

FCC TEST REPORT

FCC ID : NDZ-CT314DM

Applicant : Precision Enterprise Ltd.

Address of Applicant : Unit 2504, 25/F, Nanyang Plaza No. 57, Hung To Road,
Kwun Tong, Kowloon, Hong Kong

Equipment Under Test (EUT) :

Product description : 2.4G wireless digital receiver

Model No. : CT314DM, CT414DM, SW344-DWD, CT304DM, CT404DM, ADW-40

Frequency Range : 2402~2480MHz

Standards : FCC 15 Paragraph 15.247

Date of Test : May.17,2010

Test Engineer : Olic huang

Reviewed By : 

PERPARED BY:

Waltek Services (Shenzhen) Co., Ltd.

1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen
518105, China

Tel :+86-755-27553488

Fax:+86-755-27553868

2 Contents

	Page
1 COVER PAGE.....	1
2 CONTENTS.....	2
3 TEST SUMMARY.....	4
4 GENERAL INFORMATION.....	5
4.1 CLIENT INFORMATION	5
4.2 GENERAL DESCRIPTION OF E.U.T.....	5
4.3 DETAILS OF E.U.T.	5
4.4 DESCRIPTION OF SUPPORT UNITS	5
4.5 STANDARDS APPLICABLE FOR TESTING.....	5
4.6 TEST FACILITY.....	6
4.7 TEST LOCATION.....	6
4.8 EQUIPMENT USED DURING TEST	7
5 CONDUCTED EMISSION TEST	10
5.1 TEST EQUIPMENT.....	10
5.2 TEST PROCEDURE	10
5.3 CONDUCTED TEST SETUP	11
5.4 EUT OPERATING CONDITION	11
5.5 CONDUCTED EMISSION LIMITS	12
5.6 CONDUCTED EMISSION TEST DATA	12
5.7 CONDUCTED EMISSION TEST SETUP VIEW.....	14
6 RADIATION EMISSION TEST.....	15
6.1 TEST EQUIPMENT.....	15
6.2 MEASUREMENT UNCERTAINTY.....	15
6.3 TEST PROCEDURE	15
6.4 RADIATED TEST SETUP	16
6.5 SPECTRUM ANALYZER SETUP.....	16
6.6 CORRECTED AMPLITUDE & MARGIN CALCULATION	17
6.7 SUMMARY OF TEST RESULTS.....	17
6.8 EUT OPERATING CONDITION	18
6.9 RADIATED EMISSIONS LIMIT ON PARAGRAPH 15.209	18
6.10 RADIATED EMISSIONS TEST RESULT.....	19
6.11 RADIATED EMISSION DATA	19
7 MAXIMUM PEAK OUTPUT POWER.....	26
8 HOPPING CHANNEL NUMBER.....	27
9 FREQUENCY SEPARATED.....	28
10 DWELL TIME.....	31

11 20-DB BANDWIDTH.....35

12 RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND37

13 RF EXPOSURE TEST.....40

14 PHOTOGRAPHS OF TESTING.....42

15 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS43

15.1 EUT -COMPONENTS VIEW43

15.2 EUT - BACK VIEW43

15.3 EUT –PCB1- FRONT VIEW44

15.4 EUT-PCB1 - BACK VIEW44

15.5 EUT-PCB2 - FRONT VIEW45

15.6 EUT-PCB2 - BACK VIEW45

15.7 EUT-PCB3 - FRONT VIEW46

15.8 EUT-PCB3 - BACK VIEW46

15.9 EUT-PCB4 - FRONT VIEW47

15.10 EUT-PCB4 - BACK VIEW47

16 FCC ID LABEL.....48

3 Test Summary

Test Items	Test Requirement	Test Method	Limit / Severity	Result
Maximum peak output power	FCC Part 15:2008	ANSI C63.4: 2003	20dBm	PASS
Restricted Band	FCC Part 15:2008	ANSI C63.4: 2003	Note	PASS
Dwell time	FCC Part 15:2008	ANSI C63.4: 2003	Maximum:0.4 s	PASS
Channel separation	FCC Part 15:2008	ANSI C63.4: 2003	Channel separation at least 1MHz	PASS
Hopping channel No.	FCC Part 15:2008	ANSI C63.4: 2003	Total 40 channels	PASS
20-dB Bandwidth	FCC Part 15:2008	ANSI C63.4: 2003	Note	PASS
RF Exposure Test	FCC Part 15:2008	ANSI C63.4: 2003	Note	PASS
Mains Terminal Disturbance Voltage, 150kHz to 30MHz	FCC Part 15:2008	ANSI C63.4: 2003	N/A	PASS
Radiation Emission, 30MHz to 25GHz	FCC Part 15:2008	ANSI C63.4: 2003	N/A	PASS

Note : denote that for more details of the EUT , please refer to the relating test items as below .

Remark : the methods of measurement in all the test items were according to the FCC Public Notice DA 00-705 .

4 General Information

4.1 Client Information

Applicant: Precision Enterprise Ltd.
Address of Applicant: Unit 2504, 25/F, Nanyang Plaza No. 57, Hung To Road, Kwun Tong, Kowloon, Hong Kong.

Manufacturer: DongGuan Protronic Electronics Ltd.
Address of Manufacturer: Protronic Industrial Park, Xiangxi Village, Shipai Town, Dongguan, Guangdong China

4.2 General Description of E.U.T.

Product description: 2.4G wireless digital receiver
Model No.: CT314DM, CT414DM, SW344-DWD, CT304DM, CT404DM, ADW-40

4.3 Details of E.U.T.

Power Supply: Adapter I/P: AC 100-240V~50-60Hz,150mA
O/P: DC 5.0V,0.8A

4.4 Description of Support Units

The EUT has been tested as an independent unit.

4.5 Standards Applicable for Testing

The customer requested FCC tests for a 2.4G wireless digital receiver. The standards used were FCC 15 Paragraph 15.247, Paragraph 15.205, Paragraph 15.207, Paragraph 15.209, Paragraph 15.31, Paragraph 15.33, Paragraph 15.35.

4.6 Test Facility

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

- **FCC – Registration No.: 880581**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered 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 880581, June 24, 2008.

- **IC – Registration No.: IC 7760A**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration IC7760A, July 24, 2008.

4.7 Test Location

All Emissions tests were performed at:-

1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen 518105, Guangdong, China.

Remark : All the test results of the peripherals were conformed to the Fcc Verification requirements.

4.8 Equipment Used during Test

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Cert. No	Uncertainty
EMC Analyzer	Agilent/ E7405A	MY451149 43	W2008001	9k-26.5GHz	Aug-09	Aug-10	Wws200 81596	±1dB
Trilog Broadband Antenne	SCHWARZB ECK MESS- ELEKTROM / VULB9163	336	W2008002	30-3000 MHz	Aug-09	Aug-10		±1dB
Broad-band Horn Antenna	SCHWARZB ECK MESS- ELEKTROM / VULB9163	667	W2008003	1-18GHz	Aug-09	Aug-10		f<10 GHz: ±1dB 10GHz<f< 18 GHz: ±1.5dB
Broadband Preamplifier	SCHWARZB ECK MESS- ELEKTROM / BBV 9718	9718-148	W2008004	0.5-18GHz	Aug-09	Aug-10		±1.2dB
10m Coaxial Cable with N-male Connectors usable up to 25GHz,	SCHWARZB ECK MESS- ELEKTROM / AK 9515 H	-	-	-	Aug-09	Aug-10		-
10m 50 Ohm Coaxial Cable with N-plug, individual length, usable up to 3(5)GHz, Connector	SCHWARZB ECK MESS- ELEKTROM / AK 9513				Aug-09	Aug-10		
Positioning Controller	C&C LAB/ CC-C-IF				N/A	N/A		
Color Monitor	SUNSP0/ SP-14C				N/A	N/A		
Test Receiver	ROHDE&SC HWAHZ/ ESPI	101155	W2005001	9k-3GHz	Aug-09	Aug-10	Wws200 80942	±1dB
EMI Receiver	Beijingkehua n	KH3931		9k-1GHz	Aug-09	Aug-10		
Two-Line V-Network	ROHDE&SC HWAHZ/	100115	W2005002	50Ω/50μH	Aug-09	Aug-10	Wws200 80941	±10%

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Cert. No	Uncertainty
	ENV216							
Absorbing Clamp	ROHDE&SC HWAZ/ MDS-21	100205	W2005003	impedance 50 Ω loss : 17 dB	Aug-09	Aug-10	Wws200 80943	± 1 dB
10m 50 Ohm Coaxial Cable with N-plug, individual length, usable up to 3(5)GHz, Connectors	SCHWARZB ECK MESS- ELEKTROM / AK 9514				Aug-09	Aug-10		
Digital Power Analyzer	Em Test AG/Switzerland/ DPA 500	V07451 03095	W2008012	Power: 2000VA Vol-range: 0-300V Freq_range: 10-80Hz	Aug-09	Aug-10	Wwd200 81185	Voltage distinguish: 0.025% Power_freq distinguish: 0.02Hz
Power Source	Em Test AG/Switzerland/ ACS 500	V07451 03096	W2008013	Vol-range: 0-300V Power_freq: 10-80Hz				
Electrostatic Discharge Simulator	Em Test AG/Switzerland/DITO	V07451 03094	W2008005	Contact discharge: 500V-10KV Air discharge: 500V-16.5KV	Aug-09	Aug-10	Wwc200 82400	7.5A current will be changed in $V_m=1.5V$
RF Generator	TESEQ GmbH/ NSG4070	25781	W2008008	Freq-range: 9K-1GHz RF voltage: -60 dBm-+10dBm	Aug-09	Aug-10	Wws200 81890	Power_freq distinguish: 0.1Hz RF electricity distinguish 0.1 B
CDN M-Type	TESEQ GmbH/ CDN M016	25112	W2008009	Voltage correct factor 9.5 dB	Aug-09	Aug-10	Wwc200 82396	150K-80MHz: ± 1 dB 80-230MHz: -2-+3dB
EM-Clamp	TESEQ GmbH/ KEMZ 801	25453	W2008010	Freq_range: 0.15-1000 MHz	Aug-09	Aug-10	Wwc200 82397	0.3-400 MHz: ± 4 dB Other freq: ± 5 dB
Attenuator 6dB	TESEQ GmbH/	25365			Aug-09	Aug-10	Wws200 81597	

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Cert. No	Uncertainty
	ATN6050							
All Modules Generator	SCHAFFNER/6150	34579	W2008006	voltage:200V-4.4KV Pulse current: 100A-2.2KA	Aug-09	Aug-10	Wwc20082401	voltage: $\pm 10\%$ Pulse current: $\pm 10\%$
Capacitive Coupling Clamp	SCHAFFNER/ CDN 8014	25311			Aug-09	Aug-10	Wwc20082398	-
Signal and Data Line Coupling Network	SCHAFFNER/ CDN 117	25627	W2008011	1.2/50 μ S	Aug-09	Aug-10	Wwc20082399	-
AC Power Supply	TONGYUN/ DTDGC-4				Aug-09	Aug-10	Wws20080944	-
Exposure Level Tester ELT-400	Narda Safety TEST Solutions/2304/03	M-0155	w2008022	Test freq range: 1—400kHz	Aug-09	Aug-10	Wwd20081191	Test uncertainty : 1—120kHz: $\pm 1.83\%$, 120 kHz-400 kHz: $\pm 4.06\%$
Magnetic Field Probe 100cm ²	Narda Safety TEST Solutions/2300/90.10	M-1070	w2008021	Test freq range: 1—400kHz				Test uncertainty : 1Hz-10Hz: $\pm 16.2\%$, 10Hz - 120kHz: $\pm 2.2\%$, 120 kHz-400 kHz: $\pm 4.7\%$
Active Loop Antenna Charger 10kHz-30MHz	Beijing Dazhi / ZN30900A	-	-	10kHz-30MHz	Aug-09	Aug-10		$\pm 1\text{dB}$

5 Conducted Emission Test

Test Requirement:	FCC Part15 Paragraph 15.207
Test Method:	Based on FCC Part15 Paragraph 15.207
Test Date:	May.17,2010
Frequency Range:	150kHz to 30MHz
Class:	Class B
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

