dBm
2.404020000 GHz
Delta 2 [T1]
-21.66 dB
-360.000000000 kHz
1 PK MAXH
3DB
Center 2.404 GHz
100 kHz/
Span 1 MHz

CH Mid


RBW 100 kHz
VBW 100 kHz
SWT 2.5 ms
Delta 3 [T1]
-20.03 dB
228.000000000 kHz
Ref 10 dBm
Att 20 dB
Marker 1 [T1]
-5.29 dBm
2.440024000 GHz
Delta 2 [T1]
-20.69 dB
-360.000000000 kHz
1 PK MAXH
3DB
Center 2.44 GHz
100 kHz/
Span 1 MHz

CH High



B. Peak Power

Product	:	RFID Reader	Test Mode	:	CH Low ~ CH High
Test Item	:	Peak Power	Temperature	:	24℃
Test Voltage	:	DC 12V	Humidity	:	55%RH
Test Result	:	PASS			

Channel	Frequency (MHz)	Output Power (dBm)	FCC Limit (dBm)	Result
Low	2404	-15.03	21	PASS
Mid	2440	-16.56		PASS
High	2476	-17.04		PASS

(Note: 1. According to FCC Part15 Subpart C, Paragraph 15.247(c), we provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.)

C. 100kHz Band Edges Measurement

Product	:	RFID Reader	Test Mode	:	CH Low ~ CH High
Test Item	:	Band Edges Measurement	Temperature	:	24℃
Test Voltage	:	DC 12V	Humidity	:	55%RH
Test Result	:	PASS			

Channel	Detector	Radiated Method Max. Field Strength of Fundamental (dBμV/m)	Conducted Method Between Carrier Max. Power and Local Max. Emission in Restrict Band (dBc)	The Max. Field Strength in Restrict Band (dBμV/m)	Limit @3m (dBμVm) Peak/ Average	Margin (dB)
Low	Peak	111.55/91.48	47.81/47.60	63.74 / 43.88	74.0 / 54.0	10.26/10.12
High	Peak	112.46/95.57	51.00/51.74	61.46 /43.83	74.0 / 54.0	12.54/10.17

Note: 1. According to step 2 of Marker-Delta Method DA 00-705 (following plots included).

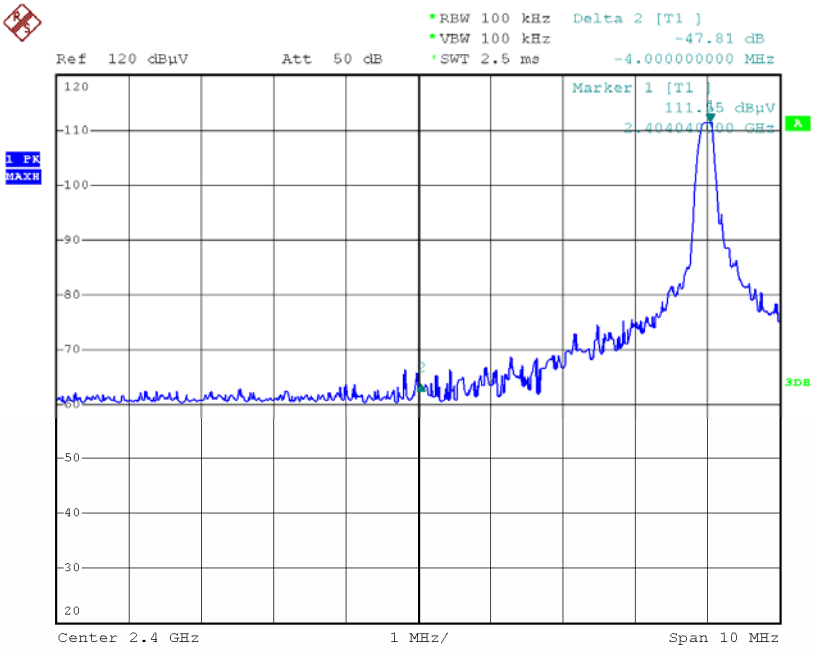
2. According to step 3 of Marker-Delta Method:

The Max. Field Strength in Restrict Band = Filed Strength of Fundamental – Between Carrier Max. Power and Local Max.

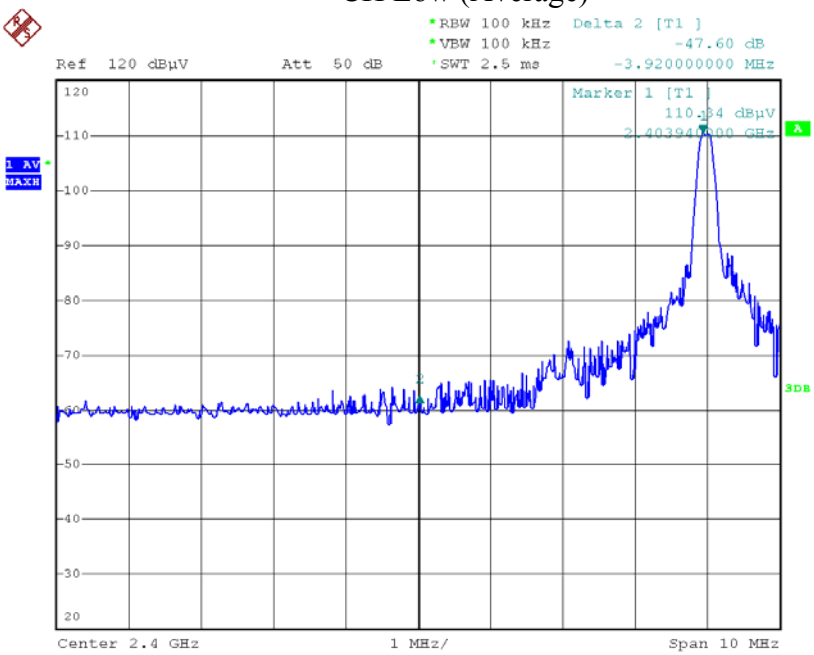
Emission in Restrict Band.

3. The average measurement was not performed when the peak measured data under the limit of average detection. If the reading given are average, peak measurement should also be supplied.