5.1 Test Equipment

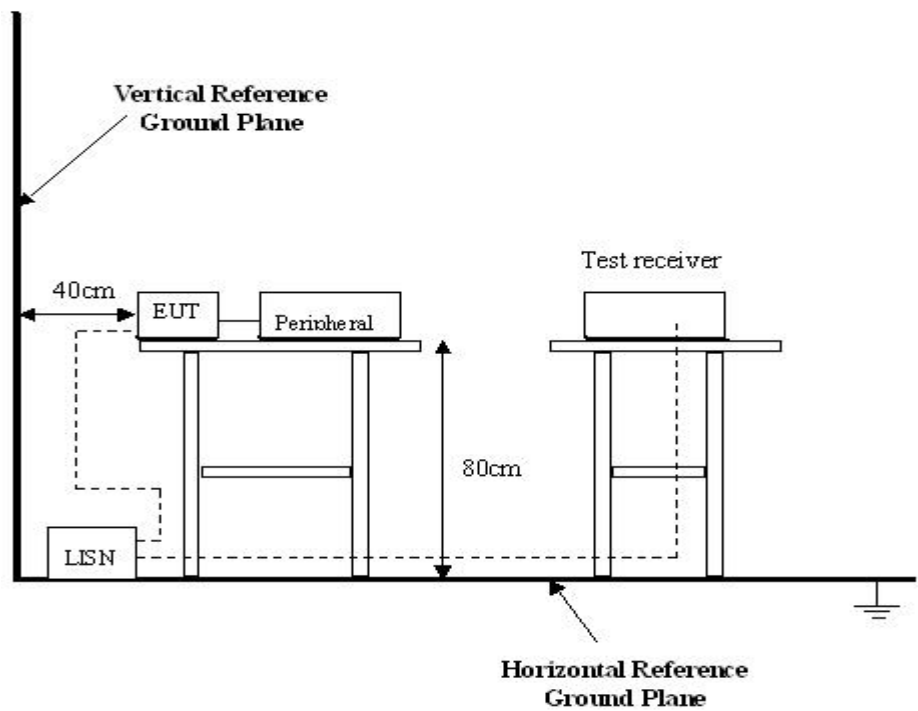
Please refer to Section 5 this report.

5.2 Test Procedure

1. The EUT was connected to LISN and placed on a table.
2. The EUT was tested according to ANSI C63.4:2003. The frequency spectrum from 150kHz to 30MHz was investigated.
3. The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

5.3 Conducted Test Setup

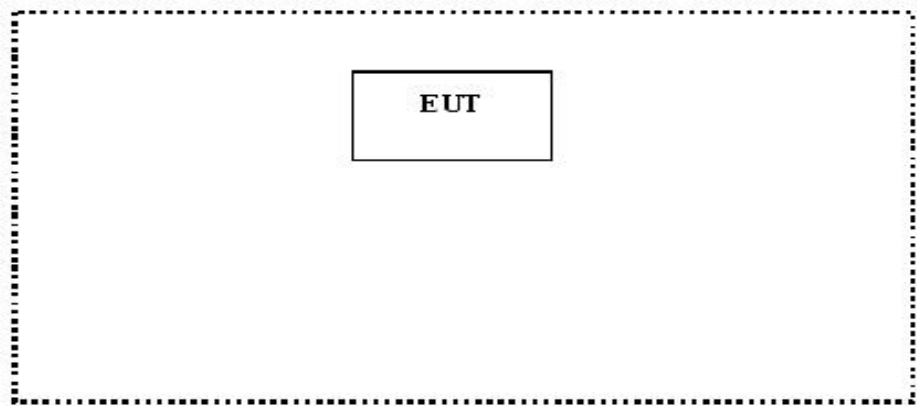
The conducted emission tests were performed using the setup accordance with the ANSI C63.4: 2003, The specification used in this report was the FCC Part15 Paragraph 15.207 limits.



5.4EUT Operating Condition

Operating condition is according to ANSI C63.4: 2003.

- A. Setup the EUT and simulators as shown on follow.
- B. Enable RF signal and confirm EUT active.
- C. Modulate output capacity of EUT up to specification.



5.5Conducted Emission Limits

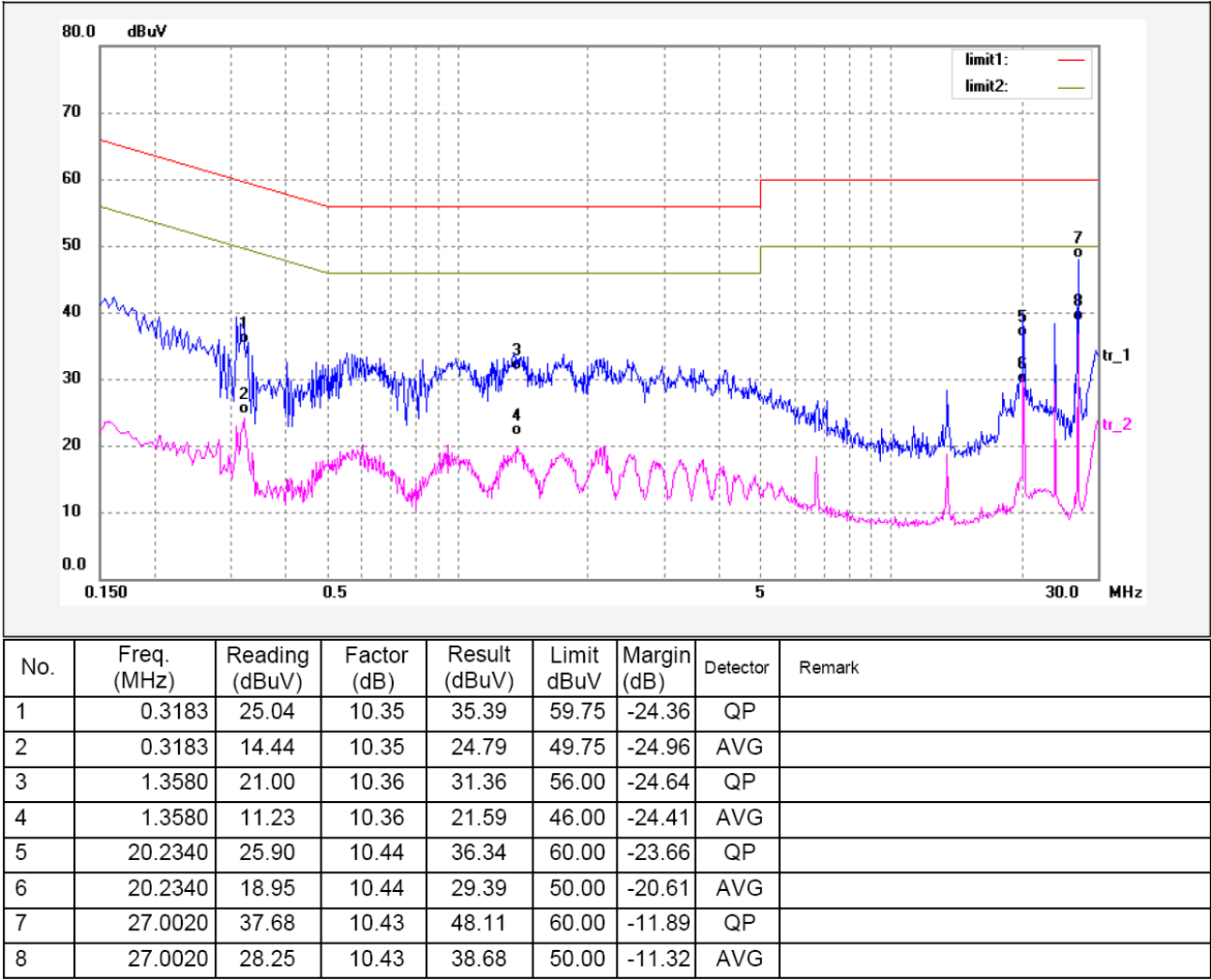
66-56 dBμV between 0.15MHz & 0.5MHz
56 dBμV between 0.5MHz & 5MHz
60 dBμV between 5MHz & 30MHz

Note: In the above limits, the tighter limit applies at the band edges.

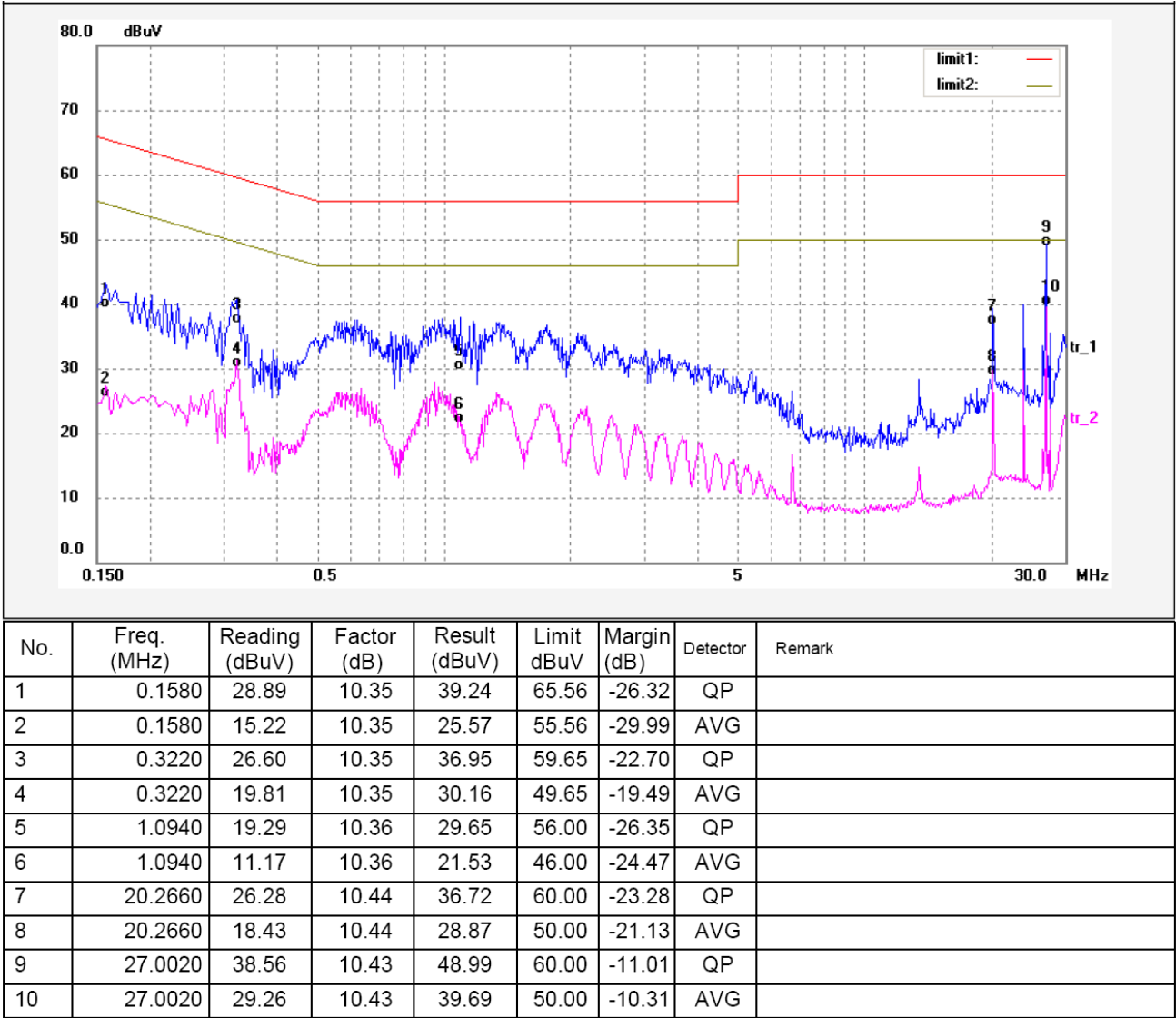
5.6 Conducted Emission Test Data

Remark: the EUT was working at normal operated mode.

Live Line



Neutral Line



5.7 Conducted Emission Test Setup View



6 Radiation Emission Test

Test Requirement:	FCC Part15 Paragraph 15.247
Test Method:	Based on ANSI 63.4:2003
Test Date:	May.17,2010
Frequency Range:	30MHz to 25GHz
Measurement Distance:	3m
Detector:	Peak for pre-scan (120kHz resolution bandwidth) Quasi-Peak if maximised peak within 6dB of limit

6.1 Test Equipment

Please refer to Section 5 this report.

6.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

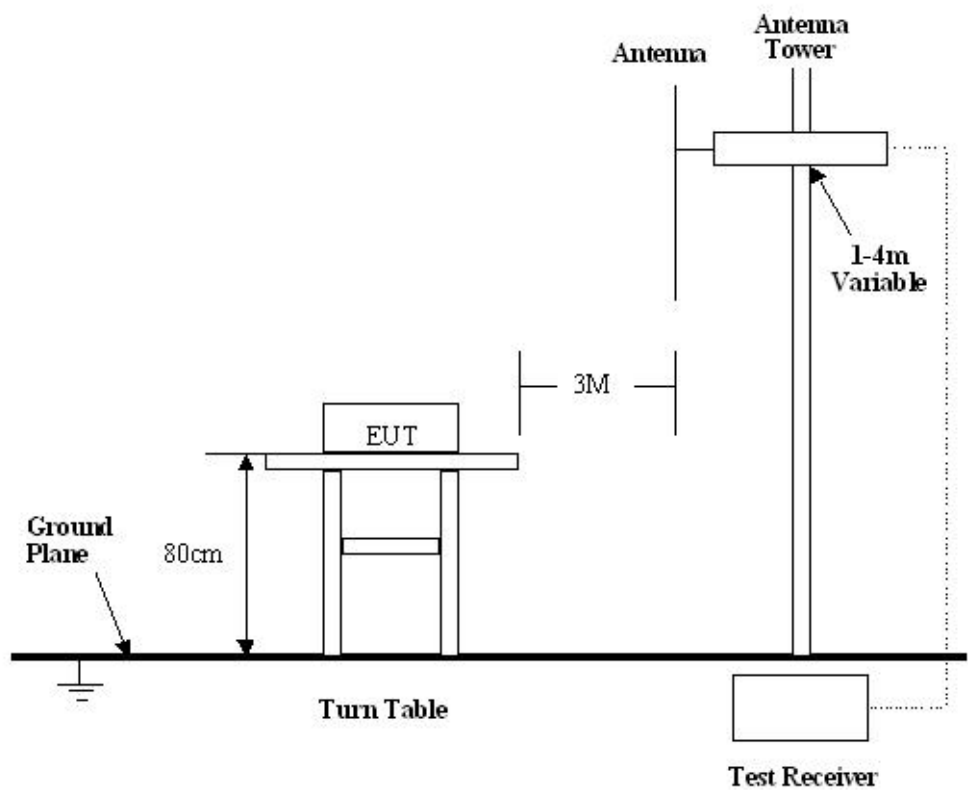
Based on ANSI C63.4: 2003, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at WALTEK SERVICES EMC Lab is +/-5.03 dB.

6.3 Test Procedure

1. The adapter uses in the equipment under test for radiated emissions test.
2. The radiation emission should be tested under 3-axes(X,Y,Z) position(X denotes lying on the table,Y denotes side stand and Z denotes vertical stand),After pre-test,It was found that the worse radiation emission was get at the X position.
So the data shown was the X position only.
3. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.
4. All data was recorded in the peak and average detection mode.
5. The EUT was under working mode during the final qualification test and the configuration was used to represent the worst case results.

6.4Radiated Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003, The specification used in this report was the FCC Part15 Paragraph 15.209 limits and Paragraph 15.247 limits.



6.5 Spectrum Analyzer Setup

According to FCC Part15 Paragraph 15.247 Rules, the system was tested to 25000 MHz. Below 1GHz

Start Frequency	30 MHz
Stop Frequency	1000 MHz
Sweep Speed	Auto
IF Bandwidth.....	120 kHz
Video Bandwidth.....	100KHz
Quasi-Peak Adapter Bandwidth	120 kHz
Quasi-Peak Adapter Mode.....	Normal
Resolution Bandwidth	100KHz

Above 1GHz

Start Frequency	1000 MHz
Stop Frequency	25000MHz
Sweep Speed	Auto
IF Bandwidth.....	120 kHz
Video Bandwidth	1MHz
Quasi-Peak Adapter Bandwidth	120 kHz
Quasi-Peak Adapter Mode.....	Normal
Resolution Bandwidth	1MHz

6.6Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor – Amplifier Gain

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Class B Limit

6.7 Summary of Test Results

According to the data in section 7.11, the EUT complied with the FCC Part15 Paragraph 15.247 standards.

6.8 EUT Operating Condition

The same as section 6.4 of this report.

Let the EUT work in test mode and test it.

6.9 Radiated Emissions Limit on Paragraph 15.209

Frequency(MHZ)	Distance(m)	Field strength(dBuV/m)
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

- Note:**
- (1) $\text{RF Voltage(dBuV)} = 20 \log \text{RF Voltage(uV)}$
 - (2) In the Above Table, the tighter limit applies at the band edges.
 - (3) Distance refers to the distance in meters between the measuring instrument antenna.
 - (4) The emission limit in this paragraph is based on measurement instrumentation employing an average detector. Measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
 - (5) Above 1GHz, make a Peak and average measurements for all emissions, Limit for peak is 74dBuV/m, According to Part 15.35(b) and average is 54BuV/m.

6.10 Radiated Emissions Test Result

Formula of conversion factors:the field strength at 3m was egtablished by adding
The meter reading of the spectrum analyzer (which is set to read in units of dBuV/m)
To the antenna correction factor supplied by the antenna manufacturer. The antenna
Correction factors are stared in terms of dB.The gain of the pressletor was accounted
For in the spectrum analyser meter reading.

Example:

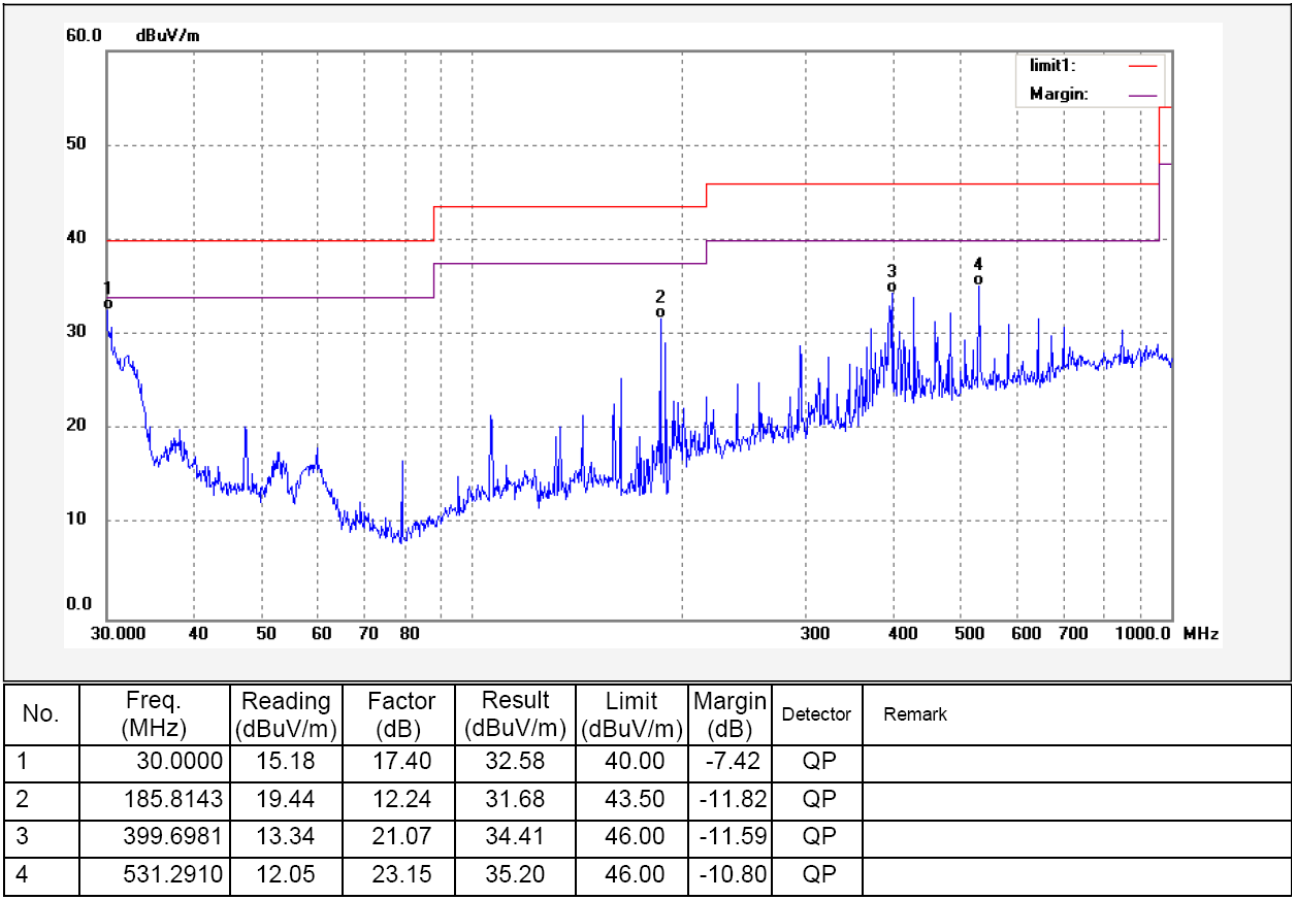
Freq(MHz) Meter Reading +ACF=FS
33 20dBuV+10.36dB=30.36dBuV/m @3m

6.11 Radiated Emission Data

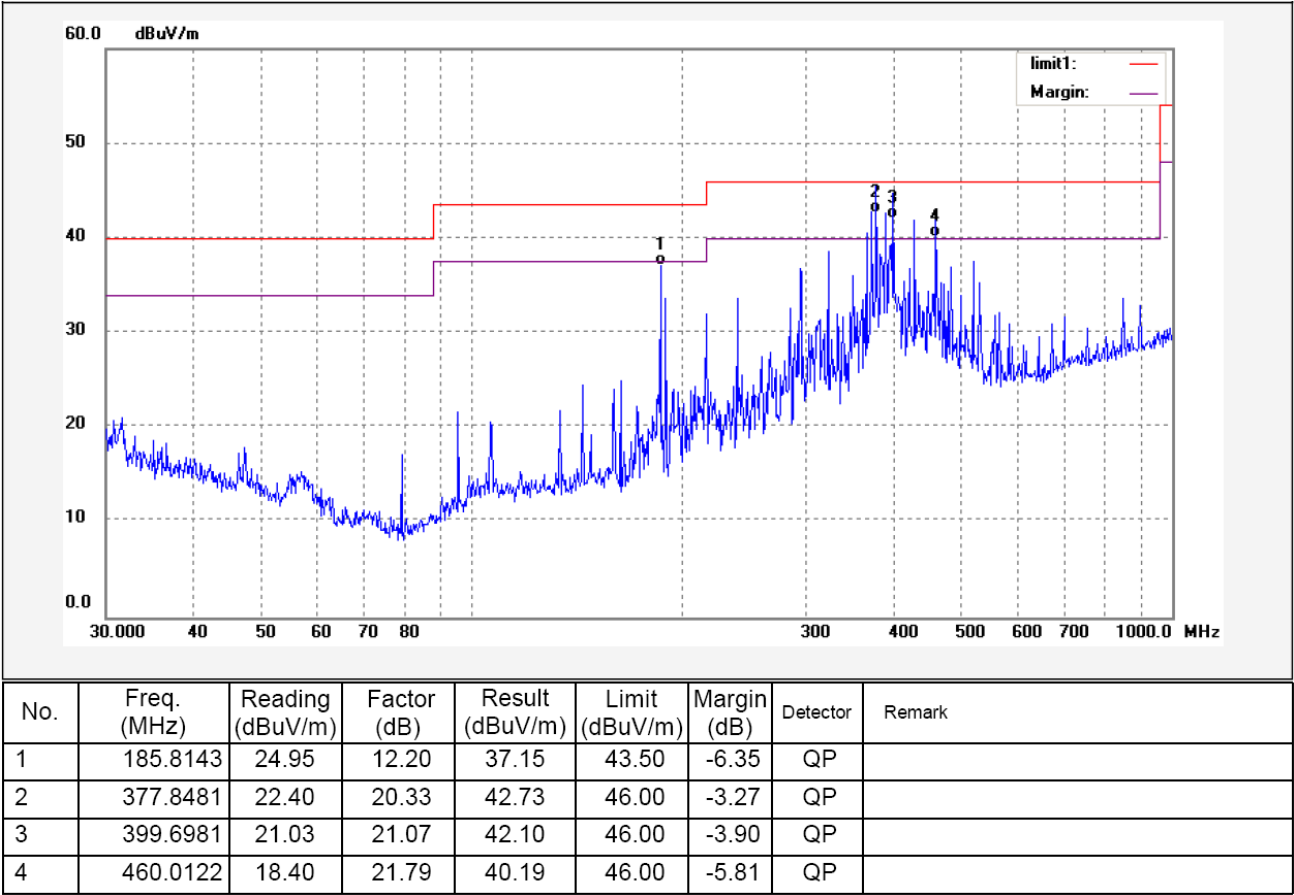
A. Test Item:	Radiated Emission Data
Test Voltage:	AC 120V
Test Mode:	TX On
Temperature:	25.5°C
Humidity:	51%RH
Test Result:	PASS

Test frequency :30-1000MHz radiation test data:

Vertical



Horizontal



Test frequency above 1GHz test data record:

And the below is the Fundamental and Harmonic .