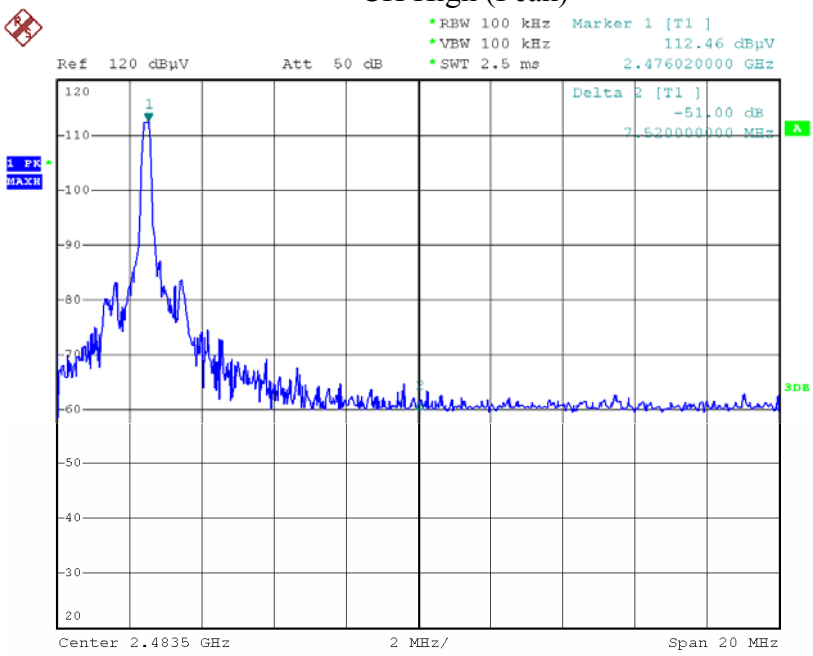
CH Low (Peak)



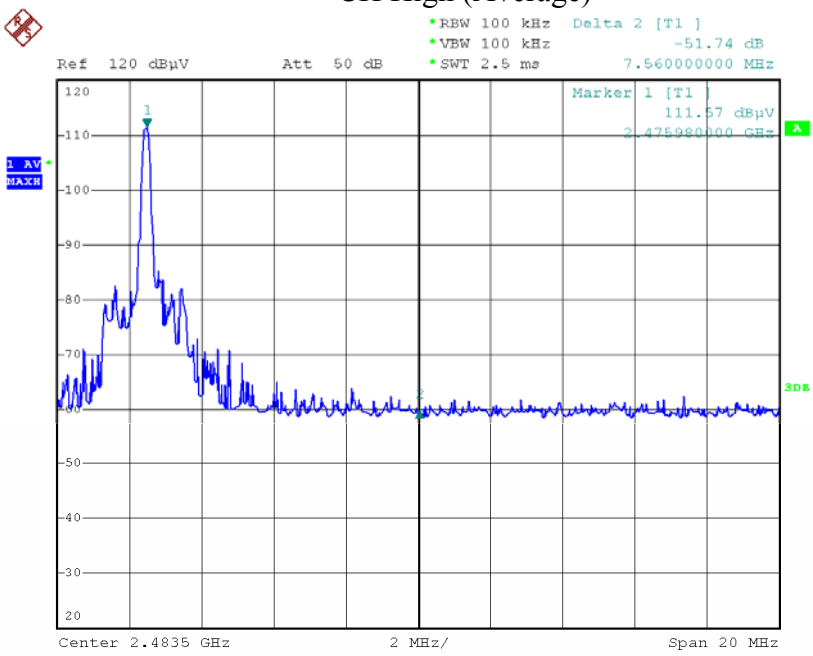
CH Low (Average)



CH High (Peak)



CH High (Average)



D. Peak Power Spectral Density

Product	:	RFID Reader	Test Mode	:	CH Low ~ CH High
Test Item	:	Peak Power Spectral Density	Temperature	:	24℃
Test Voltage	:	DC 12V	Humidity	:	55%RH
Test Result	:	N/A			

Channel	Frequency (MHz)	PPSD (dBm)	FCC Limit (dBm)	Result
Low	2404	-	8.00	N/A
Mid	2440	-		N/A
High	2476	-		N/A

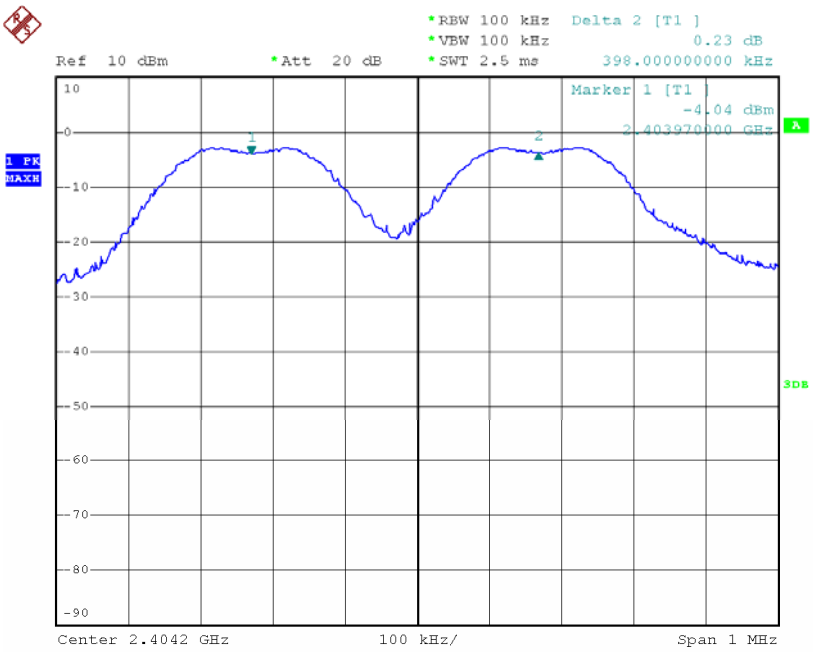
Note: Not applicable, the device is FHSS modulation.

E. Frequency Separation

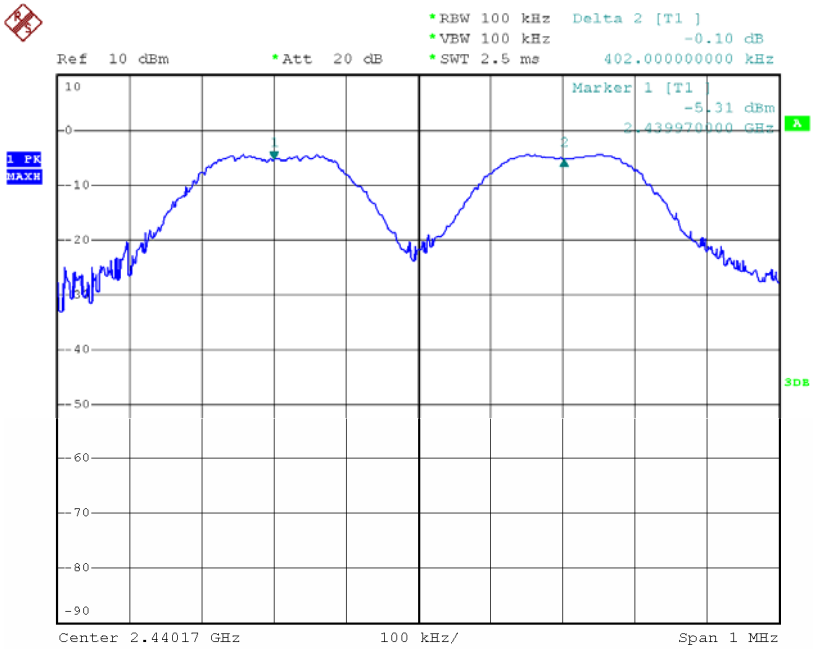
Product	:	RFID Reader	Test Mode	:	CH Low ~ CH High
Test Item	:	Frequency Separation	Temperature	:	24℃
Test Voltage	:	DC 12V	Humidity	:	55%RH
Test Result	:	PASS			