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	FCC Part15 Subpart C Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
Low frequency							
2402.00	AV	Vertical	93.66		(Fund.)	1.2	150
4804.00	AV	Vertical	48.02	54.00	5.98	1.2	0
7206.00	AV	Vertical	35.23	54.00	19.73	1.5	120
9608.00	AV	Vertical	32.52	54.00	21.48	1.8	60
12010.00	AV	Vertical	31.25	54.00	22.75	1.6	90
14412.00	AV	Vertical	31.01	54.00	22.99	1.4	120
16814.00	AV	Vertical	30.02	54.00	23.98	1.7	100
19216.00	AV	Vertical	30.67	54.00	23.33	1.5	180
21618.00	AV	Vertical	29.63	54.00	24.34	1.6	120
24020.00	AV	Vertical	29.01	54.00	24.99	1.2	135
2402.00	AV	Horizontal	91.01		(Fund.)	1.2	120
4804.00	AV	Horizontal	41.12	54.00	12.88	1.2	150
7206.00	AV	Horizontal	36.21	54.00	17.79	1.1	120
9608.00	AV	Horizontal	34.25	54.00	19.75	1.2	180
12010.00	AV	Horizontal	33.21	54.00	20.79	1.5	135
14412.00	AV	Horizontal	31.25	54.00	22.75	1.2	120
16814.00	AV	Horizontal	30.74	54.00	23.26	1.5	180
19216.00	AV	Horizontal	32.01	54.00	21.99	1.1	60
21618.00	AV	Horizontal	31.53	54.00	22.47	1.2	90
24020.00	AV	Horizontal	30.01	54.00	23.99	1.5	90
2402.00	PK	Vertical	118.11		(Fund.)	1.5	180
4804.00	PK	Vertical	45.21	74.00	29.64	1.8	30
7206.00	PK	Vertical	40.01	74.00	33.99	1.6	110
9608.00	PK	Vertical	37.42	74.00	36.58	1.4	100
12010.00	PK	Vertical	36.21	74.00	37.79	1.2	90
14412.00	PK	Vertical	32.01	74.00	41.99	1.2	60
16814.00	PK	Vertical	33.21	74.00	40.79	1.4	90
19216.00	PK	Vertical	30.10	74.00	43.90	1.2	120

21618.00	PK	Vertical	29.01	74.00	44.99	1.7	120
24020.00	PK	Vertical	29.01	74.00	44.99	1.4	135
2402.00	PK	Horizontal	115.96		(Fund.)	1.8	180
4804.00	PK	Horizontal	41.24	74.00	32.76	1.8	60
7206.00	PK	Horizontal	38.25	74.00	35.75	1.8	120
9608.00	PK	Horizontal	36.98	74.00	37.02	1.2	180
12010.00	PK	Horizontal	35.69	74.00	38.31	1.2	90
14412.00	PK	Horizontal	35.62	74.00	38.38	1.5	90
16814.00	PK	Horizontal	33.35	74.00	40.65	1.8	150
19216.00	PK	Horizontal	33.01	74.00	40.99	1.5	150
21618.00	PK	Horizontal	30.21	74.00	43.79	1.2	120
24020.00	PK	Horizontal	30.01	74.00	43.99	1.2	180
Middle frequency							
2440.00	AV	Vertical	92.35		(Fund.)	1.5	0
4880.00	AV	Vertical	48.02	54.00	5.98	1.2	90
7320.00	AV	Vertical	35.21	54.00	18.71	1.0	90
9760.00	AV	Vertical	33.33	54.00	20.67	1.2	0
12200.00	AV	Vertical	32.02	54.00	21.98	1.2	0
14640.00	AV	Vertical	32.01	54.00	21.99	1.2	150
17080.00	AV	Vertical	30.26	54.00	23.74	1.5	0
19520.00	AV	Vertical	30.01	54.00	23.99	1.5	10
21960.00	AV	Vertical	29.02	54.00	24.98	1.8	0
24400.00	AV	Vertical	28.23	54.00	25.77	1.2	90
2440.00	AV	Horizontal	90.87		(Fund.)	1.0	120
4880.00	AV	Horizontal	35.69	54.00	18.31	1.0	90
7320.00	AV	Horizontal	34.25	54.00	19.75	1.5	270
9760.00	AV	Horizontal	33.52	54.00	20.48	1.2	120
12200.00	AV	Horizontal	31.21	54.00	22.79	1.2	150
14640.00	AV	Horizontal	30.25	54.00	23.75	1.4	180
17080.00	AV	Horizontal	29.25	54.00	24.75	1.6	135
19520.00	AV	Horizontal	28.36	54.00	25.64	1.4	90
21960.00	AV	Horizontal	28.02	54.00	25.98	1.2	150
24400.00	AV	Horizontal	28.02	54.00	25.98	1.7	120
2440.00	PK	Vertical	117.15		(Fund.)	1.0	0

4880.00	PK	Vertical	44.21	74.00	29.79	1.1	90
7320.00	PK	Vertical	38.25	74.00	35.75	1.4	100
9760.00	PK	Vertical	37.94	74.00	36.06	1.3	120
12200.00	PK	Vertical	37.87	74.00	36.13	1.7	180
14640.00	PK	Vertical	36.10	74.00	38.90	1.2	0
17080.00	PK	Vertical	32.03	74.00	41.97	1.4	0
19520.00	PK	Vertical	30.21	74.00	43.79	1.5	120
21960.00	PK	Vertical	28.30	74.00	45.70	1.5	135
24400.00	PK	Vertical	28.30	74.00	45.70	1.2	120
2440.00	PK	Horizontal	113.85		(Fund.)	1.0	0
4880.00	PK	Horizontal	43.56	74.00	30.44	1.1	45
7320.00	PK	Horizontal	41.51	74.00	32.49	1.1	90
9760.00	PK	Horizontal	40.14	74.00	33.86	1.5	60
12200.00	PK	Horizontal	39.36	74.00	34.64	1.4	150
14640.00	PK	Horizontal	37.44	74.00	36.56	1.2	150
17080.00	PK	Horizontal	34.21	74.00	39.79	1.1	120
19520.00	PK	Horizontal	38.86	74.00	35.14	1.5	150
21960.00	PK	Horizontal	34.21	74.00	39.79	1.1	0
24400.00	PK	Horizontal	33.33	74.00	40.67	1.6	135
High frequency							
2480.00	AV	Vertical	94.58		(Fund.)	1.0	0
4960.00	AV	Vertical	46.25	54.00	7.75	1.2	45
7440.00	AV	Vertical	32.25	54.00	21.75	1.2	120
9920.00	AV	Vertical	30.26	54.00	23.74	1.4	60
12400.00	AV	Vertical	30.55	54.00	23.45	1.5	135
14880.00	AV	Vertical	30.34	54.00	23.66	1.8	120
17360.00	AV	Vertical	30.62	54.00	23.38	1.1	100
19840.00	AV	Vertical	30.13	54.00	23.87	1.1	60
22320.00	AV	Vertical	30.27	54.00	23.73	1.4	0
24800.00	AV	Vertical	28.25	54.00	25.75	1.5	60
2480.00	AV	Horizontal	90.54		(Fund.)	1.0	0
4960.00	AV	Horizontal	34.56	54.00	19.44	1.8	120
7440.00	AV	Horizontal	30.35	54.00	23.65	1.2	60
9920.00	AV	Horizontal	31.47	54.00	22.53	1.5	100

12400.00	AV	Horizontal	31.89	54.00	22.11	1.2	60
14880.00	AV	Horizontal	32.42	54.00	21.58	1.2	120
17360.00	AV	Horizontal	31.17	54.00	22.83	1.4	100
19840.00	AV	Horizontal	32.55	54.00	21.45	1.8	100
22320.00	AV	Horizontal	32.86	54.00	21.14	1.3	100
24800.00	AV	Horizontal	33.25	54.00	20.75	1.7	0
2480.00	PK	Vertical	119.21		(Fund.)	1.0	0
4960.00	PK	Vertical	44.21	74.00	29.79	1.2	60
7440.00	PK	Vertical	35.62	74.00	38.38	1.8	90
9920.00	PK	Vertical	35.35	74.00	38.65	1.5	180
12400.00	PK	Vertical	35.56	74.00	38.44	1.4	60
14880.00	PK	Vertical	34.21	74.00	39.79	1.2	60
17360.00	PK	Vertical	33.54	74.00	40.46	1.2	135
19840.00	PK	Vertical	36.26	74.00	37.74	1.2	120
22320.00	PK	Vertical	36.73	74.00	37.27	1.6	60
24800.00	PK	Vertical	30.21	74.00	43.99	1.4	90
2480.00	PK	Horizontal	112.25		(Fund.)	1.1	60
4960.00	PK	Horizontal	42.58	74.00	31.42	1.4	0
7440.00	PK	Horizontal	38.64	74.00	35.36	1.5	60
9920.00	PK	Horizontal	35.37	74.00	38.63	1.3	0
12400.00	PK	Horizontal	35.52	74.00	38.48	1.2	30
14880.00	PK	Horizontal	35.26	74.00	38.74	1.7	0
17360.00	PK	Horizontal	36.41	74.00	37.59	1.8	0
19840.00	PK	Horizontal	32.41	74.00	41.59	1.5	60
22320.00	PK	Horizontal	31.11	74.00	42.89	1.8	10
24800.00	PK	Horizontal	28.21	74.00	45.79	1.0	20

7 Maximum Peak Output Power

Test Requirement:	FCC Part15 Paragraph 15.247
Test Method:	Based on ANSI 63.4:2003
Test Date:	May.17,2010
Test mode:	Compliance test in the worse case: Tx Lower/Tx Middle/Tx Upper
Requirements:	Regulation 15.247(b) The limit of Maximum Peak Output Power Measurement is 0.125W

Test procedure:

The following test procedure as below:

The 2.4G wireless digital receiver output (antenna port) was connected to the spectrum analyzer.EUT and its simulators are placed on a table, let EUT working in test mode,then test it.

The bandwidth of the fundamental frequency was measured with the spectrum analyser using 100kHz RBW and 100kHz VBW.

Test Result: The unit does meet the FCC requirements.