Channel	Frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
Low	2404	398	>25kHz
Mid	2440	402	
High	2476	406	

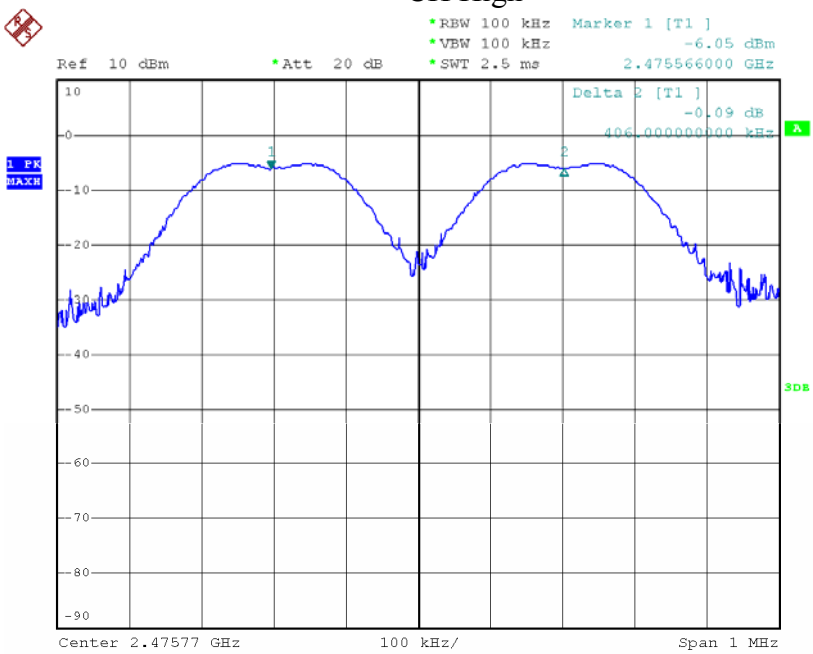
CH Low



CH Mid



CH High



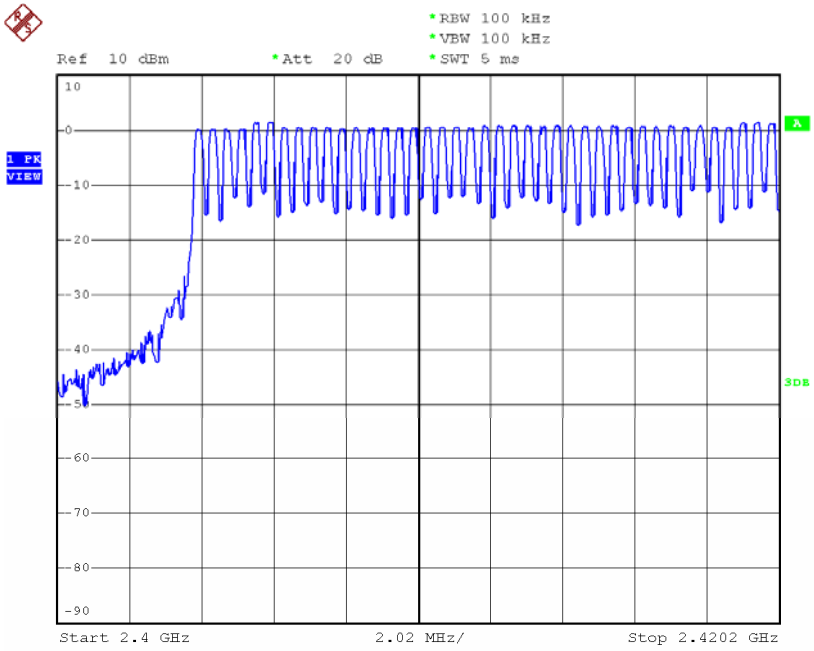
F. Number of Hopping Frequency

Product	:	RFID Reader	Test Mode	:	CH Low ~ CH High
Test Item	:	Number of Hopping Frequency	Temperature	:	24℃
Test Voltage	:	DC 12V(Power by Battery)	Humidity	:	55%RH
Test Result	:	PASS			

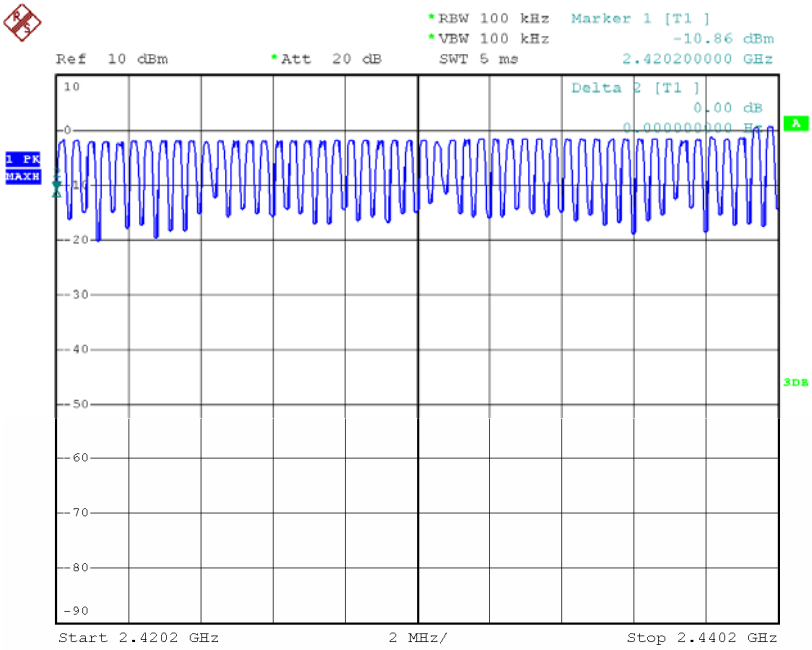
Hopping Channel Frequency Ranger	Quantity Hopping Channel Read Value	Quantity of Hopping Channel Limit
2404 ~ 2476	181	>75