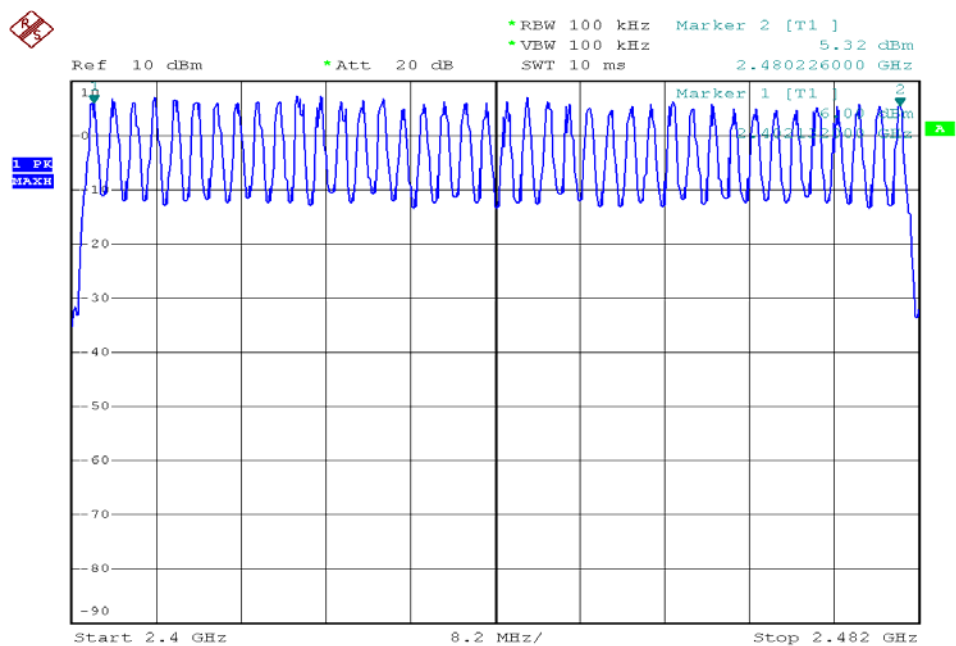
Test Channel	Fundamental Frequency(MHz)	Output Power (mW)	Limit (W)	Power output level
Lower	2402	14.54	0.125	conducted
Middle	2440	14.54	0.125	conducted
Upper	2480	13.89	0.125	conducted

Note: The EUT uses 40 channels ,and according to 47 CFR Part 15 Subpart C Section 15.247 (b),the the maximum allowable power for this device is 0.125W.

8 Hopping Channel Number

Test Requirement: FCC Part15 C
Test Method: Based on FCC Part15 Paragraph 15.247
Test Date: May.17,2010
Test mode: The EUT work in test mode(Tx) and test it
Requirements: Regulation 15.247(b) For frequency hopping systems operating In the 2400-2483.5MHz band employing at least 15 hopping channels.
Test result: The total number of channels would be 40 channels.
The unit does meet the FCC requirements.

Please refer the graph as below:



9 Frequency Separated

The requirements in this clause are only applicable to equipment using frequency hopping spread spectrum (FHSS) modulation.

Channel Separated

Definition: A hopping channel is any of the centre frequencies defined within the hopping sequence of a FHSS system.

Limit: Non-adaptive frequency hopping system shall make use of non-overlapping channels separated by the channel bandwidth as measured at 20dB below peak power.

The hopping channels defined within a hopping sequence shall be at least 1MHz apart(channel separation)

Operating Environment:

Temperature: 25.50 °C

Humidity: 51 % RH

Barometric Pressure: 1012 mbar

EUT Operation Condition:

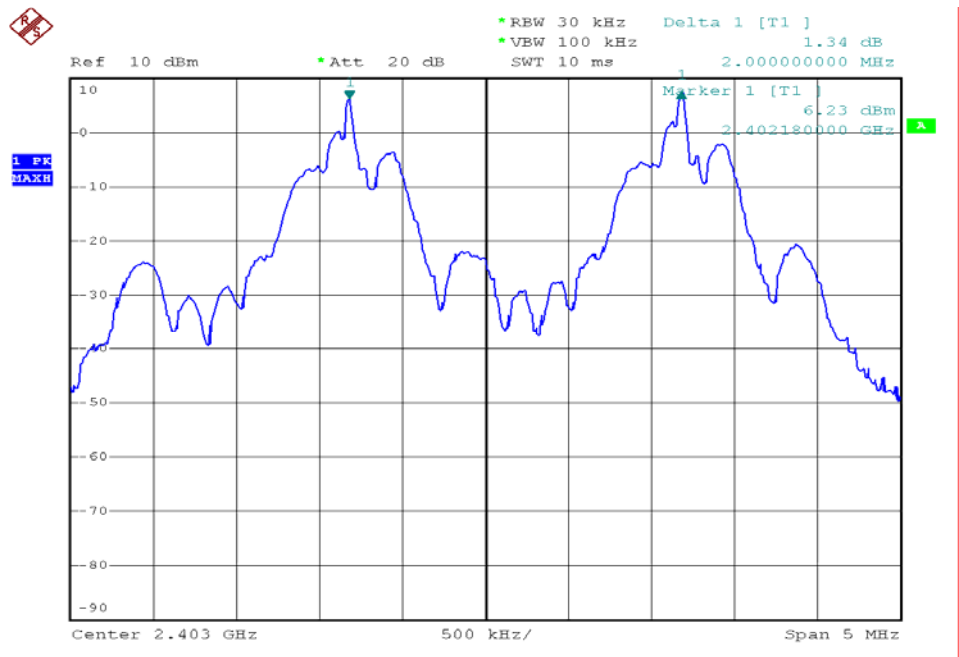
The EUT was programmed to be in continuously transmitting mode.

Test Result: PASS

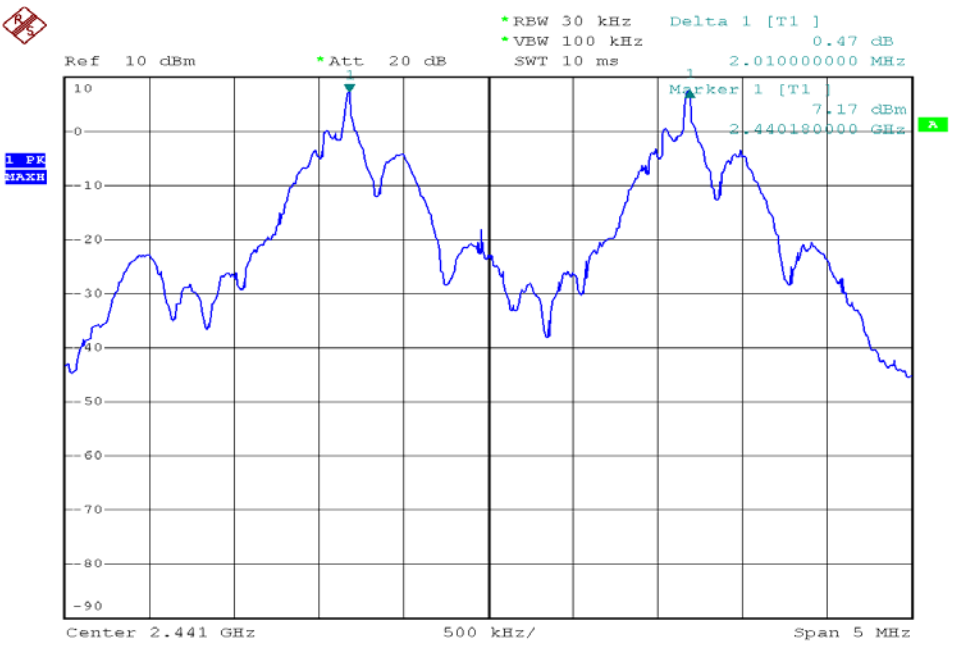
Test Channel	Channel Separation	PASS/FAIL
Lower Channels	2MHz	Pass
Middle Channels	2MHz	Pass
Upper Channels	2MHz	Pass

Please refer to the below photos for more details

Lower Channel



Middle Channel



Upper Channel



10 Dwell time

The dwell time is the time spent at a particular frequency during any single hop.

Limit: the maximum dwell time shall be less than 0.4s.

Operating Environment:

Temperature: 25.5 °C

Humidity: 51 % RH

Barometric Pressure: 1012 mbar

EUT Operation Condition:

The EUT was programmed to be in continuously transmitting mode.

11.2 Test Procedure

The EUT output antenna port was connected to the spectrum analyzer. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz, and the frequency span to zero span, measure the maximum time duration of one single pulse. So, the Dwell Time can be calculated as follows:

$$T = T_{\text{on-time}} * N_{\text{times}} / 1S * 0.4 * 40 \leq 0.4S.$$

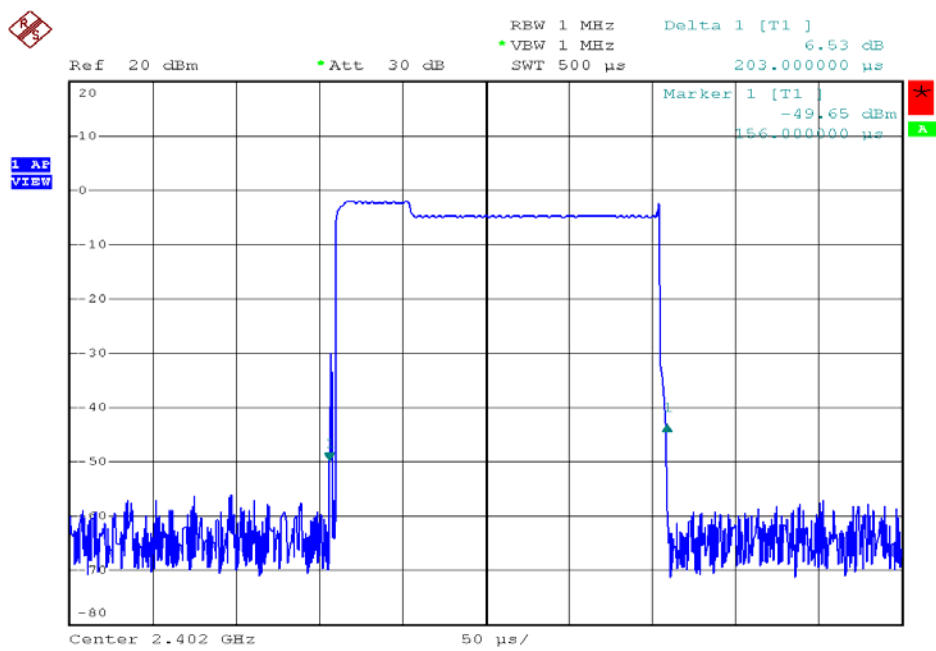
11.3 Test Result: PASS

Please refer to the below photos for more details.

Lower Frequency Channel 2402MHz

Dwell time of each occupation in this channel as follows:

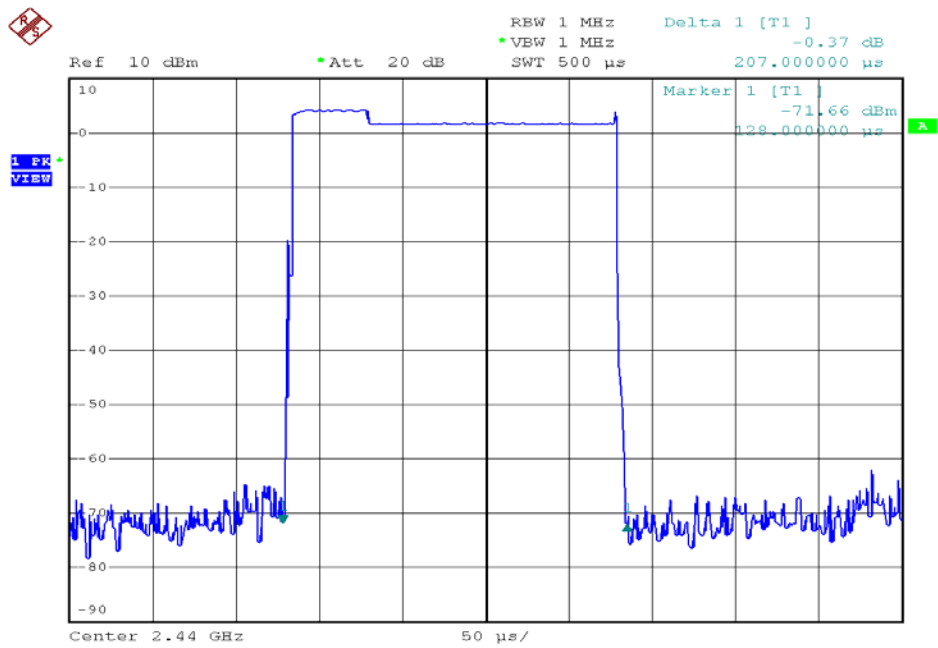
$0.000203 \times 30 / 0.5S \times 0.4 \times 40 = 0.195 < 0.4S$



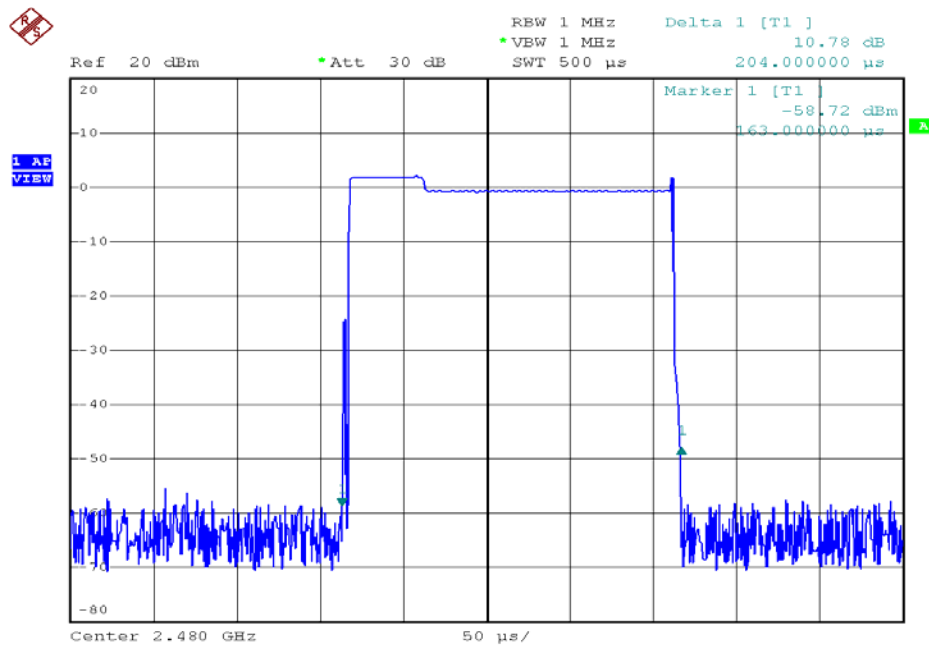
Middle Frequency Channel 2440MHz

Dwell time of each occupation in this channel as follows:

$0.000207 \times 30 / 0.5 \times 0.4 \times 40 = 0.199 < 0.4 \text{S}$



Dwell time of each occupation in this channel as follows:

$$0.000204 \times 30 / 0.5 \times 0.4 \times 40 = 0.196 < 0.4S$$


11 20-dB Bandwidth

Test Requirement: FCC Part15 C
Test Method: Based on FCC Part15 Paragraph 15.247
Test Date: May.17,2010
Test mode: The EUT work in test mode(Tx) and test it

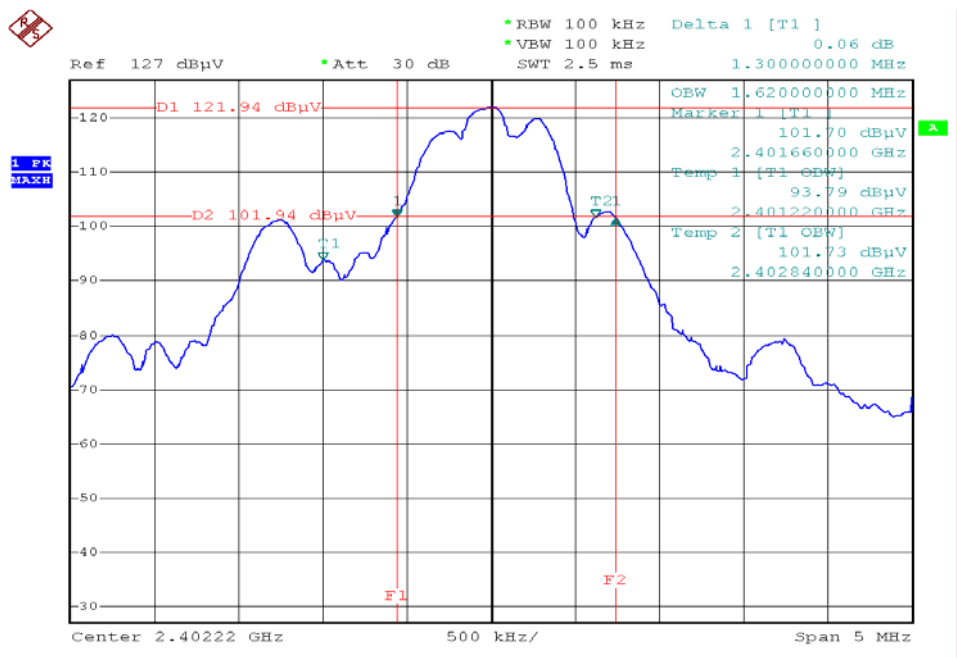
Test Procedure

- 1. The 2.4G wireless digital receiver output (antenna port) was connected to the spectrum analyzer.
- 2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 100KHz RBW and 100KHz VBW.The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power 20dB.

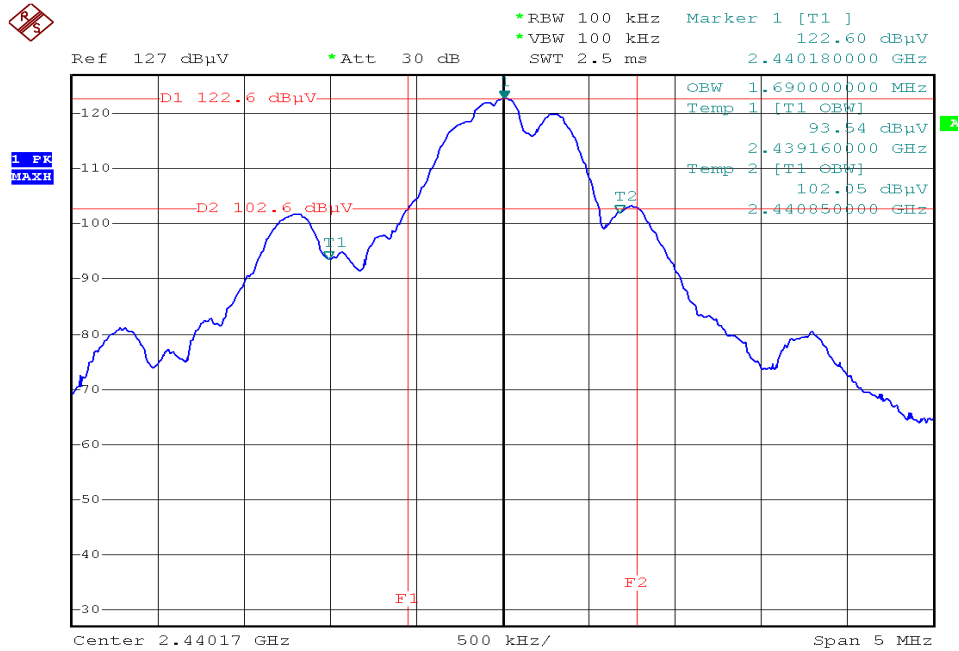
Test Result

Please refer the graph as below:

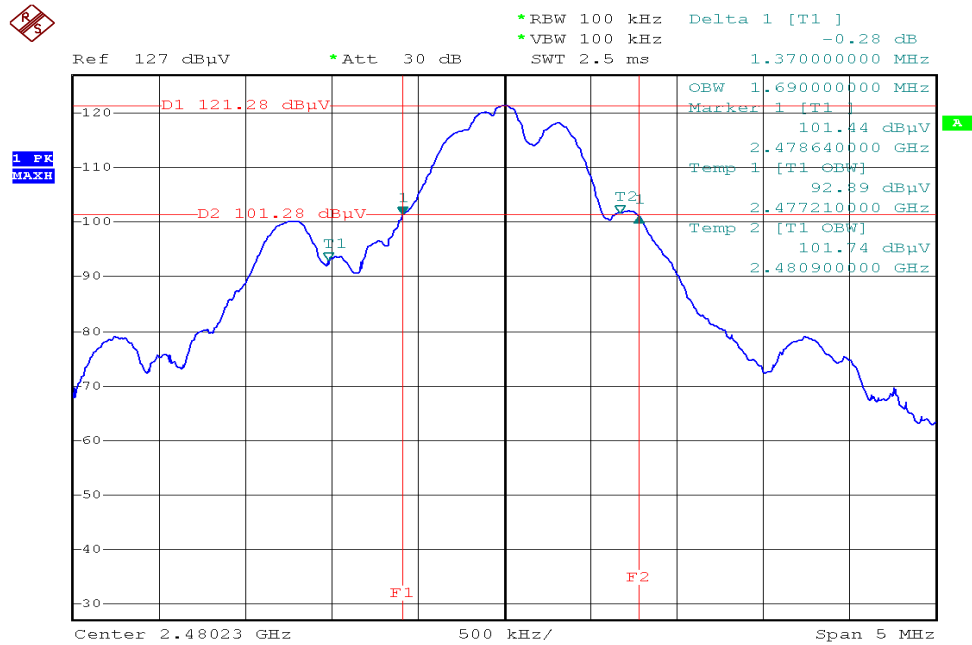
Lower Channel



Middle Channel



Upper Channel



12 Radiated spurious emissions into adjacent restricted band

Test Requirement:	FCC Part15 Paragraph 15.205
Test Method:	Based on FCC Part 15 Paragraph 15.247
Test Date:	May.17,2010
Requirements:	The EUT work in test mode(Tx) and test it

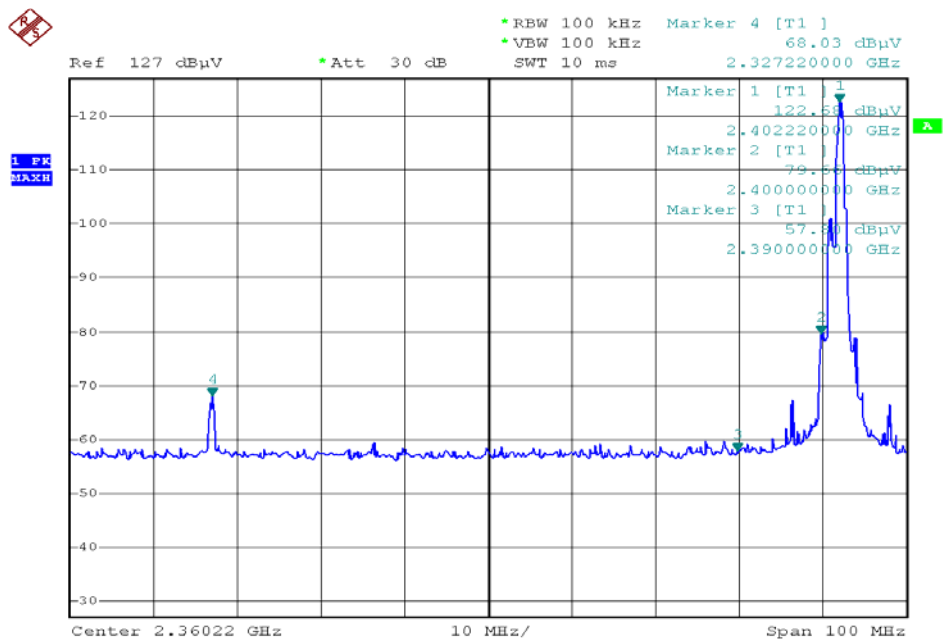
Requiments:

emissions that fall in the restricted bands(15.205).Above 1000MHz, compliance with the emissions limits in section 15.209 shall be demonstrated based on the average value of the measured emissions,The provisions in section 15.35 apply to these measurements.