Number of Hopping Frequency

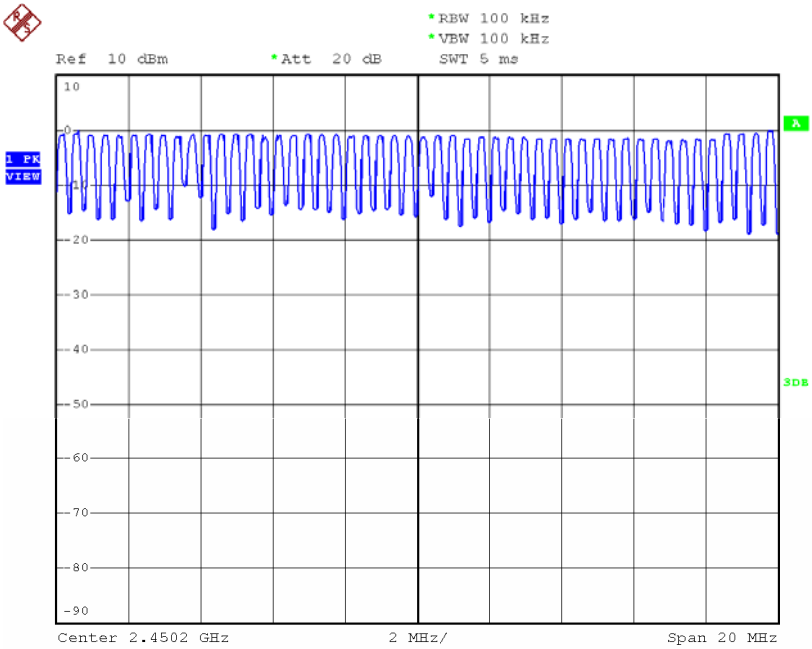
Low



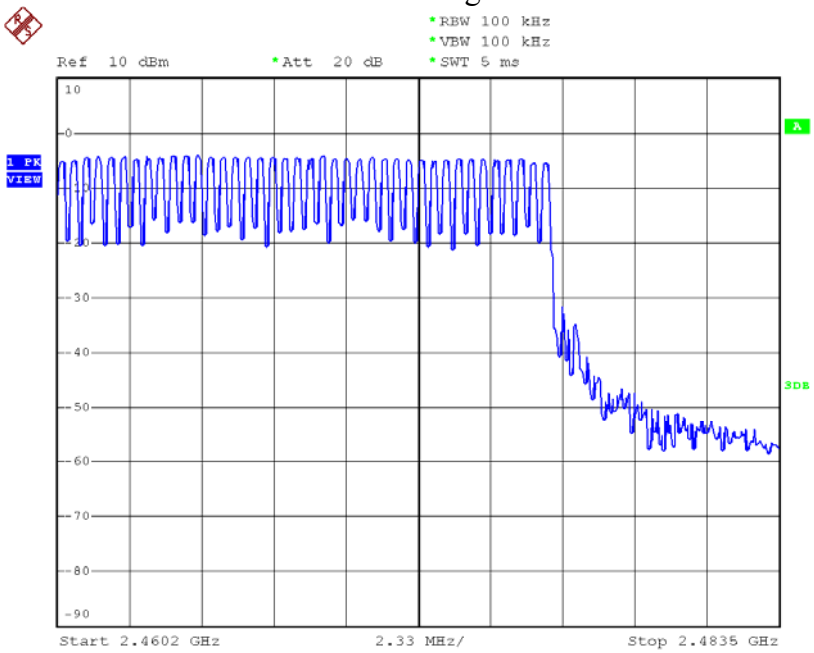
Mid-1


*RBW 100 kHz
*VBW 100 kHz
Ref 10 dBm
*Att 20 dB
SWT 5 ms
Marker 1 [T1]
-10.86 dBm
2.420200000 GHz
Delta 2 [T1]
0.00 dB
1 PK
MAXH
3DB
Start 2.4202 GHz
2 MHz/
Stop 2.4402 GHz

Mid-2


*RBW 100 kHz
*VBW 100 kHz
Ref 10 dBm
*Att 20 dB
SWT 5 ms
1 PK
VIEW
3DB
Center 2.4502 GHz
2 MHz/
Span 20 MHz

High

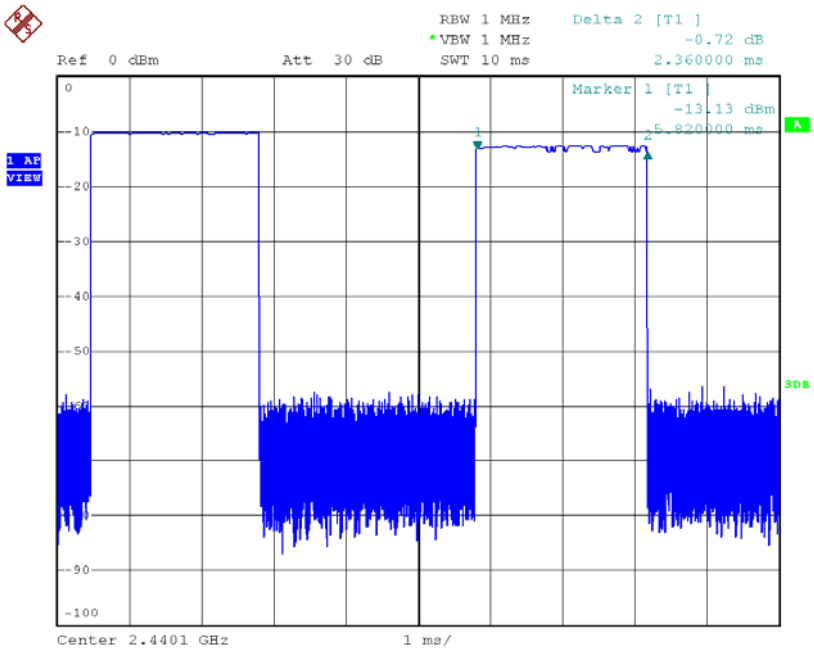

RBW 100 kHz
VBW 100 kHz
SWT 5 ms
Ref 10 dBm
Att 20 dB
1 PK
VIEW
A
3DB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Start 2.4602 GHz
2.33 MHz/
Stop 2.4835 GHz

G. Time of Occupancy (Dwell Time)

Product	:	RFID Reader	Test Mode	:	CH Low ~ CH High
Test Item	:	Time of Occupancy	Temperature	:	24℃
Test Voltage	:	DC 12V	Humidity	:	55%RH
Test Result	:	PASS			

Channel	Frequency (MHz)	Average time of occupancy Read Value (ms)	Average time of occupancy Limit (ms)
Mid	2440	2.36	400

The Equipment Under Test is a DH3(3 time slot for transmitting and 1 time slot for receiving) device.
2.36*161.16=380(ms)
Passed.