Test procedure:

An in band field strength measurement of the fundamental emission using the RBW and detector function required by C63.4-2003 and FCC Rules.The procedure was repeated with an average detector and a plot made.The calculated field strength in the adjacent restricted band is presented below.

Lower bandedge/ restricted band (Peak Value)



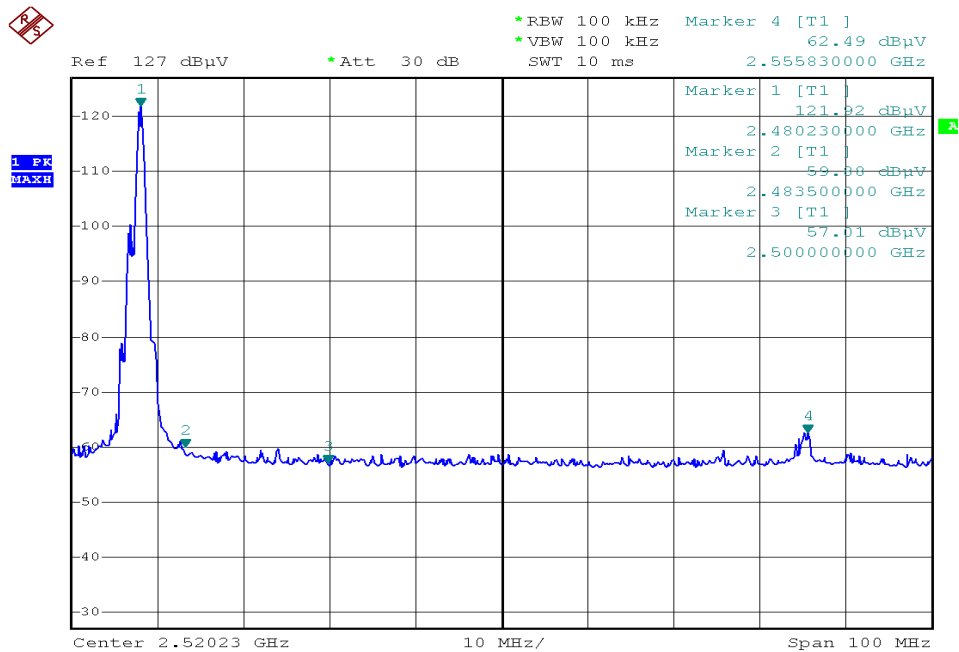
For 2400MHz bandedge checked with 2402MHz frequency operated,the delta shown at the plot is $122.68-68.03=54.65$ dB for peak detector mode.

The fundamental emission at the frequency of 2402MHz is 118.11dBuV/m for peak detector mode,so the bandedge emission is $118.11-54.65=53.46$ dBuV/m for peak detector mode.Here the limit for the emission is 74 dBuV/m for the peak detector,so the result passed.

And the same as the average detector, the bandedge emission is $93.66-54.65=39.01$ dBuV/m. Here the limit for the emission is 54.0dBuV/m for the average detector. the bandedge emission is lower than the average limit, so the result passed.

Remark: the radiation test data,please refer to the section 6.11 .

Upper Bandedge/ Restricted Band (Peak Value)



For 2483.5MHz bandedge checked with 2480MHz frequency operated,the delta shown at the plot is $121.92-62.49=59.43\text{dB}$ for peak detector mode.

The fundamental emission at the frequency of 2480MHz is 119.21dBuV/m for peak detector mode,so the bandedge emission is $119.21-59.43=59.78\text{dBuV/m}$ for peak detector mode.Here the limit for the emission is 74 dBuV/m for the peak detector,so the result passed.

And the same as the average detector, the bandedge emission is $94.58-59.43=35.15\text{dBuV/m}$. Here the limit for the emission is 54.0dBuV/m for the average detector. the bandedge emission is lower than the average limit, so the result passed.

Remark: the radation test data,please refer to the section 6.11

13 RF Exposure Test

Test Requirement:	FCC Part 2 Subpart J
Test Method:	Based on FCC Part 15 Paragraph 15.247
Test Date:	May.17,2010
Requirements:	The EUT work in test mode(Tx) and test it

Requiments:

Systems operating under the 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 limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

The procedures / limit

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	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

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

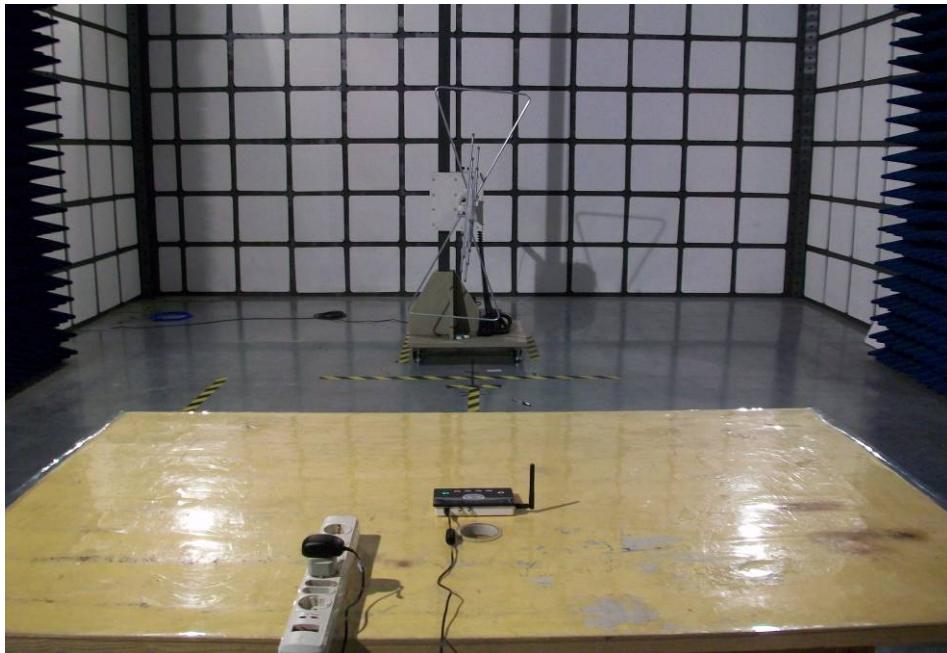
From the peak EUT RF output power, the minimum mobile separation distance,

d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

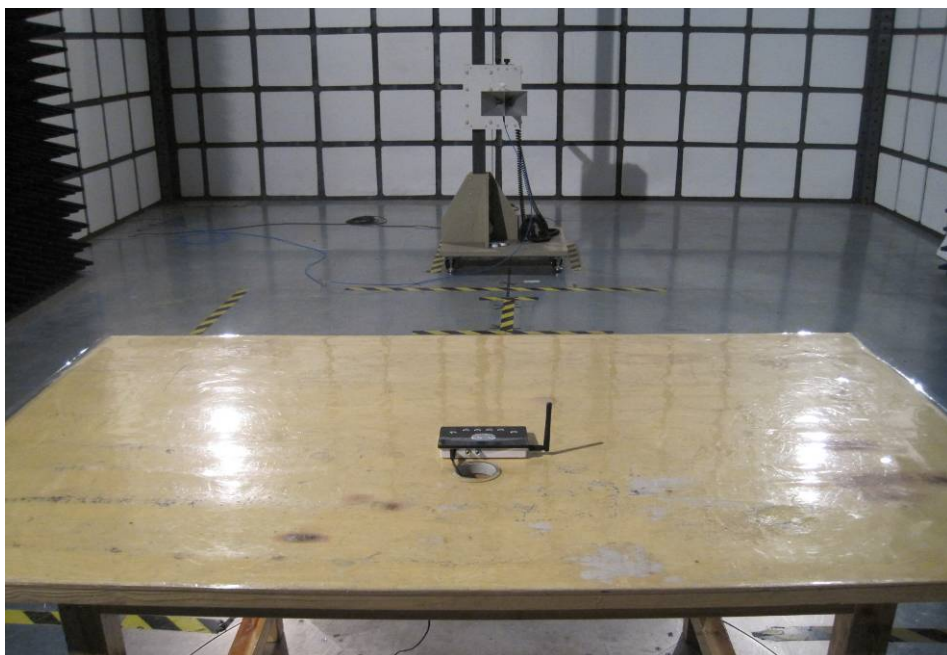
Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
-4.65	0.343	11.63	14.54	0.0009921	1	Complies
-4.65	0.343	11.43	14.54	0.0009921	1	Complies
-4.36	0.366	11.63	13.89	0.0009477	1	Complies