6. Transmitter Spurious Radiated Emission at 3 Meters

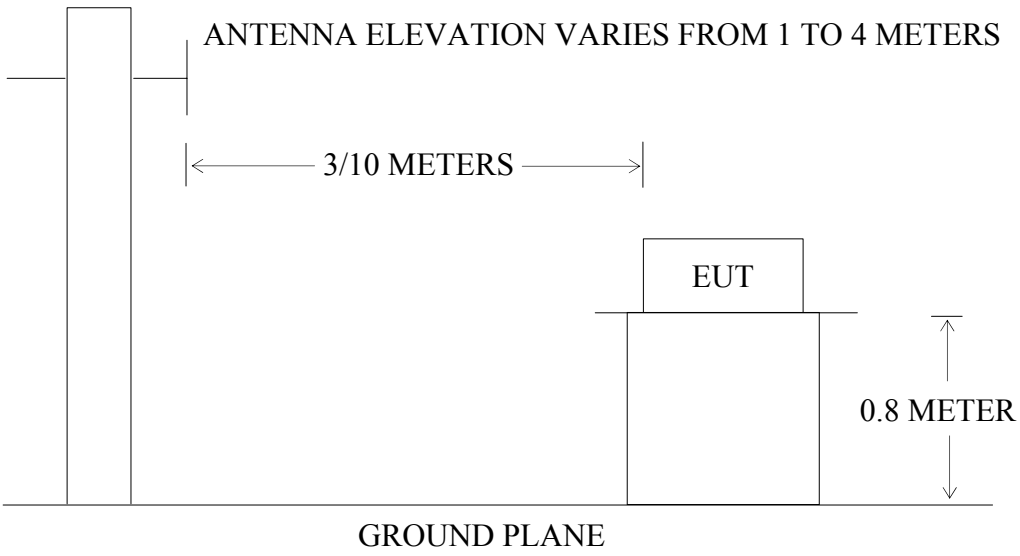
6.1 Test Equipment

Please refer to Section 2 this report

6.2 Test Procedure

1. The EUT was tested according to ANSI C63.4 – 2003. The radiated test was performed at SGS. This site is on file with the FCC laboratory division, Registration No. 556682.
2. The EUT, peripherals were put on the turntable which table size is 1m×1.5m, table high 0.8m. All set up is according to ANSI C63.4 – 2003.
3. The frequency spectrum from 30MHz to 1GHz was investigated. All readings from 30MHz to 1GHz are quasi-peak values with a resolution bandwidth of 120kHz. All reading are above 1GHz, peak values with a resolution bandwidth of 1MHz. Measurements were made at 3 meters.
4. The antenna high is varied from 1m to 4m high to find the maximum emission for each frequency.
5. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4dB of specification limit), and are distinguished with a "QP" in the data table.
6. The antenna polarization: Vertical polarization and Horizontal polarization.

6.3 Test Setup



For the actual test configuration, Please refer to the related items – Photos of Testing.

6.4 Test Procedure

Same as section 4.4 of this report

6.5 Limit

In any 100kHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20dB below that in any 100kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in section 15.209(a), which lesser attenuation.

All other emissions inside restricted bands specified in section 15.205(a) shall not exceed the general radiated emission limits specified in section 15.209(a).

Note:
Applies to harmonics/spurious emissions that fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.
47 CFR §15.237(c): The emission limits as specified above are based on measurement instrument employing an average detector. The
provisions in section 15.35 for limiting peak emissions apply.

15.205(a) – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	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	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

15.209(a) – Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

6.6 Test Result

Product	:	RFID Reader	Test Mode	:	CH Low ~ CH High
Test Item	:	Spurious Radiated Emissions	Temperature	:	24℃
Test Voltage	:	DC 12V	Humidity	:	55%RH
Test Result	:	PASS			

CH Low(2404MHz)

Freq. (MHz)	Emission (dBμV/m) Peak Detector	HORIZ / VERT	Limits (dBμV/m) Peak / Average	Margin (dB)
4808.00	54.11 / 49.51	HORIZ	74.0 / 54.0	19.89 / 4.49
7212.00	54.54 / 49.45	HORIZ	74.0 / 54.0	19.46 / 4.55
9616.00	53.91 / 49.99	HORIZ	74.0 / 54.0	20.09 / 4.01
12020.00	53.20 / 49.12	HORIZ	74.0 / 54.0	20.80 / 4.88
14424.00	53.80 / 43.75	HORIZ	74.0 / 54.0	20.20 / 4.25
16828.00	-	HORIZ	74.0 / 54.0	More than 15dB
19232.00	-	HORIZ	74.0 / 54.0	More than 15dB
21636.00	-	HORIZ	74.0 / 54.0	More than 15dB
24040.00	-	HORIZ	74.0 / 54.0	More than 15dB
4808.00	53.29 / 48.82	VERT	74.0 / 54.0	20.71 / 5.18
7212.00	51.66 / 48.03	VERT	74.0 / 54.0	22.34 / 5.97
9616.00	52.75 / 49.11	VERT	74.0 / 54.0	21.25 / 4.89
12020.00	53.50 / 49.55	VERT	74.0 / 54.0	20.50 / 4.45
14424.00	54.63 / 49.81	VERT	74.0 / 54.0	19.37 / 4.19
16828.00	-	VERT	74.0 / 54.0	More than 15dB
19232.00	-	VERT	74.0 / 54.0	More than 15dB
21636.00	-	VERT	74.0 / 54.0	More than 15dB
24040.00	-	VERT	74.0 / 54.0	More than 15dB

CH Middle(2440MHz)

Freq. (MHz)	Emission (dBμV/m) Peak Detector	HORIZ / VERT	Limits (dBμV/m) Peak / Average	Margin (dB)
4880.00	53.69 / 49.67	HORIZ	74.0 / 54.0	20.31 / 4.33
7320.00	53.07 / 48.85	HORIZ	74.0 / 54.0	20.93 / 5.15
9760.00	54.11 / 49.60	HORIZ	74.0 / 54.0	19.89 / 4.40
12200.00	54.21 / 49.74	HORIZ	74.0 / 54.0	19.79 / 4.26
14640.00	55.98 / 49.65	HORIZ	74.0 / 54.0	18.02 / 4.35
17080.00	-	HORIZ	74.0 / 54.0	More than 15dB
19520.00	-	HORIZ	74.0 / 54.0	More than 15dB
21960.00	-	HORIZ	74.0 / 54.0	More than 15dB
24400.00	-	HORIZ	74.0 / 54.0	More than 15dB
4880.00	52.38 / 49.10	VERT	74.0 / 54.0	21.12 / 4.90
7320.00	54.60 / 48.52	VERT	74.0 / 54.0	20.40 / 5.48
9760.00	53.05 / 48.60	VERT	74.0 / 54.0	20.95 / 5.40
12200.00	53.75 / 48.87	VERT	74.0 / 54.0	20.25 / 5.13
14640.00	53.84 / 48.15	VERT	74.0 / 54.0	20.16 / 5.85
17080.00	-	VERT	74.0 / 54.0	More than 15dB
19520.00	-	VERT	74.0 / 54.0	More than 15dB
21960.00	-	VERT	74.0 / 54.0	More than 15dB
24400.00	-	VERT	74.0 / 54.0	More than 15dB

CH High(2476MHz)

Freq. (MHz)	Emission (dBμV/m) Peak Detector	HORIZ / VERT	Limits (dBμV/m) Peak / Average	Margin (dB)
4952.00	52.79 / 48.13	HORIZ	74.0 / 54.0	21.21 / 5.87
7428.00	52.07 / 49.64	HORIZ	74.0 / 54.0	21.93 / 4.36
9904.00	52.86 / 48.03	HORIZ	74.0 / 54.0	21.14 / 5.97
12380.00	54.19 / 49.69	HORIZ	74.0 / 54.0	19.81 / 4.31
14856.00	53.62 / 49.75	HORIZ	74.0 / 54.0	20.38 / 4.75
17360.00	-	HORIZ	74.0 / 54.0	More than 15dB
19808.00	-	HORIZ	74.0 / 54.0	More than 15dB
22284.00	-	HORIZ	74.0 / 54.0	More than 15dB
24760.00	-	HORIZ	74.0 / 54.0	More than 15dB
4952.00	51.09 / 48.34	VERT	74.0 / 54.0	22.91 / 5.66
7428.00	52.69 / 48.21	VERT	74.0 / 54.0	21.31 / 5.79
9904.00	51.83 / 47.78	VERT	74.0 / 54.0	22.17 / 6.22
12380.00	52.46 / 48.20	VERT	74.0 / 54.0	21.54 / 5.80
14856.00	53.63 / 48.80	VERT	74.0 / 54.0	20.37 / 5.20
17360.00	-	VERT	74.0 / 54.0	More than 15dB
19808.00	-	VERT	74.0 / 54.0	More than 15dB
22284.00	-	VERT	74.0 / 54.0	More than 15dB
24760.00	-	VERT	74.0 / 54.0	More than 15dB

Note: 1. All Reading Levels below 1GHz are Quasi-Peak, above are peak and average value.
2. Emission Level = Reading Level + Probe Factor + Cable Loss
3. Receiver Setting (Peak Detector): RBW=1 MHz; VBW=1 MHz; Span=100MHz
4. Receiver Setting (AVG Detector): RBW=1 MHz; VBW=30 Hz; Span=20MHz
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the reading given are average, peak measurement should also be supplied.