14 Photographs of Testing

Radiation Emission Test View For 30MHz-1000MHz



Radiation Emission Test View For 1GHz-25GHz



15 Photographs - Constructional Details

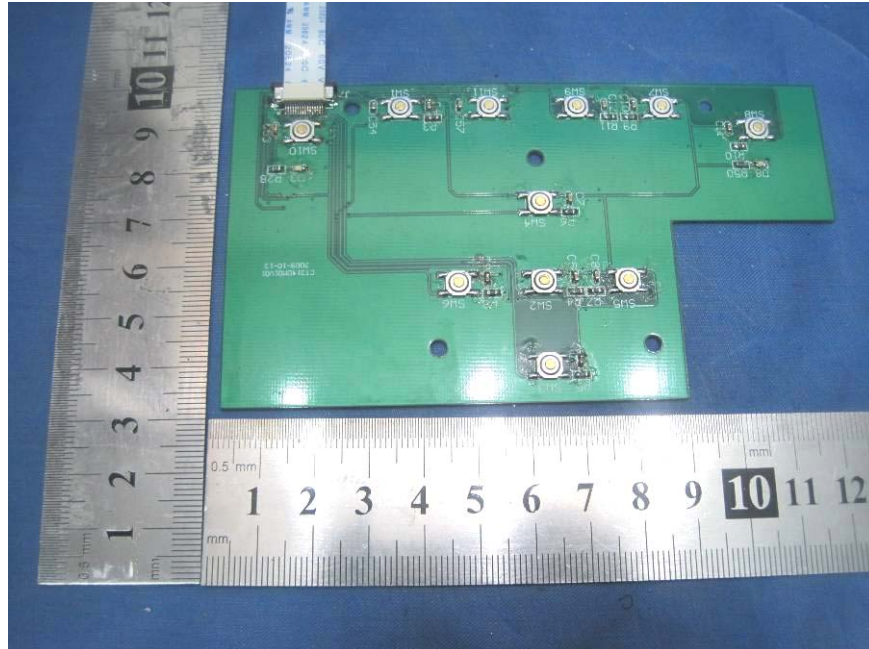
15.1 EUT -Components View



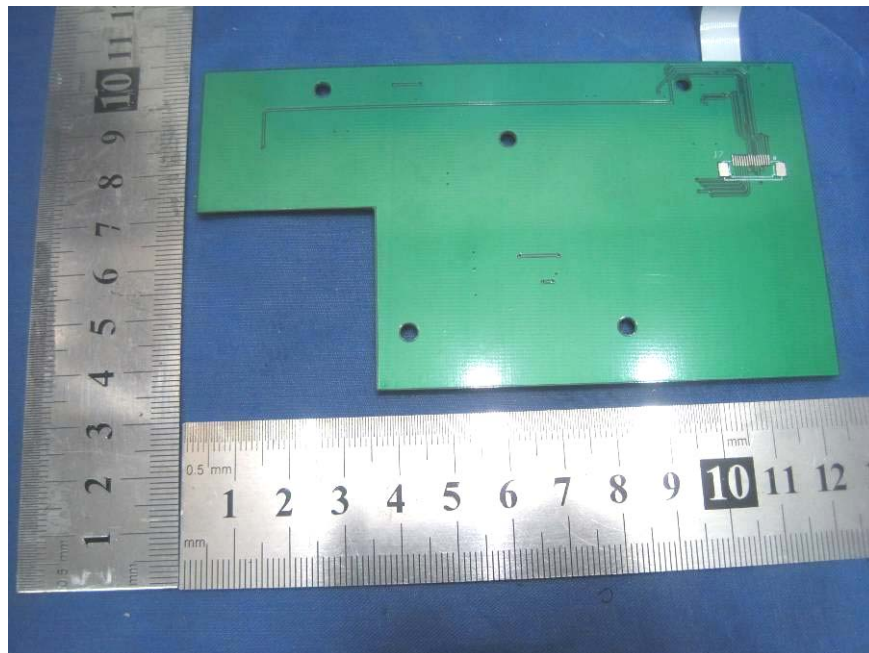
15.2 EUT - Back View



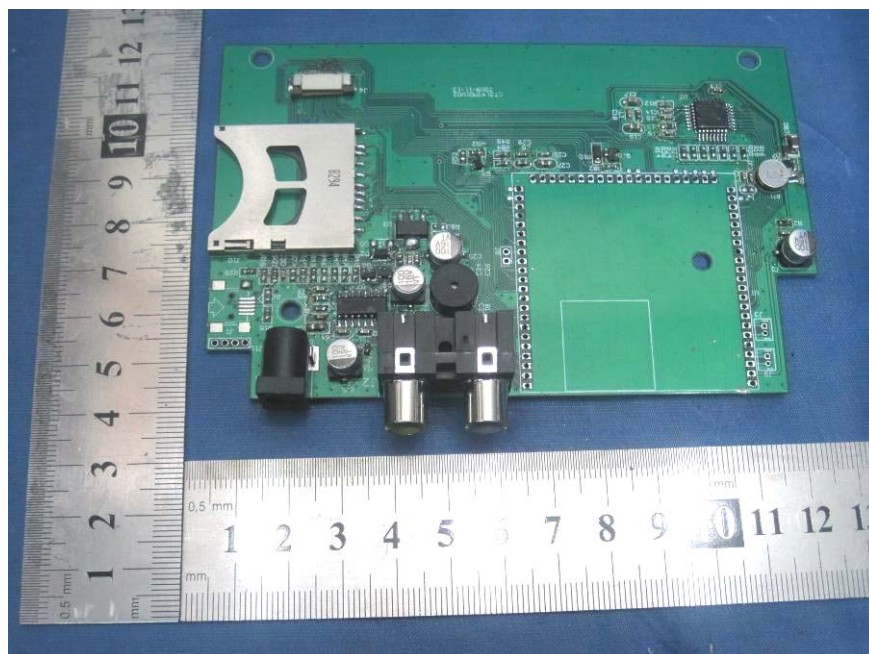
15.3 EUT –PCB1- Front View



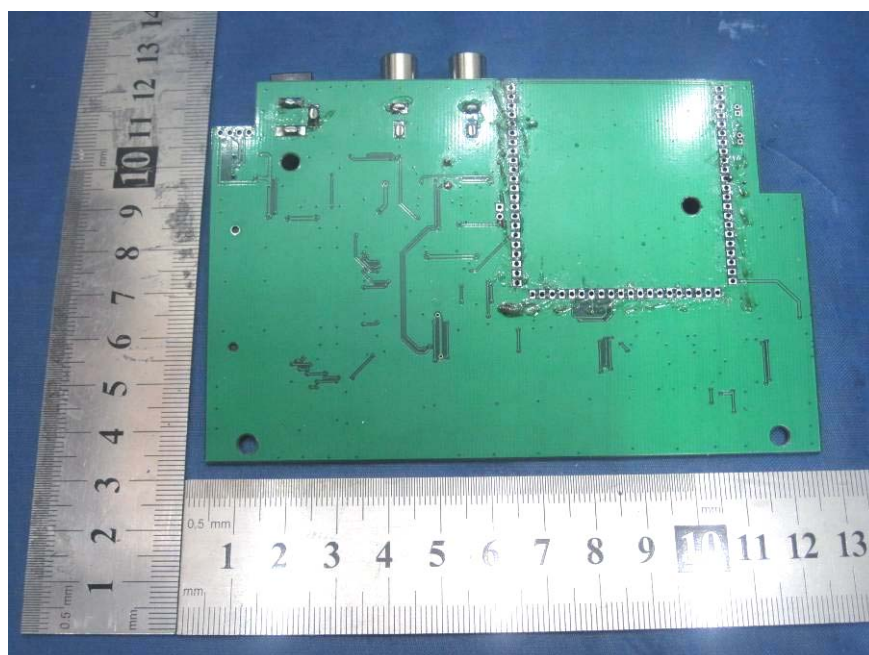
15.4 EUT-PCB1 - Back View



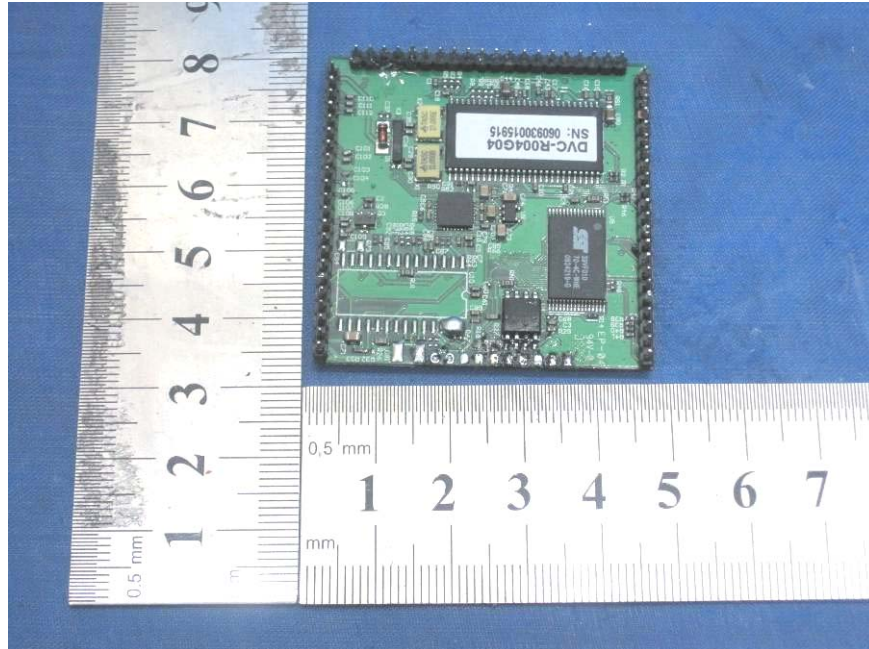
15.5 EUT-PCB2 - Front View



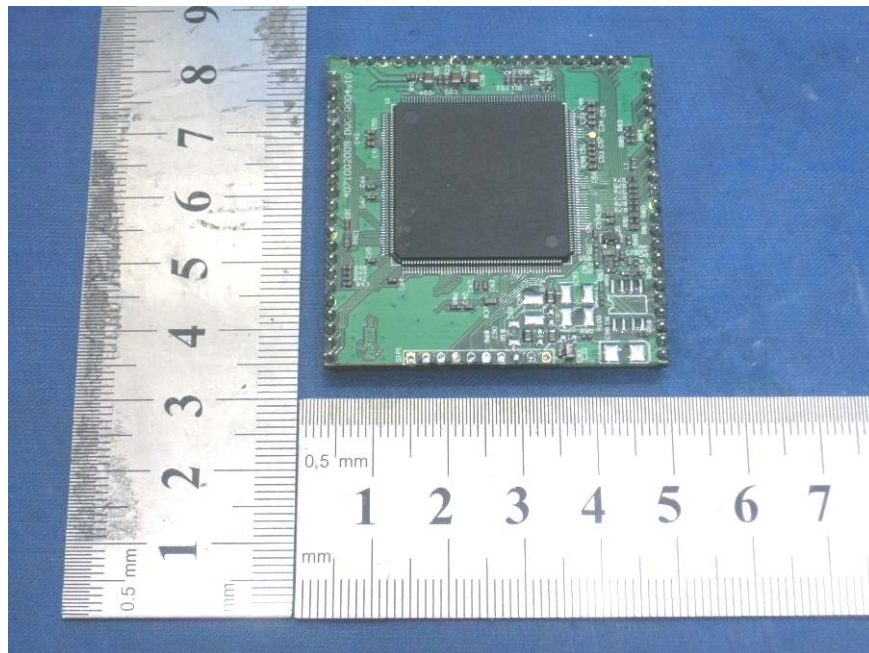
15.6 EUT-PCB2 - Back View



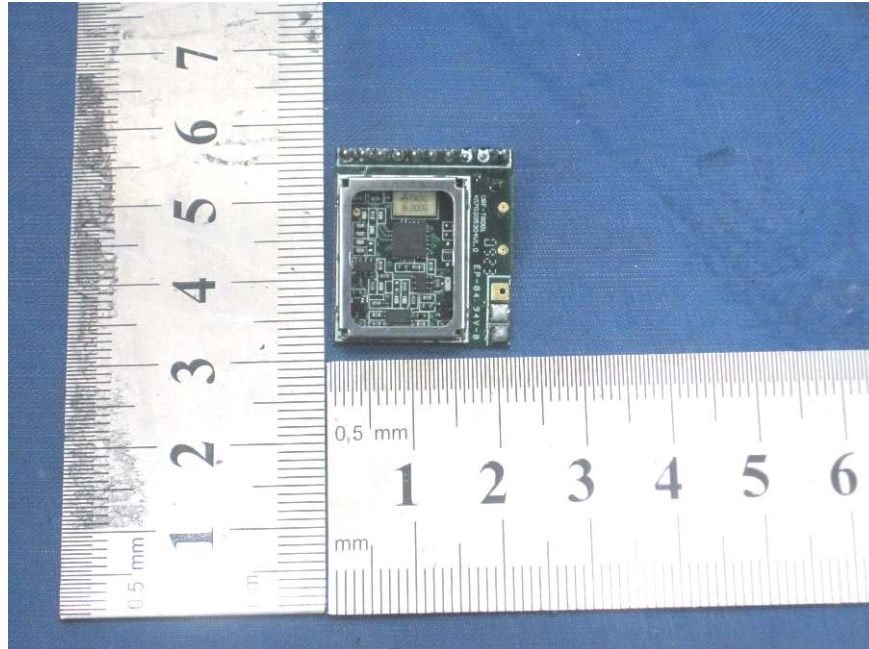
15.7 EUT-PCB3 - Front View



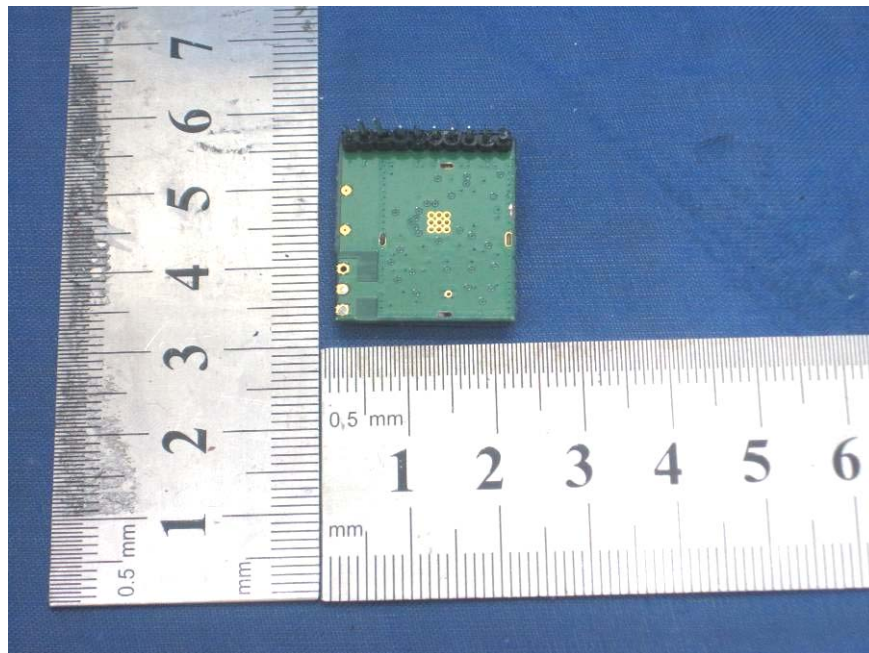
15.8 EUT-PCB3 - Back View



15.9 EUT-PCB4 - Front View



15.10 EUT-PCB4 - Back View



16 FCC ID Label

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.

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Proposed Label Location on EUT
EUT Bottom View/proposed FCC Mark Location