7. MPE Exhibit

7.1 Test Equipment

Please refer to Section 2 this report

7.2 Limit

According to FCC 15.247(i), Systems operating under provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commissions guidelines.

FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)(1) of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

7.3 Test Result

Product	:	RFID Reader	Test Mode	:	CH Low ~ CH High
Test Item	:	RF Exposure	Temperature	:	24℃
Test Voltage	:	DC 12V	Humidity	:	55%RH
Test Result	:	PASS			

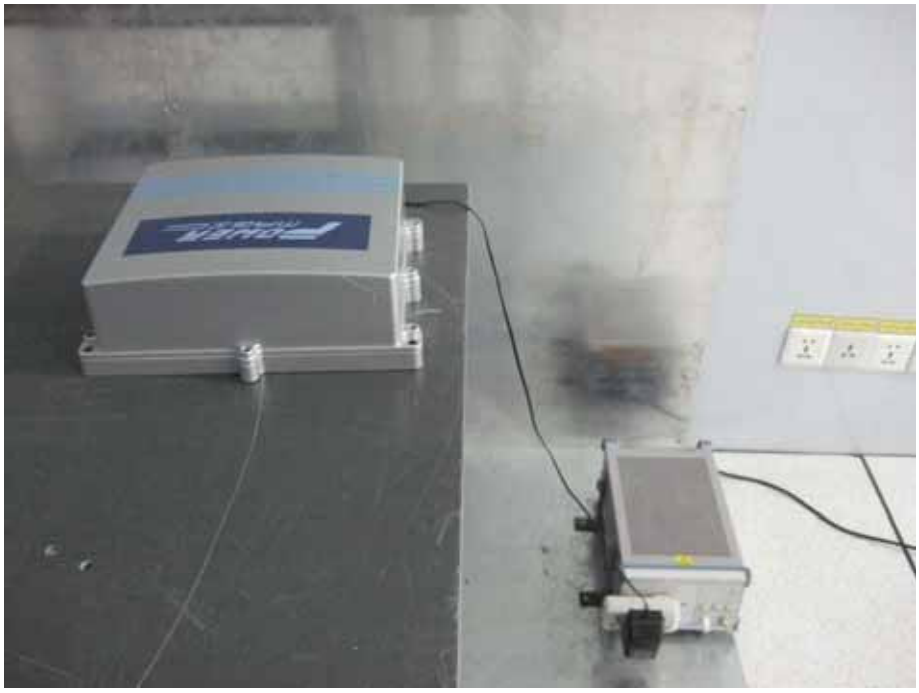
Evaluation of MPE Exhibit Compliance Requirements

MPE Prediction of MPE according to equation from page 19 of OET Bulletin 65, Edition 97-01

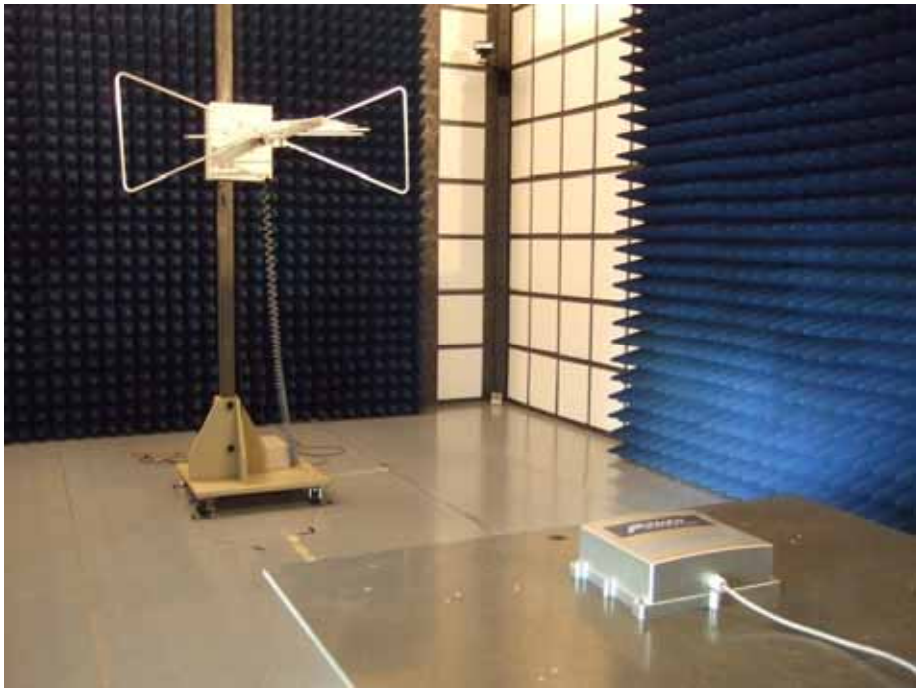
MPE Exhibit Requirements	Compliance with FCC Rules
$S = PG/4\pi R^2$ Where: S = Power density P = Power input to antenna G = Power gain of the antenna relative to an isotropic radiator R = Distance to the center of radiation of the antenna	Maximum output power at antenna input terminal: -16.56 dBm = 0.022 mW Prediction distance: <20 cm Antenna gain: 33 dBi Prediction frequency: 2440MHz MPE limit for uncontrolled exposure at prediction frequency: 1.0 mW/cm^2 Remark: No non-compliance noted. (SAR evaluation is not required for the portable device while its maximum output power is low than the general population low threshold: $60/f_{(GHz)} = 60/2.441 = 24.58mW$)

8. PHOTOGRAPH

8.1. Photo of Conducted Test



8.2. Photo of Radiation Emission Test



APPENDIX I
(Photos of EUT)

Figure 1
The EUT-Overall View

Figure 2
The EUT-Back View

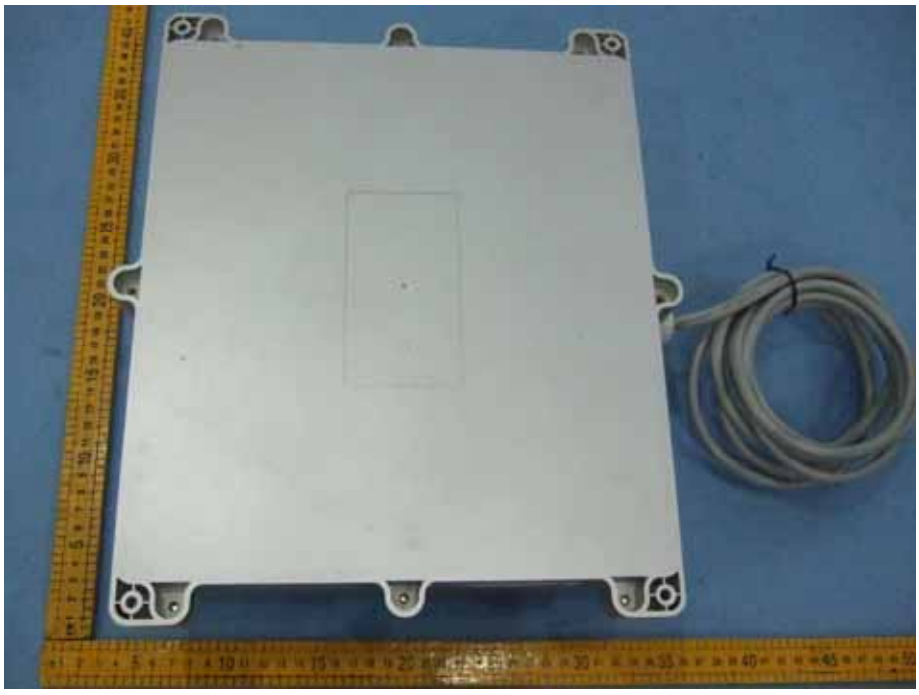


Figure 3
The EUT-Inside View

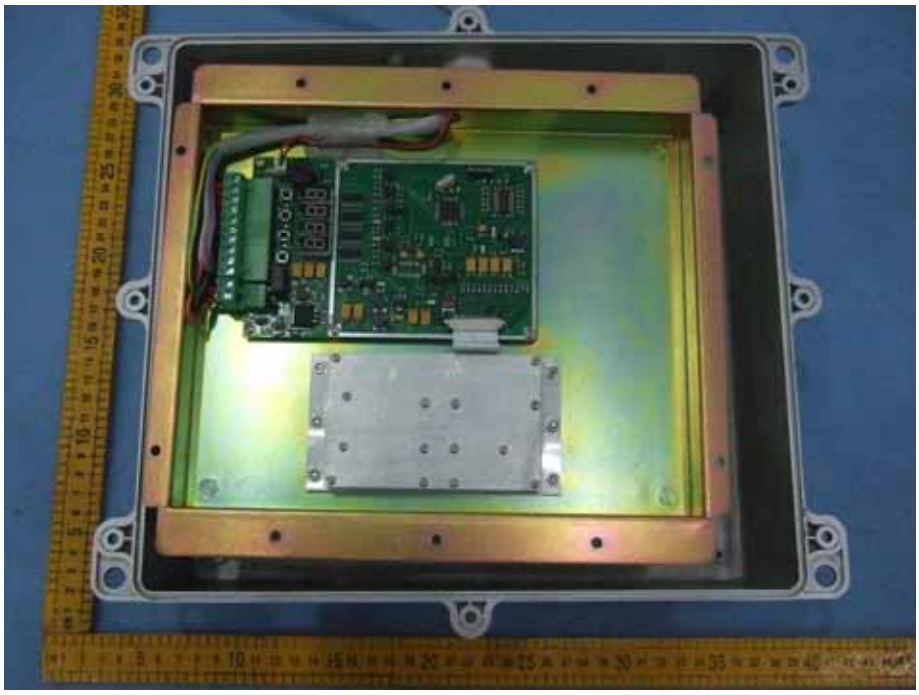


Figure 4
The EUT-Inside View

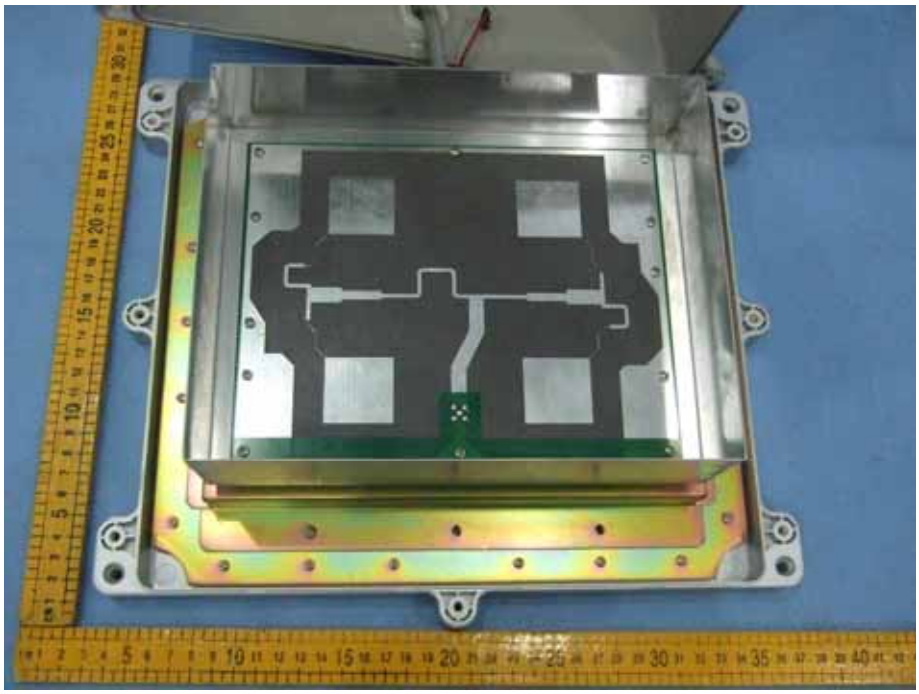


Figure 5
PCB-1 of the EUT-Front View

Figure 6
PCB-1 of the EUT-Back View

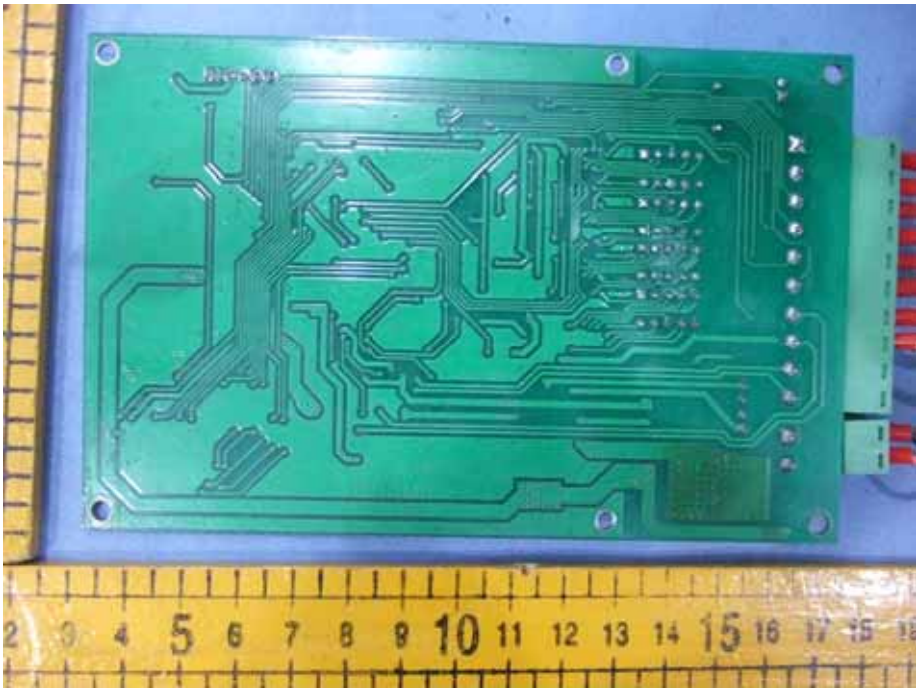


Figure 7
PCB-2 of the EUT-Front View

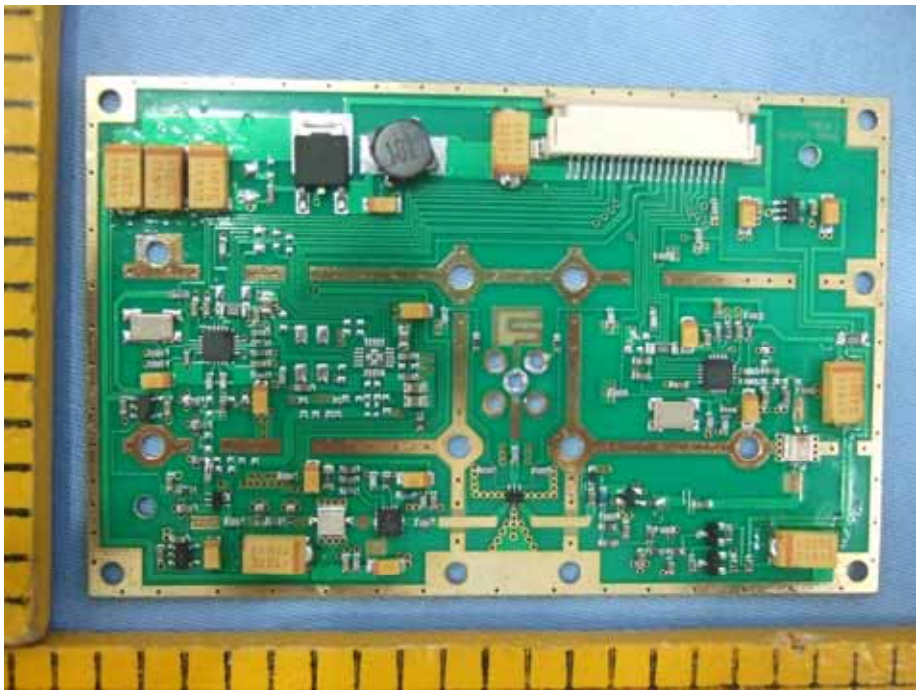


Figure 8
PCB-2 of the EUT-Back View

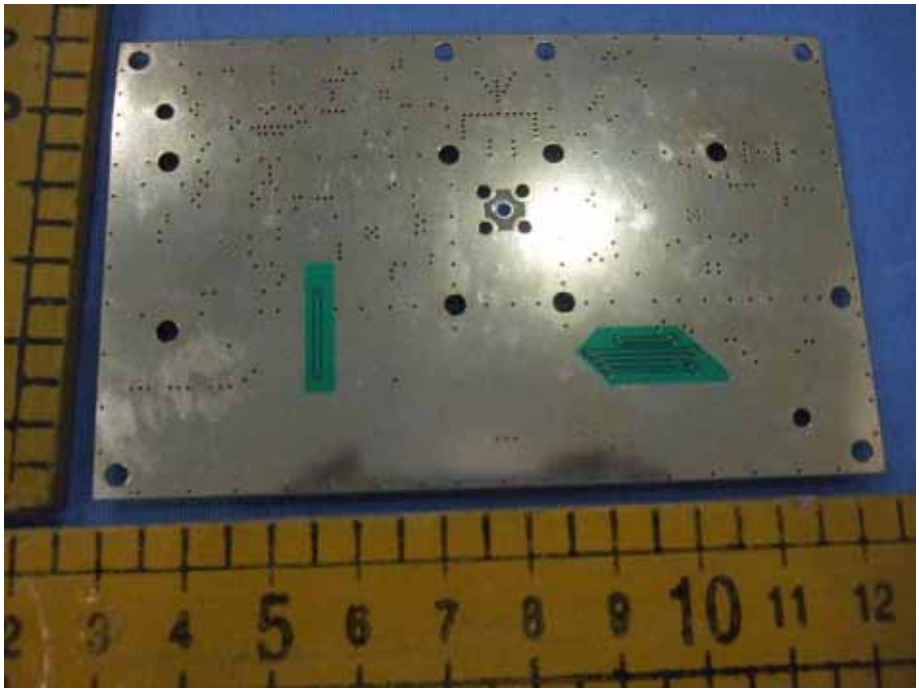


Figure 9
PCB-3 of the EUT-Front View

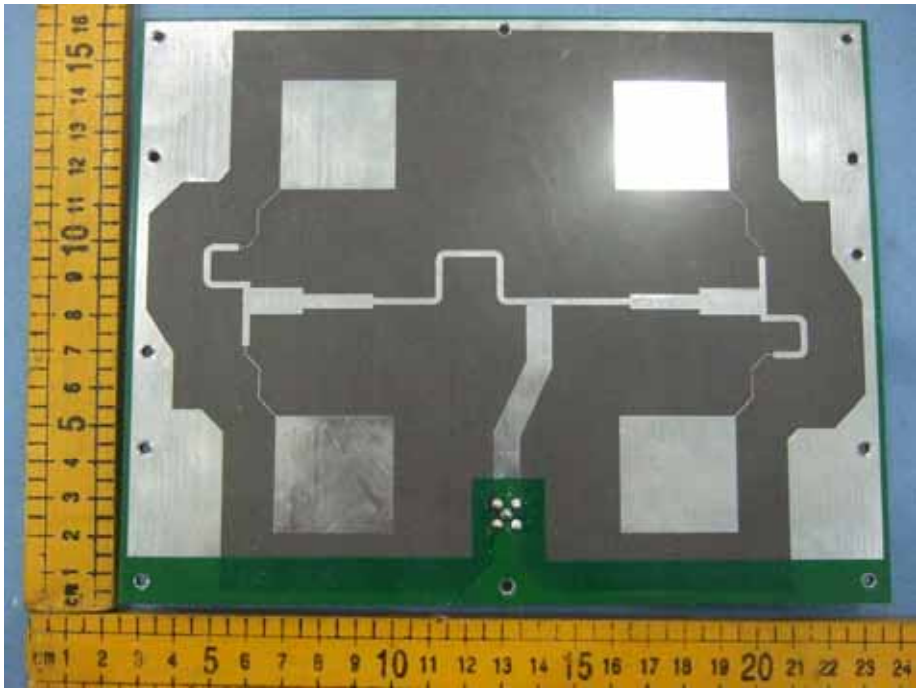


Figure 10
PCB-3 of the EUT-Back View